Mitutoyo

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Catalog No. US-1005




# Measuring Instruments Catalog

# Notes on Use

**Export Compliance**

All products in this catalog are subject to the Foreign Exchange and Foreign Trade Control laws of Japan, US Export Administration Regulations (EAR) or the Canadian Export and Import Permits Act. Re-export or relocation of any of these products may require prior approval by an appropriate governing authority. If a purchased product is exported or re-exported, even if it is not considered a regulated item by a governing authority, Mitutoyo would like to be made aware, as the customer service available for that product may be affected. If you have any questions, please consult your local Mitutoyo sales office.

**Safety Caution**

Carefully read the specifications and functions in this catalog before selecting products. Safety may be compromised if you use products for purposes other than those stated here.

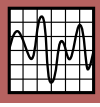
Feel free to contact your nearest Mitutoyo sales center if you wish to use a product for other purposes or in a special environment.

**Appearance and Specifications**

Appearance and specifications are subject to change without prior notice for product improvement. The product names in this catalog are registered trademarks or trademarks of Mitutoyo or their respective companies.

# Mitutoyo Precision Measuring Machines Trusted Throughout the World

# Table of Contents


| | | Pages | |
|---|---|---|---|
| A | Measurement Data Management | A-1 – 20 |  |
| B | Micrometers | B-1 – 54 |  |
| | Micrometer Heads | B-55 – 76 |  |
| C | Holtests | C-1 – 10 |  |
| | Inside Micrometers | C-11 – 19 |  |
| | Bore Gages | C-20 – 30 |  |
| D | Calipers | D-1 – 35 |  |
| | Height Gages | D-36 – 49 |  |
| | Depth Gages | D-50 – 58 |  |
| E | Gage Blocks | E-1 – 24 |  |
| | Height Master | E-25 – 31 |  |
| | Reference Gages | E-32 – 43 |  |
| | Granite Surface Plates | E-44 – 45 | |
| F | Digimatic Indicators | F-1 – 14 |  |
| | Dial Indicators | F-15 – 38 |  |
| | Dial Test Indicators | F-39 – 49 |  |
| | Thickness Gages | F-50 – 52 |  |
| | Other Gages | F-53 – 59 | |
| | Stands | F-60 – 65 | |
| G | Linear Gages | G-1 – 29 |  |
| | Mu-checker | G-30 – 33 |  |
| | Laser Scan Micrometers | G-34 – 50 |  |
| H | Digimatic Scale Units | H-1 – 8 |  |
| | Linear Scales | H-9 – 35 | |
| I | Profile Projectors | I-1 – 15 |  |
| | Microscopes | I-16 – 41 |  |
| J | Surftest | J-1 – 13 |  |
| | Formtracer | J-14 – 27 |  |
| | Contracer | J-28 – 38 |  |
| | Roundtest | J-39 – 54 | |
| K | Hardness Testing Machines | K-1 – 8 |  |
| | Rockwell Hardness Testing Machines | K-9 – 12 |  |
| | Portable Hardness Testing Machines | K-13 – 17 | |
| L | Coordinate Measuring Machines | L-1 – 15 |  |
| | Software and Probes | L-16 – 27 |  |
| | Accessories | L-28 – 29 | |
| M | Vision Measuring Systems | M-1 – 19 |  |
| N | INDEX | N-1 – 14 | |






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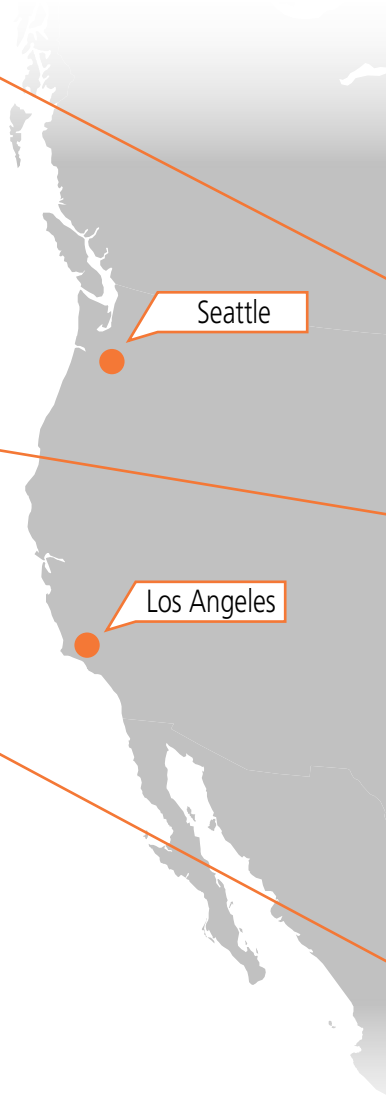
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## Mitutoyo America Corporation

Established in 1963, Mitutoyo America Corporation has locations all across the United States and Canada, including corporate offices, sales offices, M³ Solution Centers, calibration and repair laboratories, and research and development facilities. Mitutoyo America offers a full product line of precision measuring tools, instruments and equipment. Mitutoyo provides a comprehensive metrology organization, with dependable product and technical support, state-of-the-art calibration and repair services, unmatched education and training programs and cutting-edge research and development.

As the leading metrology company in the world, Mitutoyo is committed to future product development that applies breakthrough technologies to its full range of dimensional measurement tools, instruments and systems. With the belief that providing high-quality metrology goods and services to its customers will in turn, allow its customers to provide high-quality product to theirs, Mitutoyo continues to develop the most advanced and sophisticated metrology equipment available. **"Precision is our profession"** is not just the company motto, but also the principle by which every Mitutoyo employee stands when serving our customers.

# M³ Solution Centers

Mitutoyo Tools and instruments can be seen and demonstrated conveniently at any one of nine Mitutoyo M³ Centers nationwide. These centers are fully equipped featuring operational models of the latest Mitutoyo tools and instruments. By appointment or walk-in basis, product demonstrations at M³ Solution Centers are carried out by our experienced, highly trained staff. Contact your Mitutoyo distributor or the Mitutoyo regional office near you for more information.

Mcube

*M³ = Mitutoyo, Measurement, Metrology






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Mitutoyo

# Company Profile




## Product Demonstration / Application Support (M³ Solutions Centers)

With several locations across North America, Mitutoyo's M³ Solutions Centers provide hands-on access to the full range of Mitutoyo precision tools and instruments, including the latest technologies Mitutoyo has to offer. Available to walk-ins or by appointment, highly trained and industry-experienced applications engineers will provide product demonstrations, answer questions and assist in the development of application-specific solutions. Contact your Mitutoyo distributor or the M³ Solutions Center in your area for additional information.

## Sales Support / Customer Service

To ensure fast, dependable responses to all product-related questions and needs, Mitutoyo America Corporation's Sales Support group is available to assist with information on all Mitutoyo precision tools and instruments. Friendly, knowledgeable customer service representatives can provide product specifications, availability, and pricing, as well as recommend a local authorized Mitutoyo distributor.

## Technical Support Services

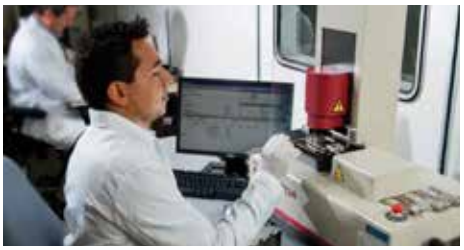
Fast technical support for all Mitutoyo precision tools, instruments and software applications is available to distributors and customers though Mitutoyo's technical support services and is only a phone call away. Highly skilled engineers and technicians with knowledge of all Mitutoyo products can provide product information, answer technical questions, and offer application guidance. Contract programming and inspection services utilizing our most advanced technologies are also available.

## Software Application Training

To maximize the value of Mitutoyo precision instrument purchases, Mitutoyo America Corporation provides customized training for all CMM, Vision, Form, and data management (MeasurLink) software applications it provides. Highly trained software instructors provide hands-on, one-on-one or group training with content appropriate for all customer needs. Training classes can be arranged at locations throughout North America.





## Calibration Services

Mitutoyo America Corporation's calibration laboratory utilizes state-of-the-art technology to calibrate virtually any metrology tool. A2LA accredited (Certificate 0750.01) to ISO/IEC 17025 for testing and calibration labs, this facility employs professional calibration technicians to provide NIST-traceable accuracy certification, as well as calibration services for Mitutoyo and other manufacturer's gages and gage blocks. Canadian calibration laboratory is CLAS accredited to ISO/IEC 17025.

## Field Service

Committed to ensuring value and longevity in its products, Mitutoyo America Corporation provides field service for all of its major measuring instrument products. A fully staffed field service department arranges the installation, repair, and A2LA-accredited calibration (Certificate 0750.01) of Mitutoyo metrology instruments. Capable of certifying calibration on any service visit, Mitutoyo's accredited field service technicians get equipment back into production quickly. Service agreements are available at the time of equipment purchase. Canadian field service laboratory is CLAS accredited to ISO/IEC 17025.



## Repair Services

Mitutoyo America Corporation's in-house repair facilities are capable of repairing the full range of Mitutoyo precision tools. Skilled technicians provide quality repairs backed by a full 90-day warranty on parts and labor. Repairs are done in either the Aurora, IL, facility or the City of Industry, CA, facility. Repair service is also available in Canada.

## Parts Center

Mitutoyo America Corporation's parts center stocks more than 10,000 individual parts for Mitutoyo products. Same day and 24-hour shipping is available for most part requests. For CMM parts, a specialized group is available to provide additional CMM support services. A Mitutoyo product parts catalog is available on CD-ROM through the Parts Center or through a local Mitutoyo distributor.

# Company Profile




## Mitutoyo Institute of Metrology

The Mitutoyo Institute of Metrology provides educational courses and on-demand resources across a wide variety of measurement related topics including basic inspection techniques, principles of dimensional metrology, calibration methods and GD&T. Through the Mitutoyo worldwide operations, we are the premier educational provider within the quality field. Our seminars are led by experienced professionals at locations across the U.S. For seminars outside the U.S., please visit the Mitutoyo Worldwide site. All courses are approved for Continuing Education Units (CEU) and include a Certificate of Attendance.





## CT Lab / MEI (R&D and Software Development)

Mitutoyo America's CT Labs and Micro Encoder Inc. are part of an international network of Mitutoyo research and development facilities charged with developing breakthrough technologies for the company's range of dimensional measurement tools, instruments and systems and for the advancement of the field of metrology. Highly skilled developers and engineers utilize cutting-edge development tools to produce the most advanced and sophisticated metrology software and equipment available. Mitutoyo America Corporation is a Microsoft® Gold Certified Partner, providing the entire organization access to a host of Microsoft® development tools and support, and ensuring that Mitutoyo software applications work reliably in Microsoft® OS and network environments.

## Mitutoyo Custom Solutions

Standard products alone cannot always solve our customers' measuring challenges. That is why we established an engineering group to integrate our equipment into application-engineered custom solutions. Called Sales Solutions, this group can create a solution as simple as fixturing. Other times, the answer may require integration of the latest metrology equipment, process control software and robotics to create an automated metrology cell. Whatever the level of complexity, for application and integration of measurement technologies simple or complex – proven or newly emerging – you can count on Sales Solutions to develop a plan to improve your process capability, productivity and bottom line.



# Global Network

Following the establishment of MTI Corporation (U.S.) in 1963, Mitutoyo has been expanding its market throughout the world. Currently, the company has R&D, manufacturing, sales, and engineering service bases in 30 countries, as well as network of distributors in some 80 countries. Mitutoyo maintains its rock-solid status as a leading global manufacturer providing services tailored to each regional society.


Sendai Sales Office


Utsunomiya Sales Office


Suwa Sales Office


Osaka Sales Office


Fukuoka Sales Office


Kawasaki Plant


Tsukuba Laboratory


Utsunomiya Operations


Gohara Production Department


Kiyohara Production Department


Kure Production Department


Nakatsugawa Plant


Miyazaki Plant


Shiwa Production Department




- Global Headquarters
- Sales
- Service Center
- Calibration Center
- M³ Solution Center
- Mitutoyo Institute of Metrology
- Research and Development Facility
- Manufacturing Facility

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**Suwa Service Center**
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**Nagoya Service Center**
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PT. Mitutoyo Indonesia

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Mitutoyo

# Meaning of Symbols

ABSOLUTE™

ABSOLUTE is a trademark of Mitutoyo Corporation.

## ABSOLUTE Linear Encoder

This is an electronic measuring scale that provides a direct readout of absolute linear position when switched on, without needing to be zeroed or reset. Electrostatic, electromagnetic and a combination of electrostatic and optical methods are used in implementing this capability but the key feature is Mitutoyo's patented technology of building absolute positional information into the scale so it can be read at start up. These linear encoders are widely used in Mitutoyo's measuring instruments as the in-built length standard and their use greatly contributes to the generation of highly reliable measurement data, particularly in harsh environments where contamination by cutting fluids, coolants and dust must not affect performance.

**Advantages:**

1. No count error occurs even if you move the slider or spindle extremely rapidly.
2. You do not have to reset the system to zero when turning on the system after turning it off*1.
3. As this type of encoder can drive with less power than the incremental encoder, the battery life is prolonged to about 3.5 years (continuous operation of 20,000 hours)*2 under normal use.

*1: Unless the battery is removed.
*2: In the case of the ABSOLUTE Digimatic caliper (electrostatic capacitance model).

IP65

IP66

IP67

IP is a trademark of Mitutoyo Corporation.

## IP Codes

These codes indicate the degree of protection provided (by an enclosure) for the electrical function of a product against the ingress of foreign bodies, dust and water as defined in IEC standards (IEC 60529: 2001) and JIS C 0920: 2003.
[IEC: International Electrotechnical Commission]

| First characteristic numeral | Degrees of protection against solid foreign objects | |
|---|---|---|
| | Brief description | Definition |
| 0 | Unprotected | — |
| 1 | Protected against solid foreign objects of Sø50mm and greater | A Sø50mm object probe shall not fully penetrate enclosure* |
| 2 | Protected against solid foreign objects of Sø12.5mm and greater | A Sø12.5mm object probe shall not fully penetrate enclosure* |
| 3 | Protected against solid foreign objects of Sø2.5mm and greater | A Sø2.5mm object probe shall not fully penetrate enclosure* |
| 4 | Protected against solid foreign objects of Sø1.0mm and greater | A Sø1.0mm object probe shall not fully penetrate enclosure* |
| 5 | Protected against dust | Ingress of dust is not totally prevented, but dust that does penetrate must not interfere with satisfactory operation of the apparatus or impair safety. |
| 6 | Dust-proof | No ingress of dust allowed. |

*: For details of the test conditions used in evaluating each degree of protection, please refer to the original standard.

| Second characteristic numeral | Degrees of protection against water | |
|---|---|---|
| | Brief description | Definition |
| 0 | Unprotected | — |
| 1 | Protected against vertical water drops | Vertically falling water drops shall have no harmful effects. |
| 2 | Protected against vertical water drops within a tilt angle of 15 degrees | Vertically falling water drops shall have no harmful effects when the enclosure is tilted at any angle up to 15° on either side of the vertical. |
| 3 | Protected against spraying water | Water sprayed at an angle up to 60° either side of the vertical shall have no harmful effects. |
| 4 | Protected against splashing water | Water splashed against the enclosure from any direction shall have no harmful effects. |
| 5 | Protected against water jets | Water projected in jets against the enclosure from any direction shall have no harmful effects. |
| 6 | Protected against powerful water jets | Water projected in powerful jets against the enclosure from any direction shall have no harmful effects. |
| 7 | Protection against water penetration | Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time. |
| 8 | Protected against the effects of continuous immersion in water | Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and user but which are more severe than for IPX7. |

TÜVRheinland CERTIFIED
www.tuv.com
ID 0000006683

## About the TÜV Rheinland certification marks

All products with the marks shown on the left have passed the IP test carried out by the German accreditation organization, TÜV Rheinland.

PROPRIETARY INSPECTION CERTIFICATE
Mitutoyo guarantees the product quality.

## Measuring Instruments Shipped with Inspection Certificate

Mitutoyo guarantees product quality as a leading precision measuring instrument manufacturer and ships measuring instruments with an inspection certificate that includes inspection data so that customers can use them with confidence.

*For the meaning of inspection marks shown at the left, refer to the detailed description of each product.

MeasurLink® ENABLED
Data Management Software by Mitutoyo

## MeasurLink ENABLED marks

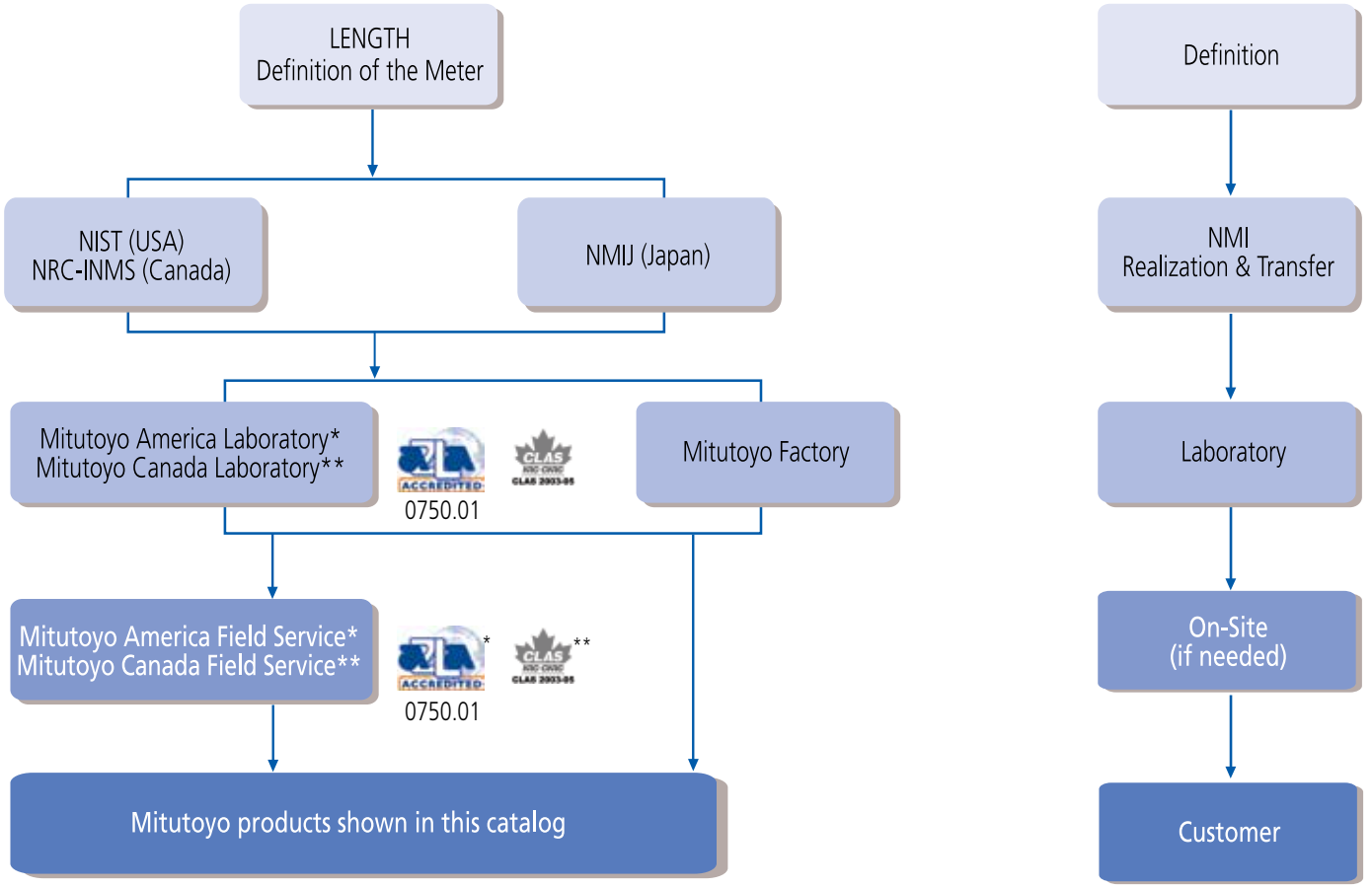
Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink.
MeasurLink® is a registered trademark of Mitutoyo Corporation in Japan and Mitutoyo America Corporation in the United States.

Main Unit Startup System

## Installation of Main Unit Startup System

As a part of the enhancement of our export control system, the large CNC measuring machines (all the CNC Coordinate Measuring Machines, Vision Measuring Systems, and Form Measuring Machines) are now equipped with a Main Unit Startup System (relocation detecting system) before export.
This system is designed to take a machine out of operation upon detecting the mechanical shock that accompanies relocation. If you intend to relocate a measuring machine fitted with this system, please contact us beforehand so that our service engineers can assist you.
On the other hand, the system may be triggered in the event of a natural event such as a powerful earthquake. In this case, our service engineers will deal with the situation at the earliest opportunity.

# Traceability Mitutoyo North America




Traceability is an essential requirement for all measurements. At Mitutoyo, we consider providing traceability to our customers to be a critical part of our business. Traceability is often referred to as a "chain of comparisons," and that chain always starts with a precise definition. For length measurements, the meter is defined by how far light moves in a vacuum in a defined amount of time. The job of reducing that definition into a practical measurement belongs to the world's National Metrology Institutes (NMI). The NMI in the United States is the National Institute of Standards and Technology (NIST), where they realize and transfer the definition of length to physical measurements of gage blocks, line scales, and other primary standards. From there, traceable measurements at other laboratories and factories are possible. Mitutoyo factories and calibration labs regularly send their standards to NIST; however, traceability can also be established through other recognized NMIs, such as the National Metrology Institute of Japan (NMIJ). The world's leading NMIs, such as NIST and NMIJ, routinely participate in intercomparisons to ensure global traceability to the same unit of length.

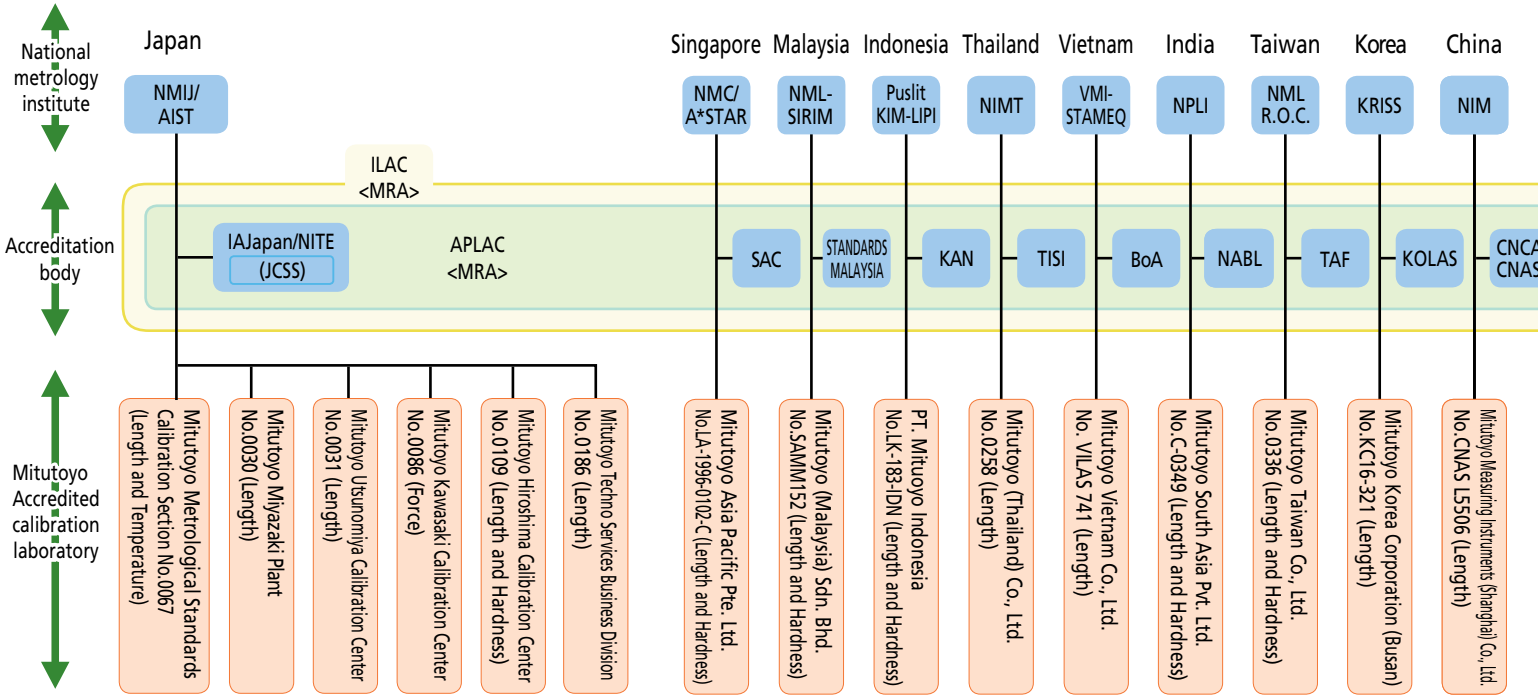
The requirements for demonstrating traceability vary from industry to industry. In the past, some industries required NIST test numbers, but that practice is now obsolete and has been replaced in many industries by the much more demanding requirement of ISO 17025 accreditation. To meet these needs, Mitutoyo America offers our customers A2LA-accredited calibrations either in our labs (Certificate 0750.01), or at your facility (Certificate 0750.01). None of our competitors can match the range and accuracy of accredited calibration services offered by Mitutoyo. Not every quality system requires accreditation, and for the less demanding needs, our standard factory issued certificates can still be used to ensure the required traceability.

Whatever the measurement, whatever the requirements for traceability, Mitutoyo has the most technically advanced metrology products and calibration services to meet your specific needs.

# Offering High-level Calibration Services

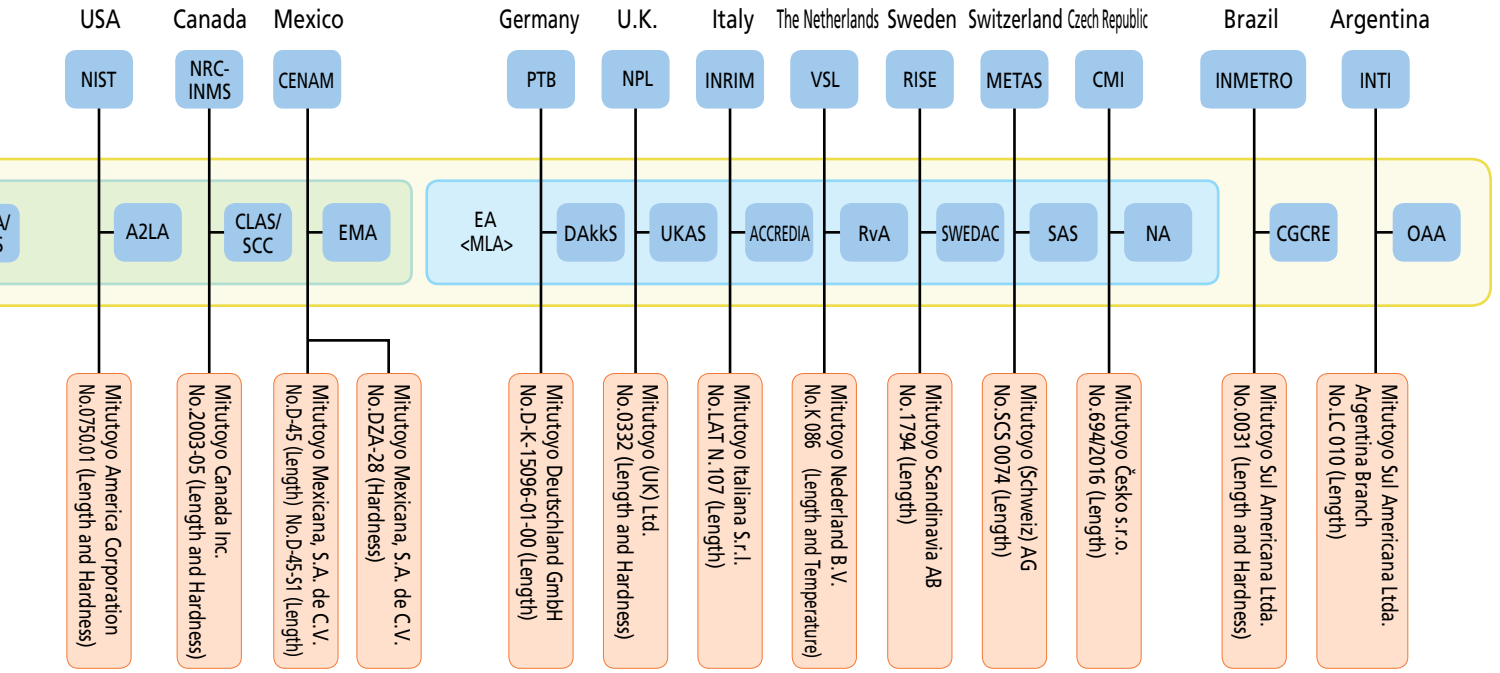
## Calibration Laboratories

Mitutoyo has built a network for comprehensive support of calibration of precision measuring products in the global market. To provide calibration services on a global scale, Mitutoyo has calibration laboratories that have received ISO/IEC 17025 certification, an international standard, from accredited organizations in each of the countries in which Mitutoyo operates in Japan and abroad.




- Japan
  - AIST : National Institute of Advanced Industrial Science and Technology
  - NMIJ : National Metrology Institute of Japan
  - IAJapan : International Accreditation Japan
  - NITE : National Institute of Technology and Evaluation
  - JCSS : Japan Calibration Service System
- Singapore
  - NMC/A*STAR : National Metrology Centre/ Agency for Science, Technology and Research
  - SAC : Singapore Accreditation Council
- Malaysia
  - NML-SIRIM : National Metrology Laboratory-Standards and Industrial Research Institute of Malaysia
  - STANDARDS MALAYSIA : STANDARDS MALAYSIA
- Indonesia
  - Puslit KIM-LIPI : Research Center for Calibration, Instrumentation and Metrology- Indonesian Institute of Science
  - KAN : Komite Akreditasi Nasional
- Thailand
  - NIMT : National Institute of Metrology (Thailand)
  - TISI : Thai Industrial Standard Institute
- Vietnam
  - VMI-STAMEQ : Vietnam Metrology Institute, Directorate for Standards and Quality
  - BoA : BUREAU OF ACCREDITATION
- India
  - NPLI : National Physical Laboratory of India
  - NABL : National Accreditation Board for Testing and Calibration Laboratories
- Taiwan
  - NML R.O.C. : National Measurement Laboratory R.O.C.
  - TAF : Taiwan Accreditation Foundation
- Korea
  - KRISS : Korea Research Institute of Standards and Science
  - KOLAS : Korea Laboratory Accreditation Scheme
- China
  - NIM : National Institute of Metrology
  - CNCA : Certification and Accreditation Administration of the people's republic of China
  - CNAS : China National Accreditation Service for Conformity Assesment
- U.S.A.
  - NIST : National Institute of Standards and Technology
  - A2LA : American Association for Laboratory Accreditation
- Canada
  - NRC-INMS : National Research Council Canada / Institute for National Measurement Standards
  - CLAS/SCC : Calibration Laboratory Assessment Service / Standards Council of Canada
- Mexico
  - CENAM : Centro Nacional de Metrología
  - EMA : Entidad Mexicana de Acreditación, a.c.
- Germany
  - PTB : Physikalisch-Technische Bundesanstalt
  - DAkkS : Deutsche Akkreditierungsstelle GmbH
- UK
  - NPL : National Physical Laboratory
  - UKAS : United Kingdom Accreditation Service

Note: The above are domestic and international locations where Mitutoyo provides ISO/IEC 17025 accredited calibration services.
(As of September, 2018)




- Italy
  - INRIM : Istituto Nazionale di Ricerca Metrologica
  - ACCREDIA : L'ENTE ITALIANO DI ACCREDITAMENTO
- The Netherlands
  - VSL : Van Swinden Laboratorium
  - RvA : Raad voor Accreditatie
- Sweden
  - RISE : RISE Research Institutes of Sweden AB
  - SWEDAC : Swedish Board for Accreditation and Conformity Assessment
- Switzerland
  - METAS : The Federal Institute of Metrology
  - SAS : Swiss Accreditation Service
- Czech Republic
  - CMI : Český Metrologický Institut
  - NA : Národní Akreditační Orgán
- Brazil
  - INMETRO : Instituto Nacional de Metrologia Qualidade e Tecnologia
  - CGCRE : Coordenação Geral de Acreditação do INMETRO
- Algentina
  - INTI : Instituto Nacional de Tecnologia Industrial
  - OAA : Organismo Argentino de Acreditación

ILAC : International Laboratory Accreditation Cooperation
APLAC : Asia-Pacific Laboratory Accreditation Cooperation
MLA : Multilateral Agreement
MRA : Mutual Recognition Arrangement
EA : European co-operation for Accreditation




















Mitutoyo

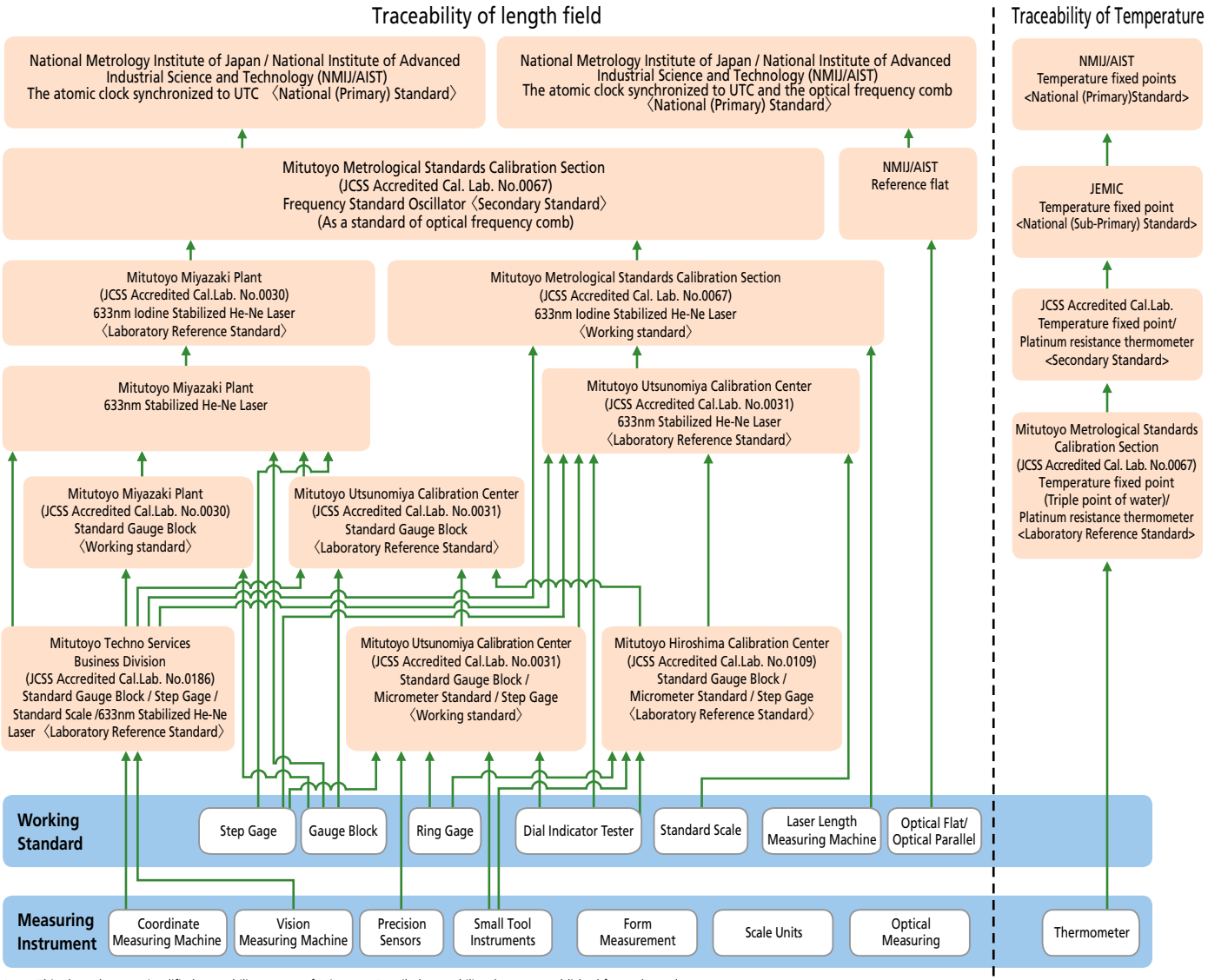
# Offering Reliable Traceability

## Mitutoyo's Traceability System

Mitutoyo's length standards are directly traceable to Japan's national standards. Mitutoyo performs calibration of standards used for calibrating measuring instruments. In this way, the establishment and maintenance of traceability for various measuring instruments used by customers is achieved. Furthermore, Mitutoyo executes the temperature calibrations that are essential for high-accuracy length measurement. In addition, the establishment and maintenance of traceability for test equipment such as hardness and vibration are achieved as well.

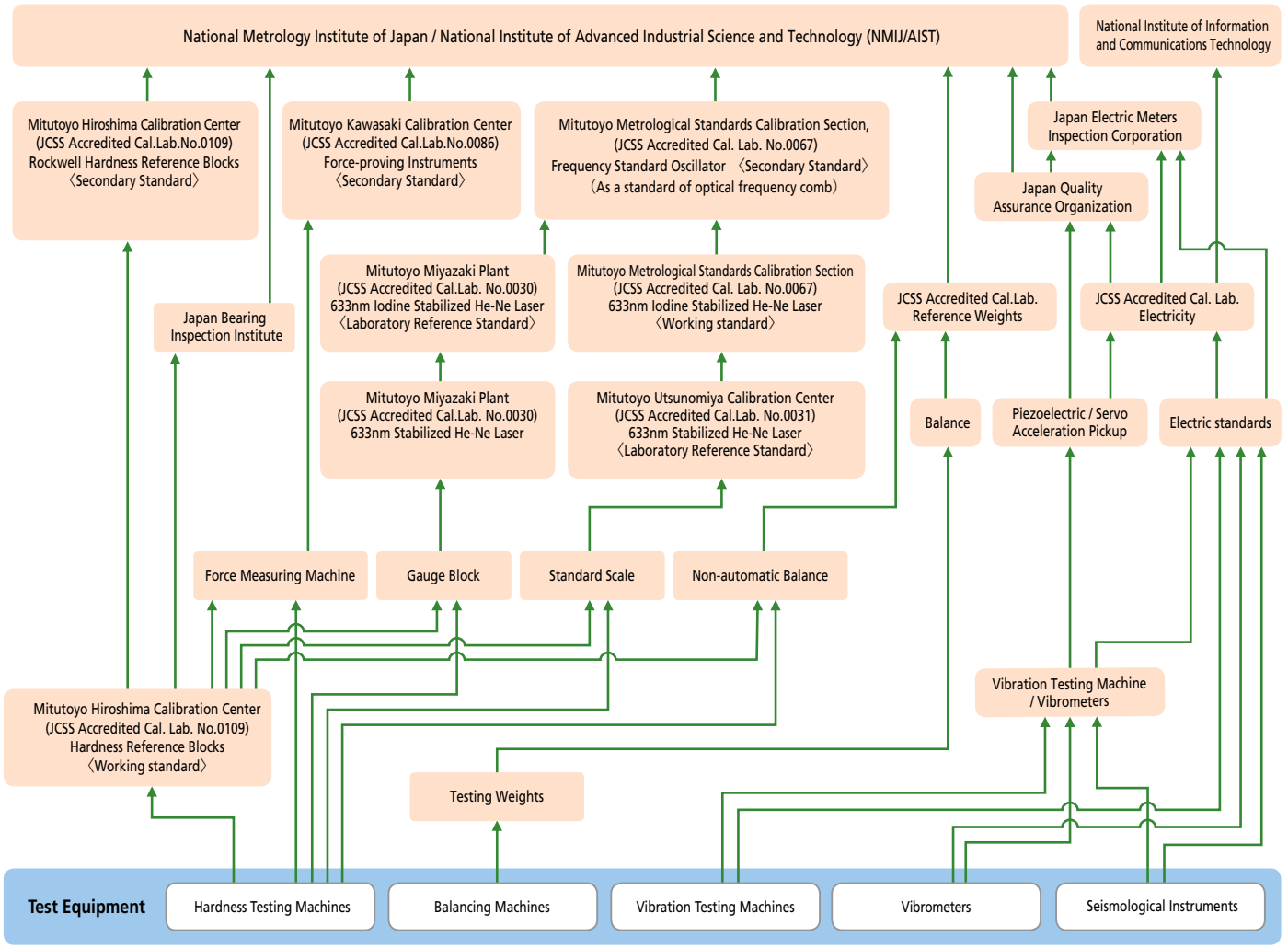


Certificate of JCSS accredited laboratory (Mitutoyo Metrological Standards Calibration Section)




Note: This chart shows a simplified traceability system of Mitutoyo. Detailed traceability charts are published for each product.

## Traceability of Test Equipment




Note: This chart shows a simplified traceability system of Mitutoyo. Detailed traceability charts are published for each product.
(As of September, 2018)

# Conformance to CE Marking

## Conformance to CE Marking

In order to improve safety, each plant has programs to comply with the Machinery Directive, the EMC Directive, and the Low Voltage Directive. Compliance to CE marking is also met. CE stands for "Conformité Européenne". CE marking indicates that a product complies with the essential requirements of the relevant European health, safety and environmental protection legislation.





Conformity evaluation for CE marking (EMC Directives)

## Major EU Directives relating to Mitutoyo products

| Name of EU Directive | Applicable range |
|---|---|
| Machinery Directive | At least one part of a machine that may cause injury to the human body if it moves due to movement of an actuator such as a motor. |
| EMC Directive (Electromagnetic Compatibility Directive) | A product that may produce electromagnetic radiation or which is influenced by electromagnetic radiation from outside. |
| Low Voltage Directive | Equipment (device) that uses AC voltage of 50 to 1000V or DC voltage of 75 to 1500V. |
| Radio Equipment Directive | All electrical and electronic equipment that intentionally transmits and receives radio waves at frequencies below 3000 GHz. |
| RoHS Directive | Restriction of the use of certain hazardous substances in electrical and electronic equipment.<br>Restricted substances and maximum concentration values tolerated by weight:<br>· Lead (0.1 %)<br>· Cadmium (0.01 %)<br>· Hexavalent chromium (0.1 %)<br>· Polybrominated biphenyls (PBB) (0.1 %)<br>· Polybrominated diphenyl ethers (PBDE) (0.1 %) |

## Response to WEEE Directive

The WEEE Directive*1 is a directive that mandates appropriate collection and recycling of electrical and electronic equipment waste.
The purpose of this directive is to increase the reuse and recycling of these products, and seeks eco-friendly product design. To differentiate between equipment waste and household waste, a crossed-out wheeled-bin symbol is marked on a product. We will promote eco-friendly design for our products.

*1 WEEE Directive: Directive 2012/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment.

## Response to REACH Regulation

REACH Regulation*2 is a regulation governing registration, evaluation, authorization and restriction of chemical substances in Europe, and all products such as substances, mixtures and molded products (including accessories and packaging materials) are regulated. Chemical substances scientifically proven to be substances that are hazardous to human health and the global environment (a substance of very high concern (SVHC)) are prohibited to be sold or information concerning them disclosed is mandated in Europe. We will actively disclose information about our products and provide replacement if we find our products contain any of the listed substances.

*2 REACH Regulation: Regulation (EC) No1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorization and Restriction of Chemicals

## Response to Management Methods for Controlling Pollution by Electronic Information Products (China RoHS)

We set the environmental protection use period regulated by China RoHS per product and label with the marks shown on the right, together with a list of the contained substances.




"Environmental Protection Use Period" mark*3

*3 The environmental protection use period does not indicate the product warranty period.

**Regarding the use of Silver Oxide batteries, please follow these precautions:**

### ⚠ Warning

- Do not heat, disassemble nor dispose of in fire.
  Doing so damages the insulation materials and may cause fire, heat generation, leakage or bursting.
- Do not short circuit.
  If the (+) and (-) terminals are connected together through a very low resistance path, such as a metal casing, a short circuit occurs.
  As a result, fire, heat generation, leakage or bursting may occur.
- Keep batteries out of children's reach.
  A young child may swallow a battery and risk danger to health.
  When you design mechanical hardware around a battery, ensure that the battery is securely contained in order to prevent children from removing it.
  When you store batteries, keep the batteries out of children's reach.
  If a battery is swallowed, consult a physician immediately.
- If leaked liquid contacts the eyes, do not rub them but immediately, wash them with clean water and consult a physician as soon as possible.
- If leaked liquid contacts clothing, to protect against irritation, wash them with clean water immediately.

### ⚠ Caution

- Do not install in reverse polarity. Take care to identify the (+) and (-) terminals correctly.
- Do not solder directly to a battery.
- Do not use new and used batteries together. Do not use different types of batteries together.
- Do not charge.
- Do not use nor leave batteries in direct sunlight nor in high-temperature areas.
- Keep batteries away from direct sunlight, high temperature and humidity.
- Avoid letting batteries contact water.
- Ensure batteries are inserted without coming into contact with metal parts of equipment.
- Read the equipment instruction manual and precautions carefully before using.
- Remove batteries from equipment that will not be used for a prolonged period.
- In case of disposal, insulate (+) and (-) terminals of a battery by applying an insulating material.



## Measurement Data Management

## INDEX


| Data Management (SPC) | |
|---|---|
| MeasurLink | A-2-10 |
| Input Tools | A-11 |
| USB Input Tool Direct: USB-ITN | A-12,13 |
| U-WAVE | A-14,15 |
| U-WAVE Fit | A-16 |
| Multiplexers – MIG-8USB, MIG-4USB | A-17 |
| Gage Selector 3 | A-18 |
| EC Counter | A-18 |
| DP-1VA | A-19 |
| SPC Connecting Cables | A-20 |




Mitutoyo

# MeasurLink®

An Integrated Solution for Quality Data Management

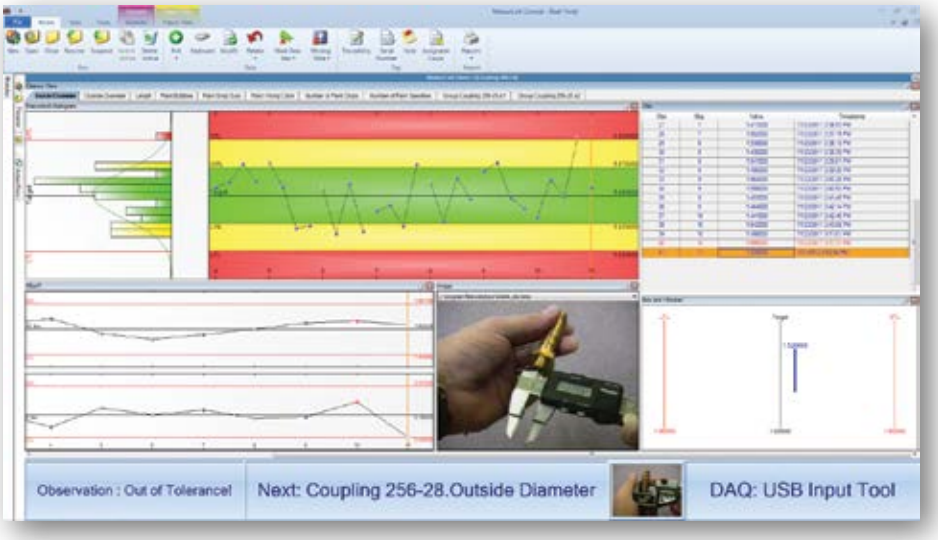
MeasurLink® meets the challenge of centralizing your quality data with the most versatile tool and instrument interface options available. This high-end statistical platform delivers real-time data—when you need it most—with instant message capabilities and comprehensive quality reporting. MeasurLink® provides part inspection visualizations that are second to none, ensuring a clear view of your inspection process and your measurement results.

Whether used as an enterprisewide quality data solution or as a stand-alone quality data station, MeasurLink® provides the complete situational awareness that you need to successfully manage your process improvement and defect prevention efforts.

MeasurLink® is backed by Mitutoyo, the global leader in metrology, combining a full product line of precision measuring tools, instruments and equipment with a worldwide information network that understands the unique precision measurement and quality management needs of every industry that it serves.

Most of Mitutoyo's electronic instruments can output data via optional connecting cables or wireless transmitters and receivers in the form of the Digimatic code. The Digimatic code can also be converted into RS-232C format with several available gage multiplexers. In this way, digital data can be sent to PCs for data acquisition and advanced statistical analysis.

As a client/server application, MeasurLink gives you the performance you need through distributed processing. Combined with a multi-user relational database, MeasurLink® delivers a safe and organized data warehousing system, making quality data available for viewing and analysis by any member of the production, engineering and managerial staff throughout your company. Inspection in the factory produces data for analysis, corrective action and various reporting needs. As the backbone of your quality efforts, MeasurLink® is guaranteed to reduce your production costs and increase your bottom line.




## MeasurLink Suite of Software

MeasurLink is an easy-to-use, Windows-based family of quality data management software applications. MeasurLink combines real-time data acquisition, on-line statistical analysis, integrated networking and quality information sharing into a comprehensive data management solution.

- **Real-Time**
  Real-time data collection
- **Process Analyzer**
  Analysis of all data
- **Process Manager**
  Network monitoring dashboard
- **Gage R&R**
  Gage repeatability and reproducibility
- **Gage Management**
  Gage inventory and calibration control
- **Report Scheduler**
  Automated report distribution



## MeasurLink 8 System Requirements

### Database Management System (DBMS) Requirements

MeasurLink 8 ships with a copy of Microsoft® SQL Server 2014 SP1, which can be for a standalone or a workgroup installation. MeasurLink 8 also supports:

- Microsoft® SQL Server 2014
- Microsoft® SQL Server 2012
- Microsoft® SQL Server 2008

### Operating System Requirements

All MeasurLink 8 products are supported on the following Microsoft® Windows Operating System versions:

- All Windows® 10 versions
- All Windows® 8 versions
- All Windows® 7 versions
- 32-bit and 64-bit supported

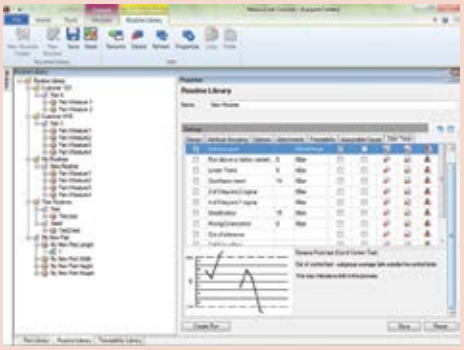
**www.measurlink.com**

Microsoft Partner
Gold Application Development

Windows 10 Compatible
Windows 8 Compatible
Compatible with Windows 7

# MeasurLink®

An Integrated Solution for Quality Data Management



**Easy-to-use** MeasurLink® provides you the most intuitive interface with complete SPC functionality to help monitor and manage your manufacturing processes. With MeasurLink®, you can easily manage the quality levels of your parts, identify problem areas and apply corrective action to areas in need of attention.




Refer to Bulletin No. (2188) for more details.

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Microsoft Partner
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Windows 10 Compatible
Windows 8 Compatible
Compatible with Windows 7

### User-friendly

Click a gage button and watch the charts update in real-time. This helps the operator stay on top of the process. Begin collecting data in minutes with Inspection Wizard.

### Data acquisition

Collects data from digital micrometers, calipers, indicators, bore gages, etc. Keyboard entry is a snap. Collect data for one or a million parts.

### Comprehensive SPC

Easy-to-use control charts, histograms, capability, detailed statistics, assignable causes, corrective actions and traceability make this software best in class.

### Variable data

Collect dimensional data (length, width, height, outside diameter, inside diameter weight, etc.). Supports derived features (calculations for run out, volume, true position, etc.) .

### Attribute data

Collect data from visual inspections (burrs, cracks, dents, missing holes, etc.) to determine the fitness of a part. Track failures using a go/no-go style or count the defects on a characteristic to determine if a part is defective. There is complete flexibility to study the individual characteristics and as a group.

### Engineering specifications

Attach drawings to parts, routines or individual characteristics for viewing. Most file formats are supported as an attachment (e.g. Word, PDF, CAD).

### Multimedia aids

Attach movies (AVI, MOV, MPG), sound (WAV) and images (BMP, JPG, TIF) to parts, routines or individual characteristics as instructional aides for an operator.

### Revision history

Track specification adjustments and preserve historical data.

### Mathematically derived characteristics

Full functioning real-time calculator with standard math functions including square root, exponential, trigonometric, sum, average, max, min, calculations.

### Variable collection frequency

Allows characteristics of the same routine to be measured at different intervals while maintaining appropriate prompted guided sequencing.

### Part pictures

View scanned blueprints and digital photographs at a glance. On-screen guided sequencing keeps the operator moving to the right feature.

### Data tests

Full support of Western Electric and Nelson Tests for pattern recognition in control charts (e.g. extreme point, trend, stratification, oscillation, etc.) along with various alerts for each failed test.

### Forced assignable cause

Force assignable cause tags on inspector during collection if process is out of control. Empower operator to build on existing pick list.

### Corrective action plans

Operators choose corrective action as applied to the part or process. Multiple corrective actions can be applied to any subgroup. Empower operator to build on existing corrective action list.

### Sequenced and random gage input

Flexible data input. Collect data by feature, by part or randomly. Guided sequencing minimizes inspection errors.

### Time-stamped data

All observation data is marked with the data and time from the computer clock.

### Flexible reporting

Build report templates with company logos and free form text. Select and position chart types to customer specification.

### Mixed variable/attribute data

Mix your dimensions and non-conformances in the same inspection routine. Track defects and defectives along with your dimensional data.

### Crystal Reports

Create your own customized Crystal Reports for use with part or run data.

### FDA 21CFR Part11 support

Provides support for medical and pharmaceutical manufacturers electronic records, including audit trails, e-signatures (Process Analyzer Professional only) and advanced security.

### Inspection wizard

Begin collecting data in 60 seconds with a "Quick Run" by defining features, tolerances and input method.

# MeasurLink® Real-Time

## On-line Real-Time Data Collection

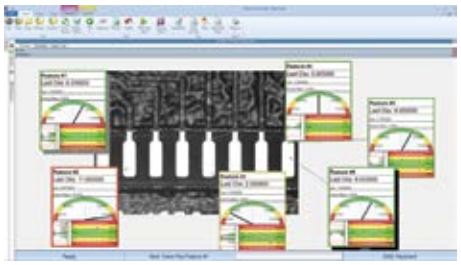
### FEATURES

MeasurLink Real-Time performs as a data acquisition clearinghouse by enabling you to connect and acquire data from virtually any measuring device. It supports the full range of metrology technology, including calipers, micrometers, indicators, CMMs, vision systems and more. Select the edition to fit the device and the needs.

### Real-Time Standard Edition

Designed for customers who want to acquire and analyze data in real-time and check variable and attribute inspection to maximize production and minimize defects. It has views to allow the user to create parts, characteristics with nominal and tolerance, and traceability lists. The data collection interface provides real-time graphics for Run charts, Control charts, Histograms and Statistics. Standard views include Datasheet (observations and charts), Classic View (chart windows), and 2D view (part images with callouts that include charts and statistical data) along with a customizable Info View and additional Manager views. Full reporting template functionality is provided.

***Supported data sources:*** *keyboard, RS232 and USB devices.*



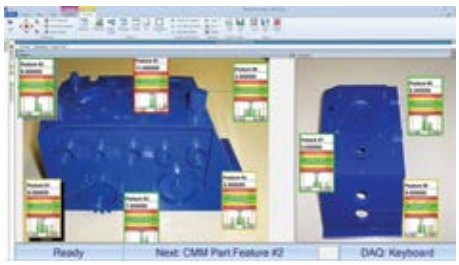
### SPECIFICATIONS

| Order No. | Description |
|---|---|
| **64AAB470** | MeasurLink 8 Real-Time Standard Edition |

### Real-Time Professional Edition

Enables customers to connect and acquire data from Mitutoyo coordinate measuring machines, vision and form measuring systems via native integration (DDE). ASCII and QMD (xml-based) file import are also supported. In addition to all of the features supported by **MeasurLink 8 Real-Time Standard Edition,** this application also supports data filters. Full reporting functionality with templates is also provided.

***Supported data sources:*** *keyboard, RS232 and USB devices, native Mitutoyo integration (DDE), ASCII and QMD (xml-based) file import.*




#### Import templates

Easily create an import template that maps data in a text file to MeasurLink information. Templates are saved to the database for everyone to use and can be added as data sources to data collection stations. An import template can be verified against the source file without adding data to the system.

#### Direct data transfer

Collect data into MeasurLink from MeasurLink enabled Mitutoyo capital equipment. This provides a tighter and more robust interface than importing data from files.

#### Filter data

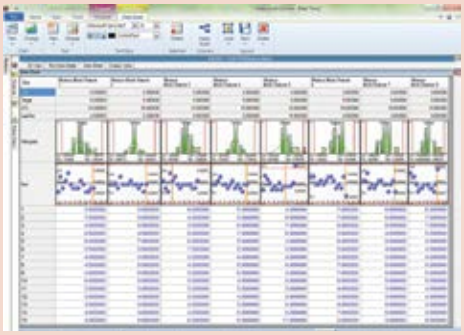
All data collected within a Real-Time run is related. Often, especially for runs containing a large volume of subgroups, requests are made for subsets of data that are further related from the entire run's population. MeasurLink provides robust filtering capabilities to comply with these requests.

#### Import data

When set up as a data source, import templates are readily available to the operator, or periodic imports can be executed.

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| **64AAB471** | MeasurLink 8 Real-Time Professional Edition |



MeasurLink is designed to detect and display patterns and provide additional statistical information. Many patterns can be seen appearing on SPC charts, including:

- Cycles
- Trends
- Freaks
- Mixtures
- Grouping or "bunching" of measurements
- Gradual change in level
- Sudden shift in level
- Instability (abnormally large fluctuations)
- Stratification (abnormally small fluctuations)
- Interactions (two or more variables acting together)
- Systematic variation
- Tendency of one chart to follow another
- Attribute data tests




Refer to Bulletin No. (2188) for more details.

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An Integrated Solution for Quality Data Management

## Real-Time Professional 3D Edition

Designed for customers who wish to collect data using the Hoops 3D graphics view, in addition to all features offered by MeasurLink 8 Real-Time Professional Edition. Hoops 3D files can be exported from most CAD systems and provides the operator with a real view of the part. Camera angle and position can be saved for each characteristic providing for an intuitive prompted guided sequencing for the inspector.

***Supported data sources:*** *keyboard, RS232, and USB devices, native Mitutoyo integration (DDE), ASCII and QMD (xml-based) file import.*





### 3D view

True three-dimensional model support with Hoops streaming files (*.HSF). Export your part's model from Catia, Solidworks or other CAD software and place callouts in the 3D space.

### Flexible callout design

Callouts provide part acceptability at a glance. You can design them the same way as for the two-dimensional view to include charts or statistical information with the ability to size any element inside the callout.

### Guided sequence

The display can automatically change during data collection to show the next or last observation point, providing a simple guided sequence for the inspection procedure. By saving a different view for each characteristic to be inspected, you can have the model rotate, pan or zoom to show the operator details of the part.

## SPECIFICATIONS

| Order No. | Description |
|---|---|
| 64AAB472 | MeasurLink 8 Real-Time Professional 3D Edition |

## Edition Definitions

| Function | Real-Time Standard Edition | Real-Time Professional Edition | Real-Time Professional 3D Edition | Process Analyzer Lite Edition | Process Analyzer Professional Edition |
|---|---|---|---|---|---|
| Classic SPC views | x | x | x | x | x |
| Datasheet | x | x | x | x | x |
| 2D View | x | x | x | x | x |
| Manager Views | x | x | x | | |
| Hoops 3D View | | | x | | |
| Filter | | x | x | | x |
| CMM/Vision/Form connectivity | | x | x | | |
| Import (ASCII) | | x | x | | |
| Audit Trails | x | x | x | x | x |
| Merge, Copy and Edit Data | | | | | x |
| Scatter Chart | | | | | x |
| Archive Data | | | | | x |
| Electronic Signatures | | | | | x |
| Summary Analysis | | | | | x |
| Test for Normality | | | | | x |

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Windows 10 Compatible | Windows 8 Compatible | Compatible with Windows 7



Mitutoyo

# MeasurLink® Process Analyzer

## Data Analysis Software for Windows

MeasurLink®
An Integrated Solution for Quality Data Management

## FEATURES

Process Analyzer is an invaluable tool for your quality team. It gives you the flexibility to analyze your processes, identify problem areas and take corrective action to improve your product's quality. Inspection runs can be sorted by inspection station, routine or part, and are displayed with the look and feel of the Windows Explorer. Inspection data can be merged, filtered, grouped, charted and printed to the user's preferences.

## Process Analyzer Lite Edition

Designed for offline viewing of real-time data in a networked environment. All views that are available in Real-Time Standard Edition are supported, with the exception of the Manager Views. Full reporting template functionality is also provided.



### Review inspection data

Analyze inspection data, view notes and traceability. Open data from different runs to compare the data and process behavior.

### Switch between databases

For larger installations that use different databases, the ability to switch the connection allows an engineer to analyze data from all sources.

### Tree control navigation

Self-organized inspection data provided in an easy to use navigation tree. Sort data by station or inspection routine, part, year, month or day.

### Reporting

Reporting is made easy through the use of a "what you see is what you get" style of template creation that allows you to pick chart and data through drag and drop with resizing. Several standard report templates are provided out of the box.

## SPECIFICATIONS

| Order No. | Description |
|---|---|
| 64AAB474 | MeasurLink 8 Process Analyzer Lite Edition |




Refer to Bulletin No. (2188) for more details.

## Process Analyzer Professional Edition

Designed for more robust manipulation of real-time data in a networked environment using advanced features not available in MeasurLink Process Analyzer Lite Edition. It enables quality engineering to slice and dice data in meaningful ways that contribute to quality control initiatives.

For larger installations that use different databases, the ability to switch the connection allows an engineer to analyze data from all sources.

### Group, Search and Sort data

View data by part, routine, station, year, month, day. Apply saved filters to data and search for specific traceability or serial number criteria.

### Merge Data

Combine lot based or just in time collected data to get a bigger picture of process variation and production quality.

### Scatter Plots

Perform correlation studies to identify process interactions.

### Summary Analysis

Use wizard to view and print a grid with capability and statistical information.

### Electronic Signatures

The e-signatures can be applied to runs only in Process Analyzer Professional. When combined with audit trails available in Real-Time, and security is implemented, then MeasurLink provides support for FDA requirements for the medical and pharmaceutical manufacturers.

### Filter Data

Robust filtering capabilities are provided. Often, for runs containing a large volume of data, requests are made for subsets of data.

### Compare Capability to Traceability

Easily view charts showing the capability of a characteristic based on the traceability, subgroup or time. Compare the capability of machines, for example. The Cpk shows green for exceeding requirements and red for failing.

Process Analyzer Professional is known as the quality manager's favorite tool. Analyze and report on data collected across all machines. For example, merge three months of data together and easily compare operators, suppliers or machines.

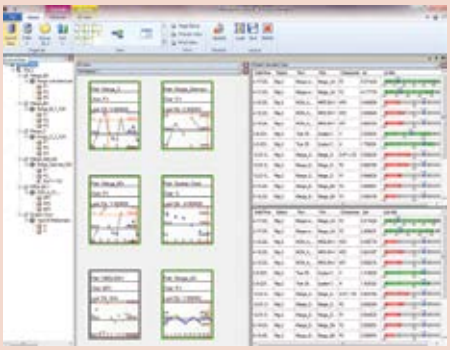


## SPECIFICATIONS

| Order No. | Description |
|---|---|
| 64AAB475 | MeasurLink 8 Process Analyzer Professional Edition |

# MeasurLink® Process Manager

## Network Monitoring Software for Windows






**Plant View** allows users the highest level view of their shop floor processes. Callouts have a meaningful border color related to tests for capability that have been enabled in each routine's properties.

### FEATURES

Real-time monitoring of data as it is collected. Provides the QC/production manager with the perfect tool to organize and maintain a shop-wide quality program at a glance.

### Process Manager Standard Edition

Process Manager provides a method to audit the entire shop floor inspection activity from a single PC. Easily see process information without walking from one inspection area to another by viewing current production across all machines. Show clients your quality operation for the entire facility.

**Log View**

Designed to display information from multiple stations in a tabular view format. The user can select the type of events to be monitored.

**Group, Search and Sort Data**

View data by part, routine, or station. Apply saved filters to data so you monitor only the data that you are responsible for.

**Manager View**

Display a snapshot window of characteristics that are currently being collected in MeasurLink Real-Time. The data can be sorted by station, capability or timestamp.

**Global Variable View**

Display process capability across all operations in your plant.

**Remote viewing**

See what the operators see and what your customers will see before product is delivered. Drill down through data to see detailed information. View traceability, assignable causes, corrective action, notes and raw data for current production across all machines.

**Ticker View**

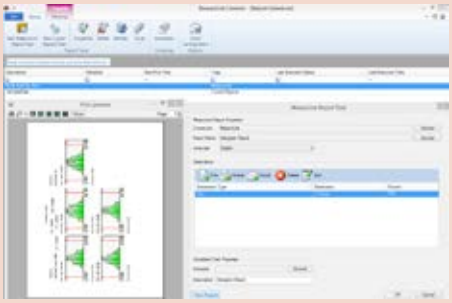
Display capability values that continuously scroll on the screen.

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| 64AAB476 | MeasurLink 8 Process Manager Standard Edition |

# MeasurLink® Report Scheduler

## Automated Report Distribution



**MeasurLink Report Scheduler** allows users to schedule Crystal Reports and MeasurLink Reports. Can be used to promote a paperless environment.

### FEATURES

Report Scheduler Standard Edition is a tool that provides automated report distribution from a Windows service environment. Create reporting tasks that will run on a given schedule.

### Report Scheduler Standard Edition

**Reporting Task Type**

Crystal Reports – Select a Crystal Reports template file and database connection to report on. Set values for parameters defined in template.

MeasurLink Reports – Select a database connection, MeasurLink report template, run or feature run data to report on, and optionally select a filter to be applied to the data.

**Destinations**

The reports can be printed, emailed, and exported in formats such as PDF. Multiple destinations can be assigned to a reporting task.

**Assign Schedule**

Schedules can be defined on hourly, daily, weekly, monthly, and yearly intervals. Define a schedule and assign it to a report task.

**View Reports**

Previewing the report allows validation of the output before scheduling the report task.

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| 64AAB538 | MeasurLink 8 Report Scheduler Standard Edition |

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Microsoft Partner
Gold Application Development

Windows 10 Compatible | Windows 8 Compatible | Compatible with Windows 7



Mitutoyo

# MeasurLink® Gage R&R

## Measurement Systems Analysis

MeasurLink®
An Integrated Solution for Quality Data Management

### FEATURES

Determines the repeatability and reproducibility, linearity, bias and stability of inspection systems, allowing you to isolate gaging problems.

### Gage R&R

Measure the capability of a measurement system for a measurement task. These techniques provide information about a measurement system's reproducibility, repeatability, location or stability. Graphical tools allow for isolation of gaging problems including inconsistencies in technique between operators or inspectors.

**Study Wizard**
User-guided study setup helps the user define the study that needs to be performed in order to determine the measurement system's capabilities. All elements required for the selected study are captured before the study is created, and the user is warned to provide any missing information before beginning the study.

**Data Input**
The data for the study can be collected directly from a gage connected to the system or transferred from Mitutoyo coordinate measuring machines, vision and form measuring systems via native integration (DDE). Users can also key in data.

**Group Studies**
All studies in the database are visible and can be organized using different criteria.

**Randomized Collection Sequence**
As recommended by the academic community, the collection sequence can be automatically randomized.

**Study Types**
MeasurLink Gage R&R uses calculation methods based on AIAG's Measurement Systems Analysis, Fourth Edition (commonly known as MSA 4). The following study types are supported:

**Location**
- Bias
- Linearity

**Reproducibility**
- Type I
- Variable Range Method

**Repeatability & Reproducibility**
- Crossed ANOVA
- Crossed Average & Range
- Nested ANOVA
- Nested Average & Range

**Stability**
- Stability

**Attribute Studies**
- Attribute MSA 4
- Attribute Short Method



In addition to the standard calculations this software also provides graphical tools for analysis of the measurement system. The Xbar and R chart can show whether there is adequate gage discrimination to record part-to-part variation in production and operator consistency. The Part-by-Appraiser plot can show a lack of consistency between operator inspection techniques.

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| 64AAB477 | MeasurLink 8 Gage R&R |

# MeasurLink® Gage Management

## Gage Inventory and Calibration Control

### FEATURES

Gage Management is essential for monitoring the calibration history of a gage. Periodic adjustments may be required to bring a gage into specification.

### Gage Management Standard Edition

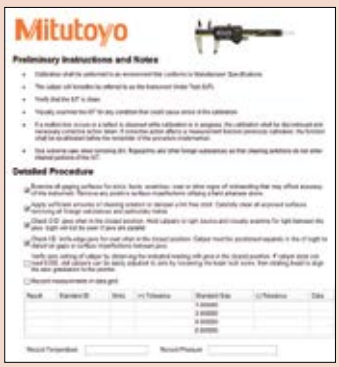
**Gage Inventory Management**
Easily enter and view details on all gages in a grid that can be grouped, filtered and sorted.

**Email List of Gages Due or Overdue**
Once the gage calibrations are scheduled, the list of gages due or overdue for calibration can be viewed as a report, and those lists are available for scheduled email notifications. Also available for gages due for Gage R&R studies (requires purchase of Gage R&R).

**Gage Calibration**
Perform and track calibrations using customizable gage calibration procedures. Also track outside calibration results. A "smart" calendar allows definition of working days.

**Gage Tracking and History**
Track gage movement as gages are transferred to various activities, locations and users. Supports vendor contact and user lists.

**Print Gage Labels**
Interface with a Brother's P-touch printer for printing labels for gages.




- Gage inventory management
- Gage calibration recall system
- Gage calibration procedure
- Assessment and reporting
- Gage vendor management
- Gage location management
- Gage R&R history

### SPECIFICATIONS

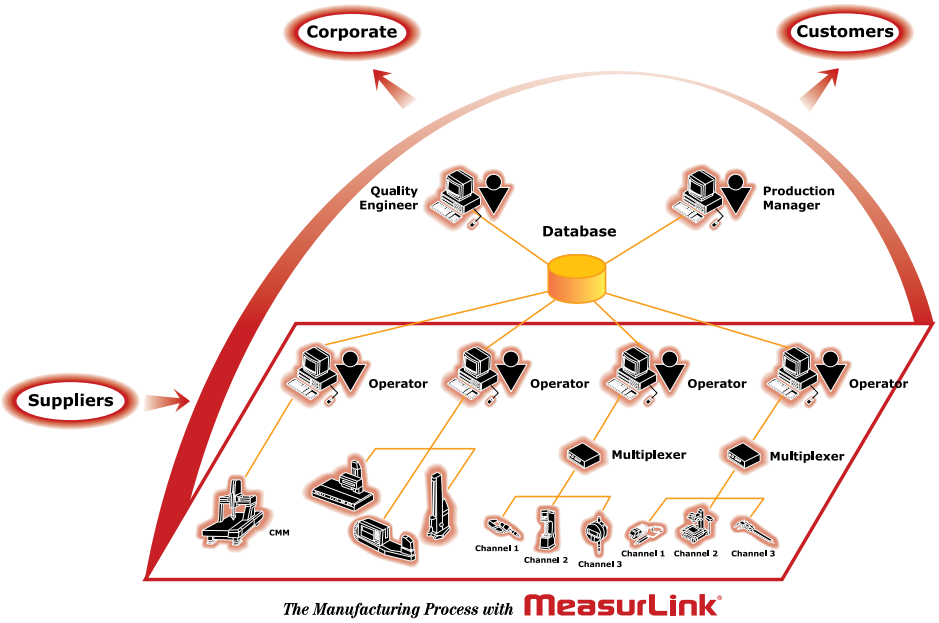
| Order No. | Description |
|---|---|
| 64AAB478 | MeasurLink 8 Gage Management |

# MeasurLink® Workgroup and Site License Packages

## Packages and Bundles

The MeasurLink suite is best acquired as a Workgroup or Site License. These packages are a mix and match bundle of any module. Workgroups are 5, 10 and 15 licenses. A site license is 30 or more licenses of MeasurLink. The package can be any combination of Real-Time*, Process Analyzer, Process Manager, Gage R&R, Gage Management and/or Report Scheduler modules. All of the stations in the installation store their data in an SQL database located on the user's network.

**Real-Time Professional 3D Edition has an additional surcharge per license.*




*The Manufacturing Process with* MeasurLink®

## MeasurLink Group Licensing

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| 64AAB479 | MeasurLink 8 Site License |

MeasurLink 8 Site License is a bundle package that provides the customer with the ability to install up to and including 30 copies (any combination) of any application in the MeasurLink 8 suite.

| Order No. | Description |
|---|---|
| 64AAB480 | MeasurLink 8 Workgroup License |

MeasurLink 8 Workgroup License is a bundle package that provides the customer with the ability to install up to and including 15 copies (any combination) of any application in the MeasurLink 8 suite.

| Order No. | Description |
|---|---|
| 64AAB482 | MeasurLink 8 Workgroup License – 10 Pack |

MeasurLink 8 Workgroup License – 10 Pack is a bundle package that provides the customer with the ability to install up to and including 10 copies (any combination) of any application in the MeasurLink 8 suite.

| Order No. | Description |
|---|---|
| 64AAB483 | MeasurLink 8 Workgroup License – 5 Pack |

MeasurLink 8 Workgroup License – 5 Pack is a bundle package that provides the customer with the ability to install up to and including 5 copies (any combination) of any application in the MeasurLink 8 suite.

| Order No. | Description |
|---|---|
| 64AAB484 | MeasurLink 8 Academic License |

MeasurLink 8 Academic License a bundle package that provides universities and technical colleges with the ability to install up to and including 20 copies (any combination) of any application in the MeasurLink 8 suite for educational purposes.

*Note: Upgrade packages are also available.*
*Please contact our sales department for details.*



**www.measurlink.com**

### Benefits include:

- Better unit cost.
- Mix and match desired modules.
- Site licenses can be shared among multiple facilities.
- Security center can manage users access with each module.
- Support Center allows users to manage the suite through the network, eliminating interruption in data collection.

# MeasurLink® Floating License

## Floating License Upgrade Option

Users who want to use MeasurLink in a terminal server environment or want to have a number of concurrent users should consider the Floating License add-on. This upgrade is available in packs of 5, 10, 15 and 30. This upgrade includes a licensing server that manages the number of licenses available.



This type of installation is common in modern IT infrastructure. Thin-Client hardware or traditional PCs can utilize this option. A user could choose to upgrade a portion of or their entire number of licenses to the Floating License upgrade option.

### Benefits include:

- Easier maintenance of installations.
- Most flexible use of modules.
- Cost-effective way to include more users without purchasing additional licenses.
- Can be added to an existing installation or integrated during the initial installation.

Microsoft Partner
Gold Application Development

Windows 10 Compatible
Windows 8 Compatible
Compatible with Windows 7

## MeasurLink Floating Option

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| 64AAB479F | MeasurLink 8 Floating License Option 30 |

MeasurLink 8 Floating License Option 30 adds the Floating Option to a new or an existing installation. Must already have a minimum of 30 licenses to add this option.

| Order No. | Description |
|---|---|
| 64AAB480F | MeasurLink 8 Floating License Option 15 |

MeasurLink 8 Floating License Option 15 adds the Floating Option to a new or an existing installation. Must already have a minimum of 15 licenses to add this option.

| Order No. | Description |
|---|---|
| 64AAB482F | MeasurLink 8 Floating License Option 10 |

MeasurLink 8 Floating License Option 10 adds the Floating Option to a new or an existing installation. Must already have a minimum of 10 licenses to add this option.

| Order No. | Description |
|---|---|
| 64AAB483F | MeasurLink 8 Floating License Option 5 |

MeasurLink 8 Floating License Option 5 adds the Floating Option to a new or an existing installation. Must already have a minimum of 5 licenses to add this option.

*Note: Upgrade packages are also available.*
*Please contact our sales department for details.*




Refer to Bulletin No. (2188) for more details.

MeasurLink® ENABLED
Data Management Software by Mitutoyo

# Input Tools

## SERIES 264 — Digimatic Gage/PC Data Input Device







### Optional Accessories

**937179T**: Foot switch
**939039**: Gage selector

SPC connecting cables refer to page A-20.



d2

**"d2" is the name for Mitutoyo Digimatic output compatible with up to 8 digits of I/O data.**

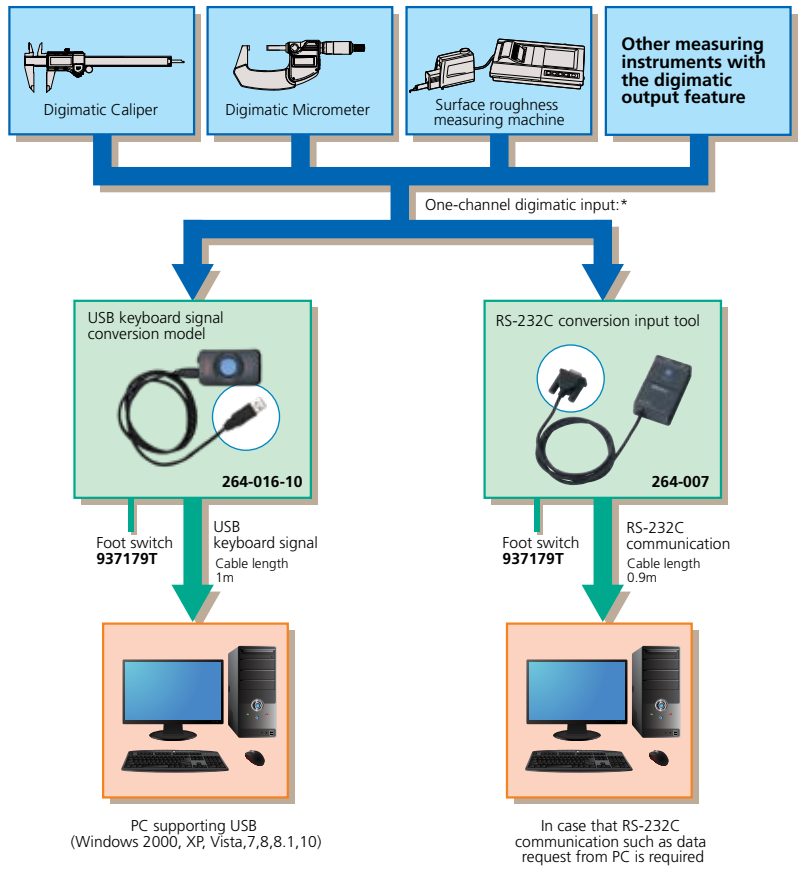
### FEATURES

- The input tool allows you to connect any Mitutoyo gage, with SPC output, directly to your PC.
- An USB keyboard signal conversion input tool, IT-016U converts measurement data to keyboard signals and directly inputs them to cells in off-the-shelf spreadsheet software such as Excel.
- An RS-232C communication input tool, IT-007R is also available to input data through RS-232C communication.
- More accurate measurement is possible using an optional foot switch.

### SPECIFICATIONS

| Product<br>**Code No.** | Input Tool for RS-232C<br>**264-007** | Input Tool for USB<br>**264-016-10** |
|---|---|---|
| Measuring Tools Required*1 | Mitutoyo Digimatic measuring tools with SPC output | |
| PC Requirement | PC Compatible,<br>(including laptops) with RS-232C Interface<br>Connects to RS-232C port on CPU<br>(D-sub 9-pin connector) | PC Compatible, (including laptops) with<br>USB 2.0 or 1.1 port |
| Outside Dimensions HxWxD | 2.8″ x 1.7″ x .9″<br>(72 x 44 x 23.5 mm) | 2.5″ x 1.5″ x .83″<br>(64 x 38 x 21 mm) |
| Mass | 3.2oz. (91g)(including cable and connector) | 2.0oz (56g) |

*1: Connecting cable (optional accessory) is required for a connection to a digimatic measuring tool.




* When you use an optional gage selector 3, you can connect up to three measuring gages and select an input by switching them. When using **264-016-10**, you can connect multiple input tools at the same time with an off-the-shelf USB hub. Simultaneous input, however, is not supported.
For cables used to connect each measuring gage and input tool, refer to page A-15.



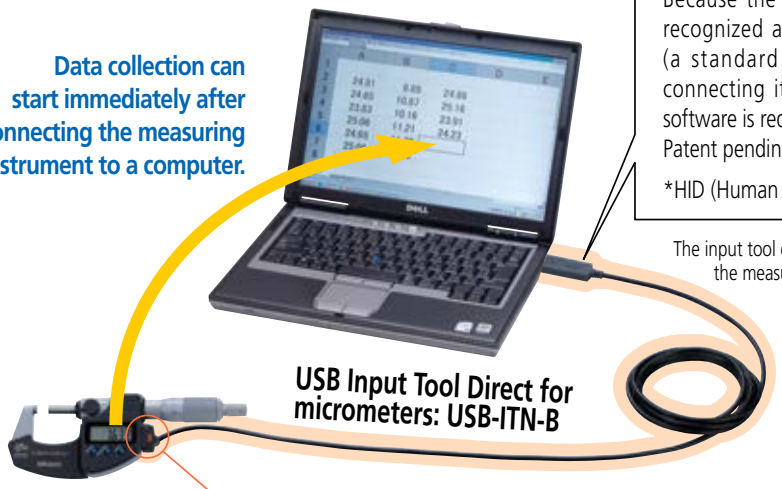
Mitutoyo

# USB Input Tool Direct: USB-ITN

**Our USB Input Tool Direct has been streamlined into a range of dedicated models for each type of measuring instrument.**

MeasurLink® ENABLED
Data Management Software by Mitutoyo

**Data collection can start immediately after connecting the measuring instrument to a computer.**



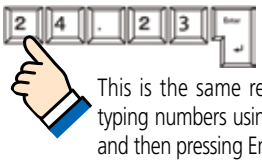

Because the input tool is automatically recognized as an *HID keyboard device (a standard Windows driver) just by connecting it to a USB port, no special software is required.
Patent pending (Japan)

*HID (Human Interface Device)

The input tool directly connects the measuring instrument to a USB port on a computer.

The values displayed on the measuring instrument can be sent to the computer just by pressing the data switch.






This is the same result as that of typing numbers using the keyboard and then pressing Enter.

### Note on using a foot switch with USB-ITN

The USB-ITPAK and USB-FSW options are required (see below).
If not using optional software the IT-016U input tool can be used with a foot switch.

Although measurement data can be simply loaded directly into an Excel spreadsheet by connecting the instrument and input tool to a computer, using the optional USB-ITPAK software enables time-saving operations and procedures that significantly improve reliability and efficiency.

d2

"d2" is the name for Mitutoyo Digimatic output compatible with up to 8 digits of I/O data.

## Measurement data collection software: USB-ITPAK 2.101 Order No. 06AFM387

This setup and data collection software is used to input data from one or more measuring instruments (connected by way of **USB-ITN**) to any Excel sheet. Supports U-Wave. (This software package cannot be used with **IT-016U**.)

**USB-ITN 2.1**



**USB dongle**

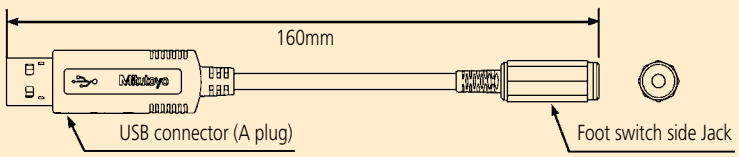


Software use requires USB dongle.

### Major features

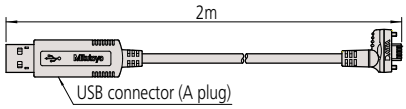
- Excel input settings: The input destination (a workbook, sheet, or cell), cell-fill direction (right or down), cell-fill interval, and other settings can be specified.
- Measurement method selection: Any of the following three methods can be selected: Sequential measurement, batch measurement, or individual measurement.
- Data input control: Data can be requested, canceled, or skipped by using mouse buttons, function keys, or foot switch.
- Character string input by the USB foot switch adapter, USB-FSW: Any previously specified character string can be input using the foot switch. Examples: *pass* or *fail*
- Number of units that can be connected (total number for both USB-ITN and USB-FSW): Up to 20 units for Windows Vista, Windows 7 and Windows 8/8.1, and up to 100 units for Windows 2000 or Windows XP.
  However, the above numbers might be less depending on the system configuration.
- Data importation time: About 0.2 to 0.3 seconds per unit. However, this value differs depending on the connected measuring instruments and measurement environment.
- Driver software: The VCP (virtual COM port) drivers for USB-ITN and USB-FSW are individually recognized using a built-in COM number. • Patent pending (Japan)

Optional:
USB-FSW
**06ADV384**



## Major specifications of USB Input Tool Direct

- Output specifications: USB 2.0 or 1.1
- Communication speed: 12 Mbps (full speed)
- Power supply: USB bus power
- Mass: 59 g
- USB 2.0 certification obtained
- Complies with the EU EMC Directive
- Illustration (Example: **USB-ITN-A**)




Note: It is recommended to use a commercially available USB hub that has USB certification.

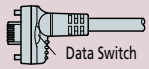
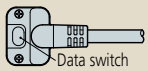
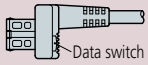
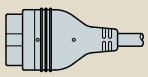
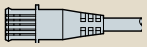
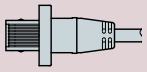
## USB-ITPAK usage environment

| | |
|---|---|
| Supported operating systems | Windows 2000 SP4, Windows XP SP2 or later, Windows Vista, Windows 7, 8 and 10 |
| Supported Excel versions | Excel 2000, 2002, 2003, 2007 and 2013 |
| Hard disk | At least 20 MB of free space (required for installation) |
| CD-ROM drive | Required for installation |
| USB ports | At least two ports (for the USB dongle and USB-ITN) |
| Resolution | At least 800 x 600 pixels, and at least 256 displayable colors |

- The natural language selected in USB-ITPAK must be the same as that used in the operating system.

## Codes for the main measuring instruments classified according to the USB Input Tool Direct code, part number, and plug type

Determine the plug type suitable for your measuring instrument (one of the seven types from **A** to **G**) in the following table, and then select the corresponding USB Input Tool Direct.

| Model | USB-ITN-A | USB-ITN-B | USB-ITN-C | USB-ITN-D | USB-ITN-E | USB-ITN-F | USB-ITN-G |
|---|---|---|---|---|---|---|---|
| Order No. | 06AFM380A | 06AFM380B | 06AFM380C | 06AFM380D | 06AFM380E | 06AFM380F | 06AFM380G |
| Whether the existence of a data switch affects usability | Incorporates a data switch, so the tool is usable regardless of whether or not the measuring instrument has a switch. | | | Does not incorporate a data switch, so an instrument fitted with a switch is required in order to use the instrument alone. (However, the tool can be used with USB-ITPAK.) | | | |
| Cable type | **A** Water-proof with switch | **B** Water-proof with switch | **C** With switch | **D** 10-pin plain | **E** 6-pin round | **F** Straight type | **G** Water-proof straight type |
| Illustration of the plug that connects to the measuring instrument |   |   |   |  |  |  |  |
| Socket type on the measuring instrument |  |  |  |  |  |  |  |
| Codes of major compatible measuring instruments | [Digimatic Caliper /Super Caliper] **-500 series CD67-S_PM CD-PMX/PM/GM -550/551 series CDC-P_PMX CDN-P_PMX** [Digimatic Carbon Fiber Caliper] **-552 series CFC-G/GL/GC/GU** [Digimatic Depth Gage] **-571 series VDS-PMX** [Digimatic Scale Unit] **-572 series SD-G** [Digimatic Exclusive Caliper] **-573 series NTD-PMX/PM**  | [Digimatic Micrometer, QuantuMike] **-293series MDC-MJ/MJB/MJT MDE-MJ** [Tubular Inside Micrometer] **-337 series IMZ-MJ -339 series IMJ-MJ** [Digimatic Micrometer Head] **-350 series MHN-MB/MJB/MJNB** [Digimatic Exclusive Micrometer] (The end of the mark is– **MJ/MJB/M/MB/PM/PMB** [Digimatic Holtest] **-468 series HTD-R**  | [Digimatic Micrometer Head] **-164 series MHD-MB** [Digimatic Caliper] **-500 series CD-CX/C/S_C - 550/ 551 CDC-C/CX, CDN-C/CX** [Digimatic Depth Gage] **-571 series VDS-DCX/DC** [Digimatic Scale Unit] **-572 series SD-D/SDV-D** [Digimatic Exclusive Caliper] **-573 series** The end of the mark is **-CX/C**  | Measuring instrument models that incorporate a data switch: [Surface Roughness Tester] **-178 series SJ-201/210/301/ 400/500** [Coating Thickness Gage] **-179 series DGE-745/755** [Linear Height] **-518 series QMH-S** [Reference Gage] **-515 series HMD-C** [Digimatic Indicator] **-543 series ID-H** [Laser Scan Micrometer] **-544 series LSM-9506/6100/ 6200/6900** [μ-checker] **Digital μ-checker** (Using the foot switch) | [Digimatic Micrometer] **-121 series BD -164 series MHD-M -227 series CLM -293 series MDQ-M MDC-M** [Tubular Inside Micrometer] **-337 series IMZ-M** [Tubular Inside Micrometer] **-339 series IMJ-M** [Digimatic Holtest] **-468 series HTD** [Reference Gage] **-515 series HME-DM** [Boremetic] **-568 series SBM-C** [Hardness Testing Machines] **-810 series HM-100/200 HV-100/HH-411 HR-500** | [Digimatic Height Gage] **-192/570/574 series HDM-A/AX, HD-A/AX HDS-H_C/C HDF-N** [Digimatic Caliper] **-500/550/551 series CD/CDC/CDN** [Digimatic Bore Gage] **-511 series CG-D** [Digimatic Indicator] **-543 seires ID-C_X/_RB/_GB** [Digimatic Depth Gage/ Digimatic Thickness Gage] **-547 series** Digimatic model (**ID-CX**) [Digimatic Carbon Fiber Caliper] **-552 series CFC-P/-L/-C/-U** [Digimatic Scale Unit] **-572 series SD-E, SDV-E SD-F, SDV-F** [Portable Hardness Testing Instruments] **-811 series HH-300** | [Digimatic Indicator] **-543 series ID-N ID-B**  |
| | | | | Measuring instrument models that do not have a data switch: [Digimatic Indicator] **-543 series ID-F** [Linear Gage/Counter] **-542 series EF-PRH/ZR, EH-P/Z/S/D EB-P/Z/D EC-D** [Litematic] **-318 series VL-A/AS/AH** | No corresponding models | [Digimatic Indicator] **-543 series ID-C/S/C_A** [Digimatic Depth Gage/ Digimatic Thickness Gage] **-547 series** Digimatic model (**ID-C**) **-575 series ID-U** | No corresponding models |

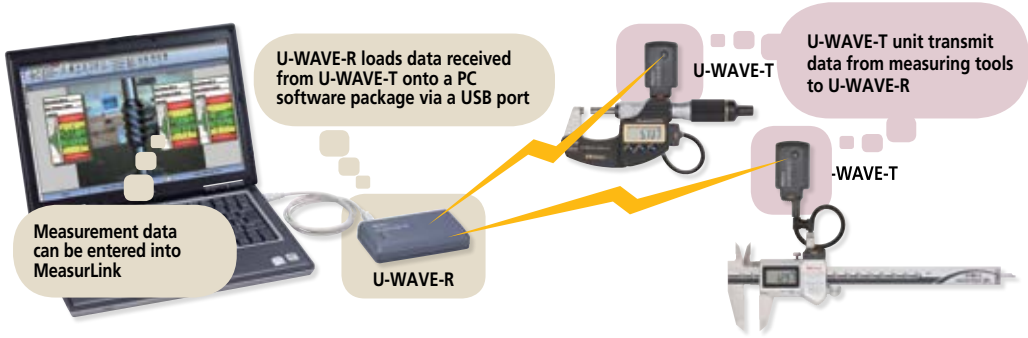


Mitutoyo

# U-WAVE

MeasurLink® ENABLED
Data Management Software by Mitutoyo

## Measurement Data Wireless Communication System




The **U-WAVE** system enables easy wireless data communication from a measuring tool to a PC using the digimatic protocol. Measurement efficiency is improved by eliminating the long and cumbersome data cables. The user-friendly interface allows data to be loaded into any software product that accepts keyboard input, such as Excel* or Notepad.

### 1 U-WAVE-R · Registered Design (Japan)

**Major Specifications of U-WAVE-R**

| Model | **U-WAVE-R** |
|---|---|
| Order No. | **02AZD810D*** |
| Power supply | USB bus power system |
| Number of **U-WAVE-R** units that can be connected to one PC | Up to 15 |
| Number of **U-WAVE-T** units that can be connected | Up to 100 |
| External dimensions | 5.51″ x 3.15″ x 1.24″ (140 x 80 x 31.6mm) |
| Mass | .29 lbs (130g) |



*Detailed information on conformity standards of wireless communication specification is given below.

### 2 U-WAVE-T · Registered Design (Japan)

**U-WAVE-T** sends measurement data to **U-WAVE-R**.

**Actual size**



Standard accessory: screwdriver

**Major specifications of U-WAVE-T**

| Model | **U-WAVE-T** (IP67 model) | **U-WAVE-T** (Buzzer) |
|---|---|---|
| Order No. | **02AZD730G*** | **02AZD880G*** |
| Protection Rating | IP67 | – |
| Data reception indication | LEDs | LEDs and Buzzer |
| Power supply | Lithium battery CR2032✳1 | |
| Battery life | Approx. 400,000 transmissions | |
| External dimensions | 1.73″ x 1.17″ x .73″ (44 x 29.6 x 18.5 mm) | |
| Mass | .05 lbs (23g) | |

*Detailed information on conformity standards of wireless communication specification is given below.

### Installation Bracket Kit

Order No. 02AZE200



(optional)

d2

"d2" is the name for Mitutoyo Digimatic output compatible with up to 8 digits of I/O data.



500 Series Caliper



293 Series Micrometer

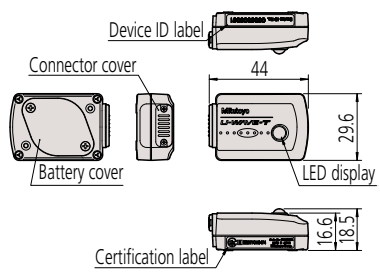


543 Series Indicator

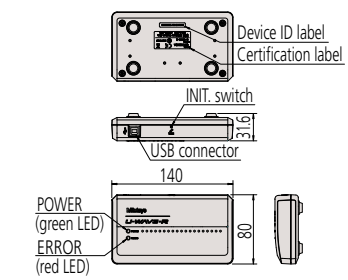
### Dimensions of Each Part

Unit: mm

**U-WAVE-T**




**U-WAVE-R**




### Specifications of wireless communication

| | | | |
|---|---|---|---|
| Conformity standards | ·European conformity standards*<br>EN 50371:2002<br>EN 300 440-1 V1.3.1<br>EN 300 440-2 V1.1.2<br>EN 301 489-01 V1.6.1<br>EN 301 489-03 V1.4.1<br>·U.S.A. conformity standards<br>47 CFR Part 15.247:(Subpart :C)<br>47 CFR Part 15,(Subpart :B)<br>·Canada conformity standards<br>RSS-210 (Issue 7)<br>RSS-Gen (Issue 2)<br>ICES 003 (Issue 4) | Wireless standards | Conform to IEEE802.15.4 |
| | | Wireless communication distance | Approx. 60ft (within visible range) |
| | | Wireless communication speed | 250 kbps |
| | | Transmission output | 1 mW (0 dBm) or less |
| | | Modulation method | DS-SS (direct sequence spread spectrum)<br>Resistant to interfering signal or noise. |
| | | Communication frequency | 2.4 GHz band<br>(ISM band: universal frequency) |
| | | Used band | 15 channels<br>(2.405 to 2.475GHz at intervals of 5MHz)<br>The noise search function can avoid interference with other communication devices. |

Note: In accordance with wireless regulations the use of this product is permitted in Japan, Europe (a total of 32 countries including 27 EU members, 4 EFTA members and Turkey), U.S.A. and Canada. This product must not be used in other countries or areas.
· This product is not compatible with the conventional Mu-WAVE, for which communication specifications are different.
* Japan conformity standards: ARIB STD-T66

# U-WAVE

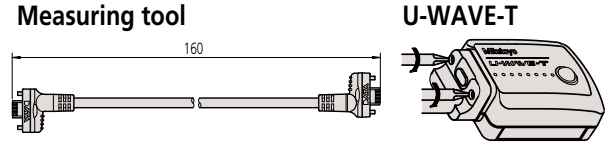
MeasurLink® ENABLED
Data Management Software by Mitutoyo

## Measurement Data Wireless Communication System

### List of U-WAVE-T Connecting Cables

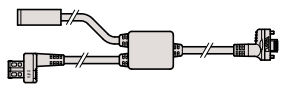
Select one from cables **A** to **G**, referring to the part number of connecting cable for wired connection in your measuring tool catalog or manual. If you are unsure which cable is appropriate, check the cable connectors, the shapes of terminal on the measuring tool side, or the codes of compatible measuring tool for cables **A** to **G** below.
It is not possible to connect to EF and EH counters.

From seven types of cables (**A** to **G** ), select one compatible with your measuring tool.



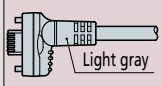
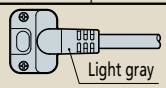
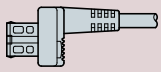
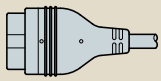
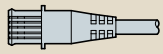
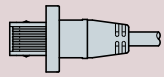

**When connected with U-WAVE-T** Select one of the USB input tool direct from table below to fit the connector (A to G) and also select either standard type (fig.1) or foot switch type (fig.2) dependent on usage.
Note: Not connectable to these Mitutoyo products: Litematic VL, Linear Gage Counter EF/EH, Surftest SJ-500.


Fig.1 Standard type connecting cable


Fig.2 Connecting cable for foot switch

| Reference Order No. of connecting cable | | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| | 1m | 05CZA624 | 05CZA662 | 959149 | 936937 | 937387 | 905338 | 21EAA194 |
| | 2m | 05CZA625 | 05CZA663 | 959150 | 965014 | 965013 | 905409 | 21EAA190 |

| | | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|
| For standard | Order No. | 02AZD790A | 02AZD790B | 02AZD790C | 02AZD790D | 02AZD790E | 02AZD790F | 02AZD790G |
| For foot switch | Order No. | 02AZE140A | 02AZE140B | 02AZE140C | 02AZE140D | 02AZE140E | 02AZE140F | 02AZE140G |

| Cable type | **A** Water-proof model with output button | **B** Water-proof model with output button | **C** With data-out button type | **D** 10-pin plain type | **E** 6-pin round | **F** Plain type straight | **G** Plain type straight water-proof model |
|---|---|---|---|---|---|---|---|
| Connector shape on the measuring tool side |  Light gray |  Light gray |  |  |  |  |  |
| Socket shape on the measuring tool |  |  |  |  |  |  |  |
| Codes of major compatible measuring tools and instruments | [Digimatic Caliper]<br>**CD67-S_PM**<br>**CD-PMX**<br>**CD-PM/GM**<br>**CDC-P_PMX**<br>**CDN-P_PMX**<br>**CFC-G/GL/GC/GU**<br>[Digimatic Caliper]<br>**NTD-PMX**<br>[Digimatic Depth Gage]<br>**VDS-PMX**<br>[Digital Scale and DRO Systems]<br>**SD-G** | [Digimatic Micrometer]<br>**MDE-MJ**<br>**MDC-MJ/MJT**<br>[Digimatic Micrometer]<br>The code suffix is -MJ.<br>**BLM-M**<br>**OMV-M**<br>**OMP-M**<br>**PDM-M**<br>**IMP-M**<br>**VM-M**<br>[Digimatic Micrometer Heads]<br>**MHN-M/MJ/MJN**<br>[Digimatic Holtest]<br>**HTD-R**<br>[Digimatic Depth Gage]<br>**DMC-M** | [Digimatic Caliper]<br>**CD-CX/-C**<br>**CD-S_C**<br>**CDC-CX/C**<br>**CDN-CX/C**<br>[Digimatic Caliper]<br>**NTD-CX/C**<br>[Digimatic Depth Gage]<br>**VDS-DCX**<br>[Digital Scale and DRO Systems]<br>**SD-D, SDV-D** | [Digimatic Indicator]<br>**ID-H/F**<br>[Linear Height]<br>**QMH-S**<br>[Linear Gage/Counter]<br>**EB,EC-D**<br>[µ-checker]<br>**Digital µ-checker**<br>[Laser Scan Micrometer]<br>**LSM-9506**<br>[Reference Gage]<br>**HDM-C**<br>[Coating Thickness Gage]<br>**DGE-745/755**<br>[Form Measurement]<br>**SJ-201/301/401** | [Digimatic Micrometer]<br>**MDQ-M**<br>**MDC-M**<br>**CLM1-QM/DK**<br>**PDM-QM**<br>**PMU-DM**<br>**BD-M**<br>[Digimatic Holtest]<br>**HTD**<br>[Reference Gage]<br>**HDM-DM**<br>[Hardness Testing Machines]<br>**HM-100/200**<br>**HV-100**<br>**HR-500**<br>**HH-411** | [Digimatic Caliper]<br>**CD, CFC-P/-L/-C/-U**<br>[Digimatic Height Gages]<br>**HD-AX, HDM-AX**<br>**HDS-H_C/-C**<br>**HDM-A**<br>**HDF-N**<br>[Digimatic Indicator]<br>**ID-C/_RB/_A/_GB**<br>**ID-S/U**<br>[Digimatic Depth Gage]<br>**Digimatic model (ID-C)**<br>[Digital Scale and DRO Systems]<br>**SD-E, SDV-E**<br>**SD-F, SDV-F**<br>[Portable Hardness Testing Instruments]<br>**HH-300** | [Digimatic Indicator]<br>**ID-N**<br>**ID-B** |

### Note on Wireless Communication Environment

Although the communication range for **U-WAVE** is approximately 60 ft. line-of-sight, performance may be affected by obstacles or environmental factors.

| Item | Contents |
|---|---|
| Concrete wall | Communication is not possible in a completely enclosed room. |
| Metal partition | Communication speed may drop or communication may be interrupted. |
| Wireless LAN, communication device such as ZigBee Bluetooth, and microwave oven | Communication speed may drop or communication may be interrupted. Maintain the set frequency and installation distance if at all possible. |
| Medical instrument | Do not use this product near a medical instrument such as a laser knife or electronic scale. |

**Cautions**

- **Safety caution:** Do not use this device near medical equipment that might malfunction due to radio interference.
- **Caution on radio law:** This device is certified as a 2.4 GHz band wide-band low-power data communication system based on the radio regulations in Japan, Europe, U.S.A. and Canada. It is prohibited by law to disassemble or modify this device or peel off the certification label from it.

d2

*"d2" is the name for Mitutoyo Digimatic output compatible with up to 8 digits of I/O data.



Mitutoyo

# U-Wave Fit

## SERIES 264 — Wireless Data Transmitter

MeasurLink® ENABLED
Data Management Software by Mitutoyo

U-WAVE fit

### FEATURES

- The transmitter is designed to fit in the space behind the display, and the connecting cable has been replaced by a rigid connector
- Approx. 20 m transmission range (within visible range)
- 2.4GHz wireless system for reliable and secure data transmission
- Easy data export to Microsoft® Excel® or SPC software applications
- Transmitter confirms data transfer by an LED signal and optional buzzer
- An IP67 transmitter is available to ensure a coolant-proof gaging system
- Low power consumption: 400,000 data transmissions with a single battery


IP65 Micrometer with
U-WAVE-TM (buzzer type) and connection unit




For micrometers
**U-WAVE-TM**

### SPECIFICATIONS

| | |
|---|---|
| Wireless communication protocol | IEEE 802. 15. 4 |
| Modulation method | DS-SS (Direct Sequence Spread Spectrum) |
| Communication distance | Approx. 20 m (within visible range) |
| Communication speed | 250 kbps |
| Communication frequency | 2.4 GHz (ISM: universal frequency band) |
| User band | 15 channels (2.405 to 2.475GHz at intervals of 5 MHz) |
| OS compatibility | Windows® 2000 Professional (≥SP4), Windows® XP Professional (≥SP2), Windows® XP Home Edition (≥SP2), Windows Vista®, Windows® 7 (32bit, 64bit), Windows® 8, 8.1, 10 (32bit, 64bit) |


**264-620**


**264-621**


**264-622**


**264-623**


**02AZF310**


**02AZF300**


Standard caliper with
U-WAVE-TC (buzzer type) and connection unit




For calipers
**U-WAVE-TC**

### U-WAVE-T (Transmitter)

| Order No. | Model | Measuring Instrument | Remarks | Data reception indication |
|---|---|---|---|---|
| **264-620** | U-WAVE-TC | 4", 6", 8", 12", IP67 caliper/standard caliper | IP67 type | LED |
| **264-621** | U-WAVE-TC | 4", 6", 8", 12", IP67 caliper/standard caliper | Buzzer type | Buzzer/LED |
| **264-622** | U-WAVE-TM | COOLANT-PROOF (IP65) micrometer | IP67 type | LED |
| **264-623** | U-WAVE-TM | COOLANT-PROOF (IP65) micrometer | Buzzer type | Buzzer/LED |
| **02AZF310*** | Connection unit | IP67 caliper/COOLANT-PROOF (IP65) micrometer | Waterproof type | – |
| **02AZF300*** | Connection unit | Standard caliper | Standard type | – |

*A connection unit is required when ordering a transmitter


**02AZD810D**

### U-WAVE-R (Receiver)

| Order No. | Remarks | Software | Number of U-WAVE-R units that can be connected to PC | Number of U-WAVE-T units that can be connected | USB cable length [m] | Dimensions (WxDxH) [mm] | Mass [g] |
|---|---|---|---|---|---|---|---|
| **02AZD810D** | U-WAVE-R + software | U-WAVE PAK | Up to 16 | Up to 100 | 1 | 140 x 80 x 31.6 | 130 |

d2

**"d2" is the name for Mitutoyo Digimatic output compatible with up to 8 digits of I/O data.**

MeasurLink® ENABLED
Data Management Software by Mitutoyo

# Multiplexers – MIG-8USB, MIG-4USB

## SERIES 982 — Digimatic/RS-232C Interface Unit

### Technical Data
Data output: Via RS-232C interface / USB

**Default Configuration**
Data length: 8 bits
Start bit: 1 bit
Stop bit: 1 bit
Parity check: None
Baud rate: 9600

### Standard Accessory
**06AEG302JA**: AC Adapter
RS232C: Cable (1.5m / 5ft)
USB Cable

### Optional Accessories
**937179T**: Foot switch

## FEATURES
- A measurement data transfer device, multiplexer MIG-8USB and MIG-4USB converts digimatic output measurement data to RS-232C or USB-HID and outputs it to an external device such as PC.
- Up to eight/four measuring instruments with the digimatic output feature can be connected.
- Units can be daisy-chained to meet any size needs.
- MIG-4USB includes toggle switch for each input.

**MIG-8USB**



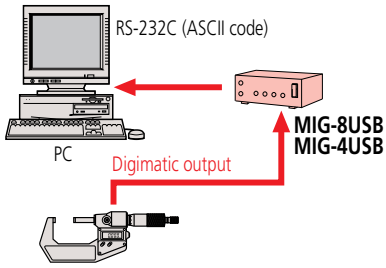

**64AAB386**
**Front view**

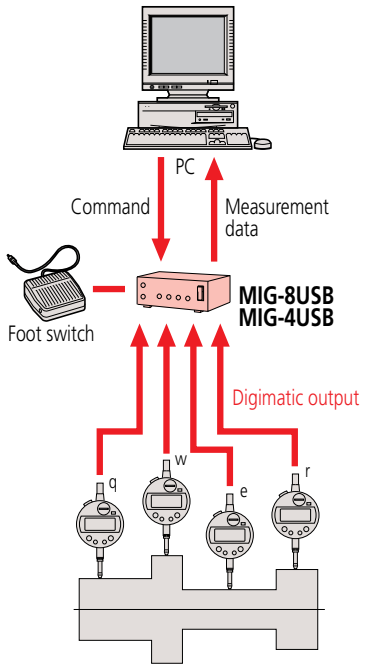



**64AAB386**
**Back view**

## SPECIFICATIONS

| Model No. | MIG-8USB | MIG-4USB |
|---|---|---|
| **Order No.** | **64AAB386** | **64AAB387** |
| Gage Capacity | 8 | 4 |
| Dimension (mm) W x D x H | 146 x 150 x 70 | 146 x 150 x 45 |
| Mass (g) | 710 | 540 |





Mitutoyo

# Gage Selector 3

## 3-channel Switching Box for Data Transmission

### FEATURES

- Thee digimatic gages can be connected.
- You can specify the gage which outputs the data with the channel switch.

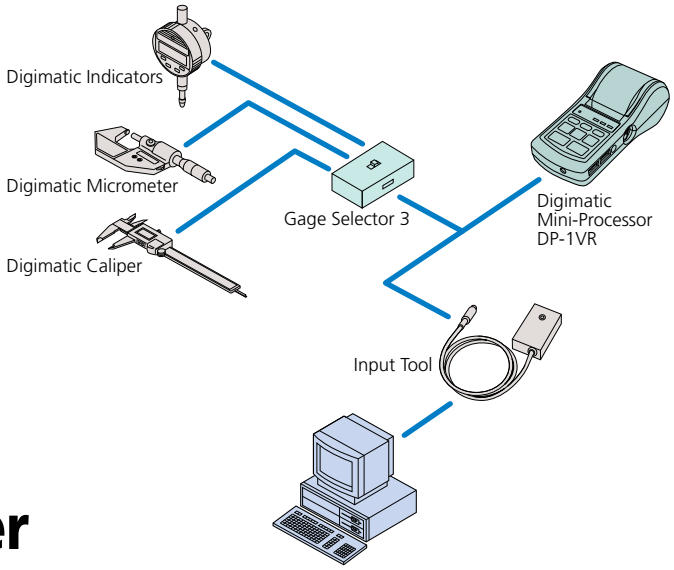



939039

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| **939039**: | Gage Selector 3 |

**Examples of Connections**




### Technical Data

Connection: Up to three gages
Signal: Digimatic code format
Connection: Bidirectional
External dimensions (W x D x H): 100 x 70 x 33mm

# EC Counter

## SERIES 542 — Assembly-type Display Unit

### FEATURES

- Compact panel mounting type and DIN size. It can be easily incorporated into each system.

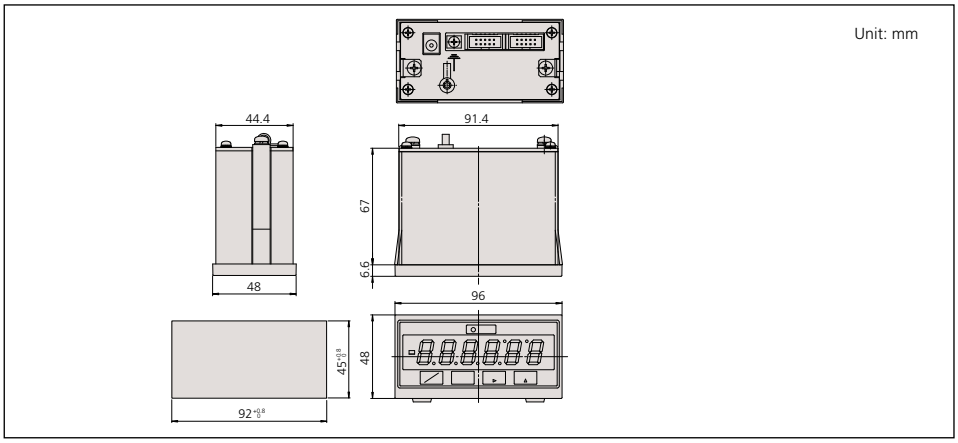



542-007A

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| **542-007A** | EC Counter |

### DIMENSIONS




### Technical Data

Applicable gage: LGD, LGS, All SPC output gages
Resolution: .00005"/.0001"/0.001mm,
.0005"/.001"/0.01mm
No. of gage input: 1
Display: 6-digit LED and a negative [-] sign
Function: Preset
Go-no-go judgment
Output (open-collector): 3-step limit signal, Normal signal
External control: Preset, Data hold
Power supply: Via AC adaptor
Dimensions (W x D x H): 96 x 48 x 84.6mm
Mass: 50g

### Standard Accessory

**06AEG302JA:** AC Adapter

# DP-1VA

## SERIES 264 — Digimatic Mini-Processor




USB connection allows collected data to be easily transferred from the DP-1VA to the PC. The output is HID or VCP so data can be sent directly to Excel or data collection software such as IT-Pak or MeasurLink.



Digimatic 2 function allows the high resolution of the gage to be output in its entirety in metric or inch.

### Standard Accessory

**06AEG302JA:** AC Adapter

### Optional Accessories

**09EAA084***: RS-232C changing cable (1m, 9pin)
**965516***: GO/±NG judgment cable
**937179T**: Foot switch
**09EAA082**: (10 rolls)

*It is impossible to use the both RS-232C cable and GO/±NG judgment cable at the same time.

■ USB cable (A-microB) (optional) 06AFZ050



■ Foot switch (optional) 937179T



**"d2" is the name for Mitutoyo Digimatic output compatible with up to 8 digits of I/O data.**

### DP-1VA Data Collection

- A gage with SPC output is connected to the DP-1VA with an SPC cable.
- The data for each part measured is printed or sent directly to a PC through a USB cable.
- This data can be triggered by the button on the gage, cable or the DP-1VA. The footswitch can also be used.

**Data Logger:**

– Data can be stored internally, printed and/or sent to a PC as it is measured or after all data has been collected
– Up to 1,000 measurements can be stored.

**Timer:**

– Data collection can be triggered by a timer function. The DP-1VA can collect data unattended to measure changes over time.

**Tolerance and SPC:**

– Tolerances can be set in the unit and statistics can be calculated and printed directly from the DP-1VA.
– No additional software is required.






**264-505A**

### SPECIFICATIONS

| Order No. | 264-505A |
|---|---|
| Data input | Digimatic, Digimatic 2, RS-232C input (for KA Counter Only) |
| Printing method | Thermal Line Printer |
| Character specifications | Total dot number: 384 dots/line |
| | Dot size: 8 dots/mm |
| | Normal font: 24 x 16 dots |
| | Large font: 36 x 24 dots |
| Print speed | 0.8 s/line when using AC adapter |
| Print capacity | 7,000 lines/roll with Large font |
| | 10,000 lines/roll with Normal font |
| Print data | Measuring data, go/±no go, number of data, maximum minimum value, range, average, standard deviation, number of defective, function defective, process capability index, histogram, D-chart, control chart generation for X-bar and central limit data, data and time |
| Printer paper | High durability thermal paper. (one roll included) |
| | Width: 58mm. Roll length: 48m |
| Power supply | 100 V 50/60 Hz AC adapter (6 V, 2 A) |
| | AA alkaline batteries x4 (not included) |
| Battery life | About 10,000 lines at 20 C |
| Data processing capability | Mode 0: 100,000 data entries |
| | Mode 1: 9,999 data entries |
| | Mode 3: sample size 10 x subgroup 9,999 = |
| | Total number of data entries: 99,990 |
| Tolerance judgement | 5 sets |
| Logging of measurement data | Max 1,000 points |
| Timer input | 0.25 s, 1 s, 5 s, 30 s, 1 min, 30 min, 60 min |
| Data Output | USB Output |
| | RS-232C output at TTL level |
| | Tolerance judgment result output (-NG, GO, +NG) |
| Clock precision | +/-2 min max/month |
| Internal battery life | 10 years |
| Operating temperature range | 0 C to 45 C with AC adapter |
| | 10 C to 45 C with batteries |
| External Dimensions | 94mm x 201mm x 75mm |

# SPC Connecting Cables

- These cables are used to output measurement data from the digimatic gage with the output feature to the digimatic mini processor, digimatic display unit, multiplexer or other device.
- Cables of one or two meters are available.
- Note that the shape of connector differs depending on the model.

**Input plug to Data Processor**



| Order No. | Applicable gages |
|---|---|
| Straight type<br>  <br>**905338**: 1m (40")<br>**905409**: 2m (80") | **All CALIPERS WITHOUT ABSOLUTE ENCODER**<br>Height Gage **570-2XX, 192-6XX, 192-67X**<br>Indicators **575-XXX, 543-6XX, 543-2XX, 543-4XX**<br>Depth Gages **547-21X, 547-25X, 571-2XX**<br>Scale Unit **572-XXX**<br>Thickness Gages **547-3XX, 547-4XX** |
| Back type<br>  <br>**905689**: 1m (40")<br>**905690**: 2m (80") | |
| Right type<br>  <br>**905691**: 1m (40")<br>**905692**: 2m (80") | |
| Left type<br>  <br>**905693**: 1m (40")<br>**905694**: 2m (80") | |
| With data out switch type<br>  <br>**959149**: 1m (40")<br>**959150**: 2m (80")<br>**04AZB512**: 1m (40") L-Type<br>**04AZB513**: 2m (80") L-Type | **ALL DIGIMATIC CALIPERS WITH ABSOLUTE ENCODER**<br>Height Gage **570-2XX**<br>Depth Gages **571-2XX**<br>Scale Unit **572-XXX**<br>Micrometers over 12"/300mm |
| With data out switch type<br>  <br>**05CZA624**: 1m (40")<br>**05CZA625**: 2m (80") | Coolant-Proof Caliper<br>**500-68X, 500-76X, 500-78X.**<br>Coolant-Proof Digimatic scale units<br>**572-61X.** |
| With data out switch type<br>  <br>**05CZA662**: 1m (40")<br>**05CZA663**: 2m (80") | **Digimatic Micrometer IP65** |
| 6 pins type<br>  <br>**937387**: 1m (40")<br>**965013**: 2m (80") | **ALL MICROMETERS (not for IP65 mics)**<br>Indicators **543-11X, 543-13X, 543-14X, 543-18X, 543-17X**<br>Holtest **468-2XX, 468-9XX**<br>Micrometer Head **164-162, 164-172, 350-71X, 329-71X**<br>Borematics **568-XXX**<br>Others Mikematic, Quickmike<br>Bench Mike **121-XXX** |
| 10 pins type<br>  <br>**936937**: 1m (40")<br>**965014**: 2m (80") | Indicators **543-5XX**<br>MU-Checkers **519-4XX, 519-621A**<br>MU-Gages **179-204, 179-205, 179-206**<br>Display **542-022-5A, 542-032-5A, 542-036-5A**<br>Display **572-011A, 572-031A**<br>Linear Height **518-3XX**<br>Litematic **318-2XX**<br>Heightmatic **57X SERIES**.<br>Digi Derm **179-7XX**<br>Hardness Tester (**Micro Hardness Type**) |
| Flat straight type<br>  <br>**21EAA194:** SPC cable (40" / 1m)<br>**21EAA190**: SPC cable (80" / 2m) | ID-N/ID-B coolant proof digimatic Indicators |






**Micrometers**



**Micrometer Heads**



**MDC Micrometer**



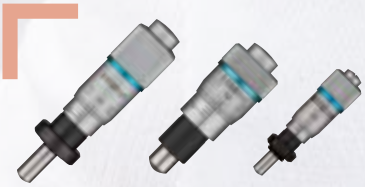
**MDH Micrometer**



**QuantuMike**



**Digimatic Outside Micrometer**



**Micrometer Heads**
fine spindle feed

## INDEX


| | |
|---|---|
| **Micrometers** | |
| Coolant-Proof Micrometer | B-2,3 |
| Digimatic Micrometer | B-4 |
| Digimatic Micrometer- MDC- Lite | B-4 |
| MDH Micrometer | B-5 |
| QuantuMike | B-6 |
| ABSOLUTE Digimatic Micrometers | B-7 |
| Quickmike | B-8 |
| Outside Micrometers | B-9, 11-19 |
| Ratchet-Thimble Micrometer | B-10 |
| Spline Micrometers | B-20 |
| Point Micrometers | B-21 |
| Crimp Height Micrometers | B-22 |
| V-Anvil Micrometers | B-23,24 |
| Limit Micrometers | B-25 |
| Pana Micrometers | B-26 |
| Spherical Face Micrometers | B-27 |
| Tube Micrometers | B-28 |
| Uni-Mike | B-29 |
| Uni-Mike | B-29 |
| Sheet Metal Micrometers | B-30 |
| Blade Micrometers | B-31 |
| Disk Micrometers | B-32,34-35 |
| Paper Thickness Micrometers | B-33 |
| Gear-Tooth Micrometers | B-36 |
| Screw Thread Micrometers | B-37,38 |
| 3-Wire Thread Measuring System | B-39 |
| Can Seam Micrometers | B-40 |
| Hub Micrometers | B-41 |
| Wire Micrometers | B-41 |
| Digital Outside Micrometers | B-42 |
| Indicating Micrometers | B-43 |
| Snap Meters | B-43 |
| Dial Snap Meters | B-44 |
| Caliper-Type Micrometers | B-45 |
| Groove Micrometers | B-46 |
| Small-Hole Gage Set | B-47 |
| Telescoping Gage Set | B-47 |
| Micrometer Stands | B-48 |
| Color Ratchet & Color Speeder | B-49 |
| Spindle Attachment Tip | B-49 |
| Micrometer Oil | B-49 |
| Optical Parallels | B-50 |
| Optical Flats | B-50 |
| Micrometer Standards | B-51 |
| Standards for Screw Thread Micrometers | B-52 |
| Standards for V-Anvil Micrometers | B-52 |
| Tool Kits | B-53,54 |
| **Micrometer Heads** | |
| Micrometer Head Selection Guide | B-55 |
| Digimatic Micrometer Heads | B-56,57 |
| Micrometer Heads | B-58-72 |
| Micro Jack | B-72 |
| Precision Lead Screw | B-73 |
| Fixtures for Micrometer Heads and Linear Gages | B-74,75 |
| Quick Guide to Precision Measuring Instruments | B-76 |
| Micro Jack | B-72 |
| Precision Lead Screw | B-73 |
| Fixtures for Micrometer Heads | B-74,75 |




Mitutoyo

# Coolant-proof Micrometer

## SERIES 293 — with Dust/Water Protection Conforming to IP65 Level

### FEATURES

- IP65 protection level, enabling use in environments exposed to cutting oil, etc*.
  *Anti-corrosion treatment is required after use.
- Measurement data output function is available with a water-resistant connection cable.
- Auto power ON/OFF function.
- A nonslip surface is employed for the frame cover and surface panel to achieve stable handheld measurement.
- Certificate of inspection* is included. (2" /50mm or less range models)**
  *It is not the type used to obtain calibration certificates.
  ** except 293-349-30
- With a standard bar except for 0-1"/0-25mm model.
- Supplied in fitted case. Plastic case up to 6"/150mm, wooden box over 6"/150mm.






293-330-30



293-252-30






Certificate of inspection

### Technical Data

Accuracy: Refer to the list of specifications.
Resolution: .00005"/0.001mm or 0.001mm (up to 4" models)
.0001" / 0.001mm (over 4" models)
Flatness: .000012"/0.3µm
Parallelism: .00004"/1µm for models up to 2"/50mm
.00008"/2µm for models up to 4"/100mm
.00012"/3µm for models up to 7"/175mm
.00016"/4µm for models up to 11"/275mm
.0002"/5µm for models over 12"/300mm
Measuring faces: Carbide tipped
Display: LCD
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 2.4 years under normal use
Dust/Water protection level: IP65

### Function

Origin-set, Zero / ABS, Hold, Auto power on/off,
Data output (output models),
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA662**: SPC cable with data switch (40"/1m)
**05CZA663**: SPC cable with data switch (80"/2m)



Oil-resistant materials are used in all plastic components.



Measurement data output function is available with a water-resistant connection cable.



SPC cable with data switch

## SPECIFICATIONS

**Metric** With ratchet stop

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.001mm | **293-230-30 / 293-240-30*** | ±1µm |
| 25 - 50mm | 0.001mm | **293-231-30 / 293-241-30*** | ±1µm |
| 50 - 75mm | 0.001mm | **293-232-30 / 293-242-30*** | ±1µm |
| 75 - 100mm | 0.001mm | **293-233-30 / 293-243-30*** | ±2µm |
| 100 - 125mm | 0.001mm | **293-250-30** | ±2µm |
| 125 - 150mm | 0.001mm | **293-251-30** | ±2µm |
| 150 - 175mm | 0.001mm | **293-252-30** | ±3µm |
| 175 - 200mm | 0.001mm | **293-253-30** | ±3µm |
| 200 - 225mm | 0.001mm | **293-254-30** | ±3µm |
| 225 - 250mm | 0.001mm | **293-255-30** | ±4µm |
| 250 - 275mm | 0.001mm | **293-256-30** | ±4µm |
| 275 - 300mm | 0.001mm | **293-257-30** | ±4µm |

*without SPC data output

**Metric** With ratchet thimble

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.001mm | **293-234-30 / 293-244-30*** | ±1µm |
| 25 - 50mm | 0.001mm | **293-235-30 / 293-245-30*** | ±1µm |
| 50 - 75mm | 0.001mm | **293-236-30 / 293-246-30*** | ±1µm |
| 75 - 100mm | 0.001mm | **293-237-30 / 293-247-30*** | ±2µm |

*without SPC data output

**Metric** Micrometer Set

| Range | Order No. | Included in set |
|---|---|---|
| 0-50mm (2pcs. Set) | **293-966-30** | 293-230-30, 293-231-30, 25mm CERA block, plastic case |
| 0-75mm (3pcs. Set) | **293-962-30** | 293-230-30, 293-231-30, 293-232-30, 2 standard bars, plastic case |
| 0-100mm (4pcs. Set) | **293-963-30** | 293-230-30, 293-231-30, 293-232-30, 293-233-30, 3 standard bars, wooden box |

**Inch/Metric** With ratchet stop

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005"/0.001mm | **293-330-30 / 293-340-30*** | ±.00005" |
| 1" - 2" / 25.4 - 50.8mm | .00005"/0.001mm | **293-331-30 / 293-341-30*** | ±.00005" |
| 2" - 3" / 50.8 - 76.2mm | .00005"/0.001mm | **293-332-30 / 293-342-30*** | ±.00005" |
| 3" - 4" / 76.2 - 101.6mm | .00005"/0.001mm | **293-333-30 / 293-343-30*** | ±.0001" |
| 4" - 5" / 101.6 - 127.0mm | .0001"/0.001mm | **293-350-30** | ±.0001" |
| 5" - 6" / 127.0 - 152.4mm | .0001"/0.001mm | **293-351-30** | ±.0001" |
| 6" - 7" / 152.4 - 177.8mm | .0001"/0.001mm | **293-352-30** | ±.00015" |
| 7" - 8" / 177.8 - 203.2mm | .0001"/0.001mm | **293-353-30** | ±.00015" |
| 8" - 9" / 203.2 - 228.6mm | .0001"/0.001mm | **293-354-30** | ±.00015" |
| 9" - 10" / 228.6 - 254.0mm | .0001"/0.001mm | **293-355-30** | ±.0002" |
| 10" - 11" / 254.0 - 279.4mm | .0001"/0.001mm | **293-356-30** | ±.0002" |
| 11" - 12" / 279.4 - 304.8mm | .0001"/0.001mm | **293-357-30** | ±.0002" |

*without SPC data output

**Inch/Metric** With ratchet thimble

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **293-334-30 / 293-344-30*** | ±.00005" |
| 0 - 1" / 0 - 25.4mm | .0001" / 0.001mm | **293-349-30*** | ±.0001" |
| 1" - 2"/ 25.4 - 50.8mm | .00005" / 0.001mm | **293-345-30*** | ±.00005" |
| 2" - 3" / 50.8 - 76.2mm | .00005" / 0.001mm | **293-346-30*** | ±.00005" |
| 3" - 4" / 76.2 - 101.6mm | .00005" / 0.001mm | **293-347-30*** | ±.0001" |

*without SPC data output

**Inch/Metric** With friction thimble

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **293-335-30 / 293-348-30*** | ±.00005" |
| 1" - 2"/ 25.4 - 50.8mm | .00005" / 0.001mm | **293-336-30** | ±.00005" |

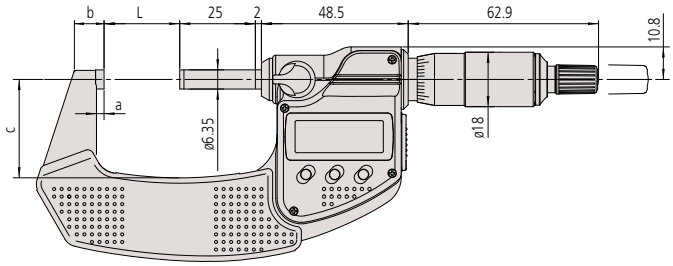
*without SPC data output

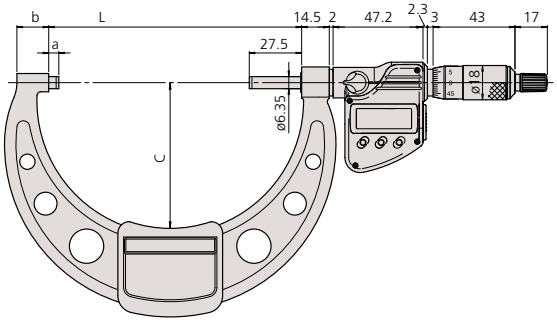
**Inch/Metric** Micrometer Set .00005" / 0.001mm graduation model

| Range | Order No. | Included in set |
|---|---|---|
| 0 - 3" / 0 - 76.2mm (3 pcs. set) | **293-960-30** | 293-330-30, 293-331-30, 293-332-30, 2 standard bars, plastic case |
| 0 - 4" / 0 - 101.6mm (4 pcs. set) | **293-961-30** | 293-330-30, 293-331-30, 293-332-30, 293-333-30, 3 standard bars, wooden box |

## DIMENSIONS AND MASS

**Ratchet-stop type (up to 100mm/4")**

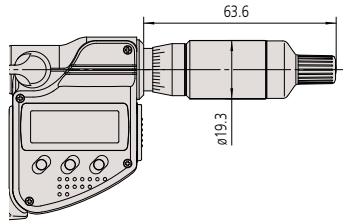



**Ratchet stop type (over 100mm/4" to 300mm/12")**

**Ratchet-thimble type and friction-thimble type**

Unit: mm




| Range (Metric / Inch) | L | a | b | c | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm / 0-1" | 0 | 2.5 | 9 | (25) | 270 |
| 25 - 50mm / 1-2" | 25 | 2.5 | 9.8 | (32.5) | 330 |
| 50 - 75mm / 2-3" | 50 | 2.5 | 12.6 | (47) | 470 |
| 75 - 100mm / 3-4" | 75 | 2.5 | 14 | (60) | 625 |
| 100 - 125mm / 4-5" | 132.8 | 5.3 | 16.7 | (76.5) | 600 |
| 125 - 150mm / 5-6" | 158.2 | 5.7 | 18.8 | (91) | 740 |
| 150 - 175mm / 6-7" | 183.6 | 6.1 | 19.1 | (103.1) | 800 |
| 175 - 200mm / 7-8" | 208.8 | 6.3 | 18.2 | (115.3) | 970 |
| 200 - 225mm / 8-9" | 234.2 | 6.7 | 16.8 | (126.8) | 1100 |
| 225 - 250mm / 9-10" | 258 | 5.5 | 18 | (139.8) | 1270 |
| 250 - 275mm / 10-11" | 284 | 18 | 28 | (152.3) | 1340 |
| 275 - 300mm / 11-12" | 309 | 18 | 28 | (166) | 1540 |



Mitutoyo

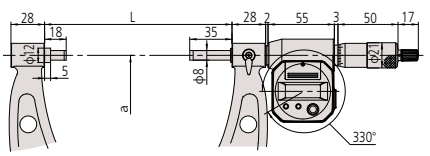
# Digimatic Micrometer

## SERIES 293




### DIMENSIONS

Unit: mm




| Range | L | a | Mass(g) |
|---|---|---|---|
| 300 - 325mm/12-13" | 353 | 187 | 2000 |
| 325 - 350mm/13-14" | 378 | 199 | 2150 |
| 350 - 375mm/14-15" | 403 | 212 | 2300 |
| 375 - 400mm/15-16" | 428 | 224 | 2450 |
| 400 - 425mm/16-17" | 453 | 236 | 2600 |
| 425 - 450mm/17-18" | 478 | 248 | 2750 |
| 450 - 475mm/18-19" | 503 | 261 | 2900 |
| 475 - 500mm/19-20" | 528 | 273 | 3100 |

### SPECIFICATIONS

**Metric** With ratchet stop

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 300 - 325mm | 0.001mm | **293-582** | ±6μm |
| 325 - 350mm | 0.001mm | **293-583** | ±6μm |
| 350 - 375mm | 0.001mm | **293-584** | ±6μm |
| 375 - 400mm | 0.001mm | **293-585** | ±7μm |
| 400 - 425mm | 0.001mm | **293-586** | ±7μm |
| 425 - 450mm | 0.001mm | **293-587** | ±7μm |
| 450 - 475mm | 0.001mm | **293-588** | ±8μm |
| 475 - 500mm | 0.001mm | **293-589** | ±8μm |

**Inch/Metric** With ratchet stop

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 12" - 13" / 304.8 - 330.2mm | .0001" / 0.001mm | **293-782** | ±.0003" |
| 13" - 14" / 330.2 - 355.6mm | .0001" / 0.001mm | **293-783** | ±.0003" |
| 14" - 15" / 355.6 - 381.0mm | .0001" / 0.001mm | **293-784** | ±.0003" |
| 15" - 16" / 381.0 - 406.4mm | .0001" / 0.001mm | **293-785** | ±.00035" |
| 16" - 17" / 406.4 - 431.8mm | .0001" / 0.001mm | **293-786** | ±.00035" |
| 17" - 18" / 431.8 - 457.2mm | .0001" / 0.001mm | **293-787** | ±.00035" |
| 18" - 19" / 457.2 - 482.6mm | .0001" / 0.001mm | **293-788** | ±.0004" |
| 19" - 20" / 482.6 - 508.0mm | .0001" / 0.001mm | **293-789** | ±.0004" |

### Technical Data

Accuracy: Refer to the list of specifications.
Resolution: .0001"/0.001mm or 0.001mm
Flatness: .000024" / 0.6μm
Parallelism: .0002"/ 5μm for models up to 15"/ 375mm
.00024"/ 6μm for models up to 19"/ 475mm
.00028"/ 7μm for models over 20"/ 500mm
Measuring faces: Carbide tipped
Display: LCD
Battery: SR44 (2 pcs.), **938882**
Battery life: Approx. 1.8 years under normal use

### Function

Preset, Zero-setting, Power ON/OFF, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**959149**: SPC cable (40"/1m) Straight type
**959150**: SPC cable (80"/2m) Straight type
**04AZB512**: SPC cable L-type (40"/1m)
**04AZB513**: SPC cable L-type (80"/2m)



# Digimatic Micrometer

## SERIES 293 MDC-Lite

### FEATURES

- Provided only with zero set and in/mm (inch/metric models only) keys.
- A ratchet stop or friction thimble for a constant measuring force.
- Measurement readout with large characters on the LCD.
- No spindle clamp. No data output.
- Supplied in fitted plastic case.




293-831-30

### SPECIFICATIONS

**Metric** With ratchet stop

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.001mm | **293-821-30** | ±2μm |

**Inch/Metric** With ratchet stop

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **293-831-30** | ±.0001" |

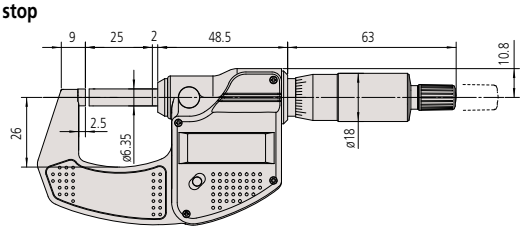
**Inch/Metric** With friction thimble

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **293-832-30** | ±.0001" |

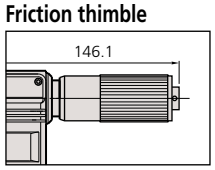
### DIMENSIONS AND MASS

Unit: mm

**Ratchet stop**




**Friction thimble**




MASS: 270g

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .00005"/0.001mm or 0.001mm
Flatness: .000012" / 0.3μm
Parallelism: .00008" / 2μm
Measuring faces: Carbide tipped
Display: LCD
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 2.4 years under normal use

### Function

Origin-set, Automatic power on/off,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error



# MDH Micrometer

## SERIES 293 — High-Accuracy Sub-Micron Digimatic Micrometer

### Technical Data

Flatness: 0.3µm/.000012"
Parallelism: 0.6µm/.000024
Measuring force: 7 to 9N

### Functions

Preset (ABS measurement system)
Zero-setting (INC measurement system)
Hold, Resolution switching, Function lock, On/off, Auto power off, Measurement data output, Error alarm

### Optional Accessories

**05CZA662**: SPC cable with data switch (1m/40")
**05CZA663**: SPC cable with data switch (2m/80")






Function lock

Heat shield





### FEATURES

- Enabling .000005"/ 0.1µm resolution measurement, this micrometer is ideal for customers who need to make highly accurate measurements with a handheld tool.
- A highly rigid frame and high-performance constant-force mechanism* enable more stable measurements, while the clicks emitted while the workpiece is being measured assure the operator that measurement is proceeding normally.

* Patent pending in Japan, the United States of America, the European Union and China.

- Body heat transferred to the instrument is reduced by a (removable) heat shield, minimizing the error caused by thermal expansion of the frame when performing handheld measurements.
- The ABS (absolute) rotary sensor also eliminates the need to perform origin setting each time the power is turned on, letting you start measuring right away. With no possibility of overspeed errors, the High-Accuracy Digimatic Micrometer also delivers a high level of reliability.




293-130-10

d2

**"d2" is the name for Mitutoyo Digimatic output compatible with up to 8 digits of I/O data.**

### SPECIFICATIONS

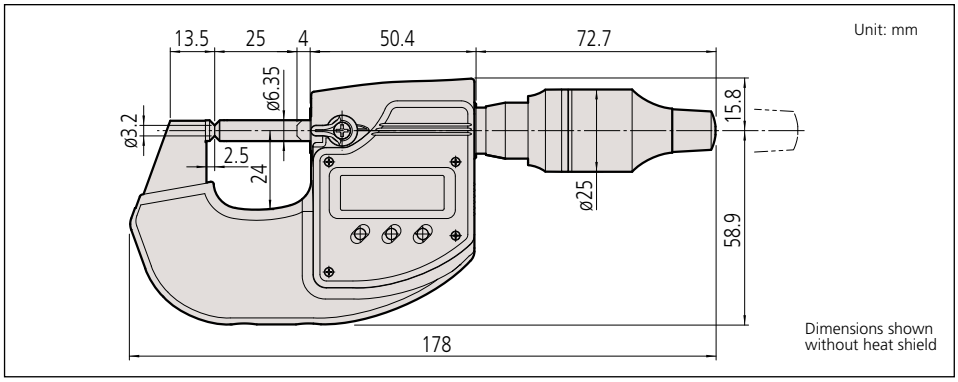
**Metric**

| Order No. | Range | Resolution | Accuracy | Measuring surface | Mass |
|---|---|---|---|---|---|
| **293-100-10** | 0 - 25mm | 0.0001mm/ 0.0005mm (switchable) | ±0.5µm | ø3.2mm | 400g (440g w/Heat shield) |

**Inch/Metric**

| Order No. | Range | Resolution | Accuracy | Measuring surface | Mass |
|---|---|---|---|---|---|
| **293-130-10** | 0 - 1" 0 - 25.4mm | .000005"/.00002" 0.0001mm/0.0005mm (switchable) | ±.00002" | ø3.2mm | 400g (440g w/Heat shield) |

### DIMENSIONS






Mitutoyo

# QuantuMike

## SERIES 293 — Coolant-proof Micrometer

### FEATURES

- Faster measurement with 2mm per revolution instead of the standard 0.5mm.
- A patented ratchet thimble mechanism helps ensure repeatability.
- A function lock helps prevent error.
- IP-65 protection level.
- Certificate of inspection provided.
- With a standard bar except for 0-25mm/0-1" model.
- Supplied in fitted plastic case.



293-180-30



293-187-30

### SPECIFICATIONS

**Metric**

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0-25mm | 0.001mm | **293-140-30** | 1µm |
| 0-25mm | 0.001mm | **293-145-30*** | 1µm |
| 25-50mm | 0.001mm | **293-141-30** | 1µm |
| 25-50mm | 0.001mm | **293-146-30*** | 1µm |
| 50-75mm | 0.001mm | **293-142-30** | 2µm |
| 50-75mm | 0.001mm | **293-147-30*** | 2µm |
| 75-100mm | 0.001mm | **293-143-30** | 2µm |
| 75-100mm | 0.001mm | **293-148-30*** | 2µm |

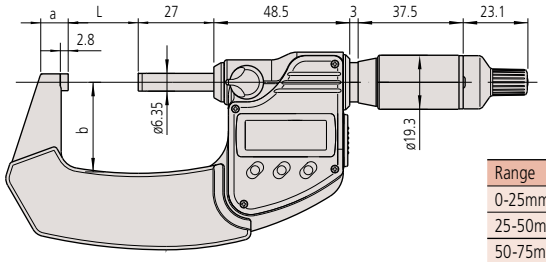
* without SPC data output

**Inch/Metric**

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0-1"/0 - 25.4mm | .00005"/0.001mm | **293-180-30** | .00005" |
| 0-1"/0 - 25.4mm | .00005"/0.001mm | **293-185-30*** | .00005" |
| 1-2"/25.4 - 50.8mm | .00005"/0.001mm | **293-181-30** | .00005" |
| 1-2"/25.4 - 50.8mm | .00005"/0.001mm | **293-186-30*** | .00005" |
| 2-3"/50.8 - 76.2mm | .00005"/0.001mm | **293-182-30** | .0001" |
| 2-3"/50.8 - 76.2mm | .00005"/0.001mm | **293-187-30*** | .0001" |
| 3-4"/76.2 - 101.6mm | .00005"/0.001mm | **293-183-30** | .0001" |
| 3-4"/76.2 - 101.6mm | .00005"/0.001mm | **293-188-30*** | .0001" |

* without SPC data output

### DIMENSIONS AND MASS




Unit: mm

Model=25-50mm/1-2"

| Range | L | a | b | Mass(g) |
|---|---|---|---|---|
| 0-25mm/0-1" | 0 | 9 | 25 | 265 |
| 25-50mm/1-2" | 25 | 9.8 | 32 | 325 |
| 50-75mm/2-3" | 50 | 12.6 | 47 | 465 |
| 75-100mm/3-4" | 75 | 14 | 60 | 620 |

TÜVRheinland CERTIFIED
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ID 4011207400

IP65

SPC

PROPRIETARY INSPECTION CERTIFICATE



Certificate of inspection provided for 0-1" and 1-2" models only.

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.001mm or .00005"/0.001mm
Flatness: 0.3µm/.000012"
Parallelism: 1µm/.00004" for models up to 50mm/2"
2µm/.00008" for models up to 100mm/4"
Measuring force: 7-12N
Measuring faces: Carbide tipped
Display: LCD
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 2.4 years under normal use
Dust/Water protection level: IP65

### Function

Origin-set, Zero / ABS, Hold, Function lock, Auto power on/off, Data output (output models),
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

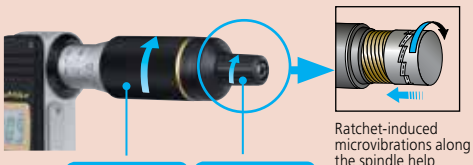
**05CZA662**: SPC cable with data switch (1m/40")
**05CZA663**: SPC cable with data switch (2m/80")



SPC cable with data switch

**516-529-26** Inspection Gage Block Set
Rectangular Steel Gage Block
10 pc. blocks and 1 pc. optical parallel

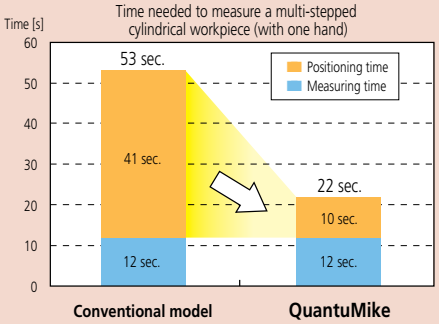
**516-319-26** Inspection Gage Block Set
Rectangular Cera Gage Block
10 pc. blocks and 1 pc. optical parallel




Ratchet-induced microvibrations along the spindle help ensure repeatable measurements.

### Significant reduction in positioning time

Time needed to measure a multi-stepped cylindrical workpiece (with one hand)



# ABSOLUTE Digimatic Micrometers

## SERIES 227 — with Adjustable Measuring Force

### FEATURES

- Constant and low measuring force mechanism in the thimble.
- Adjustable measuring force* accommodates various types of work materials.
  *0.5-2.5N or 2-10N
- The measurement-value hold function automatically retains the data at a specified measuring force, ensuring accuracy.
- Non-rotating spindle and the new ratchet friction thimble.
- Speedy spindle feed by .4"/rev and 10mm/rev for inch/metric model.
- With absolute linear scale.
- With SPC data output.
- With a standard bar to set the origin point (except for 0-15mm, 0-10mm, 0-.6", and 0-.4" models).
- Supplied in fitted plastic case.

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .00005"/0.001mm or 0.001mm
Flatness: .000012" / 0.3µm
Parallelism: .00008" / 2µm
Accuracy of selected measuring force:
± (0.1+selected measuring force/10)N
for 0.5-2.5N models
± (0.4+selected measuring force/10)N
for 2-10N models

Measuring faces: Carbide tipped
Display: LCD
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 3 years under normal use
(1 year for .6 - 1.2" / 15-30mm, .4 -.8"/
10-20mm, .8-1.2"/20-30mm range model)

### Function

Origin, Hold / Data, ON/OFF, Zero / ABS,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**937387**: SPC cable (40"/ 1m)
**965013**: SPC cable (80"/ 2m)




227-201





### SPECIFICATIONS

**Metric**

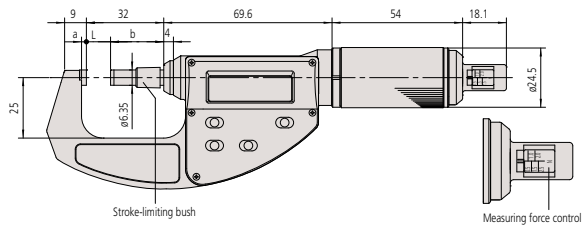
| Order No. | Range | Resolution | Accuracy | Measuring Force | Mass(g) |
|---|---|---|---|---|---|
| **227-201** | 0-15mm | 0.001mm | ±2µm | 0.5-2.5 (0.5, 1.0, 1.5, 2, 2.5) N | 300 |
| **227-203** | 15-30mm | 0.001mm | ±2µm | 0.5-2.5 (0.5, 1.0, 1.5, 2, 2.5) N | 380 |
| **227-205** | 0-10mm | 0.001mm | ±2µm | 2-10 (2, 4, 6, 8, 10) N | 340 |
| **227-206** | 10-20mm | 0.001mm | ±2µm | 2-10 (2, 4, 6, 8, 10) N | 425 |
| **227-207** | 20-30mm | 0.001mm | ±2µm | 2-10 (2, 4, 6, 8, 10) N | 415 |

**Inch/Metric**

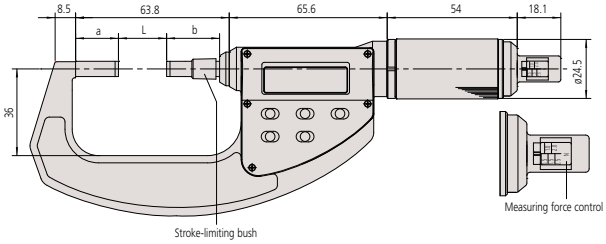
| Order No. | Range | Resolution | Accuracy | Measuring Force | Mass(g) |
|---|---|---|---|---|---|
| **227-211** | 0-.6" | .00005"/0.001mm | ±.0001" | 0.5-2.5 (0.5, 1.0, 1.5, 2, 2.5) N | 300 |
| **227-213** | .6-1.2" | .00005"/0.001mm | ±.0001" | 0.5-2.5 (0.5, 1.0, 1.5, 2, 2.5) N | 380 |
| **227-215** | 0-.4" | .00005"/0.001mm | ±.0001" | 2-10 (2, 4, 6, 8, 10) N | 340 |
| **227-216** | .4-.8" | .00005"/0.001mm | ±.0001" | 2-10 (2, 4, 6, 8, 10) N | 425 |
| **227-217** | .8-1.2" | .00005"/0.001mm | ±.0001" | 2-10 (2, 4, 6, 8, 10) N | 415 |

### DIMENSIONS AND MASS

Unit: mm




| Range | L | a | b |
|---|---|---|---|
| 0 - 15mm | 15 | 2 | 17 |
| 0 - 10mm | 10 | 2 | 22 |




| Range | L | a | b |
|---|---|---|---|
| 15 - 30mm | 30 | 12.8 | 17 |
| 10 - 20mm | 20 | 17.8 | 22 |
| 20 - 30mm | 30 | 7.8 | 22 |

# Quickmike

## SERIES 293 — IP-54 ABSOLUTE Digimatic Micrometers

The Quickmike provides a speedy spindle feed of 10mm / .4" per thimble rotation as compared to the conventional micrometer with 0.5mm / .025" per rotation. Its wide 30mm / 1.2" measuring range allows various workpieces with different shapes to be measured quickly.

## FEATURES

- Non-rotating spindle and the new ratchet friction thimble.
- Speedy spindle feed by 10mm/rev and .4"/rev for inch/metric models.
- With absolute linear scale.
- IP54 dust/water protection (when not connected with data output cable).
- With SPC data output.
- With a standard bar to set the origin point (for models with a range over 30mm / 1.2").
- Supplied in fitted plastic case.



293-676



293-677



293-678



293-679

## Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.001mm or .00005"/0.001mm
Flatness: 0.3µm / .000012"
Parallelism: 2µm / .00008" for models up to 80mm / 3.2"
3µm / .00012" for models up to 105mm / 4.2"
Measuring force: 5-10N
Measuring faces: Carbide tipped
Display: LCD
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 3 years under normal use
(1 year for models over 30mm / 1.2")
Dust/Water protection level: IP54

## SPECIFICATIONS

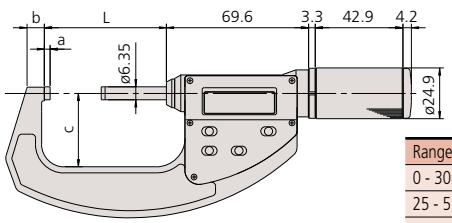
**Metric**

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 30mm | 0.001mm | **293-666** | ±2µm |
| 25 - 55mm | 0.001mm | **293-667** | ±2µm |
| 50 - 80mm | 0.001mm | **293-668** | ±3µm |
| 75 - 105mm | 0.001mm | **293-669** | ±3µm |

**Inch/Metric**

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1.2" / 0 - 30.48mm | .00005" / 0.001mm | **293-676** | ±.0001" |
| 1" - 2.2" / 25.4 - 55.88mm | .00005" / 0.001mm | **293-677** | ±.0001" |
| 2" - 3.2" / 50.8 - 81.28mm | .00005" / 0.001mm | **293-678** | ±.00015" |
| 3" - 4.2" / 76.2 - 106.68mm | .00005" / 0.001mm | **293-679** | ±.00015" |

## DIMENSIONS AND MASS

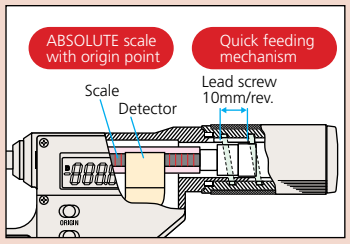



Unit: mm

| Range | L | a | b | c | Mass |
|---|---|---|---|---|---|
| 0 - 30mm / 0 - 1.2" | 34.8 | 2.8 | 6.2 | 25 | 275 |
| 25 - 55mm / 1 - 2.2" | 59.8 | 2.8 | 8.5 | 36 | 355 |
| 50 - 80mm / 2 - 3.2" | 84.8 | 2.8 | 10.3 | 47 | 525 |
| 75 - 105mm / 3 - 4.2" | 109.8 | 2.8 | 10.7 | 60 | 625 |

## Function

Origin, Hold / Data, ON/OFF, Zero / ABS,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error




## Optional Accessories

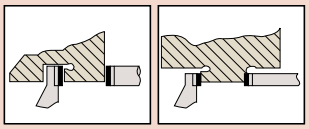
**937387**: SPC cable (1m / 40")
**965013**: SPC cable (2m / 80")

# Outside Micrometers

## SERIES 101

### Technical Data

Graduation: .0001"
Flatness: .000024"
Parallelism: .00008" for models up to 3"
.00012" for models over 3"
Measuring faces: Carbide tipped

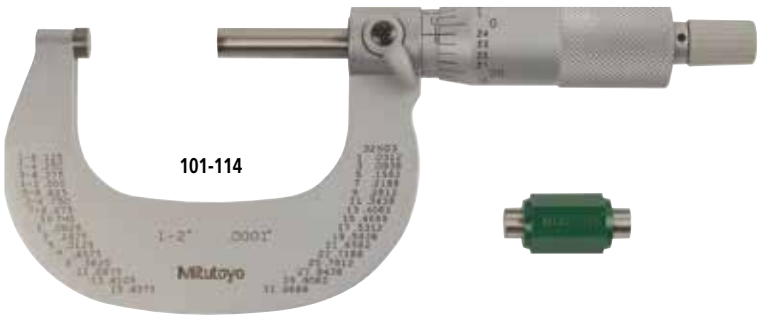


### FEATURES

- Satin chrome-finished frame, tapered (on the anvil side) for hard-to-reach places.
- With a standard bar except for 0 - 1" models.
- Supplied in fitted plastic case.



101-113



101-114

### SPECIFICATIONS

**Inch** With friction thimble

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .0001" | **101-117*** | ±.0001" | 180 |
| 1 - 2" | .0001" | **101-118*** | ±.0001" | 245 |

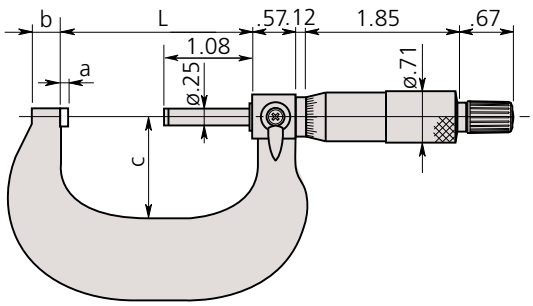
*.0001" reading is obtained with vernier.

**Inch** With ratchet stop

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .0001" | **101-113*** | ±.0001" | 180 |
| 1 - 2" | .0001" | **101-114*** | ±.0001" | 245 |
| 2 - 3" | .0001" | **101-119*** | ±.0001" | 410 |
| 3 - 4" | .0001" | **101-120*** | ±.00015" | 550 |

*.0001" reading is obtained with vernier.

### DIMENSIONS




Unit: inch

| Range | L | a | b | c |
|---|---|---|---|---|
| 0 - 1" | 1.18 | .10 | .20 | 1.10 |
| 1 - 2" | 2.16 | .08 | .31 | 1.28 |
| 2 - 3" | 3.19 | .11 | .33 | 1.77 |
| 3 - 4" | 4.19 | .11 | .33 | 2.28 |

Note: The shape of the thimble changes on the model with friction thimble.



Mitutoyo

# Ratchet Thimble Micrometer

## SERIES 102 — New smoother action ratchet thimble

### FEATURES

- Ratchet function works both from the thimble and the speeder, allowing easy one-handed operation.
- Clearly audible ratchet operation for reassurance that measurement is being performed at constant, preset force.
- Heat insulating frame minimizes thermal expansion.
- Provided with a Certificate of Inspection.
- With a standard bar except for 0 - 25mm and 0 - 1″ models.
- Supplied in fitted plastic case.






102-701



102-702

### SPECIFICATIONS

**Metric**

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.01mm | **102-701** | ±2µm |
| 0 - 25mm | 0.001mm | **102-707*** | ±2µm |
| 25 - 50mm | 0.01mm | **102-702** | ±2µm |
| 25 - 50mm | 0.001mm | **102-708*** | ±2µm |

*0.001mm reading is obtained with vernier.

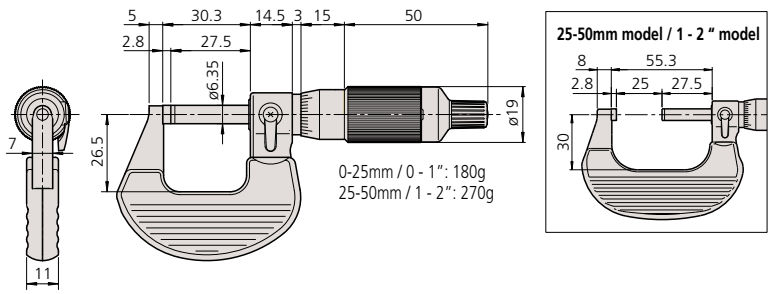
**Inch**

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" | .0001" | **102-717*** | ±.0001" |
| 1 - 2" | .0001" | **102-718*** | ±.0001" |

*.0001" reading is obtained with vernier.

### DIMENSIONS AND MASS

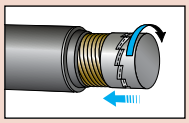
Unit: mm



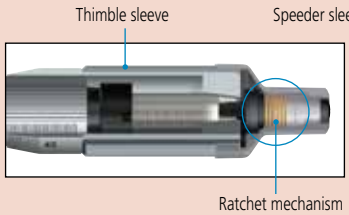

PROPRIETARY INSPECTION CERTIFICATE
Mitutoyo guarantees the product quality.

### Technical Data

Graduation: 0.01mm, 0.001mm, .001" or .0001"
Flatness: 0.6µm / .000024″
Parallelism: 2µm / .00008″
Measuring faces: Carbide tipped
Measuring force: 5-10N



Rotating the thimble/speeder sleeve when the workpiece is between the anvil and spindle causes the ratchet mechanism to tap the spindle and apply a constant measuring force to the workpiece.










# Outside Micrometers

## SERIES 102

### FEATURES

- Heat-insulated frame, tapered (on the anvil side) for hard-to-reach places.
- With a standard bar except for 0 - 25mm model.
- A ratchet stop for a constant measuring force.
- Supplied in a fitted plastic case.




102-301

### Technical Data

Graduation: 0.01mm
Flatness: 0.3µm
Parallelism: 1µm for 25mm model
3µm for models up to 100mm
Measuring faces: Carbide tipped

**Ratchet-stop type**



### SPECIFICATIONS

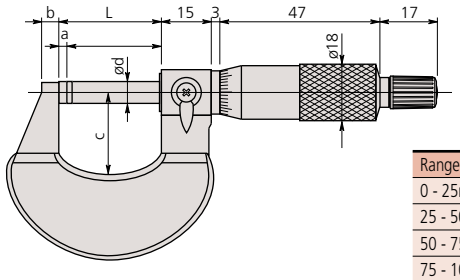
**Metric** With ratchet stop

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.01mm | **102-301** | ±2µm |
| 25 - 50mm | 0.01mm | **102-302** | ±2µm |
| 50 - 75mm | 0.01mm | **102-303** | ±2µm |
| 75 - 100mm | 0.01mm | **102-304** | ±3µm |

**Metric** Micrometer set 0.01mm Graduation model

| Range | Order No. | Included in set |
|---|---|---|
| 0 - 100mm (4 pcs/set) | **102-911-40** | • **102-301**<br>**102-302**<br>**102-303**<br>**102-304**<br>• 3 micrometer standards |

### DIMENSIONS AND MASS




Unit: mm

| Range | L | a | b | c | d | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 25mm | 30.3 | 2.8 | 5 | 26 | 6.35 | 180 |
| 25 - 50mm | 55.3 | 2.8 | 8 | 32 | 6.35 | 270 |
| 50 - 75mm | 80.3 | 2.8 | 9 | 45 | 6.35 | 375 |
| 75 - 100mm | 105.3 | 2.8 | 10 | 58 | 6.35 | 490 |

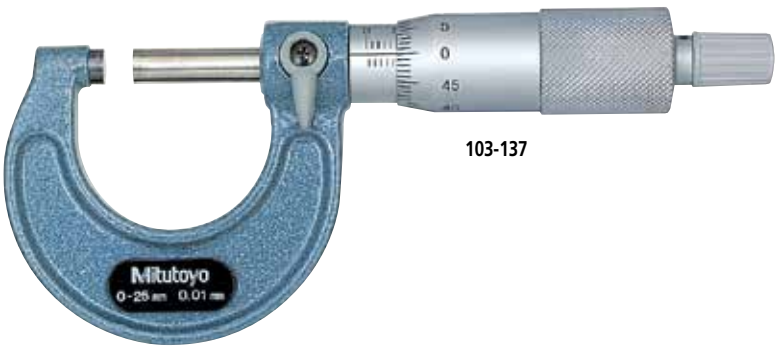
# Outside Micrometers

## SERIES 103

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo guarantees the product quality.

## FEATURES

- Hammertone, baked-enamel-finished frame.
- Ratchet stop for exact repetitive readings.
- With a standard bar except for 0-25mm model.




103-137

### Technical Data

Graduation: 0.01mm, 0.001mm
Flatness: 0.6 µm for models up to 300mm/12"
1µm for models over 300mm/12"
Parallelism: (2+R/100)µm, R=max, range (mm)
Measuring faces: Carbide tipped

## SPECIFICATIONS

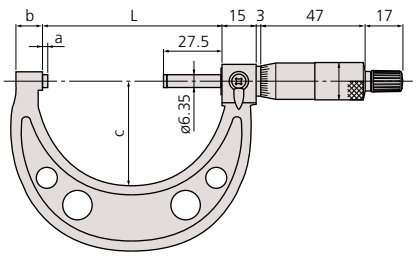
**Metric** With ratchet stop

| Range | Order No. | Accuracy | Mass (g) |
|---|---|---|---|
| 0 - 25mm | **103-137** | ±2µm | 175 |
| | **103-129*** | ±2µm | 175 |
| 25 - 50mm | **103-138** | ±2µm | 215 |
| | **103-130*** | ±2µm | 215 |
| 50 - 75mm | **103-139-10** | ±2µm | 315 |
| 75 - 100mm | **103-140-10** | ±3µm | 375 |
| 100 - 125mm | **103-141-10** | ±3µm | 515 |
| 125 - 150mm | **103-142-10** | ±3µm | 665 |
| 150 - 175mm | **103-143-10** | ±4µm | 720 |
| 175 - 200mm | **103-144-10** | ±4µm | 920 |
| 200 - 225mm | **103-145-10** | ±4µm | 1080 |
| 225 - 250mm | **103-146-10** | ±5µm | 1255 |
| 250 - 275mm | **103-147-10** | ±5µm | 1405 |
| 275 - 300mm | **103-148-10** | ±5µm | 1565 |
| 300 - 325mm | **103-149** | ±6µm | 1985 |
| 325 - 350mm | **103-150** | ±6µm | 2155 |
| 350 - 375mm | **103-151** | ±6µm | 2305 |
| 375 - 400mm | **103-152** | ±7µm | 2455 |
| 400 - 425mm | **103-153** | ±7µm | 2715 |
| 425 - 450mm | **103-154** | ±7µm | 2965 |
| 450 - 475mm | **103-155** | ±8µm | 3215 |
| 475 - 500mm | **103-156** | ±8µm | 3450 |
| (Models with a range up to 1000mm are available.) | | | |

*0.001mm reading is obtained with vernier.

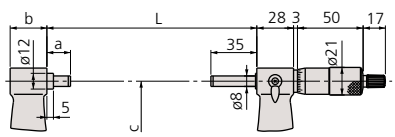
## DIMENSIONS AND MASS

Up to 300mm / 12"




| Range | L | a | b | c |
|---|---|---|---|---|
| 0 - 25mm / 0 - 1" | 30.3 | 2.8 | 9 | 28 |
| 25 - 50mm / 1 - 2" | 55.3 | 2.8 | 10 | 38 |
| 50 - 75mm / 2 - 3" | 80.3 | 2.8 | 12 | 49 |
| 75 - 100mm / 3 - 4" | 105.3 | 2.8 | 14 | 60 |
| 100 - 125mm / 4 - 5" | 132.8 | 5.3 | 17 | 79 |
| 125 - 150mm / 5 - 6" | 158.2 | 5.7 | 19 | 94 |
| 150 - 175mm / 6 - 7" | 183.6 | 6.1 | 20 | 106 |
| 175 - 200mm / 7 - 8" | 208.8 | 6.3 | 19 | 118 |
| 200 - 225mm / 8 - 9" | 234.2 | 6.7 | 18 | 130 |
| 225 - 250mm / 9 - 10" | 258 | 5.5 | 18 | 143 |
| 250 - 275mm / 10 - 11" | 284 | 6.5 | 18 | 156 |
| 275 - 300mm / 11 - 12" | 309 | 6.5 | 18 | 169 |

Over 300mm / 12"




| Range | L | a | b | c |
|---|---|---|---|---|
| 300 - 325mm / 12-13" | 353 | 18 | 28 | 187 |
| 325 - 350mm / 13-14" | 378 | 18 | 28 | 199 |
| 350 - 375mm / 14-15" | 403 | 18 | 28 | 212 |
| 375 - 400mm / 15-16" | 428 | 18 | 28 | 224 |
| 400 - 425mm / 16-17" | 453 | 18 | 28 | 236 |
| 425 - 450mm / 17-18" | 478 | 18 | 28 | 248 |
| 450 - 475mm / 18-19" | 503 | 18 | 28 | 261 |
| 475 - 500mm / 19-20" | 528 | 18 | 28 | 273 |

**Metric** Micrometer set

| Range | Order No. | Included in set | Mass (g) |
|---|---|---|---|
| 0 - 75mm (3 pc. set) | **103-927-10** | **103-137, 103-138, 103-139-10,** 2 micrometer standards | 750 |
| 0 - 150mm (6 pc. set) | **103-913-50** | **103-137, 103-138, 103-139-10, 103-140-10, 103-141-10, 103-142-10,** 5 micrometer standards | 2260 |
| 150 - 300mm (6 pc. set) | **103-915-10** | **103-143-10, 103-144-10, 103-145-10, 103-146-10, 103-147-10, 103-148-10**, 6 micrometer standards | 7695 |
| 0 - 300mm (12 pc. set) | **103-914-50** | All micrometers of **103-913-50** and **103-915-10** in one set, 11 micrometer standards | 9300 |

# Outside Micrometers

## SERIES 103— Inch Models

### FEATURES

- Hammertone, baked-enamel-finished frame.
- Ratchet stop or friction thimble for exact repetitive readings.
- With a standard bar except for 0-1″ model.




103-177




103-260

### Technical Data (Inch Model)

Accuracy: Refer to the list of specifications
Graduation: .001" or .0001"
Flatness: .000024″ for models up to 12″
.00004″ for models over 12″
Parallelism: [.00008 + .00004 (L/4)]″ L= max range (inch)
Measuring faces: Carbide tipped

### SPECIFICATIONS

**Inch** With ratchet stop

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .001" | **103-177** | ±.0001" | 175 |
| 1 - 2" | .001" | **103-178** | ±.0001" | 215 |
| 2 - 3" | .001" | **103-179** | ±.0001" | 315 |
| 3 - 4" | .001" | **103-180** | ±.00015" | 375 |
| 4 - 5" | .001" | **103-181** | ±.00015" | 515 |
| 5 - 6" | .001" | **103-182** | ±.00015" | 665 |
| 6 - 7" | .001" | **103-183** | ±.0002" | 720 |
| 7 - 8" | .001" | **103-184** | ±.0002" | 920 |
| 8 - 9" | .001" | **103-185** | ±.0002" | 1080 |
| 9 - 10" | .001" | **103-186** | ±.00025" | 1255 |
| 10 - 11" | .001" | **103-187** | ±.00025" | 1405 |
| 11 - 12" | .001" | **103-188** | ±.00025" | 1565 |
| 12 - 13" | .001" | **103-189** | ±.0003" | 1985 |
| 13 - 14" | .001" | **103-190** | ±.0003" | 2155 |
| 14 - 15" | .001" | **103-191** | ±.0003" | 2305 |
| 15 - 16" | .001" | **103-192** | ±.00035" | 2455 |
| 16 - 17" | .001" | **103-193** | ±.00035" | 2715 |
| 17 - 18" | .001" | **103-194** | ±.00035" | 2965 |
| 18 - 19" | .001" | **103-195** | ±.0004" | 3215 |
| 19 - 20" | .001" | **103-196** | ±.0004" | 3450 |
| 20 - 21" | .001" | **103-197** | ±.0004" | 4060 |
| 21 - 22" | .001" | **103-198** | ±.00045" | 4080 |
| 22 - 23" | .001" | **103-199** | ±.00045" | 4500 |
| 23 - 24" | .001" | **103-200** | ±.00045" | 4525 |
| 24 - 25" | .001" | **103-201** | ±.0005 | 4915 |
| 25 - 26" | .001" | **103-202** | ±.0005" | 4930 |
| 26 - 27" | .001" | **103-203** | ±.0005" | 5200 |
| 27 - 28" | .001" | **103-204** | ±.00055" | 5215 |
| 28 - 29" | .001" | **103-205** | ±.00055" | 5835 |
| 29 - 30" | .001" | **103-206** | ±.00055" | 5860 |
| 30 - 31" | .001" | **103-207** | ±.0006" | 6385 |
| 31 - 32" | .001" | **103-208** | ±.0006" | 6410 |
| 32 - 33" | .001" | **103-209** | ±.0006" | 6925 |
| 33 - 34" | .001" | **103-210** | ±.00065" | 6940 |
| 34 - 35" | .001" | **103-211** | ±.00065" | 7565 |
| 35 - 36" | .001" | **103-212** | ±.00065" | 7590 |
| 36 - 37" | .001" | **103-213** | ±.0007" | 8215 |
| 37 - 38" | .001" | **103-214** | ±.0007" | 8240 |
| 38 - 39" | .001" | **103-215** | ±.0007" | 8860 |
| 39 - 40" | .001" | **103-216** | ±.00075" | 8880 |

**Inch** With friction thimble

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .0001" | **103-135*** | ±.0001" | 175 |
| 1 - 2" | .0001" | **103-136*** | ±.0001" | 215 |

* .0001" Reading is obtained with vernier

**Inch** With ratchet stop

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .0001" | **103-131*** | ±.0001" | 175 |
| 1 - 2" | .0001" | **103-132*** | ±.0001" | 215 |
| 2 - 3" | .0001" | **103-217*** | ±.0001" | 315 |
| 3 - 4" | .0001" | **103-218*** | ±.00015" | 375 |
| 4 - 5" | .0001" | **103-219*** | ±.00015" | 515 |
| 5 - 6" | .0001" | **103-220*** | ±.00015" | 665 |
| 6 - 7" | .0001" | **103-221*** | ±.0002" | 720 |
| 7 - 8" | .0001" | **103-222*** | ±.0002" | 920 |
| 8 - 9" | .0001" | **103-223*** | ±.0002" | 1080 |
| 9 - 10" | .0001" | **103-224*** | ±.00025" | 1255 |
| 10 - 11" | .0001" | **103-225*** | ±.00025" | 1405 |
| 11 - 12" | .0001" | **103-226*** | ±.00025" | 1565 |

* .0001" Reading is obtained with vernier

**Inch** With Tapered Frame and Ratchet Stop

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0-1" | .001" | **103-259** | ±.0001" | 175 |
| 0-1" | .0001" | **103-260*** | ±.0001" | 175 |
| 1-2" | .0001" | **103-262*** | ±.0001" | 215 |

* .0001" Reading is obtained with vernier



Mitutoyo

# Outside Micrometers

## SERIES 103 — Inch model set

**Inch** Micrometer Set .001" Graduation Model

| Range | Order No. | Included in set | Mass (g) |
|---|---|---|---|
| 0 - 3" (3pcs./set) | **103-929** | 103-177, 103-178, 103-179, 2 Micrometer Standards | 750 |
| 0 - 4" (4pcs./set) | **103-930** | 103-177, 103-178, 103-179, 103-180, 3 Micrometer Standards | 1600 |
| 0 - 6" (6pcs./set) | **103-904-10** | 103-177, 103-178, 103-179, 103-180, 103-181, 103-182, 5 Micrometer Standards | 2200 |
| 0 - 12" (12pcs./set) | **103-905-10** | 103-177, 103-178, 103-179, 103-180, 103-181, 103-182, 103-183, 103-184, 103-185, 103-186, 103-187, 103-188, 11 Micrometer Standards | 9000 |
| 6 - 12" (6pcs./set) | **103-906** | 103-183, 103-184, 103-185, 103-186, 103-187, 103-188, 6 Micrometer Standards | 7695 |



**103-905-10**

**Inch** Micrometer Set .0001" Graduation Model

| Range | Order No. | Included in set | Mass (g) |
|---|---|---|---|
| 0 - 3" (3pcs./set) | **103-922** | 103-135, 103-136, 103-217, 2pcs. Micrometer Standards | 705 |
| 0 - 4" (4pcs./set) | **103-931** | 103-135, 103-136, 103-217, 103-218, 3pcs. Micrometer Standards | 1600 |
| 0 - 6" (6pcs./set) | **103-907-40** | 103-135, 103-136, 103-217, 103-218, 103-219, 103-220, 5 Micrometer Standards | 2200 |
| 0 - 12" (12pcs./set) | **103-908-40** | 103-135, 103-136, 103-217, 103-218, 103-219, 103-220, 103-221, 103-222, 103-223, 103-224, 103-225, 103-226, 11pcs. Micrometer Standards | 9000 |
| 6 - 12" (6pcs./set) | **103-909** | 103-221, 103-222, 103-223, 103-224, 103-225, 103-226, 6pcs. Micrometer Standards | 6945 |



**103-904-10**

# Outside Micrometers

## SERIES 340, 104 — with Interchangeable Anvils, Inch model

## FEATURES

- IP65 water/dust protection (Series 340*).
  *Models with a range up to12″ / 300mm.
- Wide measuring range with interchangeable anvils.
- With a ratchet stop for constant force.
- Supplied with zero-setting standards bar for each range.
- With SPC output (Series 340).
- Supplied in fitted wooden case.



340-352-30

## Technical Data

Accuracy: ±[.00016″ +.00004 (L/3)″] L = Max Range (Inch)
Resolution*: .0001"/0.001mm
(**340-351-30**: .00005"/0.001mm)
Graduation**: .001″ (**104-165**: is .0001″)
Flatness: .000024″ for models up to 12″
.00004″ for models over 12″
Parallelism: .00008″ for models up to 3″
.00012″ for models up to 6″
±[.00008″ + .00004 (L/4)″] L= Max range (inch)
Measuring faces: Carbide tipped (spindle only)
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years (1.8 years for models over 300mm) years under normal use
Dust/Water protection level*: IP65 (up to 12″ / 300mm)
*Digital models **Analog models

## Function of Digital Model

Zero / ABS, Data hold, Preset, Data output,
inch/mm conversion (on inch/metric models only)
Function Lock, 2 Presets
Alarm: Low voltage, Counting value composition error

## Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40″ / 1m)
**05CZA663**: SPC cable with data switch (80″ / 2m)
**959149**: SPC cable Straight type (40″/1m)*
**959150**: SPC cable Straight type (80″/2m)*
**04AZB512**: SPC cable L-type (40″/1m)*
**04AZB513**: SPC cable L-type (80″/2m)*
* models over 300mm



## SPECIFICATIONS

**Inch/Metric** Digital model

| Range | Resolution | Order No. | Mass (kg) | Remarks |
|---|---|---|---|---|
| 0-6" / 0-152.4mm | .00005" / 0.001mm | **340-351-30** | 0.96 | with 6 anvils & 5 standards |
| 6-12" / 152.4 - 304.8mm | .0001" / 0.001mm | **340-352-30** | 1.88 | with 6 anvils & 6 standards |
| 12-18" / 304.8 - 457.2mm | .0001" / 0.001mm | **340-720** | 4.75 | with 6 anvils & 6 standards |
| 18-24" / 457.2 - 609.6mm | .0001" / 0.001mm | **340-721** | 6.62 | with 6 anvils & 6 standards |
| 24-30" / 609.6 - 762.0mm | .0001" / 0.001mm | **340-722** | 10.06 | with 6 anvils & 6 standards |
| 30-36" / 762.0 - 914.4mm | .0001" / 0.001mm | **340-723** | 11.98 | with 6 anvils & 6 standards |

**Inch**

| Range | Graduation | Order No. | Mass(kg) | Remarks |
|---|---|---|---|---|
| 0-2″ | .0001″ | **104-165*** | 0.32 | with 1″ anvil & 1 standard |
| 0-6″ | .001″ | **104-137** | 1.35 | with 6 anvils & 5 standards |
| 6-12″ | .001″ | **104-138** | 2.65 | with 6 anvils & 6 standards |
| 12-16″ | .001″ | **104-152** | 3.31 | with 4 anvils & 4 standards |
| 12-18″ | .001″ | **104-201** | 4.69 | with 6 anvils & 6 standards |
| 16-20″ | .001″ | **104-153** | 4.81 | with 4 anvils & 4 standards |
| 18-24″ | .001″ | **104-202** | 6.51 | with 6 anvils & 6 standards |
| 20-24″ | .001″ | **104-154** | 6.35 | with 4 anvils & 4 standards |
| 24-28″ | .001″ | **104-155** | 7.72 | with 4 anvils & 4 standards |
| 24-30″ | .001″ | **104-203** | 9.95 | with 6 anvils & 6 standards |
| 28-32″ | .001″ | **104-156** | 9.08 | with 4 anvils & 4 standards |
| 30-36″ | .001″ | **104-204** | 11.87 | with 6 anvils & 6 standards |
| 32-36″ | .001″ | **104-157** | 10.41 | with 4 anvils & 4 standards |
| 36-40″ | .001″ | **104-158** | 11.78 | with 4 anvils & 4 standards |
| 36-42″ | .001″ | **104-205** | 13.68 | with 6 anvils & 6 standards |

*.0001" reading is obtained with vernier.

# Outside Micrometers

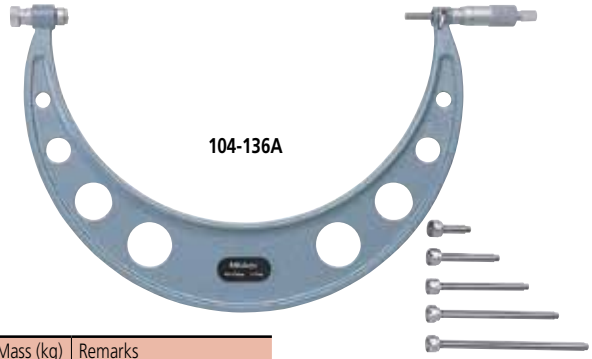
## SERIES 340, 104 — with Interchangeable Anvils, Metric Model

## FEATURES

- IP65 water/dust protection (Series 340*).
  *Models with a range up to 300mm.
- Wide measuring range with interchangeable anvils.
- With a ratchet stop for constant force.
- Supplied with zero-setting standards bar for each range.
- With SPC output (Series 340).
- Supplied in fitted wooden case.

**Digital model**




## SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Mass (kg) | Remarks |
|---|---|---|---|---|
| 0 - 150mm | 0.001mm | **340-251-30** | 0.96 | with 6 anvils & 5 standards |
| 150 - 300mm | 0.001mm | **340-252-30** | 1.88 | with 6 anvils & 6 standards |
| 300 - 400mm | 0.001mm | **340-520** | 3.31 | with 4 anvils & 4 standards |
| 400 - 500mm | 0.001mm | **340-521** | 4.81 | with 4 anvils & 4 standards |
| 500 - 600mm | 0.001mm | **340-522** | 6.35 | with 4 anvils & 4 standards |
| 600 - 700mm | 0.001mm | **340-523** | 7.72 | with 4 anvils & 4 standards |
| 700 - 800mm | 0.001mm | **340-524** | 9.08 | with 4 anvils & 4 standards |
| 800 - 900mm | 0.001mm | **340-525** | 10.41 | with 4 anvils & 4 standards |
| 900 - 1000mm | 0.001mm | **340-526** | 11.78 | with 4 anvils & 4 standards |

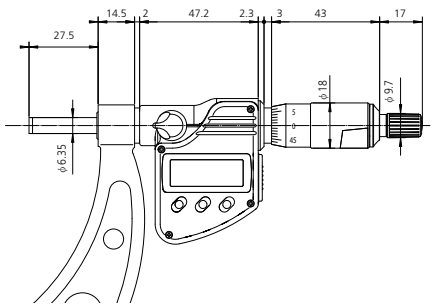
**Metric**

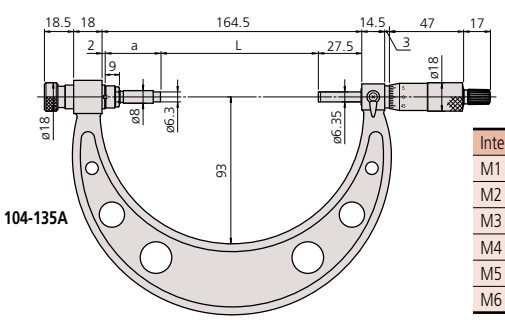
| Range | Graduation | Order No. | Mass (kg) | Remarks |
|---|---|---|---|---|
| 0 - 50mm | 0.01mm | **104-171*** | 0.32 | with 2 anvils & 1 standard |
| 0 - 100mm | 0.01mm | **104-139A** | 0.79 | with 4 anvils & 3 standards |
| 0 - 150mm | 0.01mm | **104-135A** | 1.35 | with 6 anvils & 5 standards |
| 50 - 150mm | 0.01mm | **104-161A** | 1.35 | with 4 anvils & 4 standards |
| 100 - 200mm | 0.01mm | **104-140A** | 1.38 | with 4 anvils & 4 standards |
| 150 - 300mm | 0.01mm | **104-136A** | 2.65 | with 6 anvils & 6 standards |
| 200 - 300mm | 0.01mm | **104-141A** | 2.22 | with 4 anvils & 4 standards |
| 300 - 400mm | 0.01mm | **104-142A** | 3.31 | with 4 anvils & 4 standards |
| 400 - 500mm | 0.01mm | **104-143A** | 4.81 | with 4 anvils & 4 standards |
| 500 - 600mm | 0.01mm | **104-144A** | 6.35 | with 4 anvils & 4 standards |
| 600 - 700mm | 0.01mm | **104-145A** | 7.72 | with 4 anvils & 4 standards |
| 700 - 800mm | 0.01mm | **104-146A** | 9.08 | with 4 anvils & 4 standards |
| 800 - 900mm | 0.01mm | **104-147A** | 10.41 | with 4 anvils & 4 standards |
| 900 - 1000mm | 0.01mm | **104-148A** | 11.78 | with 4 anvils & 4 standards |

*The frame is in a heat-insulated cover.

## DIMENSIONS

Unit: mm




| Interchangeable anvil | L | a |
|---|---|---|
| M1 | 0 | 135 |
| M2 | 25 | 110 |
| M3 | 50 | 85 |
| M4 | 75 | 60 |
| M5 | 100 | 35 |
| M6 | 125 | 10 |

## Technical Data

Accuracy: ±(4+R/75)µm, R=max. range (mm)
Resolution*: 0.001mm
Graduation**: 0.01mm
Flatness: 0.6µm for models up to 300mm
1µm for models over 300mm
Parallelism: 2µm for models up to 75mm
3µm for models up to 150mm
(2+R/100)µm for models over 150mm, R=max. range (mm)
Measuring faces: Carbide tipped (spindle only)
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years (1.8 years for models over 300mm) years under normal use
Dust/Water protection level*: IP65 (up to 300mm)
*Digital models **Analog models

## Function of Digital Model

Zero / ABS, Data hold, Preset, Data output,
inch/mm conversion (on inch/metric models only)
Function Lock, 2 Presets
Alarm: Low voltage, Counting value composition error

## Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80" / 2m)
**959149**: SPC cable Straight type (40"/1m)*
**959150**: SPC cable Straight type (80"/2m)*
**04AZB512**: SPC cable L-type (40"/1m)*
**04AZB513**: SPC cable L-type (80"/2m)*
* models over 300mm

# Outside Micrometers

## SERIES 105 — with Extension Anvil Collars

### Technical Data

Accuracy: ±(6+R/75)µm, R=max. range (mm)
Graduation: .001" / 0.01mm
Flatness: .000052" / 1.3µm
Parallelism: [.00016"+.00004 (L/4)"] L=max. range (inch)
(2+R/100)µm, R=max. range (mm)
Measuring faces: Carbide tipped

### Extension anvil collar

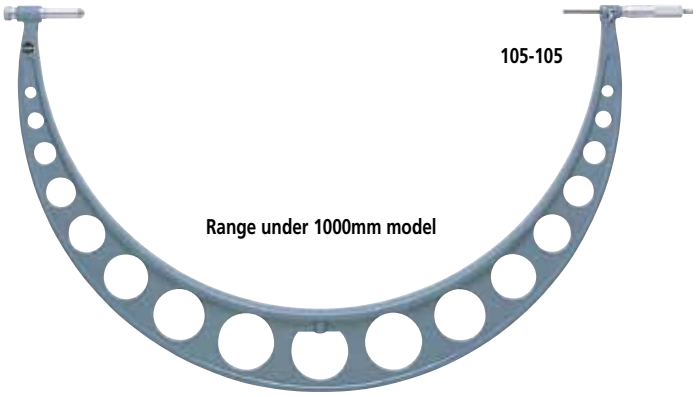


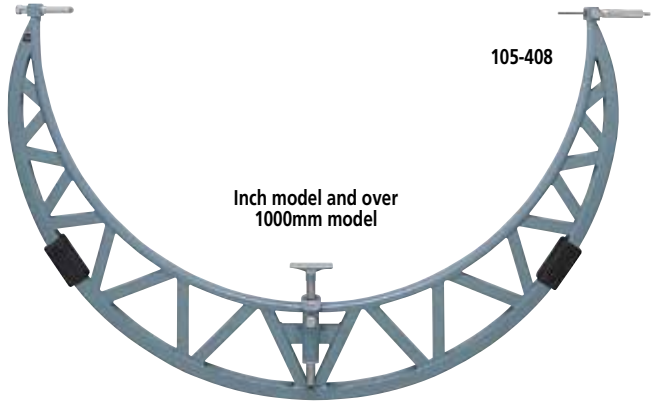




### FEATURES

- Wide measuring range with extension anvil collars.
- 50mm spindle stroke.
- With ratchet stop for constant force.
- Supplied with zero-setting standards bar for each range.
- Square and round pipes are combined for light weight and rigid frame (for models over 1000mm range).
- Workpiece stopper (for models over 1000mm range).
- Supplied in a fitted wooden case.




### SPECIFICATIONS

**Metric**

| Range | Order No. | Extension collars | Mass (kg) |
|---|---|---|---|
| 500 - 600mm | **105-103** | 50mm | 5.53 |
| 600 - 700mm | **105-104** | 50mm | 6.35 |
| 700 - 800mm | **105-105** | 50mm | 7.17 |
| 800 - 900mm | **105-106** | 50mm | 7.99 |
| 900 - 1000mm | **105-107** | 50mm | 8.81 |
| 1000 - 1100mm | **105-408** | 50mm | 6.37 |
| 1100 - 1200mm | **105-409** | 50mm | 7.08 |
| 1000 - 1200mm | **105-418** | 50mm, 100mm | 13.77 |
| 1200 - 1300mm | **105-410** | 50mm | 7.79 |
| 1300 - 1400mm | **105-411** | 50mm | 8.50 |
| 1200 - 1400mm | **105-419** | 50mm, 100mm | 15.77 |
| 1400 - 1500mm | **105-412** | 50mm | 9.21 |
| 1500 - 1600mm | **105-413** | 50mm | 10.17 |
| 1400 - 1600mm | **105-420** | 50mm, 100mm | 17.91 |
| 1600 - 1700mm | **105-414** | 50mm | 11.13 |
| 1700 - 1800mm | **105-415** | 50mm | 12.09 |
| 1600 - 1800mm | **105-421** | 50mm, 100mm | 20.80 |
| 1800 - 1900mm | **105-416** | 50mm | 13.05 |
| 1900 - 2000mm | **105-417** | 50mm | 14.01 |
| 1800 - 2000mm | **105-422** | 50mm, 100mm | 22.76 |

**Inch**

| Range | Order No. | Extension collars | Mass (kg) |
|---|---|---|---|
| 40 - 44" | **105-428** | 2" | 10.0 |
| 44 - 48" | **105-429** | 2" | 10.9 |
| 48 - 52" | **105-430** | 2" | 11.4 |
| 52 - 56" | **105-431** | 2" | 11.9 |
| 56 - 60" | **105-432** | 2" | 12.6 |
| 60 - 64" | **105-433** | 2" | 13.2 |
| 64 - 68" | **105-434** | 2" | 14.1 |
| 68 - 72" | **105-435** | 2" | 14.9 |
| 72 - 76" | **105-436** | 2" | 15.8 |
| 76 - 80" | **105-437** | 2" | 16.7 |



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# Outside Micrometers

## SERIES 406 — Non-Rotating Spindle Type

### FEATURES

- With a standard bar except for 0 -1" / 0 - 25mm model.
- With SPC output.
- Supplied in a fitted plastic case.
- Non-slip grip finish




406-350-30

### SPECIFICATIONS

**Metric** Digital model with ratchet stop

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.001mm | **406-250-30** | ±3µm |
| 25 - 50mm | 0.001mm | **406-251-30** | ±3µm |
| 50 - 75mm | 0.001mm | **406-252-30** | ±3µm |
| 75 - 100mm | 0.001mm | **406-253-30** | ±4µm |

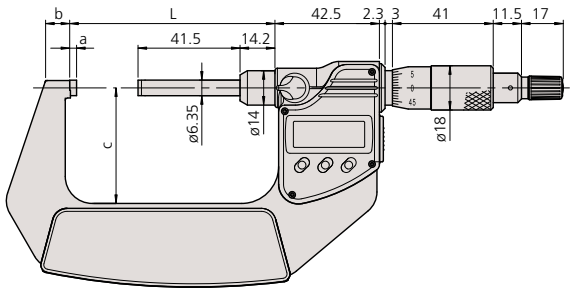
**Inch/Metric** Digital model with ratchet stop

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1"/0 - 25.4mm | .00005"/0.001mm | **406-350-30** | ±.00015" |
| 1 - 2"/25.4 - 50.8mm | .00005"/0.001mm | **406-351-30** | ±.00015" |
| 2 - 3"/50.8 - 72.6mm | .00005"/0.001mm | **406-352-30** | ±.00015" |
| 3 - 4"/76.2 - 101.6mm | .00005"/0.001mm | **406-353-30** | ±.0002" |

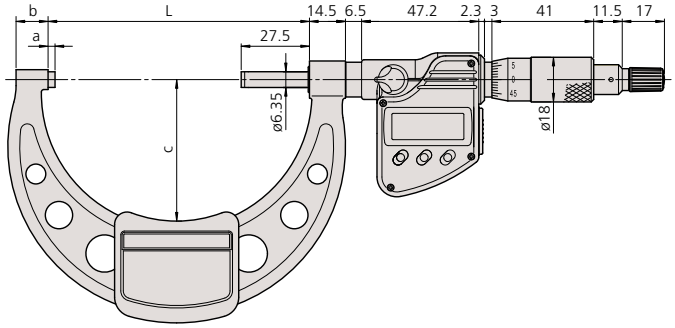
### DIMENSIONS AND MASS

**Digital models (up to 75mm)**

Unit: mm




**Digital models (over 75mm)**




### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .00005"/0.001mm or 0.001mm
Flatness: 0.3µm / .000012"
Parallelism: .00012"/3µm for models up to 3"/75mm
.00016"/4µm for 4"/100mm models
Measuring faces: Carbide tipped
Display: LCD
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 2.4 years under normal use

### Function of Digital Model

Origin-set, Zero / ABS, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80" / 2m)

# Outside Micrometers

## SERIES 107

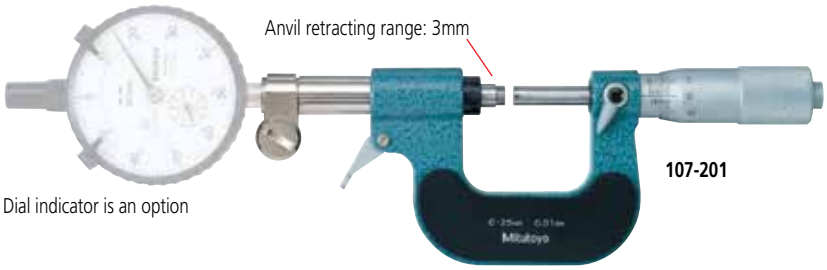
### Technical Data

Graduation: 0.01mm (thimble)
Flatness: 0.6µm
Parallelism: (2+R/100)µm, R=max. range (mm)
Measuring faces: Carbide tipped



### FEATURES

- Uses dial indicator for direct go/no-go judgment for mass-produced parts.
- Anvil retracting trigger for quick measurement.
- With a standard bar except for 0 - 25mm models.
- Supplied in fitted plastic case.



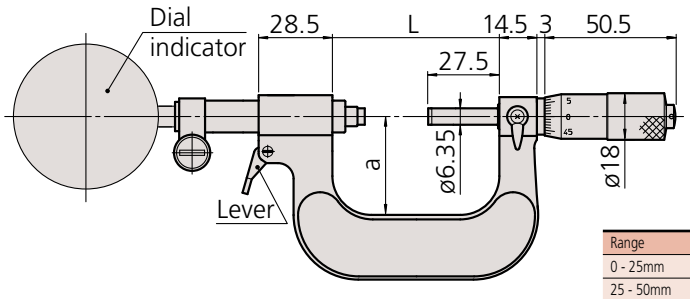

### SPECIFICATIONS

**Metric**

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.01mm | **107-201** | ±2µm |
| 25 - 50mm | 0.01mm | **107-202** | ±2µm |
| 50 - 75mm | 0.01mm | **107-203** | ±2µm |
| 75 - 100mm | 0.01mm | **107-204** | ±3µm |
| 100 - 125mm | 0.01mm | **107-205** | ±3µm |
| 125 - 150mm | 0.01mm | **107-206** | ±3µm |
| 150 - 175mm | 0.01mm | **107-207** | ±4µm |
| 175 - 200mm | 0.01mm | **107-208** | ±4µm |

### DIMENSIONS AND MASS

Unit: mm




| Range | L | a | MASS (g) |
|---|---|---|---|
| 0 - 25mm | 39.5 | 30 | 480 |
| 25 - 50mm | 64.5 | 38 | 520 |
| 50 - 75mm | 90 | 45 | 585 |
| 75 - 100mm | 115.6 | 65 | 630 |
| 100 - 125mm | 140.6 | 79 | 725 |
| 125 - 150mm | 165.6 | 93 | 810 |
| 150 - 175mm | 190.5 | 105 | 1050 |
| 175 - 200mm | 215.5 | 120 | 1170 |

# Spline Micrometers

## SERIES 331, 111

## FEATURES

- IP65 water/dust protection (Series 331).
- The anvil and spindle have a small diameter for measuring splined shafts, slots, and keyways.
- Non-slip grip finish (digital models)
- With ratchet stop for constant force.
- With SPC output (Series 331).
- With a standard bar except 0-1" and 0-25mm model.
- Supplied in fitted plastic case.




331-351-30




111-115

## Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .00005"/0.001mm or 0.001mm
Graduation**: .0001" or 0.01mm, .001"
Flatness: .000012" / 0.3µm
Parallelism: (2+R/100)µm, R=max. range (mm) [.00008" + .00004" (L/4")]
L = max. range (inch)
Measuring faces: Carbide tipped
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
Dust/Water protection level*: IP65
*Digital models **Analog models

## Function of Digital Model

Origin-set, Zero-setting, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

## Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80"/ 2m)

## SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **331-251-30** | ±2µm | Type A | 330 |
| | | **331-261-30** | ±2µm | Type B | 330 |
| 25 - 50mm | 0.001mm | **331-252-30** | ±2µm | Type A | 470 |
| | | **331-262-30** | ±2µm | Type B | 470 |
| 50 - 75mm | 0.001mm | **331-253-30** | ±2µm | Type A | 625 |
| | | **331-263-30** | ±2µm | Type B | 625 |
| 75 - 100mm | 0.001mm | **331-254-30** | ±3µm | Type A | 565 |
| | | **331-264-30** | ±3µm | Type B | 565 |

**Inch/Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1"/ 0 - 25.4mm | .00005" / 0.001mm | **331-351-30** | ±.0001" | Type A | 330 |
| | | **331-361-30** | ±.0001" | Type B | 330 |
| 1 - 2"/ 25.4-50.8mm | .00005" / 0.001mm | **331-352-30** | ±.0001" | Type A | 470 |
| | | **331-362-30** | ±.0001" | Type B | 470 |
| 2 - 3" / 50.8-76.2mm | .00005" / 0.001mm | **331-353-30** | ±.0001" | Type A | 625 |
| | | **331-363-30** | ±.0001" | Type B | 625 |
| 3 - 4" / 76.2-101.6mm | .00005" / 0.001mm | **331-354-30** | ±.00015" | Type A | 565 |
| | | **331-364-30** | ±.00015" | Type B | 565 |

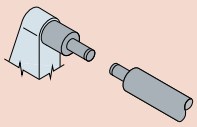
**Metric**

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **111-115** | ±3µm | Type A | 205 |
| | | **111-215** | ±3µm | Type B | 205 |
| 25 - 50mm | 0.01mm | **111-116** | ±3µm | Type A | 305 |
| 50 - 75mm | 0.01mm | **111-117** | ±3µm | Type A | 370 |
| 75 - 100mm | 0.01mm | **111-118** | ±4µm | Type A | 500 |
| 100 - 125mm | 0.01mm | **111-119** | ±4µm | Type A | 655 |
| 125 - 150mm | 0.01mm | **111-120** | ±4µm | Type A | 710 |
| 150 - 175mm | 0.01mm | **111-121** | ±5µm | Type A | 900 |
| 175 - 200mm | 0.01mm | **111-122** | ±5µm | Type A | 1040 |

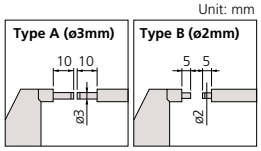
**Inch**

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .0001" | **111-166*** | ±.00015" | Type A | 205 |

* .0001" reading is obtained with vernier.



Unit: mm

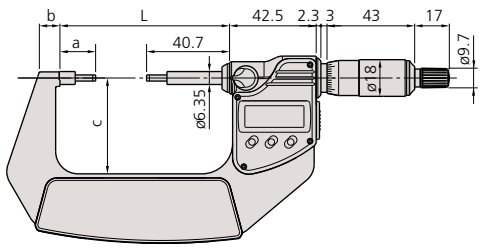





## DIMENSIONS

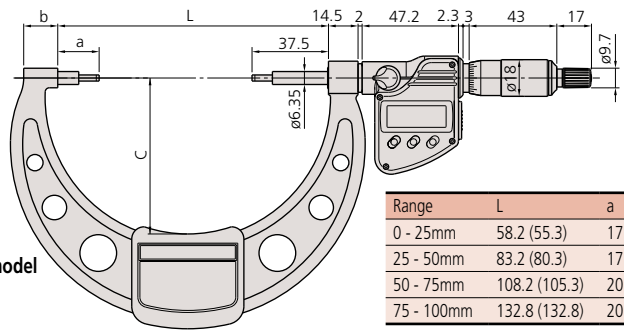
Unit: mm

**Models up to 75mm**




**Digital model**

**Models over 75mm**




**Digital model**

| Range | L | a | b | c |
|---|---|---|---|---|
| 0 - 25mm | 58.2 (55.3) | 17.5 (17.8) | 7.3 (10) | 32 (38) |
| 25 - 50mm | 83.2 (80.3) | 17.5 (17.8) | 10.1 (12) | 47 (49) |
| 50 - 75mm | 108.2 (105.3) | 20.3 (17.8) | 11.5 (14) | 60 (60) |
| 75 - 100mm | 132.8 (132.8) | 20.3 (20.3) | 16.7 (17) | 76.5 (79) |

# Point Micrometers

## SERIES 342, 142, 112

### Technical Data

Accuracy: Refer to the list of specifications.
Resolution*: .00005"/0.001mm or 0.001mm
Graduation**: .001" or 0.01mm
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
Dust/Water protection level*: IP65
*Digital models **Analog models

### Function of Digital Model

Origin-set, Zero / ABS, Data hold,
inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80" / 2m)

### FEATURES

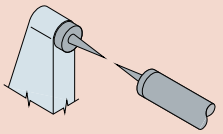
- IP65 water/dust protection (Series 342).
- Pointed spindle and anvil for measuring the web thickness of drills, small grooves, keyways, and other hard-to-reach dimensions.
- 15 degree and 30 degree measuring points are available.
- Non-slip grip finish (digital models).
- The measuring points have approximately 0.3mm / .012" radius.
- With ratchet stop for constant force.
- With SPC output (Series 342).
- With digit counter (Series 142).
- With a standard bar except 0 - 1" and 0 - 25mm model.
- Supplied in fitted plastic case.



342-351-30



112-201





Tip angle: 15° (R0.3mm)



Tip angle: 30° (R0.3mm)



## SPECIFICATIONS

**Metric** Digital model (with carbide tip)

| Range | Resolution | Order No. | Accuracy | Point | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **342-251-30** | ±2µm | 15° | 330 |
| | | **342-261-30** | ±2µm | 30° | 330 |
| 25 - 50mm | 0.001mm | **342-252-30** | ±2µm | 15° | 470 |
| | | **342-262-30** | ±2µm | 30° | 470 |
| 50 - 75mm | 0.001mm | **342-253-30** | ±2µm | 15° | 625 |
| | | **342-263-30** | ±2µm | 30° | 625 |
| 75 - 100mm | 0.001mm | **342-254-30** | ±3µm | 15° | 565 |
| | | **342-264-30** | ±3µm | 30° | 565 |

**Inch/Metric** Digital model (with carbide tip)

| Range | Resolution | Order No. | Accuracy | Point | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1"/ 0 -25.4mm | .00005" / 0.001mm | **342-351-30** | ±.0001" | 15° | 330 |
| | | **342-361-30** | ±.0001" | 30° | 330 |
| 1" - 2" / 25.4 - 50.8mm | .00005" / 0.001mm | **342-352-30** | ±.0001" | 15° | 470 |
| | | **342-362-30** | ±.0001" | 30° | 470 |
| 2" - 3" / 50.8 - 76.2mm | .00005" / 0.001mm | **342-353-30** | ±.0001" | 15° | 625 |
| | | **342-363-30** | ±.0001" | 30° | 625 |
| 3" - 4" / 76.2 - 101.6mm | .00005" / 0.001mm | **342-354-30** | ±.00015" | 15° | 565 |
| | | **342-364-30** | ±.00015" | 30° | 565 |

**Metric** Mechanical Counter Model

| Range | Graduation | Order No. | Accuracy | Point | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **142-153*** | ±3µm | 15° | 260 |
| | | **142-201*** | ±3µm | 30° | 260 |

*The points don't have carbide tips.

**Inch** Mechanical Counter Model

| Range | Graduation | Order No. | Accuracy | Point | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .001" | **142-177*** | ±.00015" | 15° | 260 |
| | | **142-225*** | ±.00015" | 30° | 260 |

*The points don't have carbide tips.

**Metric**

| Range | Graduation | Order No. | Accuracy | Point | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **112-165** | ±3µm | 15° | 205 |
| | | **112-153*** | ±3µm | 15° | 205 |
| | | **112-213** | ±3µm | 30° | 205 |
| | | **112-201*** | ±3µm | 30° | 205 |
| 25 - 50mm | 0.01mm | **112-166** | ±3µm | 15° | 305 |
| | | **112-154*** | ±3µm | 15° | 305 |
| | | **112-214** | ±3µm | 30° | 305 |
| | | **112-202*** | ±3µm | 30° | 305 |
| 50 - 75mm | 0.01mm | **112-167** | ±3µm | 15° | 370 |
| | | **112-155*** | ±3µm | 15° | 370 |
| | | **112-215** | ±3µm | 30° | 370 |
| | | **112-203*** | ±3µm | 30° | 370 |
| 75 - 100mm | 0.01mm | **112-168** | ±4µm | 15° | 500 |
| | | **112-156*** | ±4µm | 15° | 500 |
| | | **112-216** | ±4µm | 30° | 500 |
| | | **112-204*** | ±4µm | 30° | 500 |

*The points don't have carbide tips.

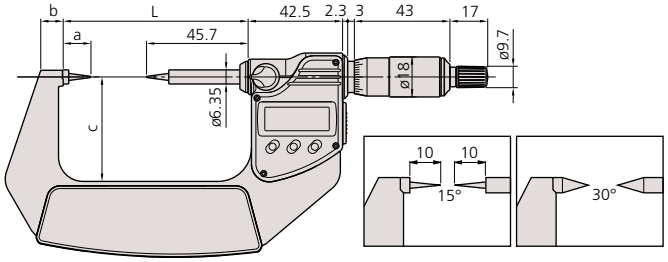
**Inch**

| Range | Graduation | Order No. | Accuracy | Point | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .001" | **112-189** | ±.00015" | 15° | 205 |
| | | **112-177*** | ±.00015" | 15° | 205 |
| | | **112-237** | ±.00015" | 30° | 205 |
| | | **112-225*** | ±.00015" | 30° | 205 |
| 1 - 2" | .001" | **112-190** | ±.00015" | 15° | 305 |
| | | **112-178*** | ±.00015" | 15° | 305 |
| | | **112-238** | ±.00015" | 30° | 305 |
| | | **112-226*** | ±.00015" | 30° | 305 |
| 2 - 3" | .001" | **112-191** | ±.00015" | 15° | 370 |

*The points don't have carbide tips.

## DIMENSIONS

**Models up to 75mm**

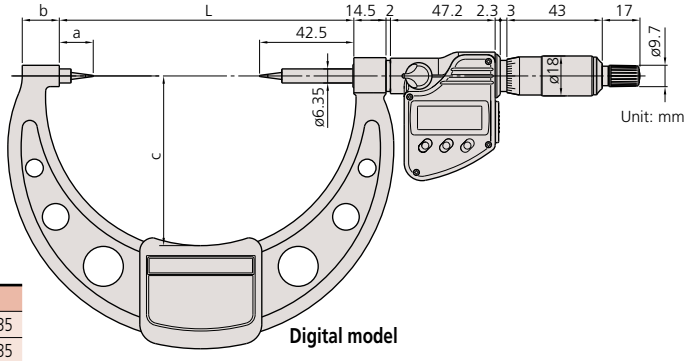



Digital model

| Range | L | a | b | c | d |
|---|---|---|---|---|---|
| 0 - 1" / 0 - 25mm | 58.2 (55.3) | 12.5 (12.8) | 7.3 (10) | 32 (38) | 6.35 |
| 1 - 2" / 25 - 50mm | 83.2 (80.3) | 12.5 (12.8) | 10.1 (12) | 47 (49) | 6.35 |
| 2 - 3" / 50 - 75mm | 108.2 (105.3) | 12.5 (15.3) | 11.5 (14) | 60 (60) | 6.35 |
| 3 - 4" / 75 -100mm | 132.8 (132.8) | 15.3 (15.3) | 16.7 (17) | 76.5 (79) | 6.35 |

( ): Analog model

**Models over 75mm**




Unit: mm

Digital model

# Crimp Height Micrometers

## SERIES 342, 142, 112 — Point Spindle and Blade Anvil

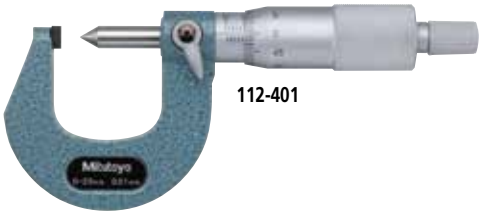
TÜVRheinland CERTIFIED www.tuv.com ID 0000040191 IP65 SPC

## FEATURES

- IP54/65 water/dust protection (Series 342).
- Measures the height of crimp contacts.
- With ratchet stop for constant force.
- Non-slip grip finish (digital models)
- With SPC output (Series 342).
- With digit counter (Series 142).
- Supplied in fitted plastic case.

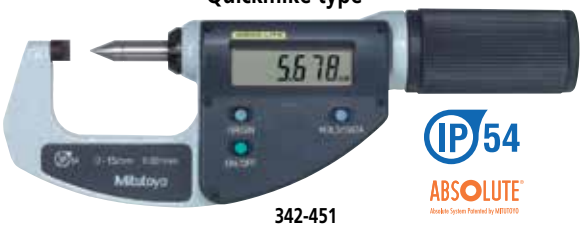


342-371-30



112-401

Quickmike type



342-451



## Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .00005" / 0.001mm or 0.001mm
Graduation**: 0.01mm
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use (3 years: Quickmike type)
Dust/Water protection level*: IP65 / IP54
*Digital models **Analog models

## Function of Digital Model

Origin-set, Zero / ABS (342-271-30, 342-371-30), Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

## Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80" / 2m )
**937387**: SPC cable for Quickmike type (40"/ 1m)
**965013**: SPC cable for Quickmike type (80" / 2m)

## SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 20mm | 0.001mm | **342-271-30** | ±3µm | 270 |

**Metric** Quickmike type

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 15mm | 0.001mm | **342-451** | ±3µm | 275 |

**Metric** Mechanical counter model

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **142-402** | ±3µm | 200 |
| 0 - 25mm | 0.001mm | **142-403*** | ±3µm | 200 |

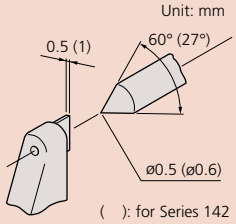
* 0.001mm reading is obtained with vernier.

**Inch/Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 0.8" / 0 - 20mm | .00005" / 0.001mm | **342-371-30** | ±.00015" | 270 |

**Metric**

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **112-401** | ±3µm | 165 |




( ): for Series 142

# V-Anvil Micrometers

## SERIES 314, 114 — 3 Flutes and 5 Flutes

### FEATURES

- Measures the outside diameter of cutting tools (such as taps, reamers, end mills) with an odd number of flutes.
- With ratchet stop for constant force.
- Supplied with setting standard.
- Non-slip grip finish (digital models).
- V-anvils with a centerline groove are available. They are useful for measuring pitch diameters of taps which have a small diameter by using single-wire method.
- With SPC output (Series 314).
- Supplied in fitted plastic case.

### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .00005" / 0.001mm or 0.001mm
Graduation**: .001" or .0001", 0.01mm
Flatness (spindle/anvil):
Analog model: .000024" / 0.6µm, .00005" / 1.3µm
Digital Model: .000012" / 0.3µm, .00004" / 1µm
Spindle face: Carbide tipped
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
*Digital models **Analog models

### Function of Digital Model

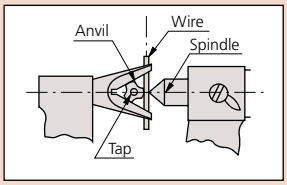
Zero / ABS, Data hold, Data output, Preset,
inch/mm conversion (on inch/metric models only)
Function lock, 2 Presets
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80" / 2m)



### Pitch Diameter Measurement of Tap by Single-wire Method Inch/Metric







314-351-30




114-121




114-202




114-204

### SPECIFICATIONS

**Metric** Digital model for 3 flutes cutting head

| Range | Resolution | Order No. | Accuracy | Remarks | Setting Standard | Mass (g) |
|---|---|---|---|---|---|---|
| 1 - 15mm | 0.001mm | **314-251-30** | ±4µm | w/Groove | ø5mm | 275 |
| | | **314-261-30** | ±4µm | — | ø5mm | 275 |
| 10 - 25mm | 0.001mm | **314-252-30** | ±4µm | w/Groove | ø10mm | 410 |
| | | **314-262-30** | ±4µm | — | ø10mm | 410 |
| 25 - 40mm | 0.001mm | **314-253-30** | ±5µm | — | ø25mm | 465 |

**Inch/Metric** Digital model for 3 flutes cutting head

| Range | Resolution | Order No. | Accuracy | Remarks | Setting Standard | Mass (g) |
|---|---|---|---|---|---|---|
| .05 - .6"/ 1.27 - 15.24mm | .00005" / 0.001mm | **314-351-30** | ±.0002" | w/Groove | ø.2" | 275 |
| | | **314-361-30** | ±.0002" | — | ø.2" | 275 |
| .4" - 1"/ 10.16 - 25.4mm | .00005" / 0.001mm | **314-352-30** | ±.0002" | w/Groove | ø.4" | 410 |
| | | **314-362-30** | ±.0002" | — | ø.4" | 410 |
| 1" - 1.6"/ 25.4 - 40.64mm | .00005" / 0.001mm | **314-353-30** | ±.00025" | — | ø 1" | 465 |

## SPECIFICATIONS

**Metric** For 3 flutes cutting head

| Range | Graduation | Order No. | Accuracy | Setting Standard | Remarks | Mass (g) |
|---|---|---|---|---|---|---|
| 1 - 15mm | 0.01mm | **114-101** | ±4µm | ø5mm | w/Groove | 120 |
| | | **114-161** | ±4µm | ø5mm | — | 120 |
| 10 - 25mm | 0.01mm | **114-102** | ±4µm | ø10mm | w/Groove | 280 |
| | | **114-162** | ±4µm | ø10mm | — | 280 |
| 2.3 - 25mm | 0.01mm | **114-204*** | ±4µm | ø5mm | — | 290 |
| 25 - 40mm | 0.01mm | **114-103** | ±5µm | ø25mm | — | 400 |
| 40 - 55mm | 0.01mm | **114-104** | ±6µm | ø40mm | — | 465 |
| 55 - 70mm | 0.01mm | **114-105** | ±6µm | ø55mm | — | 675 |
| 70 - 85mm | 0.01mm | **114-106** | ±7µm | ø70mm | — | 910 |

*Carbide-tipped anvil

**Inch** For 3 flutes cutting head

| Range | Graduation | Order No. | Accuracy | Setting Standard | Mass (g) |
|---|---|---|---|---|---|
| .05 - .6" | .001" | **114-163** | ±.0002" | ø.2" | 120 |
| .09 - 1" | .0001" | **114-202*** | ±.0002" | ø.2" | 280 |
| 1 - 1.6" | .001" | **114-113** | ±.00025" | ø1" | 400 |
| 1.6 - 2.2" | .001" | **114-114** | ±.0003" | ø1.6" | 465 |

*Carbide-tipped anvil and .0001" reading is obtained with vernier.

**Metric** For 5 flutes cutting head

| Range | Graduation | Order No. | Accuracy | Setting Standard | Remarks | Mass (g) |
|---|---|---|---|---|---|---|
| 5 - 25mm | 0.01mm | **114-121** | ±4µm | ø5mm | w/Groove | 255 |
| | | **114-165** | ±4µm | ø5mm | — | 255 |
| 2.3 - 25mm | 0.01mm | **114-137*** | ±4µm | ø5mm | — | 220 |
| 25 - 45mm | 0.01mm | **114-122** | ±5µm | ø25mm | — | 400 |
| 45 - 65mm | 0.01mm | **114-123** | ±6µm | ø55mm | — | 540 |
| 65 - 85mm | 0.01mm | **114-124** | ±7µm | ø70mm | — | 760 |

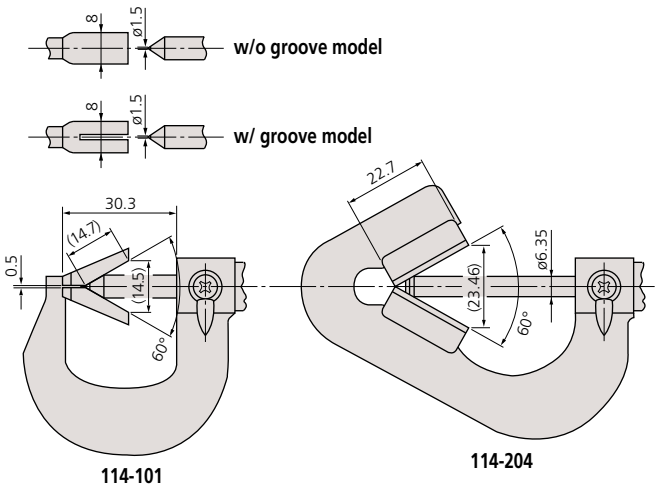
*Carbide-tipped anvil

**Inch** For 5 flutes cutting head

| Range | Graduation | Order No. | Accuracy | Setting Standard | Mass (g) |
|---|---|---|---|---|---|
| .09 - 1" | .0001" | **114-135** | ±.0002" | ø.2" | 255 |

## DIMENSIONS

Unit: mm




| Range | a |
|---|---|
| .05 - .6" / 10 - 25mm | 6.2 |
| 1 - 1.6" / 25 - 40mm | 19.14 |
| 1.6 - 2.2" / 40 - 55mm | 32.13 |
| 55 - 70mm | 45.12 |
| 70 - 85mm | 58.11 |

# Limit Micrometers

## SERIES 113

### FEATURES

- Can be used as a go/no-go gage by setting the upper and lower limits.
- Provided with a standard bar for 25mm - 50mm model.
- Supplied in fitted plastic case.






113-102

### Technical Data

Graduation: 0.01mm
Flatness: 0.6µm
Parallelism: (3+R/100)µm, R=max. range (mm)
Measuring faces: Carbide tipped

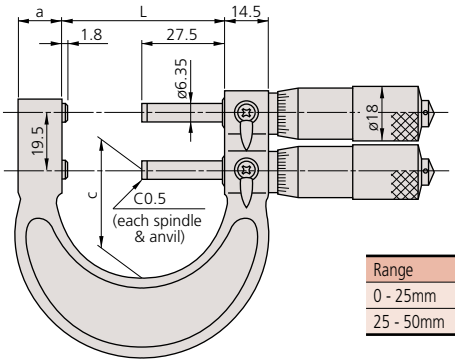
### SPECIFICATIONS

**Metric**

| Range | Graduation | **Order No.** | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.01mm | **113-102** | ±3µm |
| 25 - 50mm | 0.01mm | **113-103** | ±3µm |

### DIMENSIONS AND MASS

Unit: mm




| Range | L | a | c | Mass (G) |
|---|---|---|---|---|
| 0 - 25mm | 29.3 | 15 | 23 | 340 |
| 25 - 50mm | 54.3 | 15 | 37 | 380 |



Mitutoyo

# Pana Micrometers

## SERIES 116 — Interchangeable Anvil Type

### FEATURES

- Non-rotating spindle with optional seven interchangeable anvils (flat, spline, spherical, point, knife-edge, disk and blade) for a wide range of applications.
- Interchangeable anvils (pair) are optional.
- With a standard bar except 0-1″ and 0 - 25 mm model.
- V-anvils and conical spindle tips (matching pair) for screw thread measurement are also available.
- With ratchet stop for constant force.






**116-101**




**116-105**

Shown with optional anvils

### SPECIFICATIONS

**Metric**

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.01mm | **116-101** | ±4µm |
| 25 - 50mm | 0.01mm | **116-102** | ±4µm |

**Inch**

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" | .001" | **116-105** | ±.0002" |
| 1" - 2" | .001" | **116-106** | ±.0002" |

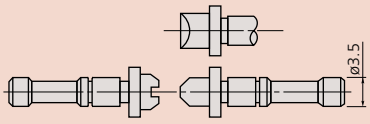
### Technical Data

Graduation: .001″ or 0.01mm
Spindle feed error: .00012″ / 3µm

### Optional Accessories

Interchangeable V-anvil and conical spindle tip set:
For Metric/Unified screw

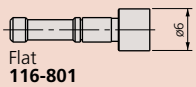
| Order No. | Assortment of anvils and tips |
|---|---|
| **116-830** | 0.4 - 0.5mm/64 - 48TPI (**116-831**)<br>0.6 - 0.9mm/44 - 28TPI (**116-832**)<br>1 - 1.75mm/24 - 14TPI (**116-833**)<br>2 - 3mm/13 - 9TPI (**116-834**)<br>3.5 - 5mm/8 - 5TPI (**116-835**)<br>5.5 - 7mm/4.5 - 3.5TPI (**116-836**) |



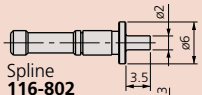

**116-830**

Interchangeable anvils set

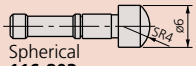
| Order No. | Assortment of anvils |
|---|---|
| **116-800** | Flat anvils (**116-801**)<br>Spline anvils (**116-802**)<br>Spherical anvils (**116-803**)<br>Point anvils (**116-804**)<br>Knife-edge anvils (**116-805**)<br>Disk anvils (**116-806**)<br>Blade anvils (**116-807**) |



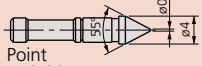

Flat
**116-801**



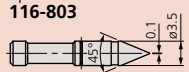

Spline
**116-802**



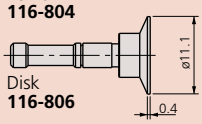

Spherical
**116-803**



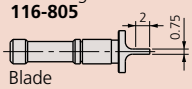

Point
**116-804**




Knife-edge
**116-805**




Disk
**116-806**




Blade
**116-807**

# Spherical Face Micrometers

## SERIES 395, 295, 115

### FEATURES

- IP65 water/dust protection (Series 395).
- Designed to measure the wall thickness of various tubing.
- With ratchet stop for constant force.
- With SPC output (Series 395).
- Non-slip grip finish (digital models).
- With digit counter (Series 295).
- With a standard bar except 0 -1" and 0 - 25mm model.
- Supplied in fitted plastic case.




115-153




395-371-30

### Technical Data

Accuracy: Refer to the list of specifications
Flatness: .000024" / 0.6µm
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
Dust/Water protection level*: IP65
*Digital models **Analog models

### Function of Digital Model

Origin-set, Zero / ABS, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

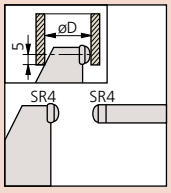
### Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80" / 2m)

Spherical anvil-spindle type



Unit: mm




Measuring faces: Carbide tipped

ød: Mini. inside dia. of tubing

### SPECIFICATIONS

**Metric** Digital model with spherical anvil

| Range | Resolution | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **395-251-30**S-F | ±2µm | D: 15mm | 270 |
| | | **395-271-30**S-S | ±2µm | D: 15mm | 270 |
| 25 - 50mm | 0.001mm | **395-252-30**S-F | ±2µm | D: 15mm | 330 |
| | | **395-272-30**S-S | ±2µm | D: 15mm | 330 |
| 50 - 75mm | 0.001mm | **395-253-30**S-F | ±2µm | D: 19mm | 470 |
| | | **395-273-30**S-S | ±2µm | D: 19mm | 470 |
| 75 - 100mm | 0.001mm | **395-254-30**S-F | ±3µm | D: 20mm | 625 |
| | | **395-274-30**S-S | ±3µm | D: 20mm | 625 |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle

**Inch/Metric** Digital model with spherical anvil

| Range | Resolution | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1"/ 0 - 25.4mm | .00005" / 0.001mm | **395-351-30**S-F | ±.0001" | D: .59" | 270 |
| | | **395-371-30**S-S | ±.0001" | D: .59" | 270 |
| 1" - 2"/ 25.4- 50.8mm | .00005" / 0.001mm | **395-352-30**S-F | ±.0001" | D: .59" | 330 |
| | | **395-372-30**S-S | ±.0001" | D: .59 | 330 |
| 2" - 3"/ 50.8-76.2mm | .00005" / 0.001mm | **395-353-30**S-F | ±.0001" | D: .75" | 470 |
| | | **395-373-30**S-S | ±.0001" | D: .75" | 470 |
| 3" - 4"/ 76.2-101.6mm | .00005" / 0.001mm | **395-354-30**S-F | ±.00015" | D: .79" | 625 |
| | | **395-374-30**S-S | ±.00015" | D: .79" | 625 |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle

**Metric** Mechanical counter model with spherical anvil

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **295-115**S-F | ±3µm | D: 10mm | 220 |
| | | **295-215**S-S | ±3µm | D: 10mm | 220 |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle

**Inch** Mechanical counter model with spherical anvil

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .0001" | **295-153**S-F* | ±.00015" | D: .40" | 220 |
| | | **295-253**S-S* | ±.00015" | D: .40" | 220 |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle
*.0001" reading is obtained with vernier.

**Metric** With spherical anvil

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **115-115**S-F | ±3µm | D: 10mm | 180 |
| | | **115-215**S-S | ±3µm | D: 10mm | 180 |
| 25 - 50mm | 0.01mm | **115-116**S-F | ±3µm | D: 11mm | 240 |
| | | **115-216**S-S | ±3µm | D: 11mm | 240 |
| 50 - 75mm | 0.01mm | **115-117**S-F | ±3µm | D: 17mm | 315 |
| | | **115-217**S-S | ±3µm | D: 17mm | 315 |
| 75 - 100mm | 0.01mm | **115-118**S-F | ±4µm | D: 18mm | 375 |
| | | **115-218**S-S | ±4µm | D: 18mm | 375 |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle

**Inch** With spherical anvil

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .0001" | **115-153**S-F* | ±.00015" | D: .40" | 180 |
| 0 - 1" | .0001" | **115-253**S-S* | ±.00015" | D: .40" | 180 |
| 1 - 2" | .001" | **115-242**S-S | ±.00015" | D: .44" | 240 |
| 2 - 3" | .001" | **115-243**S-S | ±.00015" | D: .67" | 315 |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle
*.0001" reading is obtained with vernier.

# Tube Micrometers

## SERIES 395, 295, 115— Spherical and Cylindrical Anvils

### FEATURES

- IP65 water/dust protection (Series 395).
- Designed to measure the wall thickness of various tubing.
- The Tube Micrometers have two combinations of measuring faces (carbide-tipped): spherical-flat type.
- With ratchet stop for constant force.
- With SPC output (Series 395).
- With digit counter (Series 295).
- With a standard bar except 0 -1" and 0 - 25mm model.
- Supplied in fitted plastic case.
- Non-slip grip finish (digital models).

**Pin Anvil Type**




395-261-30



### Technical Data

Accuracy: Refer to the list of specifications.
Flatness: .000024" / 0.6µm
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
Dust/Water protection level*: IP65
*Digital models

### Function of Digital Model

Origin-set, Zero / ABS, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80" / 2m)


Type A


Type B


Type C


Type D

## SPECIFICATIONS

**Metric** Digital model with cylindrical anvil

| Range | Resolution | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **395-261-30** | ±3µm | Type A | 270 |
| | | **395-262-30** | ±3µm | Type B | 270 |
| | | **395-263-30** | ±3µm | Type C | 310 |
| | | **395-264-30** | ±3µm | Type D | 310 |

**Inch/Metric** Digital model with cylindrical anvil

| Range | Resolution | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **395-362-30** | ±.00015" | Type B | 270 |
| | | **395-363-30** | ±.00015" | Type C | 310 |
| | | **395-364-30** | ±.00015" | Type D | 310 |

**Metric** Mechanical counter model

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **295-302** | ±3µm | Type A | 210 |

**Inch** Mechanical counter model

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .0001" | **295-313** | ±.00015" | Type C | 210 |
| | | **295-314** | ±.00015" | Type D | 210 |

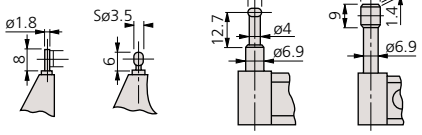
**Metric** With cylindrical anvil

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **115-302** | ±3µm | Type A | 180 |
| | | **115-308** | ±3µm | Type B | 180 |
| | | **115-315** | ±3µm | Type C | 180 |
| | | **115-316** | ±3µm | Type D | 180 |
| 25 - 50mm | 0.01mm | **115-303** | ±3µm | Type A | 240 |
| | | **115-309** | ±3µm | Type B | 240 |

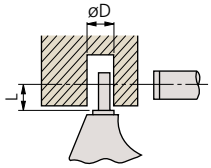
**Inch** With cylindrical anvil

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .001" | **115-305** | ±.00015" | Type A | 180 |
| | .0001" | **115-313*** | ±.00015" | Type C | 180 |
| | .0001" | **115-314*** | ±.00015" | Type D | 180 |

*.0001" reading is obtained with vernier.




Type A (Pin) | Type B (Spherical) | Type C (Spherical) | Type D (Cylindrical)




øD: Mini. inside dia. of tubing
Spindle face: Carbide tipped

| Anvil | D | L |
|---|---|---|
| Type A | 2 | 4 |
| Type B | 3.6 | 4 |
| Type C | 4.8 | 12 |
| Type D | 8.2 | 22 |

# "Uni-Mike"

## SERIES 317, 117 — Interchangeable Anvil Type

### FEATURES

- IP65 water/dust protection (Series 317).
- Measures tubing thickness, shoulder-edge distance, rivet head height, etc. with interchangeable anvils (flat anvil, rod anvil, V-anvil).
- Supplied with Flat Anvil (**201216**) and Rod Anvil: .118"/ø3mm dia. rod anvil (**201217**) for 0-1"/0-25mm models, .197"/ø5mm (**201379**) for 1-2" / 25-50mm model.
- With special Disk Anvils. The Uni-Mike is used as a height micrometer. The disks have a lapped, mirror surface.
- With a standard bar except 0 -1" and 0-25mm model.
- Supplied in fitted plastic case.
- Non-slip grip finish (digital models)



317-351-30



117-107

### Technical Data

Accuracy: Refer to the list of specifications.
Resolution*: .00005"/0.001mm or 0.001mm
Graduation**: .0001" or 0.01mm
Spindle face: Carbide tipped
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
Dust/Water protection level*: IP65
*Digital models **Analog models

### Function of Digital Model

Origin-set, Zero / ABS, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function Lock
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA662**: SPC cable with data switch (40"/ 1m)*
**05CZA663**: SPC cable with data switch (80" / 2m)*
**201218**: V-anvil
**950758**: Disc. anvil for 1" / 25m models

*Only for digital models.

### Applications



Using flat anvil (201216)



With the disc. anvil (950758) Shown above, the Uni-Mike is used as a height micrometer.

### SPECIFICATIONS

**Metric** Digital model with ratchet stop

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **317-251-30** | ±4µm | 335 |
| 25 - 50mm | 0.001mm | **317-252-30** | ±4µm | 360 |

Excluding quantizing error

**Inch/Metric** Digital model with friction thimble

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **317-351-30** | ±.0002" | 340 |
| 1 - 2" /25.4 - 50.8mm | .00005" / 0.001mm | **317-352-30** | ±.0002" | 365 |

Excluding quantizing error

**Metric** With ratchet stop

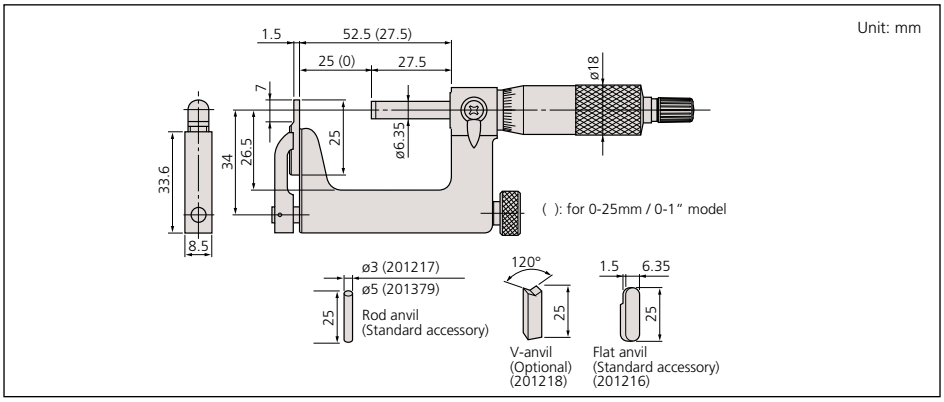
| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **117-101** | ±4µm | 255 |
| 25 - 50mm | 0.01mm | **117-102** | ±4µm | 320 |

**Inch** With friction thimble

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .0001" | **117-107*** | ±.0002" | 255 |
| 1 - 2" | .0001" | **117-108*** | ±.0002" | 320 |

* .0001" reading is obtained with vernier.

### DIMENSIONS



# Sheet Metal Micrometers

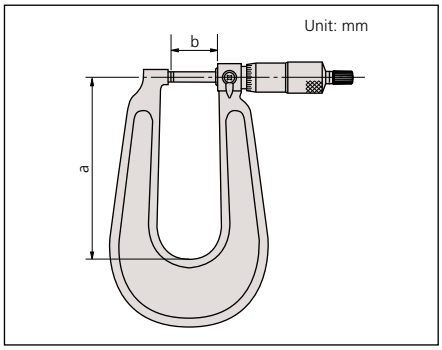
## SERIES 389, 119, 118

## FEATURES

- Measures thickness of sheet metal, paper, plastic and rubber parts.
- With ratchet stop for constant force.
- With a standard bar except for 0 - 1" / 0 - 25mm model.
- IP65 water/dust protection (Series 389*).
  *Except for **389-514 / 389-714.**
- Supplied in fitted plastic case.
- Non-slip grip finish (digital models).




## DIMENSIONS




## Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .00005"/0.001mm or 0.001mm
Graduation**: 0.01mm, .001" or .0001"
Flatness: .000024" / 0.6µm for models with 6" / 150mm throat
.00004" / 1µm for models with 12" / 300mm throat
Parallelism: .00012" / 3µm
Measuring faces: Carbide tipped
Display*: LCD
Battery*: SR44 [1 pc. (2 pcs.: **389-514** and **389-714**)], **938882**
Battery life*: Approx. 2.4 years under normal use (1.8 years: **389-514** and **389-714**)
Dust/Water protection level*: IP65
*Digital models **Analog models

## Function of Digital Model

Origin-set, Zero-setting, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

## Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m )
**05CZA663**: SPC cable with data switch (80" / 2m)
**04AZB512**: SPC cable for **389-514/389-714** (40" / 1m)
**04AZB513**: SPC cable for **389-514/389-714** (80" / 2m)

## SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Accuracy | a/b |
|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **389-251-30** | ±4µm | 160/27.5mm |
| 0 - 25mm | 0.001mm | **389-261-30**S-F | ±4µm | 160/27.5mm |
| 0 - 25mm | 0.001mm | **389-271-30**S-S | ±4µm | 160/27.5mm |
| 0 - 25mm | 0.001mm | **389-514** | ±5µm | 330/35mm |
| 25 - 50mm | 0.001mm | **389-252-30** | ±4µm | 165/27.5mm |
| 25 - 50mm | 0.001mm | **389-262-30**S-F | ±4µm | 165/27.5mm |
| 25 - 50mm | 0.001mm | **389-272-30**S-S | ±4µm | 165/27.5mm |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle

**Inch/Metric** Digital model

| Range | Resolution | Order No. | Accuracy | a/b |
|---|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **389-351-30** | ±.0002" | 6.3"/1.08" |
| | | **389-361-30**S-F | ±.0002" | 6.3"/1.08" |
| | | **389-371-30**S-S | ±.0002" | 6.3"/1.08" |
| | | **389-714** | ±.00025" | 13"/1.38" |
| 1 - 2" / 25.4 - 50.8mm | .00005" / 0.001mm | **389-352-30** | ±.0002" | 6.5"/1.08" |
| | | **389-362-30**S-F | ±.0002" | 6.5"/1.08" |
| | | **389-372-30**S-S | ±.0002" | 6.5"/1.08" |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle

**Anvil-Spindle Combinations**


Standard, Flat-Flat


Spherical-Flat (S-F)


Spherical-Spherical (S-S)

**Metric**

| Range | Graduation | Order No. | Accuracy | a/b |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **118-101** | ±4µm | 110/27.5mm |
| 0 - 25mm | 0.01mm | **118-102** | ±4µm | 160/27.5mm |
| 0 - 25mm | 0.01mm | **118-114**S-F | ±4µm | 160/27.5mm |
| 0 - 25mm | 0.01mm | **118-118**S-S | ±4µm | 160/27.5mm |
| 0 - 25mm | 0.01mm | **118-103** | ±5µm | 330/35mm |
| 25 - 50mm | 0.01mm | **118-110** | ±4µm | 165/27.5mm |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle

**Inch**

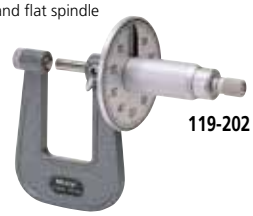
| Range | Graduation | Order No. | Accuracy | a/b |
|---|---|---|---|---|
| 0 - 1" | .0001" | **118-129** | ±.0002" | 6.3"/1.08" |
| | | **118-116**S-F | ±.0002" | 6.3"/1.08" |
| | | **118-120**S-S | ±.0002" | 6.3"/1.08" |
| | .001" | **118-107** | ±.00025" | 13"/1.38" |
| 1" - 2" | .001" | **118-112** | ±.0002" | 6.5"/1.08" |

S-F: Spherical anvil and flat spindle
S-S: Spherical anvil and spherical spindle
*.0001" reading is obtained with vernier.

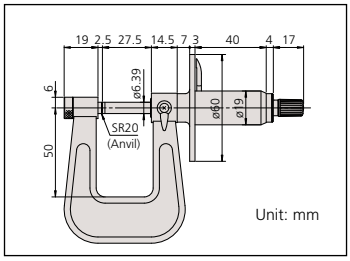
**Metric** Dial reading model

| Range | Graduation | Order No. | Accuracy | Throat |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **119-202**S-F | ±4µm | 50mm |

S-F: Spherical anvil and flat spindle


**119-202**

## DIMENSIONS AND MASS




The Series 119 is provided with a dial for making easy and quick readings.



# Blade Micrometers

## SERIES 422,122 — Non-Rotating Spindle Type

### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .00005"/0.001mm or 0.001mm
Graduation**: .0001" or 0.01mm
Parallelism: .00012" / 3µm for models up to 3" / 75mm
(3+R/100)µm for models over 75mm,
R=max. range (mm) .00016" for 4" models
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
*Digital models **Analog models

### Function of Digital Model

Origin-set, Zero / ABS, Data hold, Data output,
inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (1m / 40")
**05CZA663**: SPC cable with data switch (2m / 80")
**937387**: SPC cable for Quickmike type (1m / 40")
**965013**: SPC cable for Quickmike type (2m / 80")



### FEATURES

- The anvil and the spindle have a blade for measuring the groove diameter of shafts, keyways and other hard-to-reach areas.
- With ratchet stop for constant force.
- Non-slip grip finish (digital models).
- Speedy spindle feed of .4"/10mm /rev. (Quickmike type).
- With a standard bar except 0 - 1" and 0 -25mm model.
- Supplied in fitted plastic case.

**Quickmike type**



422-421

IP54

ABSOLUTE

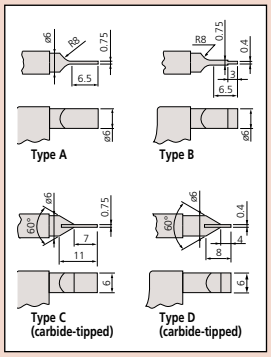


422-330-30



122-125

### TYPE AND DIMENSIONS




### SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **422-230-30** | ±3µm | Type A | 365 |
| | | **422-260-30** | ±3µm | Type B | 365 |
| | | **422-270-30** | ±3µm | Type C | 365 |
| | | **422-271-30** | ±3µm | Type D | 365 |
| 25 - 50mm | 0.001mm | **422-231-30** | ±3µm | Type A | 565 |
| | | **422-261-30** | ±3µm | Type B | 565 |
| 50 - 75mm | 0.001mm | **422-232-30** | ±3µm | Type A | 465 |
| 75 - 100mm | 0.001mm | **422-233-30** | ±4µm | Type A | 580 |

**Metric** Quickmike type

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 30mm | 0.001mm | **422-411** | ±3µm | 350 |
| 25 - 55mm | 0.001mm | **422-412** | ±3µm | 490 |

**Metric**

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **122-101** | ±3µm | Type A | 260 |
| | | **122-111** | ±3µm | Type B | 260 |
| | | **122-161** | ±3µm | Type C | 275 |
| | | **122-141** | ±3µm | Type D | 275 |
| 25 - 50mm | 0.01mm | **122-102** | ±3µm | Type A | 300 |
| | | **122-112** | ±3µm | Type B | 300 |
| | | **122-162** | ±3µm | Type C | 315 |
| | | **122-142** | ±3µm | Type D | 315 |
| 50 - 75mm | 0.01mm | **122-103** | ±3µm | Type A | 360 |
| 75 - 100mm | 0.01mm | **122-104** | ±4µm | Type A | 525 |
| 100 - 125mm | 0.01mm | **122-105** | ±4µm | Type A | 670 |
| 125 - 150mm | 0.01mm | **122-106** | ±4µm | Type A | 775 |
| 150 - 175mm | 0.01mm | **122-107** | ±5µm | Type A | 950 |
| 175 - 200mm | 0.01mm | **122-108** | ±5µm | Type A | 1140 |

**Inch/Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **422-330-30** | ±.00015" | Type A | 365 |
| | | **422-360-30** | ±.00015" | Type B | 365 |
| | | **422-370-30** | ±.00015" | Type C | 365 |
| | | **422-371-30** | ±.00015" | Type D | 365 |
| 1 - 2" / 25.4 - 50.8mm | .00005" / 0.001mm | **422-331-30** | ±.00015" | Type A | 565 |
| | | **422-361-30** | ±.00015" | Type B | 565 |
| 2 - 3" / 50.8 - 76.2mm | .00005" / 0.001mm | **422-332-30** | ±.00015" | Type A | 465 |
| 3 - 4" / 76.2 - 101.6mm | .00005" / 0.001mm | **422-333-30** | ±.0002" | Type A | 580 |

**Inch/Metric** Quickmike type

| Range | Resolution | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1.2" / 0 - 30.48mm | .00005" / 0.001mm | **422-421** | ±.00015" | Type A | 350 |
| 1 - 2.2" / 25.4 - 55.88mm | .00005" / 0.001mm | **422-422** | ±.00015" | Type A | 490 |

**Inch**

| Range | Graduation | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .0001" | **122-125** | ±.00015" | Type A | 260 |
| | | **122-135** | ±.00015" | Type B | 260 |
| | | **122-151** | ±.00015" | Type D | 275 |
| 1 - 2" | .0001" | **122-126** | ±.00015" | Type A | 300 |
| 2 - 3" | .0001" | **122-127** | ±.00015" | Type A | 360 |
| 3 - 4" | .0001" | **122-128** | ±.0002" | Type A | 525 |



Mitutoyo

# Disk Micrometers

## SERIES 323, 223, 123 - Rotating Spindle

## FEATURES

- Diameter of measuring disk: .787"/ 20mm.
- .028"/ 0.7mm (1mm: models over 100mm) edge thickness to enter narrow recesses.
- With ratchet stop for constant force.
- Non-slip grip finish (digital models).
- With a standard bar except for 0 - 1"/ 0 - 25mm model.
- With SPC output (Series 323).
- The Series 223 is provided with a mechanical digit counter for quick reading of measurements.
- Supplied in fitted plastic case. (Over 100mm models supplied wooden cases).



123-125



323-350-30



123-103



223-125

## Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .00005"/0.001mm or 0.001mm
Graduation**: .001" or 0.01mm
Flatness: .00004" / 1µm for models up to 4"/100mm
.000063" / 1.6µm for models over 4"/ 100mm
Parallelism: .00016" / 4µm for models up to 2"/ 50mm
.00024" for models up to 4"
(4+R/50)µm for models up to 100mm
(5+R/75)µm for models over 100mm, R=max. range (mm)
Measurable module: 0.5-6 (0.7-11: models over 100mm)
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
*Digital models **Analog models

## Function of Digital Model

Origin-set, Zero / ABS, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

## Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80" / 2m)

## SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **323-250-30** | ±4µm | 290 |
| 25 - 50mm | 0.001mm | **323-251-30** | ±4µm | 355 |
| 50 - 75mm | 0.001mm | **323-252-30** | ±6µm | 555 |
| 75 - 100mm | 0.001mm | **323-253-30** | ±6µm | 610 |

**Inch/Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1"/0 - 25.4mm | .00005"/ 0.001mm | **323-350-30** | ±.0002" | 290 |
| 1 - 2"/25.4 - 50.8mm | .00005"/0.001mm | **323-351-30** | ±.0002" | 355 |
| 2 - 3"/50 - 76.2mm | .00005"/0.001mm | **323-352-30** | ±.0003" | 555 |
| 3 - 4"/76.2 - 101.6mm | .00005"/0.001mm | **323-353-30** | ±.0003" | 610 |

**Metric** Mechanical counter model

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **223-101** | ±4µm | 260 |
| 25 - 50mm | 0.01mm | **223-102** | ±4µm | 290 |

**Inch** Mechanical counter model

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .001" | **223-125** | ±.0002" | 260 |

**Metric**

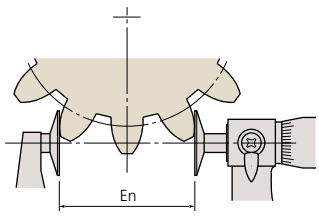
| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **123-101** | ±4µm | 200 |
| | | **123-113*** | ±4µm | 230 |
| 25 - 50mm | 0.01mm | **123-102** | ±4µm | 250 |
| | | **123-114*** | ±4µm | 270 |
| 50 - 75mm | 0.01mm | **123-103** | ±6µm | 300 |
| | | **123-115*** | ±6µm | 320 |
| 75 - 100mm | 0.01mm | **123-104** | ±6µm | 375 |
| | | **123-116*** | ±6µm | 390 |
| 100 - 125mm | 0.01mm | **123-105** | ±7µm | 520 |
| 125 - 150mm | 0.01mm | **123-106** | ±7µm | 570 |
| 150 - 175mm | 0.01mm | **123-107** | ±8µm | 730 |
| 175 - 200mm | 0.01mm | **123-108** | ±8µm | 890 |
| 200 - 225mm | 0.01mm | **123-109** | ±8µm | 1000 |
| 225 - 250mm | 0.01mm | **123-110** | ±9µm | 1200 |
| 250 - 275mm | 0.01mm | **123-111** | ±9µm | 1410 |
| 275 - 300mm | 0.01mm | **123-112** | ±9µm | 1680 |

*The measuring disks have carbide tips.
Note: The disk diameter of models over 100mm is 30mm.

**Inch**

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .001" | **123-125** | ±.0002" | 200 |
| 1 - 2" | .001" | **123-126** | ±.0002" | 250 |
| 2 - 3" | .001" | **123-127** | ±.0003" | 300 |
| 3 - 4" | .001" | **123-128** | ±.0003" | 375 |

### Root tangent length of gear (En)



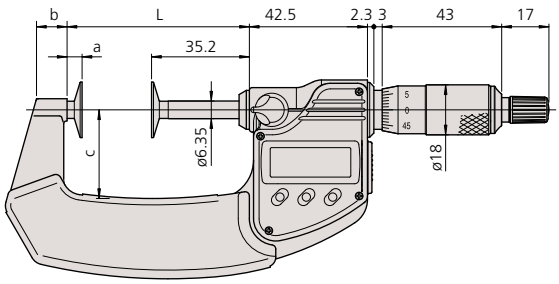

Note: Root tangent length measurement is not available for some types of gears.



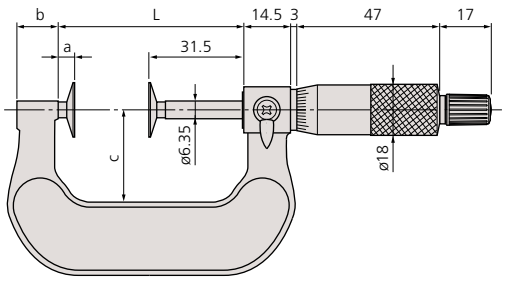
## DIMENSIONS

Unit: mm

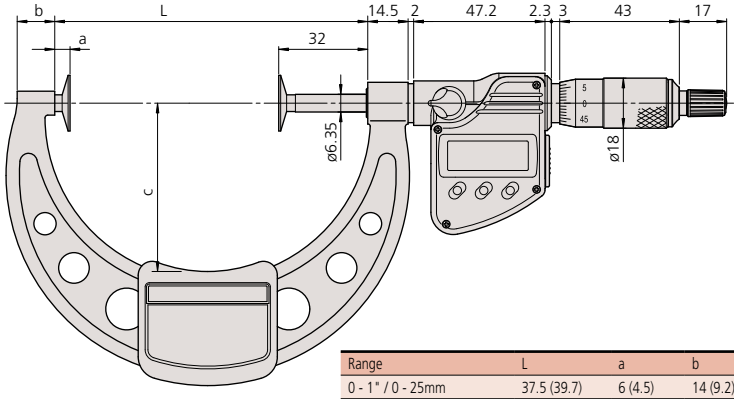
**Digital models up to 75mm**



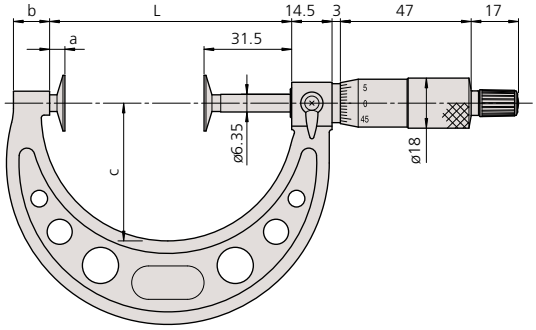

**Analog models up to 50mm**




**Digital models up to 75mm**

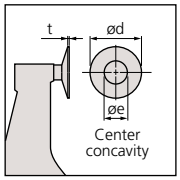



**Analog over 50mm**




| Range | L | a | b | c | ød | øe | t |
|---|---|---|---|---|---|---|---|
| 0 - 1" / 0 - 25mm | 37.5 (39.7) | 6 (4.5) | 14 (9.2) | 25 (25.4) | 20 | 8 (9.8) | 0.7 |
| 1 - 2" / 25 - 50mm | 62.5 (65.6) | 6 (5.4) | 14 (11) | 32 (31.9) | 20 | 8 (9.8) | 0.7 |
| 2 - 3" / 50 - 75mm | 87 (90.7) | 5.5 (5.5) | 11 (12.2) | 49 (50) | 20 | 8 (9.8) | 0.7 |
| 3 - 4" / 75 - 100mm | 112 (112.5) | 5.5 (5.5) | 11 (13.5) | 63 (60.5) | 20 | 8 (9.8) | 0.7 |
| 4 - 5" / 100 - 125mm | 137.5 | 6 | 12 | 79 | 30 | 12 | 1 |
| 5 - 6" / 125 - 150mm | 162.5 | 6 | 15 | 94 | 30 | 12 | 1 |
| 6 - 7" / 150 - 175mm | 187.5 | 6 | 16 | 106 | 30 | 12 | 1 |
| 7 -8" / 175 - 200mm | 212.5 | 6 | 15 | 118 | 30 | 12 | 1 |
| 8 - 9" / 200 - 225mm | 237.5 | 6 | 14 | 130 | 30 | 12 | 1 |
| 9 - 10" / 225 - 250mm | 262.5 | 6 | 14 | 143 | 30 | 12 | 1 |
| 10 - 11" / 250 - 275mm | 287.5 | 6 | 15 | 156 | 30 | 12 | 1 |
| 11 - 12" / 275 - 300mm | 312.5 | 6 | 15 | 169 | 30 | 12 | 1 |

Data in ( ) applies to those with carbide tipped disks.

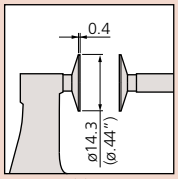



### Technical Data

Graduation: .001" or 0.01mm
Flatness: .00004" / 1µm
Parallelism: .00012" / 3µm
Measuring Force: 8.02 ±0.8N
53.9KPa ±4.9 KPa



Unit: mm




( ): Inch model

# Paper Thickness Micrometers

## SERIES 169 — Non-Rotating Spindle Type Designed for Paper Thickness Measurement

### FEATURES

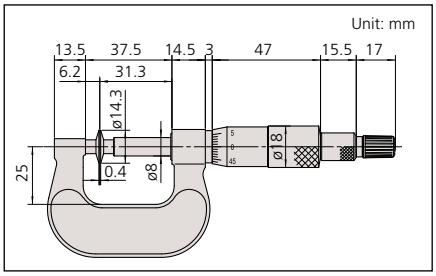
- Non-rotating spindle.
- With ratchet stop for constant force.
- Supplied in fitted plastic case.



**169-101**

### DIMENSIONS

Unit: mm




### SPECIFICATIONS

**Metric**

| Range | Graduation | **Order No.** | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **169-101** | ±4µm | 230g |

**Inch**

| Range | Graduation | **Order No.** | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .001" | **169-103** | ±.0002" | 230g |



Mitutoyo

# Disk Micrometers

## SERIES 369, 227, 169 — Non-Rotating Spindle Type

SPC

### FEATURES

- The Disk Micrometer is designed to easily measure root tangent length of spur gears and helical gears.
- Non-rotating spindle eliminates torque on workpiece.
- With standard bar except 0 - 15mm, 0 - .6" 0 - 25mm, 0 - 1", 0 - 30mm & 0 - 1.2" model.
- Speedy spindle feed of 10mm/rev. (Quickmike type).
- Diameter of measuring disk: .787" / 20mm
- With ratchet stop for constant force.
- With SPC output (Series 369).
- Supplied in fitted plastic case.
- Non-slip grip finish (digital models).



369-350-30

**Quickmike type**



369-421

IP54

ABSOLUTE

**Quickmike type with adjustable measuring force**



227-221

ABSOLUTE



169-201

### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .00005"/0.001mm or 0.001mm
Graduation**: .001" or 0.01mm
Flatness: .00004" / 1µm
Parallelism: 4µm / .00016" for models up to 2" / 50mm
6µm / .00024" for models over 2" / 50mm
Measurable module: 0.5-6
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
(1 year: Quickmike type, 3 years: Quickmike type with fine-loading)
Series 227: Refer to page B-6 for more information.
*Digital models **Analog models

### Function of Digital Model

Origin-set, Zero / ABS, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (40" / 1m)
**05CZA663**: SPC cable with data switch (80" / 2m)
**937387**: SPC cable for Quickmike type (40" / 1m)
**965013**: SPC cable for Quickmike type (80" / 2m)

### SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.001mm | **369-250-30** | ±4µm |
| 25 - 50mm | 0.001mm | **369-251-30** | ±4µm |
| 50 - 75mm | 0.001mm | **369-252-30** | ±6µm |
| 75 - 100mm | 0.001mm | **369-253-30** | ±6µm |

**Inch/Metric** Digital model

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **369-350-30** | ±.0002" |
| 1 - 2" / 25.4 - 50.8mm | .00005" / 0.001mm | **369-351-30** | ±.0002" |
| 2 - 3" / 50.8 - 76.2mm | .00005" / 0.001mm | **369-352-30** | ±.0003" |
| 3 - 4" / 76.2 - 101.6mm | .00005" / 0.001mm | **369-353-30** | ±.0003" |

**Metric** Quickmike type

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 30mm | 0.001mm | **369-411** | ±4µm |
| 25 - 55mm | 0.001mm | **369-412** | ±4µm |

**Inch/Metric** Quickmike type

| Range | Resolution | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1.2" / 0 - 30.48mm | .00005" / 0.001mm | **369-421** | ±.0002" |
| 1 - 2.2" / 25.4 - 55.88mm | .00005" / 0.001mm | **369-422** | ±.0002" |

**Metric** Quickmike type with adjustable measuring force

| Range | Resolution | Order No. | Accuracy | Measuring force |
|---|---|---|---|---|
| 0 - 10mm | 0.001mm | **227-223** | ±4µm | 2N - 10N |
| 0 - 15mm | 0.001mm | **227-221** | ±4µm | 0.5N - 2.5N |

**Metric**

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.01mm | **169-201** | ±4µm |
| 25 - 50mm | 0.01mm | **169-202** | ±4µm |
| 50 - 75mm | 0.01mm | **169-205** | ±6µm |
| 75 - 100mm | 0.01mm | **169-207** | ±6µm |

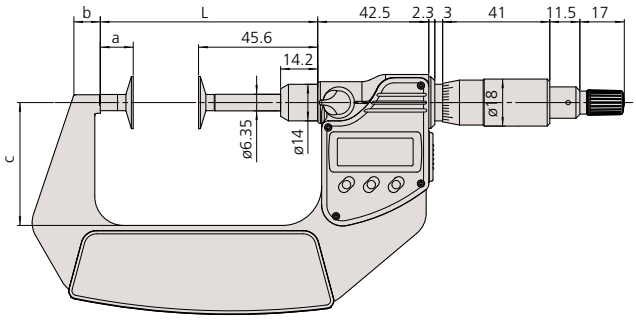
**Inch**

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" | .001" | **169-203** | ±.0002" |
| 1 - 2" | .001" | **169-204** | ±.0002" |
| 2 - 3" | .001" | **169-206** | ±.0003" |
| 3 - 4" | .001" | **169-208** | ±.0003" |

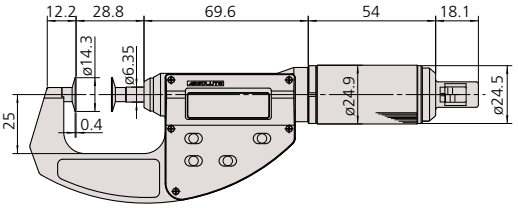
## DIMENSIONS AND MASS

Unit: mm

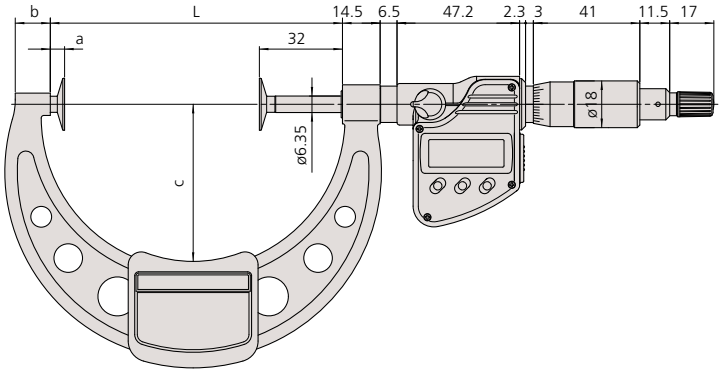
### Digital models up to 75mm



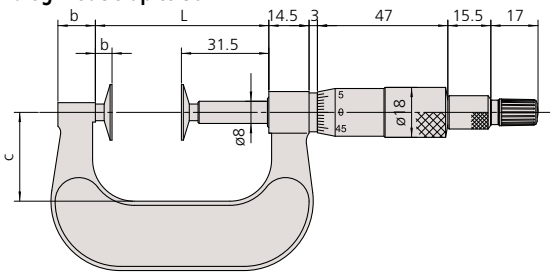

### Adjustable measuring force type



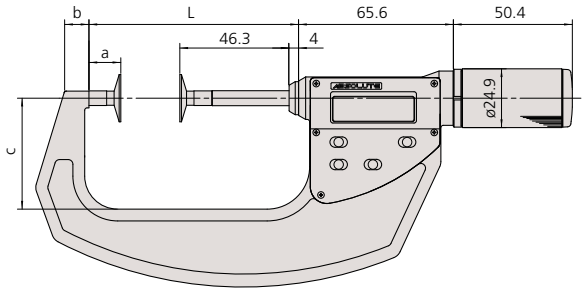

### Digital models over 75mm



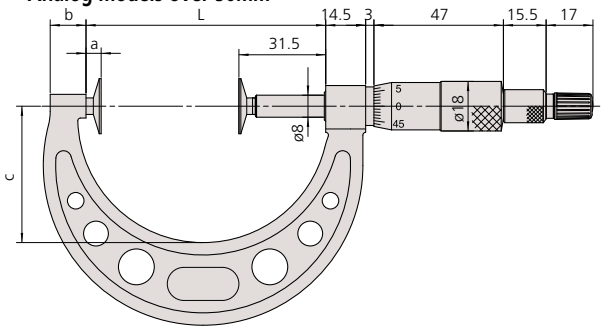

### Analog models up to 50mm

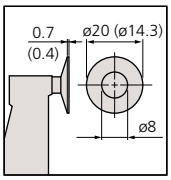



### Quickmike type




### Analog models over 50mm




( ): Adjustable measuring force type

### Digital model

| Range | L | a | b | c | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm / 0 - 1" | 58.5 | 12.9 | 7 | 32 | 340 |
| 25 - 50mm / 1 - 2" | 83.5 | 12.9 | 9.8 | 47 | 480 |
| 50 - 75mm / 2 - 3" | 108.5 | 12.9 | 11.2 | 60 | 635 |
| 75 - 100mm / 3 - 4" | 112.5 | 5.5 | 13.5 | 60.5 | 475 |
| 0 - 30mm* / 0 - 1.2" | 63.8 | 13.5 | 8.5 | 36 | 360 |
| 25 - 55mm* / 1 - 2.2" | 88.8 | 13.5 | 10.3 | 47 | 490 |

*Quickmike type

### Analog model

| Range | L | a | b | c | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm / 0 - 1" | 37.5 | 6 | 13.5 | 25 | 230 |
| 25 - 50mm / 1 - 2" | 62.5 | 6 | 13.5 | 32 | 280 |
| 50 - 75mm / 2 - 3" | 87 | 5.5 | 13 | 49.5 | 315 |
| 75 - 100mm / 3 - 4" | 112 | 5.5 | 13 | 63.5 | 400 |

# Gear Tooth Micrometers

## SERIES 324, 124 — Interchangeable Ball Anvil-Spindle Tip Type

### FEATURES

- IP65 water/dust protection (Series 324).
- Measures over-pin diameter of gears with precision steel (carbide) ball-tipped measuring faces.
- With a standard bar except 0 - 25mm and 0 - 1″ model
- Non-slip grip finish (digital models)
- Interchangeable ball anvil-spindle tips for various gear modules (0.5 - 5.25) are optional.
- With Ratchet Stop for constant force.
- With SPC output (Series 324).
- Supplied in fitted plastic case (Models over 150mm have wooden case).



324-351-30



**124-173**
Shown with optional ball anvils

### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: 0.001mm or .00005"/0.001mm
Graduation**: 0.01mm
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
Dust/Water protection level*: IP65
*Digital models **Analog models

### Function of Digital Model

Zero / ABS, Data hold, Data output, Preset, inch/mm conversion (on inch/metric models only)
Function Lock, 2 Presets
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA662**: SPC cable with data switch (1m / 40″)*
**05CZA663**: SPC cable with data switch (2m / 80″ )*
*Only for digital models

### SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **324-251-30** | ±4µm | 400 |
| 25 - 50mm | 0.001mm | **324-252-30** | ±4µm | 490 |
| 50 - 75mm | 0.001mm | **324-253-30** | ±4µm | 530 |
| 75 - 100mm | 0.001mm | **324-254-30** | ±5µm | 600 |

**Inch/Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1"/0 - 25mm | .00005″/0.001mm | **324-351-30** | ±.0002" | 400 |
| 1 - 2"/25 - 50mm | .00005″/0.001mm | **324-352-30** | ±.0002" | 490 |
| 2 - 3"/50 - 75mm | .00005″/0.001mm | **324-353-30** | ±.0002" | 530 |
| 3 - 4"/75 - 100mm | .00005″/0.001mm | **324-354-30** | ±.00025" | 600 |

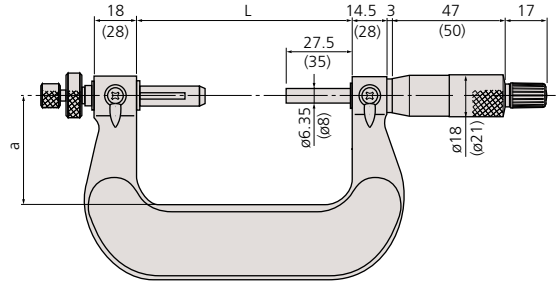
**Metric**

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **124-173** | ±4µm | 295 |
| 25 - 50mm | 0.01mm | **124-174** | ±4µm | 400 |
| 50 - 75mm | 0.01mm | **124-175** | ±4µm | 460 |
| 75 - 100mm | 0.01mm | **124-176** | ±5µm | 540 |
| 100 - 125mm | 0.01mm | **124-177** | ±5µm | 640 |
| 125 - 150mm | 0.01mm | **124-178** | ±5µm | 760 |
| 150 - 175mm | 0.01mm | **124-179** | ±6µm | 900 |
| 175 - 200mm | 0.01mm | **124-180** | ±6µm | 1060 |
| 200 - 225mm | 0.01mm | **124-181** | ±6µm | 1230 |
| 225 - 250mm | 0.01mm | **124-182** | ±7µm | 1430 |
| 250 - 275mm | 0.01mm | **124-183** | ±7µm | 1620 |
| 275 - 300mm | 0.01mm | **124-195** | ±7µm | 2070 |



### DIMENSIONS AND MASS

Unit: mm




( ): 275-300mm model

| Range | L | a | Mass (g) |
|---|---|---|---|
| 0 - 25mm | 64.5 | 32 | 295 |
| 25 - 50mm | 90 | 45 | 400 |
| 50 - 75mm | 115.6 | 65 | 460 |
| 75 - 100mm | 140.6 | 79 | 540 |
| 100 - 125mm | 165.6 | 93 | 640 |
| 125 - 150mm | 190.5 | 105 | 760 |
| 150 - 175mm | 215.5 | 120 | 900 |
| 175 - 200mm | 240.5 | 130 | 1060 |
| 200 - 225mm | 265.5 | 147 | 1230 |
| 225 - 250mm | 290.5 | 165 | 1430 |
| 250 - 275mm | 315.5 | 171 | 1620 |
| 275 - 300mm | 353 | 187 | 2070 |

### Interchangeable ball anvil-spindle tip set:

| Diameter of ball anvil | Order No. | Gear module | Diametral pitch |
|---|---|---|---|
| 0.8mm | **124-801*** | 0.5 - 0.55 | 50 |
| 1mm | **124-802*** | 0.6 - 0.65 | 45 |
| 1.191mm (3/64") | **124-803*** | 0.7 - 0.8 | 35 - 30 |
| 1.5mm | **124-821*** | 0.9 - 1 | 28 - 26 |
| 1.588mm (1/16") | **124-804*** | 0.9 - 1 | 28 - 26 |
| 2mm | **124-805*** | 1.25 | 22 |
| 2.381mm (3/32") | **124-806** | 1.5 | 17 |
| 2.5mm | **124-822** | 1.5 | 17 |
| 3mm | **124-807** | 1.75 | 15 |
| 3.175mm (1/8") | **124-808** | — | 14 |
| 3.5mm | **124-823** | 2 | 13 |
| 3.969mm (5/32") | **124-809** | 2 | 13 |
| 4mm | **124-810** | 2.25 | 11 |
| 4.5mm | **124-824** | 2.5 | 10 |
| 4.763mm (3/16") | **124-811** | 2.5 | 10 |
| 5mm | **124-812** | 2.75 | 9 |
| 5.556mm (7/32") | **124-813** | 3.0 - 3.25 | 8 |
| 6mm | **124-814** | 3.5 | 7 |
| 6.35mm (1/4") | **124-815** | 3.75 | 7 |
| 7mm | **124-816** | 4.0 | 6.5 |
| 7.144mm (9/32") | **124-817** | 4.25 | 6 |
| 7.938mm (5/16") | **124-818** | 4.5 | 5.5 |
| 8mm | **124-819** | 4.75 | 5.5 |
| 8.731mm (11/32") | **124-820** | 5.0 - 5.25 | 5 |

*Carbide-tipped type

# Screw Thread Micrometers

## SERIES 125

### FEATURES

- Provided with a 60 degree V-anvil and conical spindle for easily measuring pitch diameters of metric or unified screw threads.
- With ratchet stop for constant force.
- With a standard bar for zero point adjustment except 0 - 25mm model.
- Supplied in fitted plastic case.




125-103

### Technical Data

Accuracy: ±(2+R/75)µm, R=max. range (mm)
Graduation: 0.01mm
Spindle feed error: 3µm

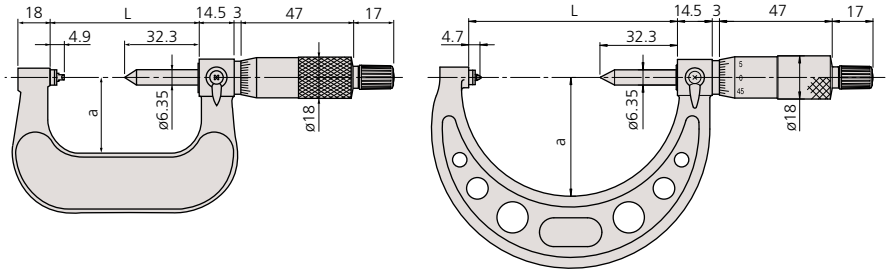


### SPECIFICATIONS

**Metric**

| Range | Graduation | Order No. | Screw to be measured (Metric/Unified) |
|---|---|---|---|
| 0 - 25mm | 0.01mm | **125-101** | 0.4 - 0.5mm/64 - 48TPI |
| | | **125-102** | 0.6 - 0.9mm/44 - 28TPI |
| | | **125-103** | 1 - 1.75mm/24 - 14TPI |
| | | **125-104** | 2 - 3mm/13 - 9TPI |
| | | **125-105** | 3.5 - 5mm/8 - 5TPI |
| 25 - 50mm | 0.01mm | **125-106** | 0.4 - 0.5mm/64 - 48TPI |
| | | **125-107** | 0.6 - 0.9mm/44 - 28TPI |
| | | **125-108** | 1 - 1.75mm/24 - 14TPI |
| | | **125-109** | 2 - 3mm/13 - 9TPI |
| | | **125-110** | 3.5 - 5mm/8 - 5TPI |
| 50 - 75mm | 0.01mm | **125-111** | 0.6 - 0.9mm/44 - 28TPI |
| | | **125-112** | 1 - 1.75mm/24 - 14TPI |
| | | **125-113** | 2 - 3mm/13 - 9TPI |
| | | **125-114** | 3.5 - 5mm/8 - 5TPI |
| | | **125-115** | 5.5 - 7mm/4.5 - 3.5TPI |
| 75 - 100mm | 0.01mm | **125-116** | 0.6 - 0.9mm/44 - 28TPI |
| | | **125-117** | 1 - 1.75mm/24 - 14TPI |
| | | **125-118** | 2 - 3mm/13 - 9TPI |
| | | **125-119** | 3.5 - 5mm/8 - 5TPI |
| | | **125-120** | 5.5 - 7mm/4.5 - 3.5TPI |

### DIMENSIONS AND MASS




Unit: mm

| Range | L | a | Mass (g) |
|---|---|---|---|
| 0 - 25mm | 37.2 | 25 | 200 |
| 25 - 50mm | 62.2 | 32 | 250 |
| 50 - 75mm | 87 | 49.5 | 260 |
| 75 - 100mm | 112 | 63.5 | 330 |



Mitutoyo

# Screw Thread Micrometers

## SERIES 326, 126 — Interchangeable Anvil-Spindle Tip Type

### FEATURES

- IP65 water/dust protection (Series 326).
- 60 degree or 55 degree V-anvil and conical spindle (interchangeable) are optional, which are made of high-grade steel, hardened and precision ground.
- With ratchet stop for constant force.
- With SPC output (Series 326).
- With a standard bar except 0 - 25mm and 0 - 1" model.
- Supplied in fitted plastic case.
- Non-slip grip finish (digital models).



**126-125**
Shown with optional anvils



**326-351-30**

### Technical Data

Resolution*: 0.001mm or .00005"/0.001mm
Graduation**: 0.01mm or .001"
Spindle feed error: 3µm / .00012"
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
Dust/Water protection level*: IP65
*Digital models **Analog models

### Function of Digital Model

Zero / ABS, Data hold, Data output, 2 Presets, Function Lock.
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA662**: SPC cable with data switch (1m / 40")*
**05CZA663**: SPC cable with data switch (2m / 80")*
*Only for digital models
(See page B-51.): Standard for screw thread micrometer

### SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **326-251-30** | ±4µm | 350 |
| 25 - 50mm | 0.001mm | **326-252-30** | ±4µm | 380 |
| 50 - 75mm | 0.001mm | **326-253-30** | ±4µm | 470 |
| 75 - 100mm | 0.001mm | **326-254-30** | ±5µm | 510 |

**Inch/Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **326-351-30** | ±.0002" | 350 |
| 1 - 2" / 25.4 - 50.8mm | .00005" / 0.001mm | **326-352-30** | ±.0002" | 380 |
| 2 - 3" / 50.8 - 76.2mm | .00005" / 0.001mm | **326-353-30** | ±.0002" | 470 |
| 3 - 4" / 76.2 - 101.6mm | .00005" / 0.001mm | **326-354-30** | ±.00025" | 510 |

**Metric**

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **126-125** | ±4µm | 240 |
| 25 - 50mm | 0.01mm | **126-126** | ±4µm | 290 |
| 50 - 75mm | 0.01mm | **126-127** | ±4µm | 390 |
| 75 - 100mm | 0.01mm | **126-128** | ±5µm | 450 |
| 100 - 125mm | 0.01mm | **126-129** | ±5µm | 530 |
| 125 - 150mm | 0.01mm | **126-130** | ±5µm | 620 |
| 150 - 175mm | 0.01mm | **126-131** | ±6µm | 730 |
| 175 - 200mm | 0.01mm | **126-132** | ±6µm | 860 |
| 200 - 225mm | 0.01mm | **126-133** | ±6µm | 1,030 |
| 225 - 250mm | 0.01mm | **126-134** | ±7µm | 1,200 |
| 250 - 275mm | 0.01mm | **126-135** | ±7µm | 1,370 |
| 275 - 300mm | 0.01mm | **126-136** | ±7µm | 1,540 |

**Inch**

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .001" | **126-137** | ±.0002" | 240 |
| 1 - 2" | .001" | **126-138** | ±.0002" | 290 |
| 2 - 3" | .001" | **126-139** | ±.0002" | 390 |
| 3 - 4" | .001" | **126-140** | ±.00025" | 450 |
| 4 - 5" | .001" | **126-141** | ±.00025" | 530 |
| 5 - 6" | .001" | **126-142** | ±.00025" | 620 |
| 6 - 7" | .001" | **126-143** | ±.0003" | 730 |

**Inch** With anvil set (126 - 800)

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .001" | **126-901** | ±.0002" | 240 |
| 1 - 2" | .001" | **126-902** | ±.0002" | 290 |
| 2 - 3" | .001" | **126-903** | ±.0002" | 390 |
| 3 - 4" | .001" | **126-904** | ±.00025" | 450 |
| 4 - 5" | .001" | **126-905** | ±.00025" | 530 |
| 5 - 6" | .001" | **126-906** | ±.00025" | 620 |



Anvil-spindle tip set:

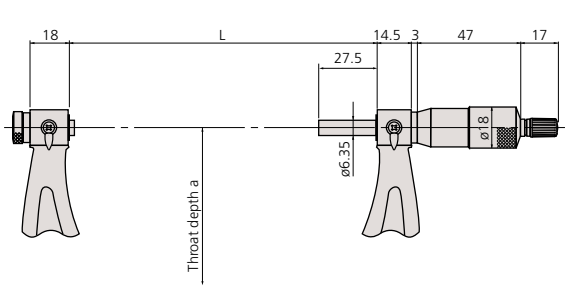
| Applications | Set Order No. | Tip Information | | |
|---|---|---|---|---|
| | | Threads Per Inch | Pitch (mm) | **Individual Order No.** |
| Metric Screw, Unified screw (60° threads) | **126-800** | 64-48 (M1) | 0.4-0.5 | **126-801** |
| | | 44-28 (M2) | 0.6-0.9 | **126-802** |
| | | 24-14 (M3) | 1-1.75 | **126-803** |
| | | 13-9 (M4) | 2-3 | **126-804** |
| | | 8-5 (M5) | 3.5-5 | **126-805** |
| | | 4.5-3.5 (M6) | 5.5-7 | **126-806** |
| Whitworth Screw (55° threads) | **126-810** | 60-48 | - | **126-811** |
| | | 48-40 | - | **126-812** |
| | | 40-32 | - | **126-813** |
| | | 32-24 | - | **126-814** |
| | | 24-18 | - | **126-815** |
| | | 18-14 | - | **126-816** |
| | | 14-10 | - | **126-817** |
| | | 10-7 | - | **126-818** |
| | | 7-4.5 | - | **126-819** |
| | | 4.5-3.5 | - | **126-820** |

Features: 60 degree or 55 degree V-anvil and conical spindle (interchangeable) are optional, which are made of high-grade special steel, hardened and precision ground.

Storage box included.

### DIMENSIONS

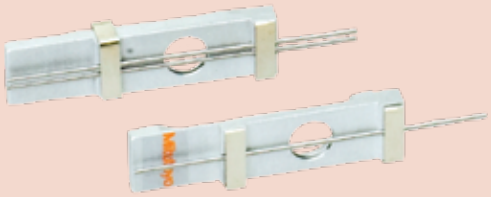
Unit: mm

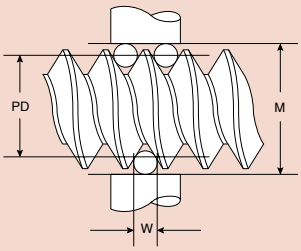



| Range | L | a |
|---|---|---|
| 0 - 25mm / 0 - 1" | 39.5 | 25 |
| 25 - 50mm / 1 - 2" | 64.5 | 32 |
| 50 - 75mm / 2 - 3" | 90 | 45 |
| 75 - 100mm / 3 - 4" | 115.6 | 65 |
| 100 - 125mm / 4 - 5" | 140.6 | 79 |
| 125 - 150mm / 5 - 6" | 165.6 | 93 |
| 150 - 175mm / 6 - 7" | 190.5 | 105 |
| 175 - 200mm / 7 - 8" | 215.5 | 120 |
| 200 - 225mm / 8 - 9" | 240.5 | 130 |
| 225 - 250mm / 9 -10" | 265.5 | 147 |
| 250 - 275mm / 10 - 11" | 290.5 | 165 |
| 275 - 300mm / 11 - 12" | 315.5 | 171 |

# 3-Wire Thread Measuring System

Individual Holder and Wire Set

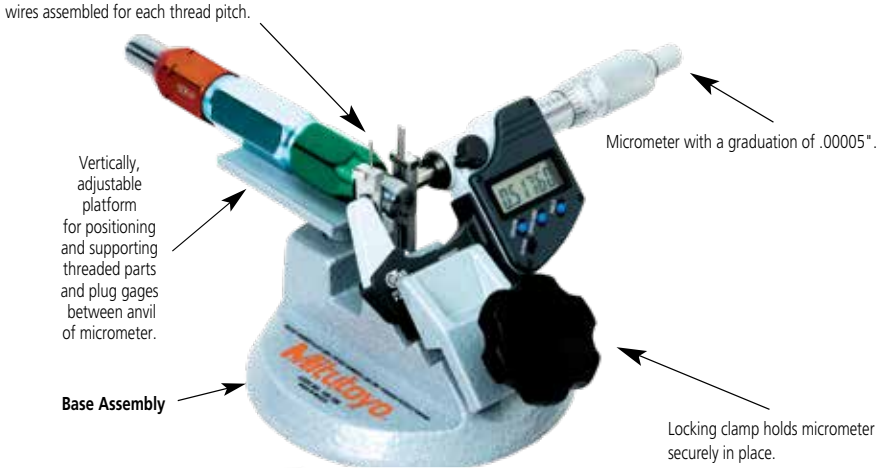





PD = Pitch Diameter
M = Measurement over wires
W = Wire diameter
C = Constant
C = .86603 x Pitch (inches) -3W
P.D. = M-C
W = .57735 x P

## FEATURES

- Fast and accurate method of thread measuring available for use with micrometer




### INCH STANDARD HOLDERS AND WIRES SETS

Compatible with micrometers with 0.25" anvils & spindles.

| Order No. [1,2] | Threads Per Inch | Thread Measuring Wire Diameter |
|---|---|---|
| 64AAA201 | 120 | .00481 |
| 64AAA202 | 100 | .00577 |
| 64AAA203 | 95 | .00601 |
| 64AAA204 | 90 | .00642 |
| 64AAA205 | 80 | .00722 |
| 64AAA206 | 72 | .00802 |
| 64AAA207 | 64 | .00902 |
| 64AAA208 | 56 | .01031 |
| 64AAA209 | 50 | .01155 |
| 64AAA210 | 48 | .01203 |
| 64AAA211 | 44 | .01312 |
| 64AAA212 | 40 | .01443 |
| 64AAA213 | 36 | .01604 |
| 64AAA214 | 32 | .01804 |
| 64AAA215 | 30 | .01925 |
| 64AAA216 | 28 | .02062 |
| 64AAA217 | 27 | .02138 |
| 64AAA218 | 26 | .02221 |
| 64AAA219 | 24 | .02406 |
| 64AAA220 | 22 | .02624 |
| 64AAA221 | 20 | .02887 |
| 64AAA222 | 18 | .03208 |
| 64AAA223 | 16 | .03608 |
| 64AAA224 | 14 | .04124 |
| 64AAA225 | 13 | .04441 |
| 64AAA226 | 12 | .04811 |
| 64AAA227 | 11.5 | .05020 |
| 64AAA228 | 11 | .05249 |
| 64AAA229 | 10 | .05774 |
| 64AAA230 | 9 | .06415 |
| 64AAA231 | 8 | .07217 |
| 64AAA232 | 7.5 | .07698 |
| 64AAA233 | 7 | .08248 |
| 64AAA234 | 6 | .09623 |
| 64AAA235 | 5.5 | .10497 |
| 64AAA236 | 5 | .11547 |

[1] For 6.35mm Spindle Diameter holder only, add "H" suffix to Order No. (i.e. 64AAA201H)
[2] For 8mm Spindle Diameter holder only, add "H8" suffix to Order No. (i.e. 64AAA201H8)

| Stand Assembly |
|---|
| Order No. 156-106 |

### METRIC HOLDERS AND WIRES SETS

| Order No.[1] | Pitch | mm Diameter | Inch Diameter |
|---|---|---|---|
| 64AAA251 | .2mm | .1155 | .00455 |
| 64AAA252 | .225mm | .1299 | .00511 |
| 64AAA253 | .25mm | .1443 | .00568 |
| 64AAA254 | .30mm | .1732 | .00682 |
| 64AAA255 | .35mm | .2021 | .00796 |
| 64AAA256 | .40mm | .2309 | .00909 |
| 64AAA257 | .45mm | .2598 | .01023 |
| 64AAA258 | .50mm | .2887 | .01137 |
| 64AAA259 | .55mm | .3175 | .01250 |
| 64AAA260 | .60mm | .3464 | .01364 |
| 64AAA261 | .70mm | .4041 | .01591 |
| 64AAA262 | .75mm | .4330 | .01705 |
| 64AAA263 | .80mm | .4619 | .01818 |
| 64AAA264 | .85mm | .4907 | .01932 |
| 64AAA265 | .90mm | .5196 | .02046 |
| 64AAA266 | 1.00mm | .5774 | .02273 |
| 64AAA267 | 1.25mm | .7217 | .02841 |
| 64AAA268 | 1.50mm | .8660 | .03410 |
| 64AAA269 | 1.75mm | 1.0104 | .03978 |
| 64AAA270 | 2.00mm | 1.1547 | .04546 |
| 64AAA271 | 2.50mm | 1.4434 | .05683 |
| 64AAA272 | 3.00mm | 1.7321 | .06819 |
| 64AAA273 | 3.50mm | 2.0207 | .07956 |
| 64AAA274 | 4.00mm | 2.3094 | .09092 |

[1] For 6.35mm Spindle Diameter holder only, add "H" suffix to Order No. (i.e. 64AAA201H)

## Applications

- Measure set of thread plug gages and working thread plug gages.
- Monitor the wear on working thread plug gages.
- Monitor and control pitch diameter variation during thread fabrication.
- Reduce measurement time to a fraction of the time normally taken using the traditional three wire method.
- Use in conjunction with go/no-go thread ring gages to control thread size to the most demanding specifications.
- Determine out of roundness and taper that may exist in threaded parts.
- Applications for preplating and post plating thread measurement.

## Tolerance of Wires:

- Diameter +/- .000010"
- Roundness +/- .000010"
- Surface finish 2 micro inches AA, lapped.
- Hardness HRC 59-64
- Certification of accuracy included.
- Traceable to NIST.
- Meets or exceeds all ANSI and ISO specs.

# Can Seam Micrometers

## SERIES 147

### FEATURES

- Measures the width, height, and depth of can seams.
- Three types of micrometers are available for: steel cans, aluminum cans and sprayer cans.
- Supplied in fitted carton.



147-103

### Technical Data

Accuracy: ±.00012″ / ±3µm
Graduation: .001″ / 0.01mm

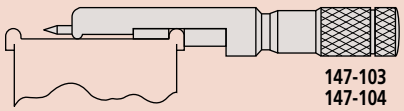
### SPECIFICATIONS

**Metric**

| Range | Graduation | Order No. | Remarks |
|---|---|---|---|
| 0 - 13mm | 0.01mm | **147-103** | for steel cans |
| | | **147-105** | for aluminum cans |
| | | **147-202** | for sprayer cans |

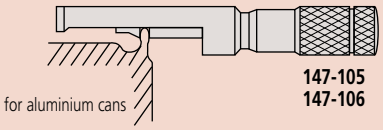
**Inch**

| Range | Graduation | Order No. | Remarks |
|---|---|---|---|
| 0 - .5" | .001" | **147-104** | for steel cans |
| | | **147-106** | for aluminum cans |
| | | **147-201** | for sprayer cans |



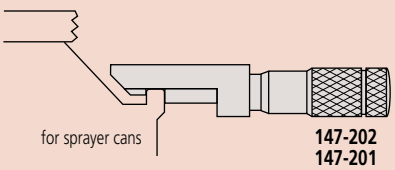
**147-103**
**147-104**

for cans
(for depth measurements up to 5mm)



for aluminium cans

**147-105**
**147-106**

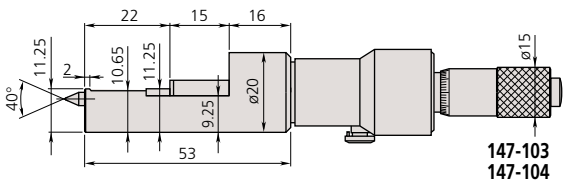


for sprayer cans

**147-202**
**147-201**

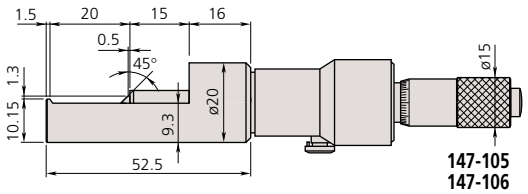
### DIMENSIONS AND MASS

Unit: mm



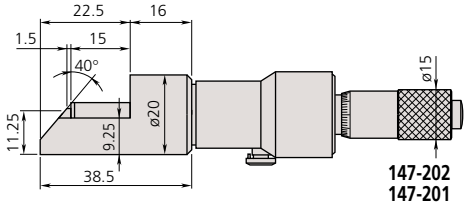

MASS: 65g

**147-103**
**147-104**




MASS: 65g

**147-105**
**147-106**




MASS: 65g

**147-202**
**147-201**



# Hub Micrometers

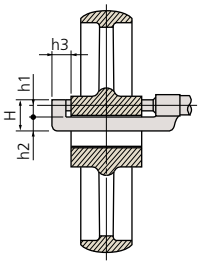
## SERIES 147

### Technical Data

Accuracy: Refer to the list of specifications
Graduation: 0.01mm / .001"
Flatness: 0.6µm / .000024"
Parallelism: (2+R/100)µm, R=max. range (mm)
[.00008" + .00004" (L/4)]", L = Max. range (inch)
Measuring faces: Carbide tipped



Unit: mm




| Range | h1 | h2 | h3 | H | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" / 0 - 25mm | 6 | 8.5 | 13.5 | 17.5 | 135 |
| 1 - 2" / 25 - 50mm | 6.5 | 11 | 14 | 20.5 | 150 |
| 3 - 4" / 50 - 75mm | 6.5 | 11 | 13 | 20.5 | 170 |
| 4 - 5" / 75 -100mm | 6.5 | 11 | 13 | 20.5 | 185 |

### FEATURES

- Measures hub thickness and shoulders inside a bore.
- With ratchet stop for constant force.
- With a standard bar except for 0 - 1" / 0 - 25mm model.
- Supplied in fitted plastic case.




147-301




147-351

### SPECIFICATIONS

**Metric**

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.01mm | **147-301** | ±2µm |
| 25 - 50mm | 0.01mm | **147-302** | ±2µm |
| 50 - 75mm | 0.01mm | **147-303** | ±2µm |
| 75 - 100mm | 0.01mm | **147-304** | ±3µm |

**Inch**

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" | .001" | **147-351** | ±.0001" |
| 1 - 2" | .001" | **147-352** | ±.0001" |
| 2 - 3" | .001" | **147-353** | ±.0001" |
| 3 - 4" | .001" | **147-354** | ±.00015" |

# Wire Micrometers

## SERIES 147

### FEATURES

- Designed for measuring wire thickness.
- Also used to measure the diameter of a small ball.
- Supplied in fitted plastic case.



147-402



147-401

### SPECIFICATIONS

**Metric**

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 10mm | 0.01mm | **147-401** | ±3µm | 65 |

**Inch**

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - .4" | .0001" | **147-402*** | ±.00015" | 65 |

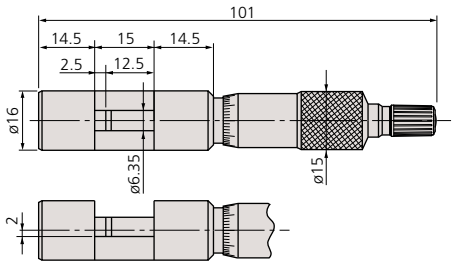
* .0001" reading is obtained with vernier.

### Technical Data

Graduation: .0001" or 0.01mm
Flatness: .000024" / 0.6µm
Parallelism: .00005" / 1.3µm
Measuring faces: Carbide tipped



### DIMENSIONS AND MASS




Unit: mm
MASS = 65g



Mitutoyo

# Digital Outside Micrometers

## SERIES 193

### FEATURES

- Mechanical digit counter with 0.01mm or .001" reading for quick and error-free reading.
- With a standard bar except for 0-25mm / 0 -1" model.
- Supplied in fitted plastic case.




193-211

### Technical Data

Counter reading: 0.01mm or .001"
Graduation: 0.01mm, 0.001mm, .001" or .0001"
Flatness: 0.6µm / .000024"
Parallelism: (2+R/100)µm, R=max. range (mm)
[.00008" + .00004" (L/4)]", L= max. range (inch)
Measuring faces: Carbide tipped



193-916

### SPECIFICATIONS

**Metric** With ratchet stop

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 25mm | 0.01mm | **193-101** | ±2µm |
| | 0.001mm | **193-111*** | ±2µm |
| 25 - 50mm | 0.01mm | **193-102** | ±2µm |
| | 0.001mm | **193-112*** | ±2µm |
| 50 - 75mm | 0.01mm | **193-103** | ±2µm |
| | 0.001mm | **193-113*** | ±2µm |
| 75 - 100mm | 0.01mm | **193-104** | ±3µm |
| | 0.001mm | **193-114*** | ±3µm |

*0.001mm reading is obtained with vernier.

**Metric** Micrometer sets

| Range | Order No. | Included in set |
|---|---|---|
| 0 - 75mm (3 pcs./set) | **193-901** | • **193-101, 193-102, 193-103** • 2 micrometer standards |
| 0 - 75mm (3 pcs./set) | **193-915** | • **193-111, 193-112, 193-113,** • 2 micrometer standards |
| 0 - 100mm (4 pcs./set) | **193-902** | • **193-101, 193-102, 193-103, 193-104** • 3 micrometer standards |
| 0 - 100mm (4 pcs./set) | **193-916** | • **193-111, 193-112, 193-113, 193-114** • 3 micrometer standards |

**Inch** With friction thimble

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 0 - 1" | .0001" | **193-211*** | ±.0001" |
| 1 - 2" | .0001" | **193-212*** | ±.0001" |

*.0001" reading is obtained with vernier.

**Inch** With ratchet stop

| Range | Graduation | Order No. | Accuracy |
|---|---|---|---|
| 2 - 3" | .0001" | **193-213*** | ±.0001" |
| 3 - 4" | .0001" | **193-214*** | ±.00015" |

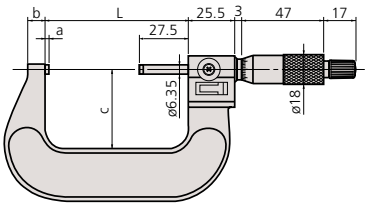
*.0001" reading is obtained with vernier.

**Inch** Micrometer sets

| Range | Order No. | Included in set |
|---|---|---|
| 0 - 3" (3 pcs./set) | **193-923** | • **193-211, 193-212, 193-213** • 2 micrometer standards |

### DIMENSIONS AND MASS

**Models up to 100mm / 4"**




Unit: mm

| Range | L | a | b | c | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm / 0 - 1" | 30 | 2.5 | 5 | 26 | 224 |
| 25 - 50mm / 1 - 2" | 55 | 2.5 | 8 | 32 | 275 |
| 50 - 75mm / 2 - 3" | 80 | 2.5 | 9 | 45 | 379 |
| 75 - 100mm / 3 - 4" | 105 | 2.5 | 9 | 57 | 489 |

Note: The shape of the thimble changes on the model with friction thimble.

# Indicating Micrometers

## SERIES 510

### FEATURES

- Retractable anvil with indicator for three-wire measurements of pitch diameter of precision screws and parallelism measurements.
- With a standard bar except for 0 - 25mm / 0 - 1″ model.
- IP protection level: 54
- Supplied in fitted plastic case.



510-131

### SPECIFICATIONS

**Metric**

| Range | Graduation | Order No. | Indicating range |
|---|---|---|---|
| 0 - 25mm | 0.001mm | **510-121*** **510-141** | ±0.060mm |
| 25 - 50mm | 0.001mm | **510-122** | ±0.060mm |
| 50 - 75mm | 0.001mm | **510-123** | ±0.060mm |
| 75 - 100mm | 0.001mm | **510-124** | ±0.060mm |

*Retractable anvil button on the right side.

**Inch**

| Range | Graduation | Order No. | Indicating range |
|---|---|---|---|
| 0 - 1" | .00005" | **510-131*** **510-151** | ±.0023" |
| 1 - 2" | .00005" | **510-132** | ±.0023" |
| 2 - 3" | .00005" | **510-133** | ±.0023" |
| 3 - 4" | .00005" | **510-134** | ±.0023" |

*Retractable anvil button on the right side.

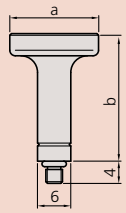
### Technical Data

Spindle feed error: 3µm / .00012″
Dial indication accuracy: 1µm / .00004″
Dispersion of indication: 0.4µm / .00002″
Graduation: 0.001mm or .0001"
Dial reading: 0.001mm or .00005"
Flatness: 0.3µm / .000012″
Parallelism: 0.6µm / .000024″ for models up to 50mm / 2″
1µm / .00004″ for models over 50mm / 2″
Measuring force: 5 - 10N (500 - 1000gf)
Measuring faces: Carbide tipped

### Optional Accessories

**04AZA124**: ø16mm / ø.63″ workpiece stopper (not available for 25mm / 1″ model)
**04AZA125**: ø14mm / ø.55" workpiece stopper
**04AZA126**: ø14mm / ø.55" workpiece stopper

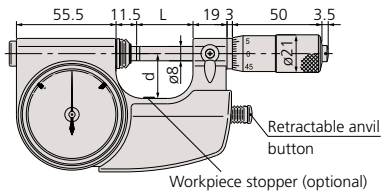
Unit: mm




| | a | b |
|---|---|---|
| **04AZA124** | 16 | 23 |
| **04AZA125** | 14 | 20.5 |
| **04AZA126** | 14 | 15 |

### DIMENSIONS AND MASS

Unit: mm




| Range | L | d | Mass (g) |
|---|---|---|---|
| 0 - 25mm / 0 - 1" | 31.5 | 25 | 520 |
| 25 - 50mm / 1 - 2" | 56.5 | 38 | 670 |
| 50 - 75mm / 2 - 3" | 81.5 | 50 | 820 |
| 75 - 100mm / 3 - 4" | 106.5 | 63 | 970 |

# Snap Meters

## SERIES 523

### FEATURES

- Various types of indicators, LVDTs and linear gages can be selected according to the measurement applications.
- Supplied in fitted plastic case.

Indicator is optional.




523-141

### SPECIFICATIONS

**Metric** Gage stem dia 8mm

| Range | Order No. | Anvil movement |
|---|---|---|
| 0 - 25mm | **523-141** | 2mm |
| 25 - 50mm | **523-142** | 2mm |
| 50 - 75mm | **523-143** | 2mm |
| 75 - 100mm | **523-144** | 2mm |

**Inch** Gage stem dia 3/8"

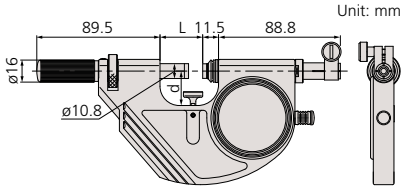
| Range | Order No. | Anvil movement |
|---|---|---|
| 0 - 1" | **523-151** | .078" |
| 1 - 2" | **523-152** | .078" |
| 2 - 3" | **523-153** | .078" |
| 3 - 4" | **523-154** | .078" |

### Technical Data

Flatness: 0.3µm / .000012″
Parallelism: 0.6µm / .000024″ for models up to 50mm / 2″
1µm / .00004″ for models over 50mm / 2″
Measuring force: 5 - 10N (500 - 1000gf)
Measuring faces: Carbide tipped

### DIMENSIONS AND MASS

Unit: mm




| Range | d | L | Mass (g) |
|---|---|---|---|
| 0 - 25mm / 0 - 1" | 25 | 31 | 710 |
| 25 - 50mm / 1 - 2" | 35 | 56 | 810 |
| 50 - 75mm / 2 - 3" | 47.5 | 81 | 920 |
| 75 - 100mm / 3 - 4" | 60 | 106 | 1050 |

# Dial Snap Meters

## SERIES 523

### FEATURES

- Direct go/no-go judgment for mass-produced parts.
- Spindle diameter: .425" / 10.8mm
- IP protection level: 54
- Supplied in fitted plastic case.



523-131

IP54

### Technical Data

Dial indication accuracy: .00005" / 1µm
Indication repeatability: .00002" / 0.4µm
Dial reading: .00005" or 0.001mm
Flatness: .000012" / 0.3µm
Parallelism: .000024" / 0.6µm for models up to 2"/ 50mm
.00004" / 1µm for models over 2" / 50mm
Measuring force: 5 - 10N (500 - 1000gf)
Measuring faces: Carbide tipped

### SPECIFICATIONS

**Metric**

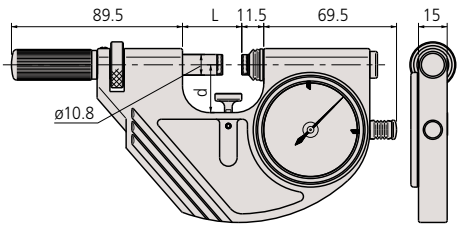
| Range | Graduation | Order No. | Indicating range |
|---|---|---|---|
| 0 - 25mm | 0.001mm | **523-121** | ±0.060mm |
| 25 - 50mm | 0.001mm | **523-122** | ±0.060mm |
| 50 - 75mm | 0.001mm | **523-123** | ±0.060mm |
| 75 - 100mm | 0.001mm | **523-124** | ±0.060mm |

**Inch**

| Range | Graduation | Order No. | Indicating range |
|---|---|---|---|
| 0 - 1" | .00005" | **523-131** | ±.0023" |
| 1 - 2" | .00005" | **523-132** | ±.0023" |
| 2 - 3" | .00005" | **523-133** | ±.0023" |
| 3 - 4" | .00005" | **523-134** | ±.0023" |

### DIMENSIONS AND MASS

Unit: mm




| Range (Metric / Inch) | d | L | Mass (g) |
|---|---|---|---|
| 0 - 1" / 0 - 25mm | 25 | 31 | 710 |
| 1 - 2" / 25 - 50mm | 35 | 56 | 810 |
| 2 - 3" / 50 - 75mm | 47.5 | 81 | 920 |
| 3 - 4" / 75 - 100mm | 60 | 106 | 1050 |

SPC

## Technical Data

Accuracy: Refer to the list of specifications.
Resolution*: 0.001mm or .00005"/0.001mm
Graduation**: 0.01mm / .001"
Flatness: 0.3µm / .000012"
Parallelism: (3+R/75)µm, R=max. range (mm)
[.00012" + .00004" (L/8)]"
L = Max, range (inch)
Measuring faces: Carbide tipped
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
*Digital models **Analog models

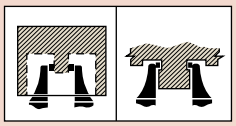
## Function of Digital Model

Origin-set, Zero-setting, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function lock
Alarm: Low voltage, Counting value composition error

## Optional Accessories for Digital Model

**05CZA662**: SPC cable with data switch (1m / 40")
**05CZA663**: SPC cable with data switch (2m / 80")





# Caliper-type Micrometers

## SERIES 343, 143

## FEATURES

- With ratchet stop for constant force.
- With SPC output (Series 343).
- With a standard bar except 0 - 25mm and 0 - 1" model.
- Supplied in fitted plastic case.
- Non-slip grip finish (digital models).




143-121




343-250-30

## SPECIFICATIONS

**Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.001mm | **343-250-30** | ±5µm | 630 |
| 25 - 50mm | 0.001mm | **343-251-30** | ±6µm | 650 |
| 50 - 75mm | 0.001mm | **343-252-30** | ±7µm | 1040 |
| 75 - 100mm | 0.001mm | **343-253-30** | ±8µm | 1090 |

**Inch / Metric** Digital model

| Range | Resolution | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" / 0 - 25.4mm | .00005" / 0.001mm | **343-350-30** | ±.00025" | 630 |
| 1 - 2" / 25.4 - 50.8mm | .00005" / 0.001mm | **343-351-30** | ±.0003" | 650 |
| 2 - 3" / 50.8 - 76.2mm | .00005" / 0.001mm | **343-352-30** | ±.00035" | 1040 |
| 3 - 4" / 76.2 - 101.6mm | .00005" / 0.001mm | **343-353-30** | ±.0004" | 1090 |

**Metric**

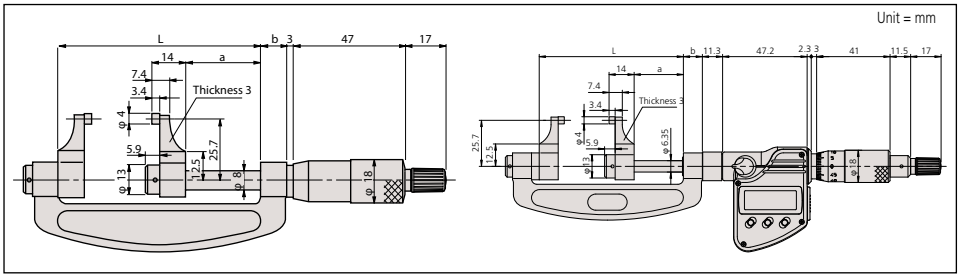
| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 25mm | 0.01mm | **143-101** | ±5µm | 210 |
| 25 - 50mm | 0.01mm | **143-102** | ±6µm | 230 |
| 50 - 75mm | 0.01mm | **143-103** | ±7µm | 280 |
| 75 - 100mm | 0.01mm | **143-104** | ±8µm | 330 |
| Models with a range up to 300mm are available. | | | | |

**Inch**

| Range | Graduation | Order No. | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 1" | .001" | **143-121** | ±.00025" | 210 |
| 1 - 2" | .001" | **143-122** | ±.0003" | 230 |
| 2 - 3" | .001" | **143-123** | ±.00035" | 280 |

## DIMENSIONS

Unit = mm





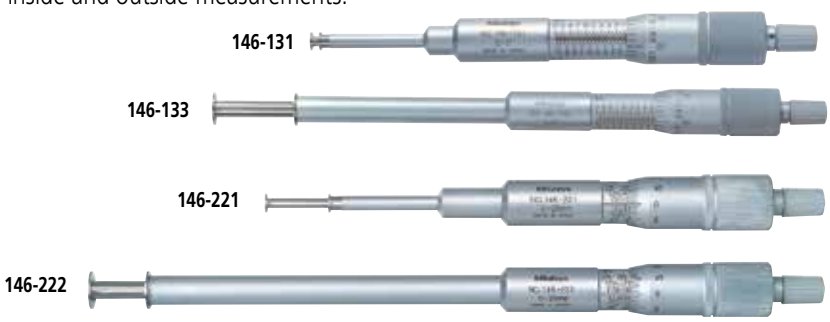

Mitutoyo

# Groove Micrometers

## SERIES 146

### FEATURES

- Flanged spindle for measuring width, depth and location of grooves inside/ outside bores, and tubes.
- Provided with two types of graduations for inside and outside measurements.
- Non-rotating spindle type has two-directional ratchet stop. (Measuring force: 0.7 - 1.2N)




### SPECIFICATIONS

**Metric** Rotating spindle type

| Range Outside | Range Inside | Graduation | Order No. | Flange | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 1.6 - 26.5mm | 0.01mm | **146-121** | ø6.35mm | 135 |
| | | | **146-122** | ø12.7mm | 185 |
| 25 - 50mm | 26.5 - 51.5mm | 0.01mm | **146-123** | ø12.7mm | 175 |
| 50 - 75mm | 51.5 - 76.5mm | 0.01mm | **146-124** | ø12.7mm | 165 |
| 75 - 100mm | 76.5 - 101.5mm | 0.01mm | **146-125** | ø12.7mm | 160 |

**Inch** Rotating spindle type

| Range Outside | Range Inside | Graduation | Order No. | Flange | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .055" - 1.05" | .001" | **146-131** | ø.25" | 135 |
| | | | **146-132** | ø.5" | 185 |
| 1" - 2" | 1.05" - 2.05" | .001" | **146-133** | ø.5" | 175 |
| 2" - 3" | 2.05" - 3.05" | .001" | **146-134** | ø.5" | 165 |
| 3" - 4" | 3.05" - 4.05" | .001" | **146-135** | ø.5" | 160 |

**Metric** Non-rotating spindle type

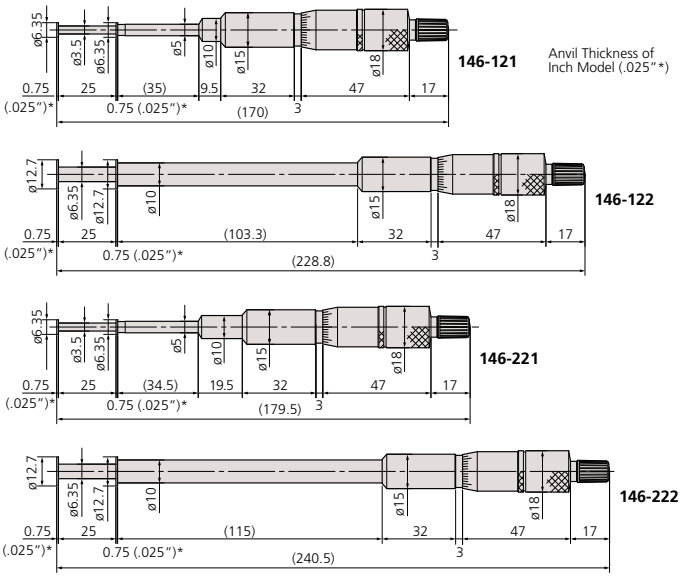
| Range Outside | Range Inside | Graduation | Order No. | Flange | Mass (g) |
|---|---|---|---|---|---|
| 0 - 25mm | 1.6 - 26.5mm | 0.01mm | **146-221** | ø6.35mm | 135 |
| | | | **146-222** | ø12.7mm | 185 |
| 25 - 50mm | 26.5 - 51.5mm | 0.01mm | **146-223** | ø12.7mm | 175 |
| 50 - 75mm | 51.5 - 76.5mm | 0.01mm | **146-224** | ø12.7mm | 165 |
| 75 - 100mm | 76.5 - 101.5mm | 0.01mm | **146-225** | ø12.7mm | 160 |

**Inch** Non-rotating spindle type

| Range Outside | Range Inside | Graduation | Order No. | Flange | Mass (g) |
|---|---|---|---|---|---|
| 0 - 1" | .055" - 1.05" | .001" | **146-231** | ø.25" | 135 |
| | | | **146-232** | ø.5" | 185 |
| 1" - 2" | 1.05" - 2.05" | .001" | **146-233** | ø.5" | 175 |
| 2" - 3" | 2.05" - 3.05" | .001" | **146-234** | ø.5" | 165 |
| 3" - 4" | 3.05" - 4.05" | .001" | **146-235** | ø.5" | 160 |

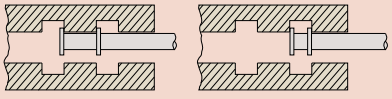
### DIMENSIONS

Unit: mm




### Technical Data

Accuracy: ± .0004" / ±10µm
Parallelism: .0004" / 10µm





# Small Hole Gage Set

## SERIES 154

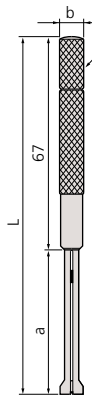
### FEATURES

- Used with an outside micrometer for measuring inside diameter of bores.
- 4 sizes of gages are supplied in a fitted pouch.
- Extra long for gaging deep and shallow holes, slots and similar workpieces.
- Gaging surface is fully hardened to ensure long tool life.



154-901

### DIMENSIONS




Unit: mm

| Order No. | L | a | b |
|---|---|---|---|
| **154-101 / 154 - 105** | 90 | 22.5 | 5.5 |
| **154-102 / 154 - 106** | 97.6 | 30 | 5.5 |
| **154-103 / 154 - 107** | 102.8 | 35 | 8.5 |
| **154-104 / 154 - 108** | 108 | 40 | 8.5 |

### SPECIFICATIONS

**Metric**

| Total range | Set Order No. | Assortment of gages |
|---|---|---|
| ø3 - 13mm (4-gage set) | **154-902** | ø3 - 5mm gage (**154-101**) |
| | | ø5 - 7.5mm gage (**154-102**) |
| | | ø7.5 - 10mm gage (**154-103**) |
| | | ø10 - 13mm gage (**154-104**) |

**Inch**

| Total range | Set Order No. | Assortment of gages |
|---|---|---|
| .125 - .5" DIA. (4-gage set) | **154-901** | .125" - .2" DIA. gage (**154-105**) |
| | | .2" - .3" DIA. gage (**154-106**) |
| | | .3" - .4" DIA. gage (**154-107**) |
| | | .4" - .5" DIA. gage (**154-108**) |

# Telescoping Gage Set

## SERIES 155

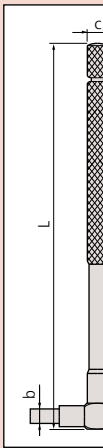
### FEATURES

- Spring-loaded plunger expands within the bore (or groove), allowing determination of the internal diameter (or groove width).
- With a knurled clamp.
- Supplied in a fitted pouch.



155-903

### DIMENSIONS




Unit: mm

| Order No. | L | a | b | c |
|---|---|---|---|---|
| **155-127 / 155 - 121** | 110 | 4 | 3 | 5 |
| **155-128 / 155 - 122** | 110 | 5 | 3.5 | 5.5 |
| **155-129 / 155 - 123** | 110 | 5 | 3.5 | 5.5 |
| **155-130 / 155 - 124** | 150 | 7.5 | 6 | 8 |
| **155-131 / 155 - 125** | 150 | 7.5 | 6 | 8 |
| **155-132 / 155 - 126** | 150 | 7.5 | 6 | 8 |

### SPECIFICATIONS

**Metric**

| Total range | Set Order No. | Included in set |
|---|---|---|
| 8 - 150mm (6-gage set) | **155-905** | 8 - 12.7mm gage (**155-127**) |
| | | 12.7 - 19mm gage (**155-128**) |
| | | 19 - 32mm gage (**155-129**) |
| | | 32 - 54mm gage (**155-130**) |
| | | 54 - 90mm gage (**155-131**) |
| | | 90 - 150mm gage (**155-132**) |

**Inch**

| Total range | Set Order No. | Included in set |
|---|---|---|
| .313 - 6" (6-gage set) | **155-903** | .313" - .5" gage (**155-121**) |
| | | .5" - .75" gage (**155-122**) |
| | | .75" - 1.25" gage (**155-123**) |
| | | 1.25" - 2.125" gage (**155-124**) |
| | | 2.125" - 3.5" gage (**155-125**) |
| | | 3.5" - 6" gage (**155-126**) |
| .50 - 6" (5-gage set) | **155-904** | **155-122, 155-123, 155-124, 155-125, 155-126** |
| .315 - 2.125" (4-gage set) | **155-907** | **155-121, 155-122, 155-123, 155-124** |

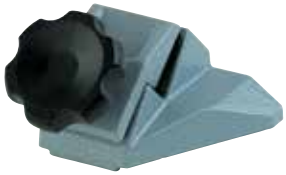


Mitutoyo

# Micrometer Stands

## SERIES 156

These stands are designed to allow bench-top use with hand micrometers or other gages.



156-105-10



156-106



156-101-10



156-102







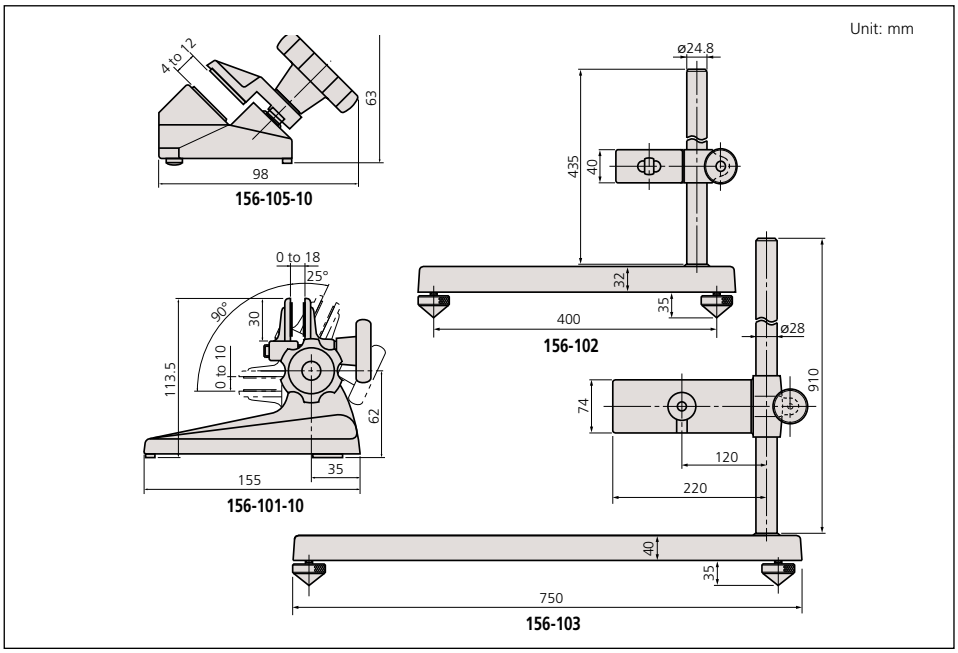


## SPECIFICATIONS

| Micrometer ranges | Order No. | Remarks |
|---|---|---|
| 0-1″ / 0-25mm, 1-2″ / 25-50mm | **156-105-10** | Fixed angle type |
| Up to 4″ / 100mm | **156-101-10** | Adjustable angle type |
| 5-12″ / 125-300mm | **156-102** | Vertical type |
| 12-40″ / 300-1000mm | **156-103** | Vertical type |
| 0-1″ / 0-25mm 1-2″ / 25-50mm | **156-106** | Fixed angle with platform |

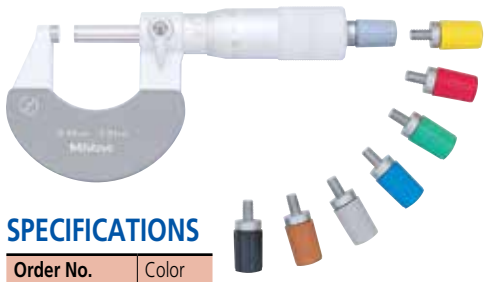
## DIMENSIONS

Unit: mm



# Color Ratchet & Color Speeder

## Color ratchet



## SPECIFICATIONS

| Order No. | Color |
|---|---|
| 985056 | Black |
| 985061 | Red |
| 985081 | Blue |
| 985071 | Yellow |
| 985076 | Green |
| 985066 | Brown |
| 04GZA241* | Gray |
| 04GZA239** | Gray |
| 04GZA243*** | Gray |

*for Series 293 digital model
** up to 300mm / 12"
** over 300mm / 12"

## Color Speeder for Ratchet Thimble Micrometer



## SPECIFICATIONS

| Order No. | Color |
|---|---|
| 04GAA899 | Black |
| 04GAA900 | Red |
| 04GAA901 | Yellow |
| 04GAA902 | Green |
| 04GAA903 | Blue |
| 04AAB208 | Gray |

# Spindle Attachment Tip

### Technical Data

Tip length: metric type: 10mm ±5µm
inch type: .5" ±.0002"

Spindle Dia: *1 .250" / 6.35mm
*1 Spindle diameter for 101469 (.250" ball) is .315"/ 8mm



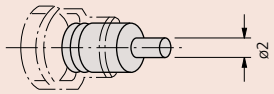
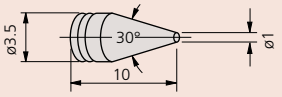
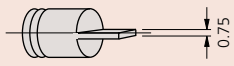

To measure odd workpieces, several convenient anvil attachments are prepared by Mitutoyo. Among them the most often used one is the ball attachment.

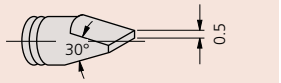
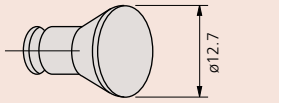
The ball attachments are hardened steel balls with .200" and .250" diameters which are placed on the .250" and .315" diameter anvils, respectively, by rubber caps. With these attachments, regular micrometers can measure cylindrical wall thickness, but, .200" or .250" must be subtracted from the readings.

Other attachments shown here are either .500" or 10mm in length. The added amount must be subtracted from the reading.

| Ball | Spline | Comparator | Blade | Knife-edge | Disk |
|---|---|---|---|---|---|
|  |  |  |  |  |  |
| 101468 (.200" ball dia.)<br>101469 (.250" ball dia.) | 208062*<br>208098 | 208063*<br>208099 | 208064*<br>208100 | 208065*<br>208101 | 208066*<br>208102 |

## DIMENSIONS

| Order No. | Dimension |
|---|---|
| 208098<br>208062* |   |
| 208099<br>208063* |   |
| 208100<br>208064* |   |

| Order No. | Dimension |
|---|---|
| 208101<br>208065* |   |
| 208102<br>208066* |   |

* metric type

# Micrometer Oil



**207000** (30ml)



Mitutoyo

# Optical Parallels

## SERIES 157

### FEATURES

- Designed to inspect parallelism and flatness of measuring faces of micrometers.
- Each set consists of 4 thicknesses.
- Supplied in fitted wooden case.



### SPECIFICATIONS

**Metric**

| Range of micrometer to be checked | Order No. | Assortment of parallels (Thickness of parallel) |
|---|---|---|
| 0-25mm | **157-903** | 12.00mm (157-101)<br>12.12mm (157-102)<br>12.25mm (157-103)<br>12.37mm (157-104) |
| 25-50mm | **157-904** | 25.00mm (157-105)<br>25.12mm (157-106)<br>25.25mm (157-107)<br>25.37mm (157-108) |

**Inch**

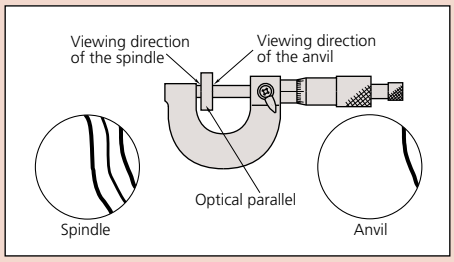
| Range of micrometer to be checked | Order No. | Assortment of parallels (Thickness of parallel) |
|---|---|---|
| 0-1" | **157-901** | .5000" (157-109)<br>.5062" (157-110)<br>.5125" (157-111)<br>.5187" (157-112) |
| 1-2" | **157-902** | 1.0000" (157-113)<br>1.0062" (157-114)<br>1.0125" (157-115)<br>1.0187" (157-116) |

### Technical Data

Flatness: .000004" / 0.1µm
Parallelism: .000008" / 0.2µm
Diameter: 1.18" / 30mm

### Parallelism check between measuring faces by means of interference fringe produced by an optical parallel.

The parallelism between the measuring faces can be determined as follows--place the optical parallel to the anvil and observe the number of interference fringes produced on the spindle side under the measuring force of the micrometers.
The parallelism is about 1µm (0.32µm x 3 = 0.96µm).
Fringe on the anvil side must not be more than one.






# Optical Flats

## SERIES 158

### FEATURES

- Used for inspecting the flatness of micrometer's or gage block's measuring faces with high accuracy.
- Supplied in fitted wooden case.



### SPECIFICATIONS

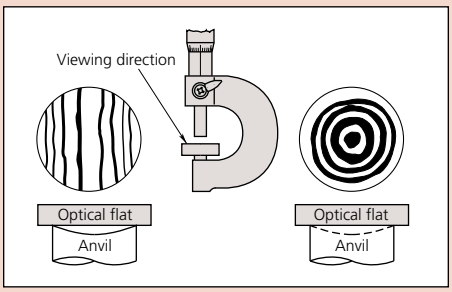
**Metric**

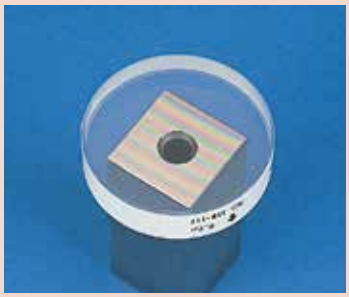
| Flatness | Order No. | Diameter/Thickness |
|---|---|---|
| 0.2µm | **158-117** | 45mm/12mm |
| | **158-119** | 60mm/15mm |
| 0.1µm | **158-118** | 45mm/12mm |
| | **158-120** | 60mm/15mm |

**Inch**

| Flatness | Order No. | Diameter/Thickness |
|---|---|---|
| .000004" | **158-122** | 1.8"/.5" |
| | **158-124** | 2.4"/.6" |

### Flatness check of measuring faces using interference fringe pattern produced by an optical flat.



# Micrometer Standards

## SERIES 167

### Technical Data

Flatness: 0.3µm / .000012″
Parallelism: 2µm / .00008″



### FEATURES

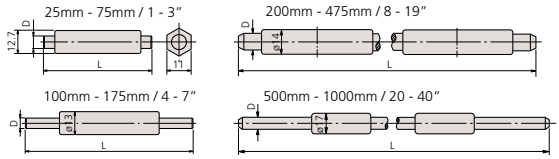
- Used for the zero point setting of outside micrometers.
- Flat and lapped measuring faces.
- Heat insulating handle to prevent expansion due to body temperature.
- Supplied in fitted carton up to 500mm / 20″ and wooden case for over 525mm / 21″ length.



167-108

167-103

### DIMENSION




### SPECIFICATIONS

**Inch**

| Length (L) | Order No. | Diameter (D) | Accuracy |
|---|---|---|---|
| 41″ | **167-405** | .47″ | .0004″ |
| 42″ | **167-406** | .47″ | .0004″ |
| 43″ | **167-407** | .47″ | .0004″ |
| 44″ | **167-408** | .47″ | .0004″ |
| 45″ | **167-409** | .47″ | .0004″ |
| 46″ | **167-410** | .47″ | .0004″ |
| 47″ | **167-411** | .47″ | .0004″ |
| 48″ | **167-412** | .47″ | .0004″ |
| 49″ | **167-413** | .47″ | .0004″ |
| 50″ | **167-414** | .47″ | .0004″ |
| 51″ | **167-415** | .47″ | .0004″ |
| 52″ | **167-416** | .47″ | .0004″ |
| 53″ | **167-417** | .47″ | .0004″ |
| 54″ | **167-418** | .47″ | .0004″ |
| 55″ | **167-419** | .47″ | .0004″ |
| 56″ | **167-420** | .47″ | .0004″ |
| 57″ | **167-421** | .47″ | .0004″ |
| 58″ | **167-422** | .47″ | .0004″ |
| 59″ | **167-423** | .47″ | .0004″ |
| 60″ | **167-424** | .47″ | .0004″ |
| 61″ | **167-425** | .47″ | .0004″ |
| 62″ | **167-426** | .47″ | .0004″ |
| 63″ | **167-427** | .47″ | .0004″ |
| 64″ | **167-428** | .47″ | .0004″ |
| 65″ | **167-429** | .47″ | .0004″ |
| 66″ | **167-430** | .47″ | .0004″ |
| 67″ | **167-431** | .47″ | .0004″ |
| 68″ | **167-432** | .47″ | .0004″ |
| 69″ | **167-433** | .47″ | .0004″ |
| 70″ | **167-434** | .47″ | .0004″ |
| 71″ | **167-435** | .47″ | .0004″ |
| 72″ | **167-436** | .47″ | .0004″ |
| 73″ | **167-437** | .47″ | .0004″ |
| 74″ | **167-438** | .47″ | .0004″ |
| 75″ | **167-439** | .47″ | .0004″ |
| 76″ | **167-440** | .47″ | .0004″ |
| 77″ | **167-441** | .47″ | .0004″ |
| 78″ | **167-442** | .47″ | .0004″ |
| 79″ | **167-443** | .47″ | .0004″ |

### Micrometer Standards Set

**Inch**

| Order No. | Size | Remarks |
|---|---|---|
| **167-912*** | 1″-5″ | 5 pcs. Set (167-141, 142, 143, 144, 145) |
| **167-913*** | 1″-11″ | 11 pcs. Set (167-141, 142, 143, 144,145, 146, 147, 148, 149, 150, 151) |

**Metric**

| Order No. | Size | Remarks |
|---|---|---|
| **167-902*** | 25-125mm | 5 pcs. Set (167-101, 102, 103, 104, 105) |
| **167-903*** | 25-275mm | 11 pcs. Set (167-101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111) |

*Supplied with fitted carrying case

**Metric**

| Length (L) | Order No. | Diameter (D) | Accuracy |
|---|---|---|---|
| 25mm | **167-101** | 6.35mm | ±1.5µm |
| 50mm | **167-102** | 6.35mm | ±2.0µm |
| 75mm | **167-103** | 6.35mm | ±2.5µm |
| 100mm | **167-104** | 7.9mm | ±3µm |
| 125mm | **167-105** | 7.9mm | ±3.5µm |
| 150mm | **167-106** | 7.9mm | ±4µm |
| 175mm | **167-107** | 7.9mm | ±4.5µm |
| 200mm | **167-108** | 9.4mm | ±5.0µm |
| 225mm | **167-109** | 9.4mm | ±5.5µm |
| 250mm | **167-110** | 9.4mm | ±6.0µm |
| 275mm | **167-111** | 9.4mm | ±6.5µm |
| 300mm | **167-112** | 9.4mm | ±7µm |
| 325mm | **167-113** | 9.4mm | ±7.5µm |
| 350mm | **167-114** | 9.4mm | ±8µm |
| 375mm | **167-115** | 9.4mm | ±8.5µm |
| 400mm | **167-116** | 9.4mm | ±9µm |
| 425mm | **167-117** | 9.4mm | ±9.5µm |
| 450mm | **167-118** | 9.4mm | ±1.0µm |
| 475mm | **167-119** | 9.4mm | ±10.5µm |
| 500mm | **167-120** | 11.9mm | ±11µm |
| 525mm | **167-121** | 11.9mm | ±11.5µm |
| 550mm | **167-122** | 11.9mm | ±12µm |
| 575mm | **167-123** | 11.9mm | ±12.5µm |
| 600mm | **167-124** | 11.9mm | ±13µm |
| 625mm | **167-125** | 11.9mm | ±13.5µm |
| 650mm | **167-126** | 11.9mm | ±14µm |
| 675mm | **167-127** | 11.9mm | ±14.5µm |
| 700mm | **167-128** | 11.9mm | ±15µm |
| 725mm | **167-129** | 11.9mm | ±15.5µm |
| 750mm | **167-130** | 11.9mm | ±16µm |
| 775mm | **167-131** | 11.9mm | ±16.5µm |
| 800mm | **167-132** | 11.9mm | ±17µm |
| 825mm | **167-133** | 11.9mm | ±17.5µm |
| 850mm | **167-134** | 11.9mm | ±18µm |
| 875mm | **167-135** | 11.9mm | ±18.5µm |
| 900mm | **167-136** | 11.9mm | ±19µm |
| 925mm | **167-137** | 11.9mm | ±19.5µm |
| 950mm | **167-138** | 11.9mm | ±20µm |
| 975mm | **167-139** | 11.9mm | ±20.5µm |
| 1000mm | **167-140** | 11.9mm | ±21µm |

**Inch**

| Length (L) | Order No. | Diameter (D) | Accuracy |
|---|---|---|---|
| 1" | **167-141** | .25" | ±.00005″ |
| 2" | **167-142** | .25" | ±.0001″ |
| 3" | **167-143** | .25" | ±.0001″ |
| 4" | **167-144** | .31" | ±.0001″ |
| 5" | **167-145** | .31" | ±.00015″ |
| 6" | **167-146** | .31" | ±.00015″ |
| 7" | **167-147** | .31" | ±.00015″ |
| 8" | **167-148** | .37" | ±.00015″ |
| 9" | **167-149** | .37" | ±.0002″ |
| 10" | **167-150** | .37" | ±.0002″ |
| 11" | **167-151** | .37" | ±.0002″ |
| 12" | **167-152** | .37" | ±.00025″ |
| 13" | **167-153** | .37" | ±.00025″ |
| 14" | **167-154** | .37" | ±.00025″ |
| 15" | **167-155** | .37" | ±.00025″ |
| 16" | **167-156** | .37" | ±.00025″ |
| 17" | **167-157** | .37" | ±.00025″ |
| 18" | **167-158** | .37" | ±.00025″ |
| 19" | **167-159** | .37" | ±.0003″ |
| 20" | **167-160** | .47" | ±.0003″ |
| 21" | **167-161** | .47" | ±.0003″ |
| 22" | **167-162** | .47" | ±.0003″ |
| 23" | **167-163** | .47" | ±.0003″ |
| 24" | **167-164** | .47" | ±.0003″ |
| 25" | **167-165** | .47" | ±.00035″ |
| 26" | **167-166** | .47" | ±.00035″ |
| 27" | **167-167** | .47" | ±.00035″ |
| 28" | **167-168** | .47" | ±.00035″ |
| 29" | **167-169** | .47" | ±.00035″ |
| 30" | **167-170** | .47" | ±.00035″ |
| 31" | **167-171** | .47" | ±.00035″ |
| 32" | **167-172** | .47" | ±.00035″ |
| 33" | **167-173** | .47" | ±.00035″ |
| 34" | **167-174** | .47" | ±.00035″ |
| 35" | **167-175** | .47" | ±.00035″ |
| 36" | **167-176** | .47" | ±.00035″ |
| 37" | **167-177** | .47" | ±.0004″ |
| 38" | **167-178** | .47" | ±.0004″ |
| 39" | **167-179** | .47" | ±.0004″ |
| 40" | **167-180** | .47" | ±.0004″ |



Mitutoyo

# Standards for Screw Thread Micrometers

## SERIES 167 — 60 degree and 55 degree

### FEATURES

- Specially designed for the zero point setting of screw thread micrometers.
- Supplied in fitted carton.




**167-264** (60°)




**167-262** (60°)

### SPECIFICATIONS

**Metric**

| Length | Order No. | Thread angle | Accuracy |
|---|---|---|---|
| 25mm | **167-261** | 60° | ±4µm |
| | **167-272** | 55° | ±4µm |
| 50mm | **167-262** | 60° | ±5µm |
| | **167-273** | 55° | ±5µm |
| 75mm | **167-263** | 60° | ±6µm |
| | **167-274** | 55° | ±6µm |
| 100mm | **167-264** | 60° | ±7µm |
| | **167-275** | 55° | ±7µm |
| 125mm | **167-265** | 60° | ±8µm |
| | **167-276** | | ±8µm |
| 150mm | **167-266** | 60° | ±9µm |
| | **167-277** | | ±9µm |
| 175mm | **167-267** | 60° | ±10µm |
| | **167-278** | | ±10µm |
| 200mm | **167-268** | 60° | ±11µm |
| | **167-279** | | ±11µm |
| 225mm | **167-269** | 60° | ±12µm |
| | **167-280** | | ±12µm |
| 250mm | **167-270** | 60° | ±13µm |
| | **167-281** | | ±13µm |
| 275mm | **167-271** | 60° | ±14µm |
| | **167-282** | | ±14µm |

**Inch**

| Length | Order No. | Thread angle | Accuracy |
|---|---|---|---|
| 1" | **167-294** | 60° | ±.00015" |
| | **167-283** | 55° | ±.00015" |
| 2" | **167-295** | 60° | ±.0002" |
| | **167-284** | 55° | ±.0002" |
| 3" | **167-296** | 60° | ±.00025" |
| | **167-285** | 55° | ±.00025" |
| 4" | **167-297** | 60° | ±.0003" |
| | **167-286** | 55° | ±.0003" |
| 5" | **167-298** | 60° | ±.00035" |
| | **167-287** | 55° | ±.00035" |
| 6" | **167-299** | 60° | ±.0004" |
| | **167-288** | 55° | ±.0004" |

### Technical Data

Thread angle: 55° or 60°
Angle Accuracy: ±2°

# Standards for V-Anvil Micrometers

## SERIES 167

### FEATURES

- Specially designed for the zero point setting of V-anvil micrometers.
- Supplied in fitted carton.




**167-329**

### SPECIFICATIONS

**Metric**

| Diameter | Order No. | Type | Accuracy |
|---|---|---|---|
| 5mm | **167-327** | Plug | ±2µm |
| 10mm | **167-328** | Plug | ±2µm |
| 25mm | **167-329** | Plug | ±2µm |
| 40mm | **167-330** | Ring | ±3µm |
| 55mm | **167-331** | Ring | ±3µm |
| 70mm | **167-332** | Ring | ±3µm |
| 85mm | **167-333** | Ring | ±3µm |

**Inch**

| Diameter | Order No. | Type | Accuracy |
|---|---|---|---|
| .2" | **167-337** | Plug | ±.0001" |
| .4" | **167-338** | Plug | ±.0001" |
| 1" | **167-339** | Plug | ±.0001" |
| 1.6" | **167-340** | Ring | ±.00015" |
| 2.2" | **167-341** | Ring | ±.00015" |
| 2.8" | **167-342** | Ring | ±.00015" |
| 3.4" | **167-343** | Ring | ±.00015" |

# Tool Kits

The Digimatic Tool Kits include Mitutoyo's highly popular 0–1″ / 0–25mm Digimatic Micrometer (choose ratchet or friction type) and 0–6″ / 0–150mm Digimatic Caliper with Absolute Encoder. The case is made of handsome, solid mahogany and has space for gage batteries. The micrometer spanner is a supplied accessory.

| Order No. 64PKA068A (Inch Tool Kit) | |
|---|---|
| **Item No.** | **Description** |
| **103-135** | Outside Micrometer (Friction Thimble Type) (Range: 0–1″, Graduation: .0001″) |
| **505-742** | Dial Caliper (Range: 0–6″, Dial Graduation: .001″) |
| **182-204** | 6″ Full-Flexible Rule (3R) |
| **64PPP932** | Mahogany Case |



**64PKA068A**

| Order No. 64PKA069A (Inch Tool Kit) | |
|---|---|
| **Item No.** | **Description** |
| **103-135** | Outside Micrometer (Friction Thimble Type) (Range: 0–1″, Graduation: .0001″) |
| **182-202** | 6″ Full-Flexible Rule (16R) |
| **513-518T** | Test Indicator Set (Range: .04″, Graduation: .001″) |
| **505-742** | 675 Dial Caliper (Range: 0–6″, Dial Graduation: .001″) |
| **050501** | Mahogany Case |



**64PKA069A**

The basic measuring instruments recommended for vocational students and machinist apprentices are supplied in this kit.

| Order No. 64PKA070A (Inch Tool Kit) | |
|---|---|
| **Item No.** | **Description** |
| **101-117** | Outside Micrometer (Friction Thimble Type) (Range: 0–1″, Graduation: .0001″) |
| **129-132** | Depth Micrometer (with 6 pcs rods) (Range: 0–6″, Graduation: .001″) |
| **182-202** | Full-Flexible Rule (16R) |
| **505-742** | Dial Caliper (Range: 0–6″, Graduation: .001″) |
| **050503** | Mahogany Case |



**64PKA070A**

For operations where depth measurements are a primary concern, this kit is ideal for measuring depths to 6″, in addition to providing the tools for regular precision measurements.

| Order No. 64PKA071B (Inch Tool Kit) | |
|---|---|
| **Item No.** | **Description** |
| **103-922** | Outside Micrometer Set (3 pcs) (Range: 0–3″, Graduation: .0001″) |
| **141-208** | Inside Micrometer (with 6 pcs rods) |
| **182-202** | Full-Flexible Rule (16R) |
| **513-518T** | Test Indicator Set (Range: .04″, Graduation: .001″) |
| **505-742** | Dial Caliper (Range: 0–6″, Dial Graduation: .001″) |
| **2416S** | Dial Indicator (Range: 1.0″, Graduation: .001″) |
| **7010S** | Magnetic Stand |
| **050504** | Mahogany Case |



**64PKA071B**

Most every routine inspection assignment can be completed with the eight high-quality Mitutoyo precision measuring instruments provided in this deluxe kit.

# Tool Kits



64PKA080B

| Order No. 64PKA080B (Inch Tool Kit) | |
|---|---|
| **Item No.** | **Description** |
| **182-102** | 6" Steel Rule (16R) |
| **103-177** | Micrometer (Ratchet Thimble) (Range 0-1", Graduation .001") |
| **505-740** | Dial Caliper (Range: 0–6", Dial Graduation: .001") |
| **64PPP932** | Mahogany Case |



64PKA073B

| Order No. 64PKA073B (Tool Kit Lite) | |
|---|---|
| **Item No.** | **Description** |
| **182-102** | 6" Steel Rule (16R) |
| **700-113-10** | 0 - 6" / 0 - 150mm MyCal Lite (Resolution: .001" / 0.1mm) |
| **293-831-30** | 0 - 1" / 0 - 25.4mm MDC Lite (Ratchet Stop)<br>(Resolution: .00005" / 0.001mm) |
| **64PPP932** | Mahogany Case |



64PKA076B

| Order No. 64PKA076B (Digimatic Tool Kit) | |
|---|---|
| **Item No.** | **Description** |
| **293-340-30** | Digimatic Micrometer (Ratchet Stop Type)<br>(Range: 0 - 1" / 0 - 25.4mm, LCD Resolution: .00005" / 0.001mm) |
| **500-196-30** | Digimatic Caliper with Absolute Encoder<br>(Range: 0 - 6" / 0 - 150mm, LCD Resolution: .0005" / 0.001mm) |
| **64PPP932** | Mahogany Case |



64PKA077B

| Order No.64PKA077B (Digimatic Tool Kit) | |
|---|---|
| **Item No.** | **Description** |
| **293-348-30** | Digimatic Micrometer (Friction Thimble Type)<br>(Range: 0 - 1" / 0 - 25.4mm, LCD Resolution: .00005" / 0.001mm) |
| **500-196-30** | Digimatic Caliper with Absolute Encoder<br>(Range: 0 - 6" / 0 - 150mm, LCD Resolution: .0005" / 0.001mm) |
| **64PPP932** | Mahogany Case |



64PKA152

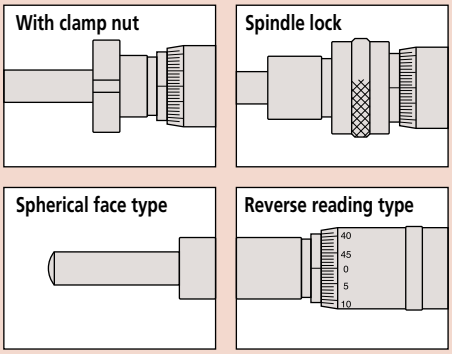
| Order No.64PKA152 (Digimatic Tool Kit) | |
|---|---|
| **Item No.** | **Description** |
| **293-185-30** | Digimatic Micrometer (Friction Thimble Type)<br>(Range: 0 - 1" / 0 - 25.4mm, LCD Resolution: .00005" / 0.001mm) |
| **500-196-30** | Digimatic Caliper with Absolute Encoder<br>(Range: 0 - 6" / 0 - 150mm, LCD Resolution: .0005" / 0.001mm) |
| **64PPP932** | Mahogany Case |

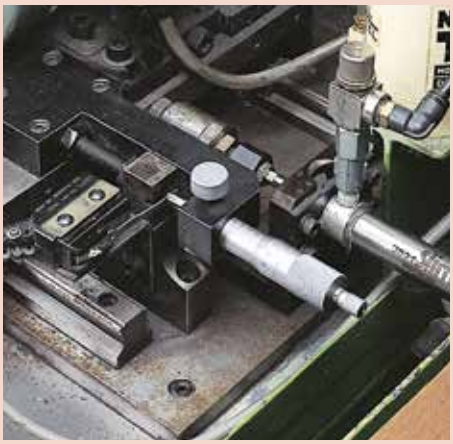
# Micrometer Head Selection Guide

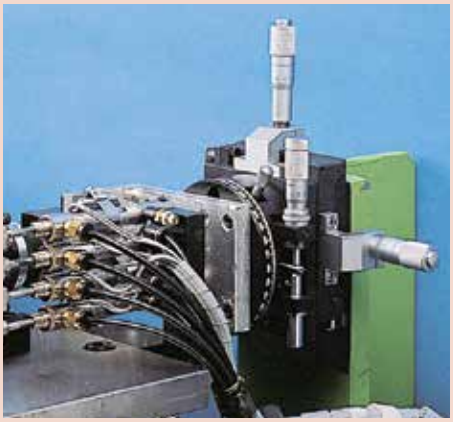
The table below provides an outline of Mitutoyo micrometer heads for each series so you can locate the pages to refer to select the micrometer head most appropriate to your specific application. When selecting consider the following points:

- Dimensions
- Graduation/resolution and accuracy
- With or without spindle lock
- With or without clamping nut
- Normal or reverse reading
- With or without ratchet stop

## Variety of Specifications





## SELECTION TABLE

| Range | Series | Remarks | Page |
|---|---|---|---|
| 0 - 1mm | 110 | Differential screw translator (extra-fine feeding) type | B-69 |
| 0 - 2.5mm | 110 | Differential screw translator (extra-fine feeding) type | B-69 |
| 0 - 5mm | 148 | Ultra-small type | B-60 |
| 0 - 6.5mm | 148 | Fine spindle feeding of 0.1mm/rev. | B-58 |
| | 148 | Fine spindle feeding of 0.25mm/rev. | B-59 |
| | 148 | Small type | B-60 |
| | 148 | Large thimble diameter for easy reading | B-61 |
| 0 - 10mm | 152 | Fine-feeding type | B-68 |
| 0 - 13mm | 148 | Common type in small size | B-62 |
| | 148 | Spindle feeding of 0.25mm/rev. | B-59 |
| | 148 | Zero-adjustable thimble type | B-63 |
| | 148 | Large thimble diameter for easy reading | B-61 |
| | 110 | Differential screw translator (extra-fine feeding) type | B-69 |
| 0 - 15mm | 149 | with carbide-tipped spindle type | B-64 |
| | 153 | Non-rotating spindle type | B-67 |
| | 152 | Quick spindle feeding of 1mm/rev. | B-68 |
| 0 - 25mm | 350 | Compact digital type | B-57 |
| | 150 | Common type in middle size | B-65 |
| | 153 | Non-rotating spindle type | B-67 |
| | 153 | Fine graduation type | B-71 |
| | 151 | Heavy-duty type (ø8mm spindle) | B-66 |
| | 152 | Quick spindle feeding of 1mm/rev. | B-68 |
| | 152 | Fine feeding type | B-68 |
| | 152 | for XY-stage | B-70 |
| | 250 | with digit counter type | B-73 |
| 0 - 50mm | 164 | Digital type | B-56 |
| | 151 | Heavy-duty type (ø8mm spindle) | B-66 |
| | 152 | Quick spindle feeding of 1mm/rev. | B-68 |
| | 152 | Fine-feeding type | B-68 |
| | 197 | Non-rotating spindle and large thimble | B-71 |

# Digimatic Micrometer Heads

## SERIES 164

### FEATURES

- The display can be rotated up to 330˚ for easy reading in any position.
- Non-rotating spindle imparts no torque on the workpiece.



164-164

### SPECIFICATIONS

**Metric**

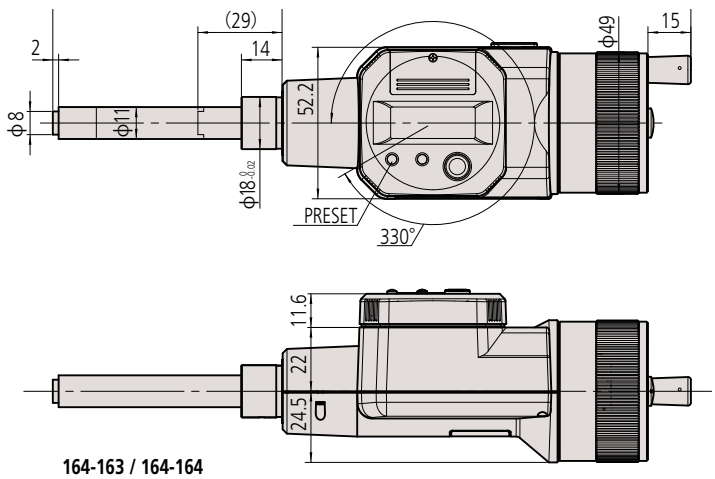
| Range | Order No. | Accuracy | Mass (g) |
|---|---|---|---|
| 0 - 50mm | **164-163** | ±3µm | 490 |

**Inch/Metric**

| Range | Order No. | Accuracy | Mass (g) |
|---|---|---|---|
| 0 - 2" / 0 - 50.8mm | **164-164** | ±.00015" | 490 |

### DIMENSIONS

Unit: mm




164-163 / 164-164

### Technical Data

Accuracy: Refer to the list of specifications.

Resolution: 0.001mm or .00005"/0.001mm
Display: LCD
Battery: SR44 (2 pcs.), **938882**
Battery life: 1.8 years

### Function

Zero-setting, Data hold, Data output, Preset, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**959149**: SPC cable (1m / 40")
**959150**: SPC cable (2m / 80")

# Digimatic Micrometer Heads

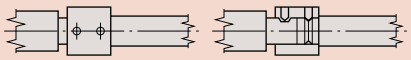
## SERIES 350

**Measuring force: 5 - 10N**

### Non-rotating device

**350-261-30, 350-361-30**

The non-rotating device provides no radial torsion on the workpiece surface so that workpiece wear and deformation are minimized.



### Technical Data

Accuracy* ±2µm Metric model
± .0001" Inch / Metric model

Resolution: 0.001mm or .00005"/0.001mm
Display: LCD
Battery: SR44 (1 pc) **938882**
Battery life: Approx. 2.4 years under normal use
Dust/Water protection level: IP65
**350-281-30, 350-282-30, 350-283-30, 350-284-30, 350-261-30**
**350-381-30, 350-382-30, 350-383-30, 350-384-30, 350-361-30**

### Function

Preset, inch/mm conversion (on inch/metric models only)
Function Lock, 2 Presets
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA662**: SPC cable with data switch (1m / 40")
**05CZA663**: SPC cable with data switch (2m / 80")

## FEATURES

- Equipped with digital display and output.
- 350 series IP65 models: the Digimatic output port enables inclusion in a statistical process control or networked measurement system.



**350-251-30**



**350-381-30**

## SPECIFICATIONS

**Metric**

| Range | Order No. | Stem | Spindle face | Stem dia. | Remarks |
|---|---|---|---|---|---|
| 0 - 25mm | **350-251-30** | Plain | Flat (carbide tip) | 10mm | |
| 0 - 25mm | **350-252-30** | w/ clamp nut | Flat (carbide tip) | 10mm | |
| 0 - 25mm | **350-253-30** | Plain | Spherical (SR4) | 10mm | |
| 0 - 25mm | **350-254-30** | w/ clamp nut | Spherical (SR4) | 10mm | |
| 0 - 25mm | **350-281-30** | Plain | Flat (carbide tip) | 12mm | IP65 |
| 0 - 25mm | **350-282-30** | w/ clamp nut | Flat (carbide tip) | 12mm | IP65 |
| 0 - 25mm | **350-283-30** | Plain | Spherical (SR4) | 12mm | IP65 |
| 0 - 25mm | **350-284-30** | w/ clamp nut | Spherical (SR4) | 12mm | IP65 |
| 0 - 25mm | **350-261-30*** | Plain | Flat | 12mm | IP65 |

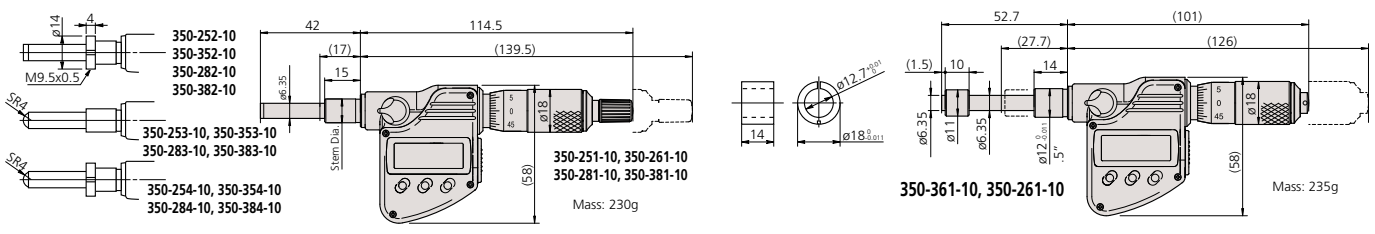
*with non-rotating device and 18mm stem bushing.

**Inch/Metric**

| Range | Order No. | Stem | Spindle face | Stem dia. | Remarks |
|---|---|---|---|---|---|
| 0 - 1" / 0 -25.4mm | **350-351-30** | Plain | Flat (carbide tip) | .375" | |
| 0 - 1" / 0 -25.4mm | **350-352-30** | w/ clamp nut | Flat (carbide tip) | .375" | |
| 0 - 1" / 0 -25.4mm | **350-353-30** | Plain | Spherical (SR4) | .375" | |
| 0 - 1" / 0 -25.4mm | **350-354-30** | w/ clamp nut | Spherical (SR4) | .375" | |
| 0 - 1" / 0 -25.4mm | **350-381-30** | Plain | Flat (carbide tip) | .5" | IP65 |
| 0 - 1" / 0 -25.4mm | **350-382-30** | w/ clamp nut | Flat (carbide tip) | .5" | IP65 |
| 0 - 1" / 0 -25.4mm | **350-383-30** | Plain | Spherical (SR4) | .5" | IP65 |
| 0 - 1" / 0 -25.4mm | **350-384-30** | w/ clamp nut | Spherical (SR4) | .5" | IP65 |
| 0 - 1" / 0 -25.4mm | **350-361-30*** | Plain | Flat | .5" | IP65 |

*with non-rotating device and 18mm stem bushing.

## DIMENSIONS AND MASS

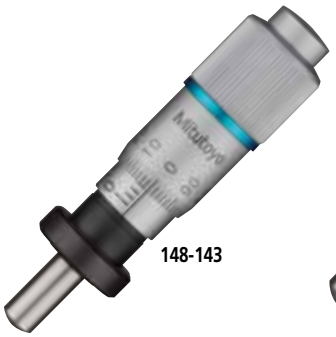


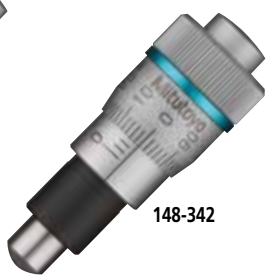
# Micrometer Heads

## SERIES 148 — Fine Spindle Feeding of 0.1mm/rev

### FEATURES

- Fine spindle feeding of just 0.1mm/rev for extra-fine adjustment and positioning.
- External dimensions are compatible with conventional 0.5mm pitch heads.


148-143


148-342


148-243

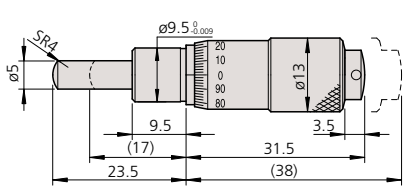
### SPECIFICATIONS

**Metric**

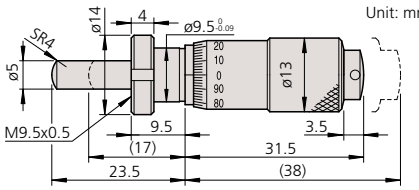
| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 6.5mm | **148-142** | ±2µm | 9.5mm | Plain | Spherical (SR4) | — |
| 0 - 6.5mm | **148-143** | ±2µm | 9.5mm | w/clamp nut | Spherical (SR4) | — |
| 0 - 6.5mm | **148-342** | ±2µm | 9.5mm | Plain | Spherical (SR4) | Thicker & shorter thimble |
| 0 - 6.5mm | **148-343** | ±2µm | 9.5mm | w/clamp nut | Spherical (SR4) | Thicker & shorter thimble |
| 0 - 6.5mm | **148-242** | ±5µm | 6mm | Plain | Spherical (SR3) | Small thimble diameter |
| 0 - 6.5mm | **148-243** | ±5µm | 6mm | w/clamp nut | Spherical (SR3) | Small thimble diameter |

### DIMENSIONS AND MASS

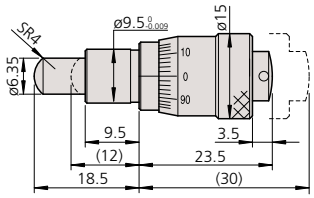
Unit: mm



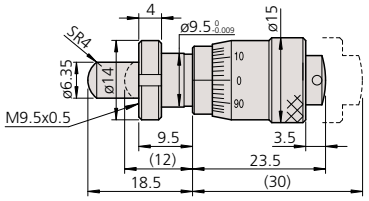
**148-142** Mass: 31g



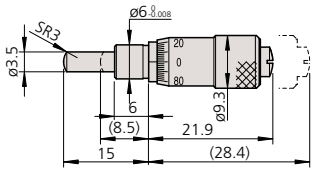
**148-143** Mass: 34g



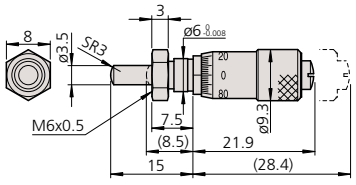
**148-342** Mass: 29g



**148-343** Mass: 31g



**148-242** Mass: 10g



**148-243** Mass: 10g

( ): when retracting the spindle until its stroke end.

### Technical Data

Graduations: 0.002mm
Spindle pitch: 0.1mm
Spindle face: Spherical of SKS3 (more than HRC60), lapped surface
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 6mm (**148-243**: 4mm)

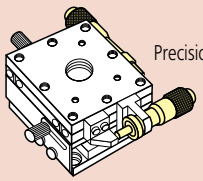
### Spindle pitch

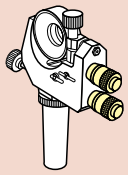

Screw Thread pitch= 0.1mm


Screw Thread pitch= 0.5mm

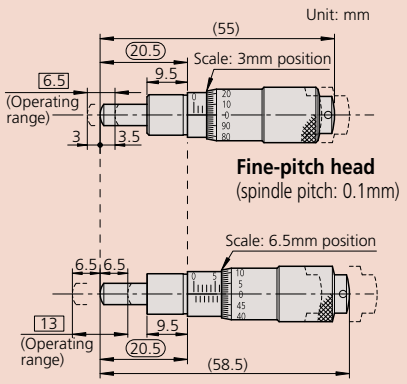
### Applications

**Semiconductor wafer positioning machinery and optical component alignment units, etc.**


Precision X-Y table positioning


Precision adjustment of mirror in holder

**Comparison of mounting dimensions between a standard fine-pitch head and a standard conventional pitch head at the mid-range travel position.**




While the fine-pitch micrometer head has a measuring range of 6.5mm, the conventional head has a larger range of 13mm. When replacing a conventional head, the fine-pitch type can use the common range in the middle of the spindle travel. The standard and compact types of fine-pitch head are completely interchangeable.

# Micrometer Heads

## SERIES 148 — Fine Spindle Feeding of 0.25 mm / rev

### Technical Data

Graduations: 0.01mm
Spindle pitch: 0.25mm
Spindle face: Spherical of SKS3 (more than HRC60), lapped surface
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 6mm

### FEATURES

- Fine spindle feeding of just 0.25mm/rev for fine adjustment and positioning.




148-132

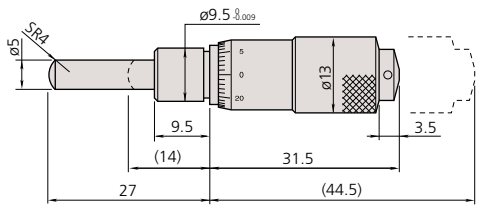
### SPECIFICATIONS

**Metric**

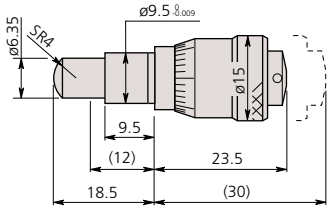
| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face |
|---|---|---|---|---|---|
| 0 - 13mm | **148-132** | 2µm | 9.5mm | Plain | Spherical (SR4) |
| 0 - 13mm | **148-133** | 2µm | 9.5mm | w/clamp nut | Spherical (SR4) |
| 0 - 6.5mm | **148-322** | 2µm | 9.5mm | Plain | Spherical (SR4) |
| 0 - 6.5mm | **148-323** | 2µm | 9.5mm | w/ clamp nut | Spherical (SR4) |

### DIMENSIONS AND MASS

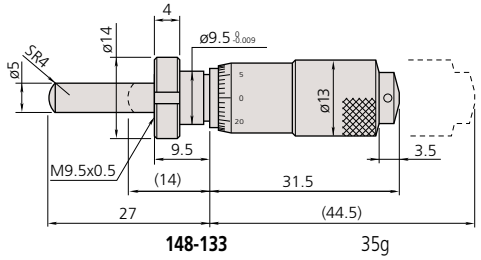
Unit: mm



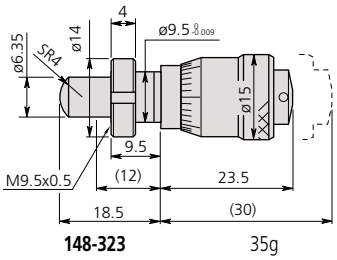

**148-132** 30g




**148-322** 30g




**148-133** 35g




**148-323** 35g

( ): when retracting the spindle until its stroke end.



Mitutoyo

# Micrometer Heads

## SERIES 148 — Ultra-Small/Small Type

## FEATURES

- Miniature micrometer heads for ease of incorporating into machines.



148-215



148-201



148-203

## Technical Data

Graduations: 0.02mm (**148-215**, **148-216**), 0.01mm or .001"
Spindle pitch: 0.5mm
Spindle face: Flat or spherical of SKS3 (more than HRC60), lapped surface
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 3mm (**148-216**, **148-218**), 4mm



Shown actual size

## SPECIFICATIONS

### Metric

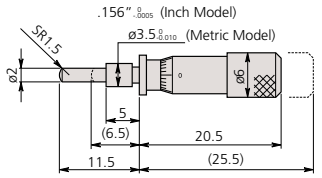
| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 5mm | **148-215** | ±5µm | 3.5mm | Plain | Spherical (SR1.5) | — |
| 0 - 5mm | **148-216** | ±5µm | 3.5mm | w/clamp nut | Spherical (SR1.5) | — |
| 0 - 6.5mm | **148-201** | ±5µm | 6mm | Plain | Flat | — |
| 0 - 6.5mm | **148-203** | ±5µm | 6mm | w/clamp nut | Flat | — |
| 0 - 6.5mm | **148-205** | ±5µm | 6mm | Plain | Spherical (SR3) | — |
| 0 - 6.5mm | **148-207** | ±5µm | 6mm | w/clamp nut | Spherical (SR3) | — |
| 6.5 - 0 mm | **148-209** | ±5µm | 6mm | Plain | Flat | Reverse reading |
| 6.5 - 0 mm | **148-211** | ±5µm | 6mm | w/ clamp nut | Flat | Reverse reading |

### Inch

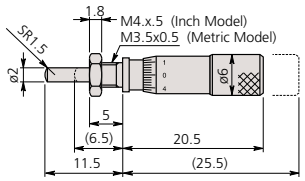
| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - .2" | **148-217** | ±5µm | .156" | Plain | Spherical (SR1.5) | — |
| 0 - .2" | **148-218** | ±5µm | .156" | w/clamp nut | Spherical (SR1.5) | — |
| 0 -.25" | **148-202** | ±5µm | .25" | Plain | Flat | — |
| 0 -.25" | **148-204** | ±5µm | .25" | w/clamp nut | Flat | — |
| 0 -.25" | **148-206** | ±5µm | .25" | Plain | Spherical (SR3) | — |
| 0 -.25" | **148-208** | ±5µm | .25" | w/clamp nut | Spherical (SR3) | — |
| .25 - 0" | **148-210** | ±5µm | .25" | Plain | Flat | Reverse reading |
| .25 - 0" | **148-212** | ±5µm | .25" | w/ clamp nut | Flat | Reverse reading |

## DIMENSIONS AND MASS

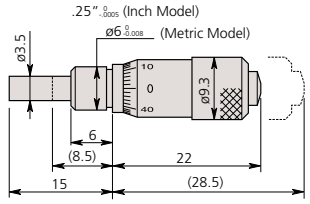
Unit: mm



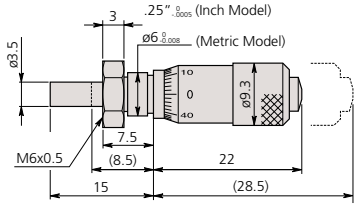

**148-215 / 148-217** Mass: 4g




**148-216 / 148-218** Mass: 4g




**148-201 / 148-202** Mass: 10g




**148-203 / 148-204** Mass: 10g

( ): when retracting the spindle until its stroke end.

# Micrometer Heads

## SERIES 148 — Large Thimble Diameter for Easy Reading


148-301


148-303


148-305

### FEATURES

- Easy reading due to the large thimble diameter. (Three types of thimble diameters can be selected.)

### SPECIFICATIONS

**Metric**

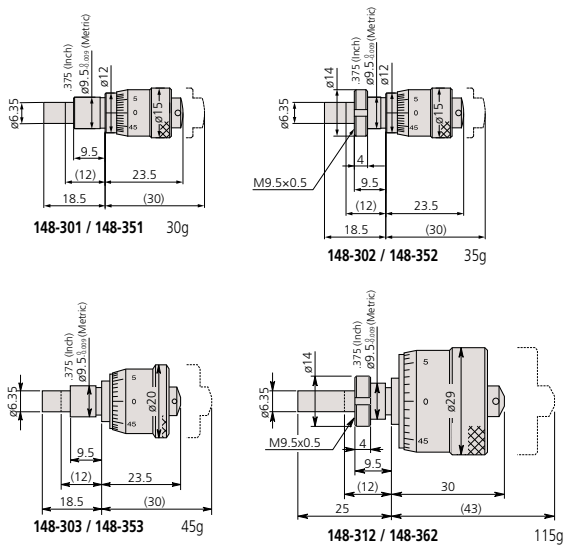
| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Thimble Dia. |
|---|---|---|---|---|---|---|
| 0 - 6.5mm | **148-301** | ±2µm | 9.5mm | Plain | Flat | 15mm |
| 0 - 6.5mm | **148-302** | ±2µm | 9.5mm | w/clamp nut | Flat | 15mm |
| 0 - 6.5mm | **148-303** | ±2µm | 9.5mm | Plain | Flat | 20mm |
| 0 - 6.5mm | **148-304** | ±2µm | 9.5mm | w/clamp nut | Flat | 20mm |
| 0 - 6.5mm | **148-305** | ±2µm | 9.5mm | Plain | Flat | 29mm |
| 0 - 6.5mm | **148-306** | ±2µm | 9.5mm | w/clamp nut | Flat | 29mm |
| 0 - 13mm | **148-307** | ±2µm | 9.5mm | Plain | Flat | 15mm |
| 0 - 13mm | **148-308** | ±2µm | 9.5mm | w/clamp nut | Flat | 15mm |
| 0 - 13mm | **148-309** | ±2µm | 9.5mm | Plain | Flat | 20mm |
| 0 - 13mm | **148-310** | ±2µm | 9.5mm | w/clamp nut | Flat | 20mm |
| 0 - 13mm | **148-311** | ±2µm | 9.5mm | Plain | Flat | 29mm |
| 0 - 13mm | **148-312** | ±2µm | 9.5mm | w/ clamp nut | Flat | 29mm |

**Inch**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Thimble Dia. |
|---|---|---|---|---|---|---|
| 0 - .25" | **148-351** | ±.0001" | .375" | Plain | Flat | .59" |
| 0 - .25" | **148-352** | ±.0001" | .375" | w/clamp nut | Flat | .59" |
| 0 - .25" | **148-353** | ±.0001" | .375" | Plain | Flat | .79" |
| 0 - .25" | **148-354** | ±.0001" | .375" | w/clamp nut | Flat | .79" |
| 0 - .25" | **148-355** | ±.0001" | .375" | Plain | Flat | 1.14" |
| 0 - .25" | **148-356** | ±.0001" | .375" | w/clamp nut | Flat | 1.14" |
| 0 - .5" | **148-357** | ±.0001" | .375" | Plain | Flat | .59" |
| 0 - .5" | **148-358** | ±.0001" | .375" | w/clamp nut | Flat | .59" |
| 0 - .5" | **148-359** | ±.0001" | .375" | Plain | Flat | .79" |
| 0 - .5" | **148-360** | ±.0001" | .375" | w/clamp nut | Flat | .79" |
| 0 - .5" | **148-361** | ±.0001" | .375" | Plain | Flat | 1.14" |
| 0 - .5" | **148-362** | ±.0001" | .375" | w/ clamp nut | Flat | 1.14" |

### DIMENSIONS AND MASS

Unit: mm




( ): when retracting the spindle until its stroke end.

### Technical Data

Graduations: 0.01mm or .001"
Spindle pitch: 0.5mm or .025"
Spindle face: Flat of SKS3 (more than HRC60), lapped surface
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 6mm



Mitutoyo

# Micrometer Heads

## SERIES 148 — Common Type in Small Size

## SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 13mm | **148-104** | ±2µm | 9.5mm | Plain | Flat | — |
| 0 - 13mm | **148-103** | ±2µm | 9.5mm | w/clamp nut | Flat | — |
| 0 - 13mm | **148-121** | ±2µm | 9.5mm | Plain* | Flat | — |
| 0 - 13mm | **148-120** | ±2µm | 9.5mm | w/clamp nut* | Flat | — |
| 0 - 13mm | **148-801** | ±2µm | 9.5mm | Plain | Spherical (SR4) | — |
| 0 - 13mm | **148-802** | ±2µm | 9.5mm | w/clamp nut | Spherical (SR4) | — |
| 0 - 13mm | **148-803** | ±2µm | 9.5mm | Plain* | Spherical (SR4) | — |
| 0 - 13mm | **148-804** | ±2µm | 9.5mm | w/clamp nut* | Spherical (SR4) | — |
| 13mm - 0 | **148-821** | ±2µm | 9.5mm | Plain | Flat | Reverse reading |
| 13mm - 0 | **148-822** | ±2µm | 9.5mm | w/clamp nut | Flat | Reverse reading |
| 13mm - 0 | **148-823** | ±2µm | 9.5mm | Plain* | Flat | Reverse reading |
| 13mm - 0 | **148-824** | ±2µm | 9.5mm | w/ clamp nut* | Flat | Reverse reading |

*with spindle lock

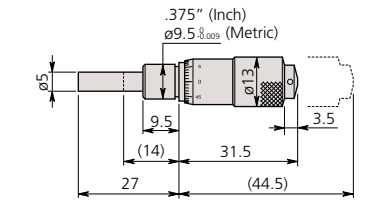
**Inch**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - .5" | **148-112** | ±.0001" | .375" | Plain | Flat | — |
| 0 - .5" | **148-111** | ±.0001" | .375" | w/clamp nut | Flat | — |
| 0 - .5" | **148-123** | ±.0001" | .375" | Plain* | Flat | — |
| 0 - .5" | **148-122** | ±.0001" | .375" | w/clamp nut* | Flat | — |
| 0 - .5" | **148-811** | ±.0001" | .375" | Plain | Spherical (SR4) | — |
| 0 - .5" | **148-812** | ±.0001" | .375" | w/clamp nut | Spherical (SR4) | — |
| 0 - .5" | **148-813** | ±.0001" | .375" | Plain* | Spherical (SR4) | — |
| 0 - .5" | **148-814** | ±.0001" | .375" | w/clamp nut* | Spherical (SR4) | — |
| .5" - 0 | **148-831** | ±.0001" | .375" | Plain | Flat | Reverse reading |
| .5" - 0 | **148-832** | ±.0001" | .375" | w/clamp nut | Flat | Reverse reading |
| .5" - 0 | **148-833** | ±.0001" | .375" | Plain* | Flat | Reverse reading |
| .5" - 0 | **148-834** | ±.0001" | .375" | w/ clamp nut* | Flat | Reverse reading |

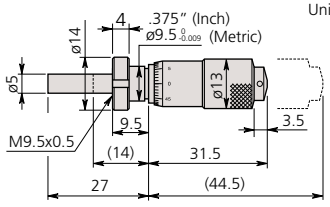
*with spindle lock

## DIMENSIONS AND MASS

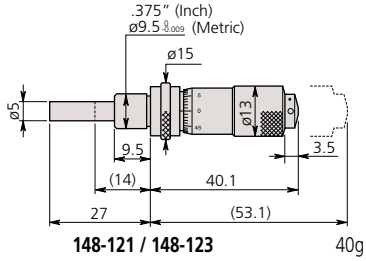
Unit: mm



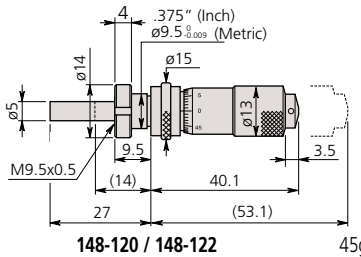

**148-104 / 148-112** 30g




**148-103 / 148-111** 35g




**148-121 / 148-123** 40g




**148-120 / 148-122** 45g

( ): when retracting the spindle until its stroke end.













### Technical Data

Graduations: 0.01mm or .001"
Spindle pitch: 0.5mm
Spindle face: Flat or spherical of SKS3 (more than HR60), lapped surface
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 6mm

# Micrometer Heads

## SERIES 148 — Common Type in Small Size with Zero-Adjustable Thimble



148-503



148-504

## FEATURES

- The thimble can be set to zero at any position by loosening the set screw.

## SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 13mm | **148-503** | ±2µm | 9.5mm | Plain | Flat | — |
| 0 - 13mm | **148-513** | ±2µm | 9.5mm | Plain | Flat | Stainless steel throughout |
| 0 - 13mm | **148-508** | ±2µm | 9.5mm | w/clamp nut | Flat | — |
| 0 - 13mm | **148-506** | ±2µm | 9.5mm | Plain* | Flat | — |
| 0 - 13mm | **148-504** | ±2µm | 9.5mm | w/clamp nut* | Flat | — |
| 0 - 13mm | **148-853** | ±2µm | 9.5mm | Plain | Spherical (SR4) | — |
| 0 - 13mm | **148-854** | ±2µm | 9.5mm | w/clamp nut* | Spherical (SR4) | — |
| 13mm - 0 | **148-863** | ±2µm | 9.5mm | Plain | Flat | Reverse reading |
| 13mm - 0 | **148-864** | ±2µm | 9.5mm | w/ clamp nut* | Flat | Reverse reading |

*with spindle lock

**Inch**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - .5" | **148-501** | ±.0001" | .375" | Plain | Flat | — |
| 0 - .5" | **148-511** | ±.0001" | .375" | Plain | Flat | Stainless steel throughout |
| 0 - .5" | **148-507** | ±.0001" | .375" | w/clamp nut | Flat | — |
| 0 - .5" | **148-505** | ±.0001" | .375" | Plain* | Flat | — |
| 0 - .5" | **148-502** | ±.0001" | .375" | w/clamp nut* | Flat | — |
| 0 - .5" | **148-851** | ±.0001" | .375" | Plain | Spherical (SR4) | — |
| 0 - .5" | **148-852** | ±.0001" | .375" | w/clamp nut* | Spherical (SR4) | — |
| .5" - 0 | **148-861** | ±.0001" | .375" | Plain | Flat | Reverse reading |
| .5" - 0 | **148-862** | ±.0001" | .375" | w/ clamp nut* | Flat | Reverse reading |

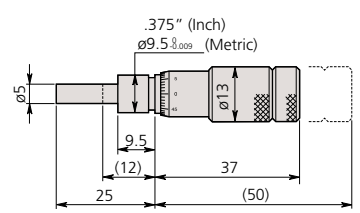
*with spindle lock

### Technical Data

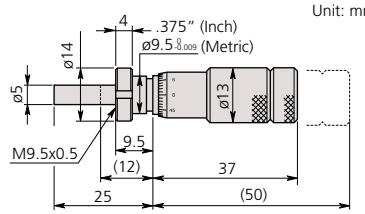
Graduations: 0.01mm or .001"
Spindle pitch: 0.5mm
Spindle face: Flat or spherical of SKS3 (more than HRC60), lapped surface
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 6mm

## DIMENSIONS AND MASS

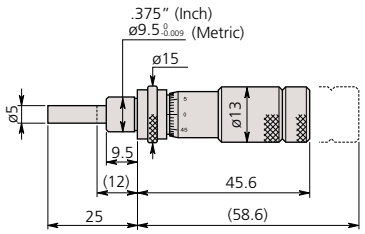
Unit: mm



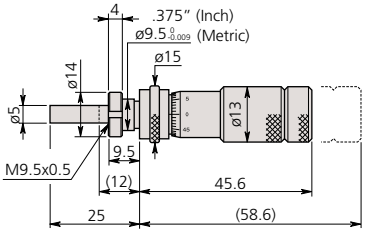

**148-503 / 148-501** 35g




**148-508 / 148-507** 40g




**148-506 / 148-505** 35g




**148-504 / 148-502** 40g

( ): when retracting the spindle until its stroke end.



Mitutoyo

# Micrometer Heads

## SERIES 149 — Common Type in Small Size with Carbide-tipped Spindle

### FEATURES

• Carbide-tipped measuring face.



149-132



149-184

### SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 15mm | **149-132** | ±2μm | 9.5mm | Plain | Flat (carbide tip) | — |
| 0 - 15mm | **149-131** | ±2μm | 9.5mm | w/clamp nut | Flat (carbide tip) | — |
| 0 - 15mm | **149-183** | ±2μm | 9.5mm | Plain* | Flat (carbide tip) | With spindle lock |
| 0 - 15mm | **149-184** | ±2μm | 9.5mm | w/clamp nut* | Flat (carbide tip) | With spindle lock |
| 0 - 15mm | **149-801** | ±2μm | 9.5mm | Plain | Spherical (SR4) | — |
| 0 - 15mm | **149-802** | ±2μm | 9.5mm | w/clamp nut | Spherical (SR4) | — |
| 15mm - 0 | **149-821** | ±2μm | 9.5mm | Plain | Flat (carbide tip) | Reverse reading |
| 15mm - 0 | **149-822** | ±2μm | 9.5mm | w/ clamp nut | Flat (carbide tip) | Reverse reading |

*with spindle lock.

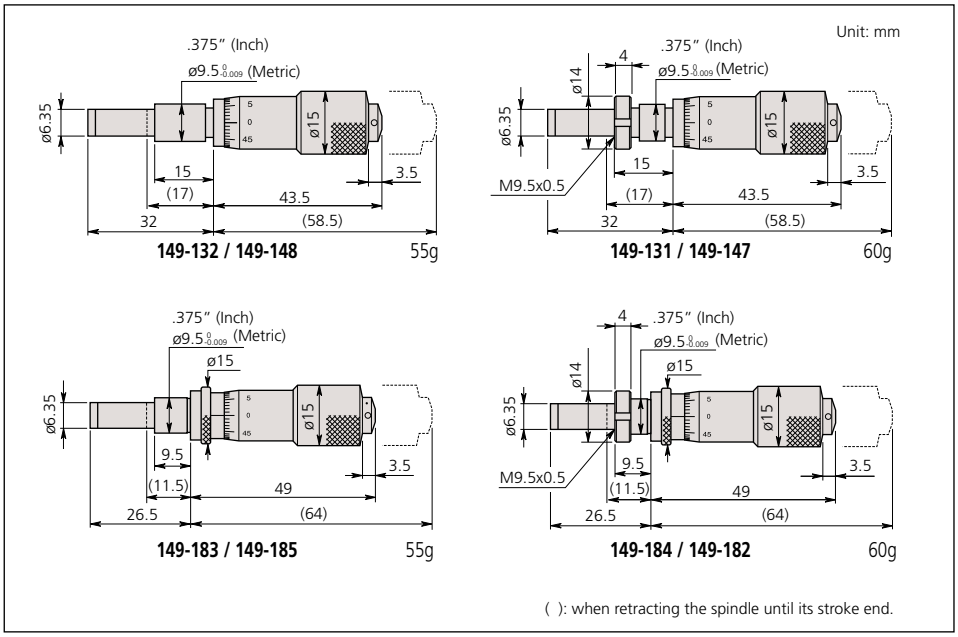
**Inch**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - .5" | **149-148** | ±.0001" | .375" | Plain | Flat (carbide tip) | — |
| 0 - .5" | **149-147** | ±.0001" | .375" | w/clamp nut | Flat (carbide tip) | — |
| 0 - .5" | **149-185** | ±.0001" | .375" | Plain* | Flat (carbide tip) | With spindle lock |
| 0 - .5" | **149-182** | ±.0001" | .375" | w/clamp nut* | Flat (carbide tip) | With spindle lock |
| 0 - .5" | **149-811** | ±.0001" | .375" | Plain | Spherical (SR4) | — |
| 0 - .5" | **149-812** | ±.0001" | .375" | w/clamp nut | Spherical (SR4) | — |
| .5" - 0 | **149-831** | ±.0001" | .375" | Plain | Flat (carbide tip) | Reverse reading |
| .5" - 0 | **149-832** | ±.0001" | .375" | w/ clamp nut | Flat (carbide tip) | Reverse reading |

*with spindle lock.

### DIMENSIONS AND MASS

Unit: mm




( ): when retracting the spindle until its stroke end.

### Technical Data

Graduations: 0.01mm or .001"
Spindle pitch: 0.5mm
Spindle face: Flat with carbide tip (more than HRA90) or spherical, lapped surface
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 6mm
(**149-131**, **149-147**: 11.5mm)

# Micrometer Heads

## SERIES 150 — Common Type in Middle Size



150-801



150-191

### Technical Data

Graduations: 0.01mm, 0.001mm, .001" or .0001"
Spindle pitch: 0.5mm
Spindle face: Flat with carbide tip* (more than HRA90) or spherical, lapped surface
*Long spindle type: SKS3 (more than HRC60)
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 11.5mm

## FEATURES

- Ratchet stop for constant force.
- Long spindle type is available for a variety of applications.
- Carbide-tipped measuring face.

## SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 25mm | **150-192** | ±2μm | 10mm | Plain | Flat (carbide tip) | — |
| 0 - 25mm | **150-191** | ±2μm | 10mm | w/clamp nut | Flat (carbide tip) | — |
| 0 - 25mm | **150-209** | ±2μm | 10mm | Plain* | Flat (carbide tip) | — |
| 0 - 25mm | **150-210** | ±2μm | 10mm | w/clamp nut* | Flat (carbide tip) | — |
| 0 - 25mm | **150-801** | ±2μm | 10mm | Plain | Spherical (SR4) | — |
| 0 - 25mm | **150-802** | ±2μm | 10mm | w/clamp nut | Spherical (SR4) | — |
| 0 - 25mm | **150-821** | ±2μm | 10mm | Plain | Flat (carbide tip) | Reverse reading |
| 0 - 25mm | **150-822** | ±2μm | 10mm | w/clamp nut | Flat (carbide tip) | Reverse reading |
| 0 - 25mm | **150-190** | ±2μm | 10mm | Plain | Flat (carbide tip) | w/ vernier (0.001mm) |
| 0 - 25mm | **150-189** | ±2μm | 10mm | w/clamp nut | Flat (carbide tip) | w/ vernier (0.001mm) |
| 0 - 25mm | **150-196** | ±2μm | 10mm | Plain* | Flat (carbide tip) | w/ vernier (.0001mm) |
| 0 - 25mm | **150-195** | ±2μm | 10mm | w/clamp nut* | Flat (carbide tip) | w/ vernier (.0001mm) |
| 0 - 25mm | **150-211** | ±2μm | 10mm | Plain* | Flat (carbide tip) | w/o ratchet stop |
| 0 - 25mm | **150-212** | ±2μm | 10mm | w/clamp nut* | Flat (carbide tip) | w/o ratchet stop |
| 0 - 25mm | **150-219** | ±2μm | 10mm | Plain | Flat | Long spindle |
| 0 - 25mm | **150-220** | ±2μm | 10mm | w/ clamp nut | Flat | Long spindle |

*with spindle lock

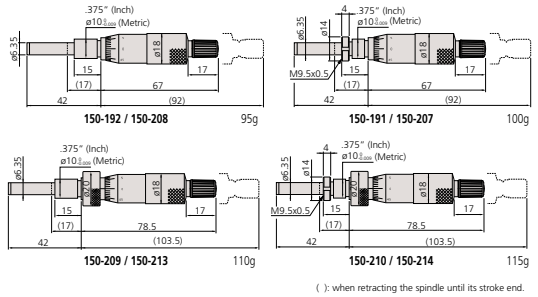
**Inch**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 1" | **150-208** | ±.0001" | .375" | Plain | Flat (carbide tip) | — |
| 0 - 1" | **150-198** | ±.0001" | .375" | Plain | Flat (carbide tip) | w/o ratchet stop |
| 0 - 1" | **150-207** | ±.0001" | .375" | w/clamp nut | Flat (carbide tip) | — |
| 0 - 1" | **150-197** | ±.0001" | .375" | w/clamp nut | Flat (carbide tip) | w/o ratchet stop |
| 0 - 1" | **150-213** | ±.0001" | .375" | Plain* | Flat (carbide tip) | — |
| 0 - 1" | **150-214** | ±.0001" | .375" | w/clamp nut* | Flat (carbide tip) | — |
| 0 - 1" | **150-811** | ±.0001" | .375" | Plain | Spherical (SR4) | — |
| 0 - 1" | **150-812** | ±.0001" | .375" | w/clamp nut | Spherical (SR4) | — |
| 0 - 1" | **150-831** | ±.0001" | .375" | Plain | Flat (carbide tip) | Reverse reading |
| 0 - 1" | **150-832** | ±.0001" | .375" | w/clamp nut | Flat (carbide tip) | Reverse reading |
| 0 - 1" | **150-206** | ±.0001" | .375" | Plain | Flat (carbide tip) | w/ vernier (.0001") |
| 0 - 1" | **150-205** | ±.0001" | .375" | w/clamp nut | Flat (carbide tip) | w/ vernier (.0001") |
| 0 - 1" | **150-215** | ±.0001" | .375" | Plain* | Flat (carbide tip) | w/ vernier (.0001") |
| 0 - 1" | **150-216** | ±.0001" | .375" | w/clamp nut* | Flat (carbide tip) | w/ vernier (.0001") |
| 0 - 1" | **150-217** | ±.0001" | .375" | Plain* | Flat (carbide tip) | w/o ratchet stop |
| 0 - 1" | **150-218** | ±.0001" | .375" | w/clamp nut* | Flat (carbide tip) | w/o ratchet stop |
| 0 - 1" | **150-221** | ±.0001" | .375" | Plain | Flat | Long spindle |
| 0 - 1" | **150-222** | ±.0001" | .375" | w/ clamp nut | Flat | Long spindle |

*with spindle lock

## DIMENSIONS AND MASS

Unit: mm




( ): when retracting the spindle until its stroke end.



Mitutoyo

# Micrometer Heads

## SERIES 151 — Common Type in Middle Size with 8mm Diameter Spindle

### FEATURES

- 8mm diameter spindle for heavy-duty use.
- Ratchet stop for constant force.
- Carbide-tipped measuring face.

### SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 25mm | **151-224** | ±2μm | 12mm | Plain | Flat (carbide tip) | — |
| 0 - 25mm | **151-223** | ±2μm | 12mm | w/clamp nut | Flat (carbide tip) | — |
| 0 - 25mm | **151-214** | ±2μm | 12mm | Plain* | Flat (carbide tip) | — |
| 0 - 25mm | **151-213** | ±2μm | 12mm | w/clamp nut* | Flat (carbide tip) | — |
| 0 - 25mm | **151-222** | ±2μm | 12mm | Plain | Flat (carbide tip) | w/ vernier (0.001mm) |
| 0 - 25mm | **151-221** | ±2μm | 12mm | w/clamp nut | Flat (carbide tip) | w/ vernier (0.001mm) |
| 0 - 25mm | **151-212** | ±2μm | 12mm | Plain* | Flat (carbide tip) | w/ vernier (0.001mm) |
| 0 - 25mm | **151-211** | ±2μm | 12mm | w/clamp nut* | Flat (carbide tip) | w/ vernier (0.001mm) |
| 0 - 25mm | **151-227** | ±2μm | 12mm | Plain | Flat (carbide tip) | w/o ratchet stop |
| 0 - 25mm | **151-228** | ±2μm | 12mm | w/clamp nut | Flat (carbide tip) | w/o ratchet stop |
| 0 - 25mm | **151-225** | ±2μm | 12mm | Plain* | Flat (carbide tip) | w/o ratchet stop |
| 0 - 25mm | **151-226** | ±2μm | 12mm | w/clamp nut* | Flat (carbide tip) | w/o ratchet stop |
| 0 - 50mm | **151-256** | ±4μm | 12mm | Plain | Flat (carbide tip) | — |
| 0 - 50mm | **151-255** | ±4μm | 12mm | w/clamp nut | Flat (carbide tip) | — |
| 0 - 50mm | **151-260** | ±4μm | 12mm | Plain | Flat (carbide tip) | w/o ratchet stop |
| 0 - 50mm | **151-259** | ±4μm | 12mm | w/ clamp nut | Flat (carbide tip) | w/o ratchet stop |

*with spindle lock

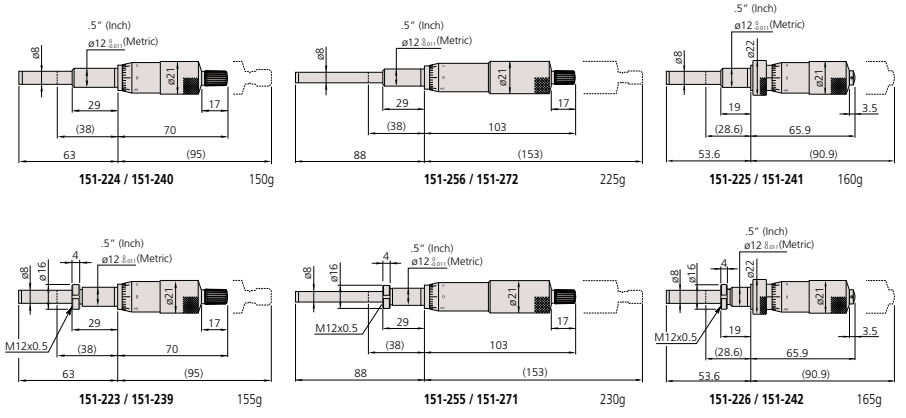
**Inch**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 1" | **151-240** | ±.0001" | .5" | Plain | Flat (carbide tip) | — |
| 0 - 1" | **151-239** | ±.0001" | .5" | w/clamp nut | Flat (carbide tip) | — |
| 0 - 1" | **151-238** | ±.0001" | .5" | Plain | Flat (carbide tip) | w/ vernier (.0001") |
| 0 - 1" | **151-237** | ±.0001" | .5" | w/clamp nut | Flat (carbide tip) | w/ vernier (.0001") |
| 0 - 1" | **151-243**** | ±.0001" | .5" | Plain* | Flat (carbide tip) | w/ vernier (.0001") |
| 0 - 1" | **151-244**** | ±.0001" | .5" | w/clamp nut* | Flat (carbide tip) | w/ vernier (.0001") |
| 0 - 1" | **151-241** | ±.0001" | .5" | Plain* | Flat (carbide tip) | w/o ratchet stop |
| 0 - 1" | **151-242** | ±.0001" | .5" | w/clamp nut* | Flat (carbide tip) | w/o ratchet stop |
| 0 - 2" | **151-272** | ±.0002" | .5" | Plain | Flat (carbide tip) | — |
| 0 - 2" | **151-271** | ±.0002" | .5" | w/clamp nut | Flat (carbide tip) | — |

*with spindle lock **with ratchet stop

### DIMENSIONS AND MASS

Unit: mm




**151-224 / 151-240** 150g

**151-256 / 151-272** 225g

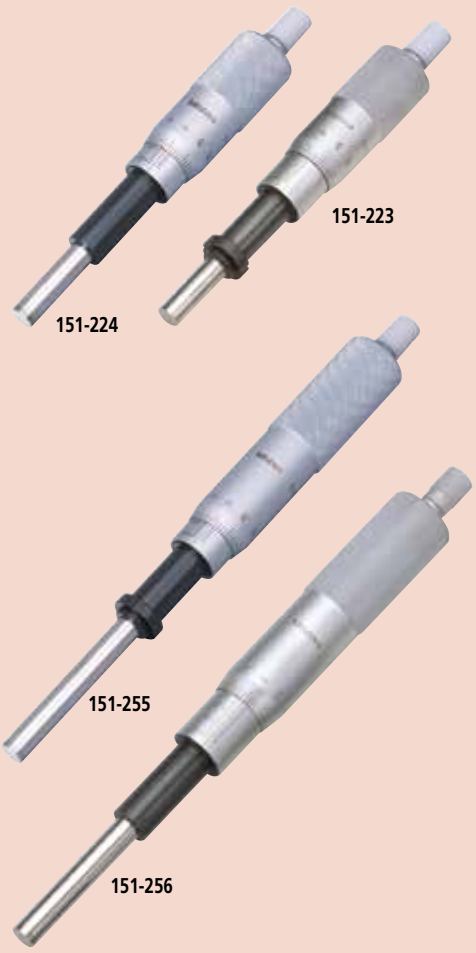
**151-225 / 151-241** 160g

**151-223 / 151-239** 155g

**151-255 / 151-271** 230g

**151-226 / 151-242** 165g

( ): when retracting the spindle until its stroke end.




### Technical Data

Graduations: 0.01mm, 0.001mm, .001" or .0001"
Spindle pitch: 0.5mm
Spindle face: Flat with carbide tip (more than HRA90), lapped surface
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 25.5mm

# Micrometer Heads

## SERIES 153 — Non-rotating Spindle Type




## FEATURES

- Carbide-tipped measuring face.
- Non-rotating spindle.

## SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 15mm | **153-101** | ±3µm | 9.5mm | Plain | Flat (carbide tip) | — |
| 0 - 25mm | **153-201*** | ±3µm | 12mm | Plain | Flat (carbide tip) | — |
| 0 - 25mm | **153-202*** | ±3µm | 12mm | Plain | Flat (carbide tip) | w/ vernier (0.001mm) |
| 0 - 25mm | **153-203** | ±3µm | 12mm | Plain | Flat (carbide tip) | — |
| 0 - 25mm | **153-204** | ±3µm | 12mm | Plain | Flat (carbide tip) | w/ vernier (0.001mm) |

*with ratchet stop

**Inch**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - .5" | **153-108** | ±.00015" | .375" | Plain | Flat (carbide tip) | — |
| 0 - 1" | **153-205*** | ±.00015" | .5" | Plain | Flat (carbide tip) | — |
| 0 - 1" | **153-206*** | ±.00015" | .5" | Plain | Flat (carbide tip) | w/ vernier (.0001") |
| 0 - 1" | **153-207** | ±.00015" | .5" | Plain | Flat (carbide tip) | — |
| 0 - 1" | **153-208** | ±.00015" | .5" | Plain | Flat (carbide tip) | w/ vernier (.0001") |

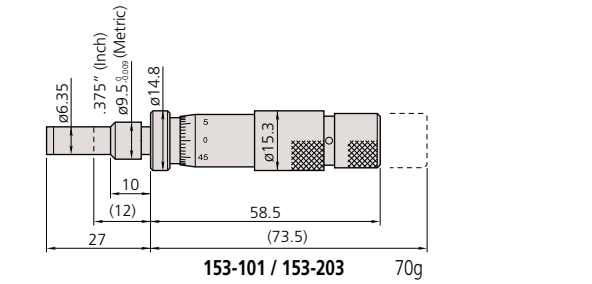
*with ratchet stop

### Technical Data

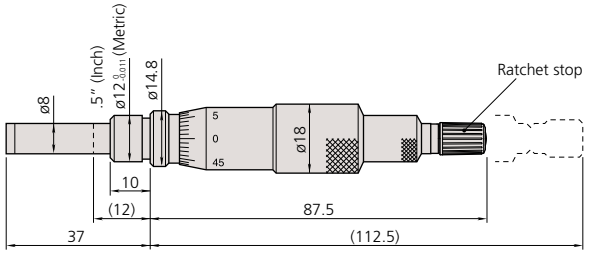
Graduations: 0.01mm, 0.001mm, .001" or .0001"
Spindle pitch: 0.5mm
Spindle face: Flat with carbide tip (more than HRA90), lapped surface
Scale surface: Hard-chrome plating

## DIMENSIONS AND MASS

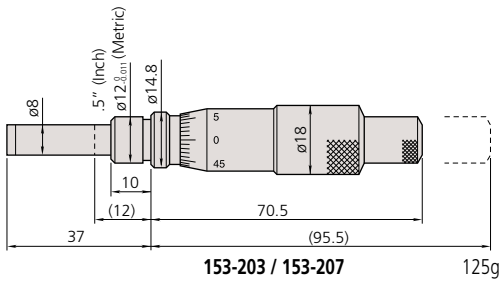
Unit: mm




**153-101 / 153-203** 70g




**153-201 / 153-205** 125g




**153-203 / 153-207** 125g

( ): when retracting the spindle until its stroke end.



Mitutoyo

# Micrometer Heads

## SERIES 152 — Quick Spindle Feeding of 1mm/rev.

### FEATURES

- Quick spindle feeding of 1mm/rev.
- Carbide-tipped measuring face.



152-102

### Technical Data

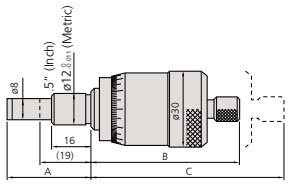
Graduations: 0.01mm
Spindle pitch: 1mm
Spindle face: Flat with carbide tip (more than HRA90), lapped surface
Scale surface: Hard-chrome plating

### SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 15mm | **152-101** | ±2µm | 12mm | Plain | Flat (carbide tip) | — |
| 0 - 25mm | **152-102** | ±2µm | 12mm | Plain | Flat (carbide tip) | — |
| 0 - 50mm | **152-103** | ±4µm | 12mm | Plain | Flat (carbide tip) | — |

### DIMENSIONS AND MASS




152-101

( ): when retracting the spindle until its stroke end.

Unit: mm

| Range | A | B | C | Mass (g) |
|---|---|---|---|---|
| 0 - 15mm | 34 | 60 | 75 | 205 |
| 0 - 25mm | 44 | 69 | 94 | 230 |
| 0 - 50mm | 69 | 94 | 144 | 355 |

# Micrometer Heads

## SERIES 152 — Large Thimble Type for Fine Feeding

### FEATURES

- The large diameter thimble for fine adjustment and positioning.
- Carbide-tipped measuring face.



152-283

### Technical Data

Graduations: 0.002mm or .0001"
Spindle pitch: 1mm
Spindle face: Flat with carbide tip (more than HRA90), lapped surface
Scale surface: White anodized aluminum
Fixture thickness for clamp nut: 22.5mm

### SPECIFICATIONS

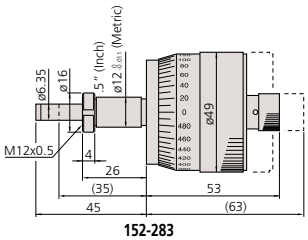
**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 10mm | **152-283** | ±2µm | 12mm | w/clamp nut | Flat (carbide tip) | — |
| 0 - 25mm | **152-332** | ±2µm | 12mm | Plain | Flat (carbide tip) | — |
| 0 - 25mm | **152-348** | ±2µm | 12mm | Plain | Flat (carbide tip) | Bidirectional graduation |
| 0 - 50mm | **152-380** | ±4µm | 12mm | Plain | Flat (carbide tip) | Bidirectional graduation |

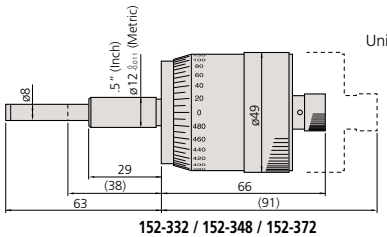
**Inch**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 1" | **152-372** | ±.0001" | .5" | Plain | Flat (carbide tip) | Bidirectional graduation |
| 0 - 2" | **152-388** | ±.0002" | .5" | Plain | Flat (carbide tip) | Bidirectional graduation |

### DIMENSIONS AND MASS




152-283




152-332 / 152-348 / 152-372

Unit: mm

# Micrometer Heads

## SERIES 110 — Differential Screw Translator (Extra-Fine Feeding) Type




### FEATURES

- Differential movements of spindle threads and units allow fine spindle feeding (0.05mm/rev*), resulting in high-resolution measurements.
  *__110-502__, __110-504__: 0.025mm/rev / .001"/rev (fine feeding)
- Carbide-tipped measuring face.
- Non-rotating spindle.

### SPECIFICATIONS

**Metric**

| Range | Order No. | Graduation | Accuracy* | Stem dia. | Stem | Spindle face |
|---|---|---|---|---|---|---|
| 0 - 1mm | **110-105** | 0.001mm | ±3 / ±1.5µm | 12mm | w/clamp nut | Flat (carbide tip) |
| 0 - 1mm | **110-106** | 0.0001mm | ±3 / ±1.5µm | 12mm | w/clamp nut | Flat (carbide tip) |
| 0 - 1mm | **110-107** | 0.001mm | ±3 / ±1.5µm | 12mm | w/clamp nut | Flat (carbide tip) |
| 0 - 1mm | **110-108** | 0.0001mm | ±3 / ±1.5µm | 12mm | w/clamp nut | Flat (carbide tip) |
| 0 - 2.5mm | **110-101** | 0.001mm | ±3 / ±1.5µm | 12mm | w/clamp nut | Spherical (SR8) |
| 0 - 2.5mm | **110-102** | 0.0001mm | ±3 / ±1.5µm | 12mm | w/clamp nut | Spherical (SR8) |
| 0 - 13mm | **110-502*** | 0.0005mm<br>0.01mm | ±3 / ±1.5µm | 9.5mm | w/clamp nut | Spherical (SR3) |

* Narrow range (within 1 rev.): 0.2mm

**Inch**

| Range | Order No. | Graduation | Accuracy* | Stem dia. | Stem | Spindle face |
|---|---|---|---|---|---|---|
| 0 - .02" | **110-115** | .00005" | ±.00015" / ±.00006" | .5" | w/clamp nut | Flat (carbide tip) |
| 0 - .02" | **110-116** | .000005" | ±.00015" / ±.00006" | .5" | w/clamp nut | Flat (carbide tip) |
| 0 - .02" | **110-117** | .00005" | ±.00015" / ±.00006" | .5" | w/clamp nut | Flat (carbide tip) |
| 0 - .02" | **110-118** | .000005" | ±.00015" / ±.00006" | .5" | w/clamp nut | Flat (carbide tip) |
| 0 - .05" | **110-111** | .00005" | ±.0002" / ±.00006" | .5" | w/clamp nut | Spherical (SR8) |
| 0 - .05" | **110-112** | .000005" | ±.0002" / ±.00006" | .5" | w/clamp nut | Spherical (SR8) |
| 0 - .5" | **110-504*** | .00002"<br>.001" | ±.00015" / ±.00006" | .375" | w/clamp nut | Spherical (SR3) |

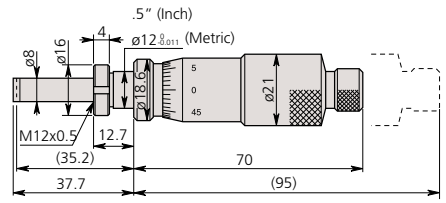
* Narrow range (within 1 rev.): .006"

### Technical Data

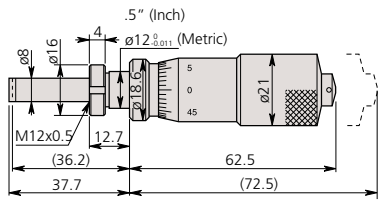
Graduations: 0.001mm, 0.0005mm, 0.0001mm, .00005" or .00002", .000005"
Spindle pitch: 0.05mm or 0.025mm
Spindle face: Flat with carbide tip (more than HRA90) or spherical, lapped surface
Scale surface: Hard-chrome plating
Fixture thickness for clamp nut: 9.5mm (11.5mm*)
*__110-502__, __110-504__

### DIMENSIONS AND MASS

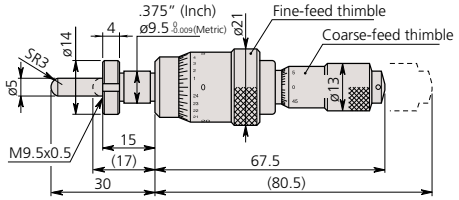
Unit: mm




**110-101 / 110-111**
**110-102 / 110-112** 150g




**110-105 / 110-115**
**110-106 / 110-116** 150g




**110-502 / 110-504** 95g

( ): when retracting the spindle until its stroke end.



Mitutoyo

# Micrometer Heads

## SERIES 152 — for XY-Stage

### FEATURES

**152-390, 152-389, 152-391, 152-392**

- Non-rotating device is attached to the spindle tip.
- Floating thimble allows easy zero setting at any spindle position.
- Bidirectional graduation for easy reading in both directions.

**152-401, 152-402**

- Adjustable spindle can be moved with the thimble and held at any position, allowing easy zero-setting.



**152-390**

### SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 25mm | **152-390** | ±2µm | 18mm | Plain | Flat (hardened) with non-rotating device | for X-axis, bidirectional grad. |
| 0 - 25mm | **152-389** | ±2µm | 18mm | Plain | | for Y-axis, bidirectional grad. |
| 0 - 25mm | **152-402*** | ±2µm | 18mm | Plain | Spherical with carbide tip (SR10) | for X-axis, with vernier |
| 0 - 25mm | **152-401*** | ±2µm | 18mm | Plain | | for Y-axis, with vernier |

*0.001mm reading is obtained with vernier

**Inch**

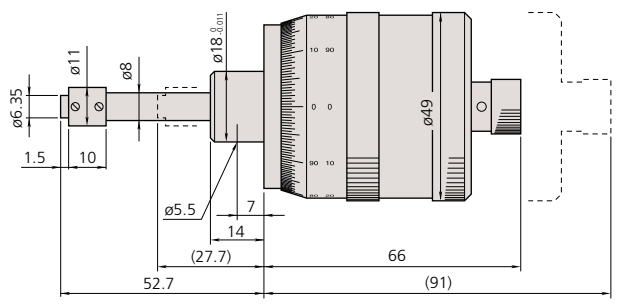
| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 1" | **152-392** | ±.0001" | .709" | Plain | Flat (hardened) with non-rotating device | for X-axis, Bidirectional grad. |
| 0 - 1" | **152-391** | ±.0001" | .709" | Plain | | for Y-axis, Bidirectional grad. |

### Technical Data

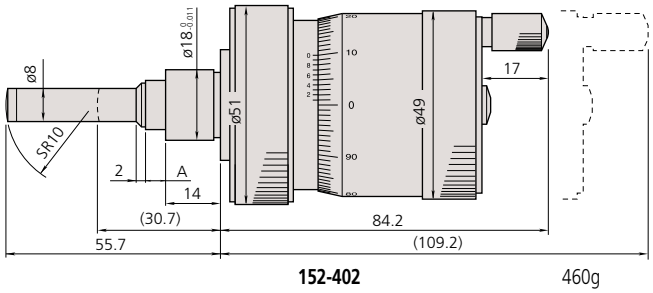
Graduations: 0.005mm, 0.001mm*
*vernier reading
Spindle pitch: 1mm
Spindle face: Flat (hardened) or spherical with carbide tip (more than HRA90), lapped surface
Scale surface: White anodized aluminum

### DIMENSIONS AND MASS

Unit: mm




**152-390 / 152-392** 270g




**152-402** 460g

( ): when retracting the spindle until its stroke end.

# Micrometer Heads

## SERIES 197 — Non-rotating Spindle and Large Thimble



197-101

### FEATURES

- Large thimble micrometer head with non-rotating spindle.
- Floating thimble allows easy zero setting at any spindle position.
- Bidirectional graduation for easy reading in both directions.
- Dual-spindle mechanism for quick feeding of 1mm/rev.
- Carbide-tipped measuring face.

### SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 50mm | **197-101** | ±5µm | 18mm | Plain | Flat (carbide tip) | Bidirectional graduation |

**Inch**

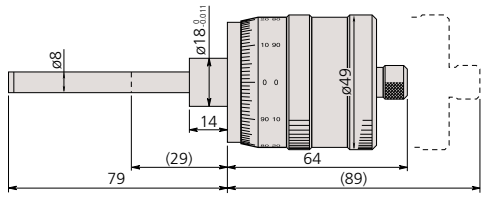
| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 2" | **197-201** | ±.0002" | .709" | Plain | Flat (carbide tip) | Bidirectional graduation |

### Technical Data

Graduations: 0.005mm or .0002"
Spindle pitch: 1mm
Spindle face: Flat with carbide tip (more than HRA90), lapped surface
Scale surface: White anodized aluminum

### DIMENSION AND MASS

Unit: mm




( ): when retracting the spindle until its stroke end.

**197-101 / 197-201** 300g

# Micrometer Heads

## SERIES 153 — Fine Graduation and High Accuracy



153-301

### FEATURES

- Fine graduation and high-resolution model.
- Large thimble micrometer head with non-rotating spindle.
- Bidirectional graduation for easy reading in both directions.
- Carbide-tipped measuring face.

### SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy* | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 25mm | **153-301** | ±1 / ±0.5µm | 18mm | Plain | Flat (carbide tip) | Bidirectional graduation |

*Wide range / narrow range

**Inch**

| Range | Order No. | Accuracy* | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 1" | **153-302** | ±.00004" / ±.00002" | .709" | Plain | Flat (carbide tip) | Bidirectional graduation |

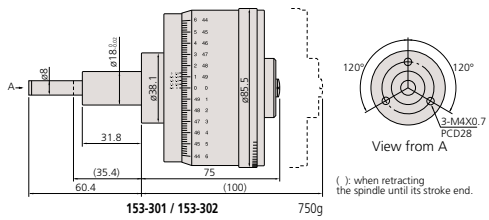
*Wide range / narrow range

### Technical Data

Graduations: 0.0005mm or .00001"
Spindle pitch: 0.5mm
Spindle face: Flat with carbide tip (more than HRA90), lapped surface
Scale surface: White anodized aluminum

### DIMENSIONS AND MASS

Unit: mm




( ): when retracting the spindle until its stroke end.

**153-301 / 153-302** 750g



Mitutoyo

# Micrometer Heads

## SERIES 250 — with Digit Counter

### FEATURES

- Digit counter for easy reading of spindle movement.
- Carbide-tipped measuring face.
- Ratchet stop for constant force.

### SPECIFICATIONS

**Metric**

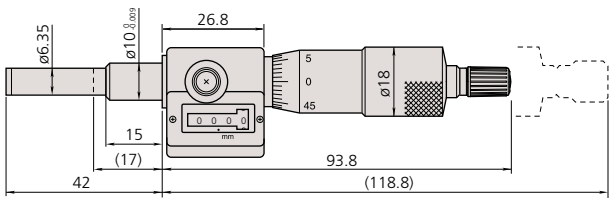
| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 25mm | **250-301** | ±2µm | 10mm | Plain | Flat (carbide tip) | — |

**Inch**

| Range | Order No. | Accuracy | Stem dia. | Stem | Spindle face | Remarks |
|---|---|---|---|---|---|---|
| 0 - 1" | **250-312** | ±.0001" | .375" | Plain | Flat (carbide tip) | w / vernier (.0001") |

### DIMENSIONS AND MASS

Unit: mm




**250-301 / 250-312** Mass: 165g

( ): when retracting the spindle with adjustable handle



**250-301**

### Technical Data

Graduations: 0.01mm or .0001"
Spindle pitch: 0.5mm
Spindle face: Flat with carbide tip (more than HRA90), lapped surface
Scale surface: Hard-chrome plating

# Micro Jack

## SERIES 7

### FEATURES

- Used for accurate leveling of machines, surface plates and other precision instruments.
- Easy adjustment under heavy load.




**7850**

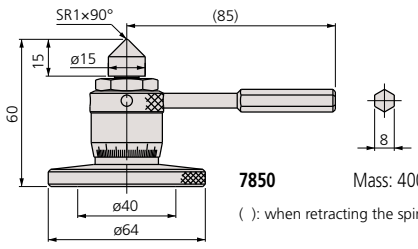
### SPECIFICATIONS

**Metric**

| Range | Order No. | Graduation | Max. Load | Remarks |
|---|---|---|---|---|
| 60 - 75mm | **7850** | 0.01mm | 400kg | adjustable handle |

### DIMENSIONS AND MASS

Unit: mm




**7850** Mass: 400g

( ): when retracting the spindle with adjustable handle

### Technical Data

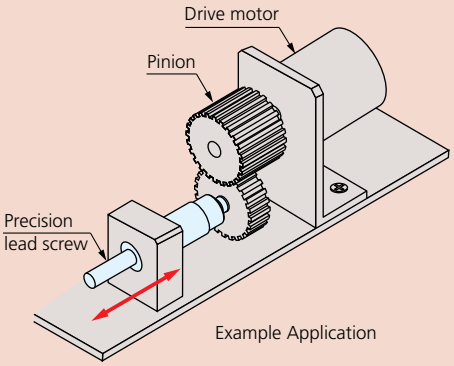
Graduations: 0.01mm



# Precision Lead Screw

## Technical Data

- Durability: 100,000 cycles are guaranteed (use condition: 4 kg load; 2 kg for AS-6.5 and BS-6.5)
- Main applications
  - Precision feed stages
  - Fine adjustment of optical elements (mirrors, prisms)
  - Fiber optic centering devices
  - Various assembly and adjustment jigs




## FEATURES

- Mitutoyo manufactures simple and economical precision lead screws for precise positioning mechanisms and fine-feed mechanisms, in addition to the conventional micrometer heads.
- Mitutoyo also manufactures screws with special specifications, such as 0.25 mm pitch, as well as those with the standard 0.5 mm feed pitch and with dimensions and forms that meet customer's requirements.



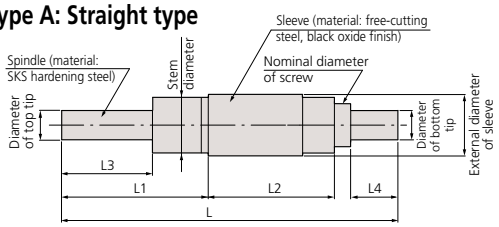

## SPECIFICATIONS

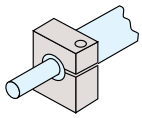
| Order No. | Model | Stroke (mm) | Feed pitch (mm) | Feed accuracy (μm) | Stem diameter (mm) | Tip diameter (mm) | Tail diameter (mm) | Screw nominal diameter | Sleeve diameter (mm) | Measuring face | Mass | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **04AZA160** | AS-6.5 | 6.5 | 0.5 | ±5 | $\phi 6^{\ 0}_{-0.008}$ | ø3.5 | $\phi 3^{\ 0}_{-0.01}$ | M4.5 x 0.5 | ø7 | Hardened | 10g | • AS type: Flat spindle tip without nut<br>• BS type: Spherical spindle tip with nut |
| **04AZA161** | BS-6.5 | | | | | | | | | | 11g | |
| **04AZA162** | AS-13 | 13 | | ±2 | $\phi 9.5^{\ 0}_{-0.009}$ | ø5 | $\phi 5^{\ 0}_{-0.012}$ | M7.35 x 0.5 | ø10.5 | | 27g | |
| **04AZA163** | BS-13 | | | | | | | | | | 30g | |
| **04AZA164** | AS-25 | 25 | | | $\phi 10^{\ 0}_{-0.009}$ | ø6.35 | $\phi 6^{\ 0}_{-0.015}$ | | ø12 | Carbide | 61g | |
| **04AZA165** | BS-25 | | | | | | | | | | 64g | |

## DIMENSIONS

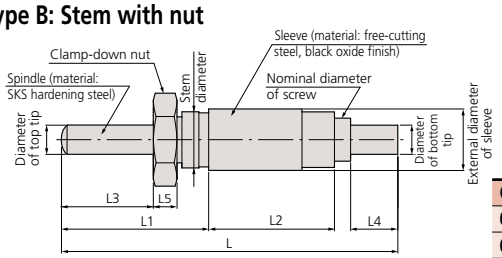
Unit: mm

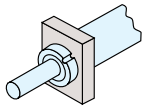
**Type A: Straight type**



**Type B: Stem with nut**



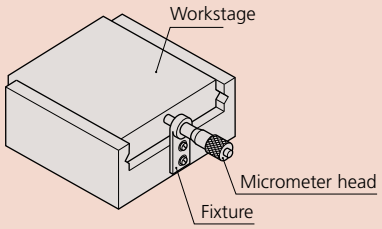



| Order No. | L | L1 | L2 | L3 | L4 | L5 |
|---|---|---|---|---|---|---|
| **04AZA160** | 39 | 15 | 14.5 | 9 | 6 | — |
| **04AZA161** | 39 | 15 | 14.5 | 7.5 | 6 | 3 |
| **04AZA162** | 57.5 | 25 | 21.5 | 15.5 | 8 | — |
| **04AZA163** | 57.5 | 25 | 21.5 | 15.5 | 8 | 4 |
| **04AZA164** | 98.5 | 42 | 39.5 | 27 | 10 | — |
| **04AZA165** | 98.5 | 42 | 39.5 | 27 | 10 | 4 |

# Fixtures for Micrometer Heads and Linear Gages

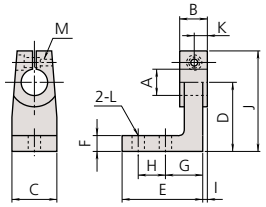
## FEATURES

- The act of fabricating brackets to mount micrometer heads for each particular application can be laborious and costly. Mitutoyo offers various types of fixtures for micrometer heads to meet a range of applications. These fixtures are made of nickel-plated cast iron.
- There are two types of fixtures for micrometer heads--with or without clamping nut on the stem.

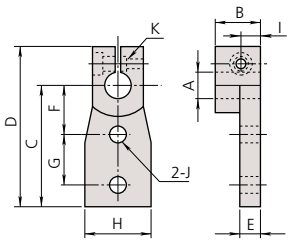



## DIMENSIONS: Fixtures for plain-stem type micrometer heads

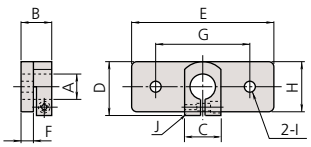
Unit: mm



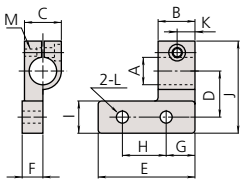

| Order No. | 303560 | 303569 | 303579 |
|---|---|---|---|
| A | ø9.5 | ø9.5 | ø10 |
| B | 9 | 14.5 | 14.5 |
| C | 14.5 | 19.5 | 19.5 |
| D | 20 | 30 | 30 |
| E | 23 | 35 | 35 |
| F | 5 | 7 | 7 |
| G | 11 | 16 | 16 |
| H | 8 | 12 | 12 |
| I | 1.5 | 3.25 | 3.25 |
| J | 32.5 | 42.5 | 42.5 |
| K | 4.5 | 7.25 | 7.25 |
| L | ø3.4 | ø4.5 | ø4.5 |
| M | M3x0.5 | M3x0.5 | M3x0.5 |



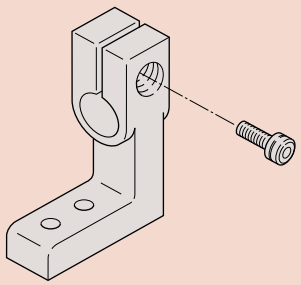

| Order No. | 303564 | 303573 | 303583 |
|---|---|---|---|
| A | ø9.5 | ø9.5 | ø10 |
| B | 9 | 14.5 | 14.5 |
| C | 30 | 40 | 40 |
| D | 42.5 | 52.5 | 52.5 |
| E | 4 | 6 | 6 |
| F | 15 | 18 | 18 |
| G | 10 | 15 | 15 |
| H | 15 | 20 | 20 |
| I | 4.5 | 7.25 | 7.25 |
| J | ø3.4 | ø4.5 | ø4.5 |
| K | M3x0.5 | M3x0.5 | M3x0.5 |




| Order No. | 303562 | 303571 | 303581 |
|---|---|---|---|
| A | ø9.5 | ø9.5 | ø10 |
| B | 9 | 14.5 | 14.5 |
| C | 15 | 15 | 15 |
| D | 20 | 22.5 | 22.5 |
| E | 40 | 60 | 60 |
| F | 3 | 5 | 5 |
| G | 30 | 40 | 40 |
| H | 15 | 20 | 20 |
| I | ø3.4 | ø4.5 | ø4.5 |
| J | M3x0.5 | M3x0.5 | M3x0.5 |




| Order No. | 303566 | 303575 | 303585 |
|---|---|---|---|
| A | ø9.5 | ø9.5 | ø10 |
| B | 9 | 14.5 | 14.5 |
| C | 15 | 15 | 15 |
| D | 15 | 20 | 20 |
| E | 25 | 40 | 40 |
| F | 8.5 | 8.5 | 8.5 |
| G | 7.5 | 10 | 10 |
| H | 10 | 20 | 20 |
| I | 10 | 15 | 15 |
| J | 32.5 | 40 | 40 |
| K | 4.5 | 7.25 | 7.25 |
| L | ø3.4 | ø4.5 | ø4.5 |
| M | M3x0.5 | M3x0.5 | M3x0.5 |



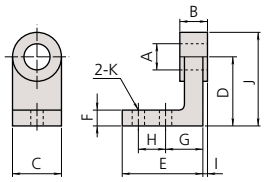
**Note:** Supplied with a socket head screw (M3x0.5x12mm) for the fixtures to be used with a micrometer head without clamp nut (plain stem type micrometer head).

# Fixtures for Micrometer Heads and Linear Gages

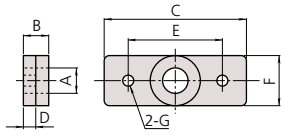


## DIMENSIONS: Fixtures for micrometer heads with clamp nut

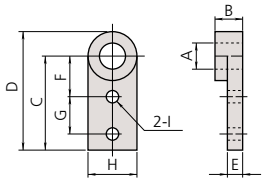
Unit: mm



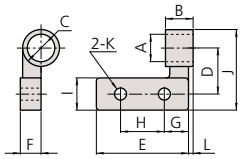

| Order No. | 303559 | 303568 | 303578 |
|---|---|---|---|
| A | ø9.5 | ø9.5 | ø10 |
| B | 6 | 11.5 | 11.5 |
| C | 14.5 | 19.5 | 19.5 |
| D | 20 | 30 | 30 |
| E | 24 | 35 | 35 |
| F | 5 | 7 | 7 |
| G | 11 | 16 | 16 |
| H | 8 | 12 | 12 |
| I | 0.5 | 1.75 | 1.75 |
| J | 27.5 | 40 | 40 |
| K | ø3.4 | ø4.5 | ø4.5 |




| Order No. | 303561 | 303570 | 303580 |
|---|---|---|---|
| A | ø9.5 | ø9.5 | ø10 |
| B | 6 | 11.5 | 11.5 |
| C | 40 | 60 | 60 |
| D | 3.5 | 5.5 | 5.5 |
| E | 30 | 40 | 40 |
| F | 15 | 20 | 20 |
| G | ø3.4 | ø4.5 | ø4.5 |




| Order No. | 303563 | 303572 | 303582 |
|---|---|---|---|
| A | ø9.5 | ø9.5 | ø10 |
| B | 6 | 11.5 | 11.5 |
| C | 30 | 40 | 40 |
| D | 37.5 | 50 | 50 |
| E | 4.5 | 6.5 | 6.5 |
| F | 15 | 18 | 18 |
| G | 10 | 15 | 15 |
| H | 15 | 20 | 20 |
| I | ø3.4 | ø4.5 | ø4.5 |




| Order No. | 303565 | 303574 | 303584 |
|---|---|---|---|
| A | ø9.5 | ø9.5 | ø10 |
| B | 6 | 11.5 | 11.5 |
| C | ø15 | ø15 | ø15 |
| D | 15 | 20 | 20 |
| E | 25 | 40 | 40 |
| F | 8.5 | 8.5 | 8.5 |
| G | 7.5 | 10 | 10 |
| H | 10 | 20 | 20 |
| I | 10 | 15 | 15 |
| J | 27.5 | 35 | 35 |
| K | ø3.4 | ø4.5 | ø4.5 |
| L | 0.75 | 1.25 | 1.25 |



Mitutoyo

# Quick Guide to Precision Measuring Instruments

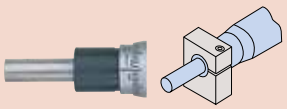
## Micrometer Heads

### Key Factors in Selection

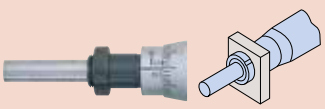
Key factors in selecting a micrometer head are the measuring range, spindle face, stem, graduations, thimble diameter, etc.

## Stem

Plain stem

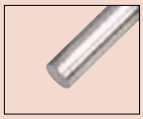


Stem locknut type

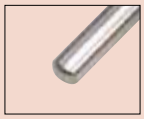


- The stem used to mount a micrometer head is classified as a "plain type" or "clamp nut type" as illustrated above. The stem diameter is manufactured to a nominal Metric or Imperial size with an h6 tolerance.
- The clamp nut stem allows fast and secure clamping of the micrometer head. The plain stem has the advantage of wider application and slight positional adjustment in the axial direction on final installation, although it does requires a split-fixture clamping arrangement or adhesive fixing.
- General-purpose mounting fixtures are available as optional accessories.

## Measuring Face



Flat face



Spherical face



Anti-rotation device

- A flat measuring face is often specified where a micrometer head is used in measurement applications.
- When a micrometer head is used as a feed device, a spherical face can minimize errors due to misalignment (Figure A). Alternatively, a flat face on the spindle can bear against a sphere, such as a carbide ball (Figure B).
- A non-rotating spindle type micrometer head or one fitted with an anti-rotation device on the spindle (Figure C) can be used if a twisting action on the workpiece must be avoided.
- If a micrometer head is used as a stop then a flat face both on the spindle and the face it contacts provides durability.

Figure A

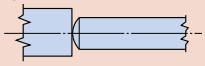


Figure B

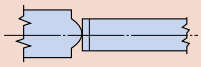
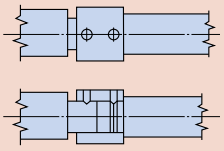


Figure C



## Non-Rotating Spindle

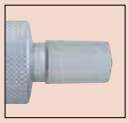
- A non-rotating spindle type head does not exert a twisting action on a workpiece, which may be an important factor in some applications.

## Spindle Thread Pitch

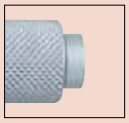
- The standard type head has 0.5mm pitch.
- 1mm-pitch type: quicker to set than standard type and avoids the possibility of a 0.5mm reading error. Excellent load-bearing characteristics due to larger screw thread.
- 0.25mm or 0.1mm-pitch type
  This type is the best for fine-feed or fine-positioning applications.

## Constant-force Device

- A micrometer head fitted with a constant-force device (ratchet or friction thimble) is recommended for measurement applications.
- If using a micrometer head as a stop, or where saving space is a priority, a head without a ratchet is probably the best choice.



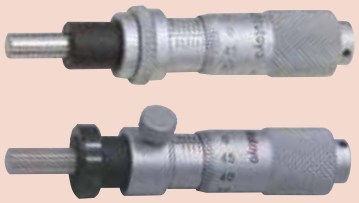
Micrometer head with constant-force device



Micrometer head without constant-force device (no ratchet)

## Spindle Lock

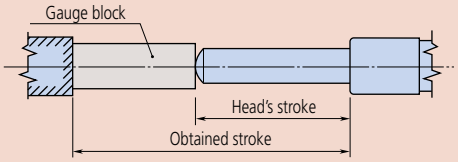
- If a micrometer head is used as a stop it is desirable to use a head fitted with a spindle lock so that the setting will not change even under repeated shock loading.



## Measuring Range (Stroke)

- When choosing a measuring range for a micrometer head, allow an adequate margin in consideration of the expected measurement stroke. Six stroke ranges, 5 to 50mm, are available for standard micrometer heads.
- Even if an expected stroke is small, such as 2mm to 3mm, it will be cost effective to choose a 25mm-stroke model as long as there is enough space for installation.
- If a long stroke of over 50mm is required, the concurrent use of a gauge block can extend the effective measuring range. (Figure D)

Figure D




- In this guide, the range (or stroke end) of the thimble is indicated by a dashed line. For stroke ends, consider the thimble as moving to the position indicated by the line when designing the jig.

## Ultra-fine Feed Applications

- Dedicated micrometer heads are available for manipulator applications, etc., which require ultra-fine feed or adjustment of spindle.





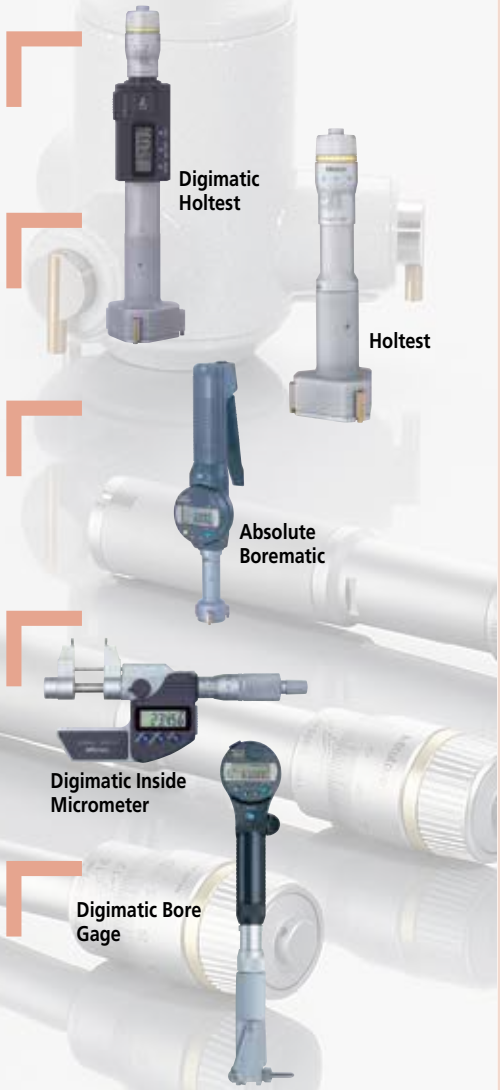
## Holtest ABSOLUTE Borematic



## Inside Micrometers



## Bore Gages




## INDEX


| | |
|---|---|
| **Holtest** | |
| Digimatic Holtest | C-2,3 |
| Holtest | C-4,5 |
| Holtest (Type II) | C-6,7 |
| Borematic | C-8,9 |
| Holtest/Digimatic Holtest/Borematic | C-10 |
| **Inside Micrometers** | |
| Tubular Inside Micrometers | C-11-12,15-17 |
| Inside Micrometers | C-13,18 |
| Digimatic Tubular Inside Micrometers | C-14 |
| Inside Micro Checker | C-19 |
| Bore Gages | |
| Bore Gages | C-20-26,28 |
| **ABSOLUTE Digimatic Bore Gage** | **C-27** |
| Bore Gage Zero Checker | C-29 |
| Setting Rings | C-29,30 |
| Bore Gages | C-28 |
| Bore Gage Zero Checker | C-29 |
| Setting Rings | C-29,30 |

# Digimatic Holtest

## SERIES 468 — Three-Point Internal Micrometers

### FEATURES

- TiN-coated measuring contact points provide excellent durability and impact resistance and allow the instrument to measure to the bottom of a blind hole ( up to 100mm / 4″models).
- Large LCD readout.
- Functions available: Presetting, Zero/ABS, Auto power On/Off, Data hold, Data output, Error alarm, Battery replacement alarm.
- With Ratchet Stop for constant force.
- Measure deep holes by attaching an extension rod (optional).
- Setting rings for origin point setting are optional.
- Supplied in fitted plastic case up to 100mm / 4″. Over 100mm / 4″ supplied in wooden case.



468-261



468-263



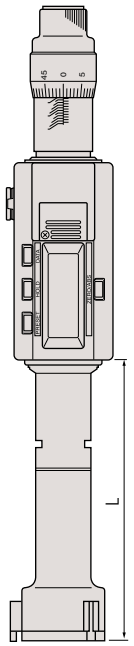
468-274



TiN-coated contact points
("-10" suffix models only)

### DIMENSIONS AND MASS

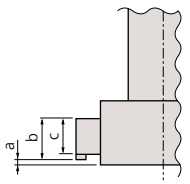
Unit: mm




| Range | L | Mass (g) |
|---|---|---|
| 6 - 8mm / .275 - .35″ | 59 | 400 |
| 8 - 10mm / .35 - .425″ | 59 | 400 |
| 10 - 12mm / .425 - .5″ | 59 | 400 |
| 12 - 16mm / .5 - .65″ | 84 | 430 |
| 16 - 20mm / .65 - .8″ | 84 | 430 |
| 20 - 25mm / .8 - 1" | 93 | 500 |
| 25 - 30mm / 1 - 1.2" | 93 | 510 |
| 30 - 40mm / 1.2 - 1.6" | 103.8 | 510 |
| 40 - 50mm / 1.6 - 2" | 103.8 | 530 |
| 50 - 63mm / 2 - 2.5" | 105.4 | 650 |
| 62 - 75mm / 2.5 - 3.0" | 105.4 | 660 |
| 75 - 88mm / 3.0 - 3.5" | 105.4 | 990 |
| 87 - 100mm / 3.5 - 4.0" | 105.4 | 1000 |
| 100 - 125mm / 4 - 5" | 151.4 | 970 |
| 125 - 150mm / 5 - 6" | 151.4 | 1060 |
| 150 - 175mm / 6 - 7" | 151.4 | 1150 |
| 175 - 200mm / 7 - 8" | 151.4 | 1240 |
| 200 - 225mm / 8 - 9" | 151.4 | 1330 |
| 225 - 250mm / 9 - 10" | 151.4 | 1420 |
| 250 - 275mm / 10 - 11" | 151.4 | 1510 |
| 275 - 300mm / 11 - 12" | 151.4 | 1600 |

#### Measuring a Blind Hole

The measuring contact points held in the jaws permit measuring the diameter of a blind hole to the bottom.
( up to 100mm / 4″models)




| Range | a | b | c |
|---|---|---|---|
| 6 - 12mm / .275 - .5″ | 2 | — | 2.5 |
| 12 - 20mm / .5 - .8″ | 0.3 | 5.6 | 3.5 |
| 20 - 30mm / .8 - 1.2″ | 0.3 | 8.3 | 5.2 |
| 30 - 50mm / 1.2 - 2" | 0.3 | 13 | 10 |
| 50 - 100mm / 2 - 4" | 0.3 | 17 | 14 |
| 100 - 300mm / 4 - 12" | 12.4 | 21 | 13.8 |

### Technical Data

Accuracy: Refer to the list of specifications.
Resolution: 0.001mm or .00005"/0.001mm
(over 4 - 5" models: .0001"/0.001mm)
Contact point: TiN coating
Measuring method: Three-point method
Display: LCD
Battery: SR44 (2 pcs.), **938882**
Battery life: Approx. 1.2 years under normal use

### Function

Zero/ABS, Auto Power On/Off, Data hold, Data output, Preset, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA662**: SPC cable (1m / 40″)
**05CZA663**: SPC cable (2m / 80″)
**04AZB157**: Mounting plate for stand
**156-101-10**: Stand

**952322**: Extension rod 100mm / 3.94″
For range 6-12mm / .275 - .5″ models

**952621**: Extension rod 150mm / 5.9″
For range 12-20mm / .5" - .8″ models

**952622**: Extension rod 150mm / 5.9″
For range 20-50mm / .8" - 2″ models

**952623**: Extension rod 150mm / 5.9″
For range 50-300mm / 2" - 12″ models





04AZB157

## SPECIFICATIONS

**Metric** ☐ with TiN-coated contact points

| Range | Accuracy | Order Code | |
|---|---|---|---|
| | | Individual | Main Body Assembly |
| 6-8 | ±2µm | **468-161** | 04AZB106 |
| 8-10 | | **468-162** | |
| 10-12 | | **468-163** | |
| 12-16 | | **468-164** | 04AZB107 |
| 16-20 | | **468-165** | |
| 20-25 | ±3µm | **468-166** | 04AZB108 |
| 25-30 | | **468-167** | |
| 30-40 | | **468-168** | |
| 40-50 | | **468-169** | |
| 50-63 | | **468-170** | 04AZB109 |
| 62-75 | | **468-171** | |
| 75-88 | | **468-172** | |
| 87-100 | | **468-173** | |
| 100-125 | ±5µm | **468-174** | 04AZB110 |
| 125-150 | | **468-175** | |
| 150-175 | | **468-176** | |
| 175-200 | | **468-177** | |
| 200-225 | | **468-178** | |
| 225-250 | | **468-179** | |
| 250-275 | | **468-180** | |
| 275-300 | | **468-181** | |

**Inch/Metric** ☐ with TiN-coated contact points

| Range | Accuracy | Order Code | |
|---|---|---|---|
| | | Individual | Main Body Assembly |
| .275-.35"/6.925-8.89mm | ±.0001" | **468-261** | 04AZB111 |
| .35-.425"/8.89-10.795mm | | **468-262** | |
| .425-.5"/10.795-12.7mm | | **468-263** | |
| .5-.65"/12.7-16.51mm | | **468-264** | 04AZB112 |
| .65-.8"/16.51-20.32mm | | **468-265** | |
| .8-1"/20.32-25.4mm | ±.00015" | **468-266** | 04AZB113 |
| 1-1.2"/25.4-30.48mm | | **468-267** | |
| 1.2-1.6"/30.48-40.64mm | | **468-268** | |
| 1.6-2"/40.64-50.8mm | | **468-269** | |
| 2-2.5"/50.8-63.5mm | | **468-270** | 04AZB114 |
| 2.5-3"/63.5-76.2mm | | **468-271** | |
| 3-3.5"/76.2-88.9mm | | **468-272** | |
| 3.5-4"/88.9-101.6mm | | **468-273** | |
| 4-5"/101.6-127mm | ±.00025" | **468-274** | 04AZB115 |
| 5-6"/127-152.4mm | | **468-275** | |
| 6-7"/152.4-177.8mm | | **468-276** | |
| 7-8"/177.8-203.2mm | | **468-277** | |
| 8-9"/203.2-228.6mm | | **468-278** | |
| 9-10"/228.6-254mm | | **468-279** | |
| 10-11"/254-279.4mm | | **468-280** | |
| 11-12"/279.4-304.8mm | | **468-281** | |



**468-986**

### Complete Unit Set

Each set includes complete gages (display units and measuring heads for each size).

**Metric** ☐ with TiN-coated contact points

| Range | Order No. | Individual range | Setting rings included | Remarks |
|---|---|---|---|---|
| 6 - 12mm | **468-981** | 6-8, 8-10, 10-12mm | ø8mm, ø10mm | — |
| 12 - 25mm | **468-982** | 12-16, 16-20, 20-25mm | ø16mm, ø20mm | — |
| 25 - 50mm | **468-983** | 25-30, 30-40, 40-50mm | ø30mm, ø40mm | — |
| 50 - 75mm | **468-984** | 50-63, 62-75mm | ø62mm | — |
| 75 - 100mm | **468-985** | 75-88, 87-100mm | ø87mm | — |

**Inch/Metric** ☐ with TiN-coated contact points

| Range | Order No. | Individual range | Setting rings included | Remarks |
|---|---|---|---|---|
| .275 - .5" / 6.925 - 12.7mm | **468-986** | .275-.35", .35-.425", .425-.5" | .35" DIA., .425" DIA. | — |
| .5 - 1" / 12.7 - 25.4mm | **468-987** | .5-.65", .65-.8", .8-1" | .65" DIA., .8" DIA. | — |
| 1 - 2" / 25.4 - 50.8mm | **468-988** | 1-1.2", 1.2-1.6", 1.6-2" | 1.2" DIA., 1.6" DIA. | — |
| 2 - 3" / 50.8 - 76.2mm | **468-989** | 2-2.5", 2.5-3" | 2.5" DIA. | — |
| 3 - 4" / 76.2 - 101.6mm | **468-990** | 3-3.5", 3.5-4" | 3.5" DIA. | — |



**468-978**

### Interchangeable Head Set

Each set includes one display unit with interchangeable measuring heads of the sizes specified.

**Metric** ☐ with TiN-coated contact points

| Range | Order No. | Individual range | Setting rings included | Remarks |
|---|---|---|---|---|
| 6 - 12mm | **468-971** | 6-8, 8-10, 10-12mm | ø8mm, ø10mm | with extension rod |
| 12 - 20mm | **468-972** | 12-16, 16-20mm | ø16mm. | with extension rod |
| 20 - 50mm | **468-973** | 20-25, 25-30, 30-40, 40-50mm | ø25mm, ø40mm | with extension rod |
| 50 - 100mm | **468-974** | 50-63, 62-75, 75-88, 87-100mm | ø62mm, ø87mm | with extension rod |
| 100 - 200mm | **468-975** | 100-125, 125-150, 150-175, 175-200mm | ø125mm, ø175mm | with extension rod |

**Inch/Metric** ☐ with TiN-coated contact points

| Range | Order No. | Individual range | Setting rings included | Remarks |
|---|---|---|---|---|
| .275 - .5" / 6.925 - 12.7mm | **468-976** | .275-.35", .35-.425", .425-.5" | .35" DIA., .425" DIA. | with extension rod |
| .5 - .8" / 12.7 - 20.32mm | **468-977** | .5-.65", .65-.8" | .65" DIA. | with extension rod |
| .8 - 2" / 20.32 - 50.8mm | **468-978** | .8-1", 1-1.2", 1.2-1.6", 1.6-2" | 1" DIA., 1.6" DIA. | with extension rod |
| 2 - 4" / 50.8 - 101.6mm | **468-979** | 2-2.5", 2.5-3", 3-3.5", 3.5-4" | 2.5" DIA., 3.5" DIA | with extension rod |
| 4 - 8" / 101.6 - 203.2mm | **468-980** | 4-5", 5-6", 6-7", 7-8" | 5" DIA., 7" DIA. | with extension rod |



Mitutoyo

# Holtest

## SERIES 368 — Three-Point/Two-Point Internal Micrometers

These Holtests are versatile, self-centering three-point internal micrometers for the accurate and efficient direct-measurement of internal diameters. Three anvils, evenly spaced at 120° apart, contact the internal wall surfaces and find true alignment with the axis of the bore for accurate ID measurement.



368-268



368-174

## FEATURES

- TiN-coated measuring contact points (over 6mm / .275″ range models) provide excellent durability and impact resistance and allow the instrument to measure to the bottom of a blind hole (up to 100mm / 4″models).
- Highly durable because of carbide-tipped contact points (anvils up to 12mm / .5″models).
- Measure deep holes using an extension rod (optional) which is available on models over 6mm (.275") measuring range.
- With Ratchet Stop for constant force.
- Setting rings for zero point adjustment are optional.
- Supplied in fitted plastic case up to 100mm / 4″. Over 100mm / 4″ supplied in wooden case.



368-001

**Two-point contact type**



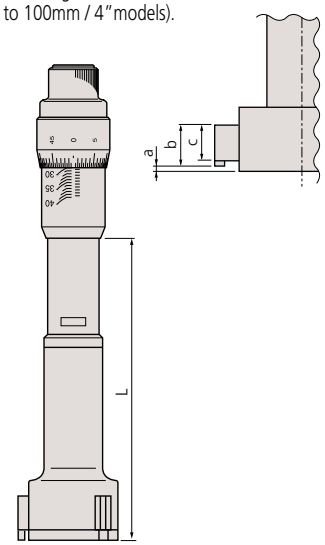
TiN-coated contact points (excluding models up to 12mm/.5")

## DIMENSIONS

Unit: mm

### Measuring a Blind Hole

The measuring contact points held in the jaws permit measuring the diameter of a blind hole right down to the bottom (up to 100mm / 4″models).




| Range | L | Mass (g) |
|---|---|---|
| 2 - 2.5mm / .08 - .1″ | 12 | 88 |
| 2.5 - 3mm / .1 - .12" | 12 | 88 |
| 3 - 4mm / .12 - .16" | 22 | 91 |
| 4 - 5mm / .16 - .2" | 22 | 91 |
| 5 - 6mm / .2 - .24" | 22 | 91 |
| 6 - 8mm / .275 - .35" | 59 | 57 |
| 8 - 10mm / .35 - .425" | 59 | 58 |
| 10 - 12mm / .425 - .5" | 59 | 59 |
| 12 - 16mm / .5 - .65" | 82 | 140 |
| 16 - 20mm / .65 - .8" | 82 | 145 |
| 20 - 25mm / .8 - 1" | 94 | 250 |
| 25 - 30mm / 1 - 1.2" | 94 | 270 |
| 30 - 40mm / 1.2 - 1.6" | 102 | 290 |
| 40 - 50mm / 1.6 - 2" | 102 | 330 |
| 50 - 63mm / 2 - 2.5" | 105 | 440 |
| 62 - 75mm / 2.5 - 3" | 105 | 450 |
| 75 - 88mm / 3 - 3.5" | 105 | 490 |
| 87 - 100mm / 3.5 - 4" | 105 | 500 |
| 100 - 125mm / 4 - 5" | 161 | 1050 |
| 125 - 150mm / 5 - 6" | 161 | 1120 |
| 150 - 175mm / 6 - 7" | 161 | 1190 |
| 175 - 200mm / 7 - 8" | 161 | 1260 |
| 200 - 225mm / 8 - 9" | 161 | 1420 |
| 225 - 250mm / 9 - 10" | 161 | 1580 |
| 250 - 275mm / 10 - 11" | 161 | 1600 |
| 275 - 300mm / 11 - 12" | 161 | 1690 |

| Range | a | b | c |
|---|---|---|---|
| 2 - 6mm / .08 - .275″ | — | — | 2 |
| 6 - 12mm / .275 - .5″ | 2 | — | 2.5 |
| 12 - 20mm / .5 - .8" | 0.3 | 5.6 | 3.5 |
| 20 - 30mm / .8 - 1.2" | 0.3 | 8.3 | 5.2 |
| 30 - 50mm / 1.2 - 2" | 0.3 | 13 | 10 |
| 50 - 100mm / 2 - 4" | 0.3 | 17 | 14 |
| 100 - 300mm / 4 - 12" | 12.4 | 21 | 13.8 |

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo guarantees the product quality.

### Technical Data

Graduation: 0.001mm, 0.005mm*, .0001" or .0002"* (*over 12mm or .5″ models)

| Range | Measuring method | Contact-point material |
|---|---|---|
| 2-6mm/.08-.28″ | Two-point method | Carbide |
| 6-300mm/.275-12″ | Three-point method | TiN coating (1700-2000HV) |

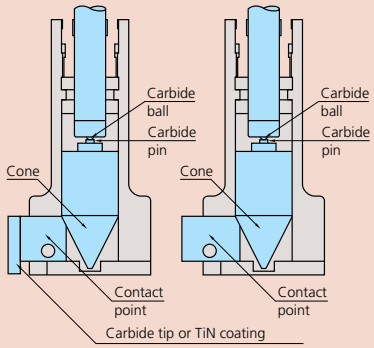
### Optional Accessories

**952322**: Extension rod 100mm / 3.94″
For range 6-12mm / .275-.5″ models

**952621**: Extension rod 150mm / 5.9″
For range 12-20mm / .5" - .8″ models

**952622**: Extension rod 150mm / 5.9″
For range 20-50mm / .8" - 2″ models

**952623**: Extension rod 150mm / 5.9″
For range 50-300mm / 2"-12″ models






Using the optional extension rod



## SPECIFICATIONS

**Metric** Individual ☐ with TiN-coated contact points

| Range | Order No. | Accuracy |
|---|---|---|
| 2 - 2.5mm | **368-001** | ±2µm |
| 2.5 - 3mm | **368-002** | ±2µm |
| 3 - 4mm | **368-003** | ±2µm |
| 4 - 5mm | **368-004** | ±2µm |
| 5 - 6mm | **368-005** | ±2µm |
| 6 - 8mm | **368-161** | ±2µm |
| 8 - 10mm | **368-162** | ±2µm |
| 10 - 12mm | **368-163** | ±2µm |
| 12 - 16mm | **368-164** | ±2µm |
| 16 - 20mm | **368-165** | ±2µm |
| 20 - 25mm | **368-166** | ±3µm |
| 25 - 30mm | **368-167** | ±3µm |
| 30 - 40mm | **368-168** | ±3µm |
| 40 - 50mm | **368-169** | ±3µm |
| 50 - 63mm | **368-170** | ±3µm |
| 62 - 75mm | **368-171** | ±3µm |
| 75 - 88mm | **368-172** | ±3µm |
| 87 - 100mm | **368-173** | ±3µm |
| 100 - 125mm | **368-174** | ±5µm |
| 125 - 150mm | **368-175** | ±5µm |
| 150 - 175mm | **368-176** | ±5µm |
| 175 - 200mm | **368-177** | ±5µm |
| 200 - 225mm | **368-178** | ±5µm |
| 225 - 250mm | **368-179** | ±5µm |
| 250 - 275mm | **368-180** | ±5µm |
| 275 - 300mm | **368-181** | ±5µm |

**Inch** Individual ☐ with TiN-coated contact points

| Range | Order No. | Accuracy |
|---|---|---|
| .08 - .1" | **368-021** | ±.0001" |
| .1 - .12" | **368-022** | ±.0001" |
| .12 - .16" | **368-023** | ±.0001" |
| .16 - .2" | **368-024** | ±.0001" |
| .2 - .24" | **368-025** | ±.0001" |
| .24 - .28" | **368-026** | ±.0001" |
| .275 - .35" | **368-261** | ±.0001" |
| .35 - .425" | **368-262** | ±.0001" |
| .425 - .5" | **368-263** | ±.0001" |
| .5 - .65" | **368-264** | ±.0001" |
| .65 - .8" | **368-265** | ±.0001" |
| .8 - 1" | **368-266** | ±.00015" |
| 1 - 1.2" | **368-267** | ±.00015" |
| 1.2 - 1.6" | **368-268** | ±.00015" |
| 1.6 - 2" | **368-269** | ±.00015" |
| 2 - 2.5" | **368-270** | ±.00015" |
| 2.5 - 3" | **368-271** | ±.00015" |
| 3 - 3.5" | **368-272** | ±.00015" |
| 3.5 - 4" | **368-273** | ±.00015" |
| 4 - 5" | **368-274** | ±.00025" |
| 5 - 6" | **368-275** | ±.00025" |
| 6 - 7" | **368-276** | ±.00025" |
| 7 - 8" | **368-277** | ±.00025" |
| 8 - 9" | **368-278** | ±.00025" |
| 9 - 10" | **368-279** | ±.00025" |
| 10 - 11" | **368-280** | ±.00025" |
| 11 - 12" | **368-281** | ±.00025" |

### Complete Unit Set

Each set includes complete gages (micrometer head units and measuring heads for each size).

**Metric** ☐ with TiN-coated contact points

| Range | Order No. | Individual range | Setting rings included | Remarks |
|---|---|---|---|---|
| 2 - 3mm | **368-906** | 2-2.5, 2.5-3mm | ø2.5mm | — |
| 3 - 6mm | **368-907** | 3-4, 4-5, 5-6mm | ø4mm, ø5mm | — |
| 6 - 12mm | **368-911** | 6-8, 8-10, 10-12mm | ø8mm, ø10mm | with extension rod |
| 12 - 20mm | **368-912** | 12-16, 16-20mm | ø16mm | with extension rod |
| 20 - 50mm | **368-913** | 20-25, 25-30, 30-40, 40-50mm | ø25mm, ø40mm | with extension rod |
| 50 - 100mm | **368-914** | 50-63, 62-75, 75-88, 87-100mm | ø62mm, ø87mm | with extension rod |
| 100 - 200mm | **368-915** | 100-125, 125-150, 150-175, 175-200mm | ø125mm, ø175mm | with extension rod |

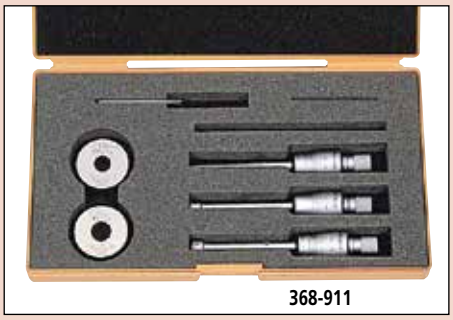
**Inch** ☐ with TiN-coated contact points

| Range | Order No. | Individual range | Setting rings included | Remarks |
|---|---|---|---|---|
| .08" - .12" | **368-926** | .08-.1", .1-.12" | .1" DIA. | — |
| .12" - .28" | **368-927** | .12-.16", .16-.2", .2-.24", .24-.28" | .16" DIA., .24" DIA. | — |
| .275" - .5" | **368-916** | .275-.35", .35-.425", .425-.5" | .35" DIA., .5" DIA. | with extension rod |
| .5" - .8" | **368-917** | .5-.65", .65-.8" | .65" DIA. | with extension rod |
| .8" - 2" | **368-918** | .8-1", 1-1.2", 1.2-1.6", 1.6-2" | 1" DIA., 1.6" DIA. | with extension rod |
| 2" - 4" | **368-919** | 2-2.5", 2.5-3", 3-3.5", 3.5-4" | 2.5" DIA., 3.5" DIA. | with extension rod |
| 4" - 8" | **368-920** | 4-5", 5-6", 6-7", 7-8" | 5" DIA., 7" DIA. | with extension rod |

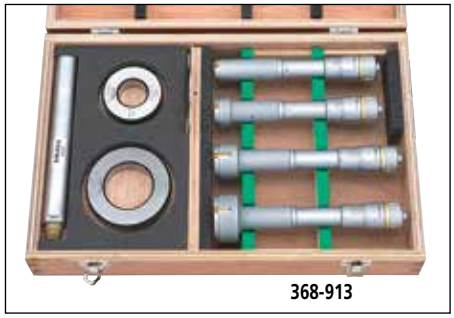
*.0001" graduation



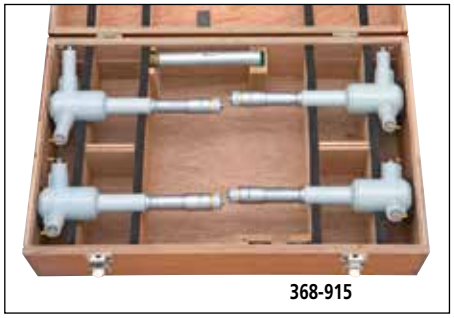
**368-906**



**368-911**



**368-913**



**368-915**



Mitutoyo

# Holtest (Type II)

## SERIES 368 — Three-Point Internal Micrometers

### FEATURES

- The Holtests (type II) have three contact points made of alloy steel.
- Measurement can be taken closer to the bottom of the blind bore (up to 100mm / 4″models).
- Measure deep holes using an extension rod (optional).
- With Ratchet Stop for constant force.
- Setting rings for origin point settings are optional.
- Supplied in fitted plastic case up to 100mm / 4″. Over 100mm / 4″ supplied in wooden case.



368-869



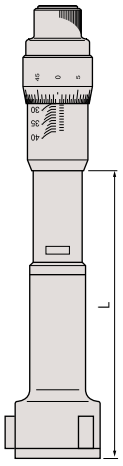
368-770



368-774

### DIMENSIONS AND MASS

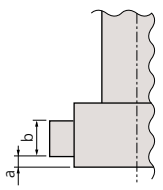
Unit: mm




| Range | L | Mass (g) |
|---|---|---|
| 12 - 16mm / .5 - .65″ | 82 | 150 |
| 16 - 20mm / .65 - .8" | 82 | 150 |
| 20 - 25mm / .8 - 1" | 94 | 260 |
| 25 - 30mm / 1 - 1.2" | 94 | 280 |
| 30 - 40mm / 1.2 - 1.6" | 102 | 290 |
| 40 - 50mm / 1.6 - 2" | 102 | 330 |
| 50 - 63mm / 2 - 2.5" | 105 | 440 |
| 62 - 75mm / 2.5 - 3" | 105 | 450 |
| 75 - 88mm / 3 - 3.5" | 105 | 560 |
| 87 - 100mm / 3.5 - 4" | 105 | 570 |
| 100 - 125mm / 4 - 5" | 161 | 1020 |
| 125 - 150mm / 5 - 6" | 161 | 1110 |
| 150 - 175mm / 6 - 7" | 161 | 1200 |
| 175 - 200mm / 7 - 8" | 161 | 1300 |
| 200 - 225mm / 8 - 9" | 161 | 1420 |
| 225 - 250mm / 9 - 10" | 161 | 1540 |
| 250 - 275mm / 10 - 11" | 161 | 1690 |
| 275 - 300mm / 11 - 12" | 161 | 1860 |

#### Measuring a Blind Hole

The measuring contact points held in the jaws permit measuring the diameter of a blind hole right down to the bottom (up to 100mm / 4″models).




| Range | a | b |
|---|---|---|
| 12 - 20mm / .5 - .8" | 2.6 | 3.5 |
| 20 - 30mm / .8 - .12" | 3.4 | 5.2 |
| 30 - 50mm / 1.2 - 2" | 3.4 | 10 |
| 50 - 100mm / 2 - 4" | 3.4 | 14 |
| 100 - 300mm / 4 - 12" | 19.6 | 13.8 |

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo guarantees the product quality.

### Technical Data

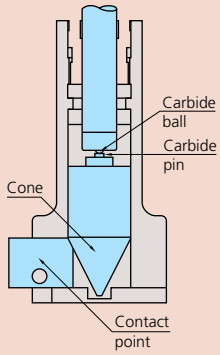
Graduation: 0.005mm or .0002"
Measuring method: Three-point method
Contact point: Hardened steel (over HRC 60)

### Optional Accessories

**952621**: Extension rod 150mm / 5.9″
For range 12-20mm / .5 - .8″ models

**952622**: Extension rod 150mm / 5.9″
For range 20-50mm / .8 - 2″ models

**952623**: Extension rod 150mm / 5.9″
For range 50-300mm / 2 - 12″ models




## HT (Type II)

| Head Assy Order No. | Measuring Range | HT (type II) Order No. |
|---|---|---|
| **04AZA839** | 12 - 16mm | **368-764** |
| **04AZA840** | 16 - 20mm | **368-765** |
| **04AZA848** | 20 - 25mm | **368-766** |
| **04AZA849** | 25 - 30mm | **368-767** |
| **04AZA857** | 30 - 40mm | **368-768** |
| **04AZA858** | 40 - 50mm | **368-769** |
| **04AZA870** | 50 - 63mm | **368-770** |
| **04AZA871** | 62 - 75mm | **368-771** |
| **04AZA872** | 75 - 88mm | **368-772** |
| **04AZA873** | 87 - 100mm | **368-773** |
| **04AZA895** | 100 - 125mm | **368-774** |
| **04AZA896** | 125 - 150mm | **368-775** |
| **04AZA897** | 150 - 175mm | **368-776** |
| **04AZA898** | 175 - 200mm | **368-777** |
| **04AZA899** | 200 - 225mm | **368-778** |
| **04AZA900** | 225 - 250mm | **368-779** |
| **04AZA901** | 250 - 275mm | **368-780** |
| **04AZA902** | 275 - 300mm | **368-781** |
| **04AZA841** | .5 - .65" | **368-864** |
| **04AZA842** | .65 - .8" | **368-865** |
| **04AZA850** | .8 - 1" | **368-866** |
| **04AZA851** | 1 - 1.2" | **368-867** |
| **04AZA859** | 1.2 - 1.6" | **368-868** |
| **04AZA860** | 1.6 - 2" | **368-869** |
| **04AZA874** | 2 - 2.5" | **368-870** |
| **04AZA875** | 2.5 - 3" | **368-871** |
| **04AZA876** | 3 - 3.5" | **368-872** |
| **04AZA877** | 3.5 - 4" | **368-873** |
| **04AZA903** | 4 - 5" | **368-874** |
| **04AZA904** | 5 - 6" | **368-875** |
| **04AZA905** | 6 - 7" | **368-876** |
| **04AZA906** | 7 - 8" | **368-877** |
| **04AZA907** | 8 - 9" | **368-878** |
| **04AZA908** | 9 - 10" | **368-879** |
| **04AZA909** | 10 - 11" | **368-880** |
| **04AZA910** | 11 - 12" | **368-881** |

# SPECIFICATIONS

**Metric** Individual

| Range | Order No. | Accuracy |
|---|---|---|
| 12 - 16mm | **368-764** | ±2µm |
| 16 - 20mm | **368-765** | ±2µm |
| 20 - 25mm | **368-766** | ±3µm |
| 25 - 30mm | **368-767** | ±3µm |
| 30 - 40mm | **368-768** | ±3µm |
| 40 - 50mm | **368-769** | ±3µm |
| 50 - 63mm | **368-770** | ±3µm |
| 62 - 75mm | **368-771** | ±3µm |
| 75 - 88mm | **368-772** | ±3µm |
| 87 - 100mm | **368-773** | ±3µm |
| 100 - 125mm | **368-774** | ±5µm |
| 125 - 150mm | **368-775** | ±5µm |
| 150 - 175mm | **368-776** | ±5µm |
| 175 - 200mm | **368-777** | ±5µm |
| 200 - 225mm | **368-778** | ±5µm |
| 225 - 250mm | **368-779** | ±5µm |
| 250 - 275mm | **368-780** | ±5µm |
| 275 - 300mm | **368-781** | ±5µm |

**Inch** Individual

| Range | Order No. | Accuracy |
|---|---|---|
| .5 - .65" | **368-864** | ±.0001" |
| .65 - .8" | **368-865** | ±.0001" |
| .8 - 1" | **368-866** | ±.00015" |
| 1 - 1.2" | **368-867** | ±.00015" |
| 1.2 - 1.6" | **368-868** | ±.00015" |
| 1.6 - 2" | **368-869** | ±.00015" |
| 2 - 2.5" | **368-870** | ±.00015" |
| 2.5 - 3" | **368-871** | ±.00015" |
| 3 - 3.5" | **368-872** | ±.00015" |
| 3.5 - 4" | **368-873** | ±.00015" |
| 4 - 5" | **368-874** | ±.00025" |
| 5 - 6" | **368-875** | ±.00025" |
| 6 - 7" | **368-876** | ±.00025" |
| 7 - 8" | **368-877** | ±.00025" |
| 8 - 9" | **368-878** | ±.00025" |
| 9 - 10" | **368-879** | ±.00025" |
| 10 - 11" | **368-880** | ±.00025" |
| 11 - 12" | **368-881** | ±.00025" |

### Complete Unit Set

Each set includes complete gages (micrometer head units and measuring heads for each size).

**Metric**

| Range | Order No. | Individual range | Setting rings included | Remarks |
|---|---|---|---|---|
| 12 - 20mm | **368-991** | 12-16, 16-20mm | ø16mm | with extension rod |
| 20 - 50mm | **368-992** | 20-25, 25-30, 30-40, 40-50mm | ø25mm, ø40mm | with extension rod |
| 50 - 100mm | **368-993** | 50-63, 62-75, 75-88, 87-100mm | ø62mm, ø87mm | with extension rod |
| 100 - 200mm | **368-994** | 100-125, 125-150, 150-175, 175-200mm | ø125mm, ø175mm | with extension rod |

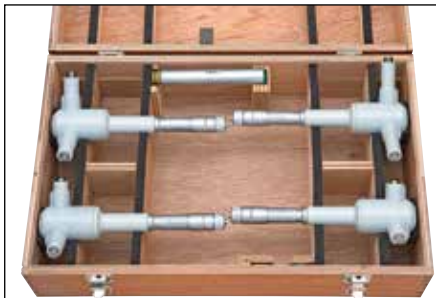
**Inch**

| Range | Order No. | Individual range | Setting rings included | Remarks |
|---|---|---|---|---|
| .5" - .8" | **368-995** | .5-.65", .65-.8" | .65" DIA. | with extension rod |
| .8" - 2" | **368-996** | .8-1", 1-1.2", 1.2-1.6", 1.6-2" | 1" DIA., 1.6" DIA. | with extension rod |
| 2" - 4" | **368-997** | 2-2.5", 2.5-3", 3-3.5", 3.5-4" | 2.5" DIA., 3.5" DIA. | with extension rod |
| 4" - 8" | **368-998** | 4-5", 5-6", 6-7", 7-8" | 5" DIA., 7" DIA. | with extension rod |


**368-991**


**368-992**


**368-993**


**368-994**

# Borematic

## SERIES 568 — ABSOLUTE Digimatic Snap Bore Gages

The Borematic enables the operator to take measurements more accurately and quicker than ever before. Once the origin point is set with the ORIGIN button, the Borematic retains the setting for the entire battery life, therefore, no longer repeated origin setting (presetting) is necessary.



568-364



568-368

### FEATURES

- TiN-coated measuring contact points provide excellent durability and impact resistance and allow the instrument to measure to the bottom of a blind hole.
- Large LCD digits of 8.5mm height for easy reading.
- 330-degree rotatable display unit for easy reading at any angle.
- Go/no-go judgment function.
- The ABSOLUTE linear encoder eliminates over-speed errors.
- With SPC data output.
- Setting rings for origin point setting are optional.
- Measure deep holes by attaching an optional extension rod.
- Measurement can be taken closer to the bottom of a blind bore.
- Supplied in fitted wooden case.



TiN-coated contact points ("-10" suffix models only)

SPC

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo guarantees the product quality.

ABSOLUTE®
Absolute System Patented by MITUTOYO

### Technical Data

Accuracy: Refer to the list of specifications.

Resolution: 0.001mm or .00005"/0.001mm
Contact point: Carbide or TiN coating*
(*over 12mm/.5" models)
Measuring method: Three-point method
Display: LCD
Battery: SR44 (1 pc.) (**938882**)
Battery life: Approx. 7,000 hours

### Functions

Zero/ABS, presetting, go/no-go judgment, power on/off, inch/mm conversion (on inch/metric models only), SPC data output, data hold

### Optional Accessories

**905338**: SPC cable (1m / 40")
**905409**: SPC cable (2m / 80")

**952322**: Extension rod 100mm / 3.94"
For range 6-12mm / .275-.5" models

**952621**: Extension rod 150mm / 5.9"
For range 12-20mm / .5" - .8" models

**952622**: Extension rod 150mm / 5.9"
For range 20-50mm / .8" - 2" models

**952623**: Extension rod 150mm / 5.9"
For range 50-300mm / 2"-12" models

– – – – : Setting ring (See page C-29.)



### SPECIFICATIONS

**Metric** Individual

| Range | Order No. | Accuracy | Mass (g) |
|---|---|---|---|
| 6 - 8mm | **568-361** | ±5µm | 480 |
| 8 - 10mm | **568-362** | ±5µm | 485 |
| 10 - 12mm | **568-363** | ±5µm | 485 |
| 12 - 16mm | **568-364** | ±5µm | 475 |
| 16 - 20mm | **568-365** | ±5µm | 480 |
| 20 - 25mm | **568-366** | ±6µm | 540 |
| 25 - 30mm | **568-367** | ±6µm | 555 |
| 30 - 40mm | **568-368** | ±6µm | 565 |
| 40 - 50mm | **568-369** | ±6µm | 610 |
| 50 - 63mm | **568-370** | ±6µm | 730 |
| 62 - 75mm | **568-371** | ±6µm | 740 |
| 75 - 88mm | **568-372** | ±6µm | 790 |
| 87 - 100mm | **568-373** | ±6µm | 800 |
| 100 - 113mm | **568-374** | ±6µm | 900 |
| 112 - 125mm | **568-375** | ±6µm | 910 |

**Inch/Metric**

| Range | Order No. | Accuracy | Mass (g) |
|---|---|---|---|
| .275 - .350" / 6.985 - 8.89mm | **568-461** | ±.00025" | 480 |
| .350 - .425" / 8.89 - 10.795mm | **568-462** | ±.00025" | 485 |
| .425 - .5" / 10.795 - 12.7mm | **568-463** | ±.00025" | 485 |
| .50 - .65" / 12.7 - 16.51mm | **568-464** | ±.00025" | 475 |
| .65 - .80" / 16.51 - 20.32mm | **568-465** | ±.00025" | 480 |
| .8 - 1.0" / 20.32 - 25.4mm | **568-466** | ±.0003" | 540 |
| 1.0 - 1.2" / 25.4 - 30.48mm | **568-467** | ±.0003" | 555 |
| 1.2 - 1.6" / 30.48 - 40.64mm | **568-468** | ±.0003" | 565 |
| 1.6 - 2.0" / 40.64 - 50.8mm | **568-469** | ±.0003" | 610 |
| 2.0 - 2.5" / 50.8 - 63.5mm | **568-470** | ±.0003" | 730 |
| 2.5 - 3.0" / 63.5 - 76.2mm | **568-471** | ±.0003" | 740 |
| 3.0 - 3.5" / 76.2 - 88.9mm | **568-472** | ±.0003" | 790 |
| 3.5 - 4.0" / 88.9 - 101.6mm | **568-473** | ±.0003" | 800 |
| 4.0 - 4.5" / 101.6 - 114.3mm | **568-474** | ±.0003" | 900 |
| 4.5 - 5.0" / 114.3 - 127mm | **568-475** | ±.0003" | 910 |

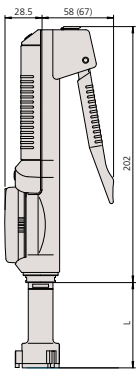
### Interchangeable Contact Head Set




### Complete Unit Set



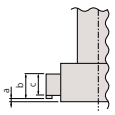

## DIMENSIONS




### Measuring a Blind Hole

The measuring pins held in the jaws permit measuring the diameter of a blind hole right down to the bottom.

Unit: mm




| Range | L | a | b | c |
|---|---|---|---|---|
| 6 - 12mm / .275 - .5" | 83 | 2 | — | 2.5 |
| 12 - 20mm / .5 - .8" | 53 | 0.3 | 5.6 | 3.5 |
| 20 - 30mm / .8 - 1.2" | 59 | 0.3 | 8.3 | 5.2 |
| 30 - 50mm / 1.2 - 2" | 67 | 0.3 | 13 | 10 |
| 50 - 125mm / 2 - 5" | 75 | 0.3 | 17 | 14 |

( ): 50-125mm model

### Complete Unit Set

Each set includes complete gage display units and measuring heads for each size and extension rod.

**Metric**

| Range | Set Order No. | Individual Order No. | Setting rings included |
|---|---|---|---|
| 6 - 12mm | **568-955** | **568-361, 568-362**<br>**568-363** | **177-125** (ø8mm)<br>**177-126** (ø10mm) |
| 12 - 25mm | **568-956** | **568-364, 568-365**<br>**568-366** | **177-177** (ø16mm)<br>**177-286** (ø20mm) |
| 25 - 50mm | **568-957** | **568-367, 568-368**<br>**568-369** | **177-139** (ø25mm)<br>**177-290** (ø40mm) |
| 50 - 75mm | **568-958** | **568-370**<br>**568-371** | **177-314** (ø62mm) |
| 75 - 100mm | **568-959** | **568-372**<br>**568-373** | **177-318** (ø87mm) |

**Inch/Metric**

| Range | Set Order No. | Individual Order No. | Setting rings included |
|---|---|---|---|
| .275" - .5" /<br>6.985 - 12.7mm | **568-965** | **568-461, 568-462**<br>**568-463** | **177-179** (.35" DIA.)<br>**177-283** (.425" DIA.) |
| .5" - 1" /<br>12.7 - 25.4mm | **568-966** | **568-464, 568-465**<br>**568-466** | **177-182** (.65" DIA.)<br>**177-287** (.8" DIA.) |
| 1" - 2" /<br>25.4 - 50.8mm | **568-967** | **568-467, 568-468**<br>**568-469** | **177-289** (1.2" DIA.)<br>**177-291** (1.6" DIA.) |
| 2" - 3" /<br>50.8 - 76.2mm | **568-968** | **568-470**<br>**568-471** | **177-315** (2.5" DIA.) |
| 3" - 4" /<br>76.2 - 101.6mm | **568-969** | **568-472**<br>**568-473** | **177-319** (3.5" DIA.) |

### Interchangeable Head Set

Each set includes one display unit with interchangeable measuring heads of the sizes specified and extension rod.

**Metric**

| Range | Set Order No. | Display Unit | Adaptor Supplied | Individual Head No. | Setting rings included |
|---|---|---|---|---|---|
| 6 - 12mm | **568-924** | **568-014** | **954595** | **04AZB136**<br>**04AZB137**<br>**04AZB138** | **177-125** (ø8mm)<br>**177-126** (ø10mm) |
| 12 - 25mm | **568-925** | **568-014** | **216556** | **04AZA719**<br>**04AZA720** | **177-177** (ø16mm)<br>**177-286** (ø20mm) |
| | | | **216557** | **04AZA728** | |
| 25 - 50mm | **568-926** | **568-014** | **216557** | **04AZA729**<br>**04AZA737**<br>**04AZA738** | **177-288** (ø30mm)<br>**177-290** (ø40mm) |
| 50 - 100mm | **568-927** | **568-014** | **216558** | **04AZA750, 04AZA751, 04AZA752**<br>**04AZA753** | **177-314** (ø62mm)<br>**177-318** (ø87mm) |

**Inch/Metric**

| Range | Set Order No. | Display Unit | Adaptor Supplied | Individual Head No. | Setting rings included |
|---|---|---|---|---|---|
| .275" - .5" /<br>6.985 - 12.7mm | **568-928** | **568-015** | **954595** | **04AZB139**<br>**04AZB140**<br>**04AZB141** | **177-179** (.35" DIA.)<br>**177-283** (.425" DIA.) |
| .5" - 1" /<br>12.7 - 25.4mm | **568-929** | **568-015** | **216556** | **04AZA721**<br>**04AZA722** | **177-182** (.65" DIA.)<br>**177-287** (.8" DIA.) |
| | | | **216557** | **04AZA730** | |
| 1" - 2" /<br>25.4 - 50.8mm | **568-930** | **568-015** | **216557** | **04AZA731**<br>**04AZA739**<br>**04AZA740** | **177-289** (1.2" DIA.)<br>**177-291** (1.6" DIA.) |
| 2" - 4" /<br>50.8 - 101.6mm | **568-936** | **568-015** | **216558** | **04AZA754**<br>**04AZA755**<br>**04AZA756**<br>**04AZA757** | **177-315** (2.5" DIA.)<br>**177-319** (3.5" DIA.) |



Mitutoyo

# Holtest/Digimatic Holtest/Borematic

## SERIES 368, 468, 568 Replacement Head Assembly List

TiN-coated measuring contact head assembly

| Head Assy Order No. | Measuring Range | HT(Type I) | | HTD | | SBM | | |
|---|---|---|---|---|---|---|---|---|
| | | Order No. | Model | Order No. | Model | Order No. | Model | Adaptor* |
| 04AZB136 | 6 - 8mm | 368-161 | HT-8R | 468-161 | HTD-8R | 568-361 | SBM-8C | |
| 04AZB137 | 8 - 10mm | 368-162 | HT-10R | 468-162 | HTD-10R | 568-362 | SBM-10C | 954595 |
| 04AZB138 | 10 - 12mm | 368-163 | HT-12R | 468-163 | HTD-12R | 568-363 | SBM-12C | |
| 04AZA719 | 12 - 16mm | 368-164 | HT-16R | 468-164 | HTD-16R | 568-364 | SBM-16C | 216556 |
| 04AZA720 | 16 - 20mm | 368-165 | HT-20R | 468-165 | HTD-20R | 568-365 | SBM-20C | |
| 04AZA728 | 20 - 25mm | 368-166 | HT-25R | 468-166 | HTD-25R | 568-366 | SBM-25C | |
| 04AZA729 | 25 - 30mm | 368-167 | HT-30R | 468-167 | HTD-30R | 568-367 | SBM-30C | 216557 |
| 04AZA737 | 30 - 40mm | 368-168 | HT-40R | 468-168 | HTD-40R | 568-368 | SBM-40C | |
| 04AZA738 | 40 - 50mm | 368-169 | HT-50R | 468-169 | HTD-50R | 568-369 | SBM-50C | |
| 04AZA750 | 50 - 63mm | 368-170 | HT-63R | 468-170 | HTD-63R | 568-370 | SBM-63C | |
| 04AZA751 | 62 - 75mm | 368-171 | HT-75R | 468-171 | HTD-75R | 568-371 | SBM-75C | 216558 |
| 04AZA752 | 75 - 88mm | 368-172 | HT-88R | 468-172 | HTD-88R | 568-372 | SBM-88C | |
| 04AZA753 | 87 - 100mm | 368-173 | HT-100R | 468-173 | HTD-100R | 568-373 | SBM-100C | |
| 04AZA775 | 100 - 125mm | 368-174 | HT-125R | 468-174 | HTD-125R | — | — | — |
| 04AZA776 | 125 - 150mm | 368-175 | HT-150R | 468-175 | HTD-150R | — | — | — |
| 04AZA777 | 150 - 175mm | 368-176 | HT-175R | 468-176 | HTD-175R | — | — | — |
| 04AZA778 | 175 - 200mm | 368-177 | HT-200R | 468-177 | HTD-200R | — | — | — |
| 04AZA779 | 200 - 225mm | 368-178 | HT-225R | 468-178 | HTD-225R | — | — | — |
| 04AZA780 | 225 - 250mm | 368-179 | HT-250R | 468-179 | HTD-250R | — | — | — |
| 04AZA781 | 250 - 275mm | 368-180 | HT-275R | 468-180 | HTD-275R | — | — | — |
| 04AZA782 | 275 - 300mm | 368-181 | HT-300R | 468-181 | HTD-300R | — | — | — |
| 04AZB139 | .275 - .35″ | 368-261 | HT-.35″R | 468-261 | HTD-.35″R | 568-461 | SBM-.35″C | |
| 04AZB140 | .35 - .425″ | 368-262 | HT-.425″R | 468-262 | HTD-.425″R | 568-462 | SBM-.425″C | 954595 |
| 04AZB141 | .425 - .5″ | 368-263 | HT-5″R | 468-263 | HTD-5″R | 568-463 | SBM-5″C | |
| 04AZA721 | .5 - .65″ | 368-264 | HT-.65″R | 468-264 | HTD-.65″R | 568-464 | SBM-.65″C | 216556 |
| 04AZA722 | .65 - .8″ | 368-265 | HT-.8″R | 468-265 | HTD-.8″R | 568-465 | SBM-.8″C | |
| 04AZA730 | .8 - 1″ | 368-266 | HT-1″R | 468-266 | HTD-1″R | 568-466 | SBM-1″C | |
| 04AZA731 | 1 - 1.2″ | 368-267 | HT-1.2″R | 468-267 | HTD-1.2″R | 568-467 | SBM-1.2″C | 216557 |
| 04AZA739 | 1.2 - 1.6″ | 368-268 | HT-1.6″R | 468-268 | HTD-1.6″R | 568-468 | SBM-1.6″C | |
| 04AZA740 | 1.6 - 2″ | 368-269 | HT-2″R | 468-269 | HTD-2″R | 568-469 | SBM-2″C | |
| 04AZA754 | 2 - 2.5″ | 368-270 | HT-2.5″R | 468-270 | HTD-2.5″R | 568-470 | SBM-2.5″C | |
| 04AZA755 | 2.5 - 3″ | 368-271 | HT-3″R | 468-271 | HTD-3″R | 568-471 | SBM-3″C | 216558 |
| 04AZA756 | 3 - 3.5″ | 368-272 | HT-3.5″R | 468-272 | HTD-3.5″R | 568-472 | SBM-3.5″C | |
| 04AZA757 | 3.5 - 4″ | 368-273 | HT-4″R | 468-273 | HTD-4″R | 568-473 | SBM-4″C | |
| 04AZA783 | 4 - 5″ | 368-274 | HT-5″R | 468-274 | HTD-5″R | — | — | — |
| 04AZA784 | 5 - 6″ | 368-275 | HT-6″R | 468-275 | HTD-6″R | — | — | — |
| 04AZA785 | 6 - 7″ | 368-276 | HT-7″R | 468-276 | HTD-7″R | — | — | — |
| 04AZA786 | 7 - 8″ | 368-277 | HT-8″R | 468-277 | HTD-8″R | — | — | — |
| 04AZA787 | 8 - 9″ | 368-278 | HT-9″R | 468-278 | HTD-9″R | — | — | — |
| 04AZA788 | 9 - 10″ | 368-279 | HT-10″R | 468-279 | HTD-10″R | — | — | — |
| 04AZA789 | 10 - 11″ | 368-280 | HT-11″R | 468-280 | HTD-11″R | — | — | — |
| 04AZA790 | 11 - 12″ | 368-281 | HT-12″R | 468-281 | HTD-12″R | — | — | — |
| 04AZA941 | 100 - 113mm | — | — | — | — | 568-374 | SBM-113C | |
| 04AZA942 | 112 - 125mm | — | — | — | — | 568-375 | SBM-125C | 216558 |
| 04AZA943 | 4 - 4.5″ | — | — | — | — | 568-474 | SBM-4.5″C | |
| 04AZA944 | 4.5 - 5″ | — | — | — | — | 568-475 | SBM-5″C | |

* Adaptors are required to connect borematic head assemblies and borematic main body units. Sets and complete units include the correct adapters for the included heads, while individual heads (purchased separately) do not.

Adaptors are not required for Vernier/Digimatic Holtests.

Separately purchased head assemblies are not covered by the guaranteed accuracy for holtests (368/468 series).

# Tubular Inside Micrometers

## SERIES 133 — Single-Rod Type

### Technical Data

Accuracy: Refer to the list of specifications.
Graduation: 0.01mm or .001"

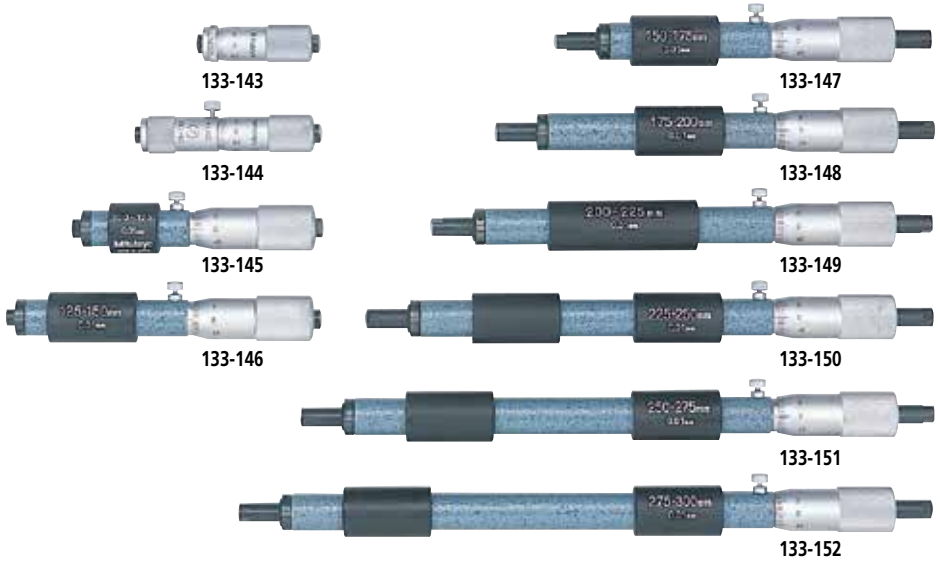
### Optional Accessories

– – – – : Setting ring (See page C-29.)



### FEATURES

- With locking clamp.
- Zero point can be readjusted by rotating the micrometer head sleeve. A key wrench is supplied.
- Clear, crisp graduations on the satin-chrome finished micrometer head.
- Carbide-tipped measuring faces.
- Supplied in fitted plastic case. Over 200mm / 8" supplied in wooden case.




### SPECIFICATIONS

**Metric** Individual

| Range | Order No. | Accuracy |
|---|---|---|
| 50 - 75mm | **133-143** | ±3µm |
| 75 - 100mm | **133-144** | ±4µm |
| 100 - 125mm | **133-145** | ±5µm |
| 125 - 150mm | **133-146** | ±5µm |
| 150 - 175mm | **133-147** | ±5µm |
| 175 - 200mm | **133-148** | ±5µm |
| 200 - 225mm | **133-149** | ±5µm |
| 225 - 250mm | **133-150** | ±6µm |
| 250 - 275mm | **133-151** | ±6µm |
| 275 - 300mm | **133-152** | ±6µm |
| 300 - 325mm | **133-153** | ±7µm |
| 325 - 350mm | **133-154** | ±7µm |
| 350 - 375mm | **133-155** | ±7µm |
| 375 - 400mm | **133-156** | ±8µm |
| 400 - 425mm | **133-157** | ±8µm |
| 425 - 450mm | **133-158** | ±8µm |
| 450 - 475mm | **133-159** | ±9µm |
| 475 - 500mm | **133-160** | ±9µm |
| 500 - 525mm | **133-161** | ±9µm |
| 525 - 550mm | **133-162** | ±10µm |
| 550 - 575mm | **133-163** | ±10µm |
| 575 - 600mm | **133-164** | ±10µm |
| 600 - 625mm | **133-165** | ±11µm |
| 625 - 650mm | **133-166** | ±11µm |
| 650 - 675mm | **133-167** | ±11µm |
| 675 - 700mm | **133-168** | ±12µm |

**Metric** Individual

| Range | Order No. | Accuracy |
|---|---|---|
| 700 - 725mm | **133-169** | ±12µm |
| 725 - 750mm | **133-170** | ±12µm |
| 750 - 775mm | **133-171** | ±13µm |
| 775 - 800mm | **133-172** | ±13µm |
| 800 - 825mm | **133-173** | ±13µm |
| 825 - 850mm | **133-174** | ±14µm |
| 850 - 875mm | **133-175** | ±14µm |
| 875 - 900mm | **133-176** | ±14µm |
| 900 - 925mm | **133-177** | ±15µm |
| 925 - 950mm | **133-178** | ±15µm |
| 950 - 975mm | **133-179** | ±15µm |
| 975 - 1000mm | **133-180** | ±16µm |

**Inch** Individual

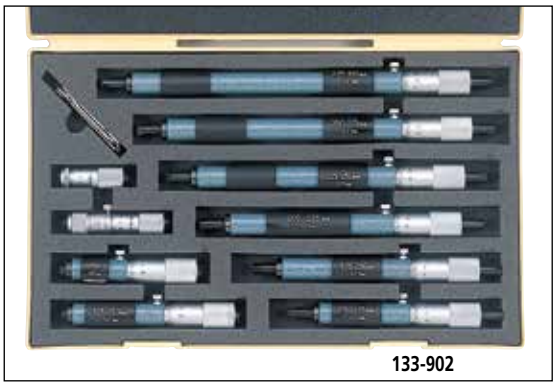
| Range | Order No. | Accuracy |
|---|---|---|
| 2" - 3" | **133-223** | ±.00015" |
| 3" - 4" | **133-224** | ±.0002" |
| 4" - 5" | **133-225** | ±.00025" |
| 5" - 6" | **133-226** | ±.00025" |
| 6" - 7 | **133-227** | ±.00025" |
| 7" - 8" | **133-228** | ±.00025" |
| 8" - 9" | **133-229** | ±.00025" |
| 9" - 10" | **133-230** | ±.0003" |
| 10" - 11" | **133-231** | ±.0003" |
| 11" - 12" | **133-232** | ±.0003" |



Mitutoyo

# Tubular Inside Micrometers

## SERIES 133



133-902

**Metric** Micrometer set

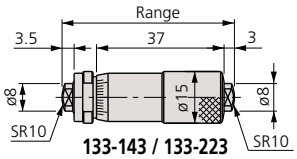
| Range | Order No. | Included in set |
|---|---|---|
| 50 - 150mm (4 pcs. set) | **133-901** | • **133-143, 133-144, 133-145, 133-146** • with fitted case |
| 50 - 300mm (10 pcs. set) | **133-902** | • **133-143, 133-144, 133-145, 133-146, 133-147, 133-148, 133-149, 133-150, 133-151, 133-152** • with fitted case |

**Inch** Micrometer set

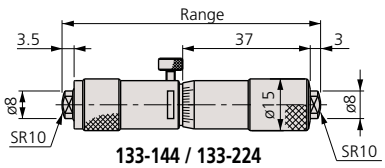
| Range | Order No. | Included in set |
|---|---|---|
| 2" - 6" (4 pcs. set) | **133-903** | • **133-223, 133-224, 133-225, 133-226** • with fitted case |
| 2" - 12" (10 pcs. set) | **133-904** | • **133-223, 133-224, 133-225, 133-226, 133-227, 133-228, 133-229, 133-230, 133-231, 133-232** • with fitted case |

## DIMENSIONS

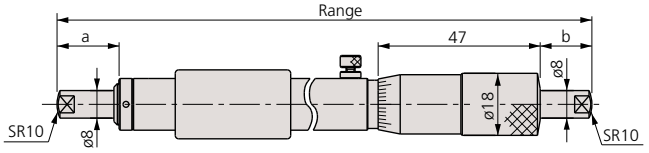
Unit: mm




133-143 / 133-223




133-144 / 133-224




| Order No. | L | a | b |
|---|---|---|---|
| **133-145 / 133-225** | 100 | 5 | 3 |
| **133-146 / 133-226** | 125 | 5 | 3 |
| **133-147 / 133-227** | 150 | 18 | 15 |
| **133-148 / 133-228** | 175 | 18 | 15 |
| **133-149 / 133-229** | 200 | 18 | 15 |
| ⋮ | ⋮ | ⋮ | ⋮ |
| **133-180 / 133-232** | 975 | 18 | 15 |

# Inside Micrometers

## SERIES 141 — Interchangeable-Rod Type

### Technical Data

Metric Model
Accuracy: ±(6+L/50)µm
L=Maximum measuring length (mm)
Fraction rounded up

Inch Model
Accuracy: ±{.00024+ (.00004xR/2)}"
R=Maximum measuring length (inch)
Fraction rounded up

Graduation: 0.01mm or .001"

### Optional Accessories

– – – – : Setting ring (See page C-29.)



**141-233**



### FEATURES

- Wide range of ID measurements with interchangeable rods.
- Each interchangeable rod is marked with its measuring range.
- The sizes of interchangeable rods can be adjusted with spacing collars.
- Both micrometer head and furnished rods are satin-chrome finished throughout.
- Supplied in fitted plastic case. Over 1000mm / 40" supplied in wooden case.

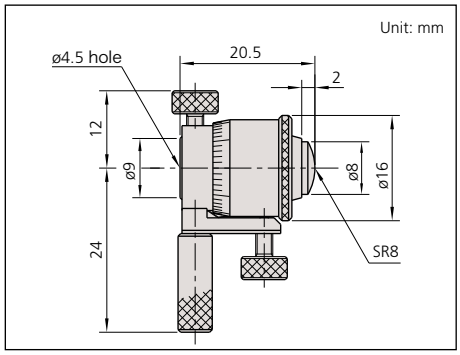


**141-101**



When using the extension rod

### DIMENSIONS




### SPECIFICATIONS

**Metric**

| Range | Order No. | Travel of micrometer head | Remarks |
|---|---|---|---|
| 25 - 32mm | **141-001 / 141-003*** | 7mm | Micrometer Head only |
| 25 - 50mm | **141-101 / 141-103*** | 7mm | with 2 rods |
| 50 - 63mm | **141-025 / 141-027*** | 13mm | Micrometer Head only |
| 50 - 200mm | **141-205 / 141-211*** | 13mm | with 3 rods |
| 50 - 300mm | **141-206 / 141-212*** | 13mm | with 5 rods |
| 200 - 225mm | **141-009 / 141-011*** | 25mm | Micrometer Head only |
| 200 - 500mm | **141-117** | 25mm | with 3 rods |
| 200 - 1000mm | **141-118** | 25mm | with 8 rods |

*with carbide-tipped face

**Inch**

| Range | Order No. | Travel of micrometer head | Remarks |
|---|---|---|---|
| 1" - 1.25" | **141-002 / 141-004*** | .25" | Micrometer Head only |
| 1" - 2" | **141-102 / 141-104*** | .25" | with 2 rods |
| 2" - 2.5" | **141-026 / 141-028*** | .5" | Micrometer Head only |
| 2" - 8" | **141-208 / 141-214*** | .5" | with 3 rods |
| 2" - 12" | **141-233 / 141-215*** | .5" | with 5 rods |
| 8" - 9" | **141-010 / 141-012*** | 1" | Micrometer Head only |
| 8" - 20" | **141-121** | 1" | with 3 rods |
| 8" - 40" | **141-122** | 1" | with 8 rods |

*with carbide-tipped face



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# Digimatic Tubular Inside Micrometers

## SERIES 337 — Extension-Rod Type / SERIES 339 — Extension-Pipe Type

## FEATURES

- Wide range of ID measurements by combining extension rods (pipes) and anvils with the micrometer head.
- The 339 Series uses highly durable extension pipes.
- Carbide-tipped measuring faces.
- Supplied in wooden case.



337-303



339-304

**Metric** Extension-rod type

| Range | Order No. | Travel of micrometer head | Extension rods |
|---|---|---|---|
| 200 - 225mm | **337-101** | 25mm | Micrometer Head only |
| 200 - 1000mm | **337-301** | 25mm | 25mm, 50mm, 100mm (2 pcs.), 200mm , 300mm |
| 200 - 1500mm | **337-302** | 25mm | 25mm, 50mm, 100mm, 200mm, 300mm (3 pcs.) |

**Inch/Metric** Extension-rod type

| Range | Order No. | Travel of micrometer head | Extension rods |
|---|---|---|---|
| 8 - 9" / 203.2 - 228.6mm | **337-102** | 1" | Micrometer Head only |
| 8 - 40" / 203.2 - 1016mm | **337-303** | 1" | 1", 2", 4" (2 pcs.), 8", 12" |
| 8 - 60" / 203.2 - 1524mm | **337-304** | 1" | 1", 2", 4", 8", 12" (3 pcs.) |

**Metric** Extension-pipe type

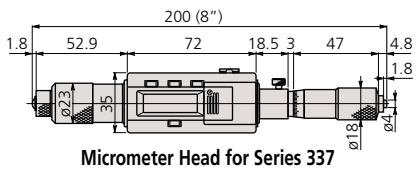
| Range | Order No. | Travel of micrometer head | Extension pipes |
|---|---|---|---|
| 200 - 225mm | **339-101** | 25mm | Micrometer Head only |
| 200 - 1000mm | **339-301** | 25mm | 25mm, 50mm, 100mm, 200mm, 400mm |
| 200 - 2000mm | **339-302** | 25mm | 25mm, 50mm, 100mm, 200mm (2 pcs.), 400mm (3 pcs.) |

**Inch/Metric** Extension-pipe type

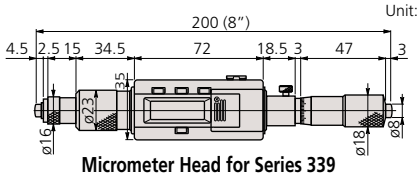
| Range | Order No. | Travel of micrometer head | Extension pipes |
|---|---|---|---|
| 8 - 9" / 203.2 - 228.6mm | **339-102** | 1" | Micrometer Head only |
| 8 - 40" / 203.2 - 1016mm | **339-303** | 1" | 1", 2", 4", 8" , 16" |
| 8 - 80" / 203.2 - 2000mm | **339-304** | 1" | 1", 2", 4", 8" (2 pcs.), 16" (3 pcs.) |

## DIMENSIONS

Unit: mm




Micrometer Head for Series 337




Micrometer Head for Series 339

( ): Inch heads

## Technical Data

Metric Model

Accuracy: ±(3+n+L/50)µm
L=Maximum measuring length (mm)
Fraction rounded up
n=Number of rods
Excluding quantizing error

Inch Model

Accuracy: ±{.00015+.00005n+.00005R*/2}"
R=Maximum measuring length (inch)
n=Number of rods
Fraction rounded up

Resolution: 0.001mm or .0001"/0.001mm
Display: LCD
Battery: SR44 (1 pcs.), **938882**
Battery life: Approx. 8 months under normal use

## Function

Zero/ABS, Data hold, Data output, Preset, inch/mm conversion (inch/mm models)
Alarm: Low voltage, Counting value composition error

## Optional Accessories

**05CZA662**: SPC cable (1m)
**05CZA663**: SPC cable (2m)
– – – – : Setting ring (See page C-29.)



# Tubular Inside Micrometers

## SERIES 137 — Extension-Rod Type

### FEATURES

- Wide range of ID measurements by combining extension rods (pipes) and anvils with the micrometer head.
- Carbide-tipped measuring faces are available.
- Supplied in fitted plastic case except 1500 mm / 60″ come in wooden case.



137-011



137-205

### Technical Data

Metric Model
Accuracy: ±(3+n+L/50)µm
L=Maximum measuring length (mm)
n=Number of rods
Fraction rounded up

Inch Model
Accuracy: ±{.00015+.00005n+.00005R*/2}"
R=Maximum measuring length (inch)
n=Number of rods
Fraction rounded up

Graduation: 0.01mm or .001"

### Optional Accessories

– – – – : Setting ring (See page C-29.)

### SPECIFICATIONS

**Metric** Extension-rod type

| Range | Order No. | Travel of micrometer head | Extension rods |
|---|---|---|---|
| 50 - 63mm | **137-011 / 137-013*** | 13mm | Micrometer Head only |
| 50 - 150mm | **137-201 / 137-206*** | 13mm | 13mm, 25mm, 50mm |
| 50 - 300mm | **137-202 / 137-207*** | 13mm | 13mm, 25mm, 50mm (2 pcs.), 100mm |
| 50 - 500mm | **137-203 / 137-208*** | 13mm | 13mm, 25mm, 50mm (2 pcs.), 100mm, 200mm |
| 50 - 1000mm | **137-204 / 137-209*** | 13mm | 13mm, 25mm, 50mm (2 pcs.), 100mm, 200mm (2 pcs.), 300mm |
| 50 - 1500mm | **137-205 / 137-210*** | 13mm | 13mm, 25mm, 50mm (2 pcs.), 100mm, 200mm (3pcs.), 300mm (2 pcs.) |

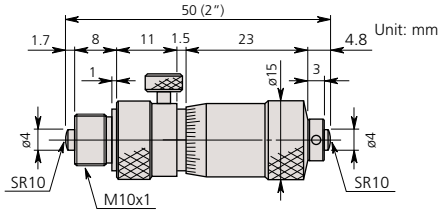
*with carbide-tipped face

**Inch** Extension-rod type

| Range | Order No. | Travel of micrometer head | Extension rods |
|---|---|---|---|
| 2" - 2.5" | **137-012 / 137-014*** | .5" | Micrometer Head only |
| 2" - 6" | **137-211 / 137-216*** | .5" | .5", 1", 2" |
| 2" - 12" | **137-212 / 137-217*** | .5" | .5", 1", 2" (2 pcs.), 4" |
| 2" - 20" | **137-213 / 137-218*** | .5" | .5", 1", 2" (2 pcs.), 4", 8" |
| 2" - 40" | **137-214 / 137-219*** | .5" | .5", 1", 2" (2 pcs.), 4", 8" (2 pcs.), 12" |
| 2" - 60" | **137-215 / 137-220*** | .5" | .5", 1", 2" (2 pcs.), 4", 8" (3 pcs.), 12" (2 pcs.) |

*with carbide-tipped face

### DIMENSIONS




137-011 / 137-012 / 137-013 / 137-014



Mitutoyo

# Tubular Inside Micrometers

## SERIES 139 — Extension-Pipe Type

### FEATURES

- Wide range of ID measurements by combining extension pipes and anvils with the micrometer head.
- Supplied in fitted wooden case, except 500 mm / 20″ which comes in plastic case.



139-177

**Metric** Extension-pipe type

| Range | Order No. | Travel of micrometer head | Extension pipes |
|---|---|---|---|
| 100 - 125mm | **139-001** | 25mm | Micrometer Head only |
| 100 - 500mm | **139-173** | 25mm | 25mm, 50mm, 100mm, 200mm |
| 100 - 900mm | **139-174** | 25mm | 25mm, 50mm, 100mm, 200mm, 400mm |
| 100 - 1300mm | **139-175** | 25mm | 25mm, 50mm, 100mm, 200mm, 400mm (2 pcs.) |
| 100 - 1700mm | **139-176** | 25mm | 25mm, 50mm, 100mm, 200mm, 400mm (3 pcs.) |
| 100 - 2100mm | **139-177** | 25mm | 25mm, 50mm, 100mm, 200mm, 400mm (4 pcs.) |

**Inch** Extension-pipe type

| Range | Order No. | Travel of micrometer head | Extension pipes |
|---|---|---|---|
| 4" - 5" | **139-002** | 1" | Micrometer Head only |
| 4" - 20" | **139-178** | 1" | 1", 2", 4", 8" |
| 4" - 36" | **139-179** | 1" | 1", 2", 4", 8", 16" |
| 4" - 52" | **139-180** | 1" | 1", 2", 4", 8", 16" (2 pcs.) |
| 4" - 68" | **139-181** | 1" | 1", 2", 4", 8", 16" (3 pcs.) |
| 4" - 84" | **139-182** | 1" | 1", 2", 4", 8", 16" (4 pcs.) |



139-201

**Inch** Extension-pipe type

| Range | Order No. | Travel of micrometer head | Extension pipes | Remarks |
|---|---|---|---|---|
| 1.5 - 2″ | **139-004** | .5" | Micrometer Head only | — |
| 4 - 5″ | **139-006** | 1" | Micrometer Head only | — |
| 1.5 - 12″ | **139-201** | .5" | .5″, 1", 2", 2.5″, 3″, 3.5″, 4", 6" | Includes **139-004** |
| 4 - 40″ | **139-202** | 1" | 1", 2", 3", 6", 9", 12", 14", 16", 17", 19″ | Includes **139-006** |

### Technical Data

Metric Model
Accuracy:
- Series 139: ±(3+n+L/50)µm
  L=Maximum measuring length (mm)
  n=number of rods
  Fraction rounded up

Inch Model
Accuracy:
- Series 139: ±{.00015+.00005n+.00005R*/2}"
  R=Maximum measuring length (inch)
  n=number of rods
  Fraction rounded up

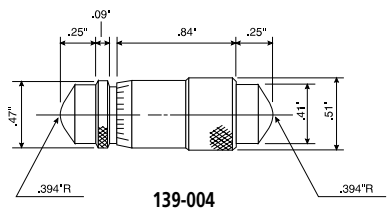
Graduation: 0.01mm or .001"
Measurement error of micrometer head: ±3µm

### Optional Accessories

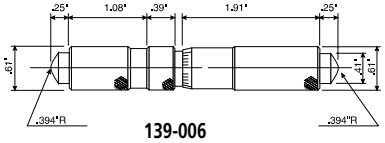
– – – – : Setting ring (See page C-29.)

### DIMENSIONS

Unit: inch

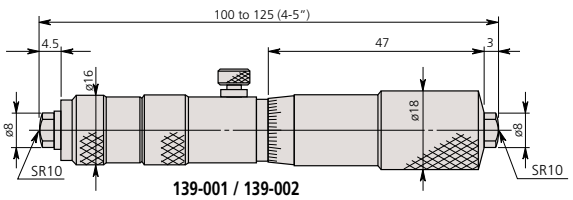



139-004




139-006

Unit: mm




139-001 / 139-002

# Tubular Inside Micrometers

## SERIES 140 — Extension-Pipe Type

### Technical Data

Metric Model
Accuracy: ±(3+n+L/50)µm
n=Number of rod,
L=Maximum measuring length (mm),
Fraction rounded up

Inch Model
Accuracy: ±{.00015+.00005n+.00005R*/2}"
n=Number of rod
R=Maximum measuring length (inch)
Fraction rounded up

Graduation: 0.01mm or .001"

### Optional Accessories

– – – – : Setting ring (See page C-29.)

### FEATURES

- Wide range of ID measurements by combining extension rods (pipes) and anvils with the micrometer head.
- The Series 140 use highly durable/ large-diameter extension pipes.
- Supplied in fitted wooden case.

**Metric** Extension-pipe type

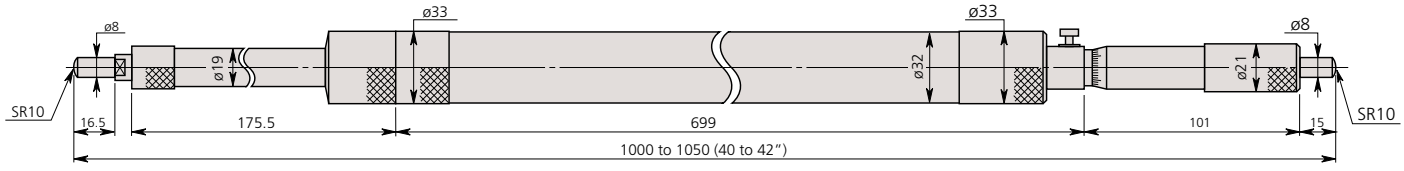
| Range | Order No. | Travel of micrometer head | Extension pipes |
|---|---|---|---|
| 1000 - 2000mm | **140-157** | 50mm | 50mm, 100mm (2 pcs.), 200mm, 500mm |
| 1000 - 3000mm | **140-158** | 50mm | 50mm, 100mm (2 pcs.), 200mm, 500mm, 1000mm |
| 1000 - 4000mm | **140-159** | 50mm | 50mm, 100mm (2 pcs.), 200mm, 500mm, 1000mm (2 pcs.) |
| 1000 - 5000mm | **140-160** | 50mm | 50mm, 100mm (2 pcs.), 200mm, 500mm, 1000mm (3 pcs.) |

**Inch** Extension-pipe type

| Range | Order No. | Travel of micrometer head | Extension pipes |
|---|---|---|---|
| 40" - 80" | **140-161** | 2" | 2", 4" (2 pcs.), 8", 20" |
| 40" - 120" | **140-162** | 2" | 2", 4" (2 pcs.), 8", 20", 40" |
| 40" - 160" | **140-163** | 2" | 2", 4" (2 pcs.), 8", 20", 40" (2 pcs.) |
| 40" - 200" | **140-164** | 2" | 2", 4" (2 pcs.), 8", 20", 40" (3 pcs.) |

### DIMENSIONS

Unit: mm




**Micrometer Head for Series 140**



Mitutoyo

# Inside Micrometers

## SERIES 345, 145 — Caliper Type

### FEATURES

- Caliper-type jaws are made of high-grade, tool steel.
- Locking clamp for positive locking of spindle.
- Non-slip grip finish (digital models)
- Satin-chrome finished.
- A special holder is available to be used with Mitutoyo micrometer stand.
- Supplied in fitted plastic case. Over 175mm / 4" supplied in wooden case.



345-350-30



145-193



145-187

### SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy |
|---|---|---|
| 5 - 30mm | **345-250-30** | ±5µm |
| 25 - 50mm | **345-251-30** | ±6µm |

**Inch/Metric** Digital model

| Range | Order No. | Accuracy |
|---|---|---|
| .2 - 1.2" / 5-30mm | **345-350-30** | ±.00025" |
| 1 - 2" / 25-50mm | **345-351-30** | ±.0003" |

**Metric**

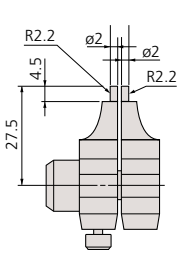
| Range | Order No. | Accuracy |
|---|---|---|
| 5 - 30mm | **145-185** | ±5µm |
| 25 - 50mm | **145-186** | ±6µm |
| 50 - 75mm | **145-187** | ±7µm |
| 75 - 100mm | **145-188** | ±8µm |
| 100 - 125mm | **145-189** | ±9µm |
| 125 - 150mm | **145-190** | ±9µm |
| 150 - 175mm | **145-191** | ±10µm |
| 175 - 200mm | **145-192** | ±10µm |
| 200 - 225mm | **145-217** | ±11µm |
| 225 - 250mm | **145-218** | ±11µm |
| 250 - 275mm | **145-219** | ±12µm |
| 275 - 300mm | **145-220** | ±12µm |

**Inch**

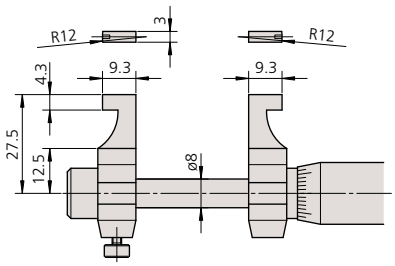
| Range | Order No. | Accuracy |
|---|---|---|
| .2 - 1.2" | **145-193** | ±.00025" |
| 1 - 2" | **145-194** | ±.0003" |
| 2 - 3" | **145-195** | ±.00035" |
| 3 - 4" | **145-196** | ±.0004" |

### DIMENSIONS

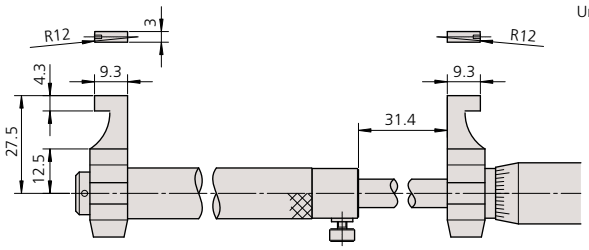
Unit: mm




145-185 / 145-193




145-186 / 145-194




Over 50mm / 2" Models.

### Technical Data

Accuracy: Refer to the list of specifications. (excluding quantizing error for digital models)
Resolution*: 0.01mm or .00005"/0.001mm
Graduation**: 0.01mm or .001"
Measuring faces: Carbide tipped
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
*Digital models **Analog models

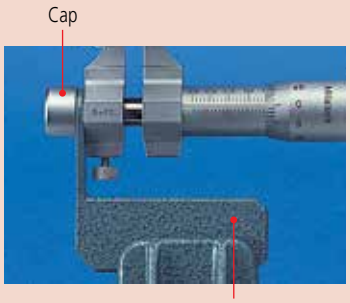
### Function of Digital Model

Origin-set, Zero-setting, Data hold, Data output, inch/mm conversion (inch/mm models)
Function Lock, 2 Presets
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA662**: SPC cable with data switch 1m / 40"
**05CZA663**: SPC cable with data switch 2m / 80"
**– – – – –**: Setting ring (See page C-29.)
**300401**: Cap for stand holder
**300400**: Stand holder





# Inside Micro Checker

## SERIES 515

## FEATURES

- The Inside Micro Checker is designed to efficiently check the zero point of a tubular inside micrometer.
- Each measuring block is made of zirconia-based ceramic and is free from deterioration and dimensional changes over time.




515-585



Standard accessory

## Technical Data

Block pitch accuracy: ±(1+L/150)µm
L= Length to check (mm)

## Standard Accessories

**611671-02**: Auxiliary Block (10mm)
**940286**: Clamping element with V-rest
**602195**: Spacer (for ø8mm measuring anvil)

## Optional Accessories

**602160**: Wooden case for 300mm Inside Micro Checker
**602163**: Wooden case for 600mm Inside Micro Checker

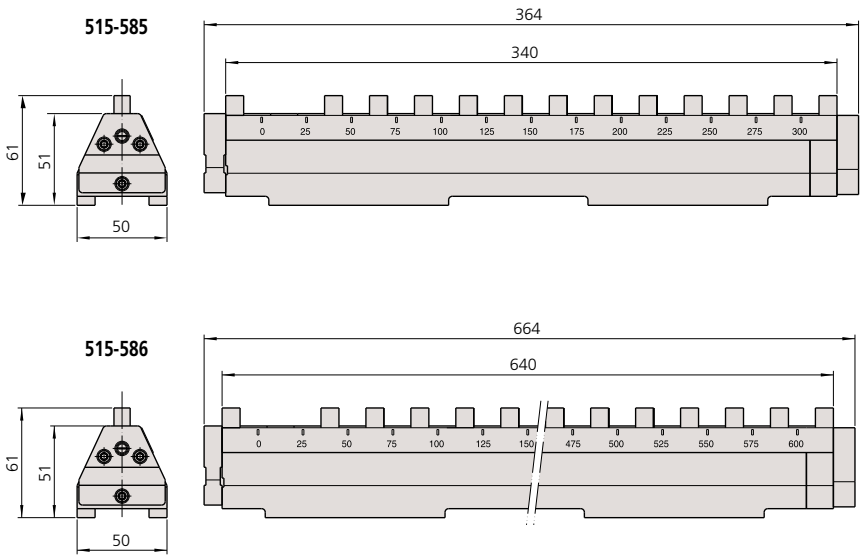



## SPECIFICATIONS

| Range | Order No. | Length to check |
|---|---|---|
| 300mm | **515-585** | 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275, 300mm |
| 600mm | **515-586** | 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275, 300, 325, 350, 375, 400, 425, 450, 475, 500, 525, 550, 575, 600mm |

## DIMENSIONS

Unit: mm



# Bore Gages

## SERIES 511 — for Small Holes

### FEATURES

- Interchangeable anvils are made of alloy steel.
- The dial indicator is fully protected by a rugged cover.

### SPECIFICATIONS

**Metric** Gage Stem ø 8mm

| Measuring Range | Order No. Without Dial Gage | Order No. With 2046SB Graduation 0.01mm | Order No. With 2109SB-10 Graduation 0.001mm | Number of Anvils | Number of Spacers |
|---|---|---|---|---|---|
| 6 - 10mm | **511-209*** | **511-211** | **511-210** | 9 | 1 |
| 10 - 18.5mm | **511-201*** | **511-204** | **511-203** | 9 | 1 |

*Does not come with Dial Gage Protector Cover ( 21DZA000 )

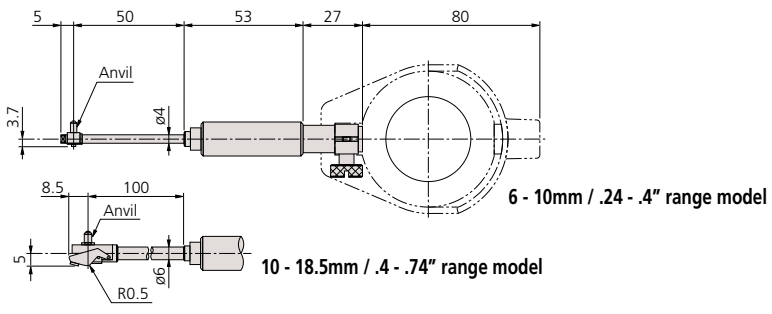
**Inch** Gage Stem Dia .375″

| Measuring Range | Order No. Without Dial Gage | Order No. With 2922SB Graduation .0005″ | Order No. With 2923SB-10 Graduation .0001" | Number of Anvils | Number of Spacers |
|---|---|---|---|---|---|
| .24 - .4″ | **511-214*** | **511-213** | **511-212** | 9 | 1 |
| .4 - .74″ | **511-205*** | **511-207** | **511-206** | 9 | 1 |

*Does not come with Dial Gage Protector Cover ( 21DZA000 )

### DIMENSIONS

Unit: mm






**511-204**

### Technical Data

Accuracy: 5µm / .0002″
Indication stability: 2µm / .00008″
Graduation: 0.01mm, 0.001mm, .0005″ or .0001"

### Measuring Heads



**6 - 10mm**
**.24 - .4″**



**10 - 18.5mm**
**.4 - .74″**

### Optional Accessories

**21DZA000**: Dial Gage Protector Cover
– – – – : Setting ring (See page C-29.)

# Bore Gages

## SERIES 511—Standard Type



511-743

Mitutoyo offers a complete selection of bore gages, all of them with interchangeable anvils and necessary accessories to perform close tolerance ID measurements.

### FEATURES

- Carbide-tipped contact points for durability.
- The dial indicator is fully protected by a rugged cover.
- Optional extension rods can be attached for measuring deep holes.

### SPECIFICATIONS

**Inch** Gage Stem ø 3/8"

| Measuring Range | Order No. Without Indicator | Order No. With 2922SB Graduation .0005" | Order No. With 2923SB-10 Graduation .0001" | Number of Anvils | Number of Spacers |
|---|---|---|---|---|---|
| .7 - 1.4" | **511-731*** | **511-741** | **511-751** | 9 | 2 |
| 1.4 -2.5" | **511-732*** | **511-742** | **511-752** | 6 | 4 |
| 2.0 - 6.0" | **511-733*** | **511-743** | **511-753** | 11 (2" sub anvil) | 4 |
| 4.0 - 6.5" | **511-734*** | **511-744** | **511-754** | 13 | 4 |
| 6.5 - 10" | **511-735*** | **511-745** | **511-755** | 6 | 7 |
| 10 16" | **511-736*** | **511-746** | **511-756** | 5 (3" sub anvil) | 7 |
| .7 - 6" | — | **511-931** | **511-932** | 26 (2" sub anvil) | 10 |

*Does not come with Dial Gage Protector Cover ( 21DZA000 )

**Metric** Gage Stem ø 8mm

| Measuring Range | Order No. Without Indicator | Order No. With 2046SB Graduation 0.01mm | Order No. With 2109SB-10 Graduation 0.001mm | Number of Anvils | Number of Spacers |
|---|---|---|---|---|---|
| 18 - 35mm | **511-701*** | **511-711** | **511-721** | 9 | 2 |
| 35 - 60mm | **511-702*** | **511-712** | **511-722** | 6 | 4 |
| 50 - 150mm | **511-703*** | **511-713** | **511-723** | 11 (50mm Sub Anvil) | 4 |
| 100 - 160mm | **511-704*** | **511-714** | **511-724** | 13 | 4 |
| 160 - 250mm | **511-705*** | **511-715** | **511-725** | 6 | 7 |
| 250 - 400mm | **511-706*** | **511-716** | **511-726** | 5 (75mm Sub Anvil) | 7 |
| 18 - 150mm | — | **511-921 (3 pc set)** | **511-922 (3 pc set)** | 26 (50mm Sub Anvil) | 10 |

*Does not come with Dial Gage Protector Cover ( 21DZA000 )

### Technical Data

Accuracy: 2µm / .00008"
Indication stability: 1µm / .00004"
Graduation: 0.01mm, 0.001mm, .0005" or .0001"



511-712



Mitutoyo

## Contact Point



18 - 35mm / .7 - 1.4″



35 - 60mm / 1.4 - 2.5″



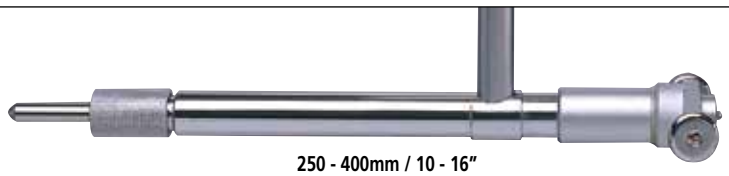
50 - 100mm / 2 - 4″



100 - 160mm / 4 - 6″



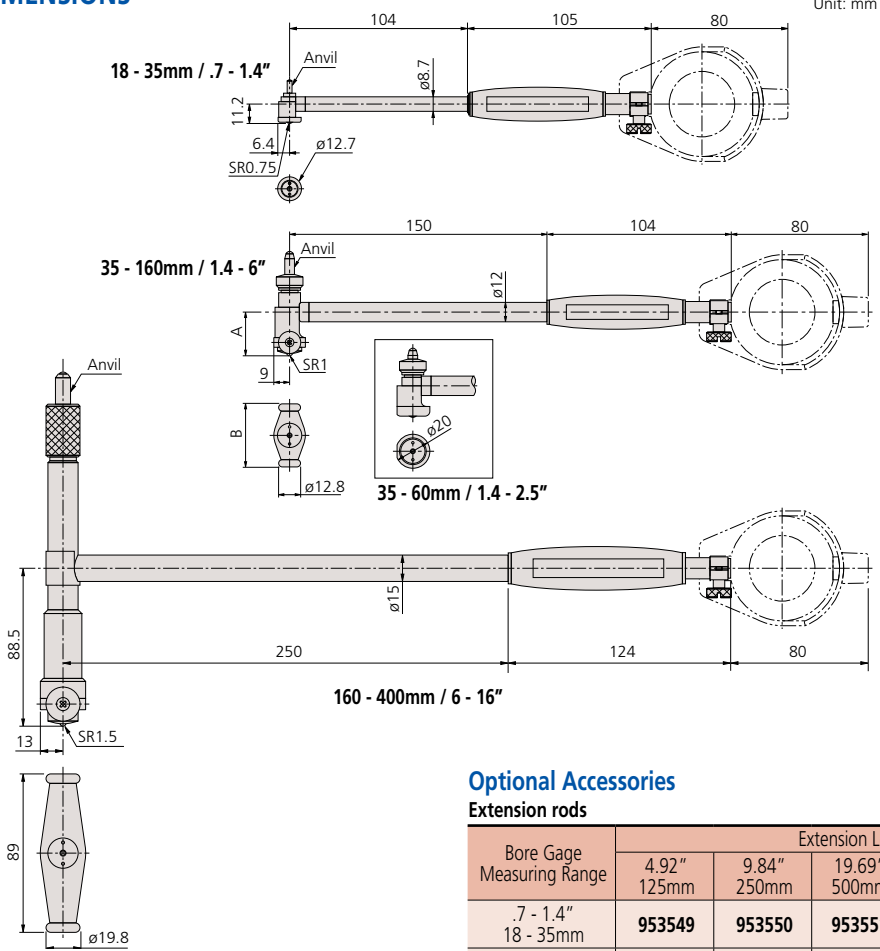
160 - 250mm / 6 - 10″

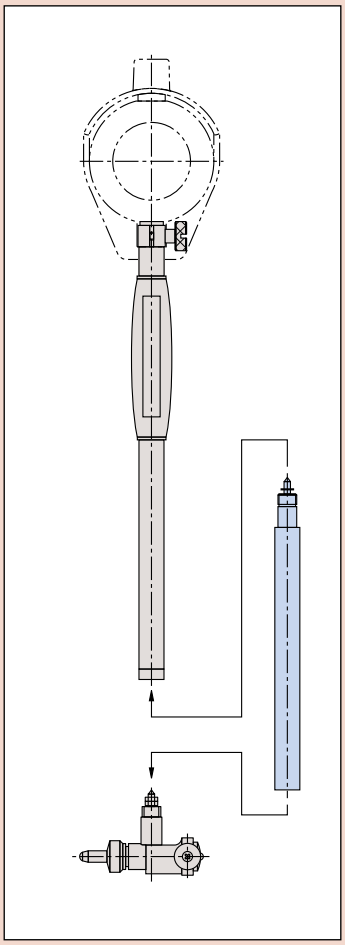


250 - 400mm / 10 - 16″

## DIMENSIONS

Unit: mm



Setting ring (See page C-29.)

## Optional Accessories

**Extension rods**

| Bore Gage Measuring Range | Extension Length | | | | | Rod Diameter | Spanner |
|---|---|---|---|---|---|---|---|
| | 4.92″ 125mm | 9.84″ 250mm | 19.69″ 500mm | 29.53″ 750mm | 39.37″ 1000mm | | |
| .7 - 1.4″ 18 - 35mm | **953549** | **953550** | **953551** | - | - | .34" 8.7mm | 102148 |
| 1.4 - 6.5″ 35 - 160mm | **953552** | **953553** | **953554** | **953555** | **953556** | .47" 12mm | 212556 |
| 6.5 - 16″ 160 - 400mm | **953557** | **952361** | **953558** | **953559** | **953560** | .59″ 15mm | 212556 |

Note: Above list is used for 511-1XX series; not available for 511-2XX Series.

# Bore Gages

## SERIES 511 — Short-Leg Type

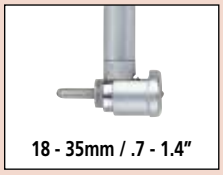


511-786

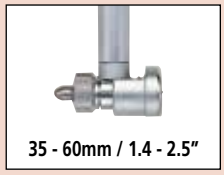
### Technical Data

Accuracy: 2µm / .00008″
Indication stability: 1µm / .00004″
Graduation: 0.01mm, 0.001mm, .0005″ or .0001″

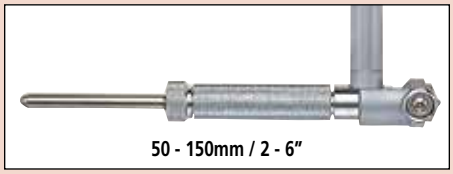
### Contact Point



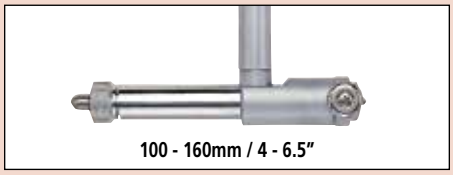
18 - 35mm / .7 - 1.4″



35 - 60mm / 1.4 - 2.5″



50 - 150mm / 2 - 6″



100 - 160mm / 4 - 6.5″

### Optional Accessories

– – – – : Setting ring (See page C-29.)

### FEATURES

- Compact and lightweight because of the short length below the grip.
- Carbide-tipped contact point for durability.

### SPECIFICATIONS

**Inch** Gage Stem ø 3/8″

| Measuring Range | Order No. With 2922SB Graduation .0005" | Order No. With 2923SB-10 Graduation .0001" | Number of Anvils | Number of Spacers |
|---|---|---|---|---|
| .7 - 1.4" | **511-786** | **511-791** | 9 | 2 |
| 1.4 - 2.5" | **511-787** | **511-792** | 6 | 4 |
| 2.0 - 6.0" | **511-788** | **511-793** | 11 (2" sub anvil) | 4 |
| 4.0 - 6.5" | **511-789** | **511-794** | 13 | 4 |

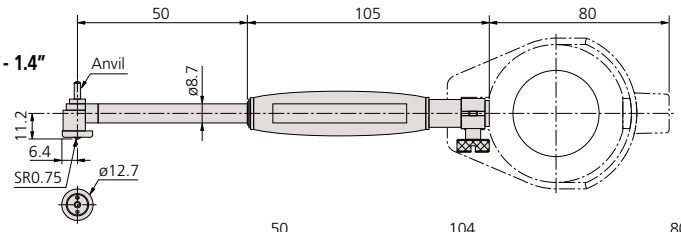
**Metric** Gage Stem ø 8mm

| Measuring Range | Order No. With 2046SB Graduation 0.01mm | Order No. With 2109SB-10 Graduation 0.001mm | Number of Anvils | Number of Spacers |
|---|---|---|---|---|
| 18 - 35mm | **511-766** | **511-771** | 9 | 2 |
| 35 - 60mm | **511-767** | **511-772** | 6 | 4 |
| 50 - 150mm | **511-768** | **511-773** | 11 (50mm Sub Anvil) | 4 |
| 100 - 160mm | **511-769** | **511-774** | 13 | 4 |

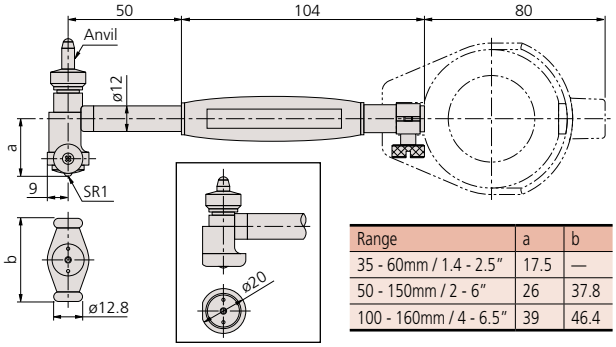
### DIMENSIONS

Unit: mm

**18 - 35mm / .7 - 1.4″**




**35 - 60mm / 1.4 - 2.5″**
**50 - 150mm / 2 - 6″**
**100 - 160mm / 4 - 6.5″**




| Range | a | b |
|---|---|---|
| 35 - 60mm / 1.4 - 2.5″ | 17.5 | — |
| 50 - 150mm / 2 - 6″ | 26 | 37.8 |
| 100 - 160mm / 4 - 6.5″ | 39 | 46.4 |



Mitutoyo

# Bore Gages

## SERIES 511 — for Blind Holes

### FEATURES

- Measure ID at position close to the bottom of blind holes.
- Carbide-contact point ensures high durability and wear resistance.
- Grip is large and hollow to reduce effect of body heat on high-accuracy measurements.



511-426



511-426

### SPECIFICATIONS

**Metric** Gage Stem ø 8mm

| Measuring Range | **Order No.** Without Dial Gage | **Order No.** With 2046SB Graduation 0.01mm | **Order No.** With 2109SB-10 Graduation 0.001mm | Number of Anvils | Number of Spacers |
|---|---|---|---|---|---|
| 15 - 35mm | **511-415*** | **511-425** | **511-435** | 11<br>10mm Sub-Anvil | 1 |
| 35 - 60mm | **511-416*** | **511-426** | **511-436** | 6 | 4 |
| 50 - 150mm | **511-417*** | **511-427** | **511-437** | 11<br>50mm Sub-Anvil | 4 |

*Does not come with Dial Gage Protector Cover (21DZA000)

**Inch** Gage Stem Dia. .375″

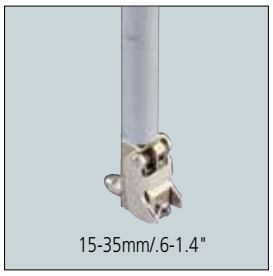
| Measuring Range | **Order No.** Without Dial Gage | **Order No.** With 2922SB Graduation .0005" | **Order No.** With 2923SB-10 Graduation .0001" | Number of Anvils | Number of Spacers |
|---|---|---|---|---|---|
| .6 - 1.4" | **511-418*** | **511-428** | **511-438** | 11<br>.4" Sub-Anvil | 1 |
| 1.4 - 2.4" | **511-419*** | **511-429** | **511-439** | 6 | 4 |
| 2 - 6" | **511-420*** | **511-430** | **511-440** | 11<br>2" Sub-Anvil | 4 |

*Does not come with Dial Gage Protector Cover (21DZA000)

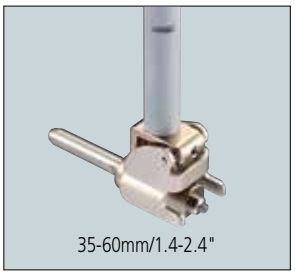
### Technical Data

Accuracy: 4µm/.00016″
Indication stability: 1µm/.0004″
Graduation: 0.01mm, 0.001mm, .0005″ or .0001"

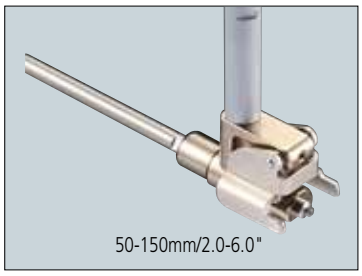
### Contact Points



15-35mm/.6-1.4"

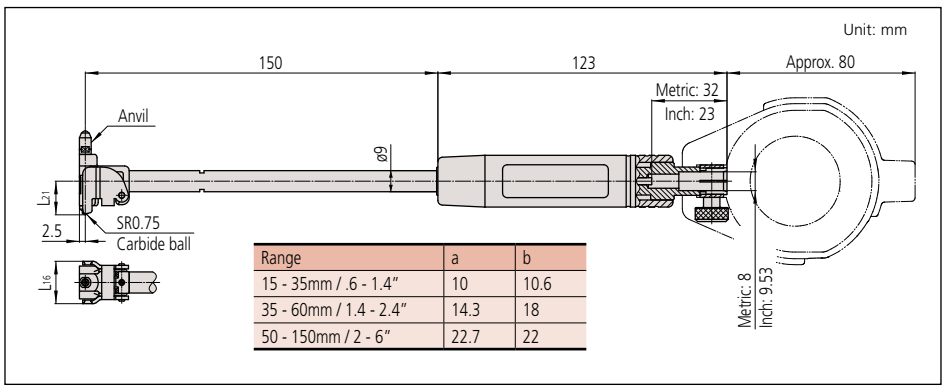


35-60mm/1.4-2.4"

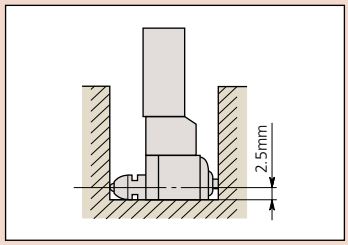


50-150mm/2.0-6.0"

### DIMENSIONS




| Range | a | b |
|---|---|---|
| 15 - 35mm / .6 - 1.4″ | 10 | 10.6 |
| 35 - 60mm / 1.4 - 2.4″ | 14.3 | 18 |
| 50 - 150mm / 2 - 6″ | 22.7 | 22 |




### Optional Accessories

– – – – : Setting ring (See page C-29.)




# Bore Gages

## SERIES 511 — with Micrometer Head

### FEATURES

- Interchangeable anvil is attached to a micrometer head for accurate dimensional setting.
- Wide measuring range with sub-anvils.
- Carbide ball contact point for durability.
- Extension rods (optional) can be attached for measuring deep holes.
- Optional setting rings offer the best method of zero-setting bore gages.

### SPECIFICATIONS

**Inch** Gage Stem ø 3/8″

| Measuring Range | Order No. Without Indicator | Order No. With 2922SB Graduation .0005" | Order No. With 2923SB-10 Graduation .0001" | Mic Head Travel | Sub Anvil |
|---|---|---|---|---|---|
| 2.4 - 4.0″ | **511-833*** | **511-843** | **511-853** | .4" | .4", .8" |
| 4.0 - 6.4″ | **511-834*** | **511-844** | **511-854** | .5" | .4", .8",.8" |
| 6.0 - 10″ | **511-835*** | **511-845** | **511-855** | .5" | .4", .8", .8", 2" |
| 10 - 16″ | **511-836*** | **511-846** | **511-856** | 1" | 1", 2", 2" |
| 16 - 24″ | **511-837*** | **511-847** | **511-857** | 2" | 2", 4" |
| 24 - 32″ | **511-838*** | **511-848** | **511-858** | 2" | 2", 4" |

*Does not come with Dial Gage Protector Cover ( 21DZA000 )

**Metric** Gage Stem ø 8mm

| Measuring Range | Order No. Without Indicator | Order No. With 2046SB Graduation 0.01mm | Order No. With 2109SB-10 Graduation 0.001mm | Mic Head Travel | Sub Anvil |
|---|---|---|---|---|---|
| 60 - 100mm | **511-803*** | **511-813** | **511-823** | 10mm | 10mm, 20mm |
| 100 - 160mm | **511-804*** | **511-814** | **511-824** | 13mm | 10mm, 20mm, 20mm |
| 150 - 250mm | **511-805*** | **511-815** | **511-825** | 13mm | 10mm, 20mm, 20mm, 50mm |
| 250 - 400mm | **511-806*** | **511-816** | **511-826** | 25mm | 25mm, 50mm, 50mm |
| 400 - 600mm | **511-807*** | **511-817** | **511-827** | 50mm | 50mm, 100mm |
| 600 - 800mm | **511-808*** | **511-818** | **511-828** | 50mm | 50mm,100mm |

*Does not come with Dial Gage Protector Cover ( 21DZA000 )

### Technical Data

Accuracy: 2µm / .00008″
Indication stability: 1µm / .00004″
Graduation: 0.01mm, 0.001mm, .0005″ or .0001"

### Optional Accessories

**Extension rods**

| Bore Gage Measuring Range | Extension Length | | | | | Rod Diameter | Spanner |
|---|---|---|---|---|---|---|---|
| | 4.92″ 125mm | 9.84″ 250mm | 19.69″ 500mm | 29.53″ 750mm | 39.37″ 1000mm | | |
| 2.4-6.4″ 60 - 160mm | **953552** | **953553** | **953554** | **953555** | **953556** | .47" 12mm | 212556 |
| 6.0 - 32.0″ 150-800mm | **953557** | **952361** | **953558** | **953559** | **953560** | .59″ 15mm | 212556 |

Note: Not available for 511-2XX Series.



Mitutoyo

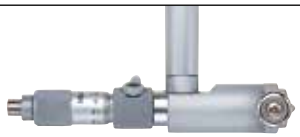
**Contact Point**



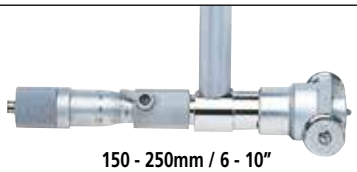
35 - 60mm / 1.4 - 2.5”



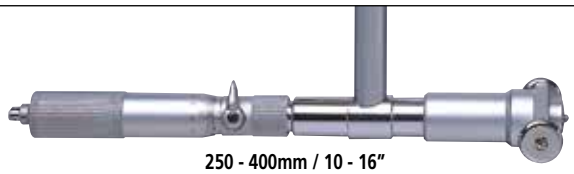
60 - 100mm / 2.4 - 4”



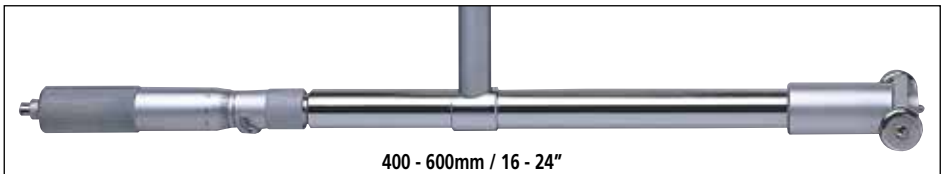
100 - 160mm / 4 - 6”



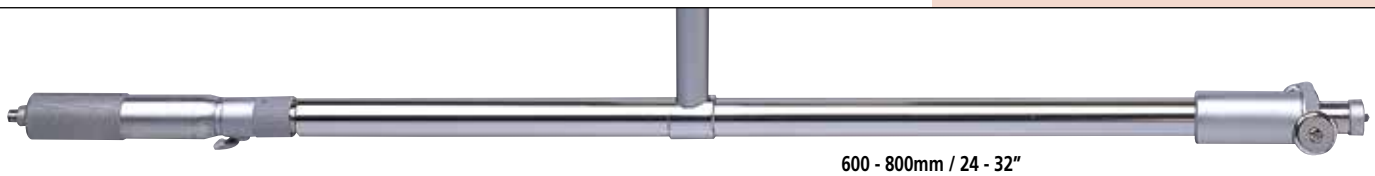
150 - 250mm / 6 - 10”



250 - 400mm / 10 - 16”



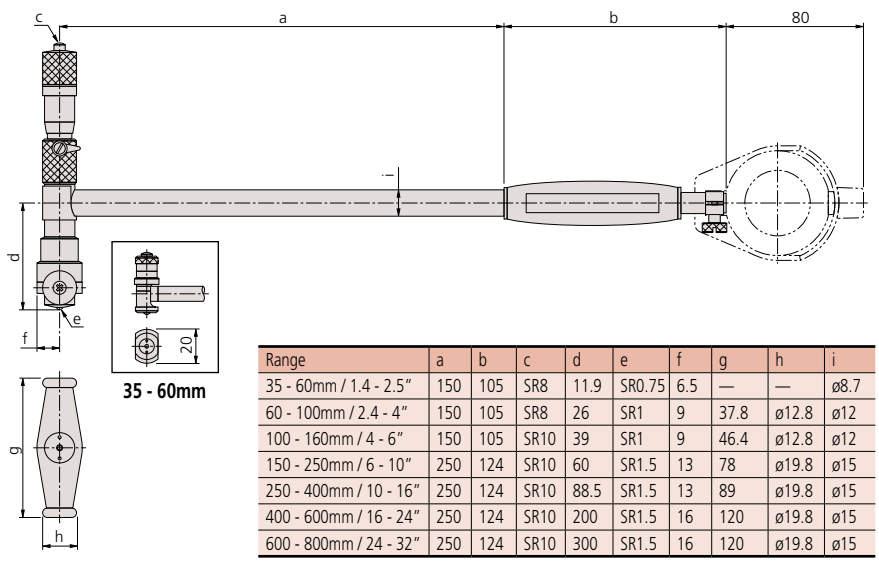
400 - 600mm / 16 - 24”



600 - 800mm / 24 - 32”

## DIMENSIONS

Unit: mm




| Range | a | b | c | d | e | f | g | h | i |
|---|---|---|---|---|---|---|---|---|---|
| 35 - 60mm / 1.4 - 2.5” | 150 | 105 | SR8 | 11.9 | SR0.75 | 6.5 | — | — | ø8.7 |
| 60 - 100mm / 2.4 - 4” | 150 | 105 | SR8 | 26 | SR1 | 9 | 37.8 | ø12.8 | ø12 |
| 100 - 160mm / 4 - 6” | 150 | 105 | SR10 | 39 | SR1 | 9 | 46.4 | ø12.8 | ø12 |
| 150 - 250mm / 6 - 10” | 250 | 124 | SR10 | 60 | SR1.5 | 13 | 78 | ø19.8 | ø15 |
| 250 - 400mm / 10 - 16” | 250 | 124 | SR10 | 88.5 | SR1.5 | 13 | 89 | ø19.8 | ø15 |
| 400 - 600mm / 16 - 24” | 250 | 124 | SR10 | 200 | SR1.5 | 16 | 120 | ø19.8 | ø15 |
| 600 - 800mm / 24 - 32” | 250 | 124 | SR10 | 300 | SR1.5 | 16 | 120 | ø19.8 | ø15 |

# ABSOLUTE Digimatic Bore Gage

## SERIES 511

This ABSOLUTE Digimatic bore gage is exclusively designed for ID measurement.



511-521

## FEATURES

- The minimum value holding function provides the easy detection of hole diameter.




- Up to three sets of master value and upper/lower tolerance value can be memorized.
- An analog bar indicator is integrated to enhance the intuition in reading.
- Go/no-go judgment is performed by setting the upper and lower tolerances.
- Up to four rods (250mm or 500mm) can be used.

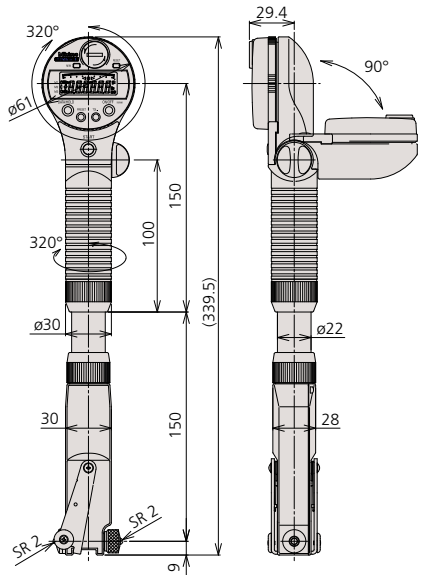
## SPECIFICATIONS

**Inch/Metric**

| Range | Order No. | Probe depth |
|---|---|---|
| 1.8 - 4" / 45 - 100mm | **511-521** | 6" (152.4mm) |
| 4 - 6.5" / 100 - 160mm | **511-522** | 6" (152.4mm) |

## DIMENSIONS AND MASS

Unit: mm




MASS: 500g

## Technical Data

Accuracy: Wide Range: 0.003mm / .00012"
Resolution: .00005" / 0.001mm
Display: LCD
Battery: SR44 (1 pc.) (**938882**)
Battery life: Approx. 9 months for normal use
Dust/Water protection level: Conforming to IP53

## Functions

Origin-set, Zero-Setting, Presetting, Power on/off, inch/mm conversion (inch/mm type only), Data output, go/no-go tolerance judgment
Alarm: Low battery voltage, scale contamination, over-flow error, tolerance limit setting error

## Optional Accessories

**21DZA089**: Extension rod 250 mm (10")
**21DZA081**: Extension rod 500 mm (20")
**516-118-10**: Origin setup metric rectangular gage block set
**516-119-10**: Origin setup metric square gage block set
**516-120-26**: GB calibration kit for series 511 bore gage. (9 pcs GB and plain jaw, 160mm holder)
**905338**: SPC cable (40" / 1m)
**905409**: SPC cable (80" / 2m)
– – – – : Setting ring (See page C-29.)



Origin setup gage block set



Example:
using four extension rods.

# Bore Gages

## SERIES 526 — for Extra Small Holes

These bore gages measure diameters of small holes. The radial displacement of split-ball contact is converted to axial displacement of measuring rod, which is shown on the dial indicator.

## FEATURES

- Optional stand (**215-120-10**) is available for efficient measurement of multiple small holes.

## SPECIFICATIONS

**Metric** Gage Stem ø 8mm

| Measuring Range | **Order No. Without Dial Gage** | **Order No.** With **2046SB** Graduation 0.01mm | **Order No.** With **2109SB-10** Graduation 0.001mm | Number of Anvils | Number of Needles | Probe depth (D) | Setting Rings |
|---|---|---|---|---|---|---|---|
| 0.95-1.55mm | **526-170-10*** | **526-173-10** | **526-172-10** | 5 | 1 | 11.5mm | - |
| 0.95-1.55mm | **526-170-11*** | **526-173-11** | **526-172-11** | 5 | 1 | 11.5mm | 5 |
| 1.5-3.95mm | **526-160-10*** | **526-163-10** | **526-162-10** | 9 | 2 | 17.5,22.5mm | - |
| 1.5-3.95mm | **526-160-11*** | **526-163-11** | **526-162-11** | 9 | 2 | 17.5,22.5mm | 9 |
| 3.7-7.3mm | **526-150-10*** | **526-153-10** | **526-152-10** | 7 | 1 | 32mm | - |
| 3.7-7.3mm | **526-150-11*** | **526-153-11** | **526-152-11** | 7 | 1 | 32mm | 7 |
| 7 - 10mm | **526-101*** | **526-126** | **526-124** | 6 | 1 | 56mm | |
| 10 - 18mm | **526-102*** | **526-127** | **526-125** | 8 | 1 | 62mm | |

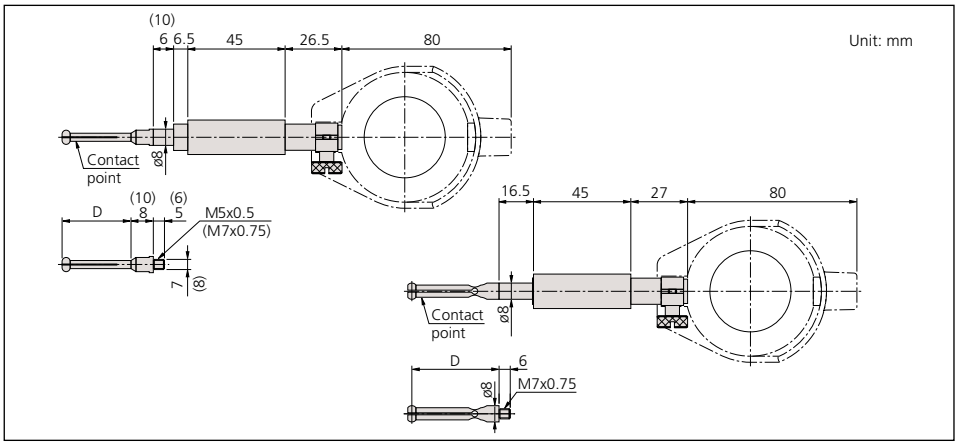
*Does not come with Dial Gage Protector (21DZA000)

**Inch** Gage Stem Dia .375″

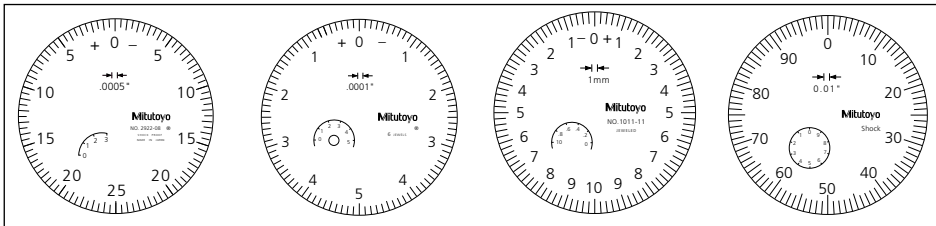
| Measuring Range | **Order No. Without Dial Gage** | **Order No.** With **2922SB** Graduation .0005" | **Order No.** With **2923SB-10** Graduation .0001" | Number of Anvils | Number of Needles | Probe depth (D) | Setting Rings |
|---|---|---|---|---|---|---|---|
| .037-.061" | **526-175-10*** | - | **526-176-10** | 5 | 1 | .453" | - |
| .037-.061" | **526-175-11*** | - | **526-176-11** | 5 | 1 | .453" | 5 |
| .059-.156" | **526-165-10*** | - | **526-166-10** | 9 | 2 | .689,.886" | - |
| .059-.156" | **526-165-11*** | - | **526-166-11** | 9 | 2 | .689,.886" | 9 |
| .146-.287" | **526-155-10*** | - | **526-156-10** | 7 | 1 | 1.26" | - |
| .146-.287" | **526-155-11*** | - | **526-156-11** | 7 | 1 | 1.26" | 7 |
| .3 - .4″ | **526-103*** | **526-119** | **526-122** | 6 | 1 | 2.2″ | |
| .4 - .7″ | **526-104*** | **526-120** | **526-123** | 8 | 1 | 2.4″ | |

*Does not come with Dial Gage Protector (21DZA000)

## DIMENSIONS




## DIAL FACES




**2922SB** .0005″ | **2923SB-10** .0001″ | **2109SB-10** 0.001mm | **2046SB** 0.01mm



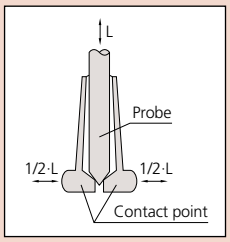
**526-172**

**526-127**

## Technical Data

Accuracy: 4µm / .00016″
Indication stability: 2µm / .00008″
Graduation: 0.01mm, 0.001mm, .0005″ or .00001"

### Contact Point




## Optional Accessory

**215-120-10**: Bore gage stand



– – – – : Setting ring (See page C-29.)



515-590

# Bore Gage Zero Checker

## SERIES 515

The Bore Gage Zero Checker allows easy zero adjustment of dial bore gages with ranges of 18mm (.7") through 400mm (16") using gage blocks.



### SPECIFICATIONS

| Order No. | Applicable range |
|---|---|
| 515-590 | 18 -400mm (.7" - 16") |

# Setting Rings

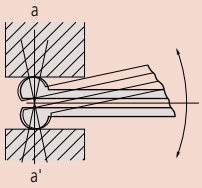
## SERIES 177 — Accessories for Inside Micrometers, Holtest and Dial Bore Gages

### FEATURES

- Used for quick and accurate setting of dial bore gages, Holtest and inside micrometers.
- If a setting ring of an optimal size is prepared, it can be used for calibration.

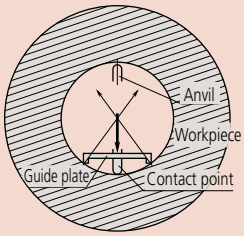
### How to read the indicated value

**Series 526**




The 526 series has a gage head with high curvature. Alignment with the diameter (a-a') is achieved by rotating the gage head in the direction indicated by the arrow, and the reading is the maximum value read from the dial indicator.

**Series 511**



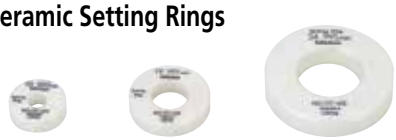

The 511 series provides a guide plate to align the setting ring diameter with the measurement axis of the bore gage.

### Steel Setting Rings



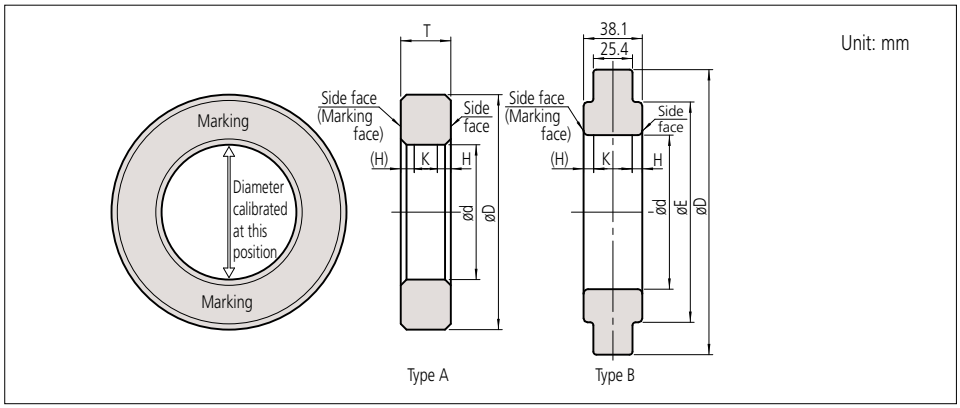
177-205 177-139 177-146 177-147 177-300

### Ceramic Setting Rings



177-424 177-429 177-432

### DIMENSIONS






Mitutoyo

# SPECIFICATIONS

## Steel Setting Rings

### Metric

| Order No. | Nominal size ød | Dimensions (mm) | | | Type | Accuracy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | øD | øE | T | | Tolerance between the nominal size and the actual diameter (µm) | Uncertainty of marked diameter value (µm)*1 | Roundness/ Cylindricity (µm)*2 | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| **177-220** | 1mm | 20 | — | 4 | A | ±10 | ±1.5 | 1 | 1.6 | 0.8 |
| **177-222** | 1.1mm | 20 | — | 4 | A | ±10 | ±1.5 | 1 | 1.6 | 0.8 |
| **177-225** | 1.2mm | 20 | — | 4 | A | ±10 | ±1.5 | 1 | 1.6 | 0.8 |
| **177-227** | 1.3mm | 20 | — | 4 | A | ±10 | ±1.5 | 1 | 1.6 | 0.8 |
| **177-230** | 1.4mm | 20 | — | 4 | A | ±10 | ±1.5 | 1 | 1.6 | 0.8 |
| **177-236** | 1.75mm | 25 | — | 5 | A | ±10 | ±1.5 | 1 | 1.6 | 1.8 |
| **177-239** | 2mm | 25 | — | 5 | A | ±10 | ±1.5 | 1 | 1.6 | 1.8 |
| **177-242** | 2.25mm | 25 | — | 5 | A | ±10 | ±1.5 | 1 | 1.6 | 1.8 |
| **177-208** | 2.5mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-246** | 2.75mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-248** | 3mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-250** | 3.25mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-252** | 3.5mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-255** | 3.75mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-204** | 4mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-257** | 4.5mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-205** | 5mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-263** | 5.5mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-267** | 6mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-271** | 6.5mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-275** | 7mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-125** | 8mm | 32 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-279** | 9mm | 32 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-126** | 10mm | 32 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-284** | 12mm | 32 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-132** | 14mm | 38 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |

| Order No. | Nominal size ød | Dimensions (mm) | | | Type | Accuracy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | øD | øE | T | | Tolerance between the nominal size and the actual diameter (µm) | Uncertainty of marked diameter value (µm)*1 | Roundness/ Cylindricity (µm)*2 | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| **177-177** | 16mm | 45 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-133** | 17mm | 45 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-285** | 18mm | 45 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-286** | 20mm | 45 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-139** | 25mm | 53 | — | 15 | A | ±10 | ±1.5 | 1 | 3.2 | 8.6 |
| **177-288** | 30mm | 71 | — | 15 | A | ±10 | ±1.5 | 1 | 3.2 | 8.6 |
| **177-140** | 35mm | 71 | — | 15 | A | ±10 | ±1.5 | 1 | 3.2 | 8.6 |
| **177-290** | 40mm | 71 | — | 15 | A | ±10 | ±1.5 | 1 | 3.2 | 8.6 |
| **177-178** | 45mm | 85 | — | 15 | A | ±10 | ±1.5 | 1 | 3.7 | 7.6 |
| **177-146** | 50mm | 85 | — | 20 | A | ±20 | ±1.5 | 1 | 3.7 | 12.6 |
| **177-292** | 60mm | 112 | — | 20 | A | ±20 | ±1.5 | 1 | 3.7 | 12.6 |
| **177-314** | 62mm | 112 | — | 20 | A | ±20 | ±1.5 | 1.5 | 3.7 | 12.6 |
| **177-147** | 70mm | 112 | — | 20 | A | ±20 | ±1.5 | 1.5 | 3.7 | 12.6 |
| **177-316** | 75mm | 125 | — | 25 | A | ±20 | ±1.5 | 1.5 | 4.2 | 16.6 |
| **177-294** | 80mm | 125 | — | 25 | A | ±20 | ±1.5 | 1.5 | 4.2 | 16.6 |
| **177-318** | 87mm | 140 | — | 25 | A | ±20 | ±1.5 | 1.5 | 4.2 | 16.6 |
| **177-148** | 90mm | 140 | — | 25 | A | ±20 | ±1.5 | 1.5 | 4.2 | 16.6 |
| **177-296** | 100mm | 160 | — | 25 | A | ±20 | ±1.5 | 2 | 4.2 | 16.6 |
| **177-298** | 125mm | 210 | 168 | 38.1 (25.4) | B | ±20 | ±2.5 | 2 | 5.3 | 27.5 |
| **177-300** | 150mm | 235 | 187 | | B | ±20 | ±2.5 | 2 | 5.3 | 27.5 |
| **177-302** | 175mm | 260 | 215 | | B | ±20 | ±2.5 | 2.5 | 5.3 | 27.5 |
| **177-304** | 200mm | 311 | 244 | | B | ±20 | ±2.5 | 2.5 | 5.3 | 27.5 |
| **177-306** | 225mm | 337 | 264 | | B | ±20 | ±2.5 | 2.5 | 5.3 | 27.5 |
| **177-308** | 250mm | 362 | 290 | | B | ±20 | ±2.5 | 3 | 5.3 | 27.5 |
| **177-310** | 275mm | 413 | 321 | | B | ±20 | ±2.5 | 3 | 5.3 | 27.5 |
| **177-312** | 300mm | 438 | 340 | | B | ±20 | ±2.5 | 3 | 5.3 | 27.5 |

### Inch

| Order No. | Nominal size ød | Dimensions (mm) | | | Type | Accuracy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | øD | øE | T | | Tolerance between the nominal size and the actual diameter (inch) | Uncertainty of marked diameter value (inch)*1 | Roundness/ Cylindricity (inch)*2 | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| **177-209** | .1″ | 25 | — | 7 | A | ±.0004″ | ±.00006″ | .00004″ | 1.5 | 4.0 |
| **177-206** | .16″ | 25 | — | 7 | A | ±.0004″ | ±.00006″ | .00004″ | 1.5 | 4.0 |
| **177-207** | .24″ | 25 | — | 7 | A | ±.0004″ | ±.00006″ | .00004″ | 1.5 | 4.0 |
| **177-281** | .275″ | 25 | — | 7 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 3.4 |
| **177-179** | .35″ | 32 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-283** | .425″ | 32 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-180** | .5″ | 32 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-181** | .6″ | 38 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-182** | .65″ | 45 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-183** | .7″ | 45 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-287** | .8″ | 45 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-184** | 1″ | 53 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.0 | 9.0 |
| **177-289** | 1.2″ | 71 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.0 | 9.0 |
| **177-185** | 1.4″ | 71 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.0 | 9.0 |
| **177-291** | 1.6″ | 71 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.0 | 9.0 |
| **177-186** | 1.8″ | 85 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.5 | 8.0 |

| Order No. | Nominal size ød | Dimensions (mm) | | | Type | Accuracy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | øD | øE | T | | Tolerance between the nominal size and the actual diameter (inch) | Uncertainty of marked diameter value (inch)*1 | Roundness/ Cylindricity (inch)*2 | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| **177-187** | 2″ | 85 | — | 20 | A | ±.0008″ | ±.00006″ | .00004″ | 3.5 | 13.0 |
| **177-293** | 2.4″ | 112 | — | 20 | A | ±.0008″ | ±.00006″ | .00004″ | 3.5 | 13.0 |
| **177-315** | 2.5″ | 112 | — | 20 | A | ±.0008″ | ±.00006″ | .00006″ | 4.0 | 12.0 |
| **177-188** | 2.8″ | 112 | — | 20 | A | ±.0008″ | ±.00006″ | .00006″ | 4.0 | 12.0 |
| **177-317** | 3″ | 125 | — | 25 | A | ±.0008″ | ±.00006″ | .00006″ | 4.0 | 17.0 |
| **177-295** | 3.2″ | 125 | — | 25 | A | ±.0008″ | ±.00006″ | .00006″ | 4.0 | 17.0 |
| **177-319** | 3.5″ | 140 | — | 25 | A | ±.0008″ | ±.00006″ | .00006″ | 4.0 | 17.0 |
| **177-189** | 3.6″ | 140 | — | 25 | A | ±.0008″ | ±.00006″ | .00006″ | 4.0 | 17.0 |
| **177-297** | 4″ | 160 | — | 25 | A | ±.0008″ | ±.00006″ | .00008″ | 4.0 | 17.0 |
| **177-299** | 5″ | 210 | 168 | 38.1 | B | ±.0008″ | ±.00010″ | .00008″ | 5.0 | 28.1 |
| **177-301** | 6″ | 235 | 187 | 38.1 | B | ±.0008″ | ±.00010″ | .00008″ | 5.0 | 28.1 |
| **177-303** | 7″ | 260 | 215 | 38.1 | B | ±.0008″ | ±.00010″ | .00010″ | 5.0 | 28.1 |
| **177-305** | 8″ | 311 | 244 | 38.1 | B | ±.0008″ | ±.00010″ | .00010″ | 5.0 | 28.1 |
| **177-307** | 9″ | 337 | 264 | 38.1 | B | ±.0008″ | ±.00010″ | .00010″ | 5.0 | 28.1 |
| **177-309** | 10″ | 362 | 290 | 38.1 | B | ±.0008″ | ±.00010″ | .00012″ | 5.0 | 28.1 |
| **177-311** | 11″ | 413 | 321 | 38.1 | B | ±.0008″ | ±.00010″ | .00012″ | 5.0 | 28.1 |
| **177-313** | 12″ | 438 | 340 | 38.1 | B | ±.0008″ | ±.00010″ | .00012″ | 5.0 | 28.1 |

## Cera Setting Rings

### Metric

| Order No. | Nominal size ød | Dimensions (mm) | | | Type | Accuracy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | øD | øE | T | | Tolerance between the nominal size and the actual diameter (µm) | Uncertainty of marked diameter value (µm)*1 | Roundness/ Cylindricity (µm)*2 | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| **177-418** | 4mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-420** | 6mm | 25 | — | 7 | A | ±10 | ±1.5 | 1 | 1.7 | 3.6 |
| **177-423** | 8mm | 32 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-424** | 10mm | 32 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-425** | 12mm | 32 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-427** | 16mm | 45 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-429** | 20mm | 45 | — | 10 | A | ±10 | ±1.5 | 1 | 2.0 | 6.0 |
| **177-430** | 25mm | 53 | — | 15 | A | ±10 | ±1.5 | 1 | 3.2 | 8.6 |
| **177-431** | 30mm | 71 | — | 15 | A | ±10 | ±1.5 | 1 | 3.2 | 8.6 |
| **177-432** | 35mm | 71 | — | 15 | A | ±10 | ±1.5 | 1 | 3.2 | 8.6 |
| **177-433** | 40mm | 71 | — | 15 | A | ±10 | ±1.5 | 1 | 3.2 | 8.6 |
| **177-434** | 45mm | 85 | — | 15 | A | ±10 | ±1.5 | 1 | 3.2 | 8.6 |

### Inch

| Order No. | Nominal size ød | Dimensions (mm) | | | Type | Accuracy | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | øD | øE | T | | Tolerance between the nominal size and the actual diameter (inch) | Uncertainty of marked diameter value (inch)*1 | Roundness/ Cylindricity (inch)*2 | Distance from the side face H (mm) | Size of warranted calibration surface K (mm) |
| **177-518** | .16″ | 25 | — | 7 | A | ±.0004″ | ±.00006″ | .00004″ | 1.5 | 4.0 |
| **177-520** | .24″ | 25 | — | 7 | A | ±.0004″ | ±.00006″ | .00004″ | 1.5 | 4.0 |
| **177-522** | .275″ | 25 | — | 7 | A | ±.0004″ | ±.00006″ | .00004″ | 1.5 | 4.0 |
| **177-523** | .35″ | 32 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-524** | .425″ | 32 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-525** | .5″ | 32 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-527** | .65″ | 45 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-529** | .8″ | 45 | — | 10 | A | ±.0004″ | ±.00006″ | .00004″ | 1.8 | 6.4 |
| **177-530** | 1″ | 53 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.0 | 9.0 |
| **177-531** | 1.2″ | 71 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.0 | 9.0 |
| **177-532** | 1.4″ | 71 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.0 | 9.0 |
| **177-533** | 1.6″ | 71 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.0 | 9.0 |
| **177-534** | 1.8″ | 85 | — | 15 | A | ±.0004″ | ±.00006″ | .00004″ | 3.0 | 8.0 |

*1 Actual diameter is marked in 0.001 mm increments.
*2 Cylindricity is defined as per JIS B 0621 definitions and designations of geometrical deviations, Section 4.4 "Cylindricity." Cylindricity is measured using three cross-sections between the top and bottom face of a ring, namely, close to the face near each sides and the center.

# D

## Small Tool Instruments
## Calipers
## Height Gages
## Depth Gages



**Digimatic Caliper**



**Digimatic Height Gages**



**Linear Height**



**Depth Gages**






**ABSOLUTE Digimatic Caliper**



**ABSOLUTE Coolant-Proof Caliper**



**Super Caliper**



**Digimatic Height Gage**

## INDEX


| | |
|---|---|
| **Calipers** | |
| Super Caliper-Solar Powered | D-2 |
| ABSOLUTE Solar Caliper | D-3 |
| ABSOLUTE Coolant-Proof Caliper | D-4,5 |
| ABSOLUTE Digimatic Caliper | D-6,7 |
| Dial Caliper | D-8,9 |
| Vernier Caliper | D-10-14 |
| ABSOLUTE Digimatic & Vernier Caliper | D-15 |
| Long-Jaw Vernier Caliper | D-16 |
| ABSOLUTE Digimatic Caliper | D-17 |
| Digimatic Carbon-Fiber Caliper | D-18,19 |
| ABSOLUTE Coolant-Proof Carbon-Fiber Caliper | D-20 |
| ABSOLUTE Back-Jaw Centerline Caliper | D-21 |
| Offset Caliper | D-22 |
| Offset Centerline Caliper | D-23 |
| Point Caliper | D-24 |
| Blade-Type Caliper | D-25 |
| Neck Caliper | D-26 |
| Tube Thickness Caliper | D-27 |
| ABSOLUTE Low-Force Caliper | D-28 |
| ABSOLUTE Snap Caliper | D-28 |
| Scribing Caliper | D-29 |
| ABSOLUTE Inside Caliper | D-30,31 |
| MyCAL-Lite | D-32 |
| Center-Line Gage | D-33 |
| Depth Base Attachment | D-33 |
| Quick Guide to Precision Measuring Instruments - Calipers | D-34,35 |
| **Digimatic Height Gages** | |
| Linear Height LH-600E | D-36,37 |
| QM-Height | D-38,39 |
| Digimatic Height Gage | D-40,41 |
| Dial Height Gage | D-42 |
| ABSOLUTE Digimatic Height Gage | D-43,44 |
| Vernier Height Gage | D-45,46 |
| Carbide-Tipped Scriber | D-47 |
| Optional Accessories for Height Gages | D-47 |
| Quick Guide to Precision Measuring Instruments - Height Gages | D-48 |
| CERA Caliper Checker | D-49 |
| **Depth Gages** | |
| Depth Micrometer | D-50,51 |
| Depth Micro Checker | D-51 |
| ABSOLUTE Digimatic Depth Gage | D-52 |
| Tire-Tread Depth Gage | D-53 |
| ABSOLUTE Point-Type Digimatic Depth Gage | D-53 |
| Vernier Depth Gage | D-54,55 |
| ABSOLUTE Digimatic Depth Gage | D-55 |
| Dial-Depth Gage | D-56 |
| Extension Bases | D-56 |
| ABSOLUTE Digimatic/Dial Depth Gage | D-57,58 |



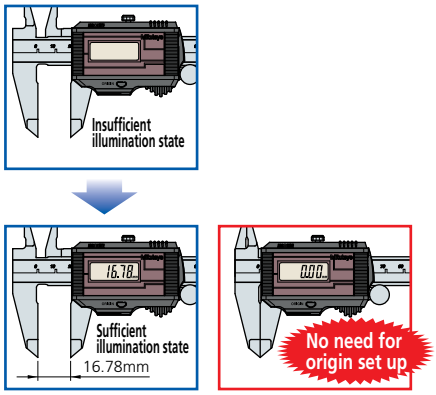

Mitutoyo

# Super Caliper–Solar Powered

## SERIES 500 — No battery or origin reset needed for IP67 Digital Caliper

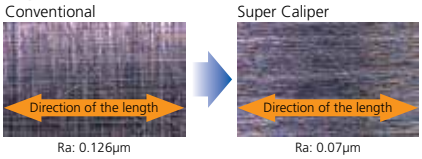
## FEATURES

- With no annoying origin restoration necessary, a measurement can be started at any time and without restrictions on operating speed.




- This unique* eco-friendly solar-powered Super Caliper requires no battery.
  *According to Mitutoyo investigation in January,2005
- The impact resistance of the display unit has been increased for improved usability in workshop conditions.
- IP67 protection ensures waterproof reliability.
- This Super Caliper uses components that do not contain harmful substances and is compatible with RoHS Directives.
- Supplied in fitted plastic case.

**Improvement in surface finish of beam**







**500-784**

## SPECIFICATIONS

### Metric

| Range | Order No. | Accuracy | Resolution |
|---|---|---|---|
| 0 - 150mm | **500-776** | ±0.02mm | 0.01mm |
| 0 - 150mm | **500-774*** | ±0.02mm | 0.01mm |
| 0 - 200mm | **500-777** | ±0.02mm | 0.01mm |
| 0 - 200mm | **500-775*** | ±0.02mm | 0.01mm |

*Without SPC data output

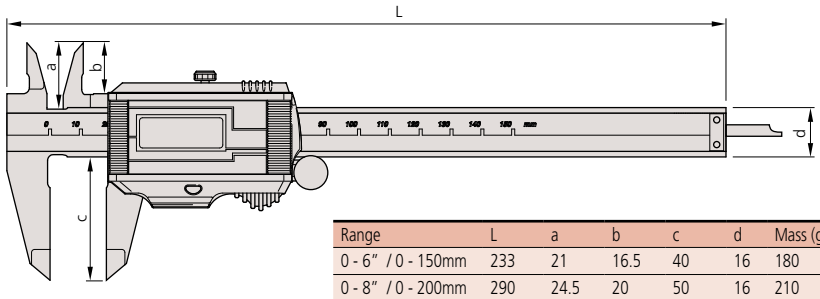
### Inch/Metric

| Range | Order No. | Accuracy | Resolution |
|---|---|---|---|
| 0 - 6" / 0 - 150mm | **500-786** | ±.001" | .0005" / 0.01mm |
| 0 - 6" / 0 - 150mm | **500-784*** | ±.001" | .0005" / 0.01mm |
| 0 - 8" / 0 - 200mm | **500-787** | ±.001" | .0005" / 0.01mm |
| 0 - 8" / 0 - 200mm | **500-785*** | ±.001" | .0005" / 0.01mm |

*Without SPC data output

## DIMENSIONS AND MASS

Unit: mm




| Range | L | a | b | c | d | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | 233 | 21 | 16.5 | 40 | 16 | 180 |
| 0 - 8" / 0 - 200mm | 290 | 24.5 | 20 | 50 | 16 | 210 |

Jaw thickness: 3.5mm

## Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm or 0.01mm
Repeatability: .0005" / 0.01mm
Display: LCD
Length standard: ABSOLUTE electromagnetic induction linear encoder
Max. response speed: Unlimited
Battery: Solar cell*
Dust/Water protection level: IP67
*Can be used continuously above 60 lux ambient illumination.

## Function

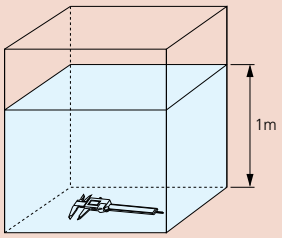
Origin-set, inch/mm conversion (on inch/metric models only)
Alarm: Counting value composition error

## Optional Accessories

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)

## IP67 protection level

Level 6: Dust-tight
No ingress of dust.
Level 7: Protected against the effects of temporary immersion in water.
Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed 1 meter in water under standardized conditions of pressure and time (30 min.).




## About the charge function (Super Caliper)

The minimum illumination required in the uncharged state is 60 lux. As shown in the table, JIS Z 9110 Artificial Illumination Intensity Standard, this Super Caliper can be used without problems in a normal work environment.

The charge function allows the operator to use this Super Caliper without interrupting work even if the ambient illumination is temporarily insufficient.

- In the fully charged state, this Super Caliper can operate for approximately an hour in an environment of 50lux illumination (less than the minimum necessary illumination intensity).
- The time necessary for full charge differs, depending on the charging conditions. If this Super Caliper is left unused in an illumination of 500 lux (usual for manufacturing environments), it takes approximately one hour to reach full charge.

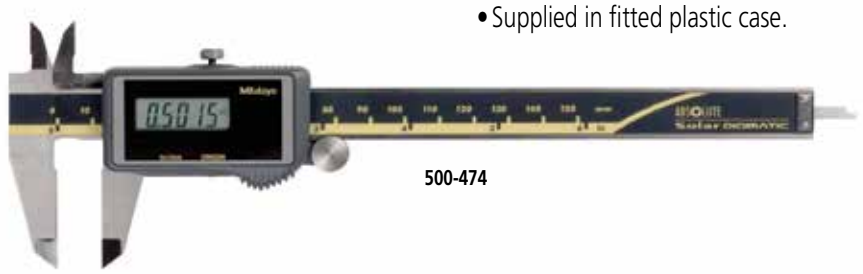
# ABSOLUTE Solar Caliper

## SERIES 500 — No battery or origin reset needed

Mitutoyo's Absolute Solar Digimatic Caliper retains its origin point for the entire life of the caliper, even the display turns off. At 60 Lux and higher, the ABSOLUTE solar caliper is turned on ready to start measurement.

### FEATURES

- No more repeated zero setting caused by low-light intensity.
- Hard-coated solar panel for increased durability.
- No fear for overspeed errors.
- With thumb roller.
- Supplied in fitted plastic case.



500-474

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm or 0.01mm
Repeatability: .0005" / 0.01mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Battery: Solar cell*
*Can be used continuously above 60 lux ambient illumination.

### Function

Origin-set, Data hold, Data output,
inch/mm conversion (on inch/metric models only)
Alarm: Counting value composition error

### Optional Accessories

**959143**: Data hold unit (SPC output model only)
**959149**: SPC cable with data switch (40" / 1m)
**959150**: SPC cable with data switch (80" / 2m)

## SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Resolution | Remarks |
|---|---|---|---|---|
| 0 - 100mm | **500-443** | ±0.02mm | 0.01mm | ø1.9mm round depth bar |
| 0 - 100mm | **500-453*** | ±0.02mm | 0.01mm | ø1.9mm round depth bar |
| 0 - 150mm | **500-444** | ±0.02mm | 0.01mm | |
| 0 - 150mm | **500-454*** | ±0.02mm | 0.01mm | |
| 0 - 200mm | **500-445** | ±0.02mm | 0.01mm | |
| 0 - 200mm | **500-455*** | ±0.02mm | 0.01mm | |

*without SPC data output

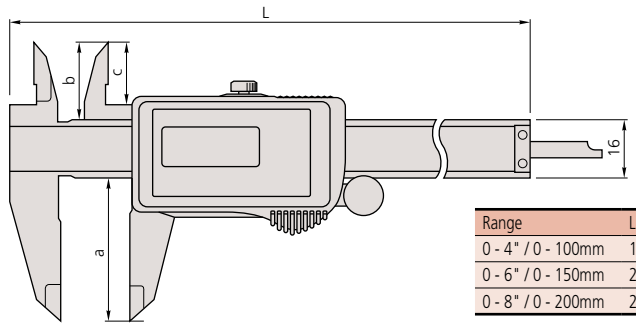
**Inch/Metric**

| Range | Order No. | Accuracy | Resolution | Remarks |
|---|---|---|---|---|
| 0 - 4" / 0 - 100mm | **500-463** | ±.001" | .0005" / 0.01mm | .075" round depth bar |
| 0 - 4" / 0 - 100mm | **500-473*** | ±.001" | .0005" / 0.01mm | .075" round depth bar |
| 0 - 6" / 0 - 150mm | **500-464** | ±.001" | .0005" / 0.01mm | |
| 0 - 6" / 0 - 150mm | **500-474*** | ±.001" | .0005" / 0.01mm | |
| 0 - 8" / 0 - 200mm | **500-465** | ±.001" | .0005" / 0.01mm | |
| 0 - 8" / 0 - 200mm | **500-475*** | ±.001" | .0005" / 0.01mm | |

*without SPC data output

## DIMENSIONS AND MASS

Unit: mm




| Range | L | a | b | c | Mass (g) |
|---|---|---|---|---|---|
| 0 - 4" / 0 - 100mm | 182 | 40 | 21 | 16.5 | 125 |
| 0 - 6" / 0 - 150mm | 233 | 40 | 21 | 16.5 | 150 |
| 0 - 8" / 0 - 200mm | 290 | 50 | 24.5 | 20 | 180 |

# ABSOLUTE Coolant-Proof Caliper

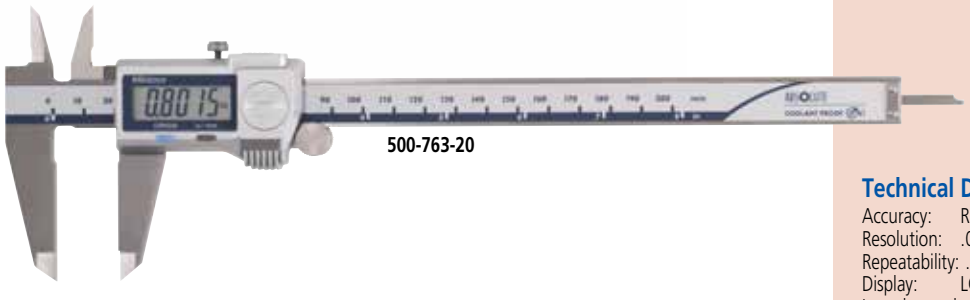
## SERIES 500 — with Dust/Water Protection Conforming to IP67 Level

### FEATURES

- Can be used in workshop conditions exposed to coolant, water, dust or oil.
- Easy to use - no need to wipe or clean the scale.
- Advanced design.
- Character height increased from 7.4mm to 9.0mm for improved readability.
- Redesigned battery cover eliminates the need for a screwdriver.
- Incorporates absolute measurement system.
- Automatic power-on/off.
- Data output function.
- With thumb roller.
- Supplied in fitted plastic case.



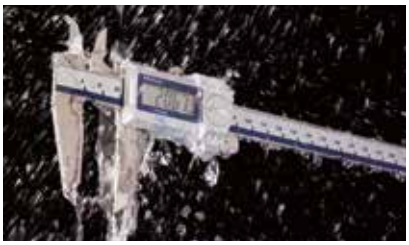
**500-752-20**



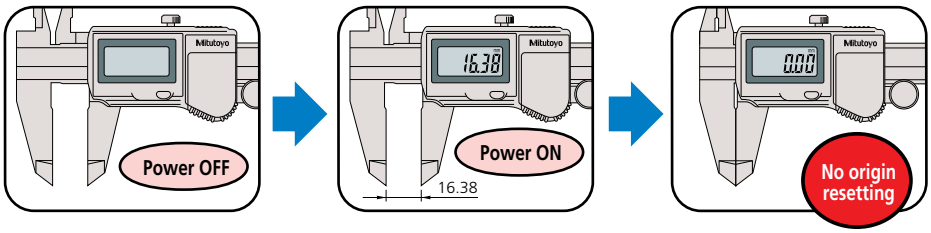
**500-763-20**

COOLANT PROOF™ IP67

COOLANT PROOF is the universal term of Mitutoyo Digimatic Small Tool Instruments that are free from measurement error and physical deterioration due to routine exposure to water, cutting oil or coolant. This high performance is achieved by using encoders that are inherently immune to contamination, where exposure is inevitable, combined with comprehensive sealing techniques and extremely oil-resistant materials to guarantee a long working life under normal operating conditions.



**Built-in ABS (absolute) scale means that these calipers are ready to use immediately after power-on without origin resetting. It's as easy as vernier caliper measurements.**




Certificate of inspection



CERTIFICATE OF INSPECTION / CERTIFICAT DE CONTROLE

Mitutoyo Corporation

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm or 0.01mm
Repeatability: .0005" / 0.01mm
Display: LCD
Length standard: ABSOLUTE electromagnetic induction linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc./2 pcs*), **938882**
Battery life: Approx. 5 years under normal use (1 year: over 12" / 300mm models)
Dust/Water protection level: IP67
*0 - 300mm model

### Function

Origin-set, Zero-setting, Automatic power on/off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)



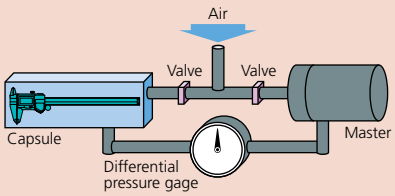
**05CZA624**



Measurement data output function is available with a water-resistant SPC cable.

## Air leakage detection system used for water-proof testing

Generally, air leakage tests are performed to evaluate water resistance. Testing begins by placing a measuring tool into the capsule. Next, air with equivalent pressure is supplied to the capsule and the master, then the valves are closed. If none of the air in the capsule seeps into the measuring tool, the capsule's air pressure will remain equal to that of the master, and the differential pressure gage will continue to point to the center. However, if some air seeps into the measuring tool, it will create an air pressure difference in the amount indicated by the differential pressure gage. Thus, detection of air pressure differences is used as a criterion for judging leakage. Every single unit of the ABS Coolant Proof calipers and Coolant Proof micrometer is tested this way for air leakage to help ensure product quality.

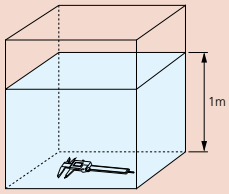





## IP67 protection level

Level 6: Dust-tight
No ingress of dust.

Level 7: Protected against the effects of temporary immersion in water.
Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed 1 meter in water under standardized conditions of pressure and time (30 min.).




## SPECIFICATIONS

**Metric** IP67 model

| Range | Order No. | Accuracy | Resolution | Remarks |
|---|---|---|---|---|
| 0-150mm | **500-702-20*** | +/-0.02mm | 0.01mm | |
| 0-150mm | **500-712-20** | +/-0.02mm | 0.01mm | |
| 0-150mm | **500-719-20** | +/-0.02mm | 0.01mm | dia. 1.9mm rod depth bar |
| 0-150mm | **500-721-20** | +/-0.02mm | 0.01mm | carbide-tipped jaws for ID measurement |
| 0-150mm | **500-723-20** | +/-0.02mm | 0.01mm | carbide-tipped jaws for OD & ID measurement |
| 0-200mm | **500-703-20*** | +/-0.02mm | 0.01mm | |
| 0-200mm | **500-713-20** | +/-0.02mm | 0.01mm | |
| 0-200mm | **500-722-20** | +/-0.02mm | 0.01mm | carbide-tipped jaws for ID measurement |
| 0-200mm | **500-724-20** | +/-0.02mm | 0.01mm | carbide-tipped jaws for OD & ID measurement |
| 0-300mm | **500-704-10*** | +/-0.03mm | 0.01mm | |
| 0-300mm | **500-714-10** | +/-0.03mm | 0.01mm | |

*without SPC data output

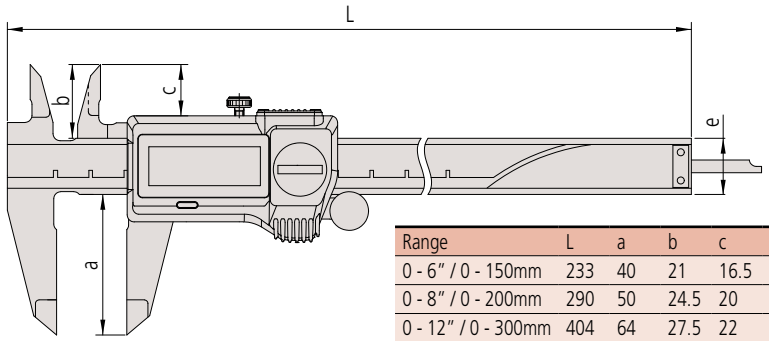
**Inch/Metric** IP67 model

| Range | Order No. | Accuracy | Resolution | Remarks |
|---|---|---|---|---|
| 0-6"/0-150mm | **500-752-20*** | +/-.001" | .0005"/0.01mm | |
| 0-6"/0-150mm | **500-762-20** | +/-.001" | .0005"/0.01mm | |
| 0-6"/0-150mm | **500-768-20*** | +/-.001" | .0005"/0.01mm | .075" rod depth bar |
| 0-6"/0-150mm | **500-769-20** | +/-.001" | .0005"/0.01mm | .075" rod depth bar |
| 0-6"/0-150mm | **500-731-20*** | +/-.001" | .0005"/0.01mm | carbide-tipped jaws for OD measurement |
| 0-6"/0-150mm | **500-735-20** | +/-.001" | .0005"/0.01mm | carbide-tipped jaws for OD measurement |
| 0-6"/0-150mm | **500-733-20*** | +/-.001" | .0005"/0.01mm | carbide-tipped jaws for OD & ID measurement |
| 0-6"/0-150mm | **500-737-20** | +/-.001" | .0005"/0.01mm | carbide-tipped jaws for OD & ID measurement |
| 0-8"/0-200mm | **500-753-20*** | +/-.001" | .0005"/0.01mm | |
| 0-8"/0-200mm | **500-763-20** | +/-.001" | .0005"/0.01mm | |
| 0-8"/0-200mm | **500-732-20*** | +/-.001" | .0005"/0.01mm | carbide-tipped jaws for OD measurement |
| 0-8"/0-200mm | **500-736-20** | +/-.001" | .0005"/0.01mm | carbide-tipped jaws for OD measurement |
| 0-8"/0-200mm | **500-734-20*** | +/-.001" | .0005"/0.01mm | carbide-tipped jaws for OD & ID measurement |
| 0-8"/0-200mm | **500-738-20** | +/-.001" | .0005"/0.01mm | carbide-tipped jaws for OD & ID measurement |
| 0-12"/0-300mm | **500-754-10*** | +/-.0015" | .0005"/0.01mm | |
| 0-12"/0-300mm | **500-764-10** | +/-.0015" | .0005"/0.01mm | |

*without SPC data output

## DIMENSIONS AND MASS

Unit: mm



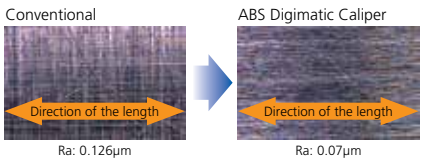

| Range | L | a | b | c | e | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | 233 | 40 | 21 | 16.5 | 16 | 168 |
| 0 - 8" / 0 - 200mm | 290 | 50 | 24.5 | 20 | 16 | 198 |
| 0 - 12" / 0 - 300mm | 404 | 64 | 27.5 | 22 | 20 | 350 |

# ABSOLUTE Digimatic Caliper

## SERIES 500 — with Exclusive ABSOLUTE Encoder Technology

Mitutoyo's absolute Digimatic Caliper is the next generation of electronic calipers. It keeps track of its origin point once set. Whenever turned on, the large LCD displays the actual slider position ready to start measurement. No more repeated zero setting is necessary with the absolute encoder technology, as well as no more concern for overspeed errors.

**High-quality guide surface finish for smooth slider movement.**




## FEATURES

- Large and clear LCD readout.
- The ZERO/ABS key allows the display to be zero-set at any slider position along the scale for incremental comparison measurements. This switch also will allow return to the absolute (ABS) coordinate and display of the true position from the origin point (usually jaws-closed point).
- Data Hold Unit (959143) is optional.
- Carbide-tipped jaw-type calipers are also available.
- Thumb roller included only on calipers up to and including 12" or 300mm.
- Supplied in fitted plastic case. Except 40" / 1000mm supplied in wooden case.

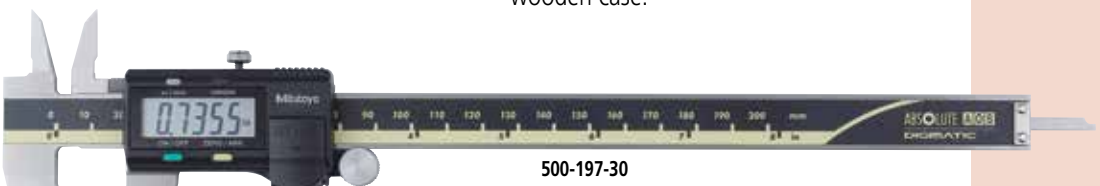
SPC

PROPRIETARY INSPECTION CERTIFICATE

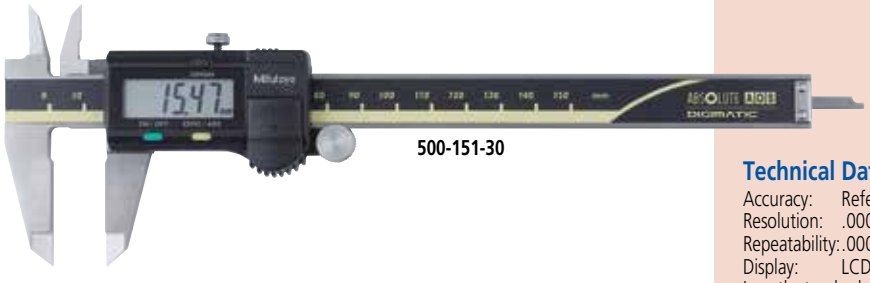
ABSOLUTE AOS DIGIMATIC

AOS: Advanced Onsite Sensor

The new Mitutoyo ABS Digimatic Caliper line with exclusive AOS sensor technology. The patented Advanced Onsite Sensor (AOS) offers improved measurement dependability by increasing resistance to harsh workshop conditions.



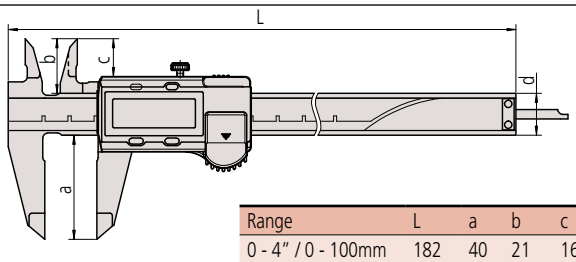
**500-197-30**



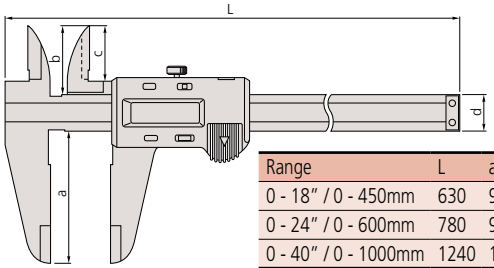
**500-151-30**

## DIMENSIONS AND MASS

Unit: mm




| Range | L | a | b | c | d | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 4" / 0 - 100mm | 182 | 40 | 21 | 16.5 | 16 | 143 |
| 0 - 6" / 0 - 150mm | 233 | 40 | 21 | 16.5 | 16 | 168 |
| 0 - 8" / 0 - 200mm | 290 | 50 | 24.5 | 20 | 16 | 198 |
| 0 - 12" / 0 - 300mm | 403 | 64 | 27.5 | 22 | 20 | 350 |




| Range | L | a | b | c | d | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 18" / 0 - 450mm | 630 | 90 | 47 | 38 | 25 | 1170 |
| 0 - 24" / 0 - 600mm | 780 | 90 | 47 | 38 | 25 | 1350 |
| 0 - 40" / 0 - 1000mm | 1240 | 130 | 61 | 50 | 32 | 3300 |

## Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm or 0.01mm
Repeatability: .0005"/ 0.01mm
Display: LCD
Length standard:
ABSOLUTE electromagnetic induction type linear encoder (200mm and smaller models)
ABSOLUTE electrostatic capacitance type linear encoder (300mm and larger models)
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 3.5 years under normal use

## Function

Origin-set, Zero-setting, Data output,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

## Optional Accessories

**959143**: Data hold unit
**959149**: SPC cable with data switch (40" / 1m)
**959150**: SPC cable with data switch (80" / 2m)

**959143**



**959149**



500-506-10

500-502-10

500-501-10

500-500-10

## SPECIFICATIONS

### Metric

| Range | Order No. | Accuracy | Resolution | Remarks |
|---|---|---|---|---|
| 0 - 100mm | **500-150-30** | ±0.02mm | 0.01mm | ø1.9mm rod depth bar |
| 0 - 150mm | **500-151-30** | ±0.02mm | 0.01mm | — |
| 0 - 150mm | **500-154-30** | ±0.02mm | 0.01mm | Carbide-tipped jaws for OD measurement |
| 0 - 150mm | **500-155-30** | ±0.02mm | 0.01mm | Carbide-tipped jaws for OD & ID measurement |
| 0 - 150mm | **500-158-30** | ±0.02mm | 0.01mm | ø1.9mm rod depth bar |
| 0 - 200mm | **500-152-30** | ±0.02mm | 0.01mm | — |
| 0 - 200mm | **500-156-30** | ±0.02mm | 0.01mm | Carbide-tipped jaws for OD measurement |
| 0 - 200mm | **500-157-30** | ±0.02mm | 0.01mm | Carbide-tipped jaws for OD & ID measurement |
| 0 - 300mm | **500-153** | ±0.03mm | 0.01mm | — |
| 0 - 450mm | **500-500-10** | ±0.05mm | 0.01mm | Without Thumb Roller |
| 0 - 600mm | **500-501-10** | ±0.05mm | 0.01mm | Without Thumb Roller |
| 0 - 1000mm | **500-502-10** | ±0.07mm | 0.01mm | Without Thumb Roller |

### Inch/Metric

| Range | Order No. | Accuracy | Resolution | Remarks |
|---|---|---|---|---|
| 0 - 4" / 0 - 100mm | **500-170-30** | ±.001" | .0005" / 0.01mm | .075" rod depth bar |
| 0 - 4" / 0 - 100mm | **500-195-30*** | ±.001" | .0005" / 0.01mm | .075" rod depth bar |
| 0 - 6" / 0 - 150mm | **500-171-30** | ±.001" | .0005" / 0.01mm | — |
| 0 - 6" / 0 - 150mm | **500-174-30** | ±.001" | .0005" / 0.01mm | Carbide-tipped jaws for OD measurement |
| 0 - 6" / 0 - 150mm | **500-175-30** | ±.001" | .0005" / 0.01mm | Carbide-tipped jaws for OD & ID measurement |
| 0 - 6" / 0 - 150mm | **500-178-30** | ±.001" | .0005" / 0.01mm | .075" rod depth bar |
| 0 - 6" / 0 - 150mm | **500-196-30*** | ±.001" | .0005" / 0.01mm | — |
| 0 - 6" / 0 - 150mm | **500-159-30*** | ±.001" | .0005" / 0.01mm | Carbide-tipped jaws for OD measurement |
| 0 - 6" / 0 - 150mm | **500-160-30*** | ±.001" | .0005" / 0.01mm | Carbide-tipped jaws for OD & ID measurement |
| 0 - 8" / 0 - 200mm | **500-172-30** | ±.001" | .0005" / 0.01mm | — |
| 0 - 8" / 0 - 200mm | **500-176-30** | ±.001" | .0005" / 0.01mm | Carbide-tipped jaws for OD measurement |
| 0 - 8" / 0 - 200mm | **500-177-30** | ±.001" | .0005" / 0.01mm | Carbide-tipped jaws for OD & ID measurement |
| 0 - 8" / 0 - 200mm | **500-197-30*** | ±.001" | .0005" / 0.01mm | — |
| 0 - 8" / 0 - 200mm | **500-163-30*** | ±.001" | .0005" / 0.01mm | Carbide-tipped jaws for OD measurement |
| 0 - 8" / 0 - 200mm | **500-164-30*** | ±.001" | .0005" / 0.01mm | Carbide-tipped jaws for OD & ID measurement |
| 0 - 12" / 0 - 300mm | **500-173** | ±.0015" | .0005" / 0.01mm | — |
| 0 - 12" / 0 - 300mm | **500-167** | ±.0015" | .0005" / 0.01mm | Carbide-tipped jaws for OD measurement |
| 0 - 12" / 0 - 300mm | **500-168** | ±.0015" | .0005" / 0.01mm | Carbide-tipped jaws for OD & ID measurement |
| 0 - 12" / 0 - 300mm | **500-193*** | ±.0015" | .0005" / 0.01mm | — |
| 0 - 12" / 0 - 300mm | **500-165*** | ±.0015" | .0005" / 0.01mm | Carbide-tipped jaws for OD measurement |
| 0 - 12" / 0 - 300mm | **500-166*** | ±.0015" | .0005" / 0.01mm | Carbide-tipped jaws for OD & ID measurement |
| 0 - 18" / 0 - 450mm | **500-505-10** | ±.002" | .0005" / 0.01mm | Without Thumb Roller |
| 0 - 24" / 0 - 600mm | **500-506-10** | ±.002" | .0005" / 0.01mm | Without Thumb Roller |
| 0 - 40" / 0 - 1000mm | **500-507-10** | ±.003" | .0005" / 0.01mm | Without Thumb Roller |

*without SPC data output



Mitutoyo

# Dial Caliper

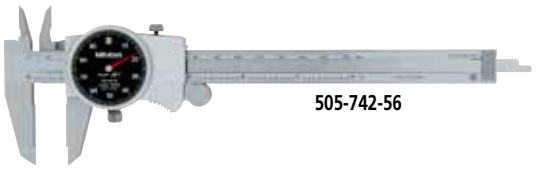
## SERIES 505

### FEATURES

- New designed dial movement for ultra-smooth sliding and high-shock protection.
- Improved finish on sliding surfaces for longevity.
- New face for improved readability.
- Lock screw for dial bezel and for holding the sliding jaw position.
- Can measure OD, ID, depth and steps.
- Models available with carbide-tipped OD and ID jaws.
- Supplied in fitted plastic case.



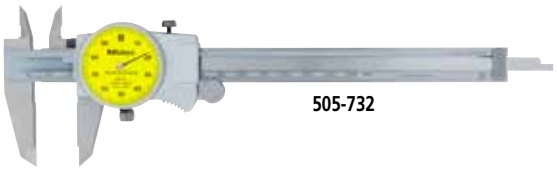
505-746



505-742-56



505-745



505-732



.100" per revolution



.200" per revolution



1mm per revolution



2mm per revolution

### SPECIFICATIONS

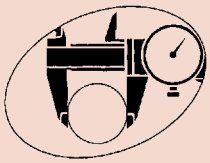
**Metric** 1mm Per One Revolution

| Range | Order No. | Accuracy | Graduation | Remarks |
|---|---|---|---|---|
| 0-150mm | **505-732** | +/-0.03mm | 0.01mm | — |
| 0-200mm | **505-733** | +/-0.03mm | 0.01mm | — |

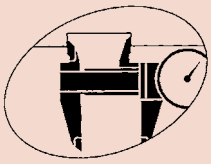
**Metric** 2mm Per One Revolution

| Range | Order No. | Accuracy | Graduation | Remarks |
|---|---|---|---|---|
| 0-150mm | **505-730** | +/-0.03mm | 0.02mm | — |
| 0-150mm | **505-734** | +/-0.03mm | 0.02mm | Carbide-tipped jaws for OD measurement |
| 0-150mm | **505-735** | +/-0.03mm | 0.02mm | Carbide-tipped jaws for OD & ID measurement |
| 0-200mm | **505-731** | +/-0.03mm | 0.02mm | — |
| 0-300mm | **505-745** | +/-0.04mm | 0.02mm | — |

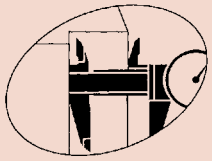
## Measurement Applications



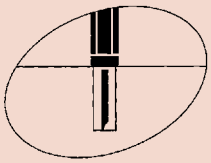
1. Outside measurement



2. Inside measurement



3. Step measurement



4. Depth measurement

## SPECIFICATIONS

**Inch** .1″ Per Revolution

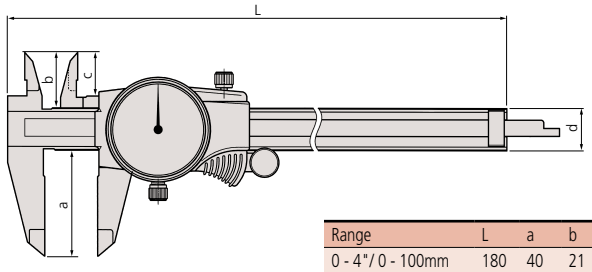
| Range | Order No. | Accuracy | Graduation | Remarks |
|---|---|---|---|---|
| 0-6″ | **505-742** | +/-.001″ | .001″ | - |
| 0-6″ | **505-742-51** | +/-.001″ | .001″ | Blue Dial Face |
| 0-6″ | **505-742-52** | +/-.001″ | .001″ | Purple Dial Face |
| 0-6″ | **505-742-53** | +/-.001″ | .001″ | Green Dial Face |
| 0-6″ | **505-742-54** | +/-.001″ | .001″ | Red Dial Face |
| 0-6″ | **505-742-55** | +/-.001″ | .001″ | Orange Dial Face |
| 0-6″ | **505-742-56** | +/-.001″ | .001″ | Black Dial Face |
| 0-6″ | **505-736** | +/-.001″ | .001″ | Carbide-tipped jaws for OD measurement |
| 0-6″ | **505-738** | +/-.001″ | .001″ | Carbide-tipped jaws for OD & ID measurement |
| 0-8″ | **505-743** | +/-.002″ | .001″ | - |
| 0-8″ | **505-737** | +/-.002″ | .001″ | Carbide-tipped jaws for OD measurement |
| 0-8″ | **505-739** | +/-.002″ | .001″ | Carbide-tipped jaws for OD & ID measurement |
| 0-12″ | **505-746** | +/-.002″ | .001″ | — |
| 0-12″ | **505-747** | +/-.002″ | .001″ | Carbide-tipped jaws for OD measurement |
| 0-12″ | **505-748** | +/-.002″ | .001″ | Carbide-tipped jaws for OD & ID |

**Inch** .2″ Per Revolution

| Range | Order No. | Accuracy | Graduation | Remarks |
|---|---|---|---|---|
| 0-6″ | **505-740** | +/-.001″ | .001″ | — |
| 0-6″ | **505-744** | +/-.001″ | .001″ | Carbide-tipped jaws for OD measurement |
| 0-8″ | **505-741** | +/-.002″ | .001″ | — |
| 0-12″ | **505-749** | +/-.002″ | .001″ | — |
| 0-12″ | **505-750** | +/-.002″ | .001″ | Carbide-tipped jaws for OD measurement |

## DIMENSIONS AND MASS

Unit: mm




| Range | L | a | b | c | d | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 4"/ 0 - 100mm | 180 | 40 | 21 | 16.5 | 16 | 150 |
| 0 - 6"/ 0 - 150mm | 231 | 40 | 21 | 16.5 | 16 | 175 |
| 0 - 8"/ 0 - 200mm | 288 | 50 | 24.5 | 20 | 16 | 185 |
| 0 - 12"/ 0 - 300mm | 403 | 64 | 27.5 | 22 | 20 | 370 |



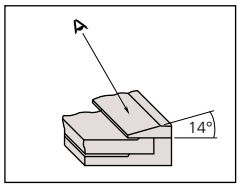
Mitutoyo

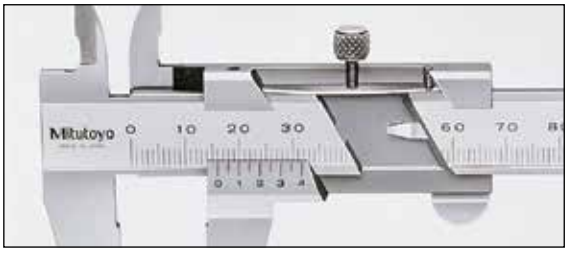
# Vernier Caliper

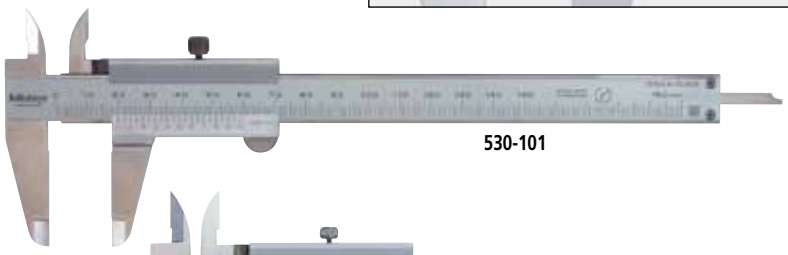
## SERIES 530 — Standard Model

### FEATURES

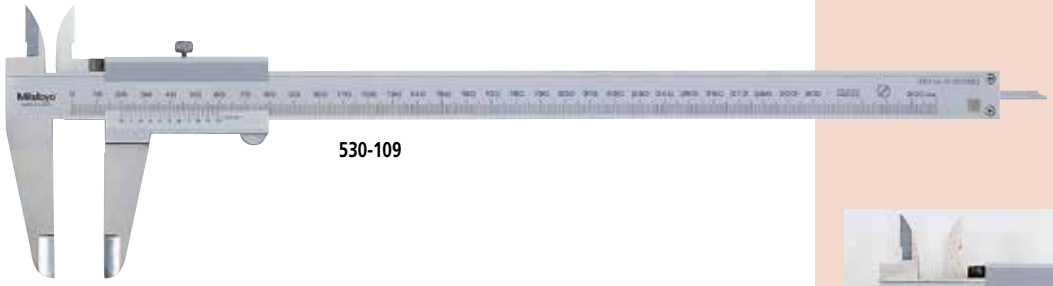
- Measures OD (outside diameter), ID (inside diameter), depth, and steps.
- The small vernier face angle (14°) provides easy reading.
- Dual reading scales on vernier. (metric/inch and inch models only).
- Lock screw for holding the sliding jaw position.
- Carbide-tipped jaw-type calipers are available.
- Supplied with vinyl holster in fitted carton. Except 24" / 600mm models are carton only. 40" / 1000mm supplied in wooden case.



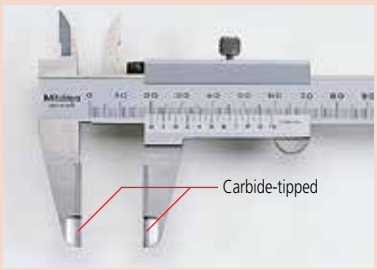



**530-101**



**530-109**



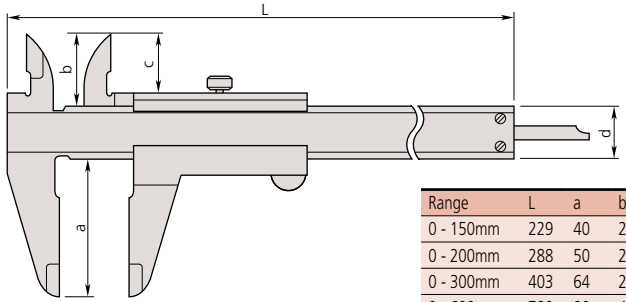

**Carbide-tipped jaw type**



**Round depth bar type**

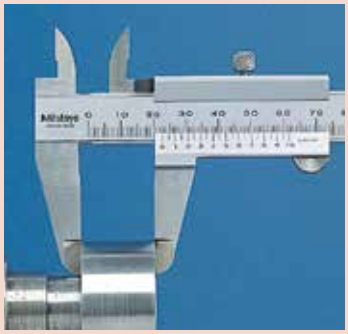
### DIMENSIONS AND MASS

Unit: mm

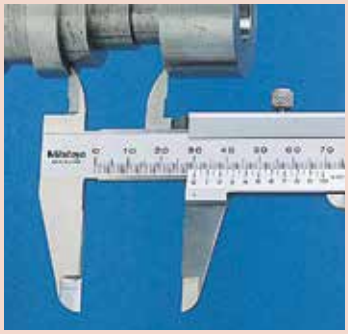



| Range | L | a | b | c | d | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 150mm | 229 | 40 | 21 | 17 | 16 | 143 |
| 0 - 200mm | 288 | 50 | 24.5 | 20.5 | 16 | 180 |
| 0 - 300mm | 403 | 64 | 27.5 | 22 | 20 | 335 |
| 0 - 600mm | 780 | 90 | 47 | 38 | 25 | 1,300 |
| 0 - 1000mm | 1240 | 130 | 60 | 50 | 32 | 3,300 |

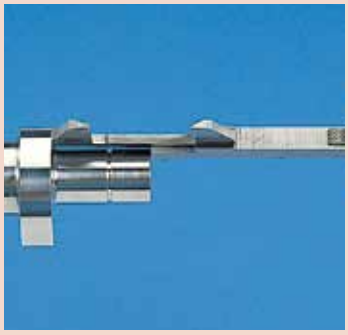
## Measurement Applications



OD measurement



ID measurement



Step measurement



Depth measurement

## SPECIFICATIONS

### Metric

| Range | Order No. | Accuracy | Graduation | Remarks |
|---|---|---|---|---|
| 0 - 150mm | **530-102** | ±0.05mm | 0.05mm | ø 1.9mm Depth bar |
| 0 - 150mm | **530-101** | ±0.05mm | 0.05mm | — |
| 0 - 150mm | **530-320** | ±0.05mm | 0.05mm | Carbide-tipped jaws for OD measurement |
| 0 - 150mm | **530-335** | ±0.05mm | 0.05mm | Carbide-tipped jaws for OD & ID measurement |
| 0 - 150mm | **530-122*** | ±0.03mm | 0.02mm | High-accuracy model |
| 0 - 200mm | **530-108** | ±0.05mm | 0.05mm | — |
| 0 - 200mm | **530-321** | ±0.05mm | 0.05mm | Carbide-tipped jaws for OD measurement |
| 0 - 200mm | **530-123*** | ±0.03mm | 0.02mm | High-accuracy model |
| 0 - 300mm | **530-109** | ±0.08mm | 0.05mm | — |
| 0 - 300mm | **530-322** | ±0.08mm | 0.05mm | Carbide-tipped jaws for OD measurement |
| 0 - 300mm | **530-124*** | ±0.04mm | 0.02mm | High-accuracy model: ±0.04mm |
| 0 - 600mm | **530-501**** | ±0.1mm | 0.05mm | — |
| 0 - 1000mm | **530-502 **** | ±0.15mm | 0.05mm | — |

*Graduation: 0.02mm
**No depth measuring bar

### Metric/Inch

with metric/inch dual scale

| Range | Order No. | Accuracy | Vernier Graduation | | Remarks |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 - 150mm / 0 - 6″ | **530-104** | ±0.05mm | 0.05mm | 1/128" | — |
| 0 - 150mm / 0 - 6″ | **530-316** | ±0.05mm | 0.05mm | 1/128" | — |
| 0 - 150mm / 0 - 6″ | **530-312*** | ±0.03mm | 0.02mm | .001" | High-accuracy model |
| 0 - 200mm / 0 - 8″ | **530-114** | ±0.05mm | 0.05mm | 1/128" | — |
| 0 - 200mm / 0 - 8″ | **530-118*** | ±0.03mm | 0.02mm | .001" | High-accuracy model |
| 0 - 300mm / 0 - 12″ | **530-115** | ±0.08mm | 0.05mm | 1/128" | — |
| 0 - 300mm / 0 - 12″ | **530-119*** | ±0.04mm | 0.02mm | .001" | High-accuracy model |

*Graduation: 0.02mm

### Inch

with inch/inch dual scale

| Range | Order No. | Accuracy | Vernier Graduation | | Remarks |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 - 6" | **530-105** | ±.0015″ | .001″ | 1/128" | — |
| 0 - 8" | **530-116** | ±.0015″ | .001″ | 1/128" | — |



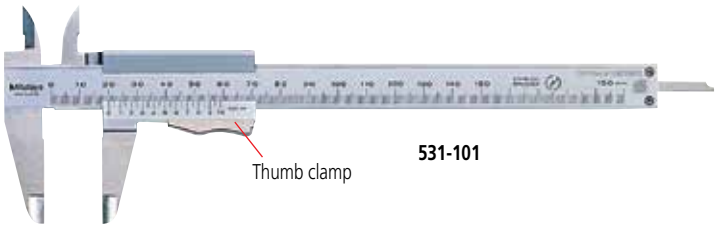
Mitutoyo

# Vernier Caliper

## SERIES 531 — with Thumb Clamp

### FEATURES

- The slider moves only when the spring loaded thumb clamp is depressed.
- Can measure OD, ID, depth and steps
- Supplied with vinyl holster in fitted carton.




531-101

### SPECIFICATIONS

**Metric**

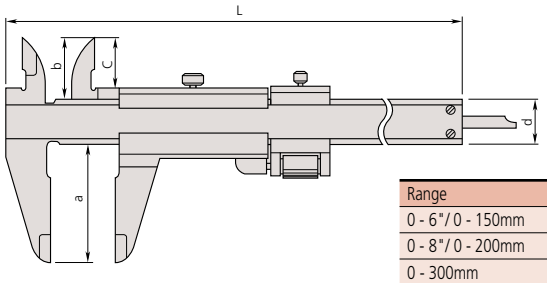
| Range | Order No. | Accuracy | Graduation | Remarks |
|---|---|---|---|---|
| 0 - 150mm | **531-101** | ±0.05mm | 0.05mm | — |
| 0 - 200mm | **531-102** | ±0.05mm | 0.05mm | — |
| 0 - 300mm | **531-103** | ±0.08mm | 0.05mm | — |

**Metric/Inch** with metric/inch dual scale

| Range | Order No. | Accuracy | Graduation | | Remarks |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 - 150mm / 0 - 6" | **531-122** | ±0.05mm | 0.05mm | 1/128" | with inch/mm conversion label |
| 0 - 150mm / 0 - 6" | **531-128** | ±0.03mm | 0.02mm | .001" | High-accuracy model |
| 0 - 200mm / 0 - 8" | **531-108** | ±0.05mm | 0.05mm | 1/128" | — |
| 0 - 200mm / 0 - 8" | **531-129** | ±0.03mm | 0.02mm | .001" | High-accuracy model |
| 0 - 300mm / 0 - 12" | **531-109** | ±0.08mm | 0.05mm | 1/128" | — |
| 0 - 300mm / 0 - 12" | **531-112** | ±0.04mm | 0.02mm | .001" | High-accuracy model |

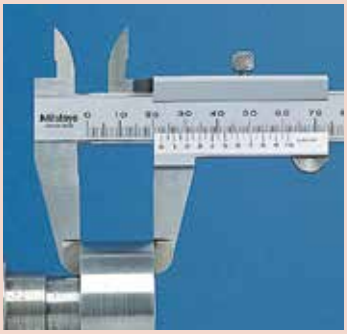
### DIMENSIONS AND MASS

Unit: mm

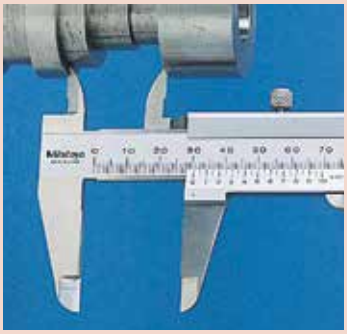



| Range | L | a | b | c | d | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 6"/ 0 - 150mm | 229 | 40 | 21.5 | 17 | 16 | 142 |
| 0 - 8"/ 0 - 200mm | 288 | 50 | 25 | 20.5 | 16 | 175 |
| 0 - 300mm | 403 | 64 | 27.5 | 22 | 20 | 360 |

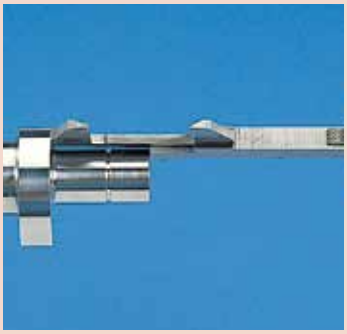
### Measurement Applications



OD measurement



ID measurement



Step measurement

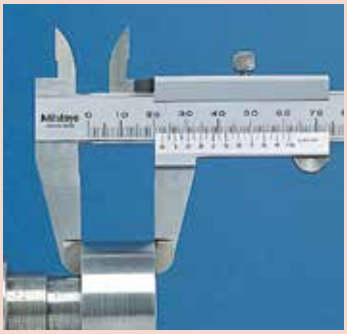


Depth measurement

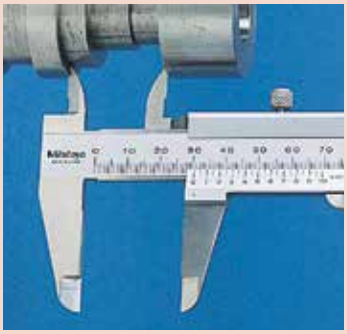
# Vernier Caliper

## SERIES 532 — with Fine Adjustment

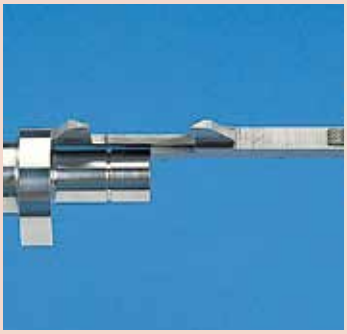
### Measurement Applications



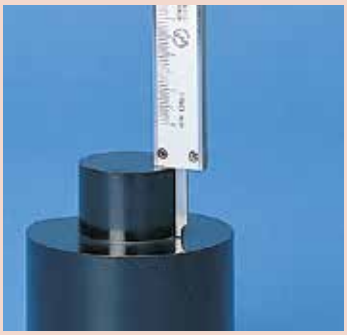
OD measurement



ID measurement



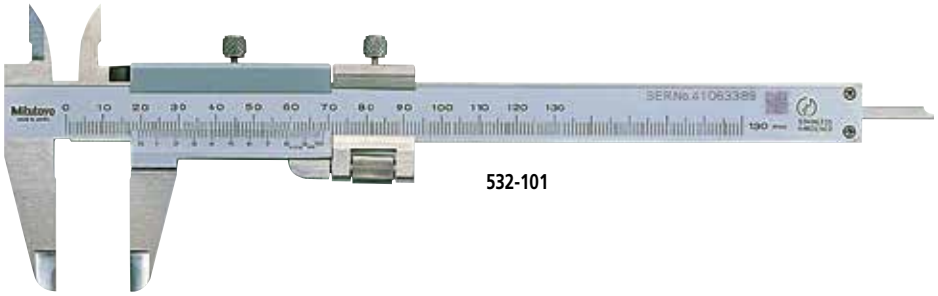
Step measurement



Depth measurement

### FEATURES

- Provided with a fine-adjustment carriage to feed the slider finely.
- Can measure OD, ID, depth and steps.
- Supplied with vinyl holster in fitted carton.



532-101

### SPECIFICATIONS

**Metric**

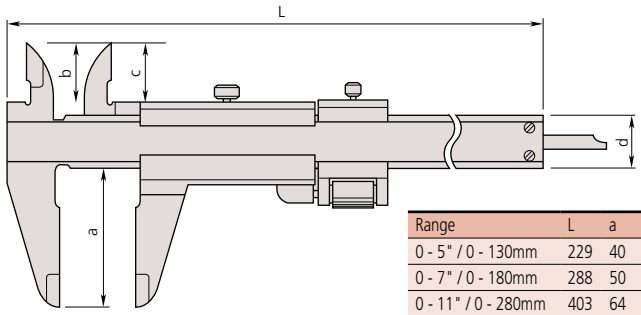
| Range | Order No. | Accuracy | Graduation |
|---|---|---|---|
| 0 - 130mm | **532-101** | ±0.03mm | 0.02mm |
| 0 - 180mm | **532-102** | ±0.03mm | 0.02mm |
| 0 - 280mm | **532-103** | ±0.04mm | 0.02mm |

**Metric/Inch** with metric/inch dual scale

| Range | Order No. | Accuracy | Graduation | |
|---|---|---|---|---|
| | | | Lower Scale | Upper Scale |
| 0 - 130mm / 0 - 5″ | **532-119** | ±0.03mm | 0.02mm | .001" |
| 0 - 180mm / 0 - 7″ | **532-120** | ±0.03mm | 0.02mm | .001" |
| 0 - 280mm / 0 - 11″ | **532-121** | ±0.04mm | 0.02mm | .001" |

### DIMENSIONS AND MASS

Unit: mm




| Range | L | a | b | c | d | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 5" / 0 - 130mm | 229 | 40 | 21.5 | 17 | 16 | 165 |
| 0 - 7" / 0 - 180mm | 288 | 50 | 25 | 20.5 | 16 | 202 |
| 0 - 11" / 0 - 280mm | 403 | 64 | 27.5 | 22 | 20 | 395 |



Mitutoyo

# Vernier Caliper

## SERIES 160 — with Nib Style Jaws and Fine Adjustment

### FEATURES

- The jaws have round measuring faces for accurate ID measurement.
- With fine adjustment carriage to feed the slider.
- Inside and outside measurements can be directly read from the upper and lower slider graduations, respectively.
- Supplied with vinyl holster in fitted carton. Except 12" / 300mm, 18" / 450mm and 24" / 600mm are fitted carton only. Over 24" / 600mm supplied in wooden case.




### SPECIFICATIONS

**Metric** with metric/metric dual scale

| Range* | Order No. | Accuracy | Graduation | | Mass (g) |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 (10) - 300mm | **160-127** | ±0.04mm | 0.02mm | 0.02mm | 450 |
| 0 (20) - 450mm | **160-128** | ±0.05mm | 0.02mm | 0.02mm | 1,200 |
| 0 (20) - 600mm | **160-101** | ±0.05mm | 0.02mm | 0.02mm | 2,600 |
| 0 (20) - 1000mm | **160-104** | ±0.07mm | 0.02mm | 0.02mm | 3,500 |
| 0 (20) - 1500mm | **160-110** | ±0.09mm | 0.02mm | 0.02mm | 4,850 |
| 0 (20) - 2000mm | **160-113** | ±0.12mm | 0.02mm | 0.02mm | 10,200 |

*( ): Minimum dimension in ID measurement

**Metric/Inch** with metric/inch dual scale

| Range* | Order No. | Accuracy | Graduation | | Mass (g) |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 (10) - 300mm / 0 (.3") - 12" | **160-150** | ±0.04mm | 0.02mm | .001" | 450 |
| 0 (20) - 450mm / 0 (.5") - 18" | **160-151** | ±0.05mm | 0.02mm | .001" | 1,200 |
| 0 (20) - 600mm / 0 (.5") - 24" | **160-153** | ±0.05mm | 0.02mm | .001" | 1,400 |
| 0 (20) - 1000mm / 0 (1") - 40" | **160-155** | ±0.07mm | 0.02mm | .001" | 3,500 |
| 0 (20) - 1500mm / 0 (1") - 60" | **160-157** | ±0.09mm | 0.02mm | .001" | 4,850 |
| 0 (20) - 2000mm / 0 (1") - 80" | **160-159** | ±0.12mm | 0.02mm | .001" | 10,200 |

*( ): Minimum dimension in ID measurement

**Inch** with inch/inch dual scale

| Range* | Order No. | Accuracy | Graduation | | Mass (g) |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 (.3") - 12" | **160-124** | ±.0015" | .001" | .001" | 450 |
| 0 (.5") - 18" | **160-116** | ±.002" | .001" | .001" | 1,200 |
| 0 (.5") - 24" | **160-102** | ±.002" | .001" | .001" | 1,400 |
| 0 (1") - 40" | **160-105** | ±.003" | .001" | .001" | 3,500 |
| 0 (1") - 60" | **160-111** | ±.004" | .001" | .001" | 4,850 |
| 0 (1") - 80" | **160-114** | ±.005" | .001" | .001" | 10,200 |

*( ): Minimum dimension in ID measurement

**Inch/Metric** with inch/metric dual scale

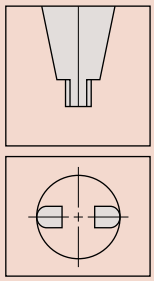
| Range* | Order No. | Accuracy | Graduation | | Mass (g) |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 (.3") - 12" / 0 (10) - 300mm | **160-125** | ±.0015" | .001" | 0.02mm | 450 |
| 0 (.5") - 18" / 0 (20) - 450mm | **160-119** | ±.002" | .001" | 0.02mm | 1,200 |
| 0 (.5") - 24" / 0 (20) - 600mm | **160-103** | ±.002" | .001" | 0.02mm | 1,400 |
| 0 (1") - 40" / 0 (20) - 1000mm | **160-106** | ±.003" | .001" | 0.02mm | 3,500 |
| 0 (1") - 60" / 0 (20) - 1500mm | **160-112** | ±.004" | .001" | 0.02mm | 4,850 |
| 0 (1") - 80" / 0 (20) - 2000mm | **160-115** | ±.005" | .001" | 0.02mm | 10,200 |

*( ): Minimum dimension in ID measurement

### Technical Data

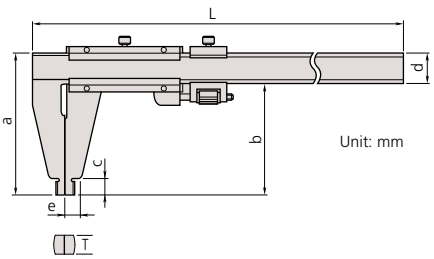
Accuracy: Refer to the list of specifications
Graduation: Refer to the list of specifications





Round surface of jaws for accurate ID measurement.

### DIMENSIONS



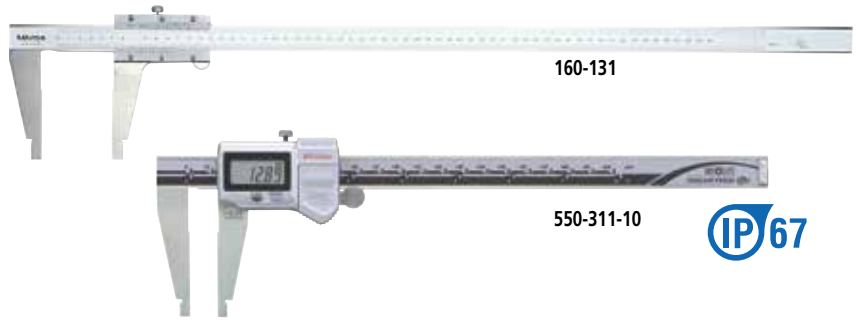

| Range | L | a | b | c | d | e | T |
|---|---|---|---|---|---|---|---|
| 0 - 12" / 0 - 300mm | 445 | 95 | 75 | 12 | 20 | 10 | 3.8 |
| 0 - 18" / 0 - 450mm | 630 | 125 | 100 | 18 | 25 | 14.8 | 6 |
| 0 - 24" / 0 - 600mm | 780 | 125 | 100 | 18 | 25 | 14.8 | 6 |
| 0 - 40" / 0 - 1000mm | 1240 | 172 | 140 | 24 | 32 | 17 | 8 |
| 0 - 60" / 0 - 1500mm | 1800 | 212 | 180 | 30 | 32 | 19 | 8 |
| 0 - 80" / 0 - 2000mm | 2300 | 220 | 180 | 30 | 40 | 23 | 12 |

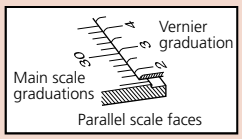
# ABSOLUTE Digimatic & Vernier Caliper

## SERIES 550, 160 — with Nib-Style Jaws

### FEATURES

- The rounded faces of the jaws are ideal for accurate ID (inside diameter) measurement.
- Inside and outside measurements can be directly read from the upper and lower slider graduations (Series 160).
- A fine-adjustment carriage type is available (Series 160).
- Parallax-free vernier scale type is available for easy and positive measurement (Series 160).
- With SPC output (Series 550).
- Supplied in fitted plastic case. Except 40"/1000mm supplied in wooden case.




### Technical Data

Accuracy: Refer to the list of specifications
Display*: LCD
Length standard*: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed*: Unlimited
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 3.5 years under normal use
*Digital models **Analog models

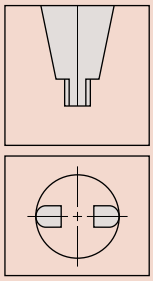
### Function of Digital Model

Origin-set, Zero-setting, Data output,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**959143**: Data hold unit
**959149**: SPC cable with data switch (40" / 1m)
**959150**: SPC cable with data switch (80" / 2m)
**05CZA624**: SPC cable with data switch (40" / 1m) for IP67 model
**05CZA625**: SPC cable with data switch (80" / 2m) for IP67 model





Round surface of jaws for accurate ID measurement.

### SPECIFICATIONS

**Metric** Digital model

| Range* | Order No. | Accuracy | Resolution | Mass (g) | Remarks |
|---|---|---|---|---|---|
| 0 (10) - 200mm | **550-301-20** | ±0.03mm | 0.01mm | 180 | IP67 |
| 0 (10) - 300mm | **550-331-10** | ±0.03mm | 0.01mm | 380 | w/ offset/preset function for easy ID measurement, IP67 |
| 0 (20) - 450mm | **550-203-10**** | ±0.05mm | 0.01mm | 1,110 | |
| 0 (20) - 600mm | **550-205-10**** | ±0.05mm | 0.01mm | 1,290 | |
| 0 (20) - 1000mm | **550-207-10**** | ±0.07mm | 0.01mm | 3,350 | |

*( ): Minimum dimension in ID measurement **Models are not IP67 rated

**Inch/Metric** Digital model

| Range* | Order No. | Accuracy | Resolution | Mass (g) | Remarks |
|---|---|---|---|---|---|
| 0 (.4") - 8" / 0 (10) - 200mm | **550-311-20** | ±.001" | .0005" / 0.01mm | 180 | IP67 |
| 0 (.4") - 12" / 0 (10) - 300mm | **550-341-10** | ±.0015" | .0005" / 0.01mm | 380 | w/ offset/preset function for easy ID measurement, IP67 |
| 0 (.5") - 18" / 0 (20) - 450mm | **550-223-10**** | ±.002" | .0005" / 0.01mm | 1,110 | — |
| 0 (.5") - 24" / 0 (20) - 600mm | **550-225-10**** | ±.002" | .0005" / 0.01mm | 1,290 | — |
| 0 (1") - 40" / 0 (20) - 1000mm | **550-227-10**** | ±.003" | .0005" / 0.01mm | 3,350 | — |

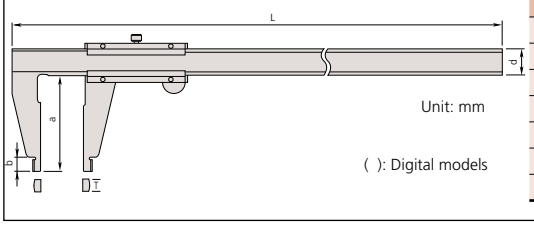
*( ): Minimum dimension in ID measurement **Models are not IP67 rated

**Metric** with metric/metric dual scale

| Range* | Order No. | Accuracy | Graduation | Mass (g) | Remarks |
|---|---|---|---|---|---|
| 0 (20) - 450mm | **160-130** | ±0.10mm | 0.02mm | 1,100 | — |
| 0 (20) - 600mm | **160-131** | ±0.10mm | 0.02mm | 1,300 | — |
| 0 (20) - 1000mm | **160-132** | ±0.15mm | 0.02mm | 3,350 | — |
| 0 (20) - 1500mm | **160-133** | ±0.22mm | 0.05mm | 4,850 | |
| 0 (20) - 2000mm | **160-134** | ±0.28mm | 0.05mm | 10,000 | |

*( ): Minimum dimension in ID measurement

### DIMENSIONS




| Range | L | a | b | d | T |
|---|---|---|---|---|---|
| 0 - 8"/ 0 - 200mm | 288 (290) | 60 | 8 | 16 | 3 |
| 0 - 12" / 0 - 300mm | 445 | 75 | 12 | 20 | 3.8 |
| 0 - 18" / 0 - 450mm | 632 | 100 | 18 | 25 | 6 |
| 0 - 24" / 0 - 600mm | 780 | 100 | 18 | 25 | 6 |
| 0 - 40" / 0 - 1000mm | 1240 | 140 | 24 | 32 | 8 |
| 0 - 60" / 0 - 1500mm | 1800 | 180 | 30 | 32 | 8 |
| 0 - 80" / 0 - 2000mm | 2300 | 180 | 30 | 40 | 12 |

# Long-Jaw Vernier Caliper

## SERIES 534

### FEATURES

- Long jaws for measuring hard-to-reach features.
- Fine adjustment for more accurate measurement (except 534-109 and 534-110)
- Supplied in fitted wooden case.




### SPECIFICATIONS

**Metric** with metric/metric dual scale without fine adjustment

| Range* | Order No. | Accuracy | Graduation | | Mass (g) |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 (10) - 300mm | **534-109** | ±0.07mm | 0.05mm | 0.05mm | 400 |
| 0 (20) - 500mm | **534-110** | ±0.13mm | 0.05mm | 0.05mm | 1,400 |

*( ): Minimum dimension in ID measurement

**Metric** with metric/metric dual scale

| Range* | Order No. | Accuracy | Graduation | | Mass (g) |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 (10) - 300mm | **534-113** | ±0.04mm | 0.02mm | 0.02mm | 460 |
| 0 (20) - 500mm | **534-114** | ±0.06mm | 0.02mm | 0.02mm | 1,500 |
| 0 (20) - 750mm | **534-115** | ±0.08mm | 0.02mm | 0.02mm | 2,900 |
| 0 (20) - 1000mm | **534-116** | ±0.10mm | 0.02mm | 0.02mm | 3,500 |

*( ): Minimum dimension in ID measurement

**Metric/Inch** with metric/inch dual scale

| Range* | Order No. | Accuracy | Graduation | | Mass (g) |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 (10) - 300mm / 0 (.3″) - 12" | **534-101** | ±0.07mm | 0.05mm | 1/128″ | 460 |
| 0 (10) - 300mm / 0 (.3″) - 12" | **534-105** | ±0.04mm | 0.02mm | .001″ | 460 |
| 0 (20) - 500mm / 0 (.8″) - 20" | **534-102** | ±0.13mm | 0.05mm | 1/128″ | 1,500 |
| 0 (20) - 500mm / 0 (.8″) - 20" | **534-106** | ±0.06mm | 0.02mm | .001″ | 1,500 |
| 0 (20) - 700mm / 0 (.8″) - 30" | **534-103** | ±0.16mm | 0.05mm | 1/128″ | 2,900 |
| 0 (20) - 700mm / 0 (.8″) - 30" | **534-107** | ±0.08mm | 0.02mm | .001″ | 2,900 |
| 0 (20) - 1000mm / 0 (.8″) - 40" | **534-104** | ±0.20mm | 0.05mm | 1/128″ | 3,500 |
| 0 (20) - 1000mm / 0 (.8″) - 40" | **534-108** | ±0.10mm | 0.02mm | .001″ | 3,500 |

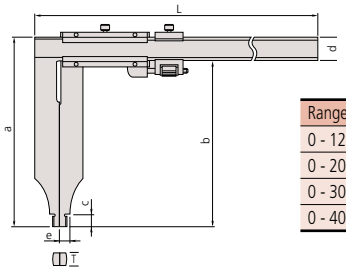
*( ): Minimum dimension in ID measurement

**Inch** with inch/inch dual scale

| Range* | Order No. | Accuracy | Graduation | | Mass (g) |
|---|---|---|---|---|---|
| | | | Lower Scale | Upper Scale | |
| 0 (.3″) - 12" | **534-117** | ±.002" | .001″ | .001″ | 400 |
| 0 (.8″) - 20" | **534-118** | ±.003" | .001″ | .001″ | 1500 |
| 0 (.8″) - 30" | **534-119** | ±.004" | .001″ | .001″ | 2900 |
| 0 (.8″) - 40" | **534-120** | ±.004" | .001″ | .001″ | 3500 |

*( ): Minimum dimension in ID measurement

### DIMENSIONS

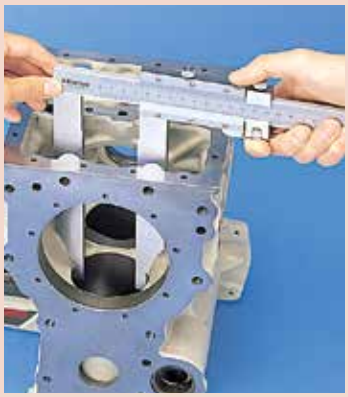


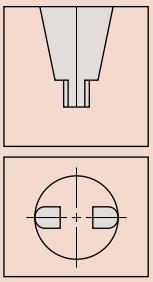

Unit: mm

| Range | L | a | b | c | d | e | T |
|---|---|---|---|---|---|---|---|
| 0 - 12″ / 0 - 300mm | 445 | 110 | 90 | 12 | 20 | 7 | 3.8 |
| 0 - 20″ / 0 - 500mm | 682 | 225 | 200 | 18.5 | 25 | 12 | 6 |
| 0 - 30″ / 0 - 750mm | 995 | 232 | 200 | 18.5 | 32 | 12 | 8 |
| 0 - 40″ / 0 - 1000mm | 1230 | 232 | 200 | 18.5 | 32 | 12 | 8 |

### Technical Data

Accuracy: Refer to the list of specifications
Graduation: Refer to the list of specifications





Round surface of jaws for accurate CD measurement.

# ABSOLUTE Digimatic Caliper

## SERIES 551 — with Nib Style and Standard Jaws

### FEATURES

- The rounded faces of the jaws are ideal for accurate ID (inside diameter) measurement.
- With SPC output.
- Supplied in fitted plastic holster in carton. 18" / 450mm and larger supplied wooden case.




### Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.01mm or .0005"/0.01mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 3.5 years under normal use

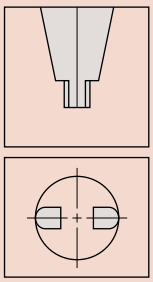
### Function of Digital Model

Origin-set, Zero-setting, Data output,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA624**: SPC cable with data switch (1m / 40") IP67
**05CZA625**: SPC cable with data switch (2m / 80") IP67





Round surface of jaws for accurate ID measurement.

### SPECIFICATIONS

**Metric** Digital model

| Range* | Order No. | Accuracy | Resolution | Mass (g) | Remarks |
|---|---|---|---|---|---|
| 0 (10) - 200mm | **551-301-20** | ±0.03mm | 0.01mm | 180 | IP67 |
| 0 (10) - 300mm | **551-331-10** | ±0.04mm | 0.01mm | 380 | with offset/preset function for easy ID measurement, IP67 |
| 0 (20) - 500mm | **551-204-10**** | ±0.06mm | 0.01mm | 1,060 | — |
| 0 (20) - 750mm | **551-206-10**** | ±0.06mm | 0.01mm | 1,410 | — |
| 0 (20) - 1000mm | **551-207-10**** | ±0.07mm | 0.01mm | 3,430 | — |

*( ): Minimum dimension in ID measurement ** Models are not IP67 rated

**Inch/Metric** Digital model

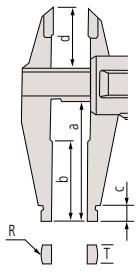
| Range* | Order No. | Accuracy | Resolution | Mass (g) | Remarks |
|---|---|---|---|---|---|
| 0 (.4") - 8" / 0 (10) - 200mm | **551-311-20** | ±.001" | .0005" / 0.01mm | 180 | IP67 |
| 0 (.4") - 12" / 0 (10) - 300mm | **551-341-10** | ±.002" | .0005" / 0.01mm | 380 | w/ offset/preset function for easy ID measurement, IP67 |
| 0 (.5") - 20" / 0 (20) - 500mm | **551-224-10**** | ±.0025" | .0005" / 0.01mm | 1,060 | — |
| 0 (.5") - 30" / 0 (20) - 750mm | **551-226-10**** | ±.0025" | .0005" / 0.01mm | 1,410 | — |
| 0 (1") - 40" / 0 (20) - 1000mm | **551-227-10**** | ±.003" | .0005" / 0.01mm | 3,430 | — |

*( ): Minimum dimension in ID measurement ** Models are not IP67 rated

### DIMENSIONS

**Series 551**

Unit: mm




| Range | a | b | c | d | R | T |
|---|---|---|---|---|---|---|
| 0 - 8" / 0 - 200mm | 60 | 43 | 8 | 30 | 5 | 3 |
| 0 - 12" / 0 - 300mm | 90 | 68 | 10 | 40.1 | 5 | 3.8 |
| 0 - 20" / 0 - 500mm | 150 | 115 | 15 | 56 | 10 | 6 |
| 0 - 30" / 0 - 750mm | 150 | 115 | 15 | 56 | 10 | 8 |
| 0 - 40" / 0 - 1000mm | 150 | 115 | 20 | 56 | 10 | 8 |

# Digimatic Carbon-Fiber Caliper

## SERIES 552 — with Optional Jaw Attachments

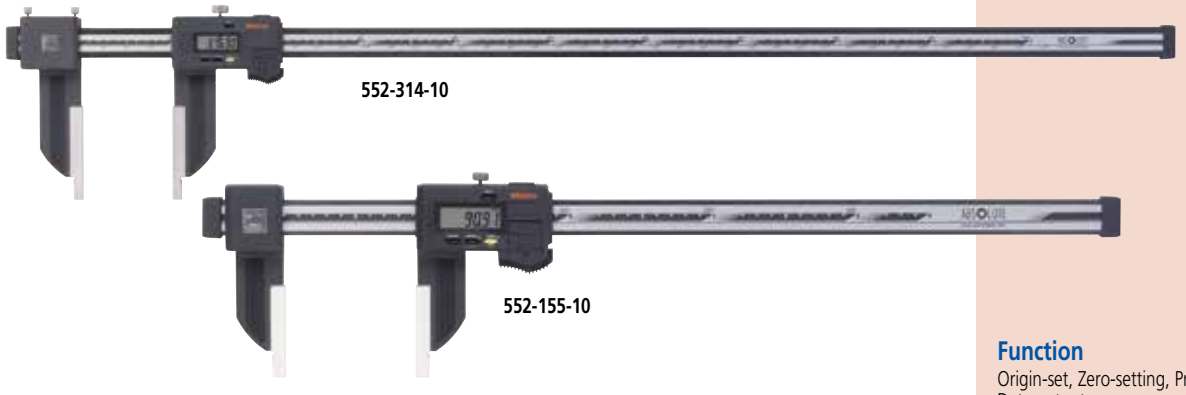
ABSOLUTE® Absolute System Patented by MITUTOYO

SPC

IP66

## FEATURES

- Lightweight Digimatic Calipers employ CFRP (Carbon-Fiber Reinforced Plastics) in the beam and jaws.
- Highly durable and easy to handle.
- The range of applications can be expanded by using the optional attachments.
- Direct readout of ID measurements from the LCD. (Offset value can be set easily by pressing the Offset key.)
- Preset function for setting a desired starting point.
- With SPC data output.
- Special model available with ceramic jaws which are suitable for measuring abrasive and magnetic products.
- Supplied in fitted wooden case.



552-314-10

552-155-10

## Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm or 0.01mm
Display: LCD
Length standard: Electrostatic capacitance type linear encoder
Max. response speed: unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 3,000 hours in continuous use

## Function

Origin-set, Zero-setting, Presetting, Offsetting, Data hold, Data output,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

## SPECIFICATIONS

### Metric

| Range* | Order No. | Accuracy | Resolution | Remarks |
|---|---|---|---|---|
| 0(20)-450mm | **552-302-10** | +/-0.04mm | 0.01mm | |
| 0(20)-450mm | **552-150-10** | +/-0.06mm | 0.01mm | long jaws 200mm |
| 0(20)-450mm | **552-155-10** | +/-0.04mm | 0.01mm | ceramic jaws |
| 0(20)-600mm | **552-303-10** | +/-0.04mm | 0.01mm | |
| 0(20)-600mm | **552-151-10** | +/-0.06mm | 0.01mm | long jaws 200mm |
| 0(20)-600mm | **552-156-10** | +/-0.04mm | 0.01mm | ceramic jaws |
| 0(20)-1000mm | **552-304-10** | +/-0.05mm | 0.01mm | |
| 0(20)-1000mm | **552-152-10** | +/-0.07mm | 0.01mm | long jaws 200mm |
| 0(20)-1500mm | **552-305-10** | +/-0.09mm | 0.01mm | |
| 0(20)-1500mm | **552-153-10** | +/-0.11mm | 0.01mm | long jaws 200mm |
| 0(20)-2000mm | **552-306-10** | +/-0.12mm | 0.01mm | |
| 0(20)-2000mm | **552-154-10** | +/-0.14mm | 0.01mm | long jaws 200mm |

*( ): Minimum dimension in ID measurement

### Inch/Metric

| Range* | Order No. | Accuracy | Resolution | Remarks |
|---|---|---|---|---|
| 0(.5")-18" | **552-312-10** | +/-.002" | .0005"/0.01mm | |
| 0(.5")-18" | **552-160-10** | +/-.0025" | .0005"/0.01mm | long jaws 7.9" |
| 0(.5")-18" | **552-165-10** | +/-.002" | .0005"/0.01mm | ceramic jaws |
| 0(.5")-24" | **552-313-10** | +/-.002" | .0005"/0.01mm | |
| 0(.5")-24" | **552-161-10** | +/-.0025" | .0005"/0.01mm | long jaws 7.9" |
| 0(.5")-24" | **552-166-10** | +/-.002" | .0005"/0.01mm | ceramic jaws |
| 0(1")-40" | **552-314-10** | +/-.002" | .0005"/0.01mm | |
| 0(1")-40" | **552-162-10** | +/-.003" | .0005"/0.01mm | long jaws 7.9" |
| 0(1")-60" | **552-315-10** | +/-.004" | .0005"/0.01mm | |
| 0(1")-60" | **552-163-10** | +/-.0045" | .0005"/0.01mm | long jaws 7.9" |
| 0(1")-80" | **552-316-10** | +/-.005" | .0005"/0.01mm | |
| 0(1")-80" | **552-164-10** | +/-.0055" | .0005"/0.01mm | long jaws 7.9" |

*( ): Minimum dimension in ID measurement

## Optional Accessories

**05CZA624**: SPC cable with data switch (40"/ 1m)
**05CZA625**: SPC cable with data switch (80"/ 2m)

**914055**:* Centerline attachments (mm)
**914056**:* Centerline attachments (inch)
**914057**:* Pointed ID measuring attachments (mm)
**914058**:* Pointed ID measuring attachments (inch)
**914053**:** Attachment clamps (for models up to 24" / 600mm range)
**914054**:** Attachment clamps (for models over 24" / 600mm range)

*Attachment clamps are required
**Attachment clamps and attachments are not available for long jaw type calipers



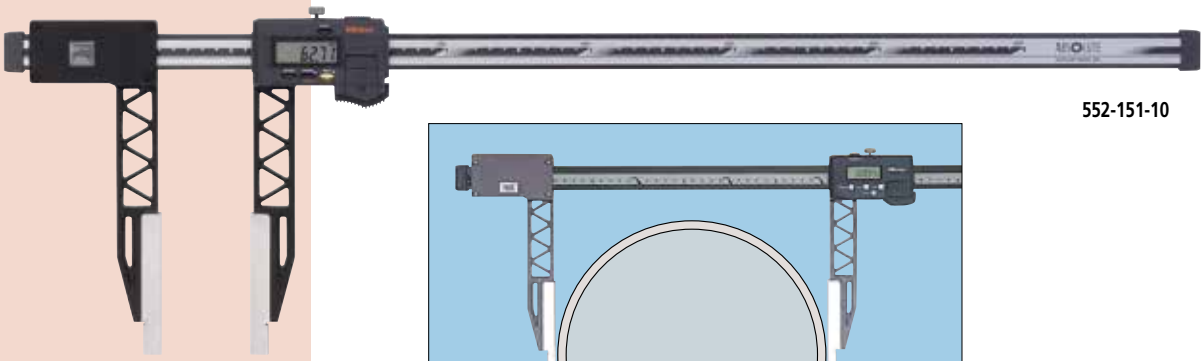
Centerline Attachments



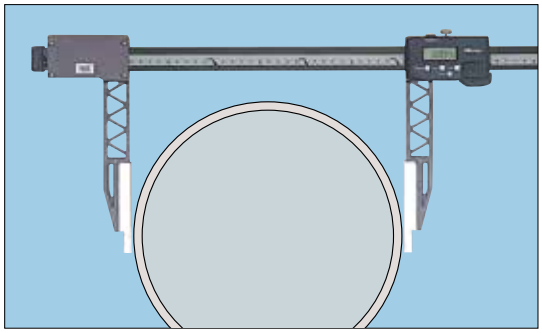
Pointed ID Measuring Attachments



Attachment Clamps



552-151-10





Ceramic jaws



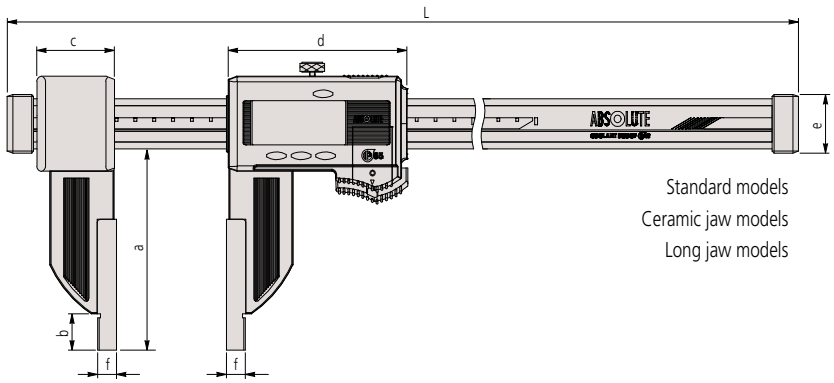
Centerline attachments



ID point attachments

## DIMENSIONS AND MASS

Unit: mm



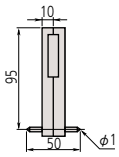

Standard models
Ceramic jaw models
Long jaw models

Standard models, Ceramic jaw models

| Range | L | a | b | c | d | e | f | Mass (g) |
|---|---|---|---|---|---|---|---|---|
| 0 - 18" / 0 - 450mm | 640 | 100 | 18 | 41.2 | 91.8 | 25 | 10 (.25") | 715 |
| 0 - 24" /0 - 600mm | 790 | 100 | 18 | 41.2 | 91.8 | 25 | 10 (.25") | 790 |
| 0 - 40" / 0 - 1000mm | 1230 | 150 | 24 | 62.8 | 113.8 | 32 | 10 (.5") | 1,760 |
| 0 - 60" / 0 - 1500mm | 1740 | 150 | 24 | 62.8 | 113.8 | 32 | 10 (.5") | 2,160 |
| 0 - 80" / 0 - 2000mm | 2250 | 150 | 24 | 62.8 | 113.8 | 32 | 10 (.5") | 2,560 |

( ): inch/mm models

Pointed ID Measuring Attachments



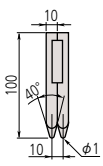

Unit: mm

Long jaw models

| Range | L | a | b | c | d | e | f | Mass (g) |
|---|---|---|---|---|---|---|---|---|
| 0 - 18" / 0 - 450mm | 680 | 200 | 24 | 89 | 91.8 | 25 | 10 (.25") | 1,215 |
| 0 - 24" / 0 - 600mm | 830 | 200 | 24 | 89 | 91.8 | 25 | 10 (.25") | 1,290 |
| 0 - 40" / 0 - 1000mm | 1280 | 200 | 24 | 110 | 113.8 | 32 | 10 (.5") | 2,090 |
| 0 - 60" / 0 - 1500mm | 1790 | 200 | 24 | 110 | 113.8 | 32 | 10 (.5") | 2,490 |
| 0 - 80" / 0 - 2000mm | 2300 | 200 | 24 | 110 | 113.8 | 32 | 10 (.5") | 2,890 |

( ): inch/mm models

Centerline Attachments





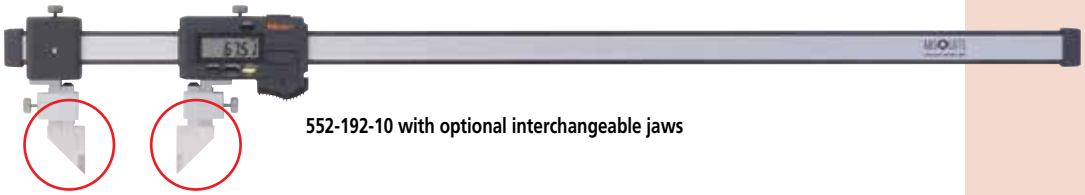

Mitutoyo

# ABSOLUTE Coolant-Proof Carbon-Fiber Caliper

## SERIES 552 — with Interchangeable Jaws

### FEATURES

- The range of applications can be expanded by using interchangeable jaws (optional).
- Quick and easy change of jaws due to the unique clamping mechanism. (A pair of clamping wheels is a standard accessory.)
- Provided with preset function for setting a desired starting point, which allows direct readout of offset measurements.
- SPC data output.



552-192-10 with optional interchangeable jaws

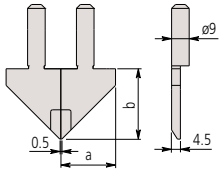
### SPECIFICATIONS

Inch/Metric

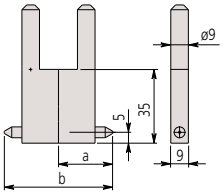
| Range | Order No. | Accuracy | Mass(g) |
|---|---|---|---|
| 0 - 18" / 0 - 450mm | **552-191-10** | ±.002" | 650 |
| 0 - 24" / 0 - 600mm | **552-192-10** | ±.002" | 725 |
| 0 - 40" / 0 - 1000mm | **552-193-10** | ±.002" | 1480 |
| 0 - 60" / 0 - 1500mm | **552-194-10** | ±.004" | 1880 |
| 0 - 80" / 0 - 2000mm | **552-195-10** | ±.005" | 2280 |

### Interchangeable Jaws (Optional)

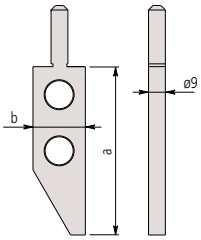
Standard type



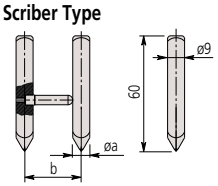

Inside point type



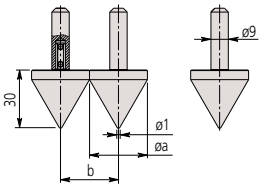

Surface Plate Type




Scriber Type




Centerline Type




Unit: mm

**Standard Type**

| Order No. | Components | a | b |
|---|---|---|---|
| 07CZA056 | Right (**07CAA044**), Left (**07CAA045**) | 28mm (1.1") | 30mm (1.2") |

**Inside Point Type**

| Order No. | Components | a | b |
|---|---|---|---|
| 07CZA058 | **07CZA041** x 2pcs. | 25mm | 50mm |
| 07CZA059 | **07CZA048** x 2pcs. | 1" | 2" |

**Scriber Type**

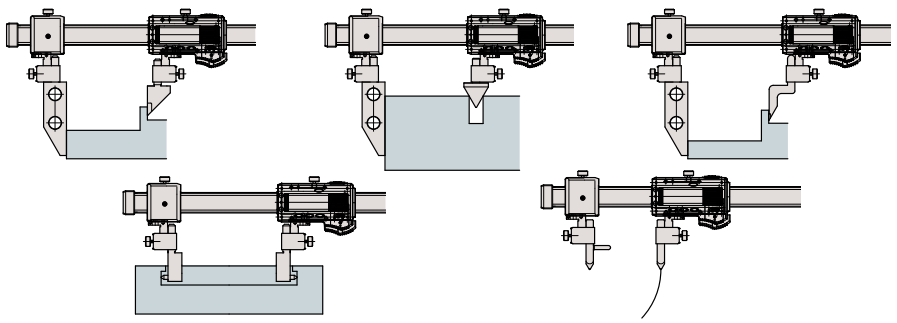
| Order No. | Components | a | b |
|---|---|---|---|
| 07CZA055 | Right (**07CZA042**), Left (**07CZA043**) | 8mm | 30mm |
| 07CZA061 | Right (**07CZA042**), Left (**07CZA049**) | 031" | 1.2" |

**Surface Plate Type**

| Order No. | a | b |
|---|---|---|
| 07CZA044 | 3.5" / 90mm | 1.1" / 28mm |

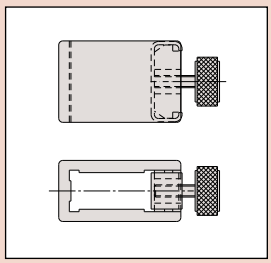
**Centerline Type**

| Order No. | Components | a | b |
|---|---|---|---|
| 07CZA057 | **07CZA039** x 2pcs. | 30mm | 30mm |
| 07CZA060 | **07CZA047** x 2pcs. | 1.2" | 1.2" |



### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm
Display: LCD
Scale type: ABSOLUTE electromagnetic linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 5,000 hours in continuous use
Dust/Water protection level: IP66
Standard accessory: Jaw clamps (2 pcs.), **05GZA033**

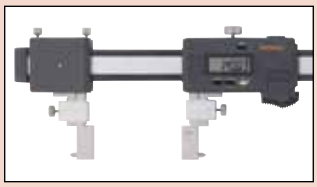


### Functions

Origin-set, Zero-setting, Presetting, Offsetting, Data hold, Automatic power on/off, Data output, inch/mm conversion (inch/mm models)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)



# ABSOLUTE Back-Jaw Centerline Caliper

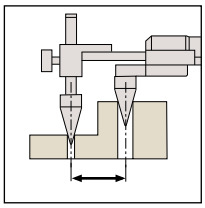
## SERIES 573 — Center-to-Center & Edge-to-Center Types

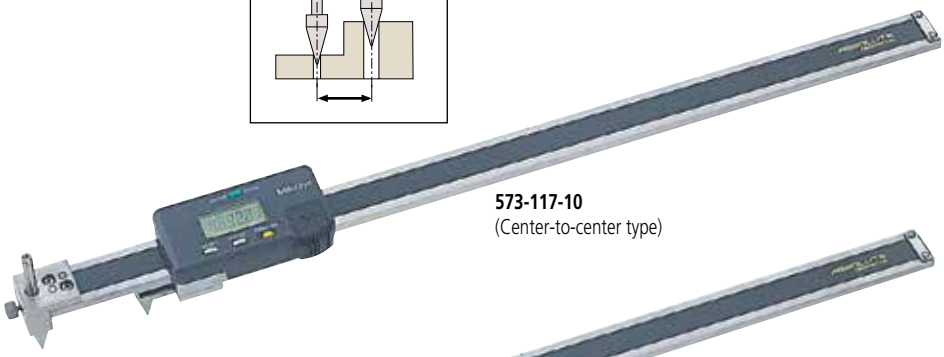
SPC

ABSOLUTE®
Absolute System Patented by MITUTOYO

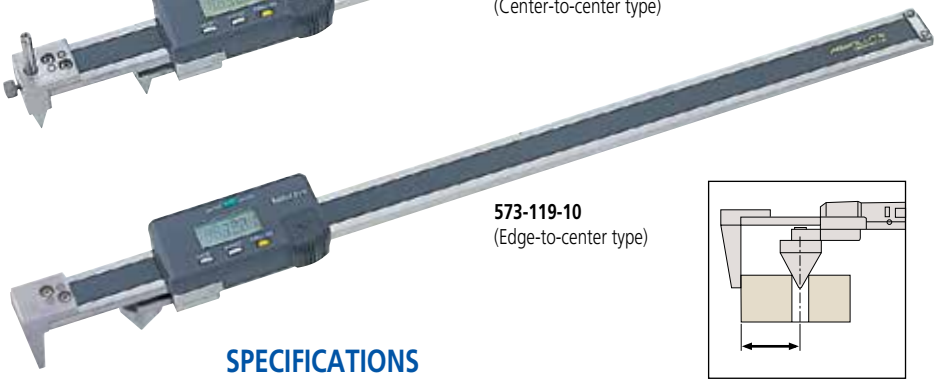
## FEATURES

- Specially designed to measure the distance between two centers or the distance from an edge to center.
- Provided with jaws on the back of the slider, measurements can be read easily by upside down.
- Direct reading of pitch measurements is available due to the offset value setting function.
- With SPC data output.
- Supplied fitted in wooden case.





**573-117-10**
(Center-to-center type)



**573-119-10**
(Edge-to-center type)



## Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.01mm
Display: LCD
Length standard*: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 3.5 years under normal use

## Function

Origin-set, Zero-setting, Power On/Off, Data output
Alarm: Low voltage, Counting value composition error

## Optional Accessories

**959143**: Data hold unit
**959149**: SPC cable with data switch (1m)
**959150**: SPC cable with data switch (2m)

## SPECIFICATIONS

**Metric** Center-to-center distance type

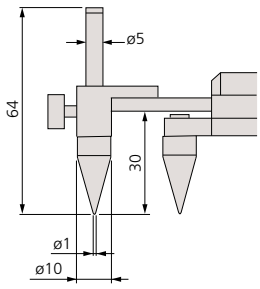
| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 10 - 200mm | **573-116-10** | ±0.10mm | 0.01mm | 482 |
| 10 - 300mm | **573-117-10** | ±0.15mm | 0.01mm | 578 |

**Metric** Edge-to-center distance type

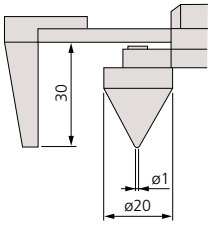
| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 10 - 200mm | **573-118-10** | ±0.10mm | 0.01mm | 485 |
| 10 - 300mm | **573-119-10** | ±0.15mm | 0.01mm | 581 |

## DIMENSIONS

Unit: mm




**573-116-10 / 573-117-10**




**573-118-10 / 573-119-10**



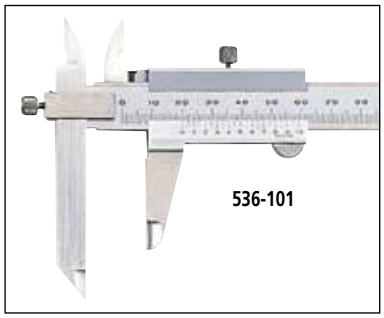
Mitutoyo

# Offset Caliper

## SERIES 573, 536 — ABSOLUTE Digimatic and Vernier Type

### FEATURES

- Main scale jaw can slide up and down to facilitate measurement of stepped sections. (Hard-to-reach dimensions such as A, B, C can be accurately measured.)
- With depth bar.
- With SPC data output. (Series 573)
- Supplied in fitted plastic case.







### SPECIFICATIONS

**Metric** Digital model

| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **573-601-20** | ±0.02mm | 0.01mm | 168 |
| 0 - 200mm | **573-602-20** | ±0.02mm | 0.01mm | 198 |
| 0 - 300mm | **573-604** | ±0.03mm | 0.01mm | 350 |

**Metric**

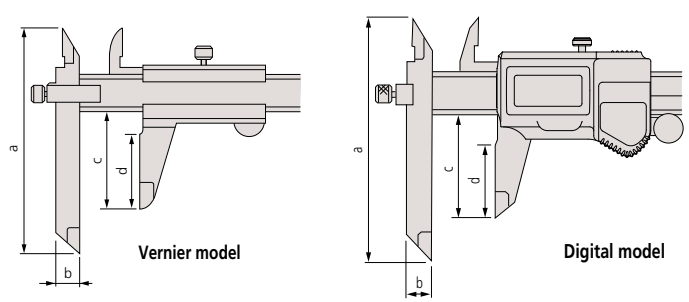
| Range | Order No. | Accuracy | Graduation | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **536-101** | ±0.05mm | 0.05mm | 150 |
| 0 - 200mm | **536-102** | ±0.05mm | 0.05mm | 200 |
| 0 - 300mm | **536-103** | ±0.08mm | 0.05mm | 400 |

**Inch/Metric** Digital model

| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | **573-701-20** | ±.001" | .0005" / 0.01mm | 168 |
| 0 - 8" / 0 - 200mm | **573-702-20** | ±.001" | .0005" / 0.01mm | 198 |
| 0 - 12" / 0 - 300mm | **573-704** | ±.0015" | .0005" / 0.01mm | 350 |

### DIMENSIONS

Unit: mm




| Range | a | b | c | d |
|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | 95 | 10 | 40 | 30.4 (30) |
| 0 - 8" / 0 - 200mm | 95 | 10 | 50 | 40.4 (38.5) |
| 0 - 12" / 0 - 300mm | 135 | 15 | 64 | 51 |

( ) Digital Model

### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .0005"/0.01mm or 0.01mm
Graduation**: 0.05mm
Display*: LCD
Length standard*: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed*: Unlimited
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 3.5 years under normal use
*Digital models **Analog models

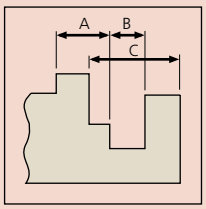
### Function of Digital Model

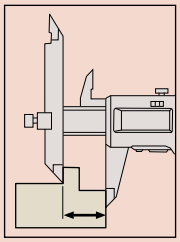
Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA624**: SPC cable with data switch (40" / 1m )
**05CZA625**: SPC cable with data switch (80" / 2m)





# Offset Centerline Caliper

## SERIES 573, 536 — ABSOLUTE Digimatic and Vernier Type

### FEATURES

- Specially designed for center to center distance measurements on the same and offset planes.
- Can also measure from edge to center.
- Hole diameter should be in the range of 1.5mm - 10mm (.06" - .4").
- With SPC data output. (Series 573)
- Supplied in fitted plastic case.



573-705-20



536-105

### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .0005"/0.01mm or 0.01mm
Graduation**: 0.05mm
Display*: LCD
Length standard*: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed*: Unlimited
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 3.5 years under normal use
*Digital models **Analog models

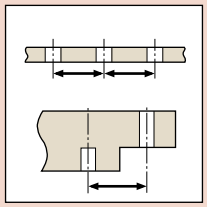
### Function of Digital Model

Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)





### SPECIFICATIONS

**Metric** Digital model

| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 10 - 150mm | **573-605-20** | ±0.03mm | 0.01mm | 157 |
| 10 - 200mm | **573-606-20** | ±0.03mm | 0.01mm | 177 |
| 10 - 300mm | **573-608** | ±0.04mm | 0.01mm | 320 |

**Inch/Metric** Digital model

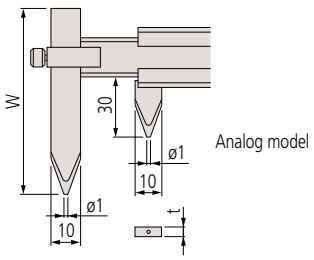
| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| .4 - 6" / 10 - 150mm | **573-705-20** | ±.0015" | .0005" / 0.01mm | 157 |
| .4 - 8" / 10 - 200mm | **573-706-20** | ±.0015" | .0005" / 0.01mm | 177 |
| .4 - 12" / 10 - 300mm | **573-708** | ±.0015" | .0005" / 0.01mm | 320 |

**Metric**

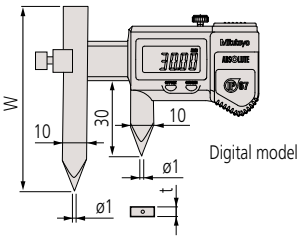
| Range | Order No. | Accuracy | Graduation | Mass (g) |
|---|---|---|---|---|
| 10 - 150mm | **536-105** | ±0.05mm | 0.05mm | 140 |
| 10 - 200mm | **536-106** | ±0.05mm | 0.05mm | 160 |
| 10 - 300mm | **536-107** | ±0.08mm | 0.05mm | 320 |

### DIMENSIONS

Unit: mm




Analog model




Digital model

| Range | W | t |
|---|---|---|
| 10 - 150mm | 75 | 3 |
| 10 - 200mm | 75 | 3 |
| 10 - 300mm | 100 | 3.8 |

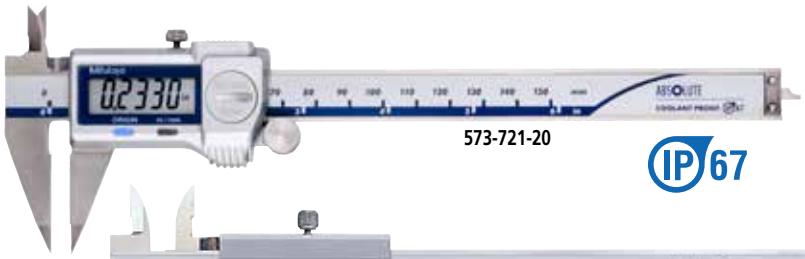
| Range | W | t |
|---|---|---|
| 10 - 160mm/.4 - 6.4" | 75 | 3.5 |
| 10 - 210mm/.4 - 8.4" | 75 | 3.5 |
| 10 - 310mm/.4 - 12.4" | 100 | 3.8 |

# Point Caliper

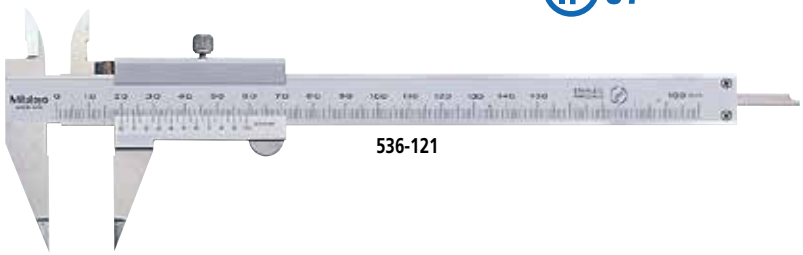
## SERIES 573, 536 — ABSOLUTE Digimatic and Vernier Type

### FEATURES

- Narrow tip jaws fit into very small grooves and tracks, making many previously difficult outside measurements far easier to obtain.
- With depth bar.
- With SPC data output. (Series 573)
- Supplied in fitted plastic case.



573-721-20



536-121

### SPECIFICATIONS

**Metric** Digital model

| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **573-621-20** | ±0.02mm | 0.01mm | 163 |
| 0 - 150mm | **573-625-20** | ±0.02mm | 0.01mm | 163 |

**Inch/Metric** Digital model

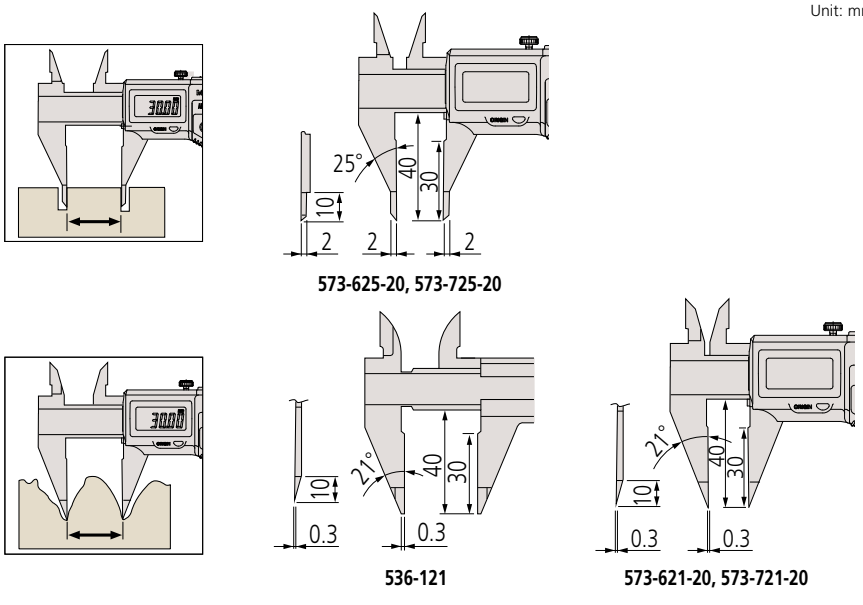
| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | **573-721-20** | ±.001" | .0005" / 0.01mm | 163 |
| 0 - 6" / 0 - 150mm | **573-725-20** | ±.001" | .0005" / 0.01mm | 163 |

**Metric**

| Range | Order No. | Accuracy | Graduation | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **536-121** | ±0.05mm | 0.05mm | 150 |

### DIMENSIONS

Unit: mm




### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .0005"/0.01mm or 0.01mm
Graduation**: 0.05mm
Display*: LCD
Length standard*: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed*: Unlimited
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 3.5 years under normal use
*Digital models **Analog models

### Function of Digital Model

Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)



# Blade-Type Caliper

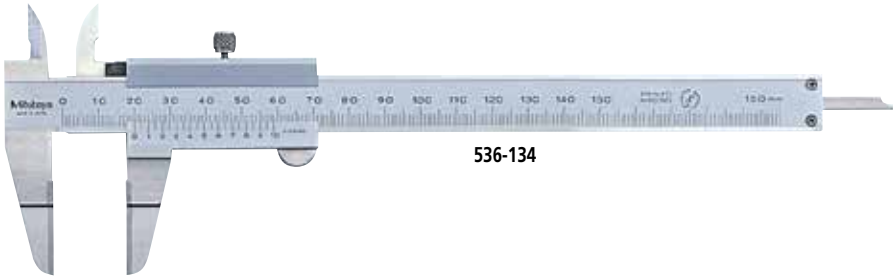
## SERIES 573, 536 — ABSOLUTE Digimatic and Vernier Type

### FEATURES

- The thin-blade type jaws fit into very small grooves and making previously difficult. outside measurements easier to obtain.
- The OD measuring faces are carbide-tipped.
- With depth bar.
- With SPC data output. (Series 573)
- Supplied in fitted plastic case.



573-734-20



536-134

### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .0005"/0.01mm or 0.01mm
Graduation**: 0.05mm
Display*: LCD
Length standard*: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed*: Unlimited
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 3.5 years under normal use
*Digital models **Analog models

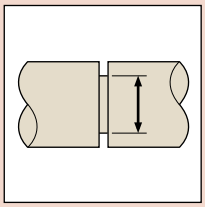
### Function of Digital Model

Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)





### SPECIFICATIONS

**Metric** Digital model

| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **573-634-20** | ±0.02mm | 0.01mm | 168 |

**Inch/Metric** Digital model

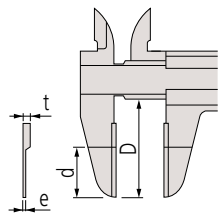
| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | **573-734-20** | ±.001" | .0005" / 0.01mm | 168 |

**Metric**

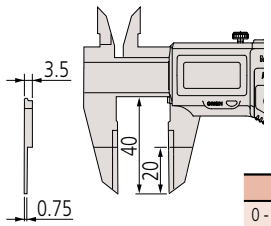
| Range | Order No. | Accuracy | Graduation | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **536-134** | ±0.05mm | 0.05mm | 130 |
| 0 - 200mm | **536-135** | ±0.05mm | 0.05mm | 160 |
| 0 - 300mm | **536-136** | ±0.08mm | 0.05mm | 340 |

### DIMENSIONS

Unit: mm




Anlog model




Digital model

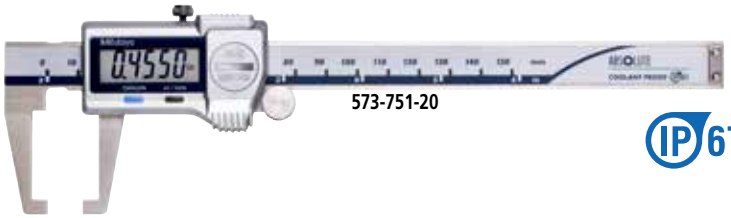
| Range | D | d | e | t |
|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | 40 | 20 | 0.75 | 3 |
| 0 - 200mm | 50 | 25 | 0.75 | 3 |
| 0 - 300mm | 64 | 30 | 1 | 3.8 |

# Neck Caliper

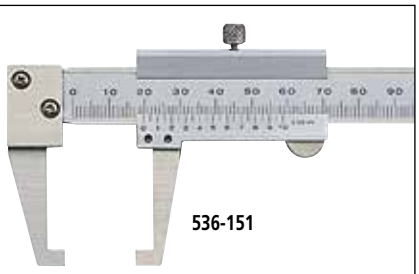
## SERIES 573, 536 — ABSOLUTE Digimatic and Vernier Type

## FEATURES

- Point-jaw type can measure wall thickness inside bores and recesses.
- Flat-jaw type can measure grooves and recesses.
- With SPC data output. (Series 573)
- Supplied in fitted plastic case.

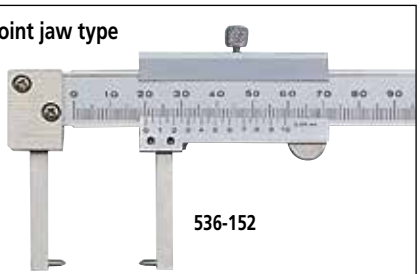


573-751-20



536-151

Point jaw type



536-152

## SPECIFICATIONS

**Metric** Digital model

| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **573-651-20** | ±0.03mm | 0.01mm | 157 |
| 0 - 150mm | **573-652-20*** | ±0.03mm | 0.01mm | 157 |

*Point jaw type

**Inch/Metric** Digital model

| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | **573-751-20** | ±.0015" | .0005" / 0.01mm | 157 |
| 0 - 6" / 0 - 150mm | **573-752-20*** | ±.0015" | .0005" / 0.01mm | 157 |

*Point jaw type

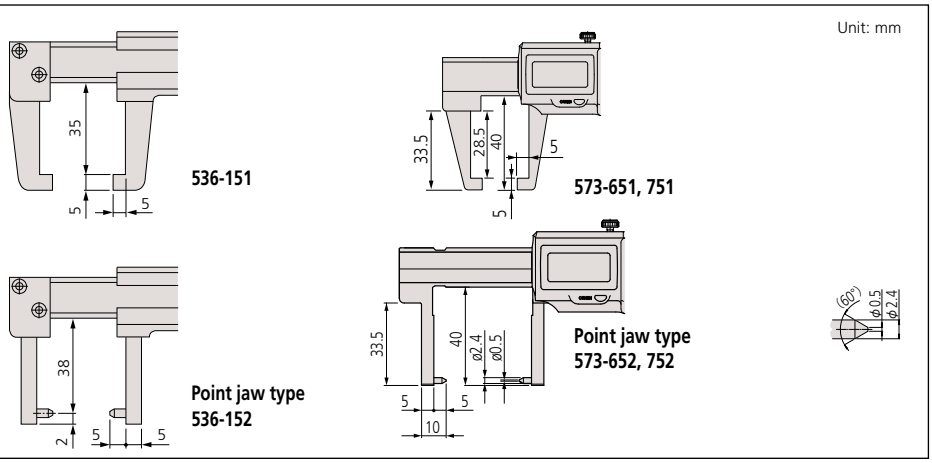
**Metric**

| Range | Order No. | Accuracy | Graduation | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **536-151** | ±0.05mm | 0.05mm | 140 |
| 0 - 150mm | **536-152*** | ±0.05mm | 0.05mm | 140 |

*Point jaw type

## DIMENSIONS

Unit: mm




### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: 0.01mm or .0005"/0.01mm
Graduation**: 0.05mm
Display*: LCD
Length standard*: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed*: Unlimited
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 3.5 years under normal use
*Digital models **Analog models

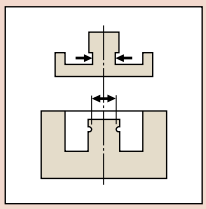
### Function of Digital Model

Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA624**: SPC cable with data switch (1m / 40")
**05CZA625**: SPC cable with data switch (2m / 80")





# Tube Thickness Caliper

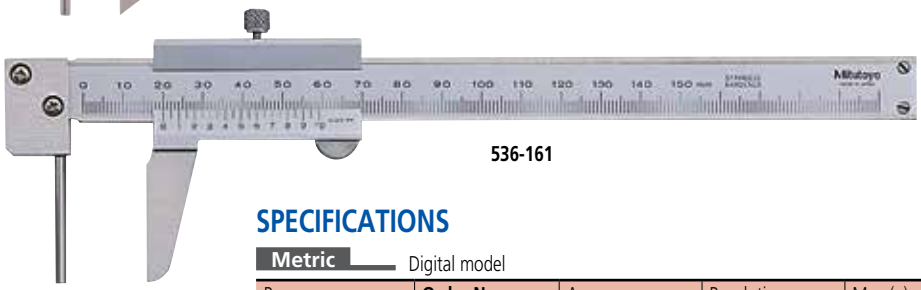
## SERIES 573, 536 — ABSOLUTE Digimatic and Vernier Type

### FEATURES

- The main scale jaw is a round bar that facilitates measurements of tube wall thickness.
- With SPC data output. (Series 573)
- Supplied in fitted plastic case.



573-761-20



536-161

### Technical Data

Accuracy: Refer to the list of specifications
Display*: LCD
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed*: Unlimited
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 3.5 years under normal use
*Digital models **Analog models

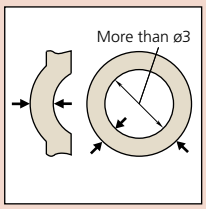
### Function of Digital Model

Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only))
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digital Model

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)






### SPECIFICATIONS

**Metric** Digital model

| Range | Order No. | Accuracy | Resolution | Mass(g) |
|---|---|---|---|---|
| 0 - 150mm | **573-661-20** | ±0.05mm | 0.01mm | 167 |

**Inch/Metric** Digital model

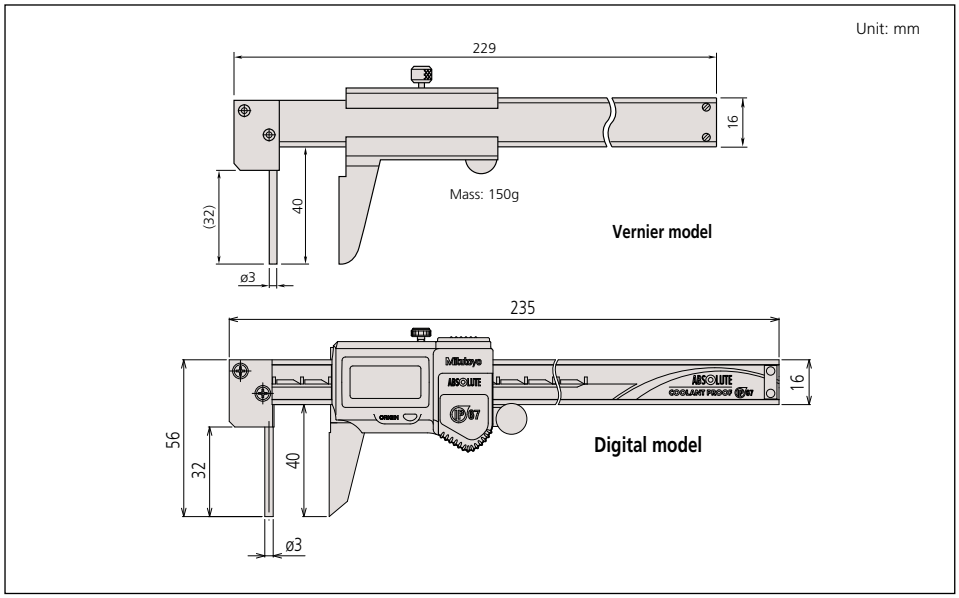
| Range | Order No. | Accuracy | Resolution | Mass(g) |
|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | **573-761-20** | ±.002" | .0005" / 0.01mm | 167 |

**Metric**

| Range | Order No. | Accuracy | Graduation | Mass(g) |
|---|---|---|---|---|
| 0 - 150mm | **536-161** | ±0.05mm | 0.05mm | 150 |

### DIMENSIONS AND MASS

Unit: mm

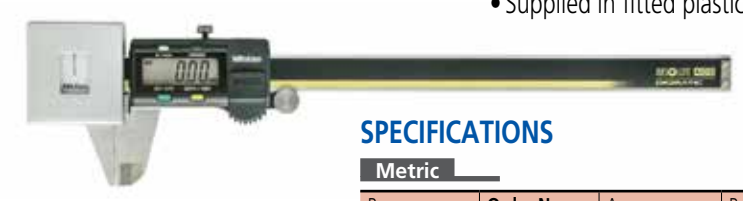


# ABSOLUTE Low-Force Caliper

## SERIES 573

### FEATURES

- Due to their low measuring force, these calipers are ideal for elastic or resilient workpieces such as plastic parts and rubber parts that standard calipers cannot measure.
- With SPC data output.
- Supplied in fitted plastic case.



573-191-30

### SPECIFICATIONS

**Metric**

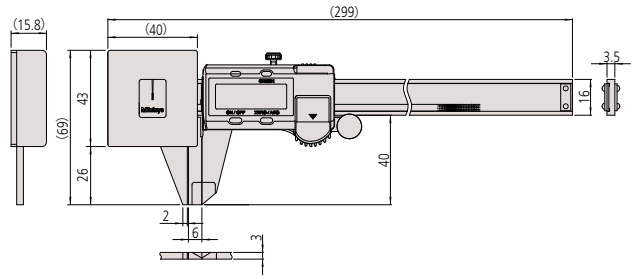
| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 180mm | **573-191-30** | ±0.05mm | 0.01mm | 253 |

**Inch/Metric**

| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 7" / 0 - 180mm | **573-291-30** | ±.002" | .0005" / 0.01mm | 253 |

### DIMENSIONS AND MASS

Unit: mm




### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm or 0.01mm
Display: LCD
Length standard: ABSOLUTE Electromagnetic Induction-type Linear Encoder
Measuring force: 0.5N-1.0N (50gf to 100gf)
Jaw retraction: 0.3mm
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 3.5 years under normal use

### Function

Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**959143**: Data hold unit
**959149**: SPC cable with data switch (40" / 1m)
**959150**: SPC cable with data switch (80" / 2m)



**Measurement procedures**



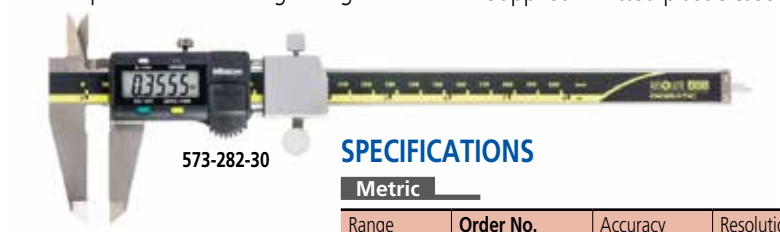
A consistently low measuring force can be guaranteed by only taking measurements when the pointer is between the two fiducial lines.

# ABSOLUTE Snap Caliper

## SERIES 573

### FEATURES

- The ABSOLUTE Digimatic snap caliper features a spring-loaded mechanism to allow quick and efficient go/no-go inspection for mass production parts.
- With SPC data output.
- Supplied in fitted plastic case.



573-282-30

### SPECIFICATIONS

**Metric**

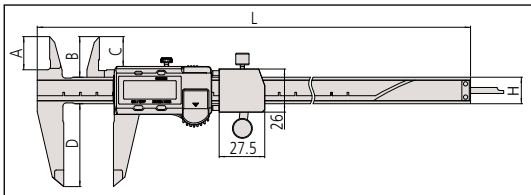
| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 100mm | **573-181-30** | ±0.02mm | 0.01mm | 213 |
| 0 - 150mm | **573-182-30** | ±0.02mm | 0.01mm | 233 |

**Inch/Metric**

| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 4" / 0 - 100mm | **573-281-30** | ±.001" | .0005" / 0.01mm | 213 |
| 0 - 6" / 0 - 150mm | **573-282-30** | ±.001" | .0005" / 0.01mm | 233 |

### DIMENSIONS AND MASS

Unit: mm




| Range | L | a | b | c | d | Mass (g) |
|---|---|---|---|---|---|---|
| 0 - 100mm | 233 | 40 | 21 | 16.5 | 16 | 213 |
| 0 - 150mm | 290 | 50 | 24.5 | 20 | 16 | 233 |

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm or 0.01mm
Repeatability: .0005" / 0.01mm
Display: LCD
Length standard: ABSOLUTE Electromagnetic Induction-type Linear Encoder
Measuring force: 7N to 14N (700gf to 1400gf)
Jaw retraction: 2mm
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 3.5 years under normal use

### Function

Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

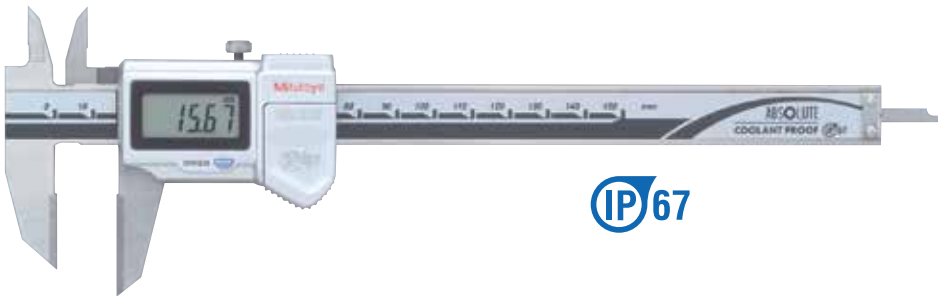
**959143**: Data hold unit
**959149**: SPC cable with data switch (40" / 1m)
**959150**: SPC cable with data switch (80" / 2m)

# Scribing Caliper

## SERIES 573, 536 — ABSOLUTE Digimatic and Vernier Type

### FEATURES

- The carbide-tipped jaws facilitate fine scribing on workpiece.
- With depth bar.
- With SPC data output. (Series 573)
- Supplied in fitted plastic case.




### Technical Data

Accuracy: Refer to the list of specifications
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 3.5 years under normal use

### Function

Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)

### SPECIFICATIONS

**Metric** Digital model

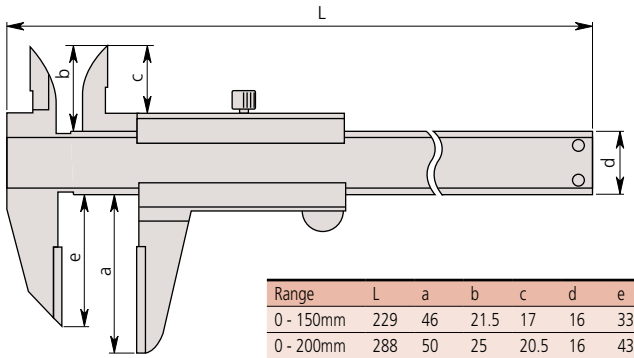
| Range | Order No. | Accuracy | Resolution | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **573-676-20** | ±0.02mm | 0.01mm | 166 |
| 0 - 200mm | **573-677-20** | ±0.02mm | 0.01mm | 196 |
| 0 - 300mm | **573-679** | ±0.03mm | 0.01mm | 345 |

**Metric** Vernier type

| Range | Order No. | Accuracy | Graduation | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **536-221** | ±0.05mm | 0.05mm | 150 |
| 0 - 200mm | **536-222** | ±0.05mm | 0.05mm | 180 |
| 0 - 300mm | **536-223** | ±0.08mm | 0.05mm | 355 |

### DIMENSIONS

Unit: mm




| Range | L | a | b | c | d | e |
|---|---|---|---|---|---|---|
| 0 - 150mm | 229 | 46 | 21.5 | 17 | 16 | 33 |
| 0 - 200mm | 288 | 50 | 25 | 20.5 | 16 | 43 |
| 0 - 300mm | 403 | 64 | 27.5 | 22 | 20 | 54 |

# ABSOLUTE Inside Caliper

## SERIES 573, 536 — Knife-edge/Inside Groove/Point-Jaw Type

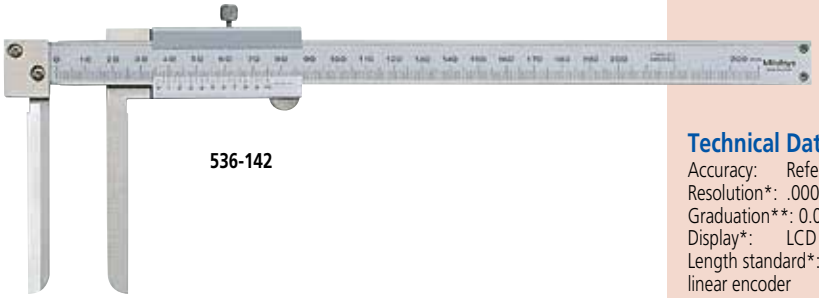
### FEATURES

- Specially designed for inside measurements in hard-to-reach places.
- With SPC data output. (Series 573)
- Supplied in fitted plastic case. 18" / 450mm and 24"/ 600mm supplied in wooden case.

**Knife-edge type**



573-742-20



536-142

**Inside-groove type**



573-745-20

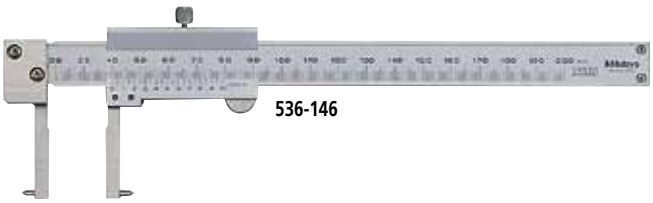


536-145

**Point-jaw type**



573-746-20



536-146

### SPECIFICATIONS

**Metric** Digital model

| Range | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|
| 10 - 200mm | **573-642-20** | ±0.05mm | Knife-edge type, Measurable min. hole diameter: ø10mm | 227 |
| 10 - 160mm | **573-645-20** | ±0.05mm | Inside-groove type, Measurable min. hole diameter: ø10mm | 147 |
| 20 - 170mm | **573-646-20** | ±0.03mm | Point-jaw type, Measurable min. hole diameter: ø20mm | 157 |

**Inch/Metric** Digital model

| Range | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|
| .4" - 8" / 10-200mm | **573-742-20** | ±.002" | Knife-edge type, Measurable min. hole diameter: ø.4" | 227 |
| .4" - 6" / 10-150mm | **573-745-20** | ±.002" | Inside-groove type, Measurable min. hole diameter: ø.4" | 147 |
| .8" - 6" / 20-150mm | **573-746-20** | ±.0015" | Point-jaw type, Measurable min. hole diameter: ø.8" | 157 |

**Metric**

| Range | Order No. | Accuracy | Remarks | Mass (g) |
|---|---|---|---|---|
| 10 - 200mm | **536-142** | ±0.12mm | Knife-edge type, Measurable min. hole diameter: ø10mm | 210 |
| 10 - 150mm | **536-145** | ±0.05mm | Inside groove type, Measurable min. hole diameter: ø10mm | 130 |
| 20 - 150mm | **536-146** | ±0.05mm | Point jaw type, Measurable min. hole diameter: ø20mm | 140 |
| 30 - 300mm | **536-147** | ±0.08mm | Point jaw type, Measurable min. hole diameter: ø30mm | 370 |
| 70 - 450mm | **536-148** | ±0.10mm | Point jaw type, Measurable min. hole diameter: ø70mm | 1,250 |
| 70 - 600mm | **536-149** | ±0.12mm | Point jaw type, Measurable min. hole diameter: ø70mm | 1,430 |

ABSOLUTE® Absolute System Patented by MITUTOYO

### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .0005"/0.01mm / 0.01mm
Graduation**: 0.05mm
Display*: LCD
Length standard*: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed*: Unlimited
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 3.5 years under normal use
*Digital models **Analog models

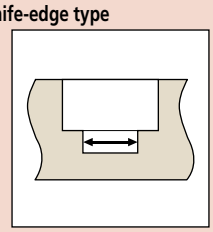
### Function of Digital Model

Origin-set, Zero-setting, Power On/Off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

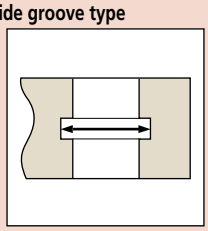
### Optional Accessories for Digital Model

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)

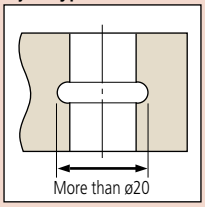
**Knife-edge type**



**Inside groove type**



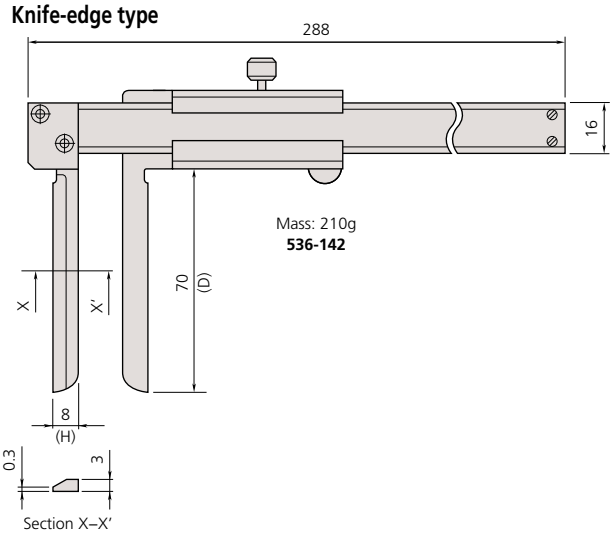
**Point jaw type**

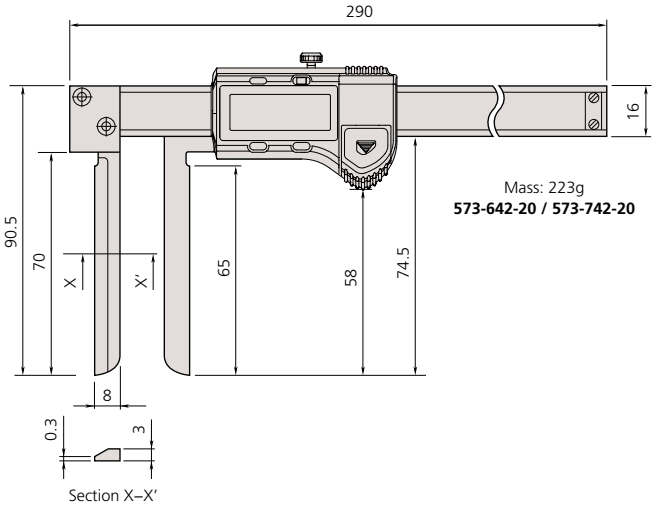


## DIMENSIONS AND MASS

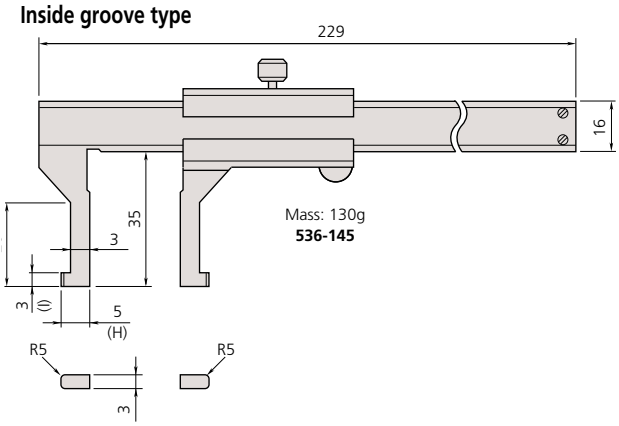
Unit: mm

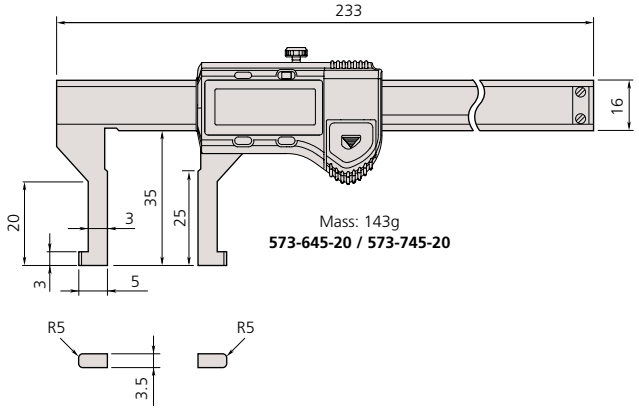
### Knife-edge type



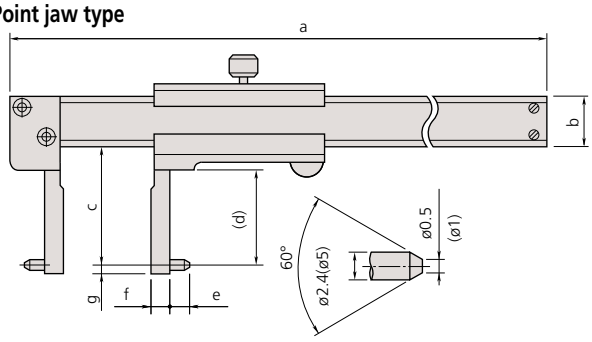



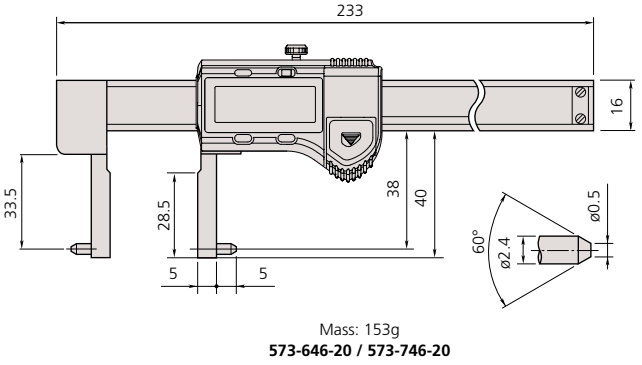

### Inside groove type




### Point jaw type



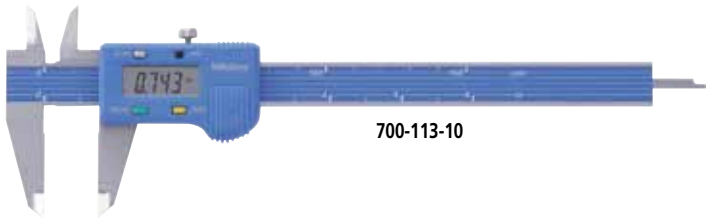

| Order No. | Range | a | b | c | d | e | f | g | Mass (g) |
|---|---|---|---|---|---|---|---|---|---|
| **536-146** | 150mm | 229 | 16 | 38 | 31 | 5 | 5 | 2 | 140 |
| **536-147** | 300mm | 403 | 20 | 98 | 89 | 5 | 10 | 2 | 370 |
| **536-148** | 450mm | 610 | 25 | 145 | 136 | 10 | 25 | 5 | 1,250 |
| **536-149** | 600mm | 750 | 25 | 145 | 136 | 10 | 25 | 5 | 1,430 |

# MyCAL-Lite

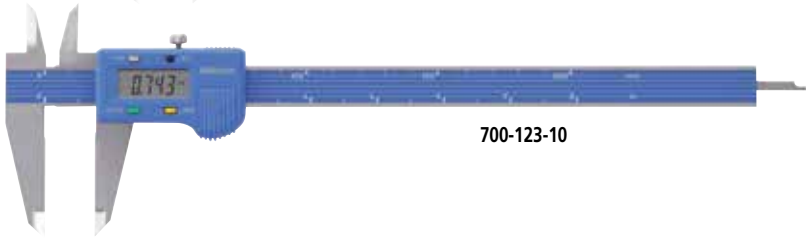
## SERIES 700 — Digital Caliper for DIY

### FEATURES

- The MyCAL-Lite is an ideal measuring tool for the DIY market.
- The LCD screen allows error-free readout of measurements.
- With depth measuring bar.



700-113-10



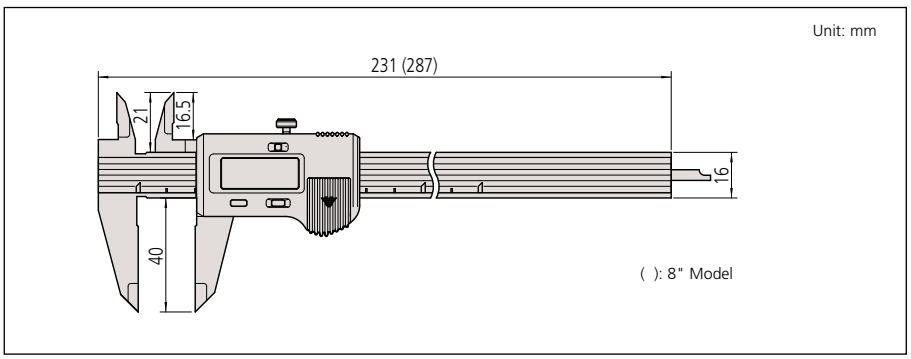
700-123-10

### SPECIFICATIONS

**Inch/Metric**

| Range | **Order No.** | Accuracy | Mass (g) |
|---|---|---|---|
| 0 - 6" / 0 - 150mm | **700-113-10** | ±.005" / ±0.2mm | 150 |
| 0 - 8" / 0 - 200mm | **700-123-10** | ±.005" / ±0.2mm | 170 |

### DIMENSIONS

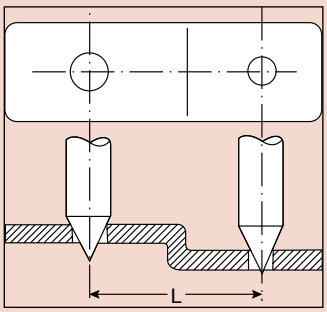



### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .001" / 0.1mm
Display: LCD
Length standard: Electrostatic capacitance type linear encoder
Max. response speed: 1800mm/s
Battery: SR44 (1 pc.), **938882**
Battery life*: Approx. 2 years under normal use

### Function

Zero-setting, Power on/off
inch/mm conversion
Alarm: Low voltage, Counting value composition error

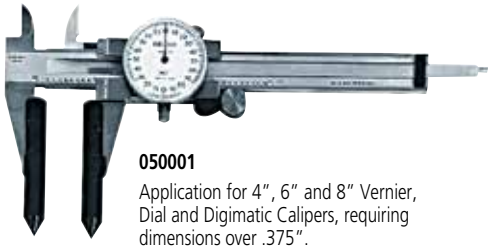



# Center Line Gage

## Optional Accessories for Caliper

### FEATURES

Pairs of conical probes are specially designed for Digimatic, Dial and Vernier calipers to quickly measure centerline distances.



**050001**

Application for 4″, 6″ and 8″ Vernier, Dial and Digimatic Calipers, requiring dimensions over .375″.



**050018**

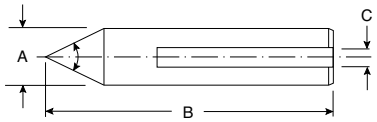
Application for 12″ Vernier, Dial and Digimatic Calipers requiring dimensions over .5″.

### SPECIFICATIONS

Center Line Gage

| Order No. | Description |
|---|---|
| **050001** | For 4, 6 and 8″ Calipers |
| **050018** | For 12″ Calipers |

### DIMENSIONS




| | A | B | C |
|---|---|---|---|
| **050001** | .375″ | 2.187″ | .141″ |
| **050018** | .500″ | 2.75″ | .154″ |

# Depth Base Attachment

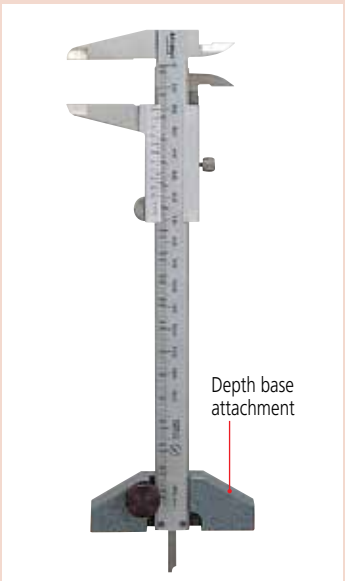
## Optional Accessories for Caliper

### FEATURES

- For 4″, 6″, 8″, 12″ / 100mm, 150mm, 200mm, 300mm, vernier, dial and digital calipers which have a depth measuring bar.
- Finely grounded base surface and secure locking clamp.



**050084-10**



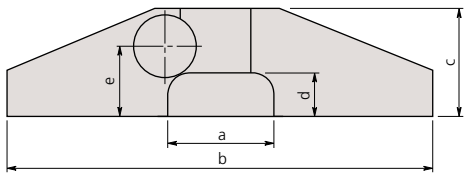

### SPECIFICATIONS

Inch/Metric

| Size | Order No. | Remarks (applicable measuring range of caliper) |
|---|---|---|
| 3″ / 75mm | **050083-10** | 4″, 6″, 8″ / 100mm, 150mm, 200mm |
| 4″ / 100mm | **050084-10** | 4″, 6″, 8″ / 100mm, 150mm, 200mm |
| 5″ / 125mm | **050085-10** | 12″ / 300mm |

### DIMENSIONS

Unit: mm




| Size | a | b | c | d | e | t |
|---|---|---|---|---|---|---|
| 3″ / 75mm | 25 | 75 | 26.5 | 13 | 18.5 | 12 |
| 4″ / 100mm | 25 | 100 | 26.5 | 13 | 18.5 | 12 |
| 5″ / 125mm | 30 | 125 | 28.5 | 13 | 20 | 14 |

t: Base thickness



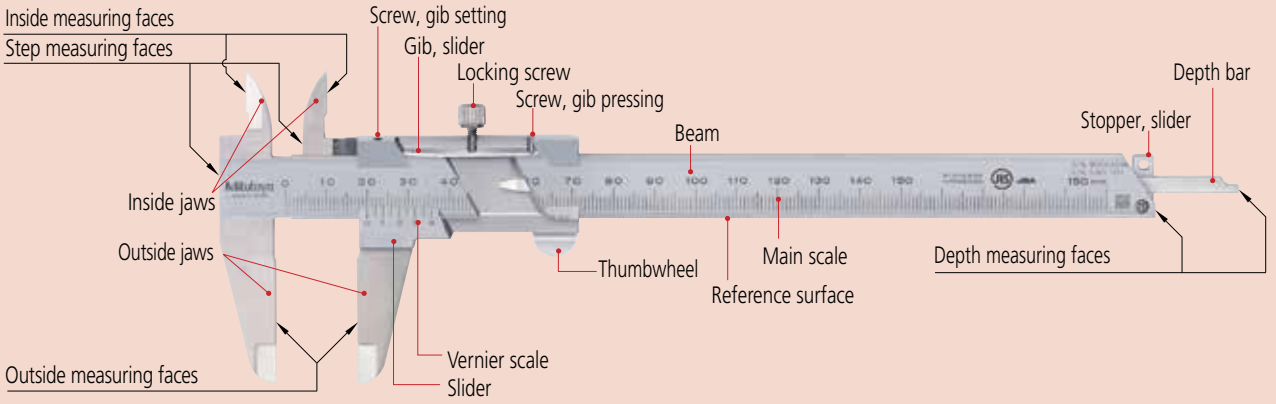
Mitutoyo

# Quick Guide to Precision Measuring Instruments

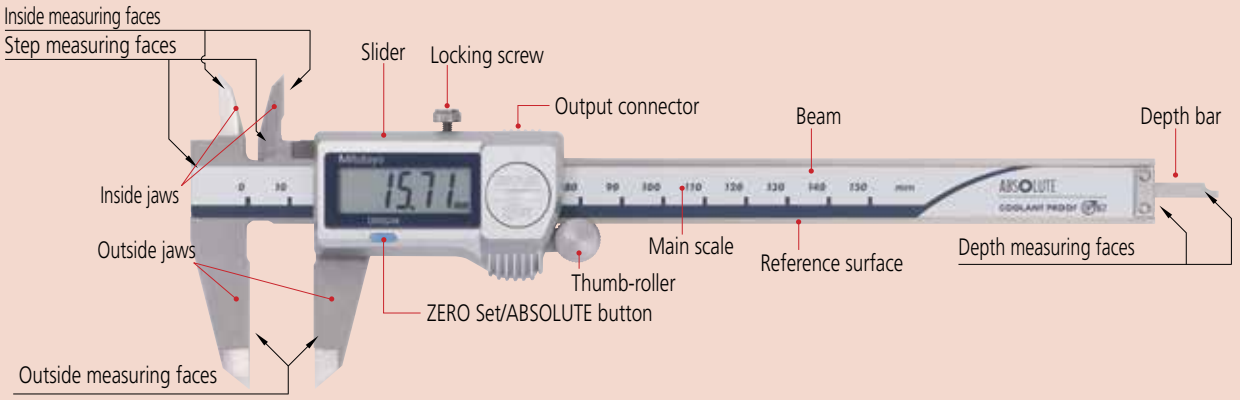
## Calipers

### Nomenclature

#### Vernier Caliper

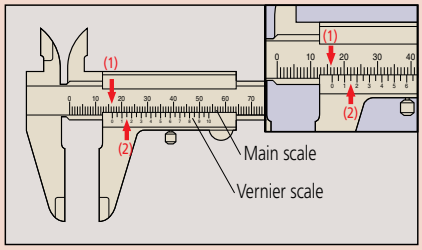



#### Absolute Digimatic Caliper



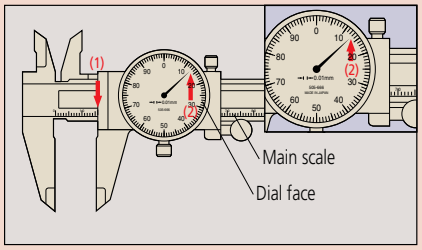

### How to Read the Scale

#### Vernier Calipers




| Graduation | 0.05mm | |
|---|---|---|
| (1) Main scale | 16 | mm |
| (2) Vernier | 0.15 | mm |
| Reading | 16.15 | mm |

#### Dial Calipers

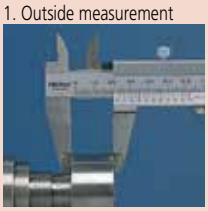



| Graduation | 0.01mm | |
|---|---|---|
| (1) Main scale | 16 | mm |
| (2) Dial face | 0.13 | mm |
| Reading | 16.13 | mm |

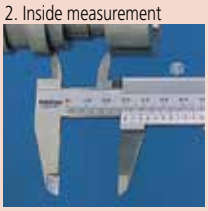
Note) Above left, 0.15 mm (2) is read at the position where a main scale graduation line corresponds with a vernier graduation line.

### Measurement applications

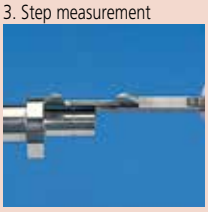
1. Outside measurement



2. Inside measurement



3. Step measurement

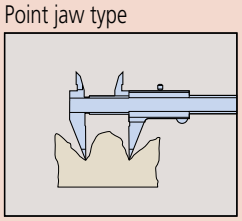


4. Depth measurement



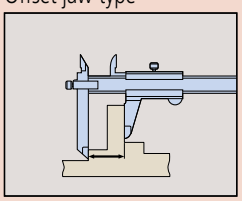
### Special Purpose Caliper Applications

Point jaw type



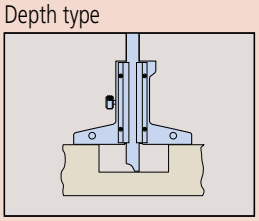
For uneven surface measurement

Offset jaw type



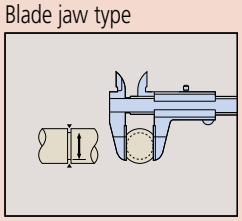
For stepped feature measurement

Depth type



For depth measurement

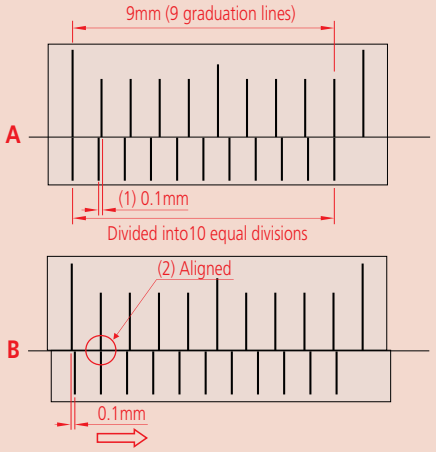
Blade jaw type



For diameter of narrow groove measurement

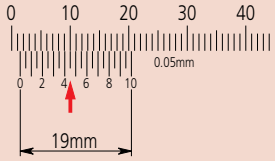
## Vernier scale

This is a short auxiliary scale that enables accurate interpolation between the divisions of a longer scale without using mechanical magnification. The principle of operation is that each vernier scale division is slightly smaller than a main scale division, so that successive vernier graduations successively coincide with main scale graduations as one is moved relative to the other. Specifically, n divisions on a vernier scale are the same length as n-1 divisions on the main scale it works with, and n defines the division (or interpolation) ratio. Although n may be any number, in practice it is typically 10, 20, 25, etc., so that the division is a useful decimal fraction. The example below is for n = 10. The main scale is graduated in mm, and so the vernier scale is 9mm (10 divisions) long, the same as 9mm (9 divisions) on the main scale. This produces a difference in length of 0.1mm (1) as shown in figure A (the 1st vernier graduation is aligned with the first main scale graduation). If the vernier scale is slid 0.1mm to the right as shown in figure B, the 2nd graduation line on the vernier scale moves into alignment with the 2nd line on the main scale (2), and so enables easy reading of the 0.1mm displacement.




Some early calipers divided 19 divisions on the main scale by 20 vernier divisions to provide 0.05mm resolution. However, the closely spaced lines proved difficult to read and so, since the 1970s, a long vernier scale that uses 39 main scale divisions to spread the lines is generally used instead, as shown below.

● 19mm Vernier scale




Scale reading 1.45mm

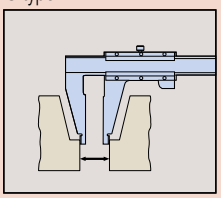
● 39mm vernier scale (long vernier scale)




Scale reading 30.35mm

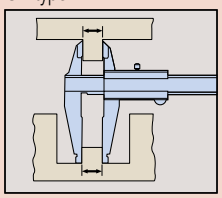
Calipers were made that gave an even finer resolution of 0.02mm. These required a 49-division vernier scale dividing 50 main scale divisions. However, they were difficult to read and are now hard to find since digital calipers with an easily read display and resolution of 0.01mm appeared.

C-type



Standard outside measurement
Inside measurement of a stepped hole
Measurement of a stepped part

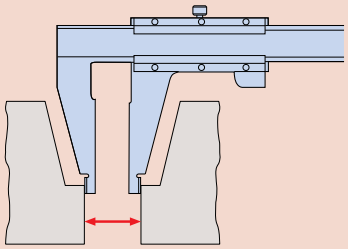
CN-type



Standard outside measurement
Measurement of a stepped hole
Measurement of a stepped part

## About Long Calipers

Steel rules are commonly used to roughly measure large workpieces, but if more accuracy is needed, then a long caliper is suitable for the job. A long caliper is convenient for its user friendliness but does require some care during use. In the first place it is important to realize there is no relationship between resolution and accuracy. For details, refer to the values in our catalog. Resolution is constant whereas the accuracy obtainable varies dramatically according to how the caliper is used.
The measuring method with this instrument is a concern since distortion of the main beam causes a large amount of the measurement error, so accuracy will vary greatly depending on the method used for supporting the caliper at the time. Also, be careful not to use too much measuring force when using the outside measuring faces as they are furthest away from the main beam so potential errors will be at a maximum here. This precaution is also necessary when using the tips of the outside measuring faces of a long-jaw caliper.



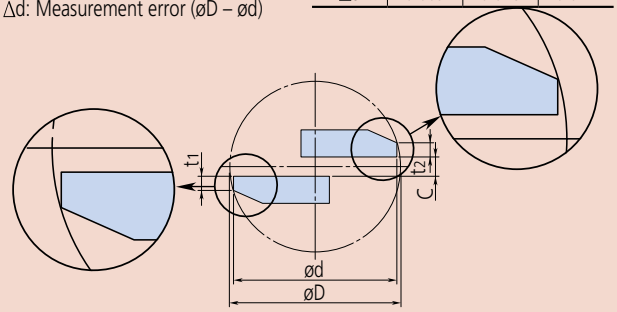
## Small hole measurement with an M-type caliper

Structural error (d) occurs when you measure the internal diameter of a small hole.

øD: True internal diameter
ød: Measured diameter
$t_1$, $t_2$: Thickness of the inside jaw
C: Distance between the inside jaws
Δd: Measurement error (øD – ød)

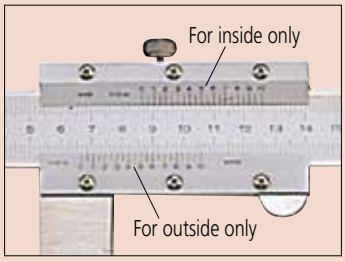
True internal diameter (øD: 5mm)
Unit: mm

| $t_1+t_2+C$ | 0.3 | 0.5 | 0.7 |
|---|---|---|---|
| Δd | 0.009 | 0.026 | 0.047 |




## Inside Measurement with a CM-type Caliper

Because the inside measuring faces of a CM-type caliper are at the tips of the jaws, the measuring face parallelism is heavily affected by measuring force, and this becomes a large factor in the measurement accuracy attainable.
In contrast to an M-type caliper, a CM-type caliper cannot measure a very small hole diameter because it is limited to the size of the stepped jaws, although normally this is not an inconvenience as it would be unusual to have to measure a very small hole with this type of caliper. Of course, the radius of curvature on the inside measuring faces is always small enough to allow correct hole diameter measurements right down to the lowest limit (jaw closure).
Mitutoyo CM-type calipers are provided with an extra scale on the slider for inside measurements so they can be read directly without the need for calculation, just as for an outside measurement. This useful feature eliminates the possibility of error that occurs when having to add the inside-jaw-thickness correction on a single-scale caliper.






# Linear Height LH-600E

## SERIES 518 — High-Performance 2D Measurement System

### FEATURES

- Excellent accuracy of (1.1+0.6L/600)µm with 0.1µm/0.5µm resolution/repeatability.
- Perpendicularity (frontal) of 5µm and straightness of 4µm are guaranteed.
- Pneumatic full/semi-floating system allows adjustment of air-cushion height.
- Basic statistical functions are provided and, additionally, RS-232C / USB data output provides the option of evaluating measurement data externally with SPC software on a PC.
- One-key operation for running a semi-automatic measurement.
- Data entry from a Digimatic tool.

With power grip







518-351A-21

### SPECIFICATIONS

Inch/Metric

| Order No. | | 518-351A-21 | 518-352A-21 w/power grip |
|---|---|---|---|
| Model | | LH-600E | LH-600EG |
| Measuring Range (stroke) | | 0-38" (24") / 0-977mm(600mm) | |
| Resolution (selectable) | | .000001"/.00001"/.0001"/.001"/ 0.0001mm/0.001mm/0.01mm/0.1mm | |
| Accuracy at 20°C | Measuring accuracy | (.000043 + .000024 x L*/24)" / (1.1 + 0.6L**/600)µm | |
| | Repeatability (2s) | Plane: .000015"/0.4µm Bore: .000035"/0.9µm | |
| | Perpendicularity | .0002"/5µm | |
| | Straightness | .0002"/4µm | |
| Drive Method | | Motor Drive (5, 10, 15, 20, 25, 30, 40mm/s=7 steps) / manual | |
| Measuring Force | | 1N | |
| Balancing Method | | Counter balance | |
| Main Unit Floating Method | | Full/semi-floating with air | |
| Air Source | | Built-in air compressor | |
| LCD | | TFT LCD (color) | |
| Language for Display | | English/German/French/Spanish/Italian/Japanese | |
| Number of Programs | | 50 (max.) | |
| Number of Datas | | 60,000 (max.) 1 program 30,000 (Max.) | |
| Power Supply | | AC Adapter/Battery (Ni-MH) | |
| Power Consumption | | 43VA | |
| Operation Time | | Approx. 5 hours | |
| Standard Accessories | | ø5 Eccentric probe (**12AAF634**) | |
| | | Probe diameter calibration block (**12AAA715**) | |
| | | Battery (**12AAF712**) | |
| | | AC adapter (**357651**), Power Cable (**02ZAA010**) | |
| | | Clear Cover (**223587**) | |
| | | Conveying handle (**510434**) | |
| Mass | | 24kg | 24.5kg |

L*=Measuring length (inch) L**=Measuring length (mm)

PROPRIETARY INSPECTION CERTIFICATE

Mitutoyo guarantees the product quality.

### Technical Data

| | |
|---|---|
| Measuring range: | 0 - 38" / 0 - 972mm |
| Slider stroke: | 24" / 600mm |
| Resolution: | .000001" / .00001" / .0001" / .001" or |
| (switchable) | 0.0001 / 0.001 / 0.01 / 0.1mm / 0.0001 / 0.001 / 0.01 / 0.1mm |
| Accuracy at 20°C: | Refer to the list of specifications |
| Floating method: | Full / semi-floating with built-in air compressor |
| Display: | TFT LCD (color) |







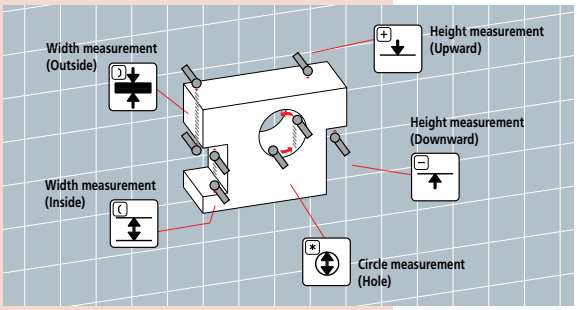

5.7" color LCD

## Optional Accessories

| | |
|---|---|
| **12AAF712:** | Battery pack |
| **12AAA797** | Thermal printer (120V) |
| **12AAA802** | Thermal printing paper (10pcs.) |
| **12AAA804** | Cable for page printer** (2m) |
| **12AAA807** | RS-232C cable (80" / 2m) |
| **12AAA808** | RS-232C cable (160" / 4m) |

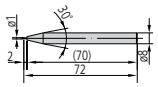




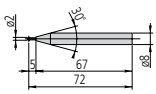



# Optional probes and calibration blocks

**12AAF666**
ø1 ball probe

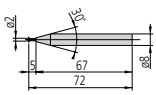



**957261**
ø2 ball probe

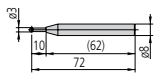



**12AAF667**
ø2 ruby ball probe

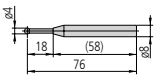




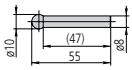

**957262**
ø3 ball probe



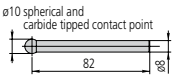

**957263**
ø4 ball probe



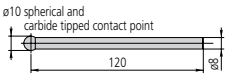

**12AAB552**
ø10 ball probe, L=55




**12AAF668**
ø10 ball probe, L=82




**12AAF669**
ø10 ball probe, L=120

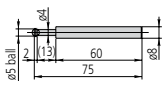



**932361**
Mu-checker lever head holder
CMM ball and disk hard probes are available.

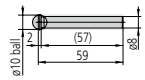
**12AAA787**
Block for calibrating probe diameter (applicable to taper probe)

**K650986**
Styli Kit M3

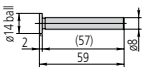
**12AAF670**
ø5 disk probe



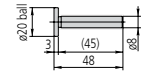

**12AAF671**
ø10 disk probe



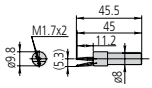

**957264**
ø14 disk probe



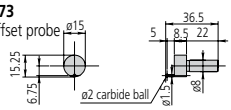

**957265**
ø20 disk probe



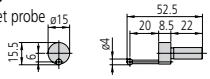

**12AAF672**
ø1 ball offset probe*
*test indicator stylus (103017)



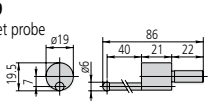

**12AAF673**
ø2 ball offset probe




**12AAA788**
ø4 ball offset probe



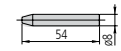

**12AAA789**
ø6 ball offset probe



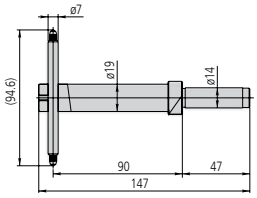

**226117**
M2 CMM stylus adapter



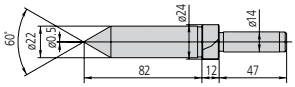

**226118**
M3 CMM stylus adapter



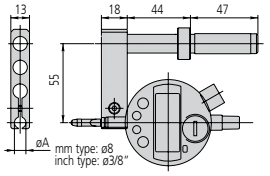

**12AAC072** Depth probe



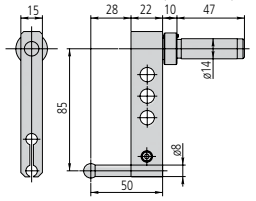

**12AAC073** ø20 taper probe



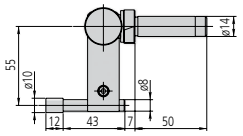

**12AAA792** Dial indicator (ø8 stem) holder
**12AAA837** Dial indicator (ø3/8"stem) holder



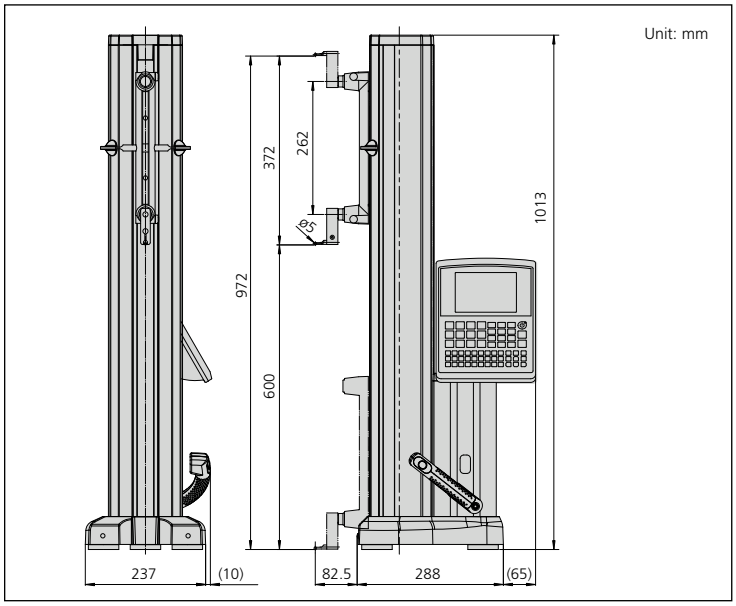

**12AAA793** Probe extension holder (85mm/3.3")




**12AAB136** ø10 cylindrical probe




## DIMENSIONS AND MASS






Mitutoyo

# QM-Height

## SERIES 518 — High-Precision ABSOLUTE Digital Height Gage

### FEATURES

- Newly developed high-accuracy and high-resolution ABSOLUTE linear encoder for position detection.
- Easy reference icon keys.
- Possible to measure inside/outside diameter via unique process (detect the circle apex and process by tracing measurement).
- Various types of optional probes are available.
- Large size LCD.
- Go/no-go judgment is performed by setting the upper and lower tolerances. If a result is out of tolerance, the display changes from green to red, so tolerance judgment can be made at a glance.
- Slider elevation knob (for travel) / wheel (for measurement).
- With SPC and USB output.



64PKA129A

64PKA130A

SPC

ABSOLUTE®
Absolute System Patented by MITUTOYO

### Technical Data

| | |
|---|---|
| Measuring range*: | 0 - 18.3" or 0 - 28.1"<br>0 - 465mm or 0 - 715mm |
| Slider stroke: | 14" / 350mm or 24" / 600mm |
| Resolution: | .00005" / .0001" / .0002" /<br>0.001mm / 0.005mm |
| Accuracy at 20°C: | Refer to the list of specifications |
| Guiding method: | Roller bearing |
| Drive method: | Manual |
| Length standard: | ABSOLUTE electromagnetic induction-type linear encoder |
| Measuring force: | 1.5±0.5N |
| Display: | LCD |
| Power supply: | AC adapter (06AEG180JA) 120V<br>battery (LR6x4) |

Battery operation time: Refer to the list of specifications

* Maximum values are obtained with the probe at the highest position. Any change of the probe orientation requires the coordinate system be re-zeroed. With the probe in the highest position, minimum measurable height is 4.53"/115mm.



### SPECIFICATIONS

Inch/Metric

| Order No. | 64PKA094A | 64PKA095A | 64PKA129A | 64PKA130A |
|---|---|---|---|---|
| Model | QMH-14"A | QMH-24"A | QMH-14"B | QMH-24"B |
| Range | 0 - 14"/ 0-350mm | 0 - 24"/ 0-600mm | 0 - 14"/ 0-350mm | 0 - 24"/ 0-600mm |
| Resolution | 0.001 / 0.005mm /.00005" / .0001" | | | |
| Accuracy at 20°C Accuracy*1 | ±(2.4+2.1L/600)μm L = Measuring length (mm) | | | |
| Repeatability*1 | 2σ≦1.8μm | | | |
| Perpendicularity | 7μm | 12μm | 7μm | 12μm |
| Guiding method | Roller bearing | | | |
| Drive method | Manual operation | | | |
| Scale type | Electromagnetic induction-type ABSOLUTE linear encoder | | | |
| Measuring force | 1.5±0.5(N) | | | |
| Data output | Digimatic output/USB | | | |
| Pneumatic floating system | NA | | Included (for movement only) | |
| Power supply | AC adapter battery / (LR6 x 4) Standard accessory / Nickel metal hydride battery (x4) | | | |
| Battery life | Approx. 300 hours (Not using pneumatic floating system) | | | |
| | Approx. 80 hours (Using pneumatic floating system regularly) | | | |
| Standard accessories | Stepped probe (05HZA148)<br>Probe diameter calibration block (12AAA715)<br>LR6 Battery / AC Adapter (06AEG180JA) 120V | | | |
| Mass | 55.16 lbs (25kg) | 63.93 lbs (29kg) | 57.32 lbs (26kg) | 66.14 lbs (30kg) |
| Dimensions | 41.85"x21.85x18.94"<br>1063(W)x555(D)x481(H) | 51.02"x21.85x18.94"<br>1296(W)x555(D)x481(H) | 41.85"x21.85x18.94"<br>1063(W)x555(D)x481(H) | 51.02"x21.85x18.94"<br>1296(W)x555(D)x481(H) |
| Main Unit | 518-231 | 518-233 | 518-235 | 518-237 |

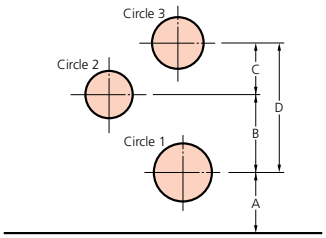
*1 Guaranteed when using the standard eccentric ø5 probe.

## Optional Accessories

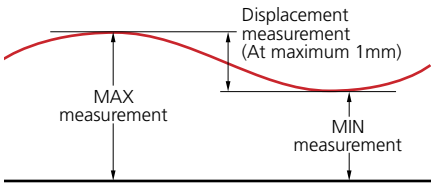
**12AAC072**: Depth probe
**12AAA792**: Dial indicator (ø8mm stem) holder
**12AAA837**: Dial indicator (ø3/8"stem) holder
**12AAA793**: Probe extension holder (3.3" / 85mm)
**12AAF667**: ø2mm ruby ball probe
**957261**: ø2mm ball probe
**957262**: ø3mm ball probe
**957263**: ø4mm ball probe
**05HAA394:** ø5mm ball probe (for 05HZA148)
**12AAB552**: ø10 mm ball probe, L=55mm
**12AAF670**: ø5mm ball probe
**12AAF671**: ø10mm ball probe
**957264**: ø14mm disk probe
**957265**: ø20mm disk probe
**12AAA788**: ø4mm ball offset probe
**05HAA394**: ø5mm ball offset probe
**12AAA789**: ø6mm ball offset probe
**05HZA173:** Scriber
**264-504-5A:** DP-1VR
**936937**: SPC cable (40" / 1m)
**965014**: SPC cable (80" / 2m)

### Circle pitch measurement

The length A, B, C and D can be determined by measuring circles 1 to 3 once each, using the memory of measuring data together with the calculation function. (A maximum of nine circle measurements can be saved.)

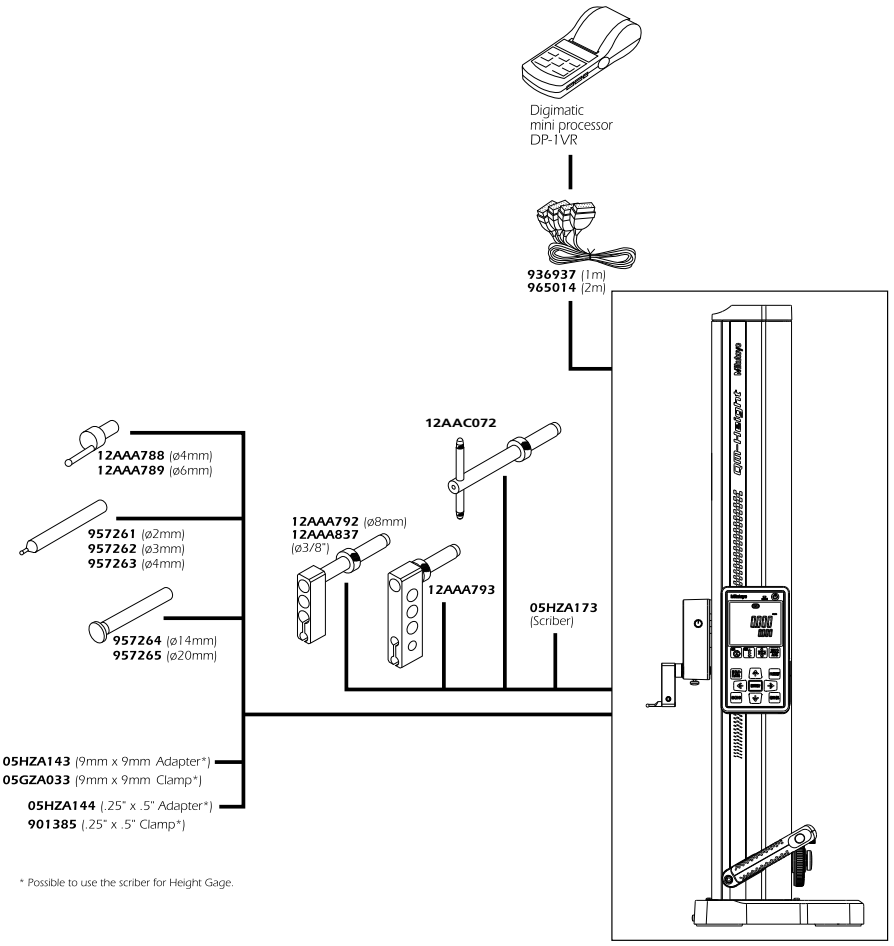



### Maximum/minimum and displacement measurement

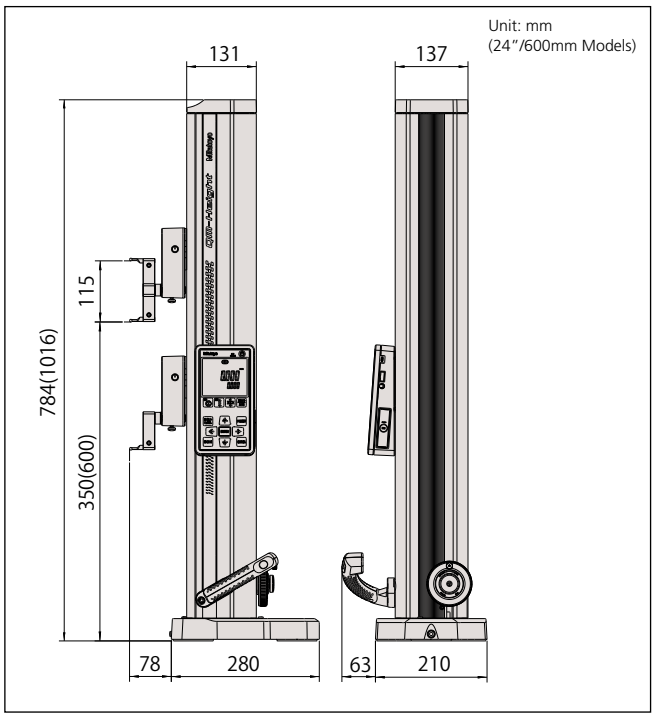





**Inside diameter measurement**




## DIMENSIONS



# Digimatic Height Gage

## SERIES 192 — Multi-Function Type with SPC Data Output

### FEATURES

- Highly versatile multi-function type.
- Carbide-tipped long scriber is provided.
- Rigid construction ensures repeatable measurement.
- Switchable resolution (.0002"/0.005mm or .0005"/0.01mm)
- Coarse/fine feed switching.
- Bi-directional touch-signal probe is an optional accessory. It can quickly and accurately measure steps, inside width and outside width.
- With SPC data output.
- Two preset reference heights.



192-670-10

### SPECIFICATIONS

**Inch/Metric**

| Range | Order No. | Accuracy | Resolution | Mass (kg) |
|---|---|---|---|---|
| 0-12"/0-300mm | **192-670-10** | ±001" | .0005"(0.01mm) [.0002"(0.005mm) Switchable)] | 5.7 |
| 0-18"/0-450mm | **192-671-10** | ±0015" | .0005"(0.01mm) [.0002"(0.005mm) Switchable)] | 7.5 |
| 0-24"/0-600mm | **192-672-10** | ±0015" | .0005"(0.01mm) [.0002"(0.005mm) Switchable)] | 8.3 |
| 0-40"/0-1000mm | **192-673-10** | ±0025" | .0005"(0.01mm) [.0002"(0.005mm) Switchable)] | 15.7 |

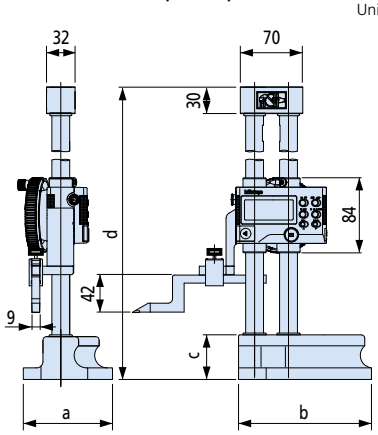
**Metric**

| Range | Order No. | Accuracy | Resolution | Mass (kg) |
|---|---|---|---|---|
| 0-300mm | **192-663-10** | ±0.02mm | Switchable between 0.01mm and 0.005mm | 5.7 |
| 0-600mm | **192-664-10** | ±0.04mm | Switchable between 0.01mm and 0.005mm | 8.3 |
| 0-1000mm | **192-665-10** | ±0.06mm | Switchable between 0.01mm and 0.005mm | 15.7 |

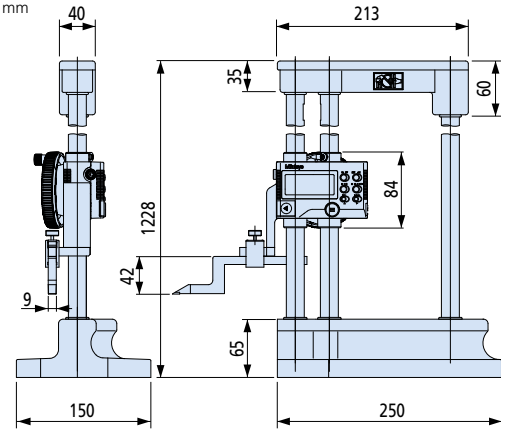
### DIMENSIONS

**0 - 12" / 0 - 300mm, 0 - 18", 0 - 24" / 0 - 600mm**

Unit: mm




**0 - 40" / 0 - 1000mm**




| Range | a | b | c | d |
|---|---|---|---|---|
| 0-12"/ 0-300mm | 100 | 149 | 50 | 510 |
| 0-18"/ 0-450mm | 120 | 180 | 54 | 649 |
| 0-24"/ 0-600mm | 120 | 180 | 54 | 802 |

SPC

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.01+0.005mm or 0.0005"(0.01mm) [0.0002"(0.005mm) switchable]
Display: LCD, 7-digits, character height 11mm
Max. response speed: 500mm/s
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 2000 hours under normal use

### Function

Zero-setting, ABS/INC switching, Two presets, Probe tip diameter compensation, -/+ switching, Power ON/OFF, Data hold, Data output,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Standard Scriber Provided

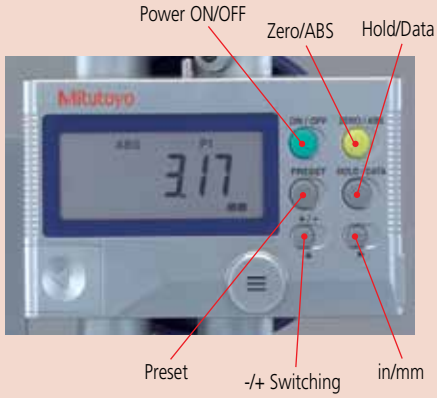
Metric models: Carbide-tipped scriber (**905200**) and scriber clamp (**05GZA033**)
Inch/Metric models: Carbide-tipped scriber (**905201**) and scriber clamp (**901385**)

### Optional Accessories

**905338**: SPC cable (40" / 1m)
**905409**: SPC cable (80" / 2m)
**905691**: SPC cable (L-shape, 40" / 1m)
**905692**: SPC cable (L-shape, 80" / 2m)
**192-007**: Bi-directional touch-signal probe (metric)
**192-008**: Bi-directional touch-signal probe (inch)
**953638**: Holding bar for test indicator (length: 50mm)
**900209**: Holding bar for test indicator (length: 100mm)
**953639**: Holding bar for test indicator (length: 2")
**900306**: Holding bar for test indicator (length: 4")
**900321**: Swivel clamp used with holding bar (metric)
**900322**: Swivel clamp used with holding bar (inch)



Shown with optional touch-signal probe



SPC

# Digimatic Height Gage

## SERIES 192 — Standard Type with SPC Data Output

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"(0.01mm) [.0002"(0.005mm)] or 0.01mm and 0.005mm
Display: LCD, 7-digit, character height 11mm
Max. response speed: 500mm/s
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 2000 hours under normal use

### Function

Zero-setting, ABS/INC switching, Two presets, Probe tip diameter compensation, -/+ switching, Power ON/OFF, Data hold, With Output,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Standard Scriber Provided

Metric models: Carbide-tipped scriber (**07GZA000**) and scriber clamp (**05GZA033**)
Inch/Metric models: Carbide-tipped scriber (**900258**) and scriber clamp (**901385**)

### Optional Accessories

**953638**: Holding bar for test indicator (length: 50mm)
**900209**: Holding bar for test indicator (length: 100mm)
**953639**: Holding bar for test indicator (length: 2")
**900306**: Holding bar for test indicator (length: 4")
**900321**: Swivel clamp used with holding bar (metric)
**900322**: Swivel clamp used with holding bar (inch)
**905338**: SPC cable (CD type) 1m
**905409**: SPC cable (CD type) 2m
**905691**: CD/Connecting cable L-Type 1m RIG
**905692**: CD/Connecting cable L-Type 2m RIG

### FEATURES

- Switchable resolution (.0002"/0.005mm or .0005"/0.01mm)
- Easy-to-use standard type.
- Carbide-tipped scriber is provided.
- Double-column structure ensures high measuring accuracy.
- Coarse/fine feed switching.
- Two preset reference heights.



192-630-10

### SPECIFICATIONS

**Inch/Metric**

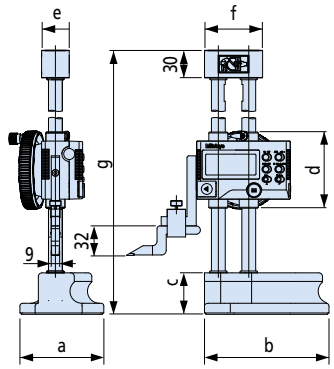
| Range | Order No. | Accuracy | Resolution | Mass (kg) |
|---|---|---|---|---|
| 0-12"/0-300mm | **192-630-10** | ±001" | .0005"(0.01mm) [.0002"(0.005mm) Switchable)] | 4.7 |
| 0-18"/0-450mm | **192-631-10** | ±002" | .0005"(0.01mm) [.0002"(0.005mm) Switchable)] | 7.5 |
| 0-24"/0-600mm | **192-632-10** | ±002" | .0005"(0.01mm) [.0002"(0.005mm) Switchable)] | 8.3 |
| 0-40"/0-1000mm | **192-633-10** | ±003" | .0005"(0.01mm) [.0002"(0.005mm) Switchable)] | 15.7 |

**Metric**

| Range | Order No. | Accuracy | Resolution | Mass (kg) |
|---|---|---|---|---|
| 0-300mm | **192-613-10** | ±0.02mm | Switchable between 0.01mm and 0.005mm | 4.7 |
| 0-600mm | **192-614-10** | ±0.05mm | Switchable between 0.01mm and 0.005mm | 8.3 |
| 0-1000mm | **192-615-10** | ±0.07mm | Switchable between 0.01mm and 0.005mm | 15.7 |

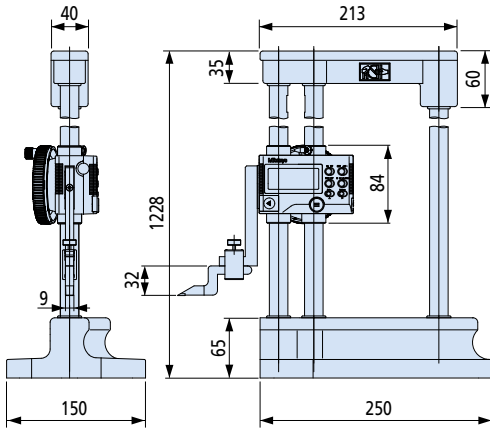
### DIMENSIONS

**0 - 12" / 0 - 300mm, 0 - 18", 0 - 24" / 0 - 600mm**




**0 - 40" / 0 - 1000mm**

Unit: mm




| Range | a | b | c | d | e | f | g |
|---|---|---|---|---|---|---|---|
| 0-12"/ 0-300mm | 91 | 135 | 45 | 83 | 30 | 63 | 475 |
| 0-18"/ 0-450mm | 120 | 180 | 54 | 84 | 32 | 70 | 649 |
| 0-24"/ 0-600mm | 120 | 180 | 54 | 84 | 32 | 70 | 802 |



Mitutoyo

# Dial Height Gage

## SERIES 192 — with Digital Counter

### FEATURES

- Easy and error-free reading with both up and down digital counters, as well as a dial.
- Provided with a feed wheel for easy coarse feeding.
- Carbide-tipped scriber is provided.
- The counters and dial can be re-zeroed at any scriber position.



192-150

### SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Graduation | Mass (kg) |
|---|---|---|---|---|
| 0 - 300mm | **192-130** | ±0.03mm | 0.01mm | 4.2 |
| 0 - 450mm | **192-131** | ±0.05mm | 0.01mm | 9.2 |
| 0 - 600mm | **192-132** | ±0.05mm | 0.01mm | 9.8 |
| 0 - 1000mm | **192-133** | ±0.07mm | 0.01mm | 17.0 |

**Inch**

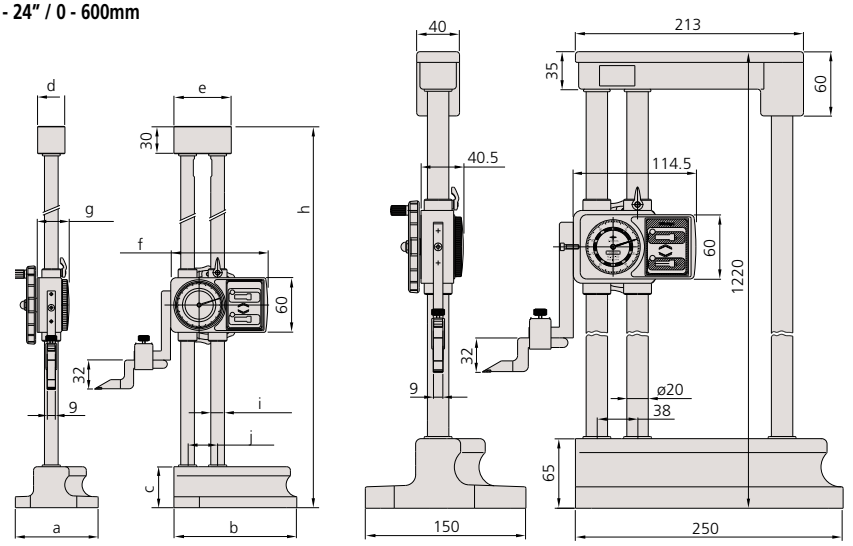
| Range | Order No. | Accuracy | Graduation | Mass (kg) |
|---|---|---|---|---|
| 0 - 12" | **192-150** | ±.0015" | .001" | 4.2 |
| 0 - 18" | **192-151** | ±.002" | .001" | 9.2 |
| 0 - 24" | **192-152** | ±.002" | .001" | 9.8 |
| 0 - 40" | **192-153** | ±.003" | .001" | 17.0 |

### DIMENSIONS

**0 - 12" / 0 - 300mm, 0 - 18" / 0 - 450mm**
**0 - 24" / 0 - 600mm**

**0 - 40" / 0 - 1000mm**

Unit: mm




| Range | a | b | c | d | e | f | g | h | i | j |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-12"/ 0-300mm | 91 | 135 | 45 | 30 | 63 | 106.5 | 35.5 | 470 | ø15 | 33 |
| 0-18"/ 0-450mm | 120 | 180 | 54 | 32 | 70 | 114.5 | 40.5 | 645 | ø20 | 38 |
| 0-24"/ 0-600mm | 120 | 180 | 54 | 32 | 70 | 114.5 | 40.5 | 798 | ø20 | 38 |

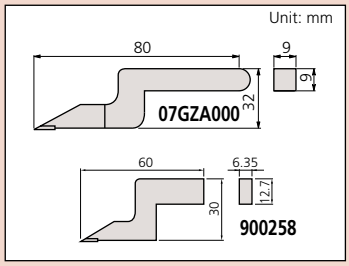
### Technical Data

Dial reading: 0.01mm or .001"

### Standard Scriber Provided

Metric models: Carbide-tipped scriber (**07GZA000**) and scriber clamp (**05GZA033**)
Inch/Metric models: Carbide-tipped scriber (**900258**) and scriber clamp (**901385**)

**Dimension of scriber**




### Optional Accessories

**953638**: Holding bar for test indicator (length: 50mm)
**900209**: Holding bar for test indicator (length: 100mm)
**953639**: Holding bar for test indicator (length: 2")
**900306**: Holding bar for test indicator (length: 4")
**900321**: Swivel clamp used with holding bar (metric)
**900322**: Swivel clamp used with holding bar (inch)



Comfortable grip base



Easy and secure clamping



Easy and error-free reading

# ABSOLUTE Digimatic Height Gage

## SERIES 570 — with ABSOLUTE Linear Encoder

## FEATURES

- Built-in ABSOLUTE linear encoder
  This encoder eliminates the necessity of setting the reference point at every power-on. It has improved reliability because no over-speed error will occur.
- Fine-adjustment carriage for smooth movement.
- Carbide-tipped scriber is provided.
- With SPC data output.




## Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/ 0.01mm or 0.01mm
Display: LCD, 6-digit
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 5000 hours under normal use

## Function

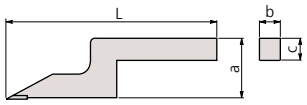
Origin setting, ABS/INC switching, Presetting, -/+ switching, Data hold, Data output,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

## Standard Scriber Provided

Metric models: Carbide-tipped scriber (**900173/905200***) and scriber clamp (**901338/05GZA033***)
*0 - 1000mm model
Inch/Metric models: Carbide-tipped scriber (**900173/905201***) and scriber clamp (**901338/901385***)
*0 - 40" model

### Dimension of scriber

Unit: mm




| Parts No. | L | a | b | c |
|---|---|---|---|---|
| 900173 | 47 | 25 | 6.35 | 12.7 |
| 905200 | 150 | 42 | 9 | 9 |
| 905201 | 150 | 45.7 | 6.35 | 12.7 |

## Optional Accessories

**905338**: SPC cable (40" / 1m)
**905409**: SPC cable (80" / 2m)
**953638**: Holding bar for test indicator (length: 50mm)
**953639**: Holding bar for test indicator (length: 2")
**902053**: Swivel clamp used with holding bar (metric)
**900322**: Swivel clamp used with holding bar (inch)

## SPECIFICATIONS

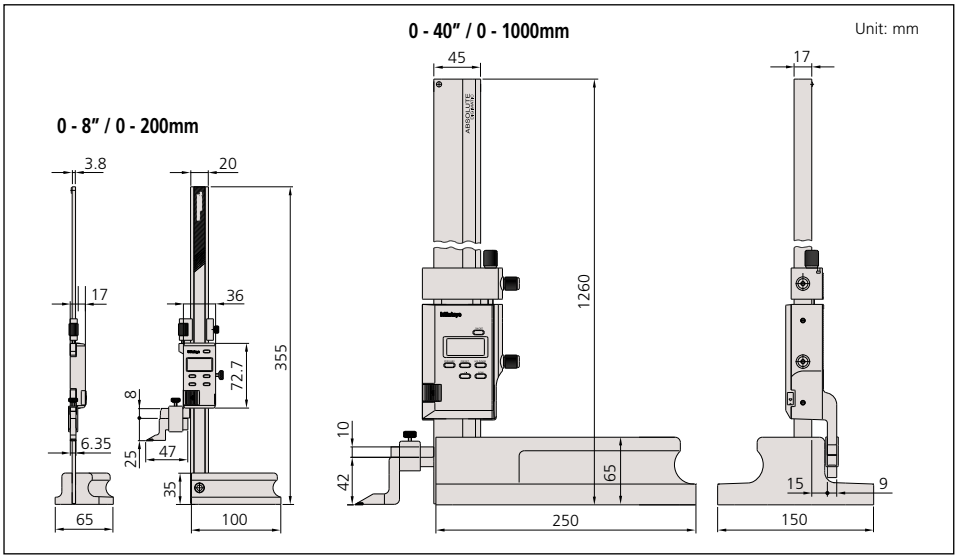
### Metric

| Range | Order No. | Accuracy | Resolution | Mass (kg) |
|---|---|---|---|---|
| 0 - 200mm | **570-227** | ±0.03mm | 0.01mm | 1.4 |
| 0 - 1000mm | **570-230** | ±0.07mm | 0.01mm | 16.8 |

### Inch/Metric

| Range | Order No. | Accuracy | Resolution | Mass(kg) |
|---|---|---|---|---|
| 0 - 8" / 0 - 200mm | **570-244** | ±.001" | .0005" / 0.01mm | 1.4 |
| 0 - 40" / 0 - 1000mm | **570-248** | ±.003" | .0005" / 0.01mm | 16.8 |

## DIMENSIONS



# ABSOLUTE Digimatic Height Gage

## SERIES 570 — with ABSOLUTE Linear Encoder

## FEATURES

- Built-in ABSOLUTE linear encoder
  This encoder eliminates the necessity of setting the reference point at every power-on. It has improved reliability because no over-speed error will occur.
- Rigid column structure ensures high measuring accuracy.
- With large, smooth slider-feed wheel.
- Carbide-tipped scriber is provided.
- With SPC data output.






## SPECIFICATIONS

**Metric**

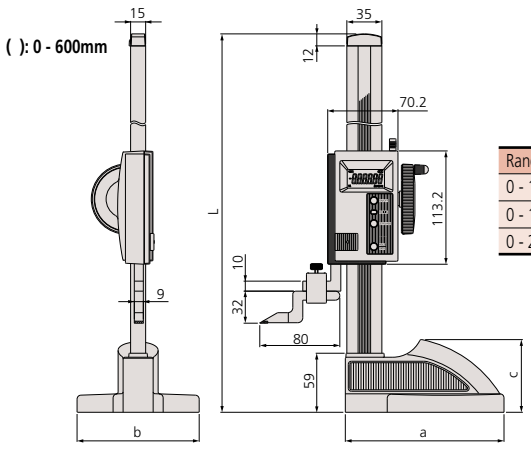
| Range | Order No. | Accuracy | Resolution |
|---|---|---|---|
| 0 - 300mm | **570-302** | ±0.03mm | 0.01mm |
| 0 - 600mm | **570-304** | ±0.05mm | 0.01mm |

**Inch/Metric**

| Range | Order No. | Accuracy | Resolution |
|---|---|---|---|
| 0 - 12" / 0 - 300mm | **570-312** | ±.0015" | .0005" / 0.01mm |
| 0 - 18" / 0 - 450mm | **570-313** | ±.002" | .0005" / 0.01mm |
| 0 - 24" / 0 - 600mm | **570-314** | ±.002" | .0005" / 0.01mm |

## DIMENSIONS AND MASS

Unit: mm




| Range | L | a | b | c | Mass (kg) |
|---|---|---|---|---|---|
| 0 - 12" / 300mm | 507 | 160 | 122 | 72.6 | 4.6 |
| 0 - 18" / 450mm | 662 | 181 | 142 | 74.1 | 5.9 |
| 0 - 24" / 600mm | 812 | 181 | 142 | 74.1 | 6.4 |

## Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm or 0.01mm
Display: LCD, 6-digit
Length standard: ABSOLUTE electrostatic capacitance-type linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 20000 hours under normal use

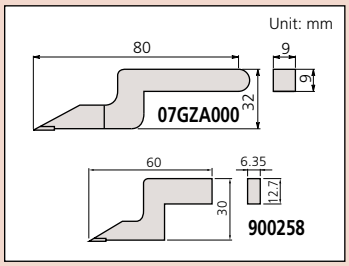
## Function

Origin setting, ABS/INC switching, Power ON/OFF, Data hold, Data output,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

## Standard Scriber Provided

Metric models: Carbide-tipped scriber (**07GZA000**), scriber clamp (**05GZA033**)
Inch/Metric models: Carbide-tipped scriber (**900258**), scriber clamp (**901385**)

### Dimension of scriber




## Optional Accessories

**905338**: SPC cable (40" / 1m)
**905409**: SPC cable (80" / 2m)
**953638**: Holding bar for test indicator (length: 50mm)
**953639**: Holding bar for test indicator (length: 2")
**902053**: Swivel clamp used with holding bar (metric)
**900322**: Swivel clamp used with holding bar (inch)


Large, smooth slider-feed wheel


Large clamp lever


Comfortable grip base

# Vernier Height Gage

## SERIES 514 — Standard Height Gage with Adjustable Main Scale

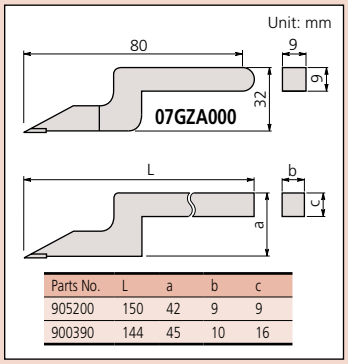
### Technical Data

Main scale adjustment: 15mm or 25mm
Slider fine feed: 4mm, 6mm, 7mm or 20mm

### Standard Scriber Provided

Up to 600mm: Carbide-tipped scriber (**07GZA000**) and scriber clamp (**05GZA033**)
0 - 1000mm: Carbide-tipped scriber (**905200**) and scriber clamp (**05GZA033**)
0 - 1500mm: Carbide-tipped scriber (**900390**) and scriber clamp (**905008**)

**Dimension of scriber**




| Parts No. | L | a | b | c |
|---|---|---|---|---|
| 905200 | 150 | 42 | 9 | 9 |
| 900390 | 144 | 45 | 10 | 16 |

### Optional Accessories

**07GZA003**: Magnifier for 300, 450mm, 600mm models
**07GZA015**: Magnifier for 1000mm and 1500mm models
**953638**: Holding bar for test indicator (length: 50mm)
**902053**: Swivel clamp used with holding bar










### FEATURES

- Zero reference point can be adjusted.
- Satin chrome-finished scales for glare-free reading.
- Extra-large base for rigidity.
- Optional magnifier for easier reading
- Carbide-tipped scriber is provided.




### SPECIFICATIONS

**Metric**

| Range | Order No. | Accuracy | Graduation | Mass (kg) |
|---|---|---|---|---|
| 0 - 300mm | **514-102** | ±0.04mm | 0.02mm | 3.1 |
| 0 - 450mm | **514-104** | ±0.05mm | 0.02mm | 3.4 |
| 0 - 600mm | **514-106** | ±0.05mm | 0.02mm | 7.4 |
| 0 - 1000mm | **514-108** | ±0.07mm | 0.02mm | 20.0 |
| 0 - 1500mm | **514-170** | ±0.18mm | 0.02mm | 26.0 |

**Inch/Metric** Inch model with inch/metric dual scale

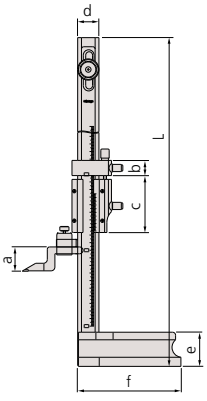
| Range | Order No. | Accuracy | Graduation | Mass (kg) |
|---|---|---|---|---|
| 0 - 12" / 0 - 300mm | **514-103** | ±.002" | .001" / 0.02mm | 3.1 |
| 0 - 18" / 0 - 450mm | **514-105** | ±.002" | .001" / 0.02mm | 3.4 |
| 0 - 24" / 0 - 600mm | **514-107** | ±.002" | .001" / 0.02mm | 7.4 |
| 0 - 40" / 0 - 1000mm | **514-109** | ±.003" | .001" / 0.02mm | 20.0 |

### DIMENSIONS

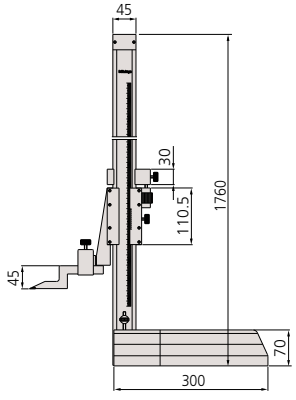
Unit: mm

| Range | L | a | b | c | d | e | f |
|---|---|---|---|---|---|---|---|
| 0 - 12" 0 - 300mm | 525 | 32 | 20 | 70 | 28 | 45 | 135 |
| 0 - 18" 0 - 450mm | 675 | 32 | 20 | 70 | 28 | 45 | 135 |
| 0 - 24" 0 - 600mm | 870 | 32 | 24 | 85 | 35 | 54 | 180 |
| 0 - 40" 0 - 1000mm | 1340 | 42 | 30 | 110 | 45 | 65 | 250 |

**0 - 40" / 0 - 1000mm**




**0 - 1500mm**






Mitutoyo

# Vernier Height Gage

## SERIES 506 — Light-Weight Height Gage

### FEATURES

- The Light-Weight Height Gage is designed for scribing from a vertical base or for small parts.
- Satin chrome-finished scales for glare-free reading.
- Beam and slider are made of stainless steel.
- Carbide-tipped scriber is provided.



506-207



506-208

### SPECIFICATIONS

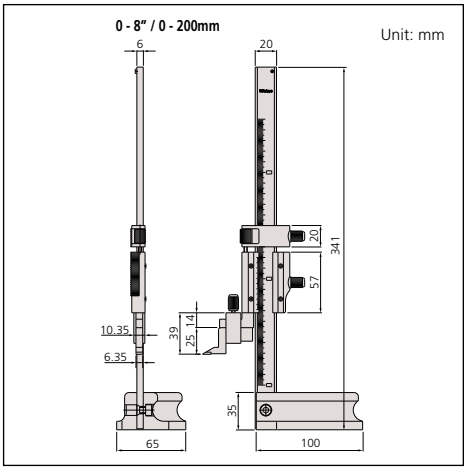
**Metric**

| Range | Order No. | Accuracy | Graduation | Mass (kg) |
|---|---|---|---|---|
| 0 - 200mm | **506-207** | ±0.03mm | 0.02mm | 1.4 |

**Inch/Metric** Inch model with inch/metric double scale

| Range | Order No. | Accuracy | Graduation | Mass (kg) |
|---|---|---|---|---|
| 0 - 8" / 0 - 200mm | **506-208** | ±.001" | .001" / 0.02mm | 1.4 |

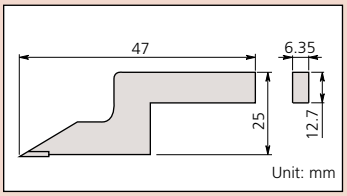
### DIMENSIONS




### Standard Scriber Provided

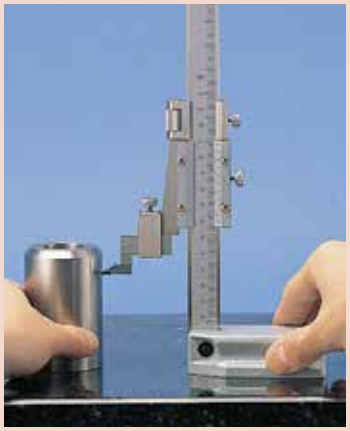
Carbide-tipped scriber (**900173**) and scriber clamp (**901338**)

**Dimension of scriber**




### Optional Accessories

**953639**: Holding bar for test indicator (length: 2" / 50mm)
**900322**: Swivel clamp used with holding bar

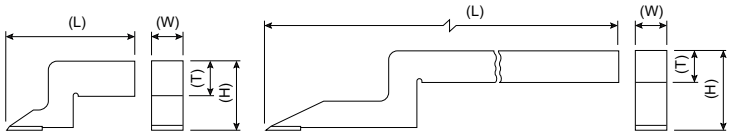


# Carbide-Tipped Scriber

## Optional Accessory for Height Gage

### FEATURES

- Use the appropriate scriber and clamp for each height gage.




### DIMENSIONS

**Metric**

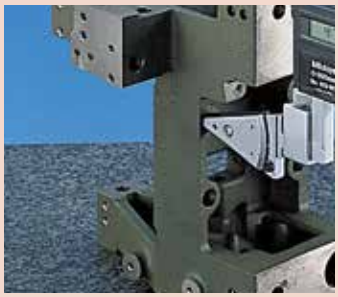
| Scriber Order No. | Clamp Order No. | Scriber Dimensions (mm) | | | |
|---|---|---|---|---|---|
| | | Length | Height | Width | Thickness |
| 900167 | 05GZA033 | 143 | 23 | 9 | 9 |
| 07GZA000 | 07GZA002 | 80 | 32 | 9 | 9 |
| 905200 | 05GZA033 | 150 | 42 | 9 | 9 |
| 900390 | 905008 | 144 | 45 | 10 | 16 |

**Inch**

| Scriber Order No. | Clamp Order No. | Scriber Dimensions (inch) | | | |
|---|---|---|---|---|---|
| | | Length | Height | Width | Thickness |
| 900258 | 901385 | 2.4 | 1.2 | .25 | .5 |
| 905201 | 901385 | 5.9 | 1.77 | .25 | .5 |
| 900172 | 901385 | 5.3 | 1.0 | .25 | .5 |
| 900173 | 901338 | 1.9 | 1.0 | .25 | .5 |

# Optional Accessories

## Optional Accessories for Height Gage



### Center Master

- Allows quick measurement of center-to-center distance between holes.
- Measurable hole diameters: .040" to 1.50" / ø1 - ø38mm.

### SPECIFICATIONS

| Order No. | Remarks |
|---|---|
| 951144 | With metric-type holding bar (9x9mm cross-section) |
| 900581 | With inch-type holding bar (.25x.5" cross-section) |





### Depth Gage Attachment

- Attached to a height gage to measure groove and hole depth.
- Minimum hole diameter: 5.5mm
- Maximum distance from the bottom of the holding bar to the contact point: 2.95" (inch type), 80mm (metric type)
- Uses standard dial indicator points.

### SPECIFICATIONS

| Order No. | Remarks |
|---|---|
| 900764 | With metric-type holding bar (9x9mm cross-section) |
| 900878 | With inch-type holding bar (.25x.5" cross-section) |



### Contact Sensor

- The contact sensor eliminates errors caused by jacking-up the height gage while taking measurements. When the scriber of a height gage touches a conductive workpiece, an indicator will light up to indicate that measurement can be taken, which results in consistent height measurement.

### SPECIFICATIONS

| Order No. | Remarks |
|---|---|
| 900872 | Battery (2pcs. SR44, required) is not included |



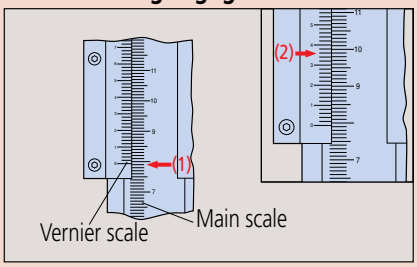
Mitutoyo

# Quick Guide to Precision Measuring Instruments

# Height Gages

## How to read

### Vernier Height gage




| Graduation | 0.02mm |
|---|---|
| (1) Main scale | 79 mm |
| (2) Vernier | 0.36 mm |
| Reading | 79.36 mm |

## General notes on use of Height Gages

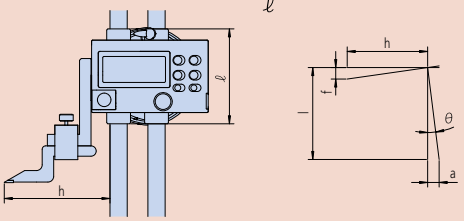
1. Potential causes of error

Like the caliper, the error factors involved include parallax effects, error caused by excessive measuring force due to the fact that a height gage does not conform to Abbe's Principle, and differential thermal expansion due to a temperature difference between the height gage and workpiece.
There are also other error factors caused by the structure of the height gage.
In particular, the error factors related to a warped reference edge and scriber installation described below should be studied before use.

2. Reference edge (column) warping and scriber installation

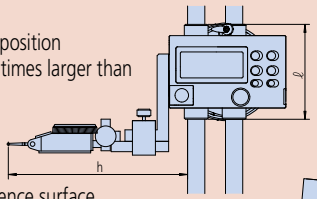
Like the caliper, and as shown in the following figure, measurement errors result when using the height gage if the reference column, which guides the slider, becomes warped. This error can be represented by the same calculation formula for errors caused by nonconformance to Abbe's Principle.

$$f = h\theta = h\frac{a}{\ell}$$



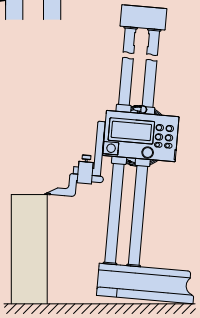

Installing the scriber (or a lever-type dial indicator) requires careful consideration because it affects the size of any error due to a warped reference column by increasing dimension h in the above formula. In other words, if an optional long scriber or lever-type dial indicator is used, the measurement error becomes larger.

Example: Effect of measuring point position
When h is 150 mm, the error is 1.5 times larger than when h is 100 mm.



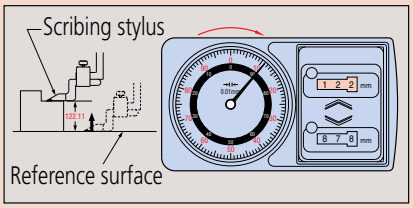

3. Lifting of the base from the reference surface

When setting the scriber height from a gauge block stack, or from a workpiece feature, the base may lift from the surface plate if excessive downwards force is used on the slider, and this results in measurement error. For accurate setting, move the slider slowly downwards while moving the scriber tip to and fro over the gauge block surface (or feature). The correct setting is when the scriber is just felt to lightly touch as it moves over the edge of the surface.
It is also necessary to make sure that the surface plate and height gage base reference surface are free of dust or burrs before use.



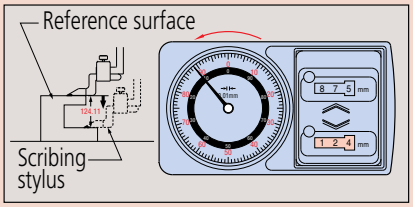
### Mechanical Digit Height gage

**Measuring upwards from a reference surface**




| | | |
|---|---|---|
| Counter | 122 | mm |
| Dial | 0.11 | mm |
| Reading | 122.11 | mm |

**Measuring downwards from a reference surface**




| | | |
|---|---|---|
| Counter | 124 | mm |
| Dial | 0.11 | mm |
| Reading | 124.11 | mm |

4. Error due to inclination of the main scale (column)

According to JIS standards, the perpendicularity of the column reference edge to the base reference surface should be better than:

$$\left(0.01+\frac{L}{1000}\right)\text{mm}$$ L indicates the measuring length (unit: mm)

This is not a very onerous specification. For example, the perpendicularity limit allowable is 0.61 mm when L is 600 mm. This is because this error factor has a small influence and does not change the inclination of the slider, unlike a warped column.

5. Relationship between accuracy and temperature

Height gages are made of several materials. Note that some combinations of workpiece material, room temperature, and workpiece temperature may affect measuring accuracy if this effect is not allowed for by performing a correction calculation.

6. The tip of a height gage scriber is very sharp and must be handled carefully if personal injury is to be avoided.

7. Do not damage a digital height gage scale by engraving an identification number or other information on it with an electric marker pen.

8. Carefully handle a height gage so as not to drop it or bump it against anything.

## Notes on using the height gage

1. Keep the column, which guides the slider, clean. If dust or dirt accumulates on it, sliding becomes difficult, leading to errors in setting and measuring.
2. When scribing, securely lock the slider in position using the clamping arrangements provided. It is advisable to confirm the setting after clamping because the act of clamping on some height gages can alter the setting slightly. If this is so, allowance must be made when setting to allow for this effect.
3. Parallelism between the scriber measuring face and the base reference surface should be 0.01 mm or better.
   Remove any dust or burrs on the mounting surface when installing the scriber or lever-type dial indicator before measurement. Keep the scriber and other parts securely fixed in place during measurement.
4. If the main scale of the height gage can be moved, move it as required to set the zero point, and securely tighten the fixing nuts.
5. Errors due to parallax error are not negligible. When reading a value, always look straight at the graduations.
6. Handling after use: Completely wipe away any water and oil. Lightly apply a thin coating of anti-corrosion oil and let dry before storage.
7. Notes on storage:
   Avoid direct sunlight, high temperatures, low temperatures, and high humidity during storage.
   If a digital height gage will not be used for more than three months, remove the battery before storage.
   If a protective cover is provided, use the cover during storage to prevent dust from adhering to the column.

# CERA Caliper Checker

## SERIES 515

## FEATURES

- The CERA Caliper Checker is designed to inspect vernier, dial and Digimatic calipers. It is comprised of permanently wrung, high-grade CERA gage blocks in a protective casting.
- The CERA Caliper Checker also stands perpendicular to a surface for height gage inspection.
- The zirconia-based ceramic CERA measuring blocks are corrosion-resistant and dimensionally stable.



515-555

## SPECIFICATIONS

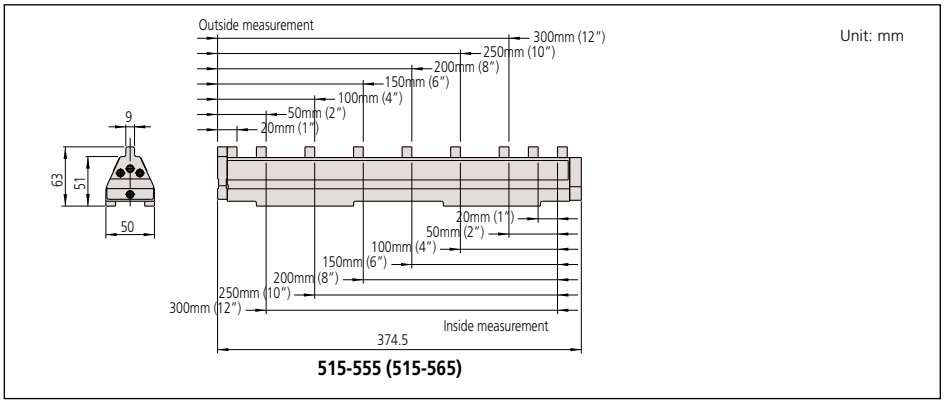
**Metric**

| Range | Order No. | Remarks (length to check) | Mass (kg) |
|---|---|---|---|
| 0 - 300mm | **515-555** | Outside measurement: 20, 50, 100, 150, 200, 250, 300mm<br>Inside measurement: 20, 50, 100, 150, 200, 250, 300mm | 4.0 |
| 0 - 600mm | **515-556-2** | Outside, Inside measurement: 20, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600mm | 8.5 |

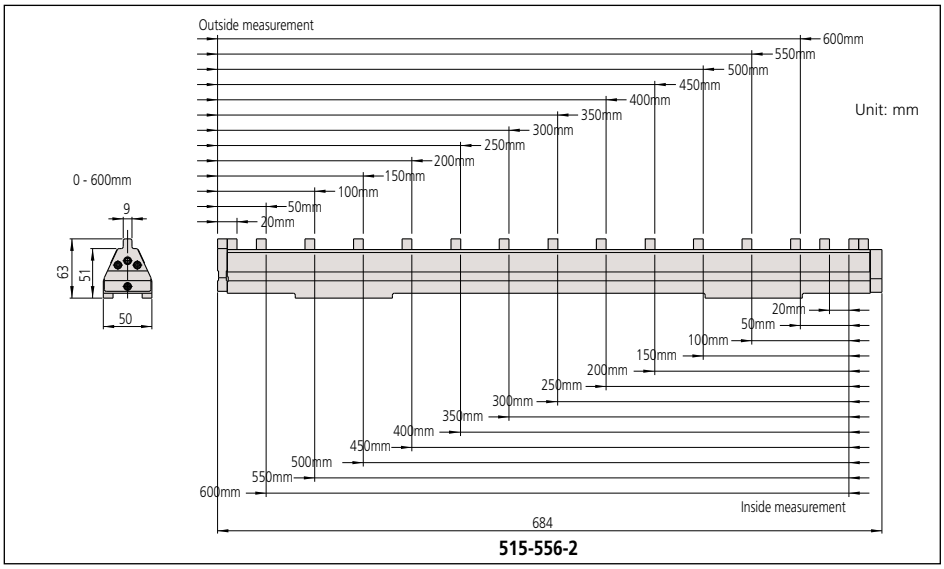
**Inch**

| Range | Order No. | Remarks (length to check) | Mass (kg) |
|---|---|---|---|
| 0 - 12″ | **515-565** | Outside measurement: 1″, 2″, 4″, 6″, 8″, 10″, 12″<br>Inside measurement: 1″, 2″, 4″, 6″, 8″, 10″, 12″ | 4.0 |

## DIMENSIONS




515-555 (515-565)




515-556-2

## Technical Data

Block pitch accuracy: ±0.005mm for range up to 300mm
±.0002″ for range up to 12 ″
±0.007mm for range up to 600mm
Parallelism of blocks: 0.002mm for range up to 300mm
0.004mm for range up to 600mm

## Optional Accessories

**602162**: Wooden case for 300mm model
**602164**: Wooden case for 600mm model



Used for caliper



Used for height gage

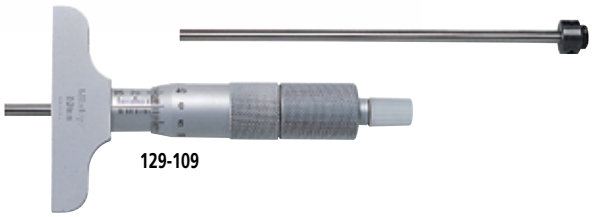
# Depth Micrometer

## SERIES 329, 129 — Interchangeable Rod Type

### FEATURES

- ø4mm interchangeable rods, with lapped measuring end, provide a wide measuring range.
- The rod length can be adjusted in 1″ or 25mm increments.
- With ratchet stop for constant force.
- With measuring rod clamp.
- With SPC output (Series 329).
- Supplied in fitted plastic case.




### SPECIFICATIONS

**Metric** Digimatic model

| Range | Order No. | Base Size | Rod Qty. |
|---|---|---|---|
| 0 - 150mm | **329-250-30** | 101.6x16mm | 6 rods |
| 0 - 300mm | **329-251-30** | 101.6x16mm | 12 rods |

**Metric**

| Range | Order No. | Base Size | Rod Qty. |
|---|---|---|---|
| 0 - 50mm | **129-109** | 63.5x16mm | 2 rods |
| 0 - 100mm | **129-111** | 63.5x16mm | 4 rods |
| 0 - 100mm | **129-115** | 101.6x16mm | 4 rods |
| 0 - 150mm | **129-112** | 63.5x16mm | 6 rods |
| 0 - 150mm | **129-116** | 101.6x16mm | 6 rods |

**Inch/Metric** Digimatic model

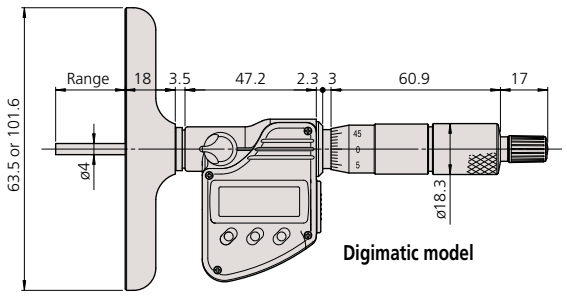
| Range | Order No. | Base Size | Rod Qty. |
|---|---|---|---|
| 0 - 6″ / 0 - 152.4mm | **329-350-30** | 4″x.63″ | 6 rods |
| 0 - 12″ / 0 - 304.8mm | **329-351-30** | 4″x.63″ | 12 rods |

**Inch**

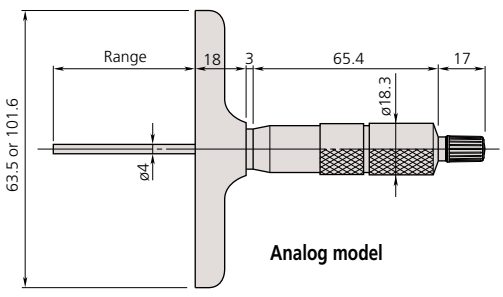
| Range | Order No. | Base Size | Rod Qty. |
|---|---|---|---|
| 0 - 4″ | **129-127** | 2.5″x.63″ | 4 rods |
| 0 - 4″ | **129-131** | 4″x.63″ | 4 rods |
| 0 - 6″ | **129-128** | 2.5″x.63″ | 6 rods |
| 0 - 6″ | **129-132** | 4″x.63″ | 6 rods |
| 0 - 12″ | **129-149** | 2.5″x.63″ | 12 rods |
| 0 - 12″ | **129-150** | 4″x.63″ | 12 rods |

### DIMENSIONS

Unit: mm




Digimatic model




Analog model

### Technical Data

Accuracy: ±.00015″/3µm for micrometer head feed
±[.00008 + (.00004xR/3)]″
R= max. measuring length (inch)
±(2+L/75)µm for interchangeable rod,
L=Max. measuring length (mm)
Resolution*: .00005″/0.001mm or 0.001mm
Graduation**: .001″ or 0.01mm
Flatness of reference surface (base):
.00005″/1.3µm for 2.5″/63.5mm wide base
.00008″/2µm for 4″/.6mm wide base
Flatness of measuring face (rod):
.000012″/0.3µm
Parallelism between reference face and measuring rod face:
[.00016 + (.00004 x R/2)]″
R=max. measuring range (inch)
(4+L/50)µm
L=Max. measuring length (mm)
Zero point error of rods:
±.0002″/4µm for 0-6″/0-150mm models
±.0003″/6µm for 0-12″/0-300mm models
Measuring rod diameter: .157″/4mm
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 2.4 years under normal use
*Digital models **Analog models

### Function of Digimatic Model

Origin-set, Zero-setting, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Function Lock, 2 Presets
Alarm: Low voltage, Counting value composition error

### Optional Accessories for Digimatic Model

**05CZA662**: SPC cable with data switch (40″ / 1m)
**05CZA663**: SPC cable with data switch (80″ / 2m)



# Depth Micrometer

## SERIES 128

### Technical Data

Accuracy: ±3µm for micrometer head feed
Graduation: .001″ or 0.01mm
Flatness of reference face: 1.3µm for 63.5mm width base,
2µm for 101.6mm width base
Flatness of measuring rod face: 0.3µm
Parallelism between reference face and measuring rod face:
(4+L/50)µm, L=Max. measuring length (mm)
Measuring rod diameter: 4mm

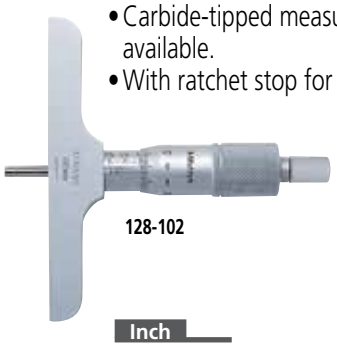


### FEATURES

- ø4mm measuring rod.
- With measuring rod clamp.
- Carbide-tipped measuring rod model is available.
- With ratchet stop for constant force.



128-101



128-102

### SPECIFICATIONS

**Metric**

| Range | Order No. | Remarks (base) |
|---|---|---|
| 0 - 25mm | **128-101** | 63.5x16mm |
| 0 - 25mm | **128-103*** | 63.5x16mm |
| 0 - 25mm | **128-102** | 101.6x16mm |
| 0 - 25mm | **128-104*** | 101.6x16mm |

*with carbide-tipped measuring rod

**Inch**

| Range | Order No. | Remarks (base) |
|---|---|---|
| 0 - 1″ | **128-105** | 2.5″x.63″ |
| 0 - 1″ | **128-106** | 4″x.63″ |

# Depth Micro Checker

## SERIES 515

### FEATURES

- The Depth Micro Checker is designed to efficiently check the zero point of a depth micrometer.



515-570



515-571

### SPECIFICATIONS

**Metric**

| Range | Order No. | Remarks (length to check) |
|---|---|---|
| 0 - 150mm | **515-570** | 25, 50, 75, 100, 125, 150mm |
| 0 - 300mm | **515-571** | 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275, 300mm |

**Inch**

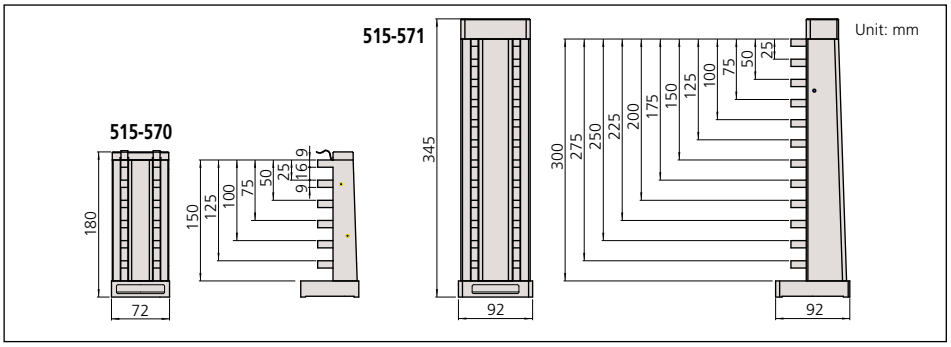
| Range | Order No. | Remarks (length to check) |
|---|---|---|
| 0 - 6″ | **515-575** | 1″, 2″, 3″, 4″, 5″, 6″ |

### Technical Data

Block pitch accuracy: ±(1+L/150)µm,
L=Length to check (mm)
Anvil block accuracy: ±0.5µm



### DIMENSIONS



# ABSOLUTE Digimatic Depth Gage

## SERIES 571

## FEATURES

- ABSOLUTE Digimatic Depth Gage can keep track of the origin point, once set, for the entire life of the battery.
- Base and measuring faces are hardened and micro-lapped.
- Optional wider extension base are available. (up to 450mm range models)
- With SPC data output.



571-263-10



571-201-30

## SPECIFICATIONS

**Metric**

| Range | Order No. | Resolution | Accuracy | Mass(g) |
|---|---|---|---|---|
| 0 - 150mm | **571-201-30** | 0.01mm | ±0.02mm | 192 |
| 0 - 150mm | **571-251-20*** | 0.01mm | ±0.02mm | 199 |
| 0 - 200mm | **571-202-30** | 0.01mm | ±0.02mm | 212 |
| 0 - 200mm | **571-252-20*** | 0.01mm | ±0.02mm | 219 |
| 0 - 300mm | **571-203-20** | 0.01mm | ±0.03mm | 310 |
| 0 - 300mm | **571-253-10*** | 0.01mm | ±0.03mm | 320 |
| 0 - 450mm | **571-204-10** | 0.01mm | ±0.05mm | 1270 |
| 0 - 600mm | **571-205-10** | 0.01mm | ±0.05mm | 1400 |
| 0 - 750mm | **571-206-10** | 0.01mm | ±0.06mm | 1530 |
| 0 - 1000mm | **571-207-10** | 0.01mm | ±0.07mm | 1760 |

*IP67 Coolant-Proof model

**Inch/Metric**

| Range | Order No. | Resolution | Accuracy | Mass(g) |
|---|---|---|---|---|
| 0 - 6″ / 0 - 150mm | **571-211-30** | .0005″ / 0.01mm | ±.001″ | 192 |
| 0 - 6″ / 0 - 150mm | **571-261-20*** | .0005″ / 0.01mm | ±.001″ | 199 |
| 0 - 8″ / 0 - 200mm | **571-212-30** | .0005″ / 0.01mm | ±.001″ | 212 |
| 0 - 8″ / 0 - 200mm | **571-262-20*** | .0005″ / 0.01mm | ±.001″ | 219 |
| 0 - 12″ / 0 - 300mm | **571-213-10** | .0005″ / 0.01mm | ±.0015″ | 310 |
| 0 - 12″ / 0 - 300mm | **571-263-10*** | .0005″ / 0.01mm | ±.0015″ | 320 |
| 0 - 18″ / 0 - 450mm | **571-214-10** | .0005″ / 0.01mm | ±.002″ | 1270 |
| 0 - 24″ / 0 - 600mm | **571-215-10** | .0005″ / 0.01mm | ±.002″ | 1400 |
| 0 - 30″ / 0 - 750mm | **571-216-10** | .0005″ / 0.01mm | ±.0025 | 1530 |
| 0 - 40″ / 0 - 1000mm | **571-217-10** | .0005″ / 0.01mm | ±.0025 | 1760 |

*IP67 Coolant-Proof model

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IP67

SPC

ABSOLUTE®
Absolute System Patented by MITUTOYO

## Technical Data

Resolution: .0005″/0.01mm or 0.01mm
Repeatability: 0.01mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance (electromagnetic induction)* type linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 20,000 hours (3 years)* under normal use
Dust/Water protection level: IP67*
*Coolant-Proof models

## Function

Origin-set, Zero-setting, Automatic power on/off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

## Optional Accessories

**959143**: Data hold unit
**959149**: SPC cable with data switch (40″ / 1m)
**959150**: SPC cable with data switch (80″ / 2m)
**05CZA624**: SPC cable with data switch (40″ / 1m)*
**05CZA625**: SPC cable with data switch (80″ / 2m)*
———: Extension base (see page D-56.)
*For IP-67 models

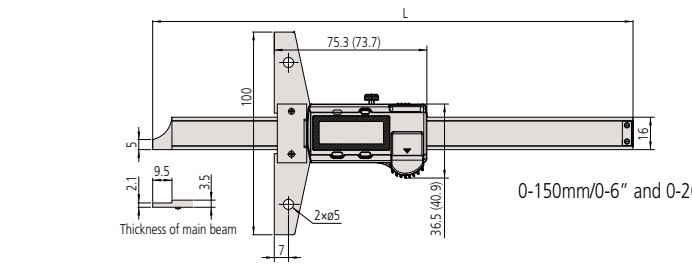




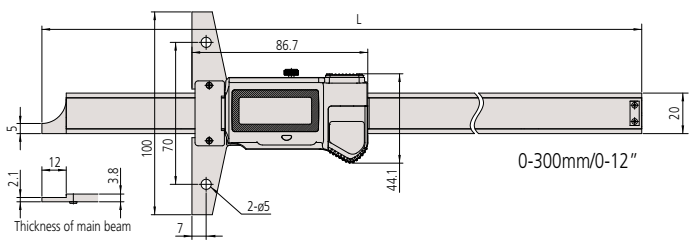
Measurement data output function is available with a water-resistant SPC cable.

## DIMENSIONS

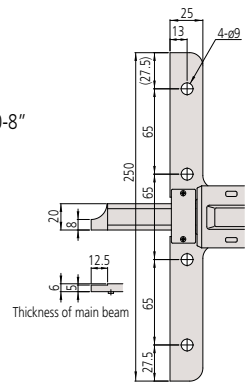
Unit: mm




0-150mm/0-6″ and 0-200mm/0-8″




0-300mm/0-12″




0-450mm/0-18″ and larger

| Range | L | Base thickness |
|---|---|---|
| 0 - 6″ / 0 - 150mm | 237 | 6 |
| 0 - 8″ / 0 - 200mm | 287 | 6 |
| 0 - 12″ / 0 - 300mm | 403 | 6 |
| 0 - 18″ / 0 - 450mm | 635 | 10 |
| 0 - 24″ / 0 - 600mm | 785 | 10 |
| 0 - 30″ / 0 - 750mm | 935 | 10 |
| 0 - 40″ / 0 - 1000mm | 1200 | 10 |

# Tire Tread Depth Gage

## SERIES 571

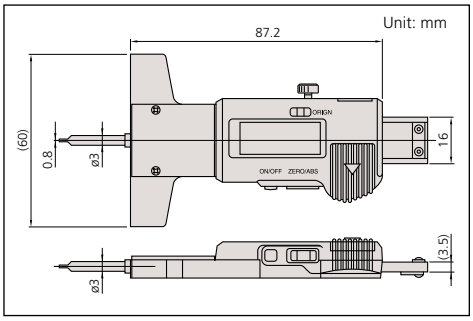
### FEATURES

- ABSOLUTE Digimatic Tread Depth Gage can keep track of the origin point, once set, for the life of the battery.
- Specially designed to measure tire tread depth.
- With SPC data output.



571-100MOT-10

### DIMENSIONS




### SPECIFICATIONS

**Metric**

| Range | Order No. | Resolution | Accuracy |
|---|---|---|---|
| 0 - 25mm | **571-100MOT-10** | 0.01mm | ±0.02mm |

**Inch/Metric**

| Range | Order No. | Resolution | Accuracy |
|---|---|---|---|
| 0 - 1" / 0 - 25mm | **571-200MOT-10** | .0005" / 0.01mm | ±.0005" |

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: .0005"/0.01mm or 0.01mm
Display: LCD
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 2000 hours

### Function

Origin-set, Zero-setting, Power ON/OFF, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**959143**: Data hold unit
**959149**: SPC cable with data switch (40" / 1m)
**959150**: SPC cable with data switch (80" / 2m)



# ABSOLUTE Point-Type Digimatic Depth Gage

## SERIES 571

### FEATURES

- ABSOLUTE Digimatic Depth Gage can keep track of the origin point, once set, for the life of the battery.
- Base and measuring faces are hardened and micro-lapped.
- Optional wider extension base are available.
- With SPC data output.



### SPECIFICATIONS

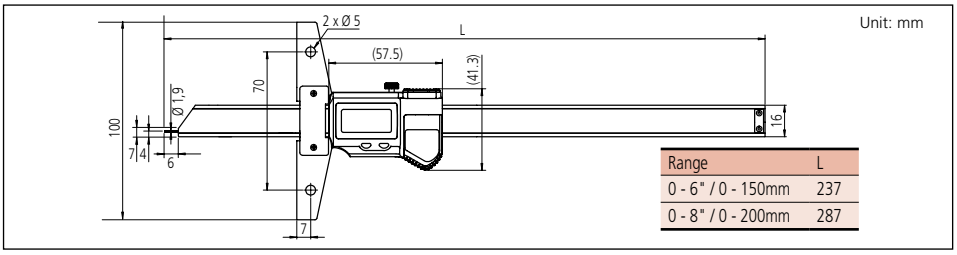
**Metric**

| Range | Order No. | Resolution | Accuracy | Mass(g) |
|---|---|---|---|---|
| 0-150mm | **571-301-20** | 0.01mm | ±0.02mm | 207 |
| 0-200mm | **571-302-20** | 0.01mm | ±0.02mm | 227 |

**Inch/Metric**

| Range | Order No. | Resolution | Accuracy | Mass(g) |
|---|---|---|---|---|
| 0-6"/0-150mm | **571-311-20** | .0005" / 0.01mm | ±.001"/±0.02mm | 207 |
| 0-8"/0-200mm | **571-312-20** | .0005" / 0.01mm | ±.001"/±0.02mm | 227 |

### DIMENSIONS




| Range | L |
|---|---|
| 0 - 6" / 0 - 150mm | 237 |
| 0 - 8" / 0 - 200mm | 287 |

### Technical Data

Resolution: .0005"/0.01mm or 0.01mm
Repeatability: .0005"/0.01mm
Display: LCD
Length standard: ABSOLUTE electromagnetic induction-type linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 20,000 hours (3 years) under normal use
Dust/Water protection level: IP67

### Function

Origin-set, Zero-setting, Automatic power on/off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)
———: Extension base (see page D-56.)



05CZA624



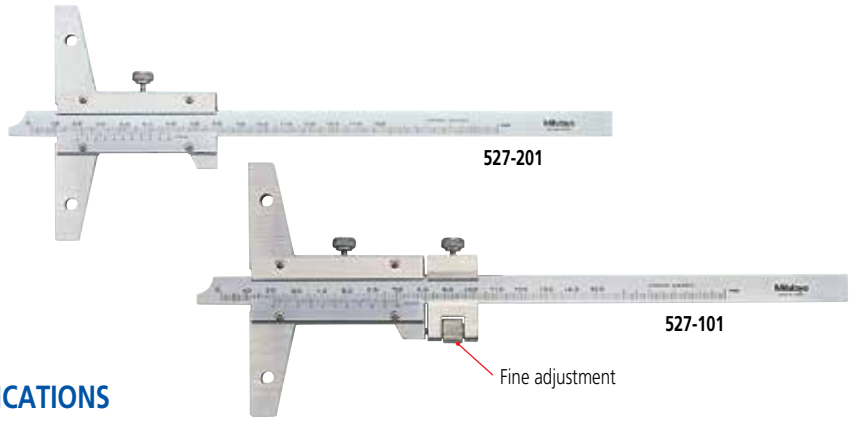
Measurement data output function is available with a water-resistant SPC cable.

# Vernier Depth Gage

## SERIES 527

### FEATURES

- Made of hardened stainless steel.
- Base and measuring faces are hardened and micro-lapped.
- Optional wider extension base are available. (up to 450mm range models)




### SPECIFICATIONS

**Metric**

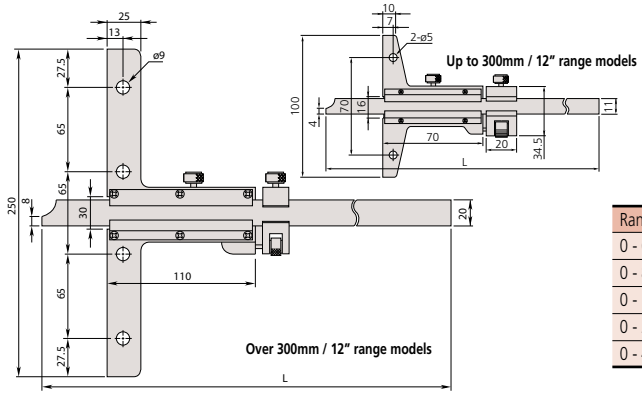
| Range | Order No. | Vernier reading | Accuracy | Mass (g) | Remarks |
|---|---|---|---|---|---|
| 0 - 150mm | **527-201** | 0.05mm | ±0.05mm | 240 | ——— |
| 0 - 150mm | **527-121** | 0.02mm | ±0.03mm | 215 | ——— |
| 0 - 150mm | **527-101** | 0.02mm | ±0.03mm | 280 | with fine adjustment |
| 0 - 200mm | **527-202** | 0.05mm | ±0.05mm | 260 | ——— |
| 0 - 200mm | **527-122** | 0.02mm | ±0.03mm | 230 | ——— |
| 0 - 200mm | **527-102** | 0.02mm | ±0.03mm | 300 | with fine adjustment |
| 0 - 300mm | **527-203** | 0.05mm | ±0.08mm | 300 | ——— |
| 0 - 300mm | **527-123** | 0.02mm | ±0.04mm | 265 | ——— |
| 0 - 300mm | **527-103** | 0.02mm | ±0.04mm | 350 | with fine adjustment |
| 0 - 600mm | **527-204** | 0.05mm | ±0.10mm | 1511 | ——— |
| 0 - 600mm | **527-104** | 0.02mm | ±0.05mm | 1511 | with fine adjustment |
| 0 - 1000mm | **527-205** | 0.05mm | ±0.15mm | 1880 | ——— |
| 0 - 1000mm | **527-105** | 0.02mm | ±0.07mm | 1880 | with fine adjustment |

**Inch**

| Range | Order No. | Vernier reading | Accuracy | Mass (g) | Remarks |
|---|---|---|---|---|---|
| 0 - 6″ | **527-111** | .001″ | ±.001″ | 280 | with fine adjustment |
| 0 - 8″ | **527-112** | .001″ | ±.001″ | 300 | with fine adjustment |
| 0 - 12″ | **527-113** | .001″ | ±.0015″ | 350 | with fine adjustment |
| 0 - 24″ | **527-114** | .001″ | ±.002″ | 1511 | with fine adjustment |
| 0 - 40″ | **527-115** | .001″ | ±.003″ | 1880 | with fine adjustment |

### DIMENSIONS

Unit: mm




| Range | L |
|---|---|
| 0 - 6″ / 0 - 150mm | 260 |
| 0 - 8″/ 0 - 200mm | 310 |
| 0 - 12″ / 0 - 300mm | 410 |
| 0 - 24″/ 0 - 600mm | 800 |
| 0 - 40″/ 0 - 1000mm | 1200 |

### Technical Data

Graduation: .001″ or 0.05mm, 0.02mm

### Optional Accessories

———: Extension base (see page D-56.)

# Vernier Depth Gage

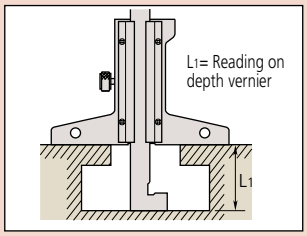
## SERIES 527 — Hook-End Type

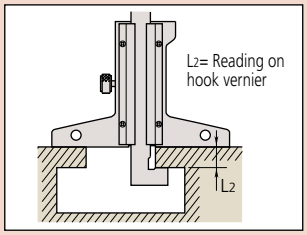
### Technical Data

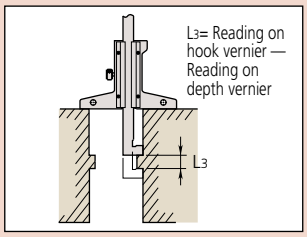
Graduation: 0.05mm or 0.02mm
Base size: 100x6.5mm (WxT)

### Optional Accessory

———: Extension base (see page D-56.)

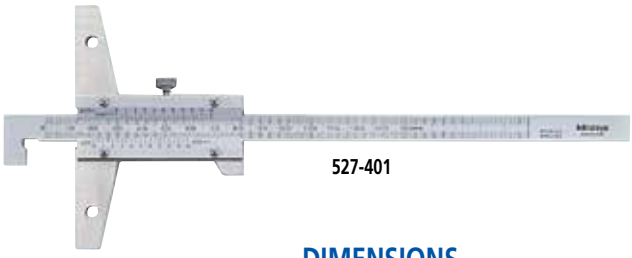



### FEATURES

- The end of the main scale is hook-shaped to allow depth and thickness measurements of a projected portion or lip in a hole, in addition to standard depth measurement.
- Fine adjustment models are available.
- Optional wider extension bases are available.



527-401

### SPECIFICATIONS

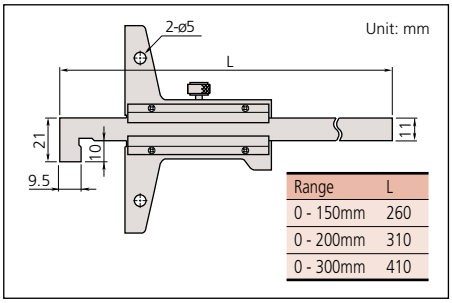
**Metric**

| Range | Order No. | Vernier reading | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **527-401** | 0.05mm | ±0.05mm | 240 |
| 0 - 200mm | **527-402** | 0.05mm | ±0.05mm | 240 |
| 0 - 300mm | **527-403** | 0.05mm | ±0.08mm | 270 |

**Metric** with fine adjustment

| Range | Order No. | Vernier reading | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 150mm | **527-411** | 0.02mm | ±0.03mm | 280 |
| 0 - 200mm | **527-412** | 0.02mm | ±0.03mm | 300 |
| 0 - 300mm | **527-413** | 0.02mm | ±0.04mm | 350 |

### DIMENSIONS




| Range | L |
|---|---|
| 0 - 150mm | 260 |
| 0 - 200mm | 310 |
| 0 - 300mm | 410 |

# ABSOLUTE Digimatic Depth Gage

## SERIES 571 — Hook-End Type

### FEATURES

- ABSOLUTE Digimatic Depth Gage can keep track of the origin point, once set, for the life of the battery.
- Base and measuring faces are hardened and micro-lapped.
- Optional wider extension bases are available.
- With SPC data output.



571-264-10

### Technical Data

Resolution: .0005"/0.01mm
Repeatability: .0005"/0.01mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance (electromagnetic induction)* type linear encoder
Max. response speed: Unlimited
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 20,000 hours (3 years)* under normal use
Dust/Water protection level: IP67

### Function

Origin-set, Zero-setting, Automatic power on/off, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

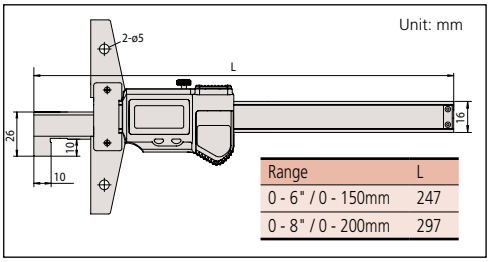
**05CZA624**: SPC cable with data switch (40" / 1m)
**05CZA625**: SPC cable with data switch (80" / 2m)
———: Extension base (see page D-56.)

### SPECIFICATIONS

**Inch/Metric**

| Range | Order No. | Resolution | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 6" / 0 - 150mm | **571-264-20** | .0005" / 0.01mm | ±.0015" | 578 |
| 0 - 8" / 0 - 200mm | **571-265-20** | .0005" / 0.01mm | ±.0015" | 598 |

### DIMENSIONS



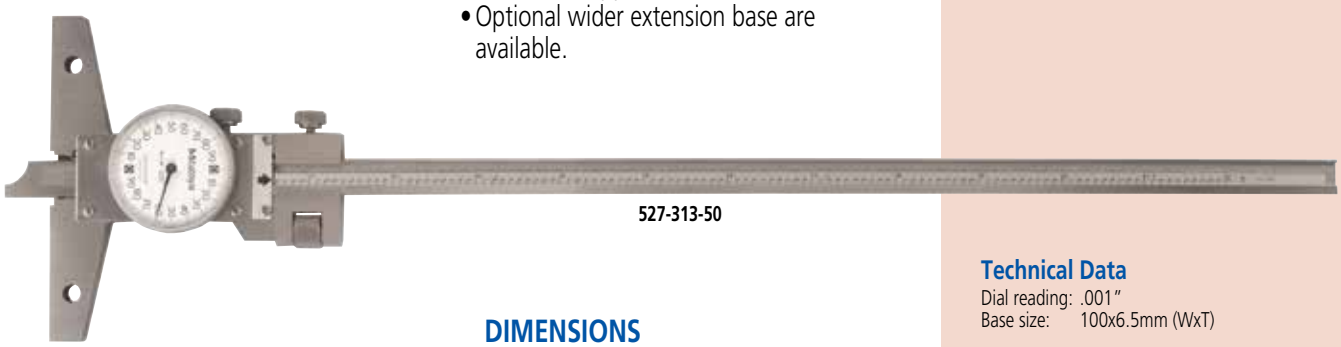

| Range | L |
|---|---|
| 0 - 6" / 0 - 150mm | 247 |
| 0 - 8" / 0 - 200mm | 297 |

# Dial Depth Gage

## SERIES 527 — With Fine Adjustment

### FEATURES

- Easier and faster reading of dial.
- Made of hardened stainless steel.
- Base and measuring faces are hardened and micro-lapped.
- Optional wider extension base are available.



527-313-50

### Technical Data

Dial reading: .001″
Base size: 100x6.5mm (WxT)

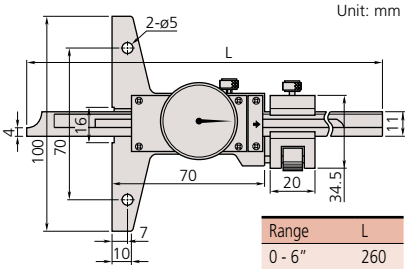
### SPECIFICATIONS

**Inch**

| Range | Order No. | Dial reading | Accuracy | Mass (g) |
|---|---|---|---|---|
| 0 - 6″ | **527-311-50** | .001″ | ±.001″ | 280 |
| 0 - 8″ | **527-312-50** | .001″ | ±.001″ | 300 |
| 0 - 12″ | **527-313-50** | .001″ | ±.0015″ | 340 |

### DIMENSIONS

Unit: mm




| Range | L |
|---|---|
| 0 - 6″ | 260 |
| 0 - 8″ | 310 |
| 0 - 12″ | 410 |

# Extension Bases

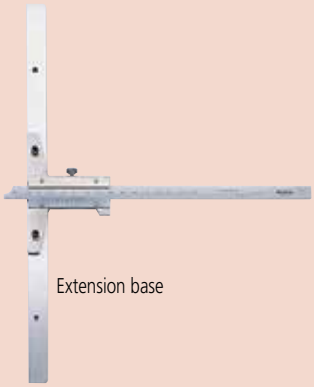
## Optional Accessory for Depth Gage

### FEATURES

- Attached to the base (reference face) plate of a depth gage to extend its span.
- These extension base cannot be attached to 0-24″ and 0-40″, 0-600mm, 0-1000mm, range models.



900372



Extension base

### SPECIFICATIONS

**Metric**

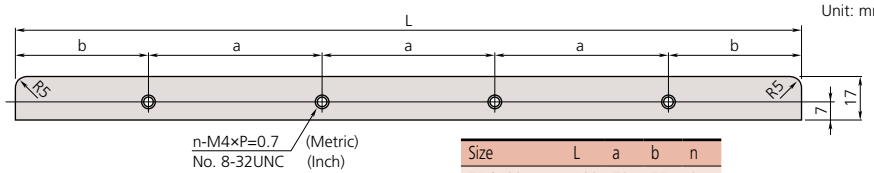
| Size | Order No. | Remarks (dimension a, b / n) | |
|---|---|---|---|
| 180mm | **900370** | 70mm, 55mm | 2 |
| 260mm | **900371** | 35mm, 60mm | 5 |
| 320mm | **900372** | 70mm, 55mm | 4 |

**Inch**

| Size | Order No. | Remarks (dimension a, b / n) | |
|---|---|---|---|
| 7″ | **900367** | 2.76″, 2.17″ | 2 |
| 10″ | **900368** | 1.38″, 2.36″ | 5 |
| 12″ | **900369** | 2.76″, 2.17″ | 4 |

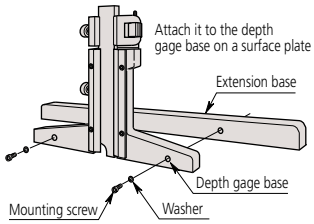
### DIMENSIONS

Unit: mm




| Size | L | a | b | n |
|---|---|---|---|---|
| 7″ / 180mm | 180 | 70 | 55 | 2 |
| 10″ / 260mm | 260 | 35 | 60 | 5 |
| 12″ / 320mm | 320 | 70 | 55 | 4 |

**Attaching the extension base**



# ABSOLUTE Digimatic/Dial Depth Gage

## SERIES 547, 7

SPC

ABSOLUTE®
Absolute System Patented by MITUTOYO

### Technical Data

Accuracy: Refer to the list of specifications
Resolution*: .0005"/0.01mm or 0.001mm, 0.01mm, .00005"/0.001mm
Dial reading**: .001" or 0.01mm
Flatness of base face: 5µm
Contact point: Carbide-tipped ball point or needle point (**7210**, **7222**)
Measuring force: 1.4N, 1.5N (digital model), 2.5N (**7213**, **7214**, **7217S**, **7218S**)
Display*: LCD
Battery*: SR44 (1 pc.), **938882**
Battery life*: Approx. 3.5 years under normal use
*Digital models **Dial models

### Technical Data of Dial Mode

Accuracy: Refer to the list of specifications
Dial reading: .001" or 0.01mm
Flatness of base face: 5µm or 2µm
Contact point: Carbide-tipped ball point (needle point: **7210**, **7222**)
Measuring force: 1.4N (2.5N: **7213**, **7214**, **7217S**, **7218S**)

### Function of Digimatic Model

Origin-set, Zero-setting, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Optional Accessories

**905338**: SPC cable (40" / 1m)
**905409**: SPC cable (80" / 2m)
**139167**: .5" Extension Rod
**301655**: 1" Extension Rod
**301657**: 2" Extension Rod
**301659**: 4" Extension Rod
**303611**: 10mm Extension Rod
**303612**: 20mm Extension Rod
**303613**: 30mm Extension Rod
**303614**: 100mm Extension Rod

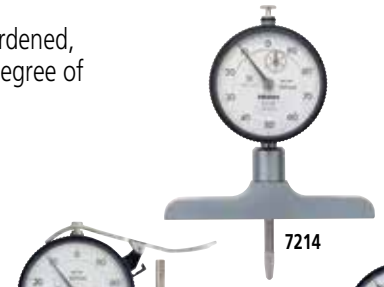
### Base Only (3/8" dia. hole)

| Part No. | length | remark |
|---|---|---|
| **902164**: | 2.5" | **7217S, 7237, 547-217S, 547-257S** |
| **902165**: | 4" | **7218S, 7238, 547-218S, 547-258S** |

### FEATURES

- ABSOLUTE Digimatic Depth Gage can keep track of the origin point, once set, for the life of the battery. (Series 547)
- Wide probing range is available with the supplied extension rod.
- Bottom surface of the base is hardened, ground and lapped for highest degree of flatness.
- Designed with a back-plunger type dial indicator for upward facing readings. (**7231**, **7237, 7238**)
- With SPC data output. (Series 547)










### SPECIFICATIONS

**Metric** Digimatic model

| Range | Order No. | Resolution | Stroke | Accuracy | Extension rod | Base (WxT) | Flatness |
|---|---|---|---|---|---|---|---|
| 0 - 200mm | **547-211** | 0.01mm | 12mm | ±0.02mm | 5 pcs. (10, 20, 30, 30, 100mm) | 63.5x16mm | 5µm |
| 0 - 200mm | **547-212** | 0.01mm | 12mm | ±0.02mm | 5 pcs. (10, 20, 30, 30, 100mm) | 101.6x16mm | 5µm |
| 0 - 200mm | **547-251** | 0.001mm | 12mm | ±0.005mm | 5 pcs. (10, 20, 30, 30, 100mm) | 63.5x16mm | 2µm |
| 0 - 200mm | **547-252** | 0.001mm | 12mm | ±0.005mm | 5 pcs. (10, 20, 30, 30, 100mm) | 101.6x16mm | 2µm |

0.01mm graduation  0.001mm graduation

**Inch/Metric** Digimatic model

| Range | Order No. | Resolution | Stroke | Accuracy | Extension rod | Base (WxT,) | Flatness |
|---|---|---|---|---|---|---|---|
| 0 - 8" / 0-200mm | **547-217S** | .0005" / 0.01mm | .5" | ±.001" | 4 pcs. (.5", 1", 2", 4") | 2.5"x.63" | .0002" |
| 0 - 8" / 0-200mm | **547-218S** | .0005" / 0.01mm | .5" | ±.001" | 4 pcs. (.5", 1", 2", 4") | 4"x.63" | .0002" |
| 0 - 8" / 0-200mm | **547-257S** | .00005" / 0.001mm | .5" | ±.0003" | 4 pcs. (.5", 1", 2", 4") | 2.5"x.63" | .00008" |
| 0 - 8" / 0-200mm | **547-258S** | .00005" / 0.001mm | .5" | ±.0003" | 4 pcs. (.5", 1", 2", 4") | 4"x.63" | .00008" |

.005"/0.01mm graduation  .00005"/0.001mm graduation

**Metric** Dial Type

| Range | Order No. | Graduation | Stroke | Accuracy | Extension rod | Base (WxT) | Flatness |
|---|---|---|---|---|---|---|---|
| 0 - 10mm | **7210*** | 0.01mm | 10mm | ±0.015mm | —— | 40x16mm, | 5µm |
| 0 - 200mm | **7211** | 0.01mm | 10mm | ±0.015mm | 5 pcs. (10, 20, 30, 30, 100mm) | 63.5x16mm | 5µm |
| 0 - 200mm | **7212** | 0.01mm | 10mm | ±0.015mm | 5 pcs. (10, 20, 30, 30, 100mm) | 101.6x16mm | 5µm |
| 0 - 210mm | **7213** | 0.01mm | 30mm | ±0.03mm | 3 pcs. (30, 60, 90mm) | 63.5x16mm | 5µm |
| 0 - 210mm | **7214** | 0.01mm | 30mm | ±0.03mm | 3 pcs. (30, 60, 90mm) | 101.6x16mm | 5µm |
| 0 - 200mm | **7220** | 0.01mm | 10mm | ±0.015mm | 5 pcs. (10, 20, 30, 30, 100mm) | 100x18mm | 5µm |
| 0 - 200mm | **7221** | 0.01mm | 10mm | ±0.015mm | 5 pcs. (10, 20, 30, 30, 100mm) | 150x18mm | 5µm |
| 0 - 10mm | **7222*** | 0.01mm | 10mm | ±0.015mm | 5 pcs. (10, 20, 30, 30, 100mm) | ø16mm | 5µm |
| 0 - 10mm | **7223** | 0.01mm | 10mm | ±0.015mm | 5 pcs. (10, 20, 30, 30, 100mm) | ø25mm | 5µm |
| 0 - 10mm | **7224** | 0.01mm | 10mm | ±0.015mm | 5 pcs. (10, 20, 30, 30, 100mm) | ø40mm | 5µm |
| 0 - 200mm | **7231** | 0.01mm | 5mm | ±0.015mm | 5 pcs. (10, 20, 30, 30, 100mm) | 63.5x16mm | 5µm |

*with needle probe

**Inch** Dial Type

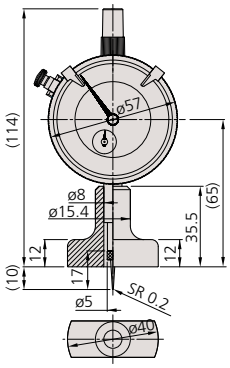
| Range | Order No. | Graduation | Stroke | Accuracy | Extension rod | Base (WxT) | Flatness |
|---|---|---|---|---|---|---|---|
| 0 - 8" | **7217S** | .001" | 1" | ±.002" | 4 pcs. (.5", 1", 2", 4") | 2.5"x.63" | .0002" |
| 0 - 8" | **7218S** | .001" | 1" | ±.002" | 4 pcs. (.5", 1", 2", 4") | 4"x.63" | .0002" |
| 0 - 8" | **7237T** | .001" | .2" | ±.002" | 4 pcs. (.5", 1", 2", 4") | 2.5"x.63" | .0002" |
| 0 - 8" | **7238T** | .001" | .2" | ±.002" | 4 pcs. (.5", 1", 2", 4") | 4"x.63" | .0002" |



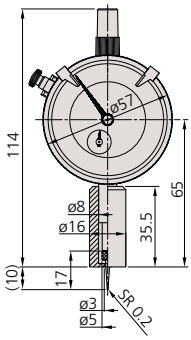
Mitutoyo

## DIMENSIONS

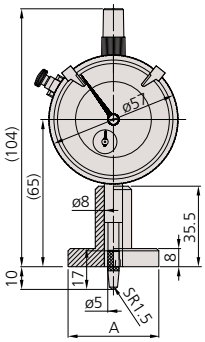
Unit: mm



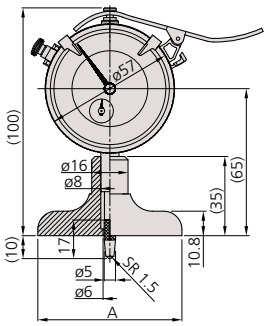

**7210**



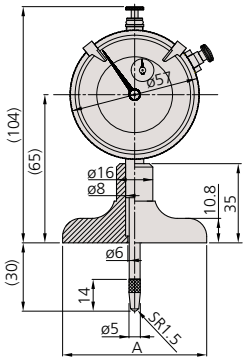

**7222**



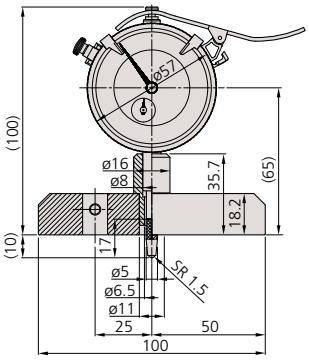

**7223** A= ø25mm
**7224** A= ø40mm



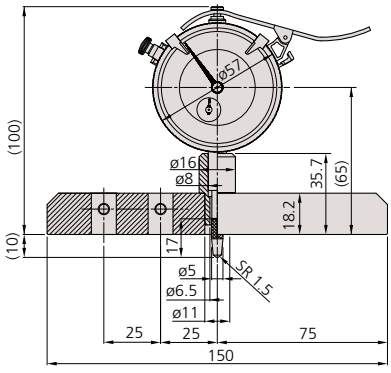

**7211** A= 63.5mm
**7212** A= 101.6mm



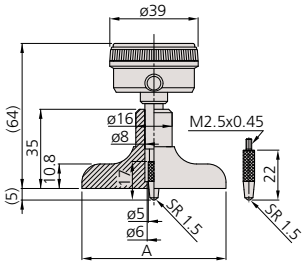

**7213**, **7217S** A= 63.5mm
**7214**, **7218S** A= 101.6mm



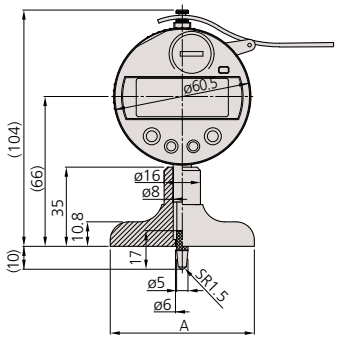

**7220**

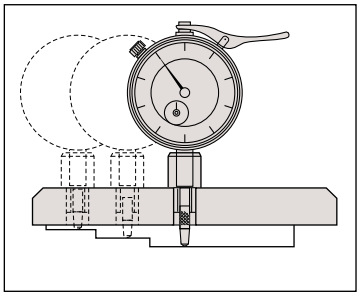



**7221**




**7237T, 7231** A=63.5mm
**7238T** A=101.6mm



**547-211**, **547-251**, **547-217S**, **547-257S** A= 63.5mm
**547-212**, **547-252**, **547-218S**, **547-258S** A= 101.6mm





## Gage Blocks



## Height Master



## Reference Gages



## Granite Surface Plates & Bench Comparator



**CERA/Steel Combination Gage Block Sets**



**Step Master**



**ZERO CERA BLOCK**



**Ceramic Straight Master**

## INDEX


| | |
|---|---|
| **Gage Blocks** | E-2-4 |
| Metric Rectangular Gage Block Set | E-5,6 |
| Inch Rectangular Gage Block Set | E-7 |
| Micrometer Inspection Gage Block Sets | E-8 |
| Bore Gage Calibration Kit | E-8 |
| Individual Metric Rectangular Gage Block | E-9,10 |
| Individual Inch Rectangular Gage Block | E-11 |
| Rectangular Gage Block with CTE | E-12 |
| Zero CERA Blocks | E-12 |
| Rectangular Gage Block Accessories | E-13-15 |
| Metric Square Gage Block Set | E-16 |
| Inch Square Gage Block Set | E-17 |
| Individual Metric Square Gage Block | E-18 |
| Individual Inch Square Gage Block | E-19 |
| Square Gage Block Accessories | E-20,21 |
| Ceraston | E-22 |
| Maintenance Kit for Gage Block | E-22 |
| Step Master | E-23 |
| Made-to-Order Block & Reference | E-23 |
| Gage Block Comparator GBCD-250 | E-24 |
| Gage Block Comparator GBCD-100A | E-24 |
| **Height Masters** | |
| Height Master | E-25 |
| Digital Height Master | E-26 |
| Riser Blocks | E-27 |
| Auxiliary Block Kit | E-27 |
| Universal Height Master | E-28 |
| High-Accuracy Check Master HMC-H | E-29 |
| CERA Straight Master SM-C | E-30 |
| Square Master | E-31 |
| **Reference Gages** | |
| Standard Scales | E-32 |
| Working Standard Scales | E-32 |
| High-Precision Square | E-33 |
| Spring Dividers and Calipers | E-33 |
| Steel Rules | E-34,35 |
| Semi-Flexible Rules | E-35 |
| Thickness/Feeler Gages | E-36 |
| Precision Levels | E-36 |
| Digital Universal Protractor | E-37 |
| Universal Bevel Protractor | E-38 |
| Bevel Protractor | E-38 |
| Radius Gages | E-39 |
| Pitch Gages | E-39 |
| Radius Gages-Sets | E-40 |
| Digital Protractor | E-41 |
| Digital Hand Tachometers | E-42 |
| Bench Center | E-43 |
| **Granite Surface Plates** | |
| Granite Surface Plate Accessories | E-43 |
| Black Granite Surface Plate | E-44,45 |
| Steel Stands | E-45 |

# Gage Block

## SERIES 516

### FEATURES

Precision gage blocks are the primary standards vital to dimensional quality control in the manufacture of parts. Mitutoyo offers a complete selection of gage blocks available in a choice of rectangular or square, metric or inch and steel or CERA (ceramic) types.

### Accuracy

Mitutoyo gage blocks guarantee such a high accuracy that users can use them without anxiety. Mitutoyo has established a traceability system for our measurement products, up to the Metrology Management Center of the National Institute of Advanced Industrial Science and Technology (AIST), and we have been certified by the Japanese government as an accredited laboratory.

### Wringing

The lapping technique is one of Mitutoyo's specialties. Our advanced lapping technique, developed for more than a half century, allows us to achieve the best flatness and surface roughness needed for gage blocks.

### Abrasion Resistance and Dimensional Stability

High-carbon, high-chrome steel is employed to sufficiently satisfy a variety of material characteristics required for gage blocks. A high degree of hardness, obtained by our heat treatment technology, as well as methodically repeated heat treatment, have successfully reduced deterioration change over time.

### CERA Blocks

CERA blocks, made of ceramic materials with superior surface quality, were developed by Mitutoyo's ultra-precision machining techniques and solve problems commonly associated with steel gage blocks.



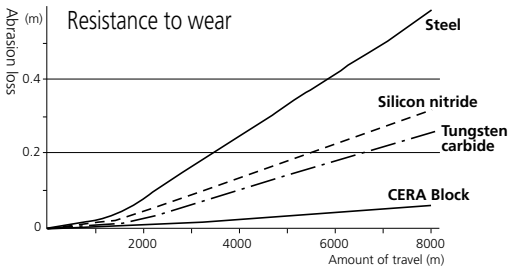

**1. Corrosion-Resistant**
Anti-corrosion treatment is not required when handled normally (i.e. with fingers), resulting in simple maintenance and storage.

**2. No Burrs Caused by Dents, etc.**
Since the CERA Block is very hard it will not scratch and is highly resistant to burrs. If a burr is formed, it can easily be removed with a ceramic deburring stone (Ceraston).

**3. Abrasion Resistant**
CERA Blocks have 10 times the abrasion resistance of steel gage blocks.

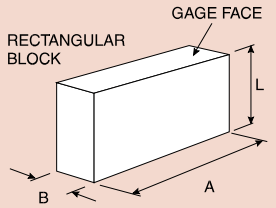
**4. Dimensional Stability**
CERA Blocks are free from dimensional change over time.

**5. Marking**
The black characters, indicating the nominal length, are inscribed by laser and are clearly visible against the white surface of the block.



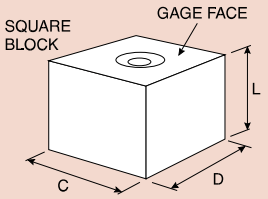

### Selecting Gage Blocks

- Select gage blocks in accordance with the combination range required. If a large length is required, add a long block set.
- Select gage blocks in accordance with the minimum length step required. Add wear block sets if necessary.
- If a set containing a large number of gage blocks is selected, the number of combination gage blocks required for a length is reduced and the number of combinations is increased. The accuracy will be retained and damage will be reduced.
- The specific gage block set for micrometer inspection and caliper inspection is available.
- If using only one length repeatedly, it is a good idea to purchase discrete gage blocks.
- The 2mm-based gage blocks, which take the base of the minimum length step as 2mm, are easy to handle and will not warp, as compared to the 1mm-based gage blocks.




**Rectangular Block**

| Gage Size | Face Width (A) | Face Depth (B) |
|---|---|---|
| Up to 2" | 1.181" | .355" |
| Over .2" up to 40" | 1.378" | .355" |
| Up to 10mm | 30mm | 9mm |
| Over 10mm up to 1000mm | 35mm | 9mm |




**Square Block**

| Gage Size | Face Width (C) | Face Depth (D) |
|---|---|---|
| Inch (up to 40") | .95" | .95" |
| Metric (up to 1000mm) | 24.1mm | 24.1mm |

## Grade and Application

Refer to the following table to select the gage block grade according to usage.

| | Applications | Grade |
|---|---|---|
| Workshop use | • Mounting tools and cutters | AS-1 or AS-2 |
| | • Manufacturing gages<br>• Calibrating instruments | 0 or AS-1 |
| Inspection use | • Inspecting mechanical parts, tools, etc. | 0 or AS-1 |
| | • Checking the accuracy of gages<br>• Calibrating instruments | 00 or 0 |
| Calibration use | • Checking the accuracy of gage blocks for workshop<br>• Checking the accuracy of gage blocks for inspection<br>• Checking the accuracy of instruments | K or 00 |
| Reference use | • Checking the accuracy of gage blocks for calibration<br>• For academic research | K |

**Grade AS-1:**
These gage blocks are intended for shop-floor use to set and calibrate fixtures, as well as precision instruments.

**Grade 0:**
This grade is used within an inspection area to verify the accuracy of plug and snap gages, as well as for setting electronic measuring devices.

**Grade 00:**
These higher accuracy gages are intended for use within a controlled environment by skilled inspection staff. Mainly used as reference standards for setting high-precision measuring equipment and for the calibration of lower grade gage blocks.

**Grade K:**
Gage blocks of this accuracy are intended for use within a temperature-controlled inspection room or calibration laboratory. They should be used as masters with certificates against other gage blocks which are calibrated by comparison.

### Combination of a Required Length

Multiple combinations of gage blocks can be used to make a required length. Care should be exercised in the following points.

1. Use as few gage blocks as possible to obtain the required length. (Select thick gage blocks whenever possible.)
2. Select gage blocks starting with the one that has the least significant digit required, and then work up to ones with more significant digits.
3. There are multiple combinations for the integer part of a length. To prevent wear as much as possible, do not always use the same gage blocks.

Example combination
Required length = 45.6785mm

**For the 1mm-based gage block set (112 pcs.)**

1.0005
1.008
1.17
17.5
\+ 25
45.6785mm

**For the 2mm-based gage block set (112 pcs.)**

2.0005
2.008
2.17
14.5
\+ 25
45.6785mm

### 6. Anti-magnetic Nature Keeps Away Steel Powders

### 7. High Wringing Force

An even, dense tissue can maintain a strong wringing force.



### 8. Material of CERA block

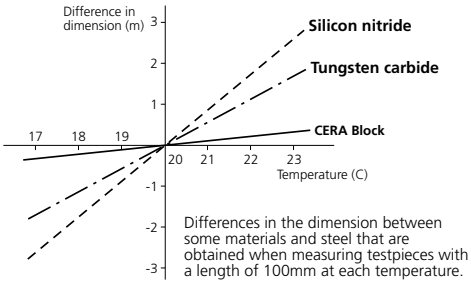
| Property \ Material | CERA Block ($ZrO_2$) | Steel (Fe) | Carbide (WC-Co) | Silicon nitride ($Si_3N_4$) |
|---|---|---|---|---|
| Hardness (HV) | 1350 | 800 | 1650 | 1500 |
| Coefficient of thermal expansion ($10^{-6}$/K) | 9.3±0.5 | 10.8±0.5 | 5.5±1.0 | 2 |
| Flexural strength by 3-point bending (MPa) | 1270 | 1960 | 1960 | 580 |
| Fracture toughness K1c (MPa•$m^{1/2}$) | 7 | 120 | 12 | 6.5 |
| Young's Modulus x104 (MPa) | 20.6 | 20.6 | 61.8 | 28.4 |
| Poisson's Ratio | 0.3 | 0.3 | 0.2 | 0.3 |
| Specific gravity | 6.0 | 7.8 | 14.8 | 3.2 |
| Thermal conductivity (W/m•k) | 2.9 | 54.4 | 79.5 | 16.7 |

### 9. Closest Expansion Coefficient to Steel

The thermal expansion coefficient of a CERA Block is similar to that of a steel gage block.

### 10. Highly Resistant Against Drops and Other Shocks

The CERA block material is one of the toughest ceramics materials. It is extremely difficult to crack under normal use.




Differences in the dimension between some materials and steel that are obtained when measuring testpieces with a length of 100mm at each temperature.

## Features of Square Gage Blocks

### 1. Perfect wringing is possible using the center hole.

After wringing the square gage blocks, an optional tie rod can be inserted through the center hole to fix the blocks using a screw.

### 2. A height reference standard can easily be made.

A precision height reference standard can be made easily and inexpensively using accessories such as the plain jaw and block base.

### 3. A dedicated inspection jig can be easily made.

A dedicated inspection jig for periodic inspection of instruments can be made easily and inexpensively.

### 4. A wide measuring surface with cross section dimensions of [24.1 x 24.1mm / .95 x .95"] is available.

A square gage block can retain stable orientation both longitudinally and laterally. A wide range of application measurements can be made, including cutting tool positioning, angle measurement with a sine bar, taper measurement with a roller, and inspection of depth micrometers.









## Long and Ultra-Thin Gage Blocks

Mitutoyo offers extra thin gage blocks from 0.10 mm to 0.99 mm (increments of 0.01 mm), as well as long gage blocks up to 1,000 mm as standard products.

# Gage Block

## SERIES 516

### Accuracies of Mitutoyo Gage Blocks

All Mitutoyo gage blocks meet or exceed all known specifications. The flatness, parallelism and surface finish necessary to achieve the required accuracies are the same as or better than government requirements.

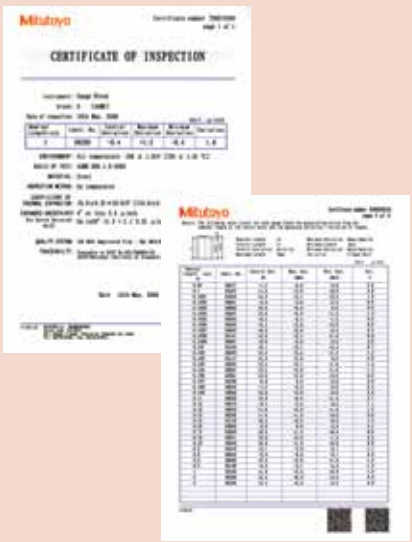
### ASME (American Society of Mechanical Engineers) Deviations and Tolerance on Length for Metric and inch Gage Blocks: ASME B89.1.9-2002 (USA)

| Nominal Length Range l n in inches | Calibration Grade K | | Grade 00 | | Grade 0 | | Grade AS-1 | | Grade AS-2 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Limit Deviations of Length at any Point From Nominal Length ± te µin. | Tolerance for the Variation In Length tv µin. | Limit Deviations of Length at any Point From Nominal Length ± te µin. | Tolerance for the Variation In Length tv µin. | Limit Deviations of Length at any Point From Nominal Length ± te µin. | Tolerance for the Variation In Length tv µin. | Limit Deviations of Length at any Point From Nominal Length ± te µin. | Tolerance for the Variation In Length tv µin. | Limit Deviations of Length at any Point From Nominal Length ± te µin. | Tolerance for the Variation In Length tv µin. |
| $l_n \leq .05$ | 12 | 2 | 4 | 2 | 6 | 4 | 12 | 6 | 24 | 12 |
| $.05 \; l_n \leq .4$ | 10 | 2 | 3 | 2 | 5 | 4 | 8 | 6 | 18 | 12 |
| $.45 \; l_n \leq 1$ | 12 | 2 | 3 | 2 | 6 | 4 | 12 | 6 | 24 | 12 |
| $1 \; l_n \leq 2$ | 16 | 2 | 4 | 2 | 8 | 4 | 16 | 6 | 32 | 12 |
| $2 \; l_n \leq 3$ | 20 | 2 | 5 | 3 | 10 | 4 | 20 | 6 | 40 | 14 |
| $3 \; l_n \leq 4$ | 24 | 3 | 6 | 3 | 12 | 5 | 24 | 8 | 48 | 14 |
| $4 \; l_n \leq 5$ | 32 | 3 | 8 | 3 | 16 | 5 | 32 | 8 | 64 | 16 |
| $5 \; l_n \leq 6$ | 32 | 3 | 8 | 3 | 16 | 5 | 32 | 8 | 64 | 16 |
| $6 \; l_n \leq 7$ | 40 | 4 | 10 | 4 | 20 | 6 | 40 | 10 | 80 | 16 |
| $7 \; l_n \leq 8$ | 40 | 4 | 10 | 4 | 20 | 6 | 40 | 10 | 80 | 16 |
| $8 \; l_n \leq 10$ | 48 | 4 | 12 | 4 | 24 | 6 | 48 | 10 | 104 | 18 |
| $10 \; l_n \leq 12$ | 56 | 4 | 14 | 4 | 28 | 7 | 56 | 10 | 112 | 20 |
| $12 \; l_n \leq 16$ | 72 | 5 | 18 | 5 | 36 | 8 | 72 | 12 | 144 | 20 |
| $16 \; l_n \leq 20$ | 88 | 6 | 20 | 6 | 44 | 10 | 88 | 14 | 176 | 24 |
| $20 \; l_n \leq 24$ | 104 | 6 | 25 | 6 | 52 | 10 | 104 | 16 | 200 | 28 |
| $24 \; l_n \leq 28$ | 120 | 7 | 30 | 7 | 60 | 12 | 120 | 18 | 240 | 28 |
| $28 \; l_n \leq 32$ | 136 | 8 | 34 | 8 | 68 | 12 | 136 | 20 | 260 | 32 |
| $32 \; l_n \leq 36$ | 152 | 8 | 38 | 8 | 76 | 14 | 152 | 20 | 300 | 36 |
| $36 \; l_n \leq 40$ | 160 | 10 | 40 | 10 | 80 | 16 | 168 | 24 | 320 | 40 |

| Nominal Length Range l n in mm | Calibration Grade K | | Grade 00 | | Grade 0 | | Grade AS-1 | | Grade AS-2 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Limit Deviations of Length at any Point From Nominal Length ± te µm | Tolerance for the Variation In Length tv µm | Limit Deviations of Length at any Point From Nominal Length ± te µm | Tolerance for the Variation In Length tv µm | Limit Deviations of Length at any Point From Nominal Length ± te µm | Tolerance for the Variation In Length tv µm | Limit Deviations of Length at any Point From Nominal Length ± te µm | Tolerance for the Variation In Length tv µm | Limit Deviations of Length at any Point From Nominal Length ± te µm | Tolerance for the Variation In Length tv µm |
| $l_n \leq 0.5$ | 0.30 | 0.05 | 0.10 | 0.05 | 0.14 | 0.10 | 0.30 | 0.16 | 0.60 | 0.30 |
| $0.5 \; l_n \leq 10$ | 0.20 | 0.05 | 0.07 | 0.05 | 0.12 | 0.10 | 0.20 | 0.16 | 0.45 | 0.30 |
| $10 \; l_n \leq 25$ | 0.30 | 0.05 | 0.07 | 0.05 | 0.14 | 0.10 | 0.30 | 0.16 | 0.60 | 0.30 |
| $25 \; l_n \leq 50$ | 0.40 | 0.06 | 0.10 | 0.06 | 0.20 | 0.10 | 0.40 | 0.18 | 0.80 | 0.30 |
| $50 \; l_n \leq 75$ | 0.50 | 0.06 | 0.12 | 0.06 | 0.25 | 0.12 | 0.50 | 0.18 | 1.00 | 0.35 |
| $75 \; l_n \leq 100$ | 0.60 | 0.07 | 0.15 | 0.07 | 0.30 | 0.12 | 0.60 | 0.20 | 1.20 | 0.35 |
| $100 \; l_n \leq 150$ | 0.80 | 0.08 | 0.20 | 0.08 | 0.40 | 0.14 | 0.80 | 0.20 | 1.60 | 0.40 |
| $150 \; l_n \leq 200$ | 1.00 | 0.09 | 0.25 | 0.09 | 0.50 | 0.16 | 1.00 | 0.25 | 2.00 | 0.40 |
| $200 \; l_n \leq 250$ | 1.20 | 0.10 | 0.30 | 0.10 | 0.60 | 0.16 | 1.20 | 0.25 | 2.40 | 0.45 |
| $250 \; l_n \leq 300$ | 1.4 | 0.10 | 0.35 | 0.10 | 0.70 | 0.18 | 1.40 | 0.25 | 2.80 | 0.50 |
| $300 \; l_n \leq 400$ | 1.80 | 0.12 | 0.45 | 0.12 | 0.90 | 0.20 | 1.80 | 0.30 | 3.60 | 0.50 |
| $400 \; l_n \leq 500$ | 2.20 | 0.14 | 0.50 | 0.14 | 1.10 | 0.25 | 2.20 | 0.35 | 4.40 | 0.60 |
| $500 \; l_n \leq 600$ | 2.60 | 0.16 | 0.65 | 0.16 | 1.30 | 0.25 | 2.60 | 0.40 | 5.00 | 0.70 |
| $600 \; l_n \leq 700$ | 3.00 | 0.18 | 0.75 | 0.18 | 1.50 | 0.30 | 3.00 | 0.45 | 6.00 | 0.70 |
| $700 \; l_n \leq 800$ | 3.40 | 0.20 | 0.85 | 0.20 | 1.70 | 0.30 | 3.40 | 0.50 | 6.50 | 0.80 |
| $800 \; l_n \leq 900$ | 3.80 | 0.20 | 0.95 | 0.20 | 1.90 | 0.35 | 3.80 | 0.50 | 7.50 | 0.90 |
| $900 \; l_n \leq 1000$ | 4.20 | 0.25 | 1.00 | 0.25 | 2.00 | 0.40 | 4.20 | 0.60 | 8.00 | 1.00 |

### Mitutoyo Gage Blocks and Inspection Certificates

A Certificate of Inspection is furnished with all Mitutoyo gage blocks with a serial number on the case and an identification number on each block. The deviation of each block is registered. For this inspection, each gage block is measured relative to the upper level master using a gage block comparator. Grade K gage blocks are manufactured by absolute measurement using an interferometer. The gage block set and discrete gage block are supplied with a Certificate of Calibration. The Certificate of Calibration specifies the deviation from the nominal length. (Comparative measurement, however, is performed for all square gage blocks.)




A Certificate of Accuracy, traceable to the NIST, is furnished with each gage block set and individual block.

**Mitutoyo America Corporation**
**Calibration Laboratory:**

ISO 17025-2005 accredited calibration available
Calibration capability up to 1000mm/40" length
Low measurement uncertainty

**Contact Information:**
965 Corporate Blvd.
Aurora, Illinois 60502
Phone: (888) 648-8869 option 7
Fax: (630) 978-6477

# Metric Rectangular Gage Block Set

## SERIES 516 — 1mm Base Block Set



Steel 112-block set



Steel 103-block set



Steel 47-block set



CERA 112-block set



CERA 56-block set



CERA/Steel combination 47-block set

### Provided with Inspection Certificate






## SPECIFICATIONS

**1mm Base Block Set**

| Blocks per set | Order No. | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|
| | Steel | CERA | | Size | Step | Qty. |
| **112** | **516-531-56** | **516-541-56** | K | 1.0005 | | 1 |
| | **516-937-26** | **516-337-26** | 00 | 1.001 - 1.009 | 0.001 | 9 |
| | **516-938-26** | **516-338-26** | 0 | 1.01 - 1.49 | 0.01 | 49 |
| | **516-939-26** | **516-339-26** | AS-1 | 0.5 - 24.5 | 0.5 | 49 |
| | **516-940-26** | **516-340-26** | AS-2 | 25 - 100 | 25 | 4 |
| **103** | **516-533-56** | **516-542-56** | K | 1.005 | | 1 |
| | **516-941-26** | **516-341-26** | 00 | 1.01 - 1.49 | 0.01 | 49 |
| | **516-942-26** | **516-342-26** | 0 | 0.5 - 24.5 | 0.5 | 49 |
| | **516-943-26** | **516-343-26** | AS-1 | 25 - 100 | 25 | 4 |
| | **516-944-26** | **516-344-26** | AS- 2 | | | |
| **87** | **516-535-56** | **515-543-56** | K | 1.001 - 1.009 | 0.001 | 9 |
| | **516-945-26** | **516-345-26** | 00 | 1.01 - 1.49 | 0.01 | 49 |
| | **516-946-26** | **516-346-26** | 0 | 0.5 - 9.5 | 0.5 | 19 |
| | **516-947-26** | **516-347-26** | AS-1 | 10 - 100 | 10 | 10 |
| | **516-948-26** | **516-348-26** | AS- 2 | | | |
| **56** | **516-536-56** | **516-544-56** | K | 0.5 | | 1 |
| | **516-953-26** | **516-353-26** | 00 | 1.001 - 1.009 | 0.001 | 9 |
| | **516-954-26** | **516-354-26** | 0 | 1.01 - 1.09 | 0.01 | 9 |
| | **516-955-26** | **516-355-26** | AS-1 | 1.1 - 1.9 | 0.1 | 9 |
| | **516-956-26** | **516-356-26** | AS-2 | 1 - 24 | 1 | 24 |
| | | | | 25 - 100 | 25 | 4 |
| **47** | **516-537-56** | **516-545-56** | K | 1.005 | | 1 |
| | **516-957-26** | **516-357-26** | 00 | 1.01 - 1.09 | 0.01 | 9 |
| | **516-958-26** | **516-358-26** | 0 | 1.1 - 1.9 | 0.1 | 9 |
| | **516-959-26** | **516-359-26** | AS-1 | 1 - 24 | 1 | 24 |
| | **516-960-26** | **516-360-26** | AS-2 | 25 - 100 | 25 | 4 |



Mitutoyo

# Metric Rectangular Gage Block Set

## SERIES 516 — Long Block Set, Wear Block Set



CERA 8-block set



Steel 8-block set

**Provided with Inspection Certificate**



## SPECIFICATIONS

### Long Block Set

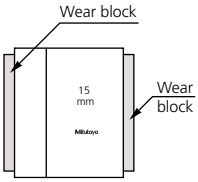
| Blocks per set | Order No. Steel | Order No. CERA | Grade ASME | Blocks included in set Size | Step | Qty. |
|---|---|---|---|---|---|---|
| **8** | — | **516-547-56** | K | 25-200 | 25 | 8 |
| | — | **516-164-26** | 00 | — | — | — |
| | **516-115-26** | **516-165-26** | 0 | — | — | — |
| | **516-116-26** | **516-166-26** | AS-1 | — | — | — |
| **8** | **516-540-56** | **516-546-56** | K | 125 - 175 | 25 | 3 |
| | **516-701-26** | **516-731-26** | 00 | 200 - 250 | 50 | 2 |
| | **516-702-26** | **516-732-26** | 0 | 300 - 500 | 100 | 3 |
| | **516-703-26** | **516-733-26** | AS-1 | | | |



**CERA 2-block set**



**Carbide 2-block**




## SPECIFICATIONS

### Wear Block Set

| Blocks per set | Order No. Carbide | Order No. CERA | Grade ASME | Blocks included in set Size | Qty. |
|---|---|---|---|---|---|
| **2** | **516-807-26** | **516-832-26** | 0 | 1 | 2 |
| | **516-806-26** | **516-833-26** | AS-1 | | |
| **2** | **516-803-26** | **516-830-26** | 0 | 2 | 2 |
| | **516-802-26** | **516-831-26** | AS-1 | | |

# Inch Rectangular Gage Block Set

## SERIES 516 — Inch Block Set, Thin Block Set, Long Block Set, Wear Block Set

Provided with Inspection Certificate



## SPECIFICATIONS

### Inch Block Set

| Blocks per set | Order No. | | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|---|
| | Steel | CERA | Steel/CERA | | Size | Step | Qty. |
| 81 | 516-549-56 | 516-557-56 | — | K | .1001 – .1009 | .0001 | 9 |
| | 516-901-26 | 516-301-26 | — | 00 | .101 – .149 | .001 | 49 |
| | 516-902-26 | 516-302-26 | — | 0 | .05 – .95 | .05 | 19 |
| | 516-903-26 | 516-303-26 | — | AS-1 | 1 - 4 | 1 | 4 |
| | 516-904-26 | 516-304-26 | | AS-2 | | | |
| 35 | 516-550-56 | 516-558-56 | — | K | .10005 | | 1 |
| | 516-913-26 | 516-313-26 | — | 00 | .1001 – .1009 | .0001 | 9 |
| | 516-914-26 | 516-314-26 | — | 0 | .101 – .109 | .001 | 9 |
| | 516-915-26 | 516-315-26 | — | AS-1 | .11 – .19 | .01 | 9 |
| | 516-916-26 | 516-316-26 | — | AS-2 | .1 - .3 | .1 | 3 |
| | | | | | .5, 1, 2, 4 | | 4 |

81-block set: All are CERA blocks, except 2″, 3″, and 4″ are steel blocks

## SPECIFICATIONS

### Thin Block Set

| Blocks per set | Order No. | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|
| | Steel | CERA | | Size | Step | Qty. |
| 28 | 516-551-56 | — | K | .02005 | | 1 |
| | 516-917-26 | — | 00 | .0201 – .0209 | .0001 | 9 |
| | 516-918-26 | — | 0 | .021 – .029 | .001 | 9 |
| | 516-919-26 | — | AS-1 | .01 – .09 | .01 | 9 |
| | 516-920-26 | — | AS-2 | | | |
| 10 | 516-926-26 | — | 0 | .005 - .050 | .005 | 10 |
| | 516-927-26 | — | AS-1 | | | |

## SPECIFICATIONS

### Long Block Set

| Blocks per set | Order No. | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|
| | Steel | CERA | | Size | Step | Qty. |
| 8 | 516-126-26 | 516-176-26 | 0 | 1-8 | 1 | 8 |
| | 516-127-26 | 516-177-26 | AS-1 | | | |
| 8 | — | 516-564-56 | K | 5 - 7 | 1 | 3 |
| | — | 516-741-26 | 00 | 8, 10, 12 | 2 | 3 |
| | 516-712-26 | 516-742-26 | 0 | 16, 20 | 4 | 2 |
| | 516-713-26 | 516-743-26 | AS-1 | | | |

## SPECIFICATIONS

### Wear Block Set

| Blocks per set | Order No. | | Grade | Blocks included in set | |
|---|---|---|---|---|---|
| | Carbide | CERA | | Size | Qty. |
| 2 | 516-809-26 | 516-836-26 | 0 | .05 | 2 |
| | 516-808-26 | 516-837-26 | AS-1 | | |
| 2 | 516-805-26 | 516-834-26 | 0 | .1 | 2 |
| | 516-804-26 | 516-835-26 | AS- 1 | | |



Mitutoyo

# Micrometer Inspection Gage Block Sets

## SERIES 516

- Gage blocks for inspecting a variety of micrometers.
- Can be measured in both vertical and horizontal posture.
- Parallelism is measured by attaching the optical parallel (optional accessory) to the gage block set.

## SPECIFICATIONS

**Metric** Micro Checker (holder only)

| Order No. | 516-607 |
|---|---|
| Applicable gage block set | 516-106-26, 516-107-26, 516-156-26, 516-157-26 |
| Applicable gage block size (mm) | 2.5, 5.1, 7.7, 10.3, 12.9, 15, 17.6, 20.2, 22.8, 25 |

**Inch/Metric** Micro Checker (holder only)

| Order No. | 516-608 |
|---|---|
| Applicable gage block set | 516-921-26, 516-922-26, 516-923-26, 516-321-26, 516-322-26, 516-323-26 |
| Applicable gage block size (inch) | .105, .210, .315, .420, .5, .605, .815, .920 |

**Metric Block Set**

| Blocks per set | Order No. Steel | Order No. CERA | Grade | Blocks included in set |
|---|---|---|---|---|
| 10 | 516-103-26<br>516-101-26 | 516-152-26<br>516-153-26 | 0<br>AS- 1 | 1.00, 1.25, 1.50, 2, 3, 5, 10, 15, 20, 25mm |
| 10 | 516-106-26<br>516-107-26 | 516-156-26<br>516-157-26 | 0<br>AS-1 | 2.5, 5.1, 7.7, 10.3, 12.9, 15, 17.6, 20.2, 22.8, 25mm<br>• Optical parallel (t = 12mm) |

**Inch Block Set**

| Blocks per set | Order No. Steel | Order No. CERA | Grade | Blocks included in set |
|---|---|---|---|---|
| 10 | 516-552-56<br>516-921-26<br>516-922-26<br>516-923-26 | 516-559-56<br>516-321-26<br>516-322-26<br>516-323-26 | K<br>00<br>0<br>AS-1 | .105, .210, .315, .420, .500, .605, .710, .815, .920, 1″<br>• Optical parallel (t = .5") |
| 10 | 516-529-26* | 516-319-26* | 0 | .087, .189, .307, .409, .472, .598, .669, .772, .890, 1"<br>• Optical parallel (t = .5") |
| 9 | 516-554-56<br>516-929-26<br>516-930-26<br>516-931-26 | 516-561-56<br>516-333-26<br>516-334-26<br>516-335-26 | K<br>00<br>0<br>AS- 1 | .0625, .100, .125, .200, .250, .300, .500, 1, 2″<br>• Optical parallel (t = .5") |
| 9 | —<br>—<br>516-934-26<br>516-935-26 | 516-563-56<br>516-329-26<br>516-330-26<br>516-331-26 | K<br>00<br>0<br>AS- 1 | .0625, .100, .125, .200, .250, .300, .500, 1, 2″ |

* For QuantuMike

### Micro Checker




(Gage blocks are optional.)

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo guarantees the product quality.

### Provided with Inspection Certificate




# Bore Gage Calibration Kit

## SERIES 516

## SPECIFICATIONS

| Blocks per set | Order No. Carbide | Grade | Blocks included in set Size |
|---|---|---|---|
| 9 | 516-120-26 | 0 | .04″, .08″, .16″, .2″, .4″, .8″, 1″, 2″, 3″<br>619018 (plain jaw 2 pc. set) and 619004 (160mm holder) |

# Individual Metric Rectangular Gage Block

## FEATURES

- If using only one length repeatedly, it is good practice to purchase discrete gage blocks.
- Each gage block is supplied with a Certificate of Inspection.
- Each Grade K gage block of ASME standard is specially supplied with a Certificate of Calibration, which certificates that the gage block was manufactured via interferometry.



## Suffix Number for Selecting Standard and Certificate Provided

**ASME**

| Grade | Steel, CERA |
|---|---|
| K | **-516**** |
| 00 | **-521*** |
| 0 | **-531*** |
| AS-1 | **-541*** |
| AS- 2 | **-551*** |

* provided with Inspection Certificate
** provided with Calibration Certificate and Inspection Certificate

Example: 611821-521
0.1mm gage block in grade 00.

We make custom length gage blocks:
0.1-1000mm




Inspection Certificate

## SPECIFICATIONS

**Metric Block**

| Length (mm) | Order No. | |
|---|---|---|
| | Steel | CERA |
| 0.1 | **611821** | — |
| 0.11 | **611860** | — |
| 0.12 | **611861** | — |
| 0.13 | **611862** | — |
| 0.14 | **611863** | — |
| 0.15 | **611822** | — |
| 0.16 | **611864** | — |
| 0.17 | **611865** | — |
| 0.18 | **611866** | — |
| 0.19 | **611867** | — |
| 0.2 | **611823** | — |
| 0.21 | **611868** | — |
| 0.22 | **611869** | — |
| 0.23 | **611870** | — |
| 0.24 | **611871** | — |
| 0.25 | **611824** | — |
| 0.26 | **611872** | — |
| 0.27 | **611873** | — |
| 0.28 | **611874** | — |
| 0.29 | **611875** | — |
| 0.3 | **611825** | — |
| 0.31 | **611876** | — |
| 0.32 | **611877** | — |
| 0.33 | **611878** | — |
| 0.34 | **611879** | — |
| 0.35 | **611826** | — |
| 0.36 | **611880** | — |
| 0.37 | **611881** | — |
| 0.38 | **611882** | — |
| 0.39 | **611883** | — |
| 0.4 | **611827** | — |
| 0.41 | **611884** | — |
| 0.42 | **611885** | — |
| 0.43 | **611886** | — |
| 0.44 | **611887** | — |
| 0.45 | **611828** | — |
| 0.46 | **611888** | — |
| 0.47 | **611889** | — |
| 0.48 | **611890** | — |
| 0.49 | **611891** | — |
| 0.5 | **611506** | **613506** |
| 0.51 | **611892** | — |
| 0.52 | **611893** | — |

| Length (mm) | Order No. | |
|---|---|---|
| | Steel | CERA |
| 0.53 | **611894** | — |
| 0.54 | **611895** | — |
| 0.55 | **611896** | — |
| 0.56 | **611897** | — |
| 0.57 | **611898** | — |
| 0.58 | **611899** | — |
| 0.59 | **611900** | — |
| 0.6 | **611901** | — |
| 0.61 | **611902** | — |
| 0.62 | **611903** | — |
| 0.63 | **611904** | — |
| 0.64 | **611905** | — |
| 0.65 | **611906** | — |
| 0.66 | **611907** | — |
| 0.67 | **611908** | — |
| 0.68 | **611909** | — |
| 0.69 | **611910** | — |
| 0.7 | **611911** | — |
| 0.71 | **611912** | — |
| 0.72 | **611913** | — |
| 0.73 | **611914** | — |
| 0.74 | **611915** | — |
| 0.75 | **611916** | — |
| 0.76 | **611917** | — |
| 0.77 | **611918** | — |
| 0.78 | **611919** | — |
| 0.79 | **611920** | — |
| 0.8 | **611921** | — |
| 0.81 | **611922** | — |
| 0.82 | **611923** | — |
| 0.83 | **611924** | — |
| 0.84 | **611925** | — |
| 0.85 | **611926** | — |
| 0.86 | **611927** | — |
| 0.87 | **611928** | — |
| 0.88 | **611929** | — |
| 0.89 | **611930** | — |
| 0.9 | **611931** | — |
| 0.91 | **611932** | — |
| 0.92 | **611933** | — |
| 0.93 | **611934** | — |
| 0.94 | **611935** | — |
| 0.95 | **611936** | — |

| Length (mm) | Order No. | |
|---|---|---|
| | Steel | CERA |
| 0.96 | **611937** | — |
| 0.97 | **611938** | — |
| 0.98 | **611939** | — |
| 0.99 | **611940** | — |
| 0.991 | **611551** | **613551** |
| 0.992 | **611552** | **613552** |
| 0.993 | **611553** | **613553** |
| 0.994 | **611554** | **613554** |
| 0.995 | **611555** | **613555** |
| 0.996 | **611556** | **613556** |
| 0.997 | **611557** | **613557** |
| 0.998 | **611558** | **613558** |
| 0.999 | **611559** | **613559** |
| 1 | **611611** | **613611** |
| 1.0005 | **611520** | **613520** |
| 1.001 | **611521** | **613521** |
| 1.002 | **611522** | **613522** |
| 1.003 | **611523** | **613523** |
| 1.004 | **611524** | **613524** |
| 1.005 | **611525** | **613525** |
| 1.006 | **611526** | **613526** |
| 1.007 | **611527** | **613527** |
| 1.008 | **611528** | **613528** |
| 1.009 | **611529** | **613529** |
| 1.01 | **611561** | **613561** |
| 1.02 | **611562** | **613562** |
| 1.03 | **611563** | **613563** |
| 1.04 | **611564** | **613564** |
| 1.05 | **611565** | **613565** |
| 1.06 | **611566** | **613566** |
| 1.07 | **611567** | **613567** |
| 1.08 | **611568** | **613568** |
| 1.09 | **611569** | **613569** |
| 1.1 | **611570** | **613570** |
| 1.11 | **611571** | **613571** |
| 1.12 | **611572** | **613572** |
| 1.13 | **611573** | **613573** |
| 1.14 | **611574** | **613574** |
| 1.15 | **611575** | **613575** |
| 1.16 | **611576** | **613576** |
| 1.17 | **611577** | **613577** |
| 1.18 | **611578** | **613578** |
| 1.19 | **611579** | **613579** |



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| Length (mm) | Order No. | |
|---|---|---|
| | Steel | CERA |
| 1.2 | 611580 | 613580 |
| 1.21 | 611581 | 613581 |
| 1.22 | 611582 | 613582 |
| 1.23 | 611583 | 613583 |
| 1.24 | 611584 | 613584 |
| 1.25 | 611585 | 613585 |
| 1.26 | 611586 | 613586 |
| 1.27 | 611587 | 613587 |
| 1.28 | 611588 | 613588 |
| 1.29 | 611589 | 613589 |
| 1.3 | 611590 | 613590 |
| 1.31 | 611591 | 613591 |
| 1.32 | 611592 | 613592 |
| 1.33 | 611593 | 613593 |
| 1.34 | 611594 | 613594 |
| 1.35 | 611595 | 613595 |
| 1.36 | 611596 | 613596 |
| 1.37 | 611597 | 613597 |
| 1.38 | 611598 | 613598 |
| 1.39 | 611599 | 613599 |
| 1.4 | 611600 | 613600 |
| 1.41 | 611601 | 613601 |
| 1.42 | 611602 | 613602 |
| 1.43 | 611603 | 613603 |
| 1.44 | 611604 | 613604 |
| 1.45 | 611605 | 613605 |
| 1.46 | 611606 | 613606 |
| 1.47 | 611607 | 613607 |
| 1.48 | 611608 | 613608 |
| 1.49 | 611609 | 613609 |
| 1.5 | 611641 | 613641 |
| 1.6 | 611516 | 613516 |
| 1.7 | 611517 | 613517 |
| 1.8 | 611518 | 613518 |
| 1.9 | 611519 | 613519 |
| 2 | 611612 | 613612 |
| 2.0005 | 611690 | — |
| 2.001 | 611691 | — |
| 2.002 | 611692 | — |
| 2.003 | 611693 | — |
| 2.004 | 611694 | — |
| 2.005 | 611695 | — |
| 2.006 | 611696 | — |
| 2.007 | 611697 | — |
| 2.008 | 611698 | — |
| 2.009 | 611699 | — |
| 2.01 | 611701 | — |
| 2.02 | 611702 | — |
| 2.03 | 611703 | — |
| 2.04 | 611704 | — |
| 2.05 | 611705 | — |
| 2.06 | 611706 | — |
| 2.07 | 611707 | — |
| 2.08 | 611708 | — |
| 2.09 | 611709 | — |
| 2.1 | 611710 | — |
| 2.11 | 611711 | — |
| 2.12 | 611712 | — |
| 2.13 | 611713 | — |
| 2.14 | 611714 | — |
| 2.15 | 611715 | — |
| 2.16 | 611716 | — |

| Length (mm) | Order No. | |
|---|---|---|
| | Steel | CERA |
| 2.17 | 611717 | — |
| 2.18 | 611718 | — |
| 2.19 | 611719 | — |
| 2.2 | 611720 | — |
| 2.21 | 611721 | — |
| 2.22 | 611722 | — |
| 2.23 | 611723 | — |
| 2.24 | 611724 | — |
| 2.25 | 611725 | — |
| 2.26 | 611726 | — |
| 2.27 | 611727 | — |
| 2.28 | 611728 | — |
| 2.29 | 611729 | — |
| 2.3 | 611730 | — |
| 2.31 | 611731 | — |
| 2.32 | 611732 | — |
| 2.33 | 611733 | — |
| 2.34 | 611734 | — |
| 2.35 | 611735 | — |
| 2.36 | 611736 | — |
| 2.37 | 611737 | — |
| 2.38 | 611738 | — |
| 2.39 | 611739 | — |
| 2.4 | 611740 | — |
| 2.41 | 611741 | — |
| 2.42 | 611742 | — |
| 2.43 | 611743 | — |
| 2.44 | 611744 | — |
| 2.45 | 611745 | — |
| 2.46 | 611746 | — |
| 2.47 | 611747 | — |
| 2.48 | 611748 | — |
| 2.49 | 611749 | — |
| 2.5 | 611642 | 613642 |
| 2.6 | 611750 | — |
| 2.7 | 611751 | — |
| 2.8 | 611752 | — |
| 2.9 | 611753 | — |
| 3 | 611613 | 613613 |
| 3.5 | 611643 | 613643 |
| 4 | 611614 | 613614 |
| 4.5 | 611644 | 613644 |
| 5 | 611615 | 613615 |
| 5.1 | 611850 | 613850 |
| 5.5 | 611645 | 613645 |
| 6 | 611616 | 613616 |
| 6.5 | 611646 | 613646 |
| 7 | 611617 | 613617 |
| 7.5 | 611647 | 613647 |
| 7.7 | 611851 | 613851 |
| 8 | 611618 | 613618 |
| 8.5 | 611648 | 613648 |
| 9 | 611619 | 613619 |
| 9.5 | 611649 | 613649 |
| 10 | 611671 | 613671 |
| 10.3 | 611852 | 613852 |
| 10.5 | 611650 | 613650 |
| 11 | 611621 | 613621 |
| 11.5 | 611651 | 613651 |
| 12 | 611622 | 613622 |
| 12.5 | 611652 | 613652 |
| 12.9 | 611853 | 613853 |

| Length (mm) | Order No. | |
|---|---|---|
| | Steel | CERA |
| 13 | 611623 | 613623 |
| 13.5 | 611653 | 613653 |
| 14 | 611624 | 613624 |
| 14.5 | 611654 | 613654 |
| 15 | 611625 | 613625 |
| 15.5 | 611655 | 613655 |
| 16 | 611626 | 613626 |
| 16.5 | 611656 | 613656 |
| 17 | 611627 | 613627 |
| 17.5 | 611657 | 613657 |
| 17.6 | 611854 | 613854 |
| 18 | 611628 | 613628 |
| 18.5 | 611658 | 613658 |
| 19 | 611629 | 613629 |
| 19.5 | 611659 | 613659 |
| 20 | 611672 | 613672 |
| 20.2 | 611855 | 613855 |
| 20.5 | 611660 | 613660 |
| 21 | 611631 | 613631 |
| 21.5 | 611661 | 613661 |
| 22 | 611632 | 613632 |
| 22.5 | 611662 | 613662 |
| 22.8 | 611856 | 613856 |
| 23 | 611633 | 613633 |
| 23.5 | 611663 | 613663 |
| 24 | 611634 | 613634 |
| 24.5 | 611664 | 613664 |
| 25 | 611635 | 613635 |
| 25.25 | 611754 | 613754 |
| 30 | 611673 | 613673 |
| 35 | 611755 | 613755 |
| 40 | 611674 | 613674 |
| 41.3 | 611857 | 613857 |
| 45 | 611756 | 613756 |
| 50 | 611675 | 613675 |
| 60 | 611676 | 613676 |
| 70 | 611677 | 613677 |
| 75 | 611801 | 613801 |
| 80 | 611678 | 613678 |
| 90 | 611679 | 613679 |
| 100 | 611681 | 613681 |
| 125 | 611802 | 613802 |
| 131.4 | 611858 | 613858 |
| 150 | 611803 | 613803 |
| 175 | 611804 | 613804 |
| 200 | 611682 | 613682 |
| 250 | 611805 | 613805 |
| 300 | 611683 | 613683 |
| 400 | 611684 | 613684 |
| 500 | 611685 | 613685 |
| 600 | 611840 | — |
| 700 | 611841 | — |
| 750 | 611842 | — |
| 800 | 611843 | — |
| 900 | 611844 | — |
| 1000 | 611845 | — |

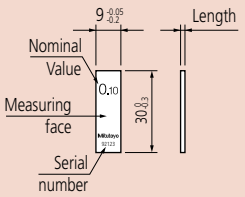
## Metric Wear Block

| Length (mm) | Order No. Tungsten carbide |
|---|---|
| 1 | 612611 |
| 2 | 612612 |

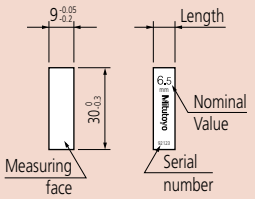
## DIMENSIONS

Unit: mm

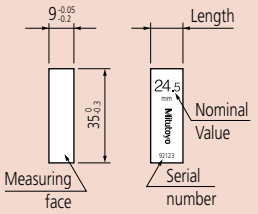
Nominal length:
0.1mm - 5.5mm



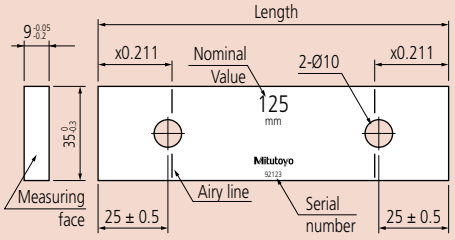

Nominal length:
6mm - 10mm




Nominal length:
10.3mm - 100mm




Nominal length 125mm - 1000mm



# Individual Inch Rectangular Gage Block

## Suffix Number for Selecting Standard and Certificate Provided

**ASME**

| Grade | Steel, CERA |
|---|---|
| K | **-516**** |
| 00 | **-521*** |
| 0 | **-531*** |
| AS-1 | **-541*** |
| AS-2 | **-551*** |

* provided with Inspection Certificate
** provided with Calibration Certificate and Inspection Certificate

Example: 611310-521
.1" gage block in grade 00.

We make custom length gage blocks:
.004 - 20"

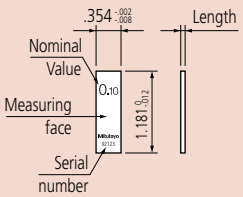



Inspection Certificate

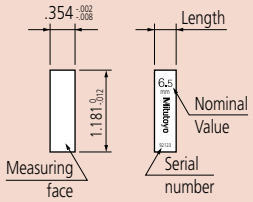
## DIMENSIONS

Unit: Inch

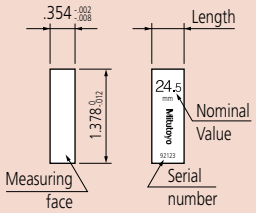
Nominal length:
.004 - .25"



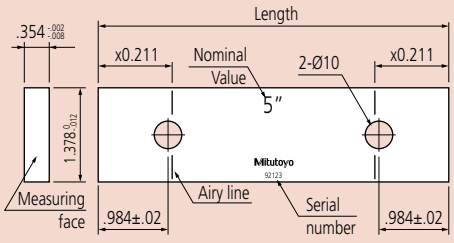

Nominal length:
.3 - 4"




Nominal length:
.45 - 4"




Nominal length 5 - 20"




## SPECIFICATIONS

**Inch Block**

| Length (inch) | Order No. | |
|---|---|---|
| | Steel | CERA |
| .004 | **611304** | — |
| .005 | **611305** | — |
| .006 | **611306** | — |
| .007 | **611307** | — |
| .008 | **611308** | — |
| .009 | **611309** | — |
| .01 | **611310** | — |
| .011 | **611311** | — |
| .012 | **611312** | — |
| .013 | **611313** | — |
| .014 | **611314** | — |
| .015 | **611315** | — |
| .016 | **611316** | — |
| .017 | **611317** | — |
| .018 | **611318** | — |
| .019 | **611319** | — |
| .02 | **611320** | — |
| .02005 | **611240** | — |
| .0201 | **611231** | — |
| .0202 | **611232** | — |
| .0203 | **611233** | — |
| .0204 | **611234** | — |
| .0205 | **611235** | — |
| .0206 | **611236** | — |
| .0207 | **611237** | — |
| .0208 | **611238** | — |
| .0209 | **611239** | — |
| .021 | **611321** | — |
| .022 | **611322** | — |
| .023 | **611323** | — |
| .024 | **611324** | — |
| .025 | **611325** | — |
| .026 | **611326** | — |
| .027 | **611327** | — |
| .028 | **611328** | — |
| .029 | **611329** | — |
| .03 | **611330** | — |
| .031 | **611331** | — |
| .03125 (1/32) | **611101** | **613103** |
| .032 | **611332** | — |
| .033 | **611333** | — |
| .034 | **611334** | — |
| .035 | **611335** | — |
| .036 | **611336** | — |
| .037 | **611337** | — |
| .038 | **611338** | — |
| .039 | **611339** | — |
| .04 | **611340** | — |
| .041 | **611341** | — |
| .042 | **611342** | — |
| .043 | **611343** | — |
| .044 | **611344** | — |
| .045 | **611345** | — |
| .046 | **611346** | — |
| .046875 (3/64) | **611102** | **613104** |
| .047 | **611347** | — |
| .048 | **611348** | — |
| .049 | **611349** | — |
| .05 | **611105** | **613105** |

| Length (inch) | Order No. | |
|---|---|---|
| | Steel | CERA |
| .06 | **611106** | — |
| .0625 | **611303** | **613303** |
| .07 | **611107** | — |
| .078125 (5/64) | **611103** | **613100** |
| .08 | **611108** | — |
| .09 | **611109** | — |
| .09375 (3/32) | **611104** | **613101** |
| .1 | **611191** | **613191** |
| .100025 | **611111** | **613110** |
| .10005 | **611135** | **613135** |
| .100075 | **611112** | **613111** |
| .1001 | **611121** | **613121** |
| .1002 | **611122** | **613122** |
| .1003 | **611123** | **613123** |
| .1004 | **611124** | **613124** |
| .1005 | **611125** | **613125** |
| .1006 | **611126** | **613126** |
| .1007 | **611127** | **613127** |
| .1008 | **611128** | **613128** |
| .1009 | **611129** | **613129** |
| .101 | **611141** | **613141** |
| .102 | **611142** | **613142** |
| .103 | **611143** | **613143** |
| .104 | **611144** | **613144** |
| .105 | **611145** | **613145** |
| .106 | **611146** | **613146** |
| .107 | **611147** | **613147** |
| .108 | **611148** | **613148** |
| .109 | **611149** | **613149** |
| .109375 (7/64) | **611110** | **613102** |
| .11 | **611150** | **613150** |
| .111 | **611151** | **613151** |
| .112 | **611152** | **613152** |
| .113 | **611153** | **613153** |
| .114 | **611154** | **613154** |
| .115 | **611155** | **613155** |
| .116 | **611156** | **613156** |
| .117 | **611157** | **613157** |
| .118 | **611158** | **613158** |
| .119 | **611159** | **613159** |
| .12 | **611160** | **613160** |
| .121 | **611161** | **613161** |
| .122 | **611162** | **613162** |
| .123 | **611163** | **613163** |
| .124 | **611164** | **613164** |
| .125 | **611165** | **613165** |
| .126 | **611166** | **613166** |
| .127 | **611167** | **613167** |
| .128 | **611168** | **613168** |
| .129 | **611169** | **613169** |
| .13 | **611170** | **613170** |
| .131 | **611171** | **613171** |
| .132 | **611172** | **613172** |
| .133 | **611173** | **613173** |
| .134 | **611174** | **613174** |
| .135 | **611175** | **613175** |
| .136 | **611176** | **613176** |
| .137 | **611177** | **613177** |
| .138 | **611178** | **613178** |

| Length (inch) | Order No. | |
|---|---|---|
| | Steel | CERA |
| .139 | **611179** | **613179** |
| .14 | **611180** | **613180** |
| .141 | **611181** | **613181** |
| .142 | **611182** | **613182** |
| .143 | **611183** | **613183** |
| .144 | **611184** | **613184** |
| .145 | **611185** | **613185** |
| .146 | **611186** | **613186** |
| .147 | **611187** | **613187** |
| .148 | **611188** | **613188** |
| .149 | **611189** | **613189** |
| .15 | **611115** | **613115** |
| .16 | **611116** | **613116** |
| .17 | **611117** | **613117** |
| .18 | **611118** | **613118** |
| .19 | **611119** | **613119** |
| .2 | **611192** | **613192** |
| .21 | **611221** | **613221** |
| .25 | **611212** | **613212** |
| .3 | **611193** | **613193** |
| .315 | **611209** | **613209** |
| .35 | **611213** | **613213** |
| .375 (3/8) | **611113** | **613112** |
| .4 | **611194** | **613194** |
| .420 | **611210** | **613210** |
| .45 | **611214** | **613214** |
| .5 | **611195** | **613195** |
| .55 | **611215** | **613215** |
| .6 | **611196** | **613196** |
| .605 | **611211** | **613211** |
| .65 | **611216** | **613216** |
| .7 | **611197** | **613197** |
| .710 | **611220** | **613220** |
| .75 | **611217** | **613217** |
| .8 | **611198** | **613198** |
| .815 | **611226** | **613226** |
| .85 | **611218** | **613218** |
| .9 | **611199** | **613199** |
| .920 | **611227** | **613227** |
| .95 | **611219** | **613219** |
| 1 | **611201** | **613201** |
| 2 | **611202** | **613202** |
| 3 | **611203** | **613203** |
| 4 | **611204** | **613204** |
| 5 | **611205** | **613205** |
| 6 | **611206** | **613206** |
| 7 | **611207** | **613207** |
| 8 | **611208** | **613208** |
| 10 | **611222** | **613222** |
| 12 | **611223** | **613223** |
| 16 | **611224** | **613224** |
| 20 | **611225** | **613225** |

**Inch Wear Block**

| Length (inch) | Order No. Tungsten carbide |
|---|---|
| .05 | **612105** |
| .1 | **612191** |



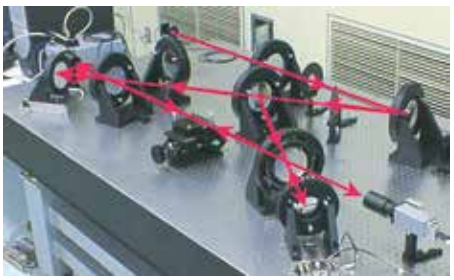
Mitutoyo

# Rectangular Gage Block with CTE

## Gage Blocks with Thermal Expansion Coefficient Data

### FEATURES

- Mitutoyo offers top-level gage blocks (steel and ceramic) which are superior to K class blocks.
- Comes with a highly accurate thermal expansion coefficient measured with a high-accuracy double-faced interferometer (DFI).
- The high-accuracy gage block interferometer (GBI) guarantees high dimensional accuracy.
- Mitutoyo offers rectangular gage blocks, having nominal values from 100 to 500mm
  Grade: K class in ASME
  Uncertainty of thermal expansion coefficient: 0.035 x $10^{-6}$/K (k = 2)
  Uncertainty of dimension measurement: 30nm (k = 2), for 100mm block



Double-faced interferometer (DFI)

### SPECIFICATIONS

**Metric Block with CTE**

| Length (mm) | Order No. Steel | Order No. CERA |
|---|---|---|
| 100 | **611681-51B** | **613681-51B** |
| 125 | **611802-51B** | **613802-51B** |
| 150 | **611803-51B** | **613803-51B** |
| 175 | **611804-51B** | **613804-51B** |
| 200 | **611682-51B** | **613682-51B** |
| 250 | **611805-51B** | **613805-51B** |
| 300 | **611683-51B** | **613683-51B** |
| 400 | **611684-51B** | **613684-51B** |
| 500 | **611685-51B** | **613685-51B** |

**Inch Block with CTE**

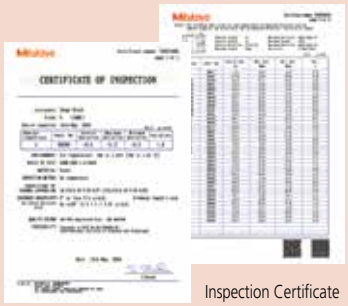
| Length (inch) | Order No. Steel | Order No.CERA |
|---|---|---|
| 4 | **611204-51B** | **613204-51B** |
| 5 | **611205-51B** | **613205-51B** |
| 6 | **611206-51B** | **613206-51B** |
| 7 | **611207-51B** | **613207-51B** |
| 8 | **611208-51B** | **613208-51B** |
| 10 | **611222-51B** | **613222-51B** |
| 12 | **611223-51B** | **613223-51B** |
| 16 | **611224-51B** | **613224-51B** |
| 20 | **611225-51B** | **613225-51B** |

### Suffix Number for Selecting Standard and Certificate Provided

**ASME**

| | Steel, CERA |
|---|---|
| Grade K | **-51B** |

-51B: provided with JCSS Calibration Certificate and Inspection Certificate



Inspection Certificate




## ZERO CERA Blocks

- Thermal expansion in the temperature range 20±1°C less than 1/500 that of steel (0±0.02×$10^{-6}$/K(20°C))
- Almost no secular change both in dimension and coefficient of thermal expansion
- Complementary ultra-low thermal expansion and high specific rigidity (Young's Modulus/ specific gravity)



### SPECIFICATIONS

**Metric Blocks**

| Order No. | | | Length (mm) |
|---|---|---|---|
| JIS/ISO/DIN | BS | ASME | |
| **617673-016** | **617673-116** | **617673-516** | 30 |
| **617675-016** | **617675-116** | **617675-516** | 50 |
| **617681-016** | **617681-116** | **617681-516** | 100 |
| **617682-016** | **617682-116** | **617682-516** | 200 |
| **617683-016** | **617683-116** | **617683-516** | 300 |
| **617684-016** | **617684-116** | **617684-516** | 400 |
| **617685-016** | **617685-116** | **617685-516** | 500 |
| **617840-016** | **617840-116** | **617840-516** | 600 |
| **617841-016** | **617841-116** | **617841-516** | 700 |
| **617843-016** | **617843-116** | **617843-516** | 800 |
| **617844-016** | **617844-116** | **617844-516** | 900 |
| **617845-016** | **617845-116** | **617845-516** | 1000 |
| **516-771-60** | **516-771-61** | **516-771-66** | Above set |

# Rectangular Gage Block Accessories

## SERIES 516 – For Gage Blocks over 100mm

Specially designed for long gage blocks over 100mm, which have two holes on the body for coupling.



516-605

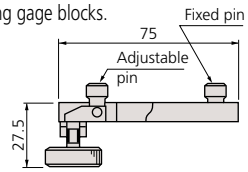
## SPECIFICATIONS

### Accessories for gage blocks over 100mm

| Order No. 516-605 | Included in set |
|---|---|
| 1 pc. | Holder A (**619031**) |
| 1 pc. | Holder B (**619032**) |
| 1 pc. | Holder C (**619033**) |
| 1 pc. | Holder D (**619034**) |
| 1 pc. | Holder E (**619035**) |
| 3 pcs. | Adaptor (**619036**) |
| 1 pc. | Holder base 35mm (**619009**) |
| 2 pcs. | Half round jaw 12mm (**619013**) |
| 1 pc. | Plain jaw (2 pc. set) (**619018**) |
| 1 pc. | Scriber point (**619019**) |

Note: These accessories can be used for inch rectangular gage blocks.

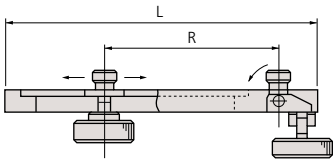
Holder A: **619031**
Used for coupling two long gage blocks.





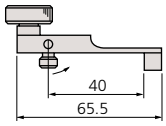

Holder B and C:
Used for coupling two long gage blocks together with other gage blocks up to 35mm (Holder B) or 140mm (Holder C). Also used for attaching jaws with two adapters.

| | Order No. | R (max.) | L |
|---|---|---|---|
| Holder B | **619032** | 90mm | 126mm |
| Holder C | **619033** | 200mm | 236mm |



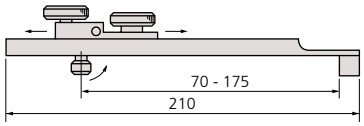



Holder D: **619034**
Used for attaching to the holder base.

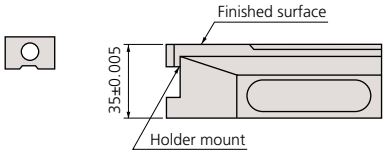




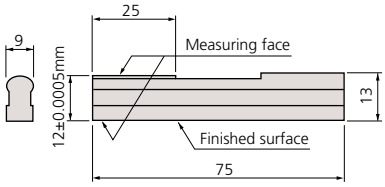

Holder E: **619035**
Used for attaching to the holder base together with other gage blocks up to 125mm. Used for attaching jaws with one adapter.



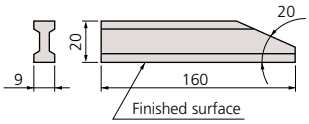

Holder base: **619009**
Adaptor: **619036**



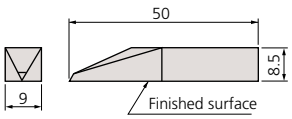

Half-round jaw: **619013**




Plain jaw: **619018** (2 pc. set)




Scriber point: **619019**






Mitutoyo

# Rectangular Gage Block Accessories

## SERIES 516

To expand the variety of rectangular gage block (steel and CERA) applications, Mitutoyo offers the gage block accessories set. By assembling the items in the set, you can easily and quickly build up a precision measuring instrument.



516-601



516-602







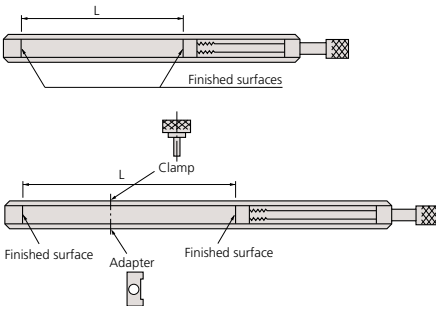
## SPECIFICATIONS

### Assortment of Accessories

| Order No. | Accessories | Metric Set Order No. | | Accessory (s) included in a set |
|---|---|---|---|---|
| | | 516-601 | 516-602 | |
| **619002** | Holder 60mm | | • | 1 pc. |
| **619003** | Holder 100mm | • | • | 1 pc. |
| **619004** | Holder 160mm | • | • | 1 pc. |
| **619005** | Holder 250mm | • | • | 1 pc. |
| **619009** | Holder Base 35mm | • | • | 1 pc. |
| **619010** | Half round jaw 2mm | • | • | 2 pcs. |
| **619011** | Half round jaw 5mm | • | • | 2 pcs. |
| **619012** | Half round jaw 8mm | • | • | 2 pcs. |
| **619013** | Half round jaw 12mm | • | | 2 pcs. |
| **619014** | Half round jaw 20mm | • | | 2 pcs. |
| **619018** | Plain jaw (2 pc. set) 160mm | • | | 1 pc. |
| **619019** | Scriber point | • | • | 1 pc. |
| **619020** | Center point | • | • | 1 pc. |
| **619021** | Tram point | • | | 2 pcs. |
| **619022** | Triangular straightness edge 100mm | • | • | 1 pc. |
| **619023** | Triangular straight edge 160mm | • | | 1 pc. |
| | **Total Qty. in set** | 22 pcs. | 14 pcs. | |

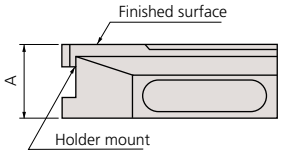
# Rectangular Gage Block Accessories

Holder:
Used as a clamp if using plain jaws, scriber point, etc.



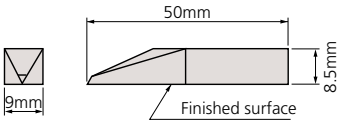

| Order No. | L |
|---|---|
| **619002** | 15 - 61mm |
| **619003** | 4 - 106mm |
| **619004** | 62 - 165mm |
| **619005** | 153 - 256mm |

Holder base 35mm: **619009**
Measures a height on the surface plate and scribes a workpiece if used with the holder.

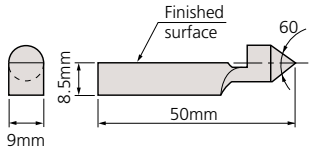



| Order No. | A |
|---|---|
| **619009** | 35±0.005mm |

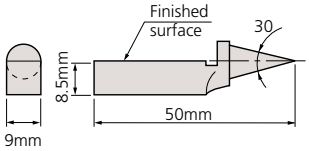
Scriber point: **619019**
Scribes a workpiece if used with the holder and holder base.



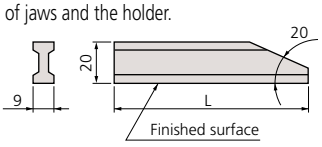

Center point: **619020**
Scribes a workpiece if used with the holder and holder base.




Tram point: **619021**
Inspects the scale of the height gage, etc., if used with the holder and holder base.



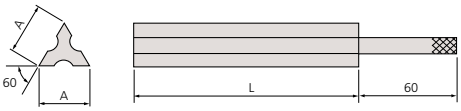

Plain jaw: **619018**
Measures an outside or inside diameter if used with a pair of jaws and the holder.




| Order No. | L |
|---|---|
| **619018*** | 160mm |

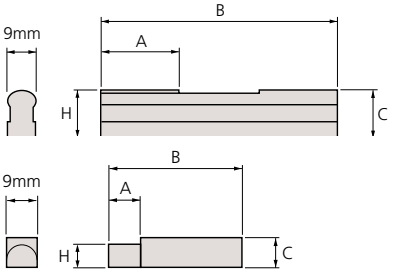
* 2 pc. set

Triangular straight edge: Measures parallelism.




| Order No. | L |
|---|---|
| **619022** | 100mm |
| **619023** | 160mm |

Half-round jaw:
Measures an outside or inside diameter if used with a pair of jaws and the holder.




| Order No. | H | A | B | C |
|---|---|---|---|---|
| **619010** | 2±0.0005mm | 6mm | 40mm | 8mm |
| **619011** | 5±0.0005mm | 6mm | 50mm | 8mm |
| **619012** | 8±0.0005mm | 12mm | 60mm | 8mm |
| **619013** | 12±0.0005mm | 25mm | 75mm | 13mm |
| **619014** | 20±0.0005mm | 25mm | 125mm | 20.5mm |



Mitutoyo

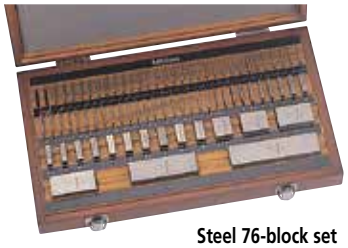
# Metric Square Gage Block Set

## SERIES 516 — Metric Block Set, Long Block Set, Wear Block Set

A square gage block can retain stable orientation both longitudinally and laterally. A wide range of application measurements can be made, including cutting tool positioning, angle measurement with a sine bar, taper measurement with a roller, and inspection of depth micrometers.



Steel 32-block set



Steel 76-block set



Steel 103-block set



Steel 112-block set

## SPECIFICATIONS

### Metric Block Set

| Blocks per set | Order No. | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|
| | Steel | CERA | | Size | Step | Qty. |
| **112** | **516-437-26** | — | 00 | 1.0005 | | 1 |
| | **516-438-26** | — | 0 | 1.001 - 1.009 | 0.001 | 9 |
| | **516-439-26** | — | AS-1 | 1.01 - 1.49 | 0.01 | 49 |
| | **516-440-26** | — | AS-2 | 0.5 - 24.5 | 0.5 | 49 |
| | — | — | — | 25 - 100 | 25 | 4 |
| **103** | **516-441-26** | — | 00 | 1.005 | | 1 |
| | **516-442-26** | — | 0 | 1.01 - 1.49 | 0.01 | 49 |
| | **516-443-26** | — | AS-1 | 0.5 - 24.5 | 0.5 | 49 |
| | **516-444-26** | — | AS-2 | 25 - 100 | 25 | 4 |
| **76** | **516-449-26** | — | 00 | 1.005 | | 1 |
| | **516-450-26** | — | 0 | 1.01 - 1.49 | 0.01 | 49 |
| | **516-451-26** | — | AS-1 | 0.5 - 9.5 | 0.5 | 19 |
| | **516-452-26** | — | AS-2 | 10 - 40 | 10 | 4 |
| | — | — | — | 50 - 100 | 25 | 3 |
| **47** | **516-457-26** | — | 00 | 1.005 | | 1 |
| | **516-458-26** | — | 0 | 1.01 - 1.09 | 0.01 | 9 |
| | **516-459-26** | — | AS-1 | 1.1 - 1.9 | 0.1 | 9 |
| | **516-460-26** | — | AS-2 | 1 - 24 | 1 | 24 |
| | | — | — | 25 - 100 | 25 | 4 |
| **32** | **516-465-26** | — | 00 | 1.005 | | 1 |
| | **516-466-26** | — | 0 | 1.01 - 1.09 | 0.01 | 9 |
| | **516-467-26** | — | AS-1 | 1.1 - 1.9 | 0.1 | 9 |
| | **516-468-26** | — | AS-2 | 1 - 9 | 1 | 9 |
| | — | — | — | 10 - 30 | 10 | 3 |
| | — | | | 60 | | 1 |

### Metric Long Block Set

| Blocks per set | Order No. | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|
| | Steel | CERA | | Size | Step | Qty. |
| **8** | **516-751-26** | — | 00 | 125, 150, 175 | 25 | 3 |
| | **516-752-26** | — | 0 | 200, 250 | 50 | 2 |
| | **516-753-26** | — | AS-1 | 300, 400, 500 | 100 | 3 |
| | **516-754-26** | — | AS-2 | | | |

### Metric Wear Block Set

| Blocks per set | Order No. | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|
| | Carbide | CERA | | Size | Step | Qty. |
| **2** | **516-820-26** | — | 0 | 1 | — | 2 |
| | **516-821-26** | — | AS-1 | | | |

**Provided with Inspection Certificate**



# Inch Square Gage Block Set

## SERIES 516 — Inch Block Set, Long Block Set, Wear Block Set

Provided with Inspection Certificate





Steel 47-block set



Steel 8-block set



Carbide 2-block set

## SPECIFICATIONS

### Inch Block Set

| Blocks per set | Order No. | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|
| | Steel | CERA | | Size | Step | Qty. |
| **81** | **516-401-26** | **516-201-26** | 00 | .1001 - .1009 | .0001 | 9 |
| | **516-402-26** | **516-202-26** | 0 | .101 - .149 | .001 | 49 |
| | **516-403-26** | **516-203-26** | AS-1 | .05 - .95 | .05 | 19 |
| | **516-404-26** | **516-204-26** | AS-2 | 1 - 4 | 1 | 4 |
| **36** | **516-421-26** | **516-221-26** | 00 | .05″ | | 1 |
| | **516-422-26** | **516-222-26** | 0 | .1001 - .1009 | .0001 | 10 |
| | **516-423-26** | **516-223-26** | AS-1 | .101 - .109 | .001 | 9 |
| | **516-424-26** | **516-224-26** | AS-2 | .11 - .19 | .01 | 9 |
| | | | | .1 - .5 | .1 | 5 |
| | | | | 1, 2, 4 | 1 | 3 |
| **28** | **516-417-26** | — | 00 | .02005″ | | 1 |
| | **516-418-26** | — | 0 | .0201 - .0209″ | .0001 | 9 |
| | **516-419-26** | — | AS-1 | .021 - .029″ | .001 | 9 |
| | **516-420-26** | — | AS-2 | .021 - .029″ | .01 | 9 |
| | | | | .10 - .090″ | | |

### Inch Long Block Set

| Blocks per set | Order No. | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|
| | Steel | CERA | | Size | Step | Qty. |
| **8** | **516-762-26** | — | 0 | 5 - 7 | 1 | 3 |
| | **516-763-26** | — | AS-1 | 8, 10, 12 | 2 | 3 |
| | | | | 16, 20 | 4 | 2 |

### Inch Wear Block Set

| Blocks per set | Order No. | | Grade | Blocks included in set | | |
|---|---|---|---|---|---|---|
| | Carbide | CERA | | Size | Step | Qty. |
| **2** | **516-824-26** | **516-846-26** | 0 | .05 | — | 2 |
| | **516-825-26** | **516-847-26** | AS-1 | | | |
| **2** | **516-826-26** | **516-844-26** | 0 | .1 | — | 2 |
| | **516-827-26** | **516-845-26** | AS-1 | | | |

### 92 pcs. Gage Blocks with accessories set in wooden box

| Blocks in set | Order No. | Grade | Blocks included in set | | | Individual No. | Description | Qty. |
|---|---|---|---|---|---|---|---|---|
| | Steel | | Size | Step | Qty | | | |
| **92** | **516-405-26** | 0 | .0625 | | 1 | **619052** | Plain Jaw .500″ | 2 |
| | | | .078125 | | 1 | **619051** | Half round jaw .250″ | 2 |
| | | | .09375 | | 1 | **619055** | Holder base .500″ | 1 |
| | | | .100025 | | 1 | **619057** | Flat head screw 1 1/4″ | 2 |
| | | | .10005 | | 1 | **619058** | Flat head screw 5/8″ | 2 |
| | | | .100075 | | 1 | **619056** | Stud | 2 |
| | | | .109375 | | 1 | **619066** | Knurled head screw | 2 |
| | | | .1001 - .1009 | .0001 | 9 | **619059** | Slotted head nut | 2 |
| | | | .101 - .149 | .001 | 49 | **619062** | Tie rod 3″ | 1 |
| | | | .05 - .95 | .05 | 4 | **619063** | Tie rod 2 1/4″ | 1 |
| | | | .16 - .19 | .01 | 19 | **619064** | Tie rod 1 1/2″ | 1 |
| | | | 1 4 | 1 | 4 | **619065** | 3/4″ | 1 |



Mitutoyo

# Individual Metric Square Gage Block



## SPECIFICATIONS

### Metric Block

| Length (mm) | Order No. | |
|---|---|---|
| | Steel | CERA |
| 0.5 | 614506 | — |
| 1 | 614611 | — |
| 1.0005 | 614520 | — |
| 1.001 | 614521 | — |
| 1.002 | 614522 | — |
| 1.003 | 614523 | — |
| 1.004 | 614524 | — |
| 1.005 | 614525 | — |
| 1.006 | 614526 | — |
| 1.007 | 614527 | — |
| 1.008 | 614528 | — |
| 1.009 | 614529 | — |
| 1.01 | 614561 | — |
| 1.02 | 614562 | — |
| 1.03 | 614563 | — |
| 1.04 | 614564 | — |
| 1.05 | 614565 | — |
| 1.06 | 614566 | — |
| 1.07 | 614567 | — |
| 1.08 | 614568 | — |
| 1.09 | 614569 | — |
| 1.1 | 614570 | — |
| 1.11 | 614571 | — |
| 1.12 | 614572 | — |
| 1.13 | 614573 | — |
| 1.14 | 614574 | — |
| 1.15 | 614575 | — |
| 1.16 | 614576 | — |
| 1.17 | 614577 | — |
| 1.18 | 614578 | — |
| 1.19 | 614579 | — |
| 1.2 | 614580 | — |
| 1.21 | 614581 | — |
| 1.22 | 614582 | — |
| 1.23 | 614583 | — |
| 1.24 | 614584 | — |
| 1.25 | 614585 | — |
| 1.26 | 614586 | — |
| 1.27 | 614587 | — |
| 1.28 | 614588 | — |
| 1.29 | 614589 | — |
| 1.3 | 614590 | — |
| 1.31 | 614591 | — |
| 1.32 | 614592 | — |

| Length (mm) | Order No. | |
|---|---|---|
| | Steel | CERA |
| 1.33 | 614593 | — |
| 1.34 | 614594 | — |
| 1.35 | 614595 | — |
| 1.36 | 614596 | — |
| 1.37 | 614597 | — |
| 1.38 | 614598 | — |
| 1.39 | 614599 | — |
| 1.4 | 614600 | — |
| 1.41 | 614601 | — |
| 1.42 | 614602 | — |
| 1.43 | 614603 | — |
| 1.44 | 614604 | — |
| 1.45 | 614605 | — |
| 1.46 | 614606 | — |
| 1.47 | 614607 | — |
| 1.48 | 614608 | — |
| 1.49 | 614609 | — |
| 1.5 | 614641 | — |
| 1.6 | 614516 | — |
| 1.7 | 614517 | — |
| 1.8 | 614518 | — |
| 1.9 | 614519 | — |
| 2 | 614612 | — |
| 2.5 | 614642 | — |
| 3 | 614613 | — |
| 3.5 | 614643 | — |
| 4 | 614614 | — |
| 4.5 | 614644 | — |
| 5 | 614615 | — |
| 5.5 | 614645 | — |
| 6 | 614616 | — |
| 6.5 | 614646 | — |
| 7 | 614617 | — |
| 7.5 | 614647 | — |
| 8 | 614618 | — |
| 8.5 | 614648- | — |
| 9 | 614619 | — |
| 9.5 | 614649 | — |
| 10 | 614671 | — |
| 10.5 | 614650 | — |
| 11 | 614621 | — |
| 11.5 | 614651 | — |
| 12 | 614622 | — |
| 12.5 | 614652 | — |

| Length (mm) | Order No. | |
|---|---|---|
| | Steel | CERA |
| 13 | 614623 | — |
| 13.5 | 614653 | — |
| 14 | 614624 | — |
| 14.5 | 614654 | — |
| 15 | 614625 | — |
| 15.5 | 614655 | — |
| 16 | 614626 | — |
| 16.5 | 614656 | — |
| 17 | 614627 | — |
| 17.5 | 614657 | — |
| 18 | 614628 | — |
| 18.5 | 614658 | — |
| 19 | 614629 | — |
| 19.5 | 614659 | — |
| 20 | 614672 | — |
| 20.5 | 614660 | — |
| 21 | 614631 | — |
| 21.5 | 614661 | — |
| 22 | 614632 | — |
| 22.5 | 614662 | — |
| 23 | 614633 | — |
| 23.5 | 614663 | — |
| 24 | 614634 | — |
| 24.5 | 614664 | — |
| 25 | 614635 | — |
| 30 | 614673 | — |
| 40 | 614674 | — |
| 50 | 614675 | — |
| 60 | 614676 | — |
| 75 | 614801 | — |
| 100 | 614681 | — |
| 125 | 614802 | — |
| 150 | 614803 | — |
| 175 | 614804 | — |
| 200 | 614682 | — |
| 250 | 614805 | — |
| 300 | 614683 | — |
| 400 | 614684 | — |
| 500 | 614685 | — |

### Metric Wear Block

| Length (mm) | Order No. Tungsten carbide |
|---|---|
| 1 | 615611 |
| 2 | 615612 |

## Suffix Number for Selecting Standard and Certificate Provided

### ASME

| Grade | Steel |
|---|---|
| K | — |
| 00 | -521* |
| 0 | -531* |
| AS-1 | -541* |
| AS-2 | -551* |

* provided with Inspection Certificate

Example: 614611-521
1mm gage block in grade 00.

We make custom length gage blocks:
0.5 - 500mm.




Inspection Certificate

# Individual Inch Square Gage Block

## Suffix Number for Selecting Standard and Certificate Provided

**ASME**

| Grade | Steel, CERA |
|---|---|
| K | — |
| 00 | **-521*** |
| 0 | **-531*** |
| AS-1 | **-541*** |
| AS-2 | **-551*** |

* provided with Inspection Certificate

Example: 614310-521
.01" gage block in grade 00.

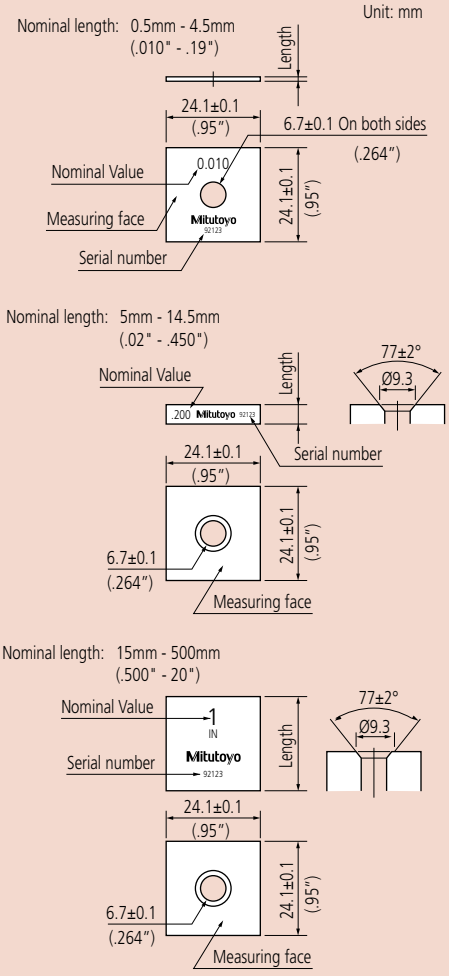
We make custom length gage blocks:
.01 - 20"




Inspection Certificate

## DIMENSIONS

Unit: mm




## SPECIFICATIONS

**Inch Block**

| Length (inch) | Order No. | |
|---|---|---|
| | Steel | CERA |
| .01 | **614310** | **—** |
| .02005 | **614240** | **—** |
| .0201 | **614231** | **—** |
| .0202 | **614232** | **—** |
| .0203 | **614233** | **—** |
| .0204 | **614234** | **—** |
| .0205 | **614235** | **—** |
| .0206 | **614236** | **—** |
| .0207 | **614237** | **—** |
| .0208 | **614238** | **—** |
| .0209 | **614239** | **—** |
| .02 | **614320** | **—** |
| .021 | **614321** | **—** |
| .022 | **614322** | **—** |
| .023 | **614323** | **—** |
| .024 | **614324** | **—** |
| .025 | **614325** | **—** |
| .026 | **614326** | **—** |
| .027 | **614327** | **—** |
| .028 | **614328** | **—** |
| .029 | **614329** | **—** |
| .03 | **614330** | **—** |
| .03125 (1/32) | **614301** | **—** |
| .04 | **614340** | **—** |
| .046875 (3/64) | **614302** | **—** |
| .05 | **614105** | **616105** |
| .06 | **614106** | **—** |
| .0625 | **614303** | **616303** |
| .07 | **614107** | **—** |
| .078125 (5/64) | **614304** | **—** |
| .08 | **614108** | **—** |
| .09 | **614109** | **—** |
| .09375 (3/32) | **614305** | **—** |
| .1 | **614191** | **616191** |
| .100025 | **614307** | **—** |
| .10005 | **614135** | **616135** |
| .100075 | **614308** | **—** |
| .1001 | **614121** | **616121** |
| .1002 | **614122** | **616122** |
| .1003 | **614123** | **616123** |
| .1004 | **614124** | **616124** |
| .1005 | **614125** | **616125** |
| .1006 | **614126** | **616126** |
| .1007 | **614127** | **616127** |
| .1008 | **614128** | **616128** |
| .1009 | **614129** | **616129** |
| .101 | **614141** | **616141** |
| .102 | **614142** | **616142** |
| .103 | **614143** | **616143** |
| .104 | **614144** | **616144** |
| .105 | **614145** | **616145** |

| Length (inch) | Order No. | |
|---|---|---|
| | Steel | CERA |
| .106 | **614146** | **616146** |
| .107 | **614147** | **616147** |
| .108 | **614148** | **616148** |
| .109 | **614149** | **616149** |
| .109375 (7/64) | **614306** | **—** |
| .11 | **614150** | **616150** |
| .111 | **614151** | **616151** |
| .112 | **614152** | **616152** |
| .113 | **614153** | **616153** |
| .114 | **614154** | **616154** |
| .115 | **614155** | **616155** |
| .116 | **614156** | **616156** |
| .117 | **614157** | **616157** |
| .118 | **614158** | **616158** |
| .119 | **614159** | **616159** |
| .12 | **614160** | **616160** |
| .121 | **614161** | **616161** |
| .122 | **614162** | **616162** |
| .123 | **614163** | **616163** |
| .124 | **614164** | **616164** |
| .125 | **614165** | **616165** |
| .126 | **614166** | **616166** |
| .127 | **614167** | **616167** |
| .128 | **614168** | **616168** |
| .129 | **614169-** | **616169** |
| .13 | **614170** | **616170** |
| .131 | **614171** | **616171** |
| .132 | **614172** | **616172** |
| .133 | **614173** | **616173** |
| .134 | **614174** | **616174** |
| .135 | **614175** | **616175** |
| .136 | **614176** | **616176** |
| .137 | **614177** | **616177** |
| .138 | **614178** | **616178** |
| .139 | **614179** | **616179** |
| .14 | **614180** | **616180** |
| .141 | **614181** | **616181** |
| .142 | **614182** | **616182** |
| .143 | **614183** | **616183** |
| .144 | **614184** | **616184** |
| .145 | **614185** | **616185** |
| .146 | **614186** | **616186** |
| .147 | **614187** | **616187** |
| .148 | **614188** | **616188** |
| .149 | **614189** | **616189** |
| .15 | **614115** | **616115** |
| .16 | **614116** | **616116** |
| .17 | **614117** | **616117** |
| .18 | **614118** | **616118** |
| .19 | **614119** | **616119** |
| .2 | **614192** | **616192** |

| Length (inch) | Order No. | |
|---|---|---|
| | Steel | CERA |
| .25 | **614212** | **616212** |
| .3 | **614193** | **616193** |
| .35 | **614213** | **616213** |
| .375 (3/8) | **614309** | **—** |
| .4 | **614194** | **616194** |
| .45 | **614214** | **616214** |
| .5 | **614195** | **616195** |
| .55 | **614215** | **616215** |
| .6 | **614196** | **616196** |
| .65 | **614216** | **616216** |
| .7 | **614197** | **616197** |
| .75 | **614217** | **616217** |
| .8 | **614198** | **616198** |
| .85 | **614218** | **616218** |
| .9 | **614199** | **616199** |
| .95 | **614219** | **616219** |
| 1 | **614201** | **616201** |
| 2 | **614202** | **616202** |
| 3 | **614203** | **616203** |
| 4 | **614204** | **616204** |
| 5 | **614205** | **—** |
| 6 | **614206** | **—** |
| 7 | **614207** | **—** |
| 8 | **614208** | **—** |
| 10 | **614222** | **—** |
| 12 | **614223** | **—** |
| 16 | **614224** | **—** |
| 20 | **614225** | **—** |

**Inch Wear Block**

| Length (inch) | Order No. Tungsten carbide |
|---|---|
| .05 | **615105** |
| .1 | **615191** |



Mitutoyo

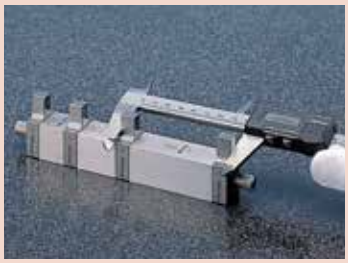
# Square Gage Block Accessories

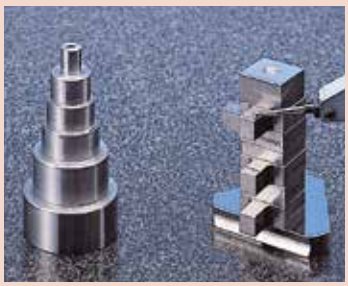
## SERIES 516

To expand the variety of square gage block applications, Mitutoyo offers the gage block accessories set. By assembling the items in the set, you can easily and quickly build up a precision measuring instrument.



516-611





## SPECIFICATIONS

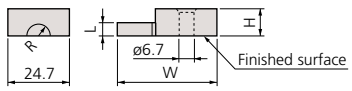
**Metric**

| Order No. 516-611 | Included in set |
|---|---|
| 2 pcs. | Half round jaw 2mm (**619070**) |
| 2 pcs. | Half round jaw 5mm (**619071**) |
| 2 pcs. | Plain jaw (**619072**) |
| 1 pc. | Center point (**619073**) |
| 1 pc. | Scriber point (**619054**) |
| 1 pc. | Block base (**619074**) |
| 2 pcs. | Flat head screw 1·1/4" (**619057**) |
| 2 pcs. | Flat head screw 5/8" (**619058**) |
| 2 pcs. | Slotted head nut (**619059**) |
| 2 pcs. | Adjustable tie rod 6" (**619060**) |
| 2 pcs. | Adjustable tie rod 4·1/2" (**619061**) |
| 1 pc. | Tie rod 3" (**619062**) |
| 1 pc. | Tie rod 2·1/4" (**619063**) |
| 1 pc. | Tie rod 1·1/2" (**619064**) |
| 1 pc. | Tie rod 3/4" (**619065**) |
| 2 pcs. | Stud (**619056**) |
| 2 pcs. | Knurled head screw (**619066**) |

**Inch**

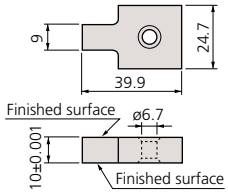
| Order No. 516-612 | Included in set |
|---|---|
| 2 pcs. | Half round jaw .125" (**619050**) |
| 2 pcs. | Half round jaw .25" (**619051**) |
| 2 pcs. | Plain jaw (**619052**) |
| 1 pc. | Center point (**619053**) |
| 1 pc. | Scriber point (**619054**) |
| 1 pc. | Block base (**619055**) |
| 2 pcs. | Flat head screw 1·1/4" (**619057**) |
| 2 pcs. | Flat head screw 5/8" (**619058**) |
| 2 pcs. | Slotted head nut (**619059**) |
| 2 pcs. | Adjustable tie rod 6" (**619060**) |
| 2 pcs. | Adjustable tie rod 4·1/2" (**619061**) |
| 1 pc. | Tie rod 3" (**619062**) |
| 1 pc. | Tie rod 2·1/4" (**619063**) |
| 1 pc. | Tie rod 1·1/2" (**619064**) |
| 1 pc. | Tie rod 3/4" (**619065**) |
| 2 pcs. | Stud (**619056**) |
| 2 pcs. | Knurled head screw (**619066**) |

Half round jaw:
Used to measure an inside or outside diameter.

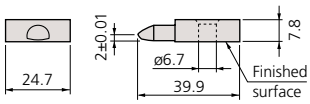



| Order No. | R | L | W | H |
|---|---|---|---|---|
| **619070** | 1.95mm | 2mm | 33.6mm | 5.3mm |
| **619071** | 4.95mm | 5mm | 39.9mm | 10.3mm |
| **619050** | .123″ | .125″ | 33.6mm | 5.3mm |
| **619051** | .248″ | .25″ | 39.9mm | 10.3mm |

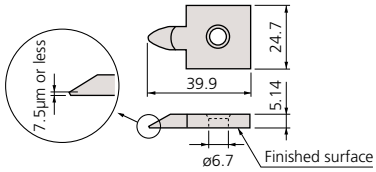
Plain jaw: **619072** (10mm), **619052** (.5")
Used to measure an inside or outside diameter.



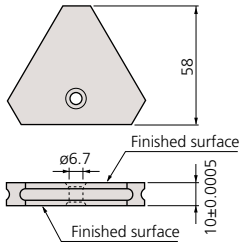

Center point: **619073** (2mm), **619053** (.1")
Used to scribe a workpiece.



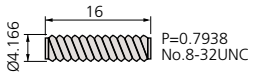

Scriber point: **619054**
Used to scribe a workpiece.



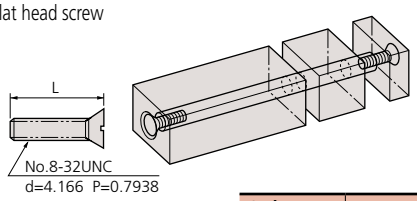

Base: **619074** (10mm), **619055** (.5")
Used as clamps by inserting them into the center hole of a square gage block.




Stud: **619056**

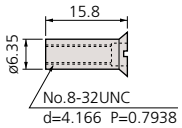



Flat head screw

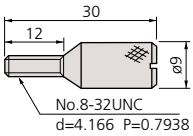



| Order No. | L |
|---|---|
| **619057** | 31.6mm |
| **619058** | 15.8mm |

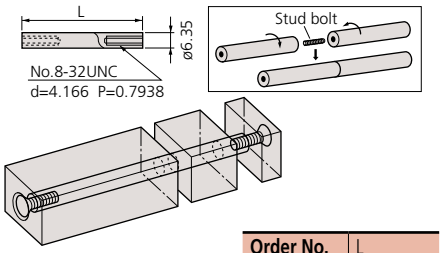
Slotted head nut: **619059**




Knurled head screw: **619066**

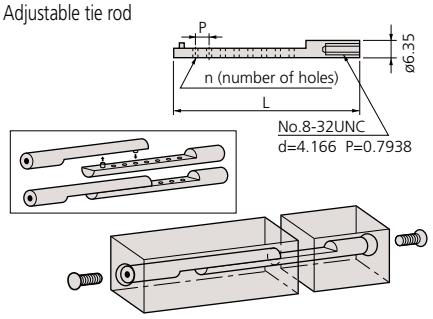



Tie rod




| Order No. | L |
|---|---|
| **619065** | 19mm |
| **619064** | 38mm |
| **619063** | 57mm |
| **619062** | 76mm |

Adjustable tie rod




| Order No. | L | P | n |
|---|---|---|---|
| **619060** | 124.5mm | 6.35mm | 14 |
| **619061** | 86.5mm | 6.35mm | 8 |

# Ceraston

## Accessory for Gage Blocks

### FEATURES

- Alumina-ceramic grinding stone for removing burrs from hard materials such as ceramics that ordinary grinding stones cannot handle.
- Can be used both for steel gage blocks and CERA Blocks.




601644 601645

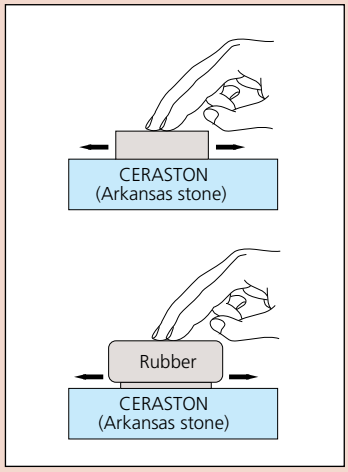
### SPECIFICATIONS

| Order No. | Dimensions (W x D x H) | Mass |
|---|---|---|
| **601645** | 100 x 25 x 12mm | 110g |
| **601644** | 150 x 50 x 20mm | 530g |



### Removing burrs

(1) Wipe any dust and oil films from the gage block and the Ceraston (or Arkansas stone) using a solvent.
(2) Place the gage block on the Ceraston so that the measuring face that has burrs is on the abrasive surface of the stone. While applying light pressure, move the gage block to and fro about ten times (Fig. 1). Use a block rubber for thin gage blocks to apply even pressure (Fig. 2).
(3) Check the measuring face for burrs with an optical flat. If the burrs have not been removed, repeat step (2). If burrs are too large, they may not be removed with a grinding stone. If so, discard the gage block.




Note: The abrasive surface of a Ceraston must be made flat by lapping it from time to time. After lapping the Ceraston, the lapping powder must be completely removed from the surface to prevent the surface of the gage block from being scratched. Mitutoyo does not carry the Arkansas stone.

# Maintenance Kit for Gage Blocks

## SERIES 516

### FEATURES

- Includes all necessary maintenance tools for daily care and storage of gage blocks.
- Supplied in a fitted wooden case for portable use.



516-650E

### SPECIFICATIONS

| Order No. | Assortment of tools and accessories |
|---|---|
| **516-650E** | Ceraston (**601645**): Used for removing burrs on the measuring surface. |
| | Optical flat (**158-117**): Used for checking whether burrs exist. |
| | Tweezers (**600004**): Used for handling thin gage blocks. |
| | Blower brush (**600005**): Used for blowing out dust on the measuring surface. |
| | Cleaning paper (**600006**): Used for wiping off rust preventive oil and contamination. |
| | Artificial leather mat (**600007**): Used as a gage block mat. |
| | Reagent bottle (**600008**): Bottle of wiping solution (100mL) |
| | Gloves |



# Step Master

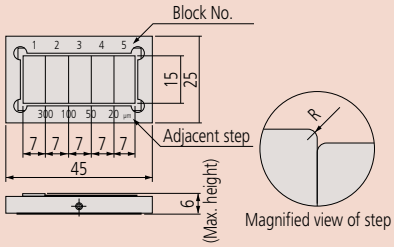
## SERIES 516

### FEATURES

Step master is a master gage used for the z-axis (vertical direction) calibration of optical instruments.

- Each adjacent step is measured down to 0.01µm by using a interferometer within ±0.20µm allowance.
- Steel and ceramic types are available.

### Dimension






**516-498**
Ceramic type



**516-199**
Steel type



### SPECIFICATIONS

**Metric**

| Order No. | Step value between adjacent blocks | | | | Remarks |
|---|---|---|---|---|---|
| | No. 1 - No. 2 | No. 2 - No. 3 | No. 3 - No. 4 | No. 4 - No. 5 | |
| **516-198** | 10µm | 5µm | 2µm | 1µm | Steel type |
| **516-199** | 300µm | 100µm | 50µm | 20µm | Steel type |
| **516-498** | 10µm | 5µm | 2µm | 1µm | Ceramic type |
| **516-499** | 300µm | 100µm | 50µm | 20µm | Ceramic type |

# Made-to-order Block & Reference

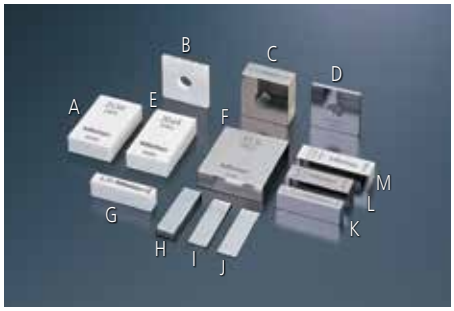
### FEATURES

- Mitutoyo can provide gage blocks and reference gages to your size and design.

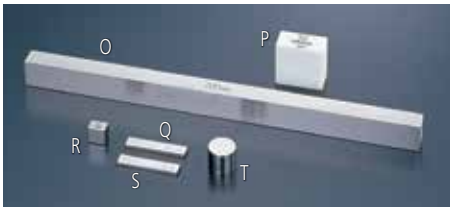
### Available Dimension

Nominal size: .004 to 20″ / 0.1 to 1000mm (steel)
.1 to 20″ / 0.5 to 500mm (ceramic)
Nominal pitch: 0.0005mm (up to 100mm)
0.001mm (over 100mm)
Minimum section dimension:
Approx. .24 x .24″ / 6 x 6mm
Maximum section dimension:
Approx. 5.5 x 5.5″ / 140 x 140mm (steel)
Approx. 6.3″ Dia. / ø160mm (steel, cylindrical)
Approx. 3.94 x 1.97″ / 100 x 50mm (ceramic)
Approx. .24″ Dia. / ø60mm (ceramic, cylindrical)
Accuracy: Gage Block Grade level

Special materials of low expansion glass and low expansion ceramic are available.




A: Ceramic rectangular gage block (21.94mm)
B: Ceramic square gage block (2.1005mm)
C: Steel square gage block (10.72mm)
D: Steel square gage block (2.2065mm)
E: Ceramic rectangular gage block (20.64mm)
F: Steel rectangular gage block (31.5mm)
G: Ceramic rectangular gage block (6.34mm)
H: Steel rectangular gage block (3.603mm)
I: Steel rectangular gage block (1.1505mm)
J: Steel rectangular gage block (0.555mm)
K: Steel rectangular gage block (6.156mm)
L: Steel rectangular gage block (9.694mm)
M: Steel rectangular gage block (10.02mm)




O: Steel long rectangular block (15 x 10 x 200mm)
P: Ceramic square block (24.1 x 24.1 x 12.3mm)
Q: Steel thin rectangular block (30 x 6 x 1.9mm)
R: Steel square block (9 x 9 x 6mm)
S: Steel thin rectangular block (30 x 6 x 2.1mm)
T: Steel cylindrical bock (ø13.08 x 12mm)




U: Cylindrical reference block for depth micrometer (ø60 x 150mm)
V: Ceramic reference plate (50 x 50 x 50mm, flatness 0.3µm)
W: Ceramic stepped block (30 x 18 x 5mm, step: 0.15mm)



Mitutoyo

# Gage Block Comparator GBCD-250

## SERIES 565 — Manual Comparator with Dual Gage Heads

### FEATURES

- Gage blocks between 0.1mm and 250mm easily can be compared with the standard gage block on the GBCD-250.
- The differential dual gaging heads assure the operator of a high-accuracy measurement with ease of use.

### SPECIFICATIONS

**Inch/Metric**

| Model No. | GBCD-250 |
|---|---|
| **Order No.** | **565-151A** |
| Range | 0.1mm - 250mm / .004 - 10" |
| Resolution | 0.000001mm(0.01µm)/.0000001in(.1µin) |
| Accuracy in narrow range (20°C) | ±(0.03+0.3L/1000)µm*<br>L = Gage block length (mm) |
| Measuring units | Laser Hologage (upper and lower) |
| Operating condition | Temperature: 20°C ±1°C<br>Humidity: 30% RH to 60% RH |
| Data output | Via SPC output port |
| Dimensions (W x D x H) | Main unit: 455 x 318 x 691mm Display unit: 345 x 397 x 187mm |
| Mass | Main unit: Approx. 52kg<br>Display unit: Approx. 9kg |

* 95% confidence interval (not including the calibration error of the standard gage block).



### Optional Accessories

**962723**: Gage head calibration kit
**02ASD130**: Square gage block holder kit
**02ASF040**: Heat protection shield
**02ASQ953**: GBPAK-M
Supporting OS: Windows XP, Vista, 7, or 10
**937179T**: Foot Switch
**936937**: Connecting cable

# Gage Block Comparator GBCD-100A

## SERIES 565 — Automatic-Type Comparator with Dual Gage Heads

### SPECIFICATIONS

| Model No. | GBCD-100A |
|---|---|
| **Order No.** | **565-160A** |
| Resolution | 0.00001mm (0.01µm) / .000001" |
| Range | 0.5mm - 100mm / .02 - 4" |
| Measuring unit | Differential (dual-head) type Mu-Checker |
| Accuracy in narrow range (20°C) | ±(0.03+0.3L/1000)µm*<br>L = Gage block length (mm) |
| Measuring force | Upper gage head: 1N (100gf)<br>Lower gage head: 0.6N (60gf) |
| Air requirement | 400kPa (4kgf/cm$^2$) |
| Operating condition | Temperature: 20°C ±1°C<br>Humidity: 58%RH ±15%RH |
| Dimensions (W x D x H) | Main unit: 710 x 366 x 783mm<br>Electronic unit: 160 x 410 x 382mm |
| Mass | Main unit: 120kg<br>Electronic unit: 14kg |

* 95% confidence interval (not including the calibration error of the standard gage block).



The GBCD-100A Automatic Gage Block Comparator is an easy-to-operate dual-head gage block inspecting system. It automatically compares workpieces with a standard gage block and determines accuracies such as central length, maximum length, minimum length and parallelism through the operation of an optional personal computer.

### Standard Accessories

GBPAK-A (software)

### Optional Accessories

**516-146-E1**: Gage block set for GBCD calibration

# Height Master

## SERIES 515

PROPRIETARY INSPECTION CERTIFICATE

Mitutoyo guarantees the product quality

### Technical Data

| | |
|---|---|
| Graduation: | .00001" or 0.001mm |
| Counter Resolution: | .001" or 0.01mm |
| Character Height: | .16" / 4mm |
| Micrometer Head | |
| Travel stroke: | 1" or 20mm |
| Pitch: | .025"/rev or 0.5mm/rev |
| Hysteresis: | .00004" or 1µm |

Provided with inspection certificate.

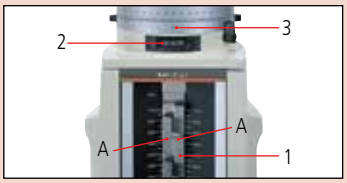
### Standard Accessories

Reference Block: 11mm for 515-322
Reference Block: .3" for 515-310, 515-311

### Optional Accessories

**515-112**: Auxiliary block kit for bore gage (mm)
**515-119**: Auxiliary block kit for bore gage (for **515-310**)
**515-121**: Auxiliary block kit for bore gage (for **515-311**)
———: Riser block

**Reading**




**Height A**

| | | |
|---|---|---|
| 1. Scale | 280. | mm |
| 2. Counter | 5.67 | mm |
| 3. Thimble | 0.000 | mm |
| | 285.670 | mm |



### FEATURES

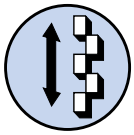
- Models with staggered arrangement of block stack have two measuring faces on the same level, one facing up and the other down (except for **515-310**).
- Each height master is supplied with a gage block for zero-setting.
- Supplied in fitted wooden case.



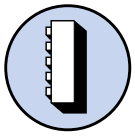
**515-322**



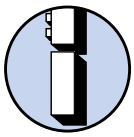
**515-310**



Staggered 20mm blocks (movable)



Vertical orientation



Riser block

### SPECIFICATIONS

**Metric**

| Range (H) | Order No. | Block step | Graduation | Block Pitch Accuracy | Parallelism of Block | Micrometer Head Accuracy | Mass (kg) |
|---|---|---|---|---|---|---|---|
| 5 < H ≤ 310mm | **515-322** | 20mm (staggered) | 0.001mm | ±1.5µm | 1µm | ±1µm | 23 |

**Inch**

| Range (H) | Order No. | Block step | Graduation | Block Pitch Accuracy | Parallelism of Block | Micrometer Head Accuracy | Mass (kg) |
|---|---|---|---|---|---|---|---|
| .2" < H ≤ 12.2" | **515-310** | .5" (straight) | .00001" | ±.00005" | .00004" | ±.00005" | 23 |
| .2" < H ≤ 12.2" | **515-311** | 1" (staggered) | .00001" | ±.00005" | .00004" | ±.00005" | 23 |



Mitutoyo

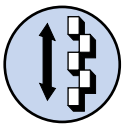
# Digital Height Master
## SERIES 515

### FEATURES

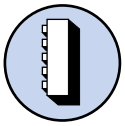
- Standard model with a digital display, featuring all essential specifications required for versatile height standard.
- With SPC output.
- Each height master is supplied with a gage block for zero setting.



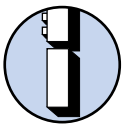
515-374



Staggered 20mm blocks (movable)



Vertical orientation



Riser block



PROPRIETARY INSPECTION CERTIFICATE

SPC

### Technical Data

| | |
|---|---|
| Resolution (LCD): | .0001" or 0.001mm |
| Graduation: | .0001" or 0.002mm |
| Character Height | .21" / 5.4mm |
| | |
| Micrometer Head | |
| Travel Stroke: | 1" or 20mm |
| Pitch: | .025"/rev or 0.5mm/rev |
| Hystersis: | .0001" for all inch models<br>0.002mm for 300mm models<br>0.0025mm for 450 & 600mm models |
| Battery: | SR44 (2 pcs.), **938882** |
| Battery life: | Approx. 1.8 years under normal use |

### Function

Zero-setting, Presetting, ABS/INC switching, Data hold, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error

### Standard Accessories

Reference Block: 11mm for Metric Height Master **611621-031**
Reference Block: .6" for for Inch Height Master **611196-531**
Provided with inspection certificate.

### Optional Accessories

**515-111**: Auxiliary block kit for bore gage (mm)
**515-120**: Auxiliary block kit for bore gage (inch)
———: Riser block (see page E-27.)
**959149**: SPC cable (40" / 1m)
**959150**: SPC cable (80" / 2m)
**050019:** Fitted mahogany case for 12" / 300mm model
**050059:** Fitted mohogany case for 18" / 450mm model
24" / 600mm model

### SPECIFICATIONS

**Metric**

| Range (H) | Order No. | Block step | Resolution | Block Pitch Accuracy | Parallelism | Micrometer Head Accuracy | Mass (kg) |
|---|---|---|---|---|---|---|---|
| 10 < H ≤ 310mm | **515-374** | 20mm (staggered) | 0.001mm | ±1.5µm | 2µm | ±2µm | 9.5 |
| 10 < H ≤ 460mm | **515-376** | 20mm (staggered) | 0.001mm | ±2.5µm | 2.5µm | ±2µm | 13.6 |
| 10 < H ≤ 610mm | **515-378** | 20mm (staggered) | 0.001mm | ±3.5µm | 2.5µm | ±2.5µm | 16.0 |

**Inch/Metric**

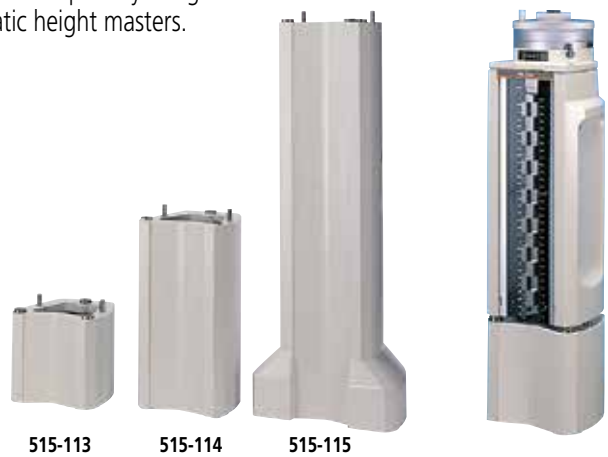
| Range (H) | Order No. | Block step | Resolution | Block Pitch Accuracy | Parallelism | Micrometer Head Accuracy | Mass (kg) |
|---|---|---|---|---|---|---|---|
| .5" < H ≤ 12" | **515-375** | 1" (staggered) | .0001" / 0.001mm | ±.0001" | .00005" | ±.0001" | 9.5 |
| .5" < H ≤ 18" | **515-377** | 1" (staggered) | .0001" / 0.001mm | ±.0001" | .0001" | ±.0001" | 13.6 |
| .5" < H ≤ 24" | **515-379** | 1" (staggered) | .0001" / 0.001mm | ±.0001" | .0001" | ±.0001" | 16.0 |

# Riser Blocks

## SERIES 515

### FEATURES

- These riser blocks are specially designed for standard/digimatic height masters.



515-113 515-114 515-115

### SPECIFICATIONS

**Metric**

| Height | Order No. | Accuracy of height | Mass (kg) |
|---|---|---|---|
| 150mm | **515-113** | ±0.6µm | 5.7 |
| 300mm | **515-114** | ±1.0µm | 11.3 |
| 600mm | **515-115** | ±2.0µm | 31 |

**Inch**

| Height | Order No. | Accuracy of height | Mass (kg) |
|---|---|---|---|
| 6″ | **515-116** | ±20µin | 5.7 |
| 12″ | **515-117** | ±40µin | 11.3 |
| 24″ | **515-118** | ±80µin | 31 |

# Auxiliary Block Kit

## SERIES 515 — for Bore Gage

### FEATURES

- Used for efficient zero-setting of dial bore gages and tubular inside micrometers (18 - 150mm) on a Height Master.



515-112

Bore gage zero-setting



### SPECIFICATIONS

**Metric**

| Order No. | Applicable height master |
|---|---|
| **515-110** | Universal Height Master |
| **515-111** | Digimatic Height Master |
| **515-112** | Height Master |

**Inch**

| Order No. | Applicable height master |
|---|---|
| **515-119** | Universal Height Master, Height Master (**515-310**) |
| **515-120** | Digimatic Height Master |
| **515-121** | Height Master (**515-311**) |



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# Universal Height Master

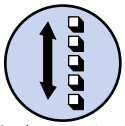
## SERIES 515 — Use in Vertical and Horizontal Orientation

### FEATURES

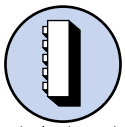
- The Universal Height Master is designed for both vertical and horizontal orientations, providing a wide range of applications, such as accuracy checking of machine tool table movements.
- Fitted wooden case supplied.



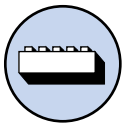
515-520



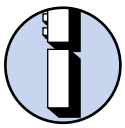
Single-row 10mm blocks (movable)



Vertical orientation



Horizontal orientation



Riser block

### SPECIFICATIONS

**Metric**

| Range (R) | Order No. | Block step | Graduation | Block Pitch Accuracy | Parallelism of Block | Micrometer Head Accuracy | Mass (kg) |
|---|---|---|---|---|---|---|---|
| 5 < R ≤ 610mm | **515-520** | 10mm (straight) | 0.001mm | ±1.5μm | 1.0μm | ±1.2μm | 42 |
| 5 < R ≤ 1010mm | **515-523** | 10mm (straight) | 0.001mm | ±3.5μm | 2.5μm | ±1.5μm | 63.5 |

**Inch**

| Range (R) | Order No. | Block step | Graduation | Block Pitch Accuracy | Parallelism of Block | Micrometer Head Accuracy | Mass (kg) |
|---|---|---|---|---|---|---|---|
| .2″ < R ≤ 18.2″ | **515-512** | .5″ (straight) | .00001″ | ±.00005″ | .00006″ | ±.00004″ | 42 |
| .2″ < R ≤ 24.2″ | **515-510** | .5″ (straight) | .00001″ | ±.0001″ | .00006″ | ±.00004″ | 50 |
| .2″ < R ≤ 40.2″ | **515-513** | .5″ (straight) | .00001″ | ±.00015″ | .00008″ | ±.00006″ | 63.5 |




### Technical Data

| | |
|---|---|
| Graduation: | 0.001mm or .00001" |
| Counter Resolution: | .001″ or 0.01mm |
| Character Height: | .16″ / 4mm |
| Block arrangement: | Straight arrangement |
| Micrometer Head | |
| Travel stroke: | 1" or 20mm |
| Pitch: | .025"/rev or 0.5mm/rev |
| Hysteresis: | .00004″ / 1.2μm up to 24.2″ / 610mm<br>.00006″ / 1.5μm for 40.2″ / 1010mm |
| Block pitch accuracy: | ±1.5μm (0 < R ≤ 310mm)<br>±2.5μm (310 < R ≤ 610mm)<br>±3.5μm (610 < R ≤ 1010mm) |
| Parallelism of blocks: | 1.0μm (0 < R ≤ 310mm)<br>2.5μm (310 < R ≤ 1010mm) |

Provided with inspection certificate.

### Optional Accessories

**900574***: Supporting base for vertical operation
Mass: 3kg
(*supplied as a standard for **515-523** and **515-513**)

**515-112**: Auxiliary block kit for bore gage (mm)

**515-119**: Auxiliary block kit for bore gage (inch)



Using in horizontal orientation



Supporting base

# High-Accuracy Check Master HMC-H

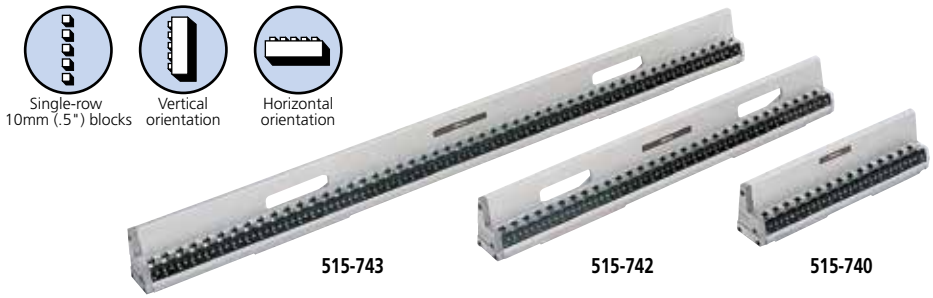
## SERIES 515

## FEATURES

- Designed to check the accuracy of table movements of machine tools and calibrate CMMs. Permanently wrung stack of gage blocks is housed in a rigid frame.
- Can be used in either vertical and horizontal orientation.
- Fitted wooden case supplied.

**Specifications for Ceramic Check Master:**

- Each measuring block is made of zirconia-based ceramic that requires no anti-corrosion treatment for measuring faces.
- Free from deterioration and dimensional changes over time.



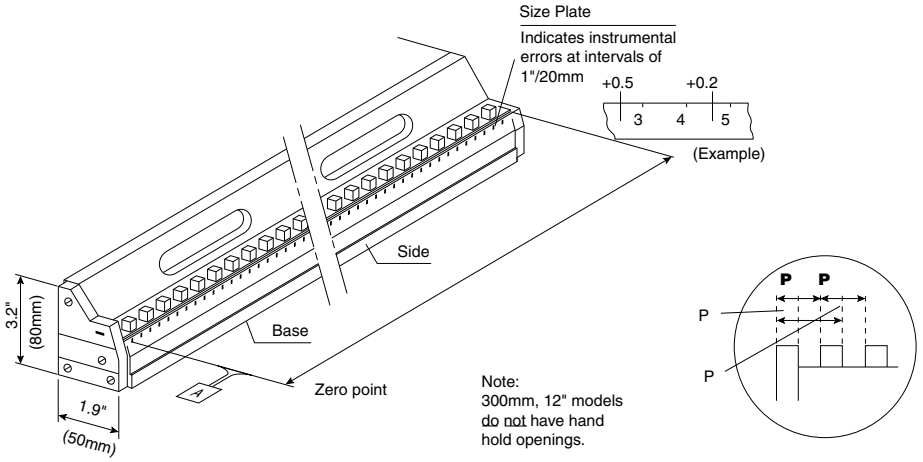

## SPECIFICATIONS

### Metric

| Range (R) | Order No. | | Pitch | | Accuracy of block pitch for the range shown below as measured from the bottom block | | | | Length | Parallelism | Mass (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Steel | Ceramic | P | P | up to 300mm | 300-600mm | 600-1000mm | 1000-1500mm | | | |
| 300mm | 515-740 | 515-760 | 20mm | 10mm | ±1.2µm | — | — | — | 331mm | 1µm | 3.6 |
| 450mm | 515-741 | 515-761 | 20mm | 10mm | ±1.2µm | ±1.8µm | — | — | 482mm | 1µm | 5.4 |
| 600mm | 515-742 | 515-762 | 20mm | 10mm | ±1.2µm | ±1.8µm | — | — | 631mm | 1.5µm | 7.2 |
| 1000mm | 515-743 | 515-763 | 20mm | 10mm | ±1.2µm | ±1.8µm | ±2.5µm | — | 1037mm | 1.5µm | 12.0 |
| 1500mm | 515-744 | 515-764 | 20mm | 10mm | ±1.2µm | ±1.8µm | ±2.5µm | ±4.0µm | 1546mm | 2µm | 18.0 |

### Inch

| Range (R) | Order No. | | Pitch | | Accuracy of block pitch for the range shown below as measured from the bottom block | | | | Length | Parallelism | Mass (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Steel | Ceramic | P | P | up to 12″ | 12-24″ | 24-40″ | 40-60″ | | | |
| 12″ | 515-730 | 515-750 | 1″ | .5″ | ±50µin | — | — | — | 13.0″ | 40µin | 3.4 |
| 18″ | 515-731 | 515-751 | 1″ | .5″ | ±50µin | ±70µin | — | — | 19.0″ | 40µin | 5.2 |
| 24″ | 515-732 | 515-752 | 1″ | .5″ | ±50µin | ±70µin | — | — | 25.0″ | 60µin | 6.9 |
| 40″ | 515-733 | 515-753 | 1″ | .5″ | ±50µin | ±70µin | ±100µin | — | 41.0″ | 60µin | 11.5 |
| 60″ | 515-734 | 515-754 | 1″ | .5″ | ±50µin | ±70µin | ±100µin | ±158µin | 61.5″ | 80µin | 17.3 |




## Technical Data

Measuring range (R): Refer to the list of specifications.
Block pitch accuracy: ±1.2µm (0 < R ≤ 310mm)
±1.8µm (310 < R ≤ 610mm)
±2.5µm (610 < R ≤ 1010mm)
±4.0µm (1010 < R ≤ 1510mm)
Parallelism of blocks: 1.0µm (0 < R ≤ 450mm)
1.5µm (450 < R ≤ 1010mm
2.0µm (1010 < R ≤ 1510mm)
Provided with inspection certificate.

## Optional Accessories

**601167**: Supporting base for vertical operation

Dimensions: 14.2"(W) x 8.7"(D) x 8.3"(H)
360mm(W) x 220mm(D) x 210mm(H)

Mass: 3kg



Supporting base

# CERA Straight Master SM-C

## SERIES 311 — Straightness Measuring Instrument

### FEATURES

CERA Straight master is a master gage used for the straightness inspection of each axis movement such as a CMM, machine tool, semiconductor-related equipment and form measuring machine.

- Made from Alumina-ceramic
- 50mm/2″ pitch gradation scales
- Precision-lapped measuring surface
- Double-faced type is lapping the double face, which can be used for straightness in horizontal and vertical as a reference square.
- Lightweight
- Supplied with fitted wooden case.






### SPECIFICATIONS

**Metric**

| Nominal length | Order No.* |
|---|---|
| 400mm | **311-302-33** |
| 700mm | **311-305-33** |
| 1000mm | **311-307-33** |
| 1300mm | **311-309-33** |

**Inch** High-accuracy model

| Nominal length | Order No.* |
|---|---|
| 16″ | **311-322-33** |
| 28″ | **311-325-33** |
| 40″ | **311-327-33** |
| 52″ | **311-329-33** |

| Straightness | Size (L x H x W) | Mass |
|---|---|---|
| 0.3μm | 440 x 35 x 50mm | 1.8kg |
| 0.5μm | 740 x 35 x 50mm | 3kg |
| 1.0μm | 1040 x 45 x 80mm | 8kg |
| 1.5μm | 1340 x 45 x 80mm | 10kg |

**Metric**

| Nominal length | Order No.* |
|---|---|
| 400mm | **311-332-33** |
| 700mm | **311-335-33** |
| 1000mm | **311-337-33** |
| 1300mm | **311-339-33** |

**Inch** Ultra-high accuracy model

| Nominal length | Order No.* |
|---|---|
| 16″ | **311-342-33** |
| 28″ | **311-345-33** |
| 40″ | **311-347-33** |
| 52″ | **311-349-33** |

| Straightness | Size (L x H x W) | Mass |
|---|---|---|
| 0.2μm | 440 x 35 x 50mm | 1.8kg |
| 0.4μm | 740 x 35 x 50mm | 3kg |
| 0.5μm | 1040 x 45 x 80mm | 8kg |
| 0.7μm | 1340 x 45 x 80mm | 10kg |

Double-faced type



### SPECIFICATIONS

**Metric**

| Nominal length | Order No.* |
|---|---|
| 400mm | **311-352-33** |
| 700mm | **311-355-33** |
| 1000mm | **311-357-33** |
| 1300mm | **311-359-33** |

**Inch** Double-faced model

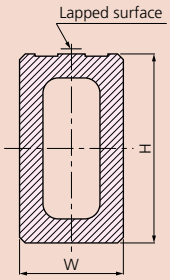
| Nominal length | Order No.* |
|---|---|
| 16″ | **311-362-33** |
| 28″ | **311-365-33** |
| 40″ | **311-367-33** |
| 52″ | **311-369-33** |

| Straightness | Size (L x H x W) | Mass |
|---|---|---|
| 0.3μm | 440 x 45 x 80mm | 3.2kg |
| 0.5μm | 740 x 45 x 80mm | 5.5kg |
| 1.0μm | 1040 x 45 x 80mm | 8kg |
| 1.5μm | 1340 x 45 x 80mm | 10kg |

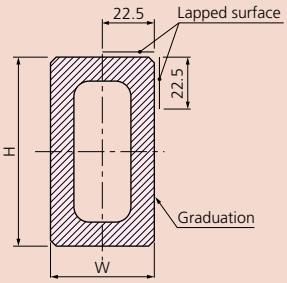
### Technical Data

Provided with inspection certificate.

### Cross section




### Double-faced type



# Square Master

## SERIES 311 — Squareness / Straightness Measuring Instrument

### Technical Data

| | |
|---|---|
| Squareness: | Refer to the list of specifications |
| Straightness: | Refer to the list of specifications |
| Dial test indicator provided | |
| Range: | 0.2mm |
| Graduation: | 0.002mm |
| Accuracy: | 3µm |

### FEATURES

- Squareness (perpendicularity) and straightness measurements can be performed accurately and efficiently by moving a lever.
- With a dial test indicator for reading displacements.
- Its own squareness is adjustable for high-accuracy measurement.



311-215



311-225



311-245

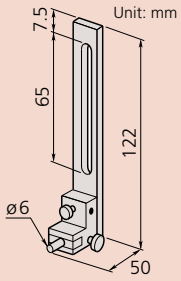
### Optional Accessory

| | |
|---|---|
| ———: | Riser blocks (see page E-27.)* |
| **900571**: | Adjustable holder |
| **900551**: | Extension holder |
| **900565**: | Feeler** |

*Not available for 450mm model.
**Adapter (**902803**) is required for metric model.

### Adjustable holder

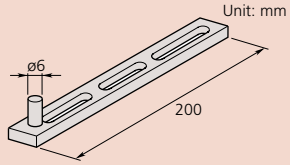
**No.900571**





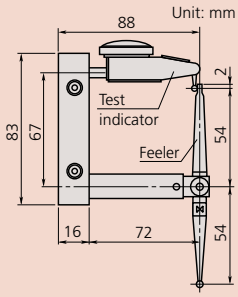

### Extension holder

**No.900551**




### Feeler

**No.900565**

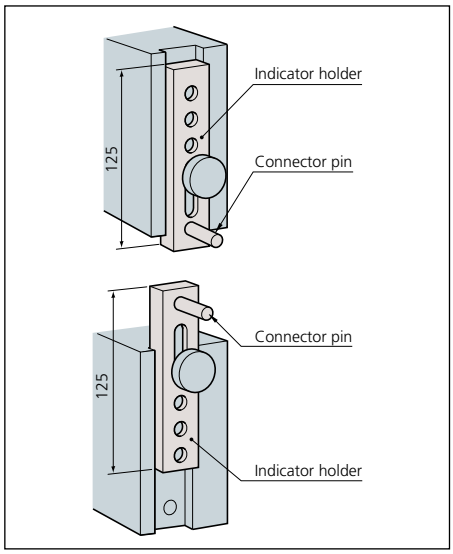





### SPECIFICATIONS

**Metric**

| Vertical travel | Order No. | Squareness | Straightness | Mass (kg) |
|---|---|---|---|---|
| 150mm | **311-215** | 3µm | 2µm | 13.7 |
| 250mm | **311-225** | 6µm | 2.5µm | 16.2 |
| 450mm | **311-245** | 9µm | 3.5µm | 24 |








Mitutoyo

# Standard Scales

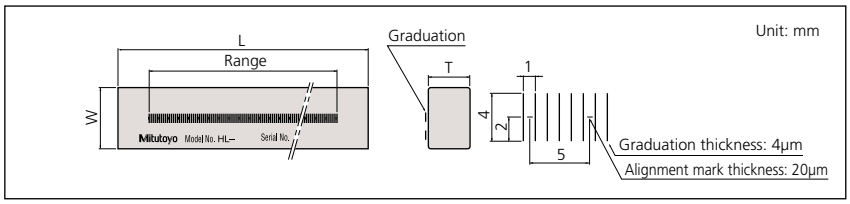
## SERIES 182 — Made of Low-Expansion Glass

### FEATURES

- High-precision glass scales manufactured under Mitutoyo's leading-edge Linear Scale production technology.
- High accuracy is guaranteed to be used as a standard for calibrating graduated scales.




### DIMENSIONS




### Technical Data

Accuracy (at 20°C): (0.5+L/1000)µm,
L = Measured length (mm)
Glass material: Low expansion glass
Thermal expansion coefficient: $8x10^{-8}$/K
Graduation: 1mm
Graduation thickness: 4µm
Mass: 0.75kg (250mm), 1.8kg (500mm)

### SPECIFICATIONS

**Metric**

| Range | Order No. | L | W | T |
|---|---|---|---|---|
| 250mm | **182-501-50** | 280mm | 20mm | 10mm |
| 250mm | **182-501-60*** | 280mm | 20mm | 10mm |
| 500mm | **182-502-50** | 530mm | 30mm | 20mm |
| 500mm | **182-502-60*** | 530mm | 30mm | 20mm |

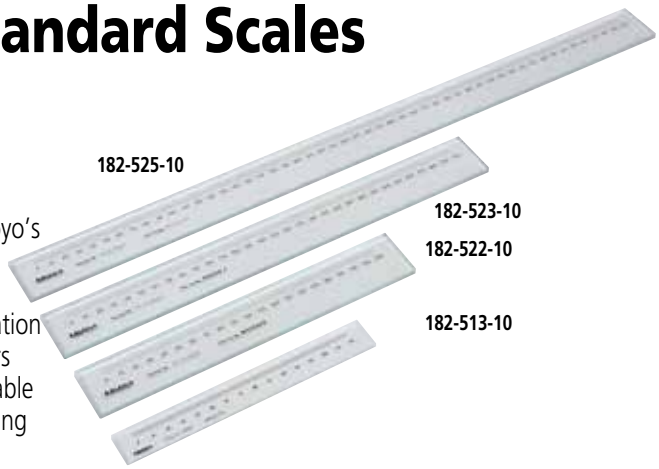
*with English JCSS certificate.

# Working Standard Scales

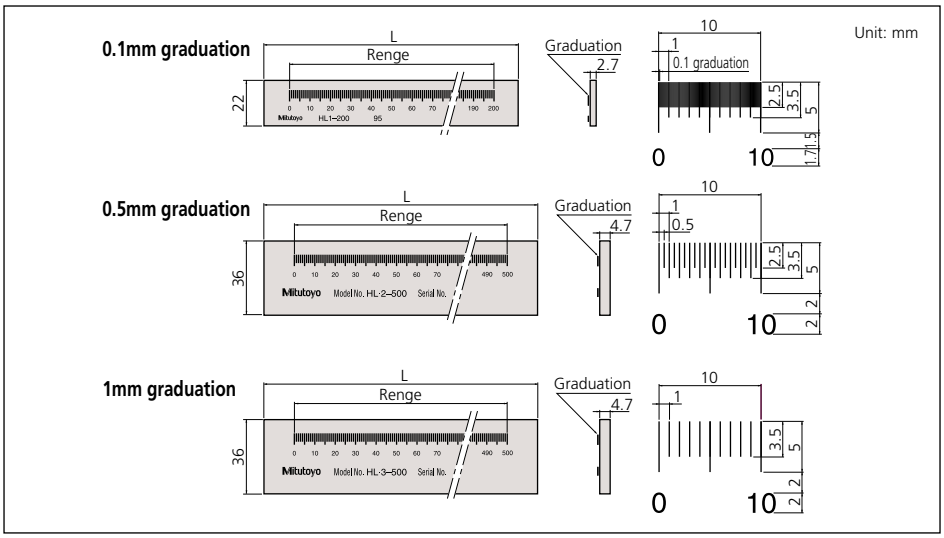
## SERIES 182

### FEATURES

- High-precision glass scales manufactured under Mitutoyo's leading-edge linear scale production technology.
- Ideal for checking magnification accuracy of profile projectors and microscopes, and the table feeding accuracy of measuring equipment.




### DIMENSIONS




### Technical Data

Accuracy (at 20°C): (1.5+2L/1000)µm,
L = Measured length (mm)
Glass material: Sodium glass
Thermal expansion coefficient: $8.5x10^{-6}$/K
Graduation: 0.1mm (thickness: 20µm)
0.5mm (thickness: 50µm)
1mm (thickness: 100µm)

### SPECIFICATIONS

**Metric**

| Range | Order No. | Graduation | L | Mass |
|---|---|---|---|---|
| 50mm | **182-511-10** | 0.1mm | 75mm | 0.23kg |
| 100mm | **182-512-10** | 0.1mm | 125mm | 0.24kg |
| 150mm | **182-513-10** | 0.1mm | 175mm | 0.35kg |
| 200mm | **182-514-10** | 0.1mm | 225mm | 0.36kg |
| 100mm | **182-521-10** | 0.5mm | 130mm | 0.27kg |
| 200mm | **182-522-10** | 0.5mm | 230mm | 0.32kg |
| 300mm | **182-523-10** | 0.5mm | 330mm | 0.57kg |
| 400mm | **182-524-10** | 0.5mm | 430mm | 0.71kg |
| 500mm | **182-525-10** | 0.5mm | 530mm | 0.86kg |
| 250mm | **182-531-10** | 1mm | 280mm | 0.55kg |
| 500mm | **182-532-10** | 1mm | 530mm | 0.86kg |
| 750mm | **182-533-10** | 1mm | 780mm | 1.22kg |
| 1000mm | **182-534-10** | 1mm | 1030mm | 1.54kg |

# High-Precision Square

## SERIES 311

### FEATURES

The High-Precision Square gage is used for inspecting the travel straightness and axial perpendicularity of moving elements on equipment, such as machine tools, CMMs, form measuring machines and semiconductor-related equipment.

- Four precision-lapped reference surfaces.
- Better than 1µm/300mm straightness and perpendicularity.



311-111



311-112



311-113

### SPECIFICATIONS

**Metric**

| Order No. | Dimension (W x L x T) | Mass |
|---|---|---|
| **311-111** | 90 x 110 x 25mm | 1.5kg |
| **311-112** | 160 x 210 x 25mm | 5.0kg |
| **311-113** | 260 x 310 x 30mm | 14.0kg |

* 311-113 is supplied with a removable handle.

# Spring Dividers and Calipers

## SERIES 950

### FEATURES

- Spring Divider — Fully hardened and tempered joints, spring, washers and divider points.
- Outside Spring Caliper — Contact ends fully rounded to give accurate dimensions.
- Inside Spring Caliper — Ends fully rounded to give accurate contact with a workpiece.



Spring divider



Outside spring calipers



Inside spring calipers

### SPECIFICATIONS

| Range | Order No. | | |
|---|---|---|---|
| | Spring divider | Outside spring calipers | Inside spring calipers |
| 6" (150mm) | **950-212** | **950-222** | **950-232** |
| 8" (200mm) | **950-213** | **950-223** | **950-233** |



Mitutoyo

# Steel Rules

## SERIES 182

### FEATURES

- Clear graduations on satin-chrome finish.
- Stainless tempered.



182-125

### SPECIFICATIONS

**Wide Rigid Rules (thickness 3/64")**

| Order No. | Size | Graduations | | | | Width | Accuracy (Length) |
|---|---|---|---|---|---|---|---|
| **182-101** | 6″(4R) | 1/8 | 1/16 | 1/32 | 1/64th | 3/4″ | |
| **182-102** | 6″(16R) | 1/32 | 1/64 | 1/50 | 1/100th | 3/4″ | |
| **182-103** | 6″(5R) | 1/32 | 1/64 | 1/10 | 1/100th | 3/4″ | |
| **182-104** | 6″(3R) | 1/32 | 1/64 | 1/10 | 1/50th | 3/4″ | +.004″ / –.0035″ |
| **182-105** | 6″ x 150mm | 1/32 | 1/64 | 1mm | 0.5mm | 3/4″ | (+0.1mm / –0.09mm) |
| **182-106** | 6″ x 150mm | 1/50 | 1/100 | 1mm | 0.5mm | 3/4″ | |
| **182-107** | 6″ x 150mm | 1/10 | 1/100 | 1mm | 0.5mm | 3/4″ | |
| **182-108** | 6″ x 150mm | 1/10 | 1/50 | 1mm | 0.5mm | 3/4″ | |
| **182-111** | 150mm | 1mm | 0.5mm | 1mm | 0.5mm | 19mm | |
| **182-121** | 12″(4R) | 1/8 | 1/16 | 1/32 | 1/64th | 1″ | |
| **182-122** | 12″(16R) | 1/32 | 1/64 | 1/50 | 1/100th | 1″ | |
| **182-123** | 12″(5R) | 1/32 | 1/64 | 1/10 | 1/100th | 1″ | +.005 / –.0035″ |
| **182-124** | 12″(3R) | 1/32 | 1/64 | 1/10 | 1/50th | 1″ | (+0.13mm / –0.09mm) |
| **182-125** | 12″ x 300mm | 1/32 | 1/64 | 1mm | 0.5mm | 1″ | |
| **182-126** | 12″ x 300mm | 1/50 | 1/100 | 1mm | 0.5mm | 1″ | |
| **182-131** | 300mm | 1mm | 0.5mm | 1mm | 0.5mm | 25mm | |
| **182-241** | 18″(4R) | 1/8 | 1/16 | 1/32 | 1/64 | 13/16″ | |
| **182-142** | 18″(16R) | 1/32 | 1/64 | 1/50 | 1/100th | 13/16″ | |
| **182-143** | 18″(5R) | 1/32 | 1/64 | 1/10 | 1/100th | 13/16″ | +.006" / -.035" |
| **182-145** | 18″ x 450mm | 1/32 | 1/64 | 1mm | 0.5mm | 13/16″ | (+0.15mm / -0.09mm) |
| **182-151** | 450mm | 1mm | 0.5mm | 1mm | 0.5mm | 30mm | |
| **182-161** | 24″(4R) | 1/8 | 1/16 | 1/32 | 1/64 | 13/16″ | |
| **182-162** | 24″(16R) | 1/32 | 1/64 | 1/50 | 1/100th | 13/16″ | |
| **182-163** | 24″(5R) | 1/32 | 1/64 | 1/10 | 1/100th | 13/16″ | +.007″ / –.0035″ |
| **182-165** | 24″ x 600mm | 1/32 | 1/64 | 1mm | 0.5mm | 13/16″ | (+0.18mm / –0.09mm) |
| **182-171** | 600mm | 1mm | 0.5mm | 1mm | 0.5mm | 30mm | |

# Steel Rules

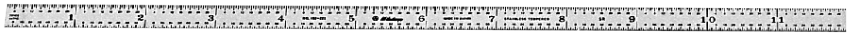
## SERIES 182

### FEATURES

- Clear graduations on satin-chrome finish.
- Stainless tempered.



182-265



182-223

### SPECIFICATIONS

**Full-Flexible Rules (thickness 1/64")**

| Order No. | Size | Graduations | | | | Width | Accuracy (Length) |
|---|---|---|---|---|---|---|---|
| **182-201** | 6″(4R) | 1/8 | 1/16 | 1/32 | 1/64th | 1/2″ | |
| **182-202** | 6″(16R) | 1/32 | 1/64 | 1/50 | 1/100th | 1/2″ | |
| **182-203** | 6″(5R) | 1/32 | 1/64 | 1/10 | 1/100th | 1/2″ | |
| **182-204** | 6″(3R) | 1/32 | 1/64 | 1/10 | 1/50th | 1/2″ | +.004″ / –.0035″ |
| **182-205** | 6″ x 150mm | 1/32 | 1/64 | 1mm | 0.5mm | 1/2″ | (+0.1mm / –0.09mm) |
| **182-206** | 6″ x 150mm | 1/50 | 1/100 | 1mm | 0.5mm | 1/2″ | |
| **182-207** | 6″ x 150mm | 1/10 | 1/100 | 1mm | 0.5mm | 1/2″ | |
| **182-208** | 6″ x 150mm | 1/10 | 1/50 | 1mm | 0.5mm | 1/2″ | |
| **182-211** | 150mm | 1mm | 0.5mm | 1mm | 0.5mm | 12mm | |
| **182-221** | 12″(4R) | 1/8 | 1/16 | 1/32 | 1/64th | 1/2″ | |
| **182-222** | 12″(16R) | 1/32 | 1/64 | 1/50 | 1/100th | 1/2″ | |
| **182-223** | 12″(5R) | 1/32 | 1/64 | 1/10 | 1/100th | 1/2″ | +.005″ / –.0035″ |
| **182-224** | 12″(3R) | 1/32 | 1/64 | 1/10 | 1/50th | 1/2″ | (+0.13mm / –0.09mm) |
| **182-225** | 12″ x 300mm | 1/32 | 1/64 | 1mm | 0.5mm | 1/2″ | |
| **182-226** | 12″ x 300mm | 1/50 | 1/100 | 1mm | 0.5mm | 1/2″ | |
| **182-231** | 300mm | 1mm | 0.5mm | 1mm | 0.5mm | 12mm | |
| **182-141** | 18″(4R) | 1/8 | 1/16 | 1/32 | 1/64 | 3/4″ | |
| **182-242** | 18″(16R) | 1/32 | 1/64 | 1/50 | 1/100th | 3/4″ | |
| **182-243** | 18″(5R) | 1/32 | 1/64 | 1/10 | 1/100th | 3/4″ | +.006″ / -.0035″ |
| **182-245** | 18″ x 450mm | 1/32 | 1/64 | 1mm | 0.5mm | 3/4″ | (+0.15mm / -0.09mm) |
| **182-251** | 450mm | 1mm | 0.5mm | 1mm | 0.5mm | 18mm | |
| **182-261** | 24″(4R) | 1/8 | 1/16 | 1/32 | 1/64 | 3/4″ | |
| **182-262** | 24″(16R) | 1/32 | 1/64 | 1/50 | 1/100th | 3/4″ | |
| **182-263** | 24″(5R) | 1/32 | 1/64 | 1/10 | 1/100th | 3/4″ | +.007″ / –.0035″ |
| **182-264** | 24″(3R) | 1/32 | 1/64 | 1/10 | 1/50th | 3/4″ | (+0.18mm / –0.09mm) |
| **182-265** | 24″ x 600mm | 1/32 | 1/64 | 1mm | 0.5mm | 3/4″ | |
| **182-271** | 600mm | 1mm | 0.5mm | 1mm | 0.5mm | 18mm | |

# Semi-Flexible Rules

## SERIES 182

### FEATURES

- Engraved on frontside only



### SPECIFICATIONS

**Inch/Metric**

| Order No. | Size | Graduations | | | | | Width | Accuracy (Length) |
|---|---|---|---|---|---|---|---|---|
| **182-301** | 4″ x 100mm | 1/2mm | 1mm | 1/32 | 1/64 | 1/16th | 5/8″ | +.004″ / –.0035″ |
| **182-302** | 6″ x 150mm | 1/2mm | 1mm | 1/32 | 1/64 | 1/16th | 5/8″ | (+0.1mm / –0.09mm) |
| **182-303** | 8″ x 200mm | 1/2mm | 1mm | 1/32 | 1/64 | 1/16th | 5/8″ | +.005″ / –.0035″ |
| **182-305** | 12″ x 300mm | 1/2mm | 1mm | 1/32 | 1/64 | 1/16th | 5/8″ | +0.13mm / –0.09mm) |
| **182-307** | 20″ x 500mm | 1/2mm | 1mm | 1/32 | 1/64 | 1/16th | 5/8″ | +.007″ / –.0035″ (+0.18mm / –0.09mm) |
| **182-309** | 40″ x 1000mm | 1/2mm | 1mm | 1/32 | 1/64 | 1/16th | 5/8″ | +.008″/–.004″ (+0.2mm / –0.1mm) |



Mitutoyo

# Thickness/Feeler Gages

## SERIES 950, 184

### FEATURES

- Each leaf is marked with its thickness.
- Each leaf is detachable.



184-303S

### SPECIFICATIONS

**Inch**

| Range | Order No. | Type of Blade | Blade Length | Composition of leaves |
|---|---|---|---|---|
| .0015" - .035" (26 leaves) | **950-251** | Straight 1/2" width | 3" | .002 thru .018" by .001" step plus .0015,.020 .022, .024, .025, .028, .030, .032" |
| .0015" - .025" (26 leaves) | **950-252** | Tapered 1/4" width at tip | 3" | .002 thru .025 by .001" step plus .0015, .0025" |
| .0015" - .200" (15 leaves) | **950-254** | Straight 1/2" width | 3" | .0015, .002, .003, .004, .006, .008, .010, .012, .015, .020, .030, .040, .075, .100, .200" |
| .0015" - .200" (13 leaves) | **950-255** | Straight 1/2" width | 4 .5" | .0015, .002, .003, .004, .006, .008, .010, .020, .030, .040, .075, .100, .200" |
| .0015" - .015" (9 leaves) | **950-256** | Straight 1/2" width | 6" | .0015, .002, .003, .004, .006, .008, .010, .012, .015" |

**Metric**

| Range | Order No. | Type of Blade | Blade Length | Composition of leaves |
|---|---|---|---|---|
| 0.05 - 1mm | **184-313S** | Straight 13mm width | 100mm | 28 leaves: 0.05 - 0.15mm by 0.01mm, 0.2 - 1mm by 0.05mm |
| | **184-303S** | | 150mm | 28 leaves: 0.05 - 0.15mm by 0.01mm, 0.2 - 1mm by 0.05mm |
| 0.05 - 1mm | **184-304S** | Straight 13mm width | 150mm | 20 leaves: 0.05 - 1mm by 0.05mm |
| 0.05 - 1mm | **184-305S** | Straight 13mm width | 100mm | 13 leaves: 0.05 - 0.3mm by 0.05mm, 0.4 - 1mm by 0.1mm |
| | **184-301S** | | 150mm | 13 leaves: 0.05 - 0.3mm by 0.05mm, 0.4 - 1mm by 0.1mm |
| 0.05 - 0.8mm | **184-306S** | Straight 13mm width | 100mm | 10 leaves: 0.05 - 0.2mm by 0.05mm, 0.3 - 0.8mm by 0.1mm |
| | **184-308S** | | 150mm | 10 leaves: 0.05 - 0.2mm by 0.05mm, 0.3 - 0.8mm by 0.1mm |
| 0.03 - 0.5mm | **184-307S** | Straight 13mm width | 100mm | 13 leaves: 0.03 - 0.1mm by 0.01mm, 0.2 - 0.5mm by 0.1mm, 0.15mm |
| | **184-302S** | | 150mm | 13 leaves: 0.03 - 0.1mm by 0.01mm, 0.2 - 0.5mm by 0.1mm, 0.15mm |

### Technical Data

Accuracy of Leaves Thickness

| **Nominal Thickness** | **Tolerance** |
|---|---|
| Metric | |
| 0.01mm to less than 0.06mm: | ±0.003mm |
| 0.06mm to less than 0.10mm: | ±0.004mm |
| 0.10mm to less than 0.35mm: | ±0.005mm |
| 0.35mm to less than 0.65mm: | ±0.008mm |
| 0.65mm to less than 3.0mm: | ±0.01mm |
| Inch | |
| .0015 to less than .007": | ±.0002" |
| .007 to less than .015": | ±.0003" |
| .015 to less than .025": | ±.0004" |
| .026 to less than .030": | ±.00045" |
| .031 to less than .040": | ±.0005" |
| .041 to less than .075": | ±.00055" |
| .076 to less than .100": | ±.0006" |
| .101 to less than .200": | ±.00065" |
| .200" and over : | ±.00075" |

# Precision Levels

## SERIES 960

### FEATURES

- High-precision longitudinal and transverse vials make it possible to check or level surfaces.
- Supplied in wooden box.

### SPECIFICATIONS

**Metric**

| Order No. | Sensitivity | Accuracy | Dimensions (W x D x H) |
|---|---|---|---|
| **960-703** | 0.02mm/m | ±0.006mm | 200 x 44 x 200mm |

**Inch**

| Order No. | Sensitivity | Accuracy | Dimensions | | |
|---|---|---|---|---|---|
| | | | W | D | H |
| **960-611** | .0012"/12" | ±.0006" | 7.87" | 1.73" | 1.50" |
| **960-612** | .0006"/12" | ±.0003" | 7.87" | 1.73" | 1.50" |
| **960-613** | .00024"/12" | ±.00017" | 7.87" | 1.73" | 1.50" |



960-703



960-611

### Wooden Box Part No.

| Part No. | Spare |
|---|---|
| 073112 | **960-703** |
| 063413 | **960-611** |
| | **960-611** |
| | **960-613** |

# Digital Universal Protractor

## SERIES 187

### Technical Data

| | |
|---|---|
| Range: | -360° to +360° |
| Tolerance: | ±2′ (±0.03°) |
| Repeatability: | 1′ |
| Resolution: | 1′ (0.01°) |
| Battery: | Lithium Battery |
| Battery life: | 2,000 hours |

### Function

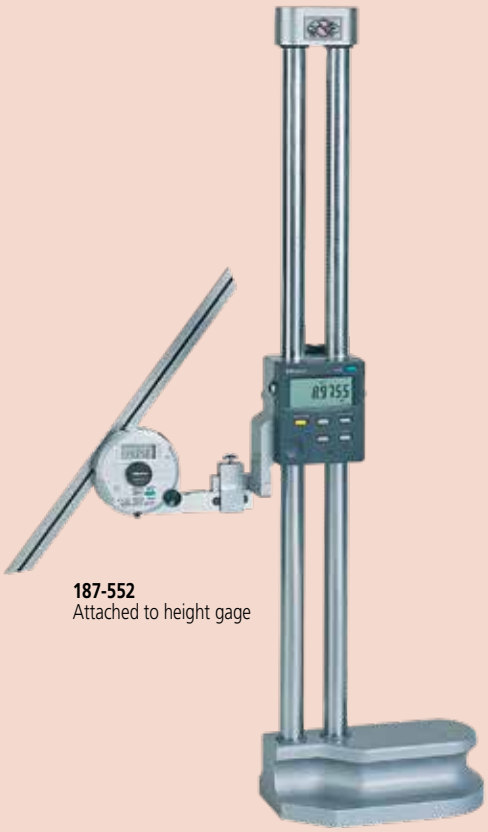
Presetting

### Standard Accessories

12" Blade (Code No. 187-103)
Battery (CR2032) (Part No. 05SAA217)
Clamp box for Inch Height Gage (Part No. 950749)
Plastic Case

### Optional Accessories

**187-104** 6" blade
**187-105** Acute angle attachment
**950750** Clamp box for Metric Height Gage
**905338** Connecting cable (40" / 1m)
**905409** Connecting cable (80" / 2m)



**187-552**
Attached to height gage

### FEATURES

- Data output function make it easy to see the statistical data.
- Can be attached to height gages. gage holder (950750, metric)
- Setting preset value.
- Removable blade.

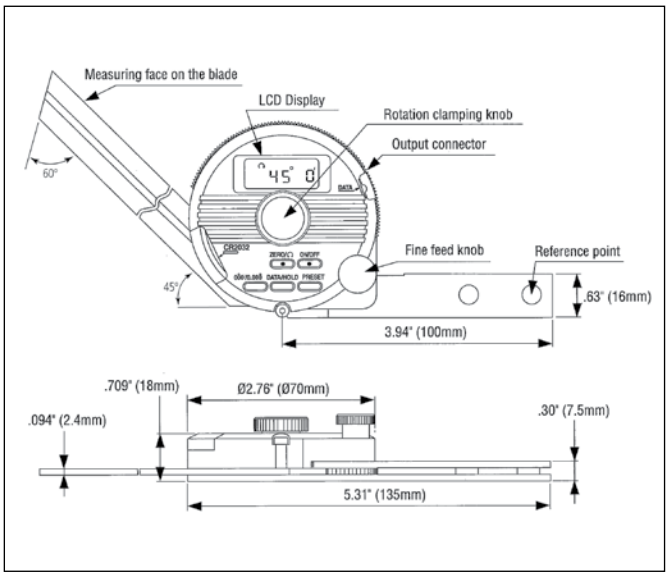


**187-552**

### SPECIFICATIONS

| Code No. | 187-552 |
|---|---|
| Model | BP-D300E |
| Blade | 12" (187-103) |
| Display | LCD - 5 digit, (-) sign, character height 6.5mm |
| Measuring range | -360° ~ +360° |
| Resolution | 1′ (0.01°) |
| Accuracy | ± 2′ (±0.03°) |
| Repeatability | 1′ (0.01°) |
| Mass | 1.45 lbs (659g) |
| Dust / Water protection level | IP40 |
| Function | Zero, Direction select, Data output / Data hold, Preset, Switchable Seagesimal or Decimal Natation |
| Max. response speed | 3 rps |
| Battery | Lithium battery (CR2032) 1 pc. (Part No. 05SAA217) |
| Battery life | 2,000 hours |
| Alarm | Battery voltage low, Over speed error (Err) |
| Temperature | Operation temperature: 0 to 40°C<br>Storage temperature: -10 to 60°C |

### DIMENSIONS

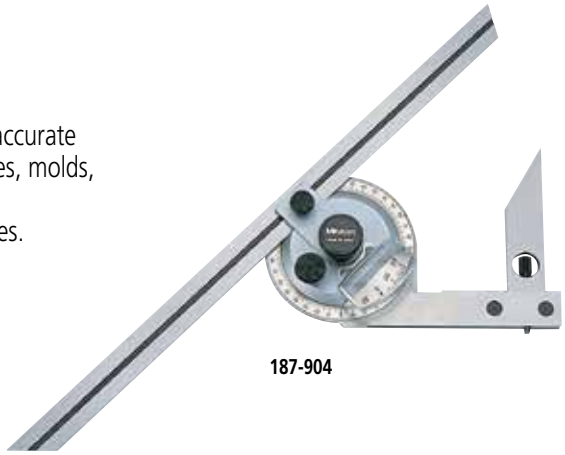


# Universal Bevel Protractor

## SERIES 187

### FEATURES

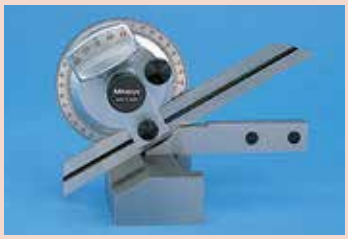
- High-precision angle gage for accurate angle measurement of machines, molds, and jigs.
- Can be attached to height gages.



187-904

### Technical Data

| | |
|---|---|
| Graduation: | 5min. (0˚ - 90˚ - 0˚) |
| Accuracy | |
| Vernier | ±5′ |
| Straightness | [.00016"+(.00005xL/2)]" |
| Parallelism | [.00016"+(.00005xL/2)]" |
| L = Length in inch | |
| Diameter: | 2.56" / 70mm |





### SPECIFICATIONS

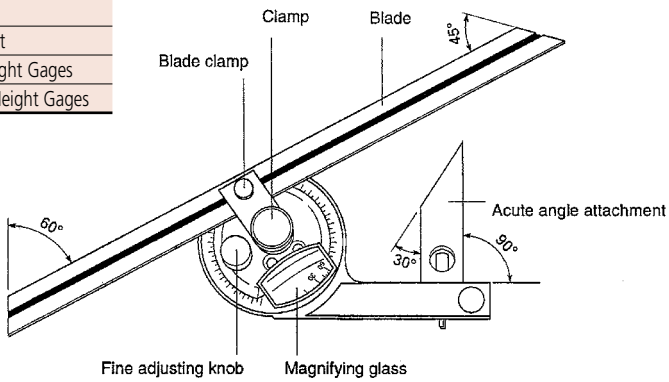
**Universal Bevel Protractors**

| | Graduation | | |
|---|---|---|---|
| **Order No.** | Dial | Vernier | Remarks |
| **187-904** | 1° | 5 min | with 6″ blade (**187-104**) and Clamp box for Inch Height Gages (**950749**) |
| **187-906** | 1° | 5min | with 12″ blade (**187-103**) and Clamp box for Inch Height Gages (**950749**) |

**Universal Bevel Protractor Accessories and Parts**

| Order No. | Remarks |
|---|---|
| **187-103** | 12″ Blade |
| **187-104** | 6″ Blade |
| **187-105** | Acute angle attachment |
| **950749** | Clamp box for Inch Height Gages |
| **950750** | Clamp box for Metric Height Gages |

### DIMENSIONS

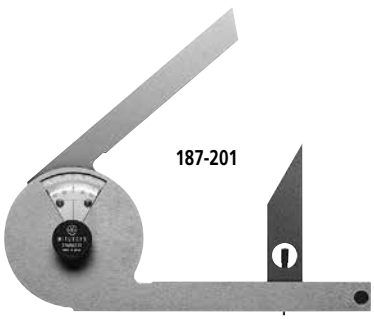



# Bevel Protractor

## SERIES 187

### FEATURES

- Consists of three sheets of stainless steel, the middle one of which is made for angle measurements.



187-201

### Technical Data

| | |
|---|---|
| Graduation: | 5 min. (0° - 90° - 0°) |
| Blade edge angle: | 30° and 60° |
| Diameter: | 2.56″ / 70mm |

### SPECIFICATIONS

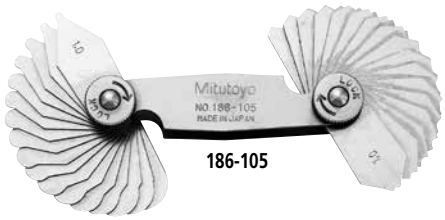
| Order No. | Graduation | Remarks |
|---|---|---|
| **187-201** | 1˚ / 5 min | Center black knob locks the blade position Protractor Graduation: 0°–90°, 90°–0° |

# Radius Gages

## SERIES 186

### FEATURES

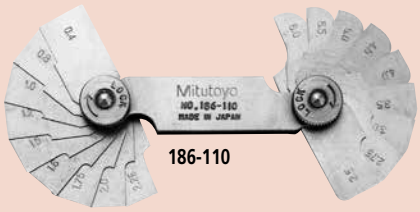
- Radius size is stamped on each gage.
- Both concave and convex radius gages become a pair.
- With a locking clamp.



186-105

### Technical Data

Accuracy: ±.002″



186-110

### SPECIFICATIONS

**Metric**

| Range | Order No. | Composition of leaves | Remarks |
|---|---|---|---|
| 0.4 - 6mm | **186-110** | 18 leaves: 0.4, 0.8, 1, 1.2, 1.5, 1.6mm, 1.75 - 3mm by 0.25mm, 3.5 - 6mm by 0.5mm | 90° arc |
| 1 - 7mm | **186-105** | 34 pairs: 1 - 3mm by 0.25mm 3.5 - 7mm by 0.5mm | 180° arc |
| 7.5 - 15mm | **186-106** | 32 pairs: 7.5 - 15mm by 0.5mm | 180° arc |
| 15.5 - 25mm | **186-107** | 15 pairs: 15.5 - 20mm by 0.5mm, 21 - 25mm by 1mm | 180° arc |

**Inch**

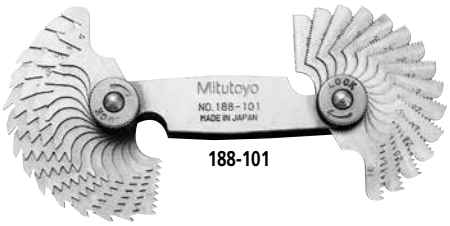
| Range | Order No. | Composition of leaves | Remarks |
|---|---|---|---|
| 1/32" - 17/64" | **186-103** | 16 leaves: 1/32" - 17/64" by 64ths | 90° arc |
| 1/32" - 1/4" | **186-101** | 15 pairs: 1/32" - 1/4" by 64ths | 180° arc |
| 17/64" - 1/2" | **186-102** | 16 pairs: 17/64" - 1/2" by 64ths | 180° arc |
| 9/32" - 33/64" | **186-104** | 16 leaves: 9/32" - 33/64" by 64ths | 90° arc |

# Pitch Gages

## SERIES 188, 950

### FEATURES

- Thread pitch size is stamped on each gage.
- Metric, Unified, and Whitworth screw pitch gages.



188-101

### Technical Data

| TPI | Metric | Accuracy | |
|---|---|---|---|
| | | Pitch (mm) | Angular ( minutes) |
| 4-6 | 6.35-4.23 | ±0.05 | ±35 |
| 7-12 | 3.63-2.12 | ±0.05 | ±40 |
| 13-25 | 1.95-1.02 | ±0.05 | ±45 |
| 26-48 | 0.98-0.53 | ±0.05 | ±50 |
| 60 | 0.42 | ±0.05 | ±60 |

### SPECIFICATIONS

**Metric Screw Pitch Gages (60˚)**

| Range | Order No. | Composition of leaves |
|---|---|---|
| 0.25 - 2.5mm | **188-153** | 28 leaves: 0.25, 0.30. 0.35, 0.40, 0.45, 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 1.00, 1.10, 1.20, 1.25, 1.30, 1.40, 1.50, 1.60, 1.70, 1.75, 1.80, 1.90, 2.00. 2.50 mm |
| 0.35 - 6mm | **188-130** | 22 leaves: 0.35, 0.4, 0.45, 0.5, 0.6, 0.7, 0.75, 0.8, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6mm and 60° angle gage |
| 0.4 - 7mm | **188-122** | 21 leaves: 0.4, 0.5, 0.7, 0.75, 0.8, 0.9, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7mm |
| 0.4 - 7mm | **188-121** | 18 leaves: 0.4, 0.5, 0.75, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7mm |

**Unified Screw Pitch Gages (60˚)**

| Range | Order No. | Composition of leaves |
|---|---|---|
| 4 - 42 TPI | **188-111** | 30 leaves: 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, 11½, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42 TPI |
| 4 - 84 TPI | **950-253** | 51 leaves: 4, 41/2, 5, 51/2, 6, 7, 8, 9, 10, 11, 111/2, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84 TPI |

Note: Metric and Unified Pitch Gage Set (**188-151**) is available. It consists of **188-122** (Metric) and **188-111** (Unified).

**Metric and Unified Screw Pitch Gage Set (60˚)**

| Range | Order No. | Composition of leaves |
|---|---|---|
| 0.4 - 7mm / 4 - 42 TPI | **188-151** | 51 leaves: Set of 188-122 and 188-111 |
| 0.5 - 6mm / 4 - 56 TPI | **188-152** | 28 leaves: 4, 6, 8, 10, 11, 11-1/2, 12, 13, 16, 20, 28, 32, 40, 56 TPI 0.50, 0.75, 1.00, 1.25, 1.50, 1.75, 2.00, 2.50, 3.00, 3.50, 4.00, 4.50, 5.00. 6.00 mm |

**Whitworth Screw Pitch Gages (55˚)**

| Range | Order No. | Composition of leaves |
|---|---|---|
| 4 - 42 TPI | **188-101** | 30 leaves: 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, 11½, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42 TPI |
| 4 - 60 TPI | **188-102** | 28 leaves: 4, 4½, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 34, 36, 40, 48, 60 TPI |

# Radius Gages-Sets

## SERIES 186

### FEATURES

Radius Gages are recommended for checking or laying out concave or convex radii. An individual gage for each dimension makes it possible to verify radius or fillet dimensions easier, faster and more accurately in machining, layout, inspection and pattern-making work. The measuring surfaces are precisely finished with smooth, accurate edges. Radius gages are available separately or in six sets. Each radius gage has five measuring locations, and it is identified with its particular radius dimensions. The gages have a satin or dull-chrome finish.

The holding cases, provided to protect the sets of radius gages, have indexed pockets to facilitate the selection of the proper size gage. A 4″ long holder is furnished with Set No. 186-901 to make it possible to check radii in confined or hard-to-reach locations.



**186-901**

### SPECIFICATIONS

**Metric**

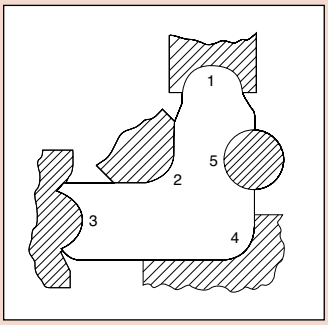
| Order No. | No. of Leaves | Sizes | Remarks |
|---|---|---|---|
| **186-902** | 26 | 0.5 - 13mm by 0.5mm | 90° arc |

**Inch**

| Order No. | No. of Leaves | Sizes | Remarks |
|---|---|---|---|
| **186-901** | 25 | 1/64″–17/64″ by 64ths and 9/32″–1/2″ by 32nds | Holder |
| **186-903** | 17 | 1/64″–17/64″ by 64ths | |
| **186-904** | 8 | 9/32″–1/2″ by 32nds | |
| **186-905** | 8 | 9/16″–1″ by 16ths | Holder |
| **186-906** | 26 | .010–.030″ by .005″<br>.040–.100″ by .010″<br>.120–.300″ by .020″<br>.350–.500″ by .050″ | Holder |
| **186-907** | 10 | .550–1″ by .050″ | |

Replacement handle: **950753**

Accuracy: ±.0016" / 0.04mm




5 concave and convex radii per leaf.

**Decimal**

| Radius | Part No. | Radius | Part No. |
|---|---|---|---|
| .010″ | **211798** | .240″ | **211816** |
| .015″ | **211799** | .260″ | **211817** |
| .020″ | **211800** | .280″ | **211818** |
| .025″ | **211801** | .300″ | **211819** |
| .030″ | **211802** | .350″ | **211820** |
| .040″ | **211803** | .400″ | **211821** |
| .050″ | **211804** | .450″ | **211822** |
| .060″ | **211805** | .500″ | **211823** |
| .070″ | **211806** | .550″ | **211824** |
| .080″ | **211807** | .600″ | **211825** |
| .090″ | **211808** | .650″ | **211826** |
| .100″ | **211809** | .700″ | **211827** |
| .120″ | **211810** | .750″ | **211828** |
| .140″ | **211811** | .800″ | **211829** |
| .160″ | **211812** | .850″ | **211830** |
| .180″ | **211813** | .900″ | **211831** |
| .200″ | **211814** | .950″ | **211832** |
| .220″ | **211815** | 1.000″ | **211833** |

**Fraction**

| Radius | Part No. | Radius | Part No. |
|---|---|---|---|
| 1/64″ | **201441** | 5/16″ | **201459** |
| 1/32″ | **201442** | 11/32″ | **201460** |
| 3/64″ | **201443** | 3/8″ | **201461** |
| 1/16″ | **201444** | 13/32″ | **201462** |
| 5/64″ | **201445** | 7/16″ | **201463** |
| 3/32″ | **201446** | 15/32″ | **201464** |
| 7/64″ | **201447** | 1/2″ | **201465** |
| 1/8″ | **201448** | 9/16″ | **211790** |
| 9/64″ | **201449** | 5/8″ | **211791** |
| 5/32″ | **201450** | 11/16″ | **211792** |
| 11/64″ | **201451** | 3/4″ | **211793** |
| 3/16″ | **201452** | 13/16″ | **211794** |
| 13/64″ | **201453** | 7/8″ | **211795** |
| 7/32″ | **201454** | 15/16″ | **211796** |
| 15/64″ | **201455** | 1″ | **211797** |
| 1/4″ | **201456** | | |
| 17/64″ | **201457** | | |
| 9/32″ | **201458** | | |

# Digital Protractor

## SERIES 950

### FEATURES

These digital protractors present inclination values on an easy-to-read LCD. The measurements are generated by an electronic gravity sensor and processed by the latest low-power electronic circuit technology.

- Full 360° range (90° x 4).
- Machined aluminum frame.
- Alternate reference (zero).
- Reading hold.
- Simple calibration requiring no special fixtures.
- Display remains upright to view at all angles. (950-317, Pro 360 Model).
- RS232C output. (950-318 Pro 3600 Model).
- Supplied in fitted carrying case.




Front View



950-317 Back View



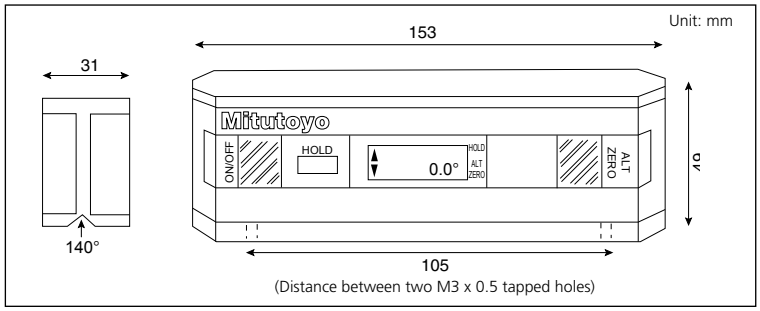
950-318 Back View

### SPECIFICATIONS

| Order No. | 950-317 | 950-318 |
|---|---|---|
| Model | Pro 360 | Pro 3600 |
| Range | 360° (90°x4) | 360° (90°x4) |
| Resolution | 0.1° | 0.01° (0° to 9.99°)<br>0.1° (10° to 90°) |
| Accuracy | ±0.1°Level ±10°, Plumb ±10°<br>±0.2° Maximum error | ±0.05° (0° to 10°)<br>±0.1° (80° to 90°)<br>±0.2° (10° to 80°) |
| Repeatability | ±0.1° | ±0.05° |
| Cross Axis Error | Minimal | Minimal |
| Battery Life | 500 Hrs. Standard 9-Volt Battery | 500 Hrs. Standard 9-Volt Battery |
| Temperature<br>Operation<br>Storage | -5°C to 50°C (23° to 122°F)<br>-20°C to 65°C (-4°F to 149°F) | -5°C to 50°C (23° to 122°F)<br>-20°C to 65°C (-4°F to 149°F) |
| Weight | 289g (10.2oz.) | 295g (10.4oz.) |
| Output | N/A | RS-232C Compatible |
| Standard Accessories | Plastic Case | Plastic Case |

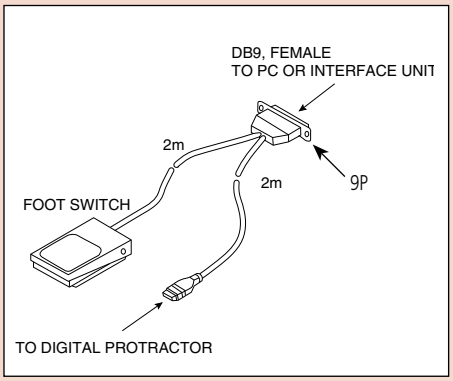
±Represents clockwise or counter-clockwise slope.

### DIMENSIONS




### Optional Accessories

**50AAA983A** RS-232C Output cable w/foot switch




**50AAA983A** RS-232C Output cable w/foot switch 10P-9P



Mitutoyo

# Digital Hand Tachometers

## SERIES 982

### FEATURES

- New digital hand tachometers are compact and easy to handle.
- NIST certification is supplied with each digital hand tachometer.
- Model PH-200LC (982-552) has laser diode detection and a combination of contact and non-contact measurement.
- Supplied with plastic carrying case.



982-551



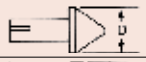
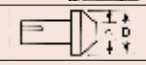
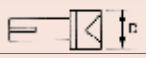
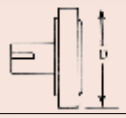
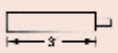
982-552




### SPECIFICATIONS

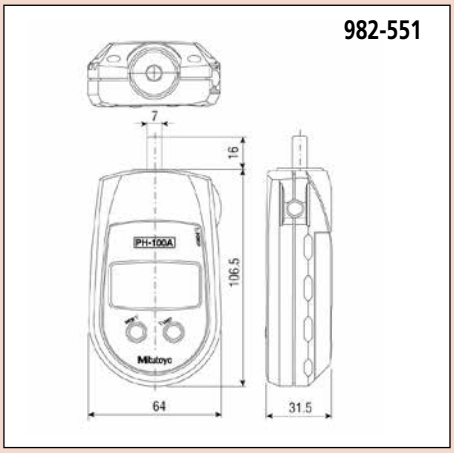
| Order No. | 982-551 | 982-552 |
|---|---|---|
| Model No. | PH-100A | PH-200LC |
| Revolution per minute | 1.0 – 25,000 rpm | — |
| Rotation speed | — | Non-contact: 6.0 – 99,999 rpm;<br>Contact: 6.0 – 25,000 rpm |
| Measuring accuracy<br>Revolution<br>Surface, Speed, Length | 1.0 – 599.9rpm: ±1rpm, 600.0 – 25,000 rpm:<br>±0.006% and ±0.5 digit<br>±0.4% and 1 digit | 6.0 – 599.9 rpm: ±1rpm, 600.0 – 99,999 rpm<br>±0.006% and ±0.5 digit<br>±0.4% and ±1 digit |
| Detection | Optical coupler, 20 pulses per revolution | Laser diode |
| Outside dimensions | 4.83″ L x 2.52″ W x 1.24″ H<br>(122.5mm x 64mm x 31.5mm) | 4.55″ L x 2.52″ W x 1.24″ H<br>Overall length with contact adapter: 149mm |
| Mass | 170 g | 160 g |
| Power | Battery: AA 3 pcs. | Battery: AA 3 pcs. |

### Optional Accessories for Digital Hand Tachometers

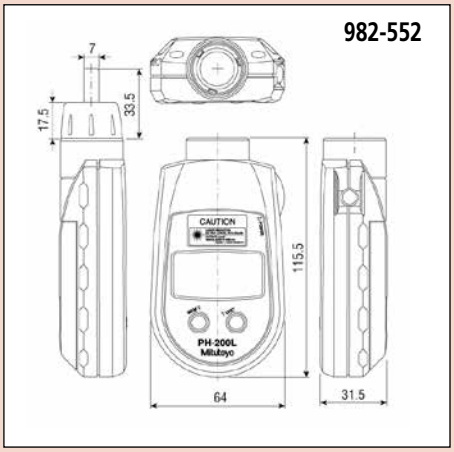
| Order No. | Description | Dimension | Drawing |
|---|---|---|---|
| **010049** | Cone Adapter, Standard | D = 1/2″ |  |
| **010051** | Cone Adapter, 3/4″ | D = 3/4″ | |
| **010052** | Cone Adapter, 1-1/4″ | D = 1-1/4″<br>d = 1/2″ |  |
| **010053** | Funnel Adapter, Standard | D = 1/2″ |  |
| **010054** | Funnel Adapter, 3/4″ | D = 3/4″ | |
| **010055** | Measuring Wheel FPM (6″ cir), Standard | D = 1.91″ |  |
| **010056** | Measuring Wheel FPM (12″ cir) | D = 3.82″ | |
| **010057** | Measuring Wheel YPM (0.1 yard cir) | D = 1.15″ | |
| **010058** | Measuring Wheel MPM (0.1 meter cir) | D = 1.25″ | |
| **010059** | Reflective Tabs 1/2″ square (35 pcs) | |  |
| **010060** | Extension Shaft (3″ length) | |  |

### DIMENSIONS

982-551




982-552



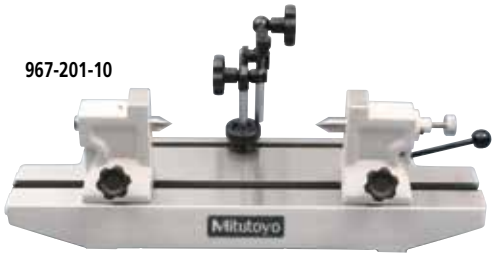
# Bench Center

## SERIES 967

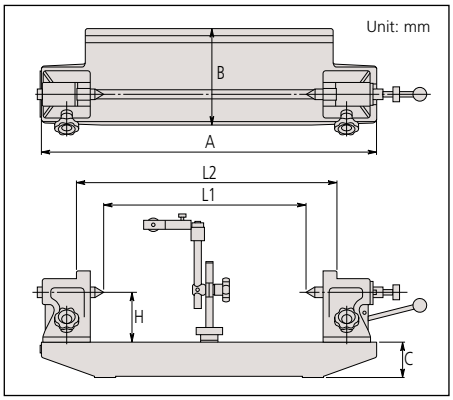
### Technical Data
Spindle tip material: Hardened Steel

### FEATURES
- Used with a dial test indicator (optional), the bench center provides precision measurement of concentricity verification on cylindrical workpieces.
- With an indicator clamp. (Holding stem diameter: 9.53mm / .375")

967-201-10




### DIMENSIONS




| Order No. | A | B | C | H | L1 | L2 |
|---|---|---|---|---|---|---|
| **967-203-10** | 310 | 113 | 40 | 50 | 150 | 220 |
| **967-201-10** | 500 | 144 | 55 | 75 | 300 | 400 |
| **967-204-10** | 700 | 202 | 80 | 100 | 450 | 590 |
| **967-202-10** | 900 | 222 | 100 | 125 | 600 | 730 |

### Standard Accessories:
**56AAK066** Indicator rod assembly
**967-201-10**
**967-203-10**

**56AAK961R** Indicator rod assembly
**967-202-10**
**967-204-10**

### Optional Accessories:
**56AAJ988** Special attachment for mounting **967-201-10** in vertical position.

**56AAJ987** Special attachment for mounting **967-203-10** in vertical position.

### SPECIFICATIONS

| Order No. | Center-to-Center | Workpiece Capacity Diameter | Max. Weight Hold | Parallelism of Centers | Flatness of Surface | Attachment Diameter | Mass (kg) |
|---|---|---|---|---|---|---|---|
| **967-203-10** | 5.9" / 150mm | 3.8" | 15.5lbs.(7kg) | .00024" | .0005" | 3/8", 8mm | 7 |
| **967-201-10** | 11.8" / 300mm | 5.8" | 35 lbs. (16kg) | .0004" | .0006" | 3/8", 8mm | 13 |
| **967-204-10** | 17.7" / 450mm | 7.8" | 44 lbs. (20kg) | .0004" | .0007" | 3/8", 8mm | 60 |
| **967-202-10** | 23.6" / 600mm | 9.8" | 66 lbs. (30kg) | .00047" | .00075" | 3/8", 8mm | 70 |

# Granite Surface Plate Accessories

## SERIES 517

These accessories are made from the same high-quality black granite as Mitutoyo surface plates, allowing flexibility in work holding and positioning.

### SPECIFICATIONS

**Angle Blocks** with or without inserts

| Grade | Laboratory* | | | Master** | | |
|---|---|---|---|---|---|---|
| | | 4 Face | | | 4 Face | |
| Size | 2 Face | no inserts | w/ inserts | 2 Face | no inserts | w/ inserts |
| 4 x 4 x 4" | **517-767** | **517-761** | **517-773** | **517-867** | **517-861** | **517-873** |
| 6 x 6 x 6" | **517-768** | **517-762** | **517-774** | **517-868** | **517862** | **517-874** |

*Laboratory overall accuracy: .000025" per 6".
**Master overall accuracy: .000050" per 6".

**Parallels**

| Grade | Laboratory | | | Master | | |
|---|---|---|---|---|---|---|
| Size | Pair Accuracy | 2 Face | 4 Face | Accuracy | 2 Face | 4 Face |
| .75 x 1 x 6" | .00003" | **517-755** | **517-750** | .00006" | **517-855** | **517-850** |
| .75 x 1.5 x 9" | .00004" | **517-756** | **517-751** | .00008" | **517-856** | **517-851** |
| 1 x 2 x 12" | .00006" | **517-757** | **517-752** | .0001" | **517-857** | **517-852** |

**V-Blocks** Matching Pair

V-1 type have matching accuracy on "V" from the bottom face only.
V-5 type have four face matching accuracy plus "V".

| Grade | Laboratory* | | Master** | |
|---|---|---|---|---|
| Size | V-1 | V-5 | V-1 | V-5 |
| 2 x 2 x 2.5" | **517-787** | **517-783** | **517-887** | **517-883** |
| 3 x 3 x 3" | **517-788** | **517-784** | **517-888** | **517-884** |
| 6 x 6 x 6" | **517-789** | **517-785** | **517-889** | **517-885** |

*Laboratory overall accuracy: .00005" per 6".
**Master overall accuracy: .0001" per 6

Angle Blocks



**517-862**
(without inserts)

**517-884** V-Blocks (matching pair)



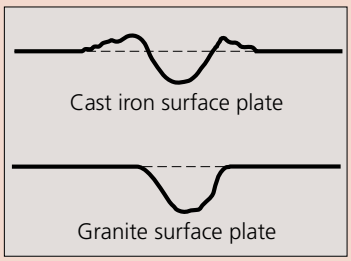
**517-852**
Parallels
(in pairs)

# Black Granite Surface Plate

## SERIES 517

### FEATURES

- Natural granite seasoned for thousands of years is free from deterioration or dimensional change over time.
- Granite surface plate has many advantages over cast iron surface plates:
  Twice as hard as cast iron.
  Minimal changes in dimension due to temperature changes.
  Free from wringing, so there is no interruption of work.
  Free from burrs or protrusions because of the fine grain structure and insignificant stickiness; this ensures a high degree of flatness over a long service life and causes no damage to other parts or instruments.
- Trouble-free operation for use with magnetic materials.
- Long life and rust-free, resulting in low maintenance costs.
- Mitutoyo granite surface plates meet or exceed federal specification GGG-P-463c. Each surface plate is shipped with a Certificate of Accuracy which guarantees its accuracy and verifies its traceability to NIST.
- All plates from 48"x108" and larger are machine base gray granite. Smaller plates are black granite.
- Surface plates, to size of specifications other than standard, available by special order.
- Surface plates, with the bolt screws, available by special order.
- All Mitutoyo surface plates shipped F.O.B. Escondido, CA.







### SPECIFICATIONS

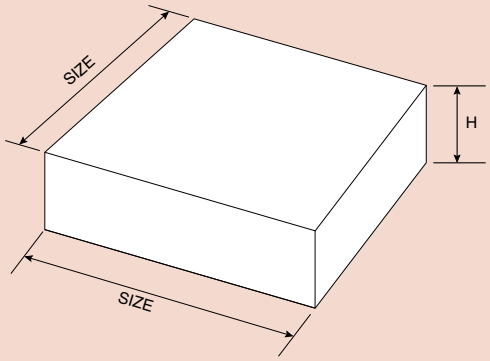
**Inch** 100 lbs.-Load / sq. ft. no ledge

| Size | AA Laboratory Grade | | | | A Inspection Grade | | | | B Shop Grade | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | Acc.* | **Order No.** | Wt. (lbs) | H | Acc.* | **Order No.** | Wt. (lbs) | H | Acc.* | **Order No.** | Wt. (lbs) |
| 8 x 12" | 3" | 50 | **517-700** | 30 | 2" | 100 | **517-800** | 25 | 2" | 200 | **517-900** | 25 |
| 9 x 12" | 3" | 50 | **517-701** | 40 | 3" | 100 | **517-801** | 40 | 2" | 200 | **517-901** | 30 |
| 12 x 12" | 3" | 50 | **517-702** | 50 | 3" | 100 | **517-802** | 50 | 3" | 200 | **517-902** | 50 |
| 12 x 18" | 4" | 50 | **517-703** | 100 | 4" | 100 | **517-803** | 100 | 4" | 200 | **517-903** | 100 |
| 18 x 18" | 4" | 50 | **517-704** | 150 | 4" | 100 | **517-804** | 150 | 3" | 200 | **517-904** | 100 |
| 18 x 24" | 4" | 65 | **5 17-705** | 200 | 4" | 130 | **517-805** | 200 | 4" | 260 | **517-905** | 200 |
| 24 x 24" | 5" | 70 | **517-706** | 310 | 4" | 140 | **517-806** | 259 | 3" | 280 | **517-906** | 200 |
| 24 x 30" | 5" | 75 | **517-707** | 400 | 5" | 150 | **517-807** | 400 | 4" | 300 | **517-907** | 300 |
| 24 x 36" | 6" | 85 | **517-708** | 600 | 5" | 170 | **517-808** | 500 | 4" | 340 | **517-908** | 400 |
| 24 x 48" | 8" | 150 | **517-709** | 1000 | 6" | 300 | **517-809** | 800 | 5" | 600 | **517-909** | 650 |
| 30 x 36" | 6" | 100 | **517-710** | 800 | 5" | 200 | **517-810** | 600 | 5" | 400 | **517-910** | 600 |
| 30 x 48" | 8" | 150 | **517-711** | 1300 | 6" | 300 | **517-811** | 1000 | 6" | 600 | **517-911** | 1000 |
| 30 x 60" | 12" | 200 | **517-712** | 1900 | 10" | 500 | **517-812** | 1535 | 8" | 1000 | **517-912** | 1150 |
| 36 x 36" | 6" | 100 | **517-713** | 900 | 5" | 200 | **517-813** | 780 | 5" | 400 | **517-913** | 700 |
| 36 x 48" | 8" | 150 | **517-714** | 1500 | 6" | 300 | **517-814** | 1200 | 6" | 600 | **517-914** | 1200 |
| 36 x 60" | 12" | 200 | **517-715** | 2850 | 10" | 400 | **517-815** | 2350 | 8" | 800 | **517-915** | 1900 |
| 36 x 72" | 12" | 250 | **517-716** | 3400 | 10" | 500 | **517-816** | 2850 | 8" | 1000 | **517-916** | 2300 |
| 48 x 48" | 8" | 200 | **517-717** | 2025 | 6" | 400 | **517-817** | 1525 | 6" | 800 | **517-917** | 1500 |
| 48 x 60" | 12" | 250 | **517-718** | 3800 | 10" | 500 | **517-818** | 3150 | 8" | 1000 | **517-918** | 2525 |
| 48 x 72" | 12" | 300 | **517-719** | 4500 | 10" | 600 | **517-819** | 3800 | 8" | 1200 | **517-919** | 3050 |
| 48 x 84" | 14" | 350 | **517-720** | 6150 | 12" | 700 | **517-820** | 5325 | 10" | 1400 | **517-920** | 4450 |
| 48 x 96" | 14" | 400 | **517-721** | 7000 | 12" | 800 | **517-821** | 6050 | 10" | 1600 | **517-921** | 5150 |
| 48 x 108" | 14" | 500 | **517-722** | 7900 | 12" | 1000 | **517-822** | 6830 | 10" | 2000 | **517-922** | 5700 |
| 48 x 120" | 18" | 700 | **517-723** | 11300 | 16" | 1400 | **517-823** | 10160 | 14" | 2800 | **517-923** | 8800 |
| 48 x 144" | 18" | 800 | **517-724** | 13500 | 16" | 1600 | **517-824** | 12200 | 14" | 3200 | **517-924** | 10500 |
| 60 x 60" | 14" | 250 | **517-725** | 5500 | 12" | 500 | **517-825** | 4800 | 10" | 1000 | **517-925** | 4000 |
| 60 x 72" | 14" | 350 | **517-726** | 6600 | 12" | 700 | **517-826** | 5750 | 10" | 1400 | **517-926** | 4900 |
| 60 x 96" | 14" | 500 | **517-727** | 8800 | 12" | 1000 | **517-827** | 7600 | 10" | 2000 | **517-927** | 6500 |
| 60 x 120" | 16" | 700 | **517-728** | 11050 | 14" | 1400 | **517-828** | 11100 | 12" | 2800 | **517-928** | 9800 |
| 60 x 144" | 18" | 900 | **517-729** | 16950 | 16" | 1800 | **517-829** | 15100 | 14" | 3600 | **517-929** | 14200 |
| 72 x 72" | 14" | 400 | **517-730** | 8000 | 12" | 800 | **517-830** | 7000 | 10" | 1600 | **517-930** | 5700 |
| 72 x 96" | 16" | 500 | **517-731** | 12025 | 14" | 1000 | **517-831** | 10800 | 12" | 2000 | **517-931** | 9200 |
| 72 x 120" | 16" | 700 | **517-732** | 15070 | 14" | 1400 | **517-832** | 13400 | 12" | 2800 | **517-932** | 11400 |
| 72 x 144" | 18" | 1000 | **517-733** | 20300 | 16" | 2000 | **517-833** | 18100 | 14" | 4000 | **517-933** | 15900 |

* Accuracies shown in microinches (µin)

# Black Granite Surface Plate

## SERIES 517




**Inch** 50 lbs.-Load / sq. ft. no ledge

| Size | AA Laboratory Grade | | | | A Inspection Grade | | | | B Shop Grade | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | Acc. | **Order No.** | Wt. | H | Acc. | **Order No.** | Wt. | H | Acc. | **Order No.** | Wt. |
| 8 x 12″ | 2″ | 50 | **517-740** | 25 | 2″ | 100 | **517-840** | 25 | 2″ | 200 | **517-940** | 25 |
| 12 x 18″ | 3″ | 50 | **517-741** | 80 | 3″ | 100 | **517-841** | 80 | 2″ | 200 | **517-941** | 60 |
| 18 x 24″ | 4″ | 65 | **517-742** | 200 | 3″ | 130 | **517-842** | 165 | 2″ | 260 | **517-942** | 100 |
| 24 x 36″ | 5″ | 85 | **517-743** | 500 | 4″ | 170 | **517-843** | 400 | 3″ | 340 | **517-943** | 300 |
| 36 x 48″ | 6″ | 150 | **517-746** | 1200 | 5″ | 300 | **517-846** | 1000 | 4″ | 600 | **517-946** | 800 |

# Steel Stands

## SERIES 517

Steel stands for supporting black granite surface plates, at working levels, are available either stationary or with casters. Sizes and weights are given below.

### SPECIFICATIONS

| Size | Stationary | | With Casters | |
|---|---|---|---|---|
| | **Order No.** | Wt. | **Order No.** | Wt. |
| 12 x 18″ | **517-950** | 42lbs | **517-950-1** | 46lbs |
| 18 x 18″ | **517-951** | 46lbs | **517-951-1** | 50lbs |
| 18 x 24″ | **517-952** | 50lbs | **517-952-1** | 56lbs |
| 24 x 24″ | **517-954** | 65lbs | **517-954-1** | 69lbs |
| 24 x 30″ | **517-955** | 70lbs | **517-955-1** | 74lbs |
| 24 x 36″ | **517-956** | 73lbs | **517-956-1** | 77lbs |
| 24 x 48″ | **517-957** | 90lbs | **517-957-1** | 94lbs |
| 30 x 36″ | **517-960** | 85lbs | **517-960-1** | 89lbs |
| 30 x 48″ | **517-961** | 95lbs | **517-961-1** | 99lbs |
| 30 x 60″ | **517-962** | 105lbs | **517-962-1** | 109lbs |
| 36 x 36″ | **517-963** | 95lbs | **517-963-1** | 99lbs |
| 36 x 48″ | **517-964** | 105lbs | **517-964-1** | 109lbs |
| 36 x 60″ | **517-965** | 160lbs | **517-965-1** | 164lbs |
| 36 x 72″ | **517-966** | 180lbs | **517-966-1** | 184lbs |
| 48 x 48″ | **517-967** | 190lbs | **517-967-1** | 194lbs |
| 48 x 60″ | **517-968** | 200lbs | **517-968-1** | 204lbs |
| 48 x 72″ | **517-969** | 205lbs | **517-969-1** | 209lbs |
| 48 x 84″ | **517-970** | 320lbs | **517-970-1** | 324lbs |
| 48 x 96″ | **517-971** | 335lbs | **517-971-1** | 339lbs |
| 48 x 108″ | **517-972** | 350lbs | **517-972-1** | 354lbs |
| 48 x 120″ | **517-973** | 365lbs | **517-973-1** | 369lbs |
| 48 x 144″ | **517-974** | 430lbs | **517-974-1** | 434lbs |
| 60 x 60″ | **517-975** | 245lbs | | |
| 60 x 72″ | **517-976** | 340lbs | | |
| 60 x 96″ | **517-977** | 375lbs | | |
| 60 x 120″ | **517-978** | 455lbs | | |
| 60 x 144″ | **517-979** | 480lbs | | |
| 72 x 72″ | **517-980** | 380lbs | | |
| 72 x 96″ | **517-981** | 465lbs | | |
| 72 x 120″ | **517-982** | 510lbs | | |
| 72 x 144″ | **517-983** | 530lbs | | |

48x72 and smaller include keepers to prevent the surface plate from being pushed off the stand.

Note: Stands can only be purchased with granite surface plates. Working height is 36″ unless otherwise specified.



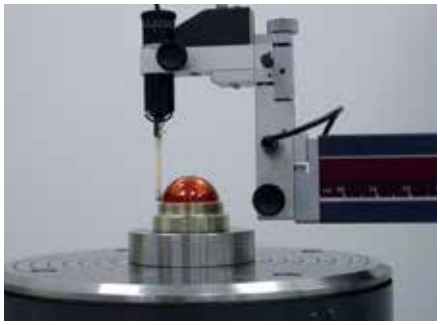


Mitutoyo

# MITUTOYO CALIBRATION SERVICES







Mitutoyo America has expanded three-dimensional calibration and inspection services at our new precision measurement facility located in our corporate headquarters in Aurora, IL. Equipped with multiple Mitutoyo Legex CMMs, along with high-accuracy vision and form measuring instruments, our laboratory offers accredited dimensional measurement services with uncertainty as low as 0.25 µm (10 µinches). And for form measurement, our uncertainty goes as low as 5 nanometers (0.2 µinches).

Our experienced staff is ready for your challenges – we specialize in specialty gage calibration, complex prototype or master parts, specialty and custom-built 3D gages, and long length standards such as ball bars, step gages and gage blocks. We can also assist you in the validation of your measurement processes by providing accredited reference values on your parts.

Mitutoyo America calibration and inspection services are accredited to ISO/IEC 17025 by A2LA (Certificate 0750.01). We welcome customer tours of our laboratory.

If you have any questions or would like more information regarding Mitutoyo Calibration Services, contact: **mim@mitutoyo.com**

Mitutoyo
CALIBRATION
SERVICES






**Digimatic Indicators**



**Dial Indicators**



**Dial Test Indicators**



**Dial Indicator Applications and Stands**




## INDEX


| | |
|---|---|
| **Digimatic Indicators** | |
| ABSOLUTE Solar Digimatic Indicator ID-S | F-2,3 |
| ABSOLUTE Digimatic Indicator ID-U | F-4 |
| ABSOLUTE Digimatic Indicator ID-C | F-5,6 |
| ABSOLUTE Digimatic Indicator ID-C Calculation Type | F-7 |
| ABSOLUTE Digimatic Indicator ID-C With Max./ Min. Value Holding Function | F-8 |
| ABSOLUTE Digimatic Indicator ID-C Specially Designed for Bore Gage Application | F-9 |
| ABSOLUTE Digimatic Indicator ID-C With Green/Red LED and Go/No-go Signal Output Function | F-10 |
| ABSOLUTE Digimatic Indicator ID-H | F-11 |
| ABSOLUTE Digimatic Indicator ID-F | F-12 |
| ABSOLUTE Digimatic Indicator ID-N / B | F-13 |
| EC Counter | F-14 |
| **Dial Indicators** | F-15-21, 23-30 |
| Special Dial Indicators | F-22 |
| Back Plunger Dial Indicators | F-31,32 |
| Backs | F-33 |
| Contact Points | F-34,35 |
| Spindle Lifting Lever and Cable | F-36 |
| Color Spindle Caps | F-37 |
| Limit Stickers | F-37 |
| Dial Indicator Repair Tool Kit | F-38 |
| Dial Crystal Setter | F-38 |
| **Dial Test Indicators** | F-39-43 |
| Pocket Dial Test Indicators | F-44,45 |
| Dial Test Indicators | F-46 |
| Contact Points and Clamp Holders | F-47 |
| Dial Indicator Applications | |
| i-Checker | F-48 |
| UDT-2 Dial Gage Testers | F-49 |
| Calibration Testers | F-49 |
| Thickness Gages | F-50-52 |
| Quick-Mini | F-53 |
| Digimatic Caliper Gages | F-54,55 |
| Dial Caliper Gages | F-56,57 |
| Dial Tension Gages | F-58 |
| V-Block Sets | F-58 |
| Magnetic V-Block | F-58 |
| Dial Snap Gages | F-59 |
| **Stands** | |
| Dial/Test Indicator & Magnetic Stand Sets | F-60 |
| Magnetic Stands | F-60 |
| Dial Gage Stands | F-61 |
| Transfer Stands | F-62 |
| Granite Comparator Stands | F-63 |
| Comparator Stands | F-64 |
| Precision Granite Stands | F-65 |

# ABSOLUTE Solar Digimatic Indicator ID-S

## 543 Series – With Simple Design

### FEATURES

- Mitutoyo's unique ABSOLUTE sensor automatically restores the last origin position when the indicator is turned on. This allows quick-start operation, which is particularly useful in multipoint measurement.
- Measurement tool with a solar power source. Ready for use from 40 lux illumination.
- Similar in size to Series 2 dial indicators.
- SPC output provided.
- Two large buttons (three on inch/mm models) improve functionality.

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo guarantees the product quality.



**543-502B**
ID-S112ESB



**543-500**
ID-S112S

### SPECIFICATIONS

**Inch/Metric** with 3/8" dia. Stem, #4-48UNF Thread

| Order | Model | Range | Resolution | Accuracy | Stem Diameter | Measuring Force | Back Type |
|---|---|---|---|---|---|---|---|
| **543-502** | ID-S112ES | .5"/12.7mm | .00005"/0.001mm | .0001"/0.003mm | 3/8" (ANSI/AGD) | 1.5N or less | Lug Back |
| **543-502B** | ID-S112ESB | .5"/12.7mm | .00005"/0.001mm | .0001"/0.003mm | 3/8" (ANSI/AGD) | 1.5N or less | Flat Back |
| **543-507** | ID-S1012ES | .5"/12.7mm | .0005"/0.01mm | .001"/0.02mm | 3/8" (ANSI/AGD) | 1.5N or less | Lug Back |
| **543-507B** | ID-S1012ESB | .5"/12.7mm | .0005"/0.01mm | .001"/0.02mm | 3/8" (ANSI/AGD) | 1.5N or less | Flat Back |

**Metric** with 8mm dia. Stem, M2.5x.45 Thread

| Order | Model | Range | Resolution | Accuracy | Stem Diameter | Measuring Force | Back Type |
|---|---|---|---|---|---|---|---|
| **543-500** | ID-S112S | 12.7mm | 0.001mm | 0.003mm | 8mm (ISO) | 1.5N or less | Lug Back |
| **543-500B** | ID-S112SB | 12.7mm | 0.001mm | 0.003mm | 8mm (ISO) | 1.5N or less | Flat Back |
| **543-505** | ID-S1012S | 12.7mm | 0.01mm | 0.02mm | 8mm (ISO) | 1.5N or less | Lug Back |
| **543-505B** | ID-S1012SB | 12.7mm | 0.01mm | 0.02mm | 8mm (ISO) | 1.5N or less | Flat Back |

**Inch/Metric** with 8mm dia. Stem, M2.5x.45 Thread

| Order | Model | Range | Resolution | Accuracy | Stem Diameter | Measuring Force | Back Type |
|---|---|---|---|---|---|---|---|
| **543-501** | ID-S112MS | .5"/12.7mm | .00005"/0.001mm | .0001"/0.003mm | 8mm (ISO) | 1.5N or less | Lug Back |
| **543-501B** | ID-S112MSB | .5"/12.7mm | .00005"/0.001mm | .0001"/0.003mm | 8mm (ISO) | 1.5N or less | Flat Back |
| **543-506** | ID-S1012MS | .5"/12.7mm | .0005"/0.01mm | .001"/0.02mm | 8mm (ISO) | 1.5N or less | Lug Back |
| **543-506B** | ID-S1012MSB | .5"/12.7mm | .0005"/0.01mm | .001"/0.02mm | 8mm (ISO) | 1.5N or less | Flat Back |

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.01mm, 0.001mm, .00005"/0.001mm, or .0005"/0.01mm
Display: LCD
Length Standard: ABSOLUTE electrostatic capacitance-type linear encoder
Max. Response Speed: Unlimited
Measuring Force: Refer to the list of specifications
Battery: Solar Battery*
Dust/Water Protection Level: IP42
*Can be used continuously above 40 lux

### Function

Origin Set, Counting Direction Switching, in/mm conversion

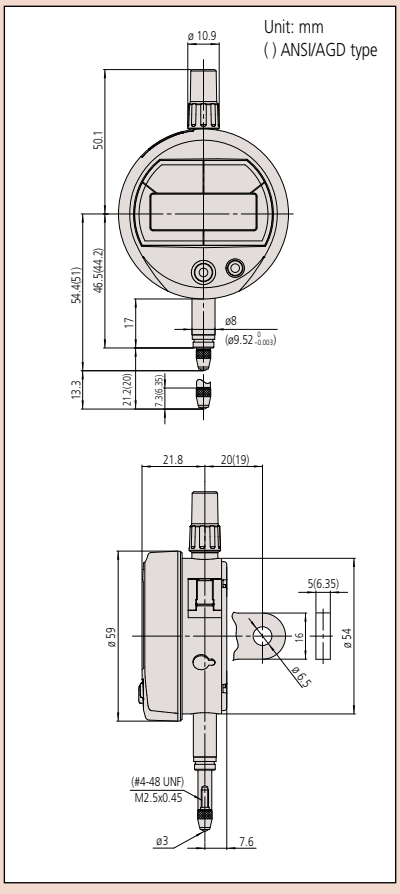
### Optional Accessories

| | |
|---|---|
| **21EZA198** | Lifting lever (mm) |
| **21EZA199** | Lifting lever (inch) |
| **540774** | Lifting cable |
| **21EZA105** | Lifting knob (mm) |
| **21EZA150** | Lifting knob (inch) |
| **905338** | SPC cable (1m) |
| **905409** | SPC cable (2m) |
| ———: | Backs (See page F-33.) |
| ———: | Contact points (See page F-34.) |

### About the charge function:

Reserve capacity allows a fully charged ID-S Solar to be used for about 3.5 hours under light conditions below the minimum level. The charging time differs depending on the environment, but it usually takes about 1.5 hours for a fully discharged ID-S Solar to fully recharge under light conditions of 500 lux.

### DIMENSIONS



# ABSOLUTE Digimatic Indicator ID-S

## SERIES 543 — with Simple Design

SPC

ABSOLUTE®
Absolute System Patented by MITUTOYO

PROPRIETARY INSPECTION CERTIFICATE
Mitutoyo guarantees the product quality.

## FEATURES

- After the initial zero-setting with the Origin button, the repeated absolute positioning is no longer necessary over entire battery life.
- Unlimited response speed eliminates over-speed errors
- Similar in size to standard Series 2 dial indicators.
- SPC data output.



543-782B



543-792B

## Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.01mm, 0.001mm, .0005"/0.01mm, .0001"/0.001mm or .00005"/0.001mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance-type linear encoder
Max. response speed: Unlimited
Measuring force: Refer to the list of specifications
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 20,000 hours under normal use
Dust/Water protection level: IP42 (IP53: **543-794B**, **543-795B**, **543-796B**)
Inspection certificate is included.

## Function

Origin-set, Zeroset, Counting direction switching, Power ON/OFF, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error, Over-flow error

## Optional Accessories

**905338:** SPC cable (40" / 1m)
**905409:** SPC cable (80" / 2m)
**21EZA198:** Spindle lifting lever (ISO/JIS type)
**21EZA199:** Spindle lifting lever (ANSI/AGD type)
**540774:** Spindle lifting cable (stroke: .4" / 10mm)
**21EZA105** Lifting knob (mm)
**21EZA150** Lifting knob (inch)
**125317:** Spare rubber boot (for dust-proof type)
**———:** Backs (See page F-33.)
**———:** Contact points (See page F-34.)

## SPECIFICATIONS

**Inch/Metric** Stem dia. 3/8", #4-48 UNF Thread — ISO/JIS type — ANSI/AGD type

| Resolution | Range | Order No. | | Model | Accuracy | Measuring force | Remarks |
|---|---|---|---|---|---|---|---|
| | | w/ lug back | w/ flat-back | | | | |
| .00005"/0.001mm | .5" / 12.7mm | **543-792** | **543-792B** | ID-S112EX | ±.0001" | 1.5N or less | — |
| .00005"/0.001mm | .5" / 12.7mm | **543-796** | **543-796B** | ID-S112PEX | ±.0001" | 2.5N | Dust-proof |
| .0001"/0.001mm | .5" / 12.7mm | **543-793** | **543-793B** | ID-S112TX | ±.0001" | 1.5N or less | — |
| .0005"/0.01mm | .5" / 12.7mm | **543-783** | **543-783B** | ID-S1012EX | ±.0010" | 1.5N or less | — |

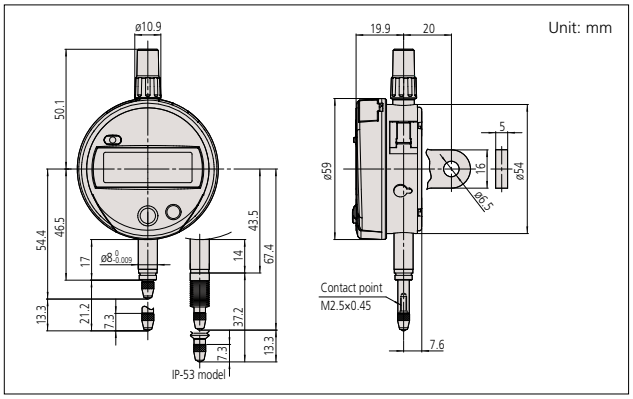
**Inch/Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. | | Model | Accuracy | Measuring force | Remarks |
|---|---|---|---|---|---|---|---|
| | | w/ lug back | w/ flat-back | | | | |
| .00005"/0.001mm | .5" / 12.7mm | **543-791** | **543-791B** | ID-S112MX | ±.0001" | 1.5N or less | — |
| .00005"/0.001mm | .5" / 12.7mm | **543-795** | **543-795B** | ID-S112PMX | ±.0001" | 2.5N or less | Dust-proof |
| .0005"/0.01mm | .5" / 12.7mm | **543-782** | **543-782B** | ID-S1012MX | ±.0008" | 1.5N or less | — |

**Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. | | Model | Accuracy | Measuring force | Remarks |
|---|---|---|---|---|---|---|---|
| | | w/ lug back | w/ flat-back | | | | |
| 0.001mm | 12.7mm | **543-790** | **543-790B** | ID-S112X | 0.003mm | 1.5N or less | — |
| 0.001mm | 12.7mm | **543-794** | **543-794B** | ID-S112PX | 0.003mm | 2.5N or less | Dust-proof |
| 0.01mm | 12.7mm | **543-781** | **543-781B** | ID-S1012X | 0.02mm | 1.5N or less | — |

## DIMENSIONS




Note 1: Dimensions of the inch (ANSI/AGD Type) dial indicator partly differ from those of the metric (ISO/JIS Type) indicator.
Note 2: Inch (ANSI/AGD Type) dial indicators are provided with a stem of 3/8" dia. and #4-48UNF thread mount for the contact point.



Mitutoyo

# ABSOLUTE Digimatic Indicator ID-U

## SERIES 575 — With Slim and Simple Design

### FEATURES

- Slim digital indicator with low price.
- Large LCD and simple key operation.
- After the initial origin setting, the ID-U no longer needs absolute positioning over entire battery life; the origin is remembered even after power-off.
- Ideal for installation into measuring devices because of compact design and long battery life.
- Employing the ABSOLUTE linear encoder, the ID-U always displays the spindle "Absolute Position" from the origin at power-on. Also unlimited response speed eliminates over-speed errors.
- Flat back type only has no option for backs.
- SPC data output.



575-121

IP42



575-123

SPC

ABSOLUTE®
Absolute System Patented by MITUTOYO

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.01mm or .0005"/0.01mm,
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Measuring force: Refer to the list of specifications
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 20,000 hours under normal use
Dust/Water protection level: IP42

### Function

Origin-set, Zeroset, Counting direction switching, Power ON/OFF, Data output,
inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error, Over-flow error

### Optional Accessories

**905338**: SPC cable (40" / 1m)
**905409**: SPC cable (80" / 2m)
**540774**: Spindle lifting cable (stroke: .4" / 10mm)
———: Contact points (See page F-34.)

### SPECIFICATIONS

**Inch/Metric** Stem dia. 3/8", #4-48 UNF Thread — ISO/JIS type — ANSI/AGD type

| Resolution | Range | Order No. | Model | Accuracy | Measuring force |
|---|---|---|---|---|---|
| .0005"/0.01mm | 1" / 25.4mm | **575-123** | ID-U1025E | .0008" | 1.8N or less |

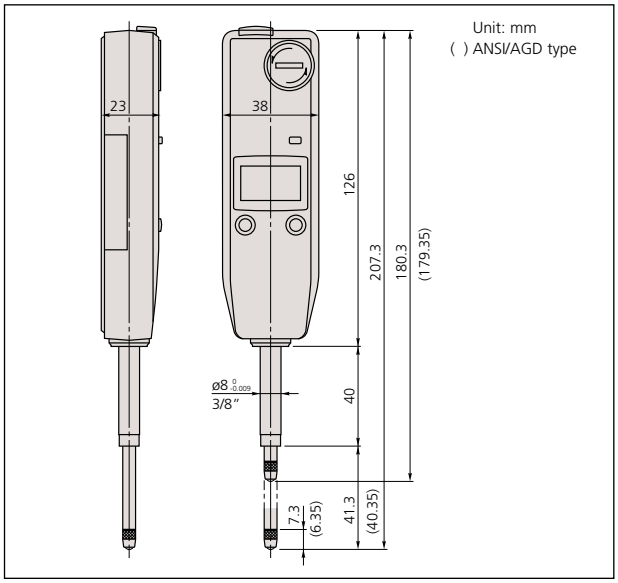
**Inch/Metric** Stem ø 8mm, M2.5 x 0.45 Thread

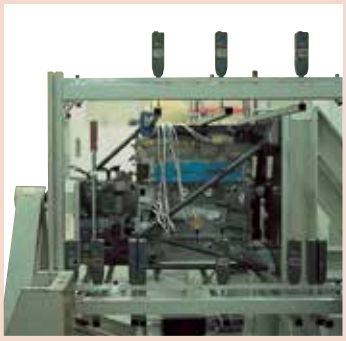
| Resolution | Range | Order No. | Model | Accuracy | Measuring force |
|---|---|---|---|---|---|
| .0005"/0.01mm | 1" / 25.4mm | **575-122** | ID-U1025M | .0008" | 1.8N or less |

**Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. | Model | Accuracy | Measuring force |
|---|---|---|---|---|---|
| 0.01mm | 25.4mm | **575-121** | ID-U1025 | 0.02mm | 1.8N or less |

### DIMENSIONS



Application example

# ABSOLUTE Digimatic Indicator ID-C

## SERIES 543 — Standard Type

SPC

ABSOLUTE®
Absolute System Patented by MITUTOYO

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo guarantees the product quality.

### Technical Data

Accuracy: Refer to the list of specifications

| Resolution: | | |
|---|---|---|
| | 0.01mm type | 0.01mm |
| | 0.001mm type* | 0.001mm/0.01mm |
| | .0005"/0.01mm type | .0005"/0.01mm |
| | .00005"/0.001mm type* | .0005"/.0001"/.00005"/0.01mm/0.001mm |

* Switchable resolution

Display: LCD
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Measuring force: Refer to the list of specifications
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 7,000 hours under normal use
Dust/Water protection level: IP42
Inspection certificate is included

### Function

Origin-set/Preset, Zeroset, go/no-go judgment, Counting direction switching, Power ON/OFF, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error, Over-flow error, Tolerance limit setting error
Internal calculations using the simple formula of [F(x) = Ax] are available.

### Optional Accessories

**905338**: SPC cable (40" / 1m)
**905409**: SPC cable (80" / 2m)
**21EZA198**: Spindle lifting lever (ISO/JIS type)*
**21EZA199**: Spindle lifting lever (ANSI/AGD type)*
**21EZA105**: Spindle lifting knob (12.7mm/.5"ISO/JIS type)**
**21EZA150**: Spindle lifting knob(12.7mm/.5"ANSI/AGD type)**
**21EZA197**: Spindle lifting knob (25.4mm/1", 50.8mm/2" models)
**21EZA200**: Spindle lifting knob (50.8mm/2")
**540774**: Spindle lifting cable (stroke: (1"/ 25.4mm)
**02ACA571**: Auxiliary spindle spring for 25mm/1" models***
**02ACA773**: Auxiliary spindle spring for 50mm/2" models***
———: Backs (See page F-33.)
———: Contact points (See page F-34.)

*Can be used on 12mm/.5" models only.
**Not available for low measuring force models.
***Required when orienting gage upside down.

### FEATURES

- Similar in size to Series 2 dial indicators.
- Large, easy-to-read LCD.
- Go/no-go judgment can be performed by setting upper and lower tolerance limits. The judgment result (go/no-go) can be displayed in full-size characters.
- The positive/negative count resulting from the spindle's up/down movement can be toggled.
- Internal calculations using the simple formula of [F(x) = Ax)] are available.
- Employing the ABSOLUTE linear encoder, the ID-C always displays the spindle "Absolute Position" from the origin at power-on. Also unlimited response speed eliminates over-speed errors.
- The ID-C indicator face can be rotated 330° to an appropriate angle for easy reading.
- With SPC data output.



543-392
IP42



543-402
IP42



543-472B
IP42



543-492B
IP42



Mitutoyo

## SPECIFICATIONS

**Inch/Metric** Stem dia. 3/8", #4-48 UNF Thread — ISO/JIS type — ANSI/AGD type

| Resolution | Range | Order No. (w/lug, flat-back) | | Model | Accuracy | Measuring force | Remarks |
|---|---|---|---|---|---|---|---|
| .00005"/0.001mm* | .5" / 12.7mm | **543-392** | **543-392B** | ID-C112EXB | .0001" | 1.5N or less | — |
| .00005"/0.001mm* | .5" / 12.7mm | **543-396** | **543-396B** | ID-C112CEX | .0001" | 0.4N - 0.7N | Low measuring force |
| .00005"/0.001mm* | 1" / 25.4mm | — | **543-472B** | ID-C125EXB | .0001" | 1.8N or less | — |
| .00005"/0.001mm* | 2" / 50.8mm | — | **543-492B** | ID-C150EXB | .0002" | 2.3N or less | — |
| .0005"/0.01mm | .5" / 12.7mm | **543-402** | **543-402B** | ID-C1012EX | .001" | 0.9N or less | — |
| .0005"/0.01mm | .5" / 12.7mm | **543-406** | **543-406B** | ID-C1012CEX | .001" | 0.2N - 0.5N | Low measuring force |
| .0005"/0.01mm | 1" / 25.4mm | — | **543-476B** | ID-C1025EXB | .001" | 1.8N or less | — |
| .0005"/0.01mm | 2" / 50.8mm | — | **543-496B** | ID-C112CEXB | .0016" | 2.3N or less | — |

* Switchable Resolution Type

**Inch/Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. (w/lug, flat-back) | | Model | Accuracy | Measuring force | Remarks |
|---|---|---|---|---|---|---|---|
| .00005"/0.001mm* | .5" / 12.7mm | **543-391** | **543-391B** | ID-C112MX | .0001" | 1.5N or less | — |
| .00005"/0.001mm* | .5" / 12.7mm | **543-395** | **543-395B** | ID-C112CMX | .0001" | 0.4N - 0.7N | Low measuring force |
| .00005"/0.001mm* | 1" / 25.4mm | — | **543-471B** | ID-C125MXB | .0001" | 1.8N or less | — |
| .00005"/0.001mm* | 2" / 50.8mm | — | **543-491B** | ID-C150MXB | .0002" | 2.3N or less | — |
| .0005"/0.01mm | .5" / 12.7mm | **543-401** | **543-401B** | ID-C1012MX | .001" | 0.9N or less | — |
| .0005"/0.01mm | .5" / 12.7mm | **543-405** | **543-405B** | ID-C1012CMX | .001" | 0.2N - 0.5N | Low measuring force |
| .0005"/0.01mm | 1" / 25.4mm | — | **543-475B** | ID-C1025MXB | .001" | 1.8N or less | — |
| .0005"/0.01mm | 2" / 50.8mm | — | **543-495B** | ID-C1050MXB | .0016" | 2.3N or less | — |

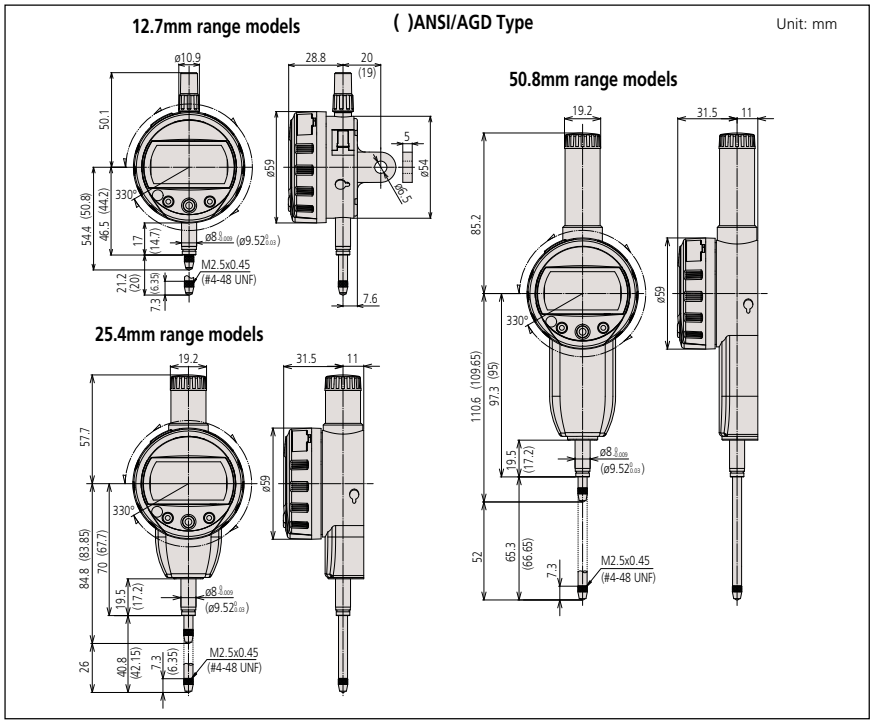
* Switchable Resolution Type

**Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. (w/lug, flat-back) | | Model | Accuracy | Measuring force | Remarks |
|---|---|---|---|---|---|---|---|
| 0.001mm* | 12.7mm | **543-390** | **543-390B** | ID-C112X | 0.003mm | 1.5N or less | — |
| 0.001mm* | 12.7mm | **543-394** | **543-394B** | ID-C112CX | 0.003mm | 0.4N - 0.7N | Low measuring force |
| 0.001mm* | 25.4mm | — | **543-470B** | ID-C125XB | 0.003mm | 1.8N or less | — |
| 0.001mm* | 50.8mm | — | **543-490B** | ID-C150XB | 0.006mm | 2.3N or less | — |
| 0.01mm | 12.7mm | **543-400** | **543-400B** | ID-C1012X | 0.02mm | 0.9N or less | — |
| 0.01mm | 12.7mm | **543-404** | **543-404B** | ID-C1012CX | 0.02mm | 0.2N - 0.5N | Low measuring force |
| 0.01mm | 25.4mm | — | **543-474B** | ID-C1025XB | 0.03mm | 1.8N or less | — |
| 0.01mm | 50.8mm | — | **543-494B** | ID-C1050XB | 0.04mm | 2.3N or less | — |

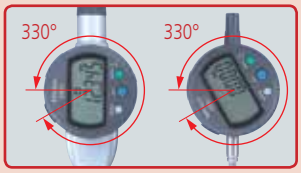
* Switchable Resolution Type

## DIMENSIONS




### 330° Rotary display

The display can be rotated 330°, allowing use at a position where you can easily read the measurement value.




### Calculation: f(x) = Ax

Mounting the **ID-C** on a measuring jig and setting the multiplying factor A (to any value) allows direct measurement without using a conversion table and improves measurement efficiency.






Application example

### Function locking

Ensures reliability of measurement by locking the settings to prevent preset function settings from being changed by mistake.




### Setting measuring force on low measuring force models.

**•543-404/404B/405/405B/406/406B**

| Spindle orientation | Spring | Weight (approximately 0.1N) | Maximum measuring force |
|---|---|---|---|
| Pointing vertically downward | Yes | Yes | 0.5N |
| | Yes | No | 0.4N |
| | No | Yes | 0.3N |
| | No | No | 0.2N |
| Horizontal | Yes | No | 0.2N |

Note: Operation using configurations other than shown above is not guaranteed.

**•543-394/394B/395/395B/396/396B**

| Spindle orientation | Spring | Weight (approximately 0.1N) | Maximum measuring force |
|---|---|---|---|
| Pointing vertically downward | Yes | Yes | 0.7N |
| | Yes | No | 0.6N |
| | No | Yes | 0.4N |
| | No | No | Not guaranteed |
| Horizontal | Not guaranteed | | |

Note: Operation using configurations other than shown above is not guaranteed.

# ABSOLUTE Digimatic Indicator ID-C

## SERIES 543 — Calculation Type

SPC

ABSOLUTE® Absolute System Patented by MITUTOYO

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo Guarantees the product quality.

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: 12 Steps
.00005/.0001/.0005"
0.001/0.01mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance-type linear encoder
Max. response speed: Unlimited
Measuring force: Refer to the list of specifications
Battery: CR2032 (1 pc.), **05SAA217**
Battery life: Approx. 12 months under normal use
IP Rating: Equivalent to IP-42*1

*1 A protection class indication (IP=International Protection) is based on the IEC 60529 /DIN40050 part 1/JIS D0207, C0920. The level indicated is valid only if the output connector cap is installed.

### Function

Key Lock, Parameter Lock, PC-USB Input, Analog Bar, FAST measurement frequency, Preset (up to 3 values), Tolerance Judgment , Peak Detection , Calculation, inch/mm conversion (on inch/metric models only), Counting direction switching, Data Output
Alarm: Low voltage, Counting value composition error, Over-flow error, Tolerance limit setting error

### Optional Accessories

**905338:** Connecting Cable (1m)
**905409:** Connecting Cable (2m)
**21EZA313:** Parameter Setting USB Cable
**21EZA198:** Spindle lifting lever (12.7mm ISO/JIS type)
**21EZA199:** Spindle lifting lever (12.7mm ASME/AGD type)
**21EZA105:** Lifting Knob (12.7mm/.5" ISO/JIS Models)
**21EZA150:** Lifting Knob (12.7mm/.5" ASME/AGD Models)
**21EZA197:** Lifting Knob (for 25.4/1"mm models)
**21EZA200:** Lifting Knob (for 50.8/2"mm models)
**540774:** Spindle lifting cable
———: Backs (See page F-33.)
———: Contact points (See page F-34.)

### APPLICATIONS



- Various fixtures suited for individual workpieces can be prepared.
- Measuring accuracy is subject to fixture accuracy

### FEATURES

- The new Calculation-Type Digimatic Indicator features both a Key-Lock and Parameter-Lock to prevent accidental changing of settings during operation.
- Improved parameter setting software makes easy to set all available parameters, and determine and upload the proper coefficients for calculation. (optional)
- Fast measurement frequency allows the user to increase the number of readings per second from 10 to 50, allowing higher accuracy measurements of TIR and MAX/MIN.
- An analog bar provides easy-to-read values when scanning for Max, Min, and TIR Values.
- The Absolute Digimatic indicator performs internal calculations using the formula Ax+B+Cx-1 (assuming spindle displacement as x) while the specified coefficients A, B and C can be set with respect to the purpose of measurement or dimensions of the fixtures. This unique features allows you to read your measurements directly, without the need for conversions.



543-342B

### SPECIFICATIONS

ISO/JIS type ANSI/AGD type

**Inch/Metric** Stem dia. 3/8" #4-48 UNF Thread

| Resolution | Range | Order No.* | Model | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| .00005/.0001/.0005" 0.001/0.01mm Selectable | .5"/12.7mm | **543-342B** | ID-C112REXB | ±.00010"/0.003mm | 1.5N or less |
| | 1"/25.4mm | **543-592B** | ID-C125REXB | ±.00010"/0.003mm | 1.8N or less |
| | 2"/50.8mm | **543-597B** | ID-C150REXB | ±.00025"/0.006mm | 2.3N or less |

**Inch/Metric** Stem ø 8mm, M2.5 x 0.45 Thread

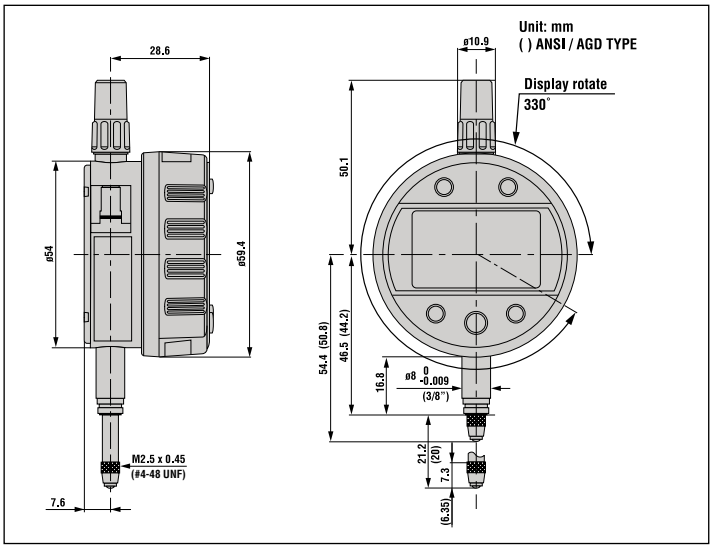
| Resolution | Range | Order No.* | Model | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| .00005/.0001/.0005" 0.001/0.01mm Selectable | .5"/12.7mm | **543-341B** | ID-C112RMXB | ±.00010"/0.003mm | 1.5N or less |
| | 1"/25.4mm | **543-591B** | ID-C125RMXB | ±.00010"/0.003mm | 1.8N or less |
| | 2"/50.8mm | **543-596B** | ID-C150RMXB | ±.00025"/0.006mm | 2.3N or less |

**Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No.* | Model | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| 0.001/0.01mm Selectable | .5"/12.7mm | **543-340B** | ID-C112RXB | 0.003mm | 1.5N or less |
| | 1"/25.4mm | **543-590B** | ID-C125RXB | 0.003mm | 1.8N or less |
| | 2"/50.8mm | **543-595B** | ID-C150RXB | 0.006mm | 2.3N or less |

*Flat back

### DIMENSIONS






Mitutoyo

# ABSOLUTE Digimatic Indicator ID-C

## SERIES 543 — With Max./Min. Value Holding Function

## FEATURES

- The new Peak Hold-Type Digimatic Indicator features both a Key-Lock and Parameter-Lock to prevent accidental changing of settings during operation.
- Parameter setting software makes it even eay to set all available parameters.
- An analog bar provides easy-to-read values when scanning for Max, Min and TIR Values.
- The maximum, minimum or runout value can be displayed during measurement.
- Go/no-go judgment is performed by setting the upper and lower tolerances for max., min. and runout values.
- High speed sampling ratio of 50 times/s.
- Employing the ABSOLUTE linear encoder, the Signal ID-C always displays the spindle Absolute Position from the origin when turned on.




543-302B

## SPECIFICATIONS

ISO/JIS type ANSI/AGD type

**Inch/Metric** Stem dia. 3/8" #4-48 UNF Thread

| Resolution | Range | Order No. | | Model | Accuracy |
|---|---|---|---|---|---|
| | | w/lug | Flat-back | | |
| .00005/.0001/.0005" 0.001/0.01mm Selectable | .5"/12.7mm | **543-302** | **543-302B** | ID-C112AEX(B) | ±.00010"/0.003mm |

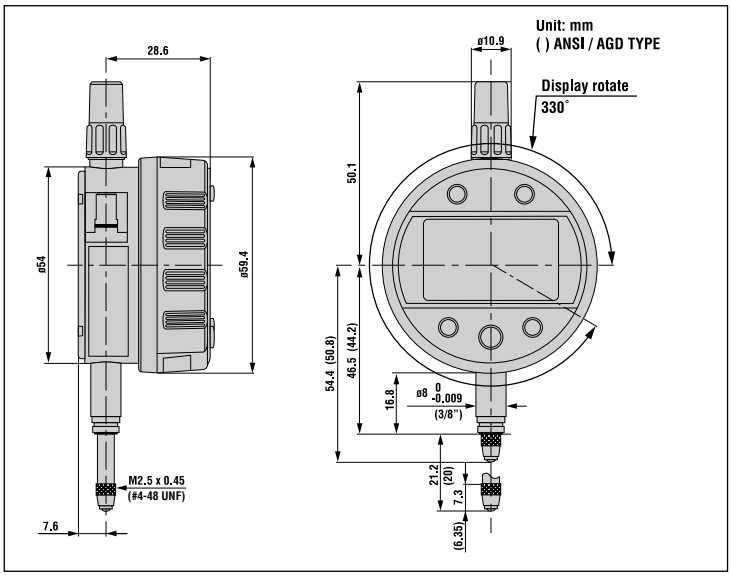
**Inch/Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. | | Model | Accuracy |
|---|---|---|---|---|---|
| | | w/lug | Flat-back | | |
| .00005/.0001/.0005" 0.001/0.01mm Selectable | .5"/12.7mm | **543-301** | **543-301B** | ID-C112AMX(B) | ±.00010"/0.003mm |

**Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. | | Model | Accuracy |
|---|---|---|---|---|---|
| | | w/lug | Flat-back | | |
| 0.001-0.01mm Selectable | 12.7mm | **543-300** | **543-300B** | ID-C112AX(B) | 0.003mm |

## DIMENSIONS




SPC

ABSOLUTE® Absolute System Patented by MITUTOYO

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE Mitutoyo Guarantees the product quality.

## Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.001-0.01mm or .00005-.0005"/ 0.001-0.01mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance-type linear encoder
Max. response speed: Unlimited
Measuring force: 1.5N or less
Battery: CR2032 (1 pc.), **05SAA217**
Battery life: Approx. 12 months under normal use
IP Rating: Equivalent to IP-42[*1]

[*1] A protection class indication (IP=International Protection) is based on the IEC 60529 /DIN40050 part 1/JIS D0207, C0920. The level indicated is valid only if the output connector cap is installed.

## Function

Key Lock, Parameter Lock, PC-USB Input, Analog Bar, Fast measurement frequency, Preset (up to 3 values), Tolerance Judgment , Peak Detection , Calculation (Ax), inch/mm conversion (on inch/metric models only) Counting direction switching, Data Output
Alarm: Low voltage, Counting value composition error, Overflow error, Tolerance limit setting error

## Optional Accessories

**905338:** Connecting Cable (1m)
**905409:** Connecting Cable (2m)
**21EZA313:** Parameter Setting USB Cable
**21EZA198:** Spindle lifting lever (12.7mm ISO/JIS type)
**21EZA199:** Spindle lifting lever (12.7mm ASME/AGD type)
**21EZA105:** Lifting Knob (12.7mm/.5" ISO/JIS models)
**21EZA150:** Lifting Knob (12.7mm/.5" ASME/AGD models)
**21EZA197:** Lifting Knob (for 25.4/1"mm models)
**21EZA200:** Lifting Knob (for 50.8/2"mm models)
**540774:** Spindle lifting cable
———: Backs (See page F-33.)
———: Contact points (See page F-34.)

# ABSOLUTE Digimatic Indicator ID-C

## SERIES 543 — Specially Designed for Bore Gage Application

SPC

ABSOLUTE®
Absolute System Patented by MITUTOYO

PROPRIETARY INSPECTION CERTIFICATE
Mitutoyo guarantees the product quality

### Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.001-0.01mm or
.00005-.0005"/0.001-0.01mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Measuring force: 1.5N or less
Battery: CR2032 (1 pc.), **05SAA217**
Battery life: Approx. 12 months under normal use
IP Rating: Equivalent to IP-42*1

*1 A protection class indication (IP=International Protection) is based on the IEC 60529 /DIN40050 part 1/JIS D0207, C0920. The level indicated is valid only if the output connector cap is installed.

### Function

Key Lock, Parameter Lock, PC-USB Input, Analog Bar, Fast measurement frequency, Preset (up to 3 values), Tolerance Judgment , Peak Detection (Min Only), inch/mm conversion (on inch/metric models only), Data Output
Alarm: Low voltage, Counting value composition error, Overflow error, Tolerance limit setting error

### Optional Accessories

**905338:** Connecting Cable (1m)
**905409:** Connecting Cable (2m)
**21EZA313:** Parameter Setting USB Cable
Applicable Gages Series 511 and 526



Installed on optional bore gage probe (**511-703**)

### FEATURES

- The new Bore Gage-Type Digimatic Indicator features both a Key-Lock and Parameter-Lock to prevent accidental changing of settings during operation.
- Parameter setting software makes it easy to set all available parameters. (optional)
- Fast measurement frequency allows the user to increase the number of readings per second from 10 to 50.
- The minimum value holding function provides the easy detection of hole diameter.
- An analog bar indicator is integrated to enhance the intuition in reading.
- Go/no-go judgment is performed by setting the upper and lower tolerances.
- Up to three sets of master values and upper/lower tolerance values can be memorized.
- Employing the ABSOLUTE linear encoder, the ID-C always displays the spindle Absolute Position from the origin when turned on.



**543-310B**

### SPECIFICATIONS

ISO/JIS type ANSI/AGD type

**Inch/Metric** Stem dia. 3/8" #4-48 UNF Thread

| Resolution | Range | Order No. | Model | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| .00005/.0001/.0005" 0.001/0.01mm Selectable | .5"/12.7mm | **543-312B** | ID-C112GEXB | ±.00010"/0.003mm | 1.5N or less |

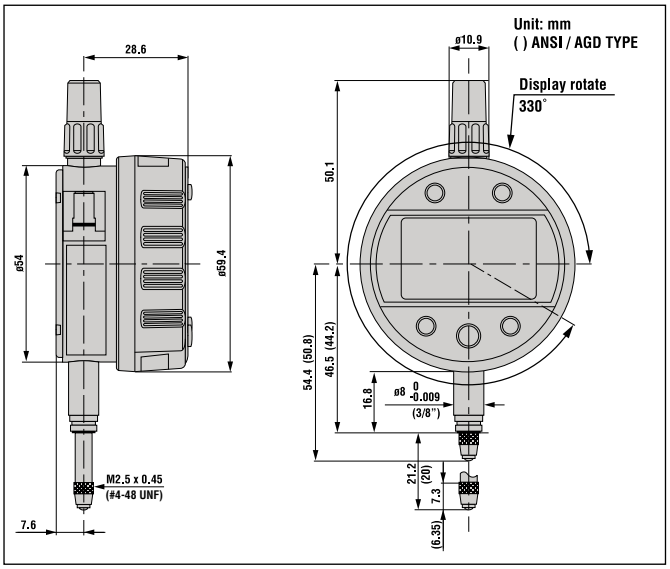
**Inch/Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. | Model | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| .00005/.0001/.0005" 0.001/0.01mm Selectable | .5"/12.7mm | **543-311B** | ID-C112GMXB | ±.00010"/0.003mm | 1.5N or less |

**Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. | Model | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| 0.001/0.01mm Selectable | 12.7mm | **543-310B** | ID-C112GXB | 0.003mm | 1.5N or less |

### DIMENSIONS






Mitutoyo

# ABSOLUTE Digimatic Indicator ID-C

## SERIES 543 — With Green/Red LED and Go/No-go Signal Output Function

## FEATURES

- With the max./min. value holding function, the signal ID-C can output the go/no-go judgment result against the peak values set. Substitute for the mechanical/electrical contact, the judgment is carried out by calculating the measurement data obtained. This provides high reliability with no deterioration of the contact point and volume adjustment.
- The signal can be output to an external device such as a sequencer through the NPN open-collector.
- The go/no-go judgment result is also indicated by the green/red LED and the "<, O, >" signs on LCD.
- Employing the ABSOLUTE linear encoder, the Signal ID-C always displays the spindle Absolute Position from the origin when powered up.
- The Signal ID-C achieves the IP54 protection level to resist dust and contaminants for safe operation in harsh machine shop environments.
- The high-speed detector measures 100 times per second.
- Analog Bar




## SPECIFICATIONS

**Inch/Metric** Stem dia. 3/8" #4-48 UNF Thread ISO/JIS type ANSI/AGD type

| Resolution | Range | Order No. (w/ lug, flat-back) | | Model | Accuracy | Measuring force |
|---|---|---|---|---|---|---|
| .00005/.0001/.0005" 0.001/0.01mm | .5" / 12.7mm | **543-352** | **543-352B** | ID-C112JEX(B) | ±.00010/0.003mm | 2.5N or less |

**Inch/Metric** Stem ø 8mm, M2.5 x 0.45 Thread

| Resolution | Range | Order No. (w/ lug, flat-back) | | Model | Accuracy | Measuring force |
|---|---|---|---|---|---|---|
| .00005/.0001/.0005" 0.001/0.01mm | .5" / 12.7mm | **543-351** | **543-351B** | ID-C112JMX(B) | ±.00010/0.003mm | 2.5N or less |

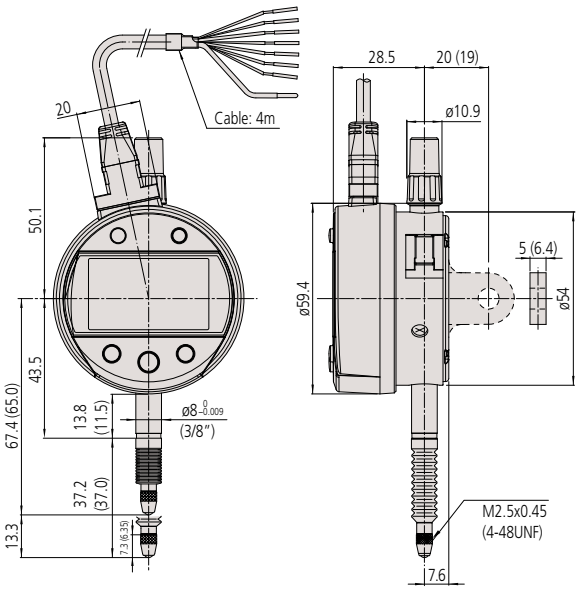
**Metric** Stem ø 8mm, M2. x 0.45 Thread

| Resolution | Range | Order No. (w/ lug, flat-back) | | Model | Accuracy | Measuring force |
|---|---|---|---|---|---|---|
| 0.001/0.01mm | 12.7mm | **543-350** | **543-350B** | ID-C112JX(B) | 0.003mm | 2.5N or less |

## DIMENSIONS

Unit: mm

**ISO/JIS Type**
**() ANSI/ADG Type**




ABSOLUTE® Absolute System Patented by MITUTOYO

Mitutoyo guarantees the product quality. PROPRIETARY INSPECTION CERTIFICATE

## Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.001mm, .00005"/0.001mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Measuring force: 2.5N or less
Power supply: DC 5-24V±10%
Dust/Water protection level: IP54

## Function

Data output (–NG/OK/NG signal, NPN open collector), Remote control (hold-preset, preset-recall, zero-set), Origin-Set, Preset (up to 3 values), Zero-Set, Analog-Bar, go/no-go judgment, Max/Min/Runout value holding, Counting direction switching, Power ON/OFF, inch/mm conversion (on inch/metric models only), calibration mode

Internal calculations using the simple formula of [F(x) = Ax] are available.

Alarm: Low voltage, Counting value composition error, Overflow error, Tolerance limit setting error

## Optional Accessories

**902011**: Spindle lifting lever* (ISO/JIS type)
**902794**: Spindle lifting lever* (ANSI/AGD type)
**540774**: Spindle lifting cable* (Stroke: .4" / 10mm)
**125317**: Rubber boot
———: Backs (See page F-33.)
———: Contact points (See page F-34.)
**21EAA194**: Connecting Cable (1m)**
**21EAA190**: Connecting Cable (2m)**
**21EZA345A**: Digimatic Power Supply Unit**

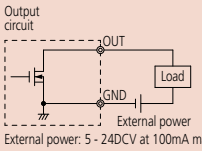
*When using the spindle lifting lever/cable, IP54 is not guaranteed.
** Used only for calibration mode and for automated testing with an i-Checker

## Output pattern

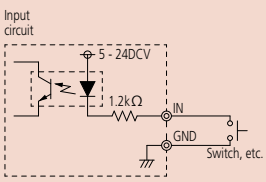
| Wire | – NG | OK | + NG | Composition error |
|---|---|---|---|---|
| Orange (– NG) | Low | High | High | High |
| Green (OK) | High | Low | High | High |
| Brown (+ NG) | High | High | Low | High |
| LED | Red | Green | Red | Red (blinking) |
| LCD | < | O | > | "x.xxE" indication |

## I/O Specifications

| Wire | Signal | I/O | Description |
|---|---|---|---|
| Black | – V (GND) | — | Connected to minus (-) terminal |
| Red | + V (GND) | I | Power supply (5-24VDC) |
| Orange | – NG | O | Tolerance judgment result output: Only the terminal corresponding to a judgment result is set to the below level. |
| Green | OK | O | |
| Brown | + NG | O | |
| Yellow | PRESET_RECALL ZERO | I | External input terminal: If the relevant terminal is set to the low level, its signal becomes true. |
| Blue | PEAK_START | I | |
| Shield | FG | — | Connected to GND |




External power: 5 - 24DCV at 100mA max.




Input current: Max. 20mA

# Digimatic Indicator ID-H

## SERIES 543 — High-Accuracy and High-Functional Type

### FEATURES

- This new generation digital indicator offers the excellent accuracy and functionality expected from this class of indicator. Take advantage of its high accuracy backed by 0.5µm / .00002" resolution, remote control functionality via a handheld controller (or an RS-232C interface) and easy runout measurements with the analog bar display.
- The maximum, minimum, or runout value can be displayed during measurement.
- Go/no-go judgment is performed by setting the upper and lower tolerances. If a judgment result is out of tolerance, the display backlighting changes from green to red, so tolerance judgment can be made at a glance.
- With SPC data output.
- With RS-232C input/output.



**21EZA099**
Remote controller (optional)



**543-561A**



**543-564A**

### SPECIFICATIONS

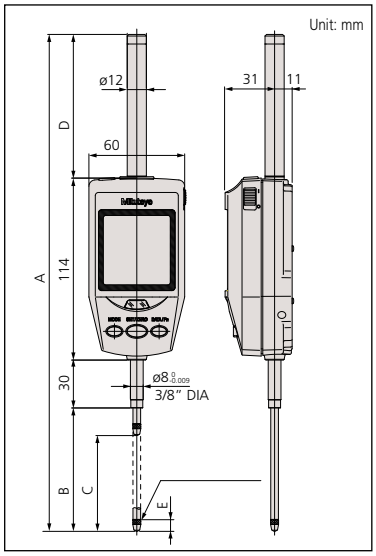
**Inch/Metric** Stem dia. 3/8" #4-48 UNF Thread

| Resolution | Range | Order No. | Model | Accuracy |
|---|---|---|---|---|
| .00002", .00005", .0001", 0.0005mm, 0.001mm | 1.2" / 30.4mm | **543-562A** | ID-H530E | 0.0015mm |
| | 2.4" / 60.9mm | **543-564A** | ID-H560E | 0.0025mm |

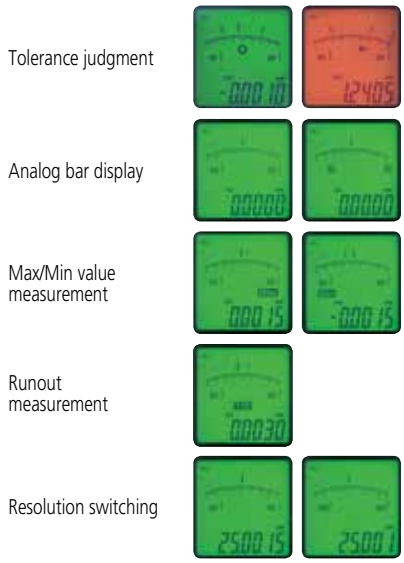
**Metric** Stem ø 8mm M2.5 X 0.45 Thread

| Resolution | Range | Order No. | Model | Accuracy |
|---|---|---|---|---|
| 0.0005mm, 0.001mm | 30.4mm | **543-561A** | ID-H530 | 0.0015mm |
| | 60.9mm | **543-563A** | ID-H560 | 0.0025mm |

### DIMENSIONS




| Order No. | A | B | C | D | E |
|---|---|---|---|---|---|
| **543-561A** | 251.3 | 47.3 | 30.48 | 60 | 7.3 |
| **543-562A** | 250.35 | 46.35 | 30.48 | 60 | 6.35 |
| **543-563A** | 311.3 | 77.3 | 60.96 | 90 | 7.3 |
| **543-564A** | 310.35 | 76.35 | 60.96 | 90 | 6.35 |




### Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.0005mm/0.001mm or .00002"/.00005" /.0001"/0.0005mm/0.001mm
Display: LCD
Length standard: Linear encoder
Max. response speed: 1000mm/s
Measuring force: 2.0N/2.5N* or less (*60mm range models)
Power supply: 6V DC (via AC adaptor)

### Function

Origin-set/Preset, Zeroset, go/no-go judgment, Max/Min value hold, Runout measurement, Resolution switching, Counting direction switching, Power ON/OFF, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error, Overflow error, Tolerance limit setting error

### Standard Accessories

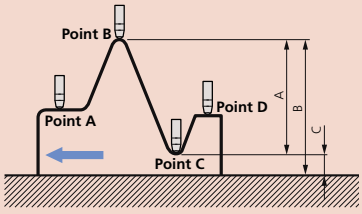
**06AEG180JA**: AC Adapter 120v
**137693**: Lifting Lever

### Optional Accessories

**936937**: SPC cable (40" / 1m)
**965014**: SPC cable (80" / 2m)
**21EAA131**: RS-232C cable (80" / 2m)
**21EZA099**: Remote controller
**540774**: Spindle lifting cable (stroke: .4" / 10mm)
**21EZA101**: Spindle lifting knob
**264-504-5A**: Digimatic Min-processor DP-1VR
**21EZA152A**: FREE PARAMETER SETTING SOFTWARE
———: Backs (See page F-33.)
———: Contact points (See page F-34.)

### Application

**Difference/Runout measurement**
**Example: Indicator travel from points A to D**
Difference (or Total Runout) is displayed as A. Dimensions B (maximum value) and C (minimum value) can be recalled from memory with a simple key sequence.



# ABSOLUTE Digimatic Indicator ID-F

## SERIES 543 — With Back-lit LCD

## FEATURES

- With ABSOLUTE linear encoder technology, once the measurement reference point has been set it, will not be lost when the power is turned on.
- Go/no-go judgment is performed by setting the upper and lower tolerances. If a judgment result is out of tolerance, the display backlighting changes from green to red, so tolerance judgment can be made at a glance.



- The maximum, minimum, or runout value can be displayed during measurement.
- An analog bar indicator has been integrated to handle upper/lower limit approaching and zero approaching. The display range can be changed.
- With SPC data output.



543-552A

543-558A

## SPECIFICATIONS

**Inch/Metric** Stem dia. 3/8" #4-48 UNF Thread

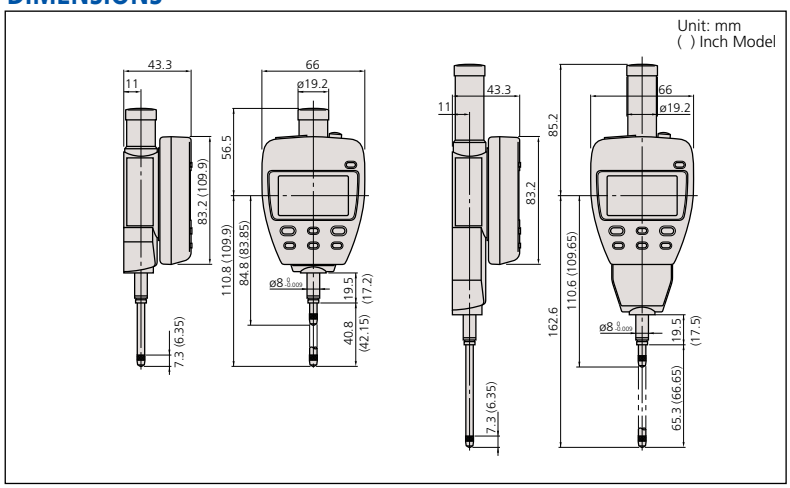
| Resolution | Range | Order No. | Model | Accuracy |
|---|---|---|---|---|
| .00005", .0001", .0005", .001", 0.001mm, 0.01mm | 1" / 25.4mm | **543-552A** | ID-F125E | .00012" |
| | 2" / 50.8mm | **543-558A** | ID-F150HE | .00012" |

**Metric** Stem ø 8mm M2.5 X 0.45 Thread

| Resolution | Range | Order No. | Model | Accuracy |
|---|---|---|---|---|
| 0.001mm, 0.01mm | 25mm | **543-551A** | ID-F125 | 0.003mm |
| | 50mm | **543-557A** | ID-F150H | 0.003mm |

## DIMENSIONS

Unit: mm
( ) Inch Model




## Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.01mm/0.001mm or .00005"/.0001"/.0005"/.001"/0.001mm/0.01mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance type linear encoder
Max. response speed: Unlimited
Measuring force: 1.8N/2.3N* or less (*50mm range models)
Power supply: 9V DC (via AC adaptor)

## Function

Origin-set/Preset, Zeroset, Go/no-go judgment, Max/Min value hold, Runout measurement, Resolution switching, Counting direction switching, Power ON/OFF, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error, Overflow error, Tolerance limit setting error

## Standard Accessories

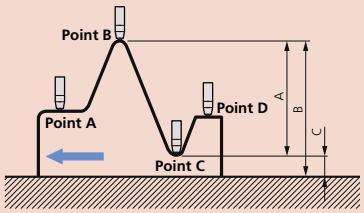
**06AEG302JA**: AC Adapter 120v
**137693**: Lifting Level

## Optional Accessories

**936937**: SPC cable (40" / 1m)
**965014**: SPC cable (80" / 2m)
**540774**: Spindle lifting cable (stroke: .4" / 10mm)
**02ACA571**: Auxiliary spindle spring for 25mm/1" models*
**02ACA773**: Auxiliary spindle spring for 50mm/2" models*
**264-504-5A**: Digimatic Min-processor DP-1VR
**543-004-1**: Digimatic presetter
———: Backs (See page F-33.)
———: (See page F-34.)
*Required when orienting the indicator upside down.

## Application

**Difference/Runout measurement**
**Example: Indicator travel from points A to D**
Difference (or Total Runout) is displayed as A. Dimensions B (maximum value) and C (minimum value) can be recalled from memory with a simple key sequence.



# ABSOLUTE Digimatic Indicator ID-N / B

## SERIES 543 — With Dust/Water Protection Conforming to IP66

### FEATURES

- Proven ABSOLUTE sensor.
- Rated to IP66 water- and dust-proofing standard, and oil resistance improved.
- Slim body design is advantageous for multi-point measurements.
- Improvement in workability with the LCD readout-rotation function.
- Back plunger design (ID-B).
- Built-in tolerance judgment function.
- Switchable resolution.
- Waterproof data output connector.
- Built-in hold/preset function.



Slim type ID-N
**543-576**



Back plunger type ID-B
**543-586**



### Technical Data

Accuracy: Refer to the list of specifications
Resolution: 0.01mm, 0.01mm/0.001mm, .0005"/0.01mm or .0005"/.00005"/0.01mm/0.001mm
Display: LCD
Length standard: ABSOLUTE electrostatic capacitance-type linear encoder
Max. response speed: Unlimited
Measuring force: 2.5N (2.0N: Back plunger type)
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 7000 hours under normal use
Dust/Water protection level: IP66

### Function

Zero-setting, Presetting, Direction switching, Tolerance judgment, Display hold, Data output, inch/mm conversion (on inch/metric models only)
Alarm: Low voltage, Counting value composition error, Overflow error, Tolerance limit setting error

### Optional Accessories

**21EZA105:** Lifting knob (for ISO/JIS model, ID-N only)
**21EZA150:** Lifting knob (for AGD model, ID-N only)
**21EZA145:** Lug (for JIS/ISO model)
**21EZA146:** Lug (for AGD model)
**02ACA376:** Rubber boot (for ID-N, NBR)
**238774:** Rubber boot (for ID-N, silicon)
**125317:** Rubber boot (for ID-B, NBR)
**21EAA212:** Rubber boot (for ID-B, silicon)
**21EAA194:** SPC cable (40" / 1m)
**21EAA190:** SPC cable (80" / 2m)
**21EAA210:** Bifurcated connecting cable with zero-setting terminal (40" / 1m)
**21EAA211:** Bifurcated connecting cable with zero-setting terminal (80" / 2m)
———: Contact points (See page F-34.)







## ID-B Digimatic Indicators

### SPECIFICATIONS

**Metric** Stem ø 8mm M2.5 X 0.45 Thread

| Resolution | Range | Order No. | Model No. | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| 0.01mm | 5.0mm | **543-580** | ID-B1005 | 0.02mm | 2.0N or less |
| 0.001mm | 5.0mm | **543-585** | ID-B105 | 0.003mm | 2.0N or less |

**Inch / Metric** Stem dia. 3/8" #4-48 UNF Thread

| Resolution | Range | Order No. | Model No. | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| .0005" / 0.01mm | .22" / 5.6mm | **543-581** | ID-B1005E | .0008" / 0.02mm | 2.0N or less |
| .0005" / 0.01mm<br>.00005" / 0.001mm | .22" / 5.6mm | **543-586*** | ID-B105E | .00012" / 0.003mm | 2.0N or less |

* Switchable resolution

## ID-N Digimatic Indicators

**Metric** Stem ø 8mm M2.5 X 0.45 Thread

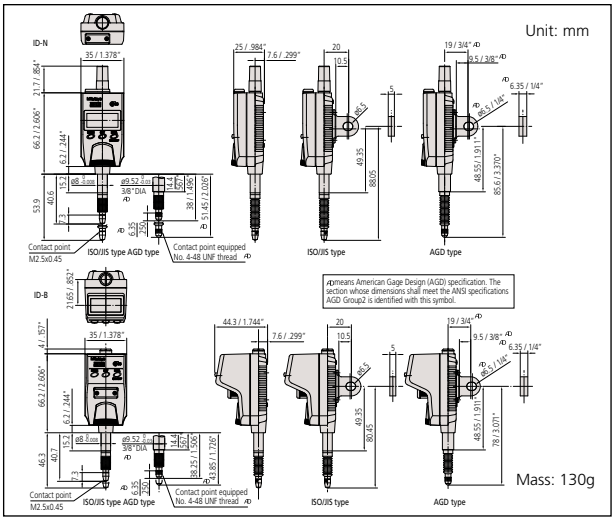
| Resolution | Range | Order No. | Model No. | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| 0.01mm | 5.0mm | **543-570** | ID-N1012 | 0.02mm | 2.0N or less |
| 0.001mm / 0.01mm | 5.0mm | **543-575** | ID-N112 | 0.003mm | 2.0N or less |

**Inch / Metric** Stem dia. 3/8" #4-48 UNF Thread

| Resolution | Range | Order No. | Model No. | Accuracy | Measuring Force |
|---|---|---|---|---|---|
| .0005" / 0.01mm | .5" / 12.7mm | **543-571** | ID-N1012E | .0008" / 0.02mm | 2.0N or less |
| .0005" / 0.01mm<br>.00005" / 0.001mm | .5" / 12.7mm | **543-576*** | ID-N112E | .00012" / 0.003mm | 2.0N or less |

* Switchable resolution

### DIMENSIONS AND MASS



# EC Counter

## SERIES 542 — Low-Cost, Assembly-Type Display Unit

### FEATURES

- Employed the DIN size (96 X 48mm) and mount-on-panel configuration, which greatly facilitates the incorporation into a system.
- Possible to produce either tolerance judgment output or Digimatic output.

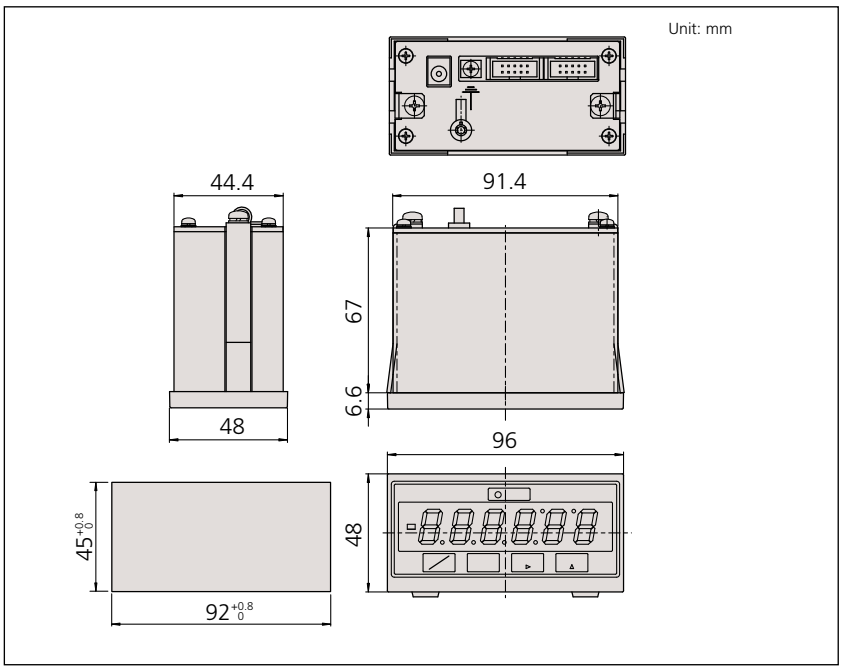



542-007A

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| 542-007A | EC Counter |

### DIMENSIONS




### EC Counter

#### Technical Data

Applicable gage: LGD, LGS, All SPC output gages
Resolution: 0.001mm, 0.01mm, .00005. .0005", .0001"
No. of gage input: 1
Display: 6-digit LED and a negative [-] sign
Function: Preset
Go/no-go judgment
Output (open-collector): 3-Step limit signal*, Digimatic
External control: Preset, Data hold
Power supply: Via AC adaptor
Dimensions (W x D x H): 96 x 48 x 84.6mm
Mass: 500g
*Requires C162-155 (see Optional Accessories)

#### Standard Accessories

**06AEG302JA:** AC Adapter

#### Optional Accessories

**936937:** SPC cable (40"/1m)
**965014:** SPC cable (80"/1m)
**214938:** PJ-2 (DC Plug)
**C162-155:** Go/no-go judgment cable

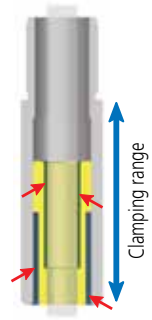
# Dial Indicators

## Description of Icon

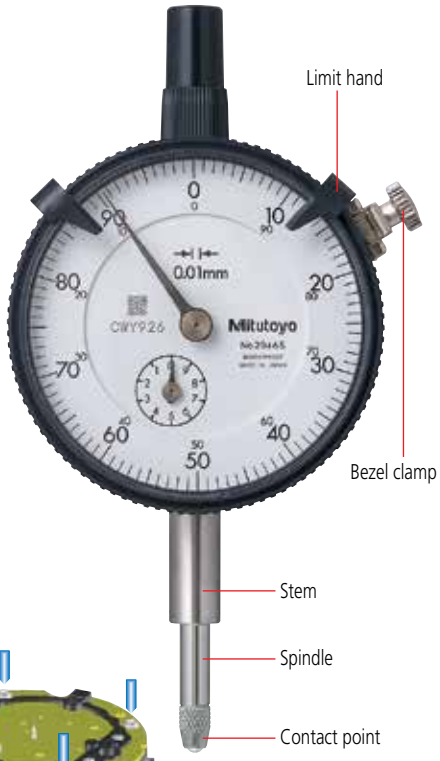
| Icon | Description |
|---|---|
| | Reverse reading type suitable for depth and step measurement |
| | One revolution type for easy and error-free reading |
| | Double scale spacing type, easy to read |
| | Shockproof |
| | Waterproof |
| | With damper at lowest rest point |
| | Jeweled bearing |
| STOP | Peak retaining |
| 2X | Long stem |
| | Dustproof |
| | With coaxial revolution counter |
| 90° | Back plunger |
| | Adjustable hand |
| | Double-face type |

## FEATURES: S Series

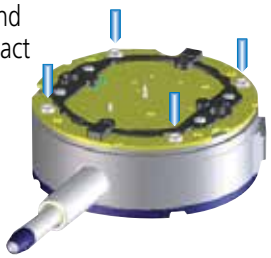
- Revolutionary stem-bush design for trouble-free stem clamping (longer clamping range).
- No through screw hole on the frame for high dust-resistance.



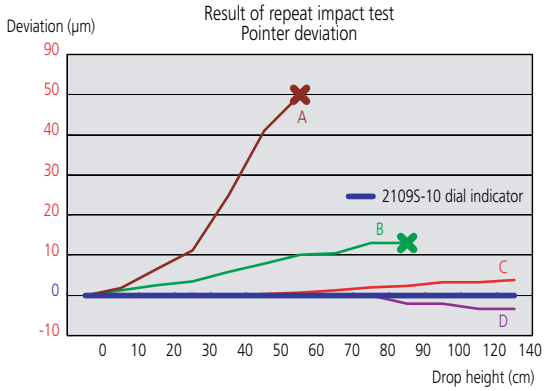
Clearance to avoid direct influence of clamping force

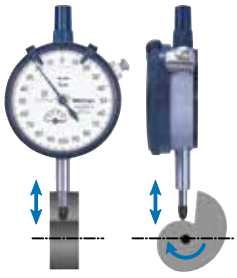


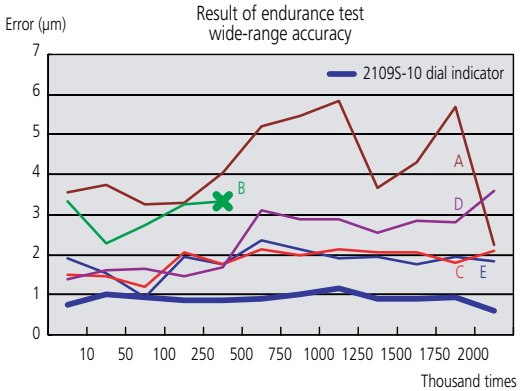

- Involute curved lifting lever for smooth movement of spindle and dovetail joint for tool-less connection.
- Grater rigidity in the bearing plate for reducing the retracing error (20%) and 4-screw mounting for increasing impact resistance.







Endurance testing with cam
Rotation speed: 120rpm



# Dial Indicators

## SERIES 0 - Compact type



1911T-10

Balanced scale



1911T-10
Jeweled bearing

Balanced scale



1913T-10
Jeweled bearing

## SPECIFICATIONS

**Inch** Stem dia. 3/8", #4-48 UNF Thread — ANSI/AGD type

| Graduation | Range | Range/rev | Dial reading | Order No. w/ lug | Order No. Flat-back | Accuracy First 2.5 Rev | Accuracy Overall Accuracy | Measuring force | Jeweled bearing |
|---|---|---|---|---|---|---|---|---|---|
| .0001" | .025" | .01" | 0-5-0 | **1925T-10** | **1925TB-10** | ±.0002" | ±.0002" | 0.3 - 1.8N | ✔ |
| .0005" | .05" | .02" | 0-10-0 | **1923T-10** | **1923TB-10** | ±.0005" | ±.0005" | 0.3 - 1.8N | ✔ |
| .001" | .1" | .04" | 0-20-0 | **1921T-10** | **1921TB-10** | ±.001" | ±.001" | 0.3 - 1.8N | ✔ |

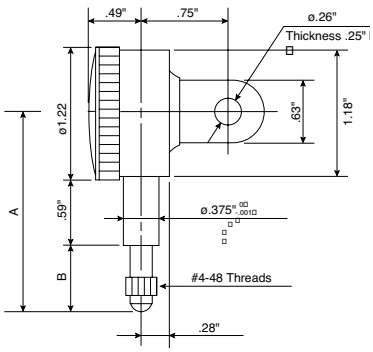
**Metric** Stem ø 8mm, M2.5 x 0.45 Thread — ISO/JIS type

| Graduation | Range | Range/Rev | Dial reading | Order No. w/ lug | Order No. Flat-back | Accuracy Any Rev | Accuracy Overall Accuracy | Measuring force | Jeweled bearing |
|---|---|---|---|---|---|---|---|---|---|
| 0.002mm | 0.5mm | 0.2mm | 0-100-0 | **1913T-10** | **1913TB-10** | ±5µm | ±6µm | 0.3 - 1.8N | ✔ |
| 0.01mm | 2.5mm | 1mm | 0-50-0 | **1911T-10** | **1911TB-10** | ±10µm | ±12µm | 0.3 - 1.8N | ✔ |

Jeweled bearing

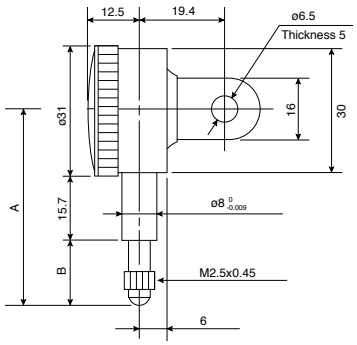
## DIMENSIONS

**Inch Model** Unit: Inch




| Order Number | A | B |
|---|---|---|
| **1925T-10** | 1.48" | .28" |
| **1923T-10** | 1.51" | .31" |
| **1921T-10** | 1.58" | .37" |

**Metric Model** Unit: mm




| Order Number | A | B |
|---|---|---|
| **1911T-10** | 42 | 11.5 |
| **1913T-10** | 39.5 | 9 |

# Dial Indicators

## SERIES 1



1803S-10



1411S



1506S

## SPECIFICATIONS

**Inch** Stem dia. 3/8" #4-48 UNF Thread ☐ ANSI/AGD type

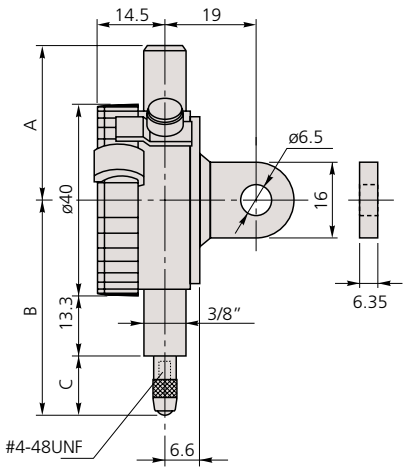
| Graduation | Range | Range / Rev | Dial reading | Order No. (W/Lug) | Order No. (Flat-back) | Accuracy First 2.5 Rev | Accuracy Overall Accuracy | Measuring force | Shockproof | Jeweled bearing |
|---|---|---|---|---|---|---|---|---|---|---|
| .0001" | .025" | .01" | 0-10 | **1802S-10** | **1802SB-10** | ±.0001" | ±.0001" | 1.4N or less | ✔ | ✔ |
| .0001" | .025" | .01" | 0-5-0 | **1803S-10** | **1803SB-10** | ±.0001" | ±.0001" | 1.4N or less | ✔ | ✔ |
| .0005" | .1" | .04" | 0-40 | **1670S** | **1670SB** | ±.0005" | ±.0005" | 1.4N or less | | |
| .0005" | .1" | .04" | 0-20-0 | **1671S** | **1671SB** | ±.0005" | ±.0005" | 1.4N or less | | |
| .0005" | .125" | .05" | 0-50 | **1506S** | **1506SB** | ±.0005" | ±.0005" | 1.4N or less | | |
| .0005" | .125" | .05" | 0-25-0 | **1507S** | **1507SB** | ±.0005" | ±.0005" | 1.4N or less | | |
| .001" | .125" | .05" | 0-50 | **1780S** | **1780SB** | ±.001" | ±.001" | 1.4N or less | | |
| .001" | .125" | .025" | 0-25-0 | **1781S** | **1781SB** | ±.001" | ±.001" | 1.4N or less | | |
| .001" | .25" | .1" | 0-100 | **1410S** | **1410SB** | ±.001" | ±.001" | 1.4N or less | | |
| .001" | .25" | .1" | 0-100 | **1410S-10** | **1410SB-10** | ±.001" | ±.001" | 1.4N or less | | ✔ |
| .001" | .25" | .1" | 0-50-0 | **1411S** | **1411SB** | ±.001" | ±.001" | 1.4N or less | | |

Shockproof  Jeweled bearing

**Metric** Metric - ANSI Standard Stem dia. 3/8"#4-48 UNF Thread yellow dial face ☐ ANSI/AGD type

| Graduation | Range | Range /Rev | Dial reading | Order No. (W/Lug) | Order No. (Flat-back) | Accuracy First 2.5 Rev | Accuracy Overall Accuracy | Measuring force |
|---|---|---|---|---|---|---|---|---|
| 0.002mm | 0.5mm | 0.2mm | 0-20 | **1010S-11** | **1010SB-11** | ±0.002mm | ±0.002mm | 1.5N or less |
| 0.002mm | 0.5mm | 0.2mm | 0-10-0 | **1011S-11** | **1011SB-11** | ±0.002mm | ±0.002mm | 1.5N or less |
| 0.01mm | 2.5mm | 1mm | 0-100 | **1230S-01** | **1230SB-01** | ±0.01mm | - | 1.4N or less |
| 0.01mm | 2.5mm | 1mm | 0-50-0 | **1231S-01** | **1231SB-01** | ±0.01mm | - | 1.4N or less |
| 0.01mm | 5mm | 1mm | 0-100 | **1044S-01** | **1044SB-01** | ±0.01mm | ±0.013mm | 1.4N or less |
| 0.01mm | 5mm | 1mm | 0-50-0 | **1045S-01** | **1045SB-01** | ±0.01mm | ±0.013mm | 1.4N or less |

## DIMENSIONS




Unit: mm

| Order No. | A | B | C |
|---|---|---|---|
| **1802S(B)-10** | 32.5 | 43.4 | 9.6 |
| **1803S(B)-10** | 32.5 | 43.4 | 9.6 |
| **1670S(B)** | 32.5 | 44.2 | 10.4 |
| **1671S(B)** | 32.5 | 44.2 | 10.4 |
| **1506S(B)** | 32.5 | 45.2 | 11.4 |
| **1507S(B)** | 32.5 | 45.2 | 11.4 |
| **1780S(B)** | 32.5 | 45.2 | 11.4 |
| **1781S(B)** | 32.5 | 45.2 | 11.4 |
| **1410S(B)** | 32.5 | 48.7 | 14.9 |
| **1410S(B)-10** | 32.5 | 48.7 | 14.9 |
| **1411S(B)** | 32.5 | 48.7 | 14.9 |
| **1230S(B)-01** | 32.5 | 44.2 | 10.4 |
| **1231S(B)-01** | 32.5 | 44.2 | 10.4 |
| **1044S(B)-01** | 32.5 | 46.7 | 12.9 |
| **1045S(B)-01** | 32.5 | 46.7 | 12.9 |



Mitutoyo

# Dial Indicators

## SERIES 1



1040S



1013S



1045S



1109S-10

**Metric** Stem ø 8mm M2.5 X 0.45 Thread

ISO/JIS type

| Graduation | Range | Range / Rev | Dial reading | Order No. (W/Lug) | Order No. (Flat-back) | Accuracy First 2.5 Rev | Accuracy Overall Accuracy | Measuring force | Shockproof | Waterproof | Jeweled bearing |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.001mm | 1mm | 0.2mm | 0-100-0 | **1109S-10** | **1109SB-10** | ±0.001mm | ±0.007mm | 1.5N or less | ✔ | | ✔ |
| 0.002mm | 1mm | 0.2mm | 0-100-0 | **1013S-10** | **1013SB-10** | ±0.002mm | ±0.01mm | 1.5N or less | ✔ | | ✔ |
| 0.005mm | 3.5mm | 0.5mm | 0-50 | **1124S** | **1124SB** | ±0.005mm | ±0.013mm | 1.4N or less | | | ✔ |
| 0.01mm | 3.5mm | 0.5mm | 0-50 | **1040S** | **1040SB** | ±0.01mm | ±0.013mm | 1.5N or less | | | |
| 0.01mm | 3.5mm | 0.5mm | 0-25-0 | **1041S** | **1041SB** | ±0.01mm | ±0.013mm | 1.5N or less | | | |
| 0.01mm | 4mm | 1mm | 0-50-0 | **1003T** | **1003TB** | ±0.01mm | ±0.013mm | 0.3 - 1.4N | | | |
| 0.01mm | 5mm | 1mm | 0-100 | **1044S** | **1044SB** | ±0.01mm | ±0.013mm | 1.5N or less | | | |
| 0.01mm | 5mm | 1mm | 0-100 | **1044S-60** | **1044SB-60** | ±0.01mm | ±0.013mm | 2N or less | | ✔ | |
| 0.01mm | 5mm | 1mm | 0-100 | **1044S-15** | **1044SB-15** | ±0.01mm | ±0.013mm | .4N or less | ✔ | | |
| 0.01mm | 5mm | 1mm | 0-50-0 | **1045S** | **1045SB** | ±0.01mm | ±0.013mm | 1.4N or less | | | |

Shockproof  Waterproof  Jeweled bearing



1003T

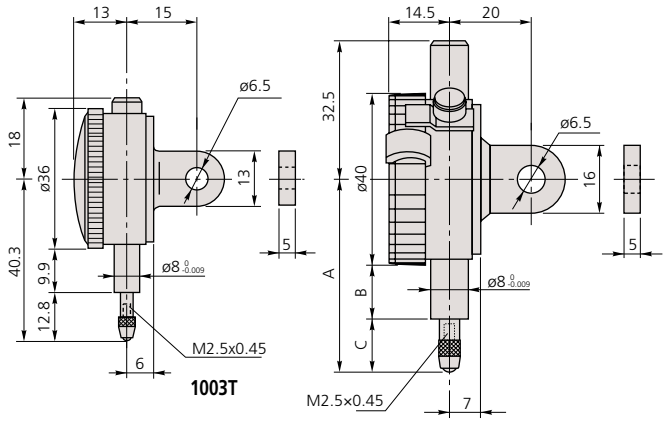


1044S

## DIMENSIONS

Unit: mm

ISO/JIS Type




| Order No. | A | B | C |
|---|---|---|---|
| **1040S** | 46 | 13 | 12.5 |
| **1041S** | 46 | 13 | 12.5 |
| **1044S** | 47.5 | 13 | 14 |
| **1044S-10** | 47.5 | 13 | 14 |
| **1044S-60** | 57 | 11.5 | 25 |
| **1045S** | 47.5 | 13 | 14 |
| **1124S** | 46 | 13 | 12.5 |
| **1013S** | 49 | 13 | 15.5 |
| **1109S** | 49 | 13 | 15.5 |

## Optional Accessories

———: Backs (See page F-33.)
———: Contact points (See page F-34.)

# Dial Indicators

## SERIES 1 — Compact One Revolution Type for Error-free Reading

One revolution type



1929S

Unlike many other dial indicators, the one-revolution dial indicator shows the entire spindle travel or range as one sweep of the hand, eliminating the possibility of reading errors due to miscounting the multiple revolutions. With one-revolution dial indicators, within tolerance and out of tolerance can't be misinterpreted. Unique shock-proof mechanism provides improved immunity to shock due to sudden spindle retraction caused by high impact.

Shockproof type
Dustproof type
Waterproof type
Jeweled bearing type



**1929S**
**1929S-62**



**1900S-10**
**1900S-72**

## SPECIFICATIONS

**Inch**

Stem dia. 3/8", #4-48 UNF Thread

ANSI/AGD type

| Graduation | Range (range/full stroke) | Dial reading | Order No. | | Accuracy | Measuring force | | | — | — |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | w/lug | Flat-back | | | | | | |
| .0001" | .006" / .0079" | 3-0-3 | **1910S-72** | **1910SB-72** | ±.0001" | 1.4N or less | ✔ | ✔ | — | — |
| .0005" | .04" / .055" | 20-0-20 | **1909S-62** | **1909SB-62** | ±.0005" | 1.4N or less | ✔ | ✔ | — | — |

**Metric**

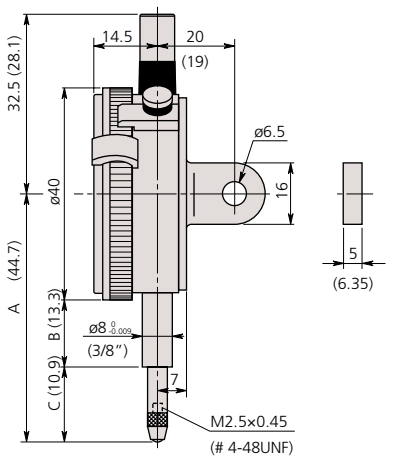
Stem ø 8mm, M2.5 x 0.45 Thread

ISO/JIS type

| Graduation | Range (range/full stroke) | Dial reading | Order No. | | Accuracy | Measuring force | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | w/lug | Flat-back | | | | | | |
| 0.001mm | 0.1mm / 0.14mm | 50-0-50 | **1900S-10** | **1900SB-10** | ±0.005mm | 1.5N or less | ✔ | — | — | ✔ |
| 0.001mm | 0.1mm / 0.14mm | 50-0-50 | **1900S-72** | **1900SB-72** | ±0.006mm | 1.5N or less | ✔ | ✔ | — | ✔ |
| 0.01mm | 1mm / 1.4mm | 50-0-50 | **1929S** | **1929SB** | ±0.011mm | 1.4N or less | ✔ | — | — | — |
| 0.01mm | 1mm / 1.4mm | 50-0-50 | **1929S-62** | **1929SB-62** | ±0.011mm | 1.4N or less | ✔ | ✔ | — | — |

## DIMENSIONS

Unit: mm




| Order No. | A | B | C |
|---|---|---|---|
| **1929S** | 47.5 | 13.8 | 13.7 |
| **1929S-62** | 47.5 | 13.8 | 13.7 |
| **1900S-10** | 53.5 | 16.8 | 16.7 |
| **1900S-72** | 53.5 | 16.8 | 16.7 |

( ): ANSI / AGD type

## Optional Accessories

———: Backs (See page F-33.)
———: Contact points (See page F-34.)

# Dial Indicators

## SERIES 2 — Standard One Revolution Type for Error-free Reading

One revolution type.

Shockproof type | Waterproof type | Dustproof type | Jeweled bearing type

## SPECIFICATIONS

**Metric** Stem ø 8mm, M2.5 x 0.45 Thread — ISO/JIS type

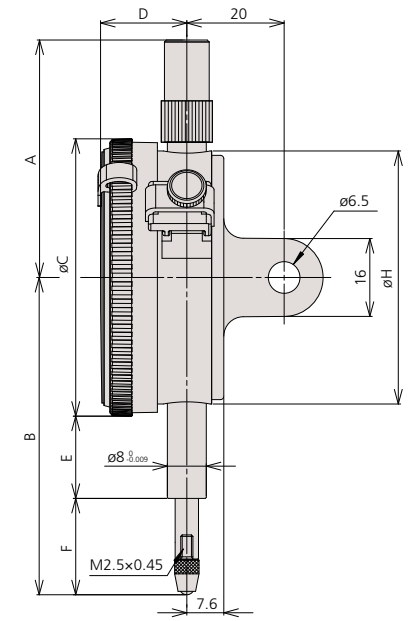
| Graduation | Range (range/full stroke) | Dial reading | Order No. w/ lug | Order No. Flat-back | Accuracy | Measuring force | Shockproof | Waterproof | Dustproof | Jeweled bearing |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.001mm | 0.08mm / 0.1mm | 40-0-40 | **2900S-10** | **2900SB-10** | ±0.003mm | 1.4N or less | ✔ | — | — | ✔ |
| 0.001mm | 0.08mm / 0.1mm | 40-0-40 | **2900S-70** | **2900SB-70** | ±0.003mm | 2.0N or less | ✔ | ✔ | — | ✔ |
| 0.001mm | 0.08mm / 0.1mm | 40-0-40 | **2900S-72** | **2900SB-72** | ±0.003mm | 2.0N or less | ✔ | — | ✔ | ✔ |
| 0.001mm | 0.16mm / 0.2mm | 80-0-80 | **2901S-10** | **2901SB-10** | ±0.004mm | 1.4N or less | ✔ | — | — | ✔ |
| 0.01mm | 0.8mm / 1mm | 40-0-40 | **2929S** | **2929SB** | ±0.009mm | 2.0N or less | ✔ | — | — | — |
| 0.01mm | 0.8mm / 1mm | 40-0-40 | **2929S-60** | **2929SB-60** | ±0.009mm | 2.0N or less | ✔ | ✔ | — | — |
| 0.01mm | 0.8mm / 1mm | 40-0-40 | **2929S-62** | **2929SB-62** | ±0.009mm | 2.0N or less | ✔ | — | ✔ | — |
| 0.01mm | 1.6mm / 2mm | 80-0-80 | **2959S** | **2959SB** | ±0.013mm | 1.4N or less | ✔ | — | — | — |
| 0.01mm | 0.5mm / 0.7.mm | 25-0-25 | — | **2971TB*** | ±0.008mm | 0.4 - 1.4N | ✔ | — | ✔ | — |
| 0.01mm | 1mm / 1.4mm | 50-0-50 | — | **2972TB*** | ±0.008mm | 0.4 - 1.4N | ✔ | — | ✔ | — |
| 0.02mm | 1.6mm / 2mm | 80-0-80 | — | **2973TB*** | ±0.016mm | 0.4 - 1.4N | ✔ | — | ✔ | — |
| 0.1mm | 4mm / 10mm | 2-0-2 | **2928S** | **2928SB** | ±0.040mm | 1.4N or less | ✔ | — | — | — |

* Flat-back type only. (Lug-on-center back is not available.)

## DIMENSIONS

**ISO/JIS Type**

Unit: mm




| Order No. | A | B | C | D | E | F | H |
|---|---|---|---|---|---|---|---|
| **2971TB** | 43.2 | 65.6 | 57 | 16.5 | 19.8 | 16.8 | 55 |
| **2972TB** | 43.2 | 66.0 | 57 | 16.5 | 19.8 | 17.2 | 55 |
| **2973TB** | 43.2 | 66.3 | 57 | 16.5 | 19.8 | 17.5 | 55 |
| **2929S** | 48.8 | 65.2 | 57 | 17.7 | 12.3 | 29.2 | 52 |
| **2929S-62** | 48.8 | 65.2 | 57 | 17.7 | 16.9 | 19.8 | 52 |
| **2929S-60** | 48.8 | 70 | 57 | 17.7 | 12.3 | 29.2 | 52 |
| **2959S** | 48.8 | 65.2 | 57 | 17.7 | 16.9 | 19.8 | 52 |
| **2900S-10** | 48.8 | 66 | 57 | 17.7 | 16.9 | 20.6 | 52 |
| **2900S-72** | 48.8 | 66 | 57 | 17.7 | 16.9 | 20.6 | 52 |
| **2900S-70** | 48.8 | 67 | 57 | 17.7 | 12.3 | 26.2 | 52 |
| **2901S-10** | 48.8 | 66.1 | 57 | 17.7 | 16.9 | 20.7 | 52 |
| **2928S** | 48.8 | 65.2 | 57 | 17.7 | 16.9 | 19.8 | 52 |



**2900S-10**



**2929S**
**2929S-60**
**2929S-62**



**2959S**



**2900S-10**
**2900S-70**
**2900S-72**



**2901S-10**

## Optional Accessories

———: Backs (See page F-33.)
———: Contact points (See page F-34.)

# Dial Indicators

## SERIES 2 — Standard One Revolution Type for Error-free Reading




2909S-62




2978TB

## FEATURES

- Unique shock-proof mechanism provides improved immunity to shock due to sudden spindle retraction caused by high impact.
- The crystal is hard coated for durability and scratch resistance.
- Approximately 40% lighter than conventional dial indicator.
- Improved resistance to shop-floor contaminants such as water and dust.
- Due to the spindle bushing being offset from the stem, spindle movement will not be hindered or jammed when clamping along the stem.
- A pair of limit hands are provided for quick and easy tolerance judgment (go/no-go).

One revolution type.

## SPECIFICATIONS

**Inch** Stem 3/8" dia. , #4-48 UNF Thread — ANSI/AGD type

| Graduation | Range | Range/full stroke | Dial reading | Order No. w/ lug | Order No. Flat-back | Accuracy | Measuring force | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| .0001" | .008" | .01" | 4-0-4 | **2910S-10** | **2910SB-10** | ±.0001" | 1.8N or less | ✔ | | ✔ |
| .0001" | .008" | .01" | 4-0-4 | **2910S-72** | **2910SB-72** | ±.0001" | 2.5N or less | ✔ | ✔ | ✔ |
| .0005" | .04" | .05" | 20-0-20 | **2909S-62** | **2909SB-62** | ±.0005" | 2.5N or less | ✔ | ✔ | |
| .0005" | .02" | .028" | 10-0-10 | — | **2976TB*** | ±.0005" | 0.4 - 1.4N | ✔ | ✔ | |
| .0005" | .04" | .055" | 20-0-20 | — | **2977TB*** | ±.0005" | 0.4 - 1.4N | ✔ | ✔ | |
| .001" | .06" | .079" | 30-0-30 | — | **2978TB*** | ±.001" | 0.4 - 1.4N | ✔ | ✔ | |

*Flat-back type only. (Lug-on-center back is not available.)

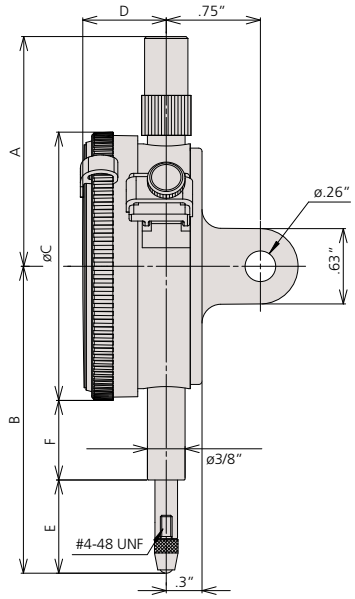
**Metric** Stem 3/8" dia. , #4-48 UNF Thread Yellow Dial Face — ANSI/AGD type

| Graduation | Range | Range/full stroke) | Dial reading | Order No. w/ lug | Order No. Flat-back | Accuracy | Measuring force | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.001mm | 0.08mm | 0.1mm | 40-0-40 | **2900S-73** | **2900SB-73** | ±0.003mm | 2.0N or less | ✔ | ✔ | ✔ |

*Flat-back type only. (Lug-on-center back is not available.)

## DIMENSIONS

Unit: inch




| Order No. | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| **2976TB** | 1.70 | 2.55 | 2.24 | .65 | .62 | .78 |
| **2977TB** | 1.70 | 2.56 | 2.24 | .65 | .64 | .78 |
| **2978TB** | 1.70 | 2.57 | 2.24 | .65 | .65 | .78 |
| **2909S-62** | 1.92 | 2.04 | 2.24 | .7 | .36 | .54 |
| **2910S-10** | 1.92 | 2.02 | 2.24 | .7 | .36 | .54 |
| **2910S-72** | 1.92 | 2.02 | 2.24 | .7 | .36 | .54 |
| **2900S-73** | 1.92 | 1.99 | 2.24 | .7 | .33 | .54 |

## Optional Accessories

———: Backs (See page F-33.)
———: Contact points (See page F-34.)

# Special Dial Indicators

## SERIES 2



Adjustable hand



2048S-10

### Adjustable hand dial gage

The hand position can be adjusted independently of the vertical movement of the spindle by rotating the top knob.




Peak hold



2046S-80

### Peak hold dial gage

A mechanism that stops the pointer and the spindle at the depressed position where the spindle is depressed makes the pointer stop and display the maximum value.

## SPECIFICATIONS

**Inch** Stem dia. 3/8" #4-48 UNF Thread — ANSI/AGD type

| Graduation | Range | Range /rev | Dial reading | Order No. w/lug | Order No. Flat-back | Accuracy First 2.5 Rev | Accuracy Overall Accuracy | Measuring force | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| .001″ | .5″ | .1" | 0-100 | **2915S-10** | **2915SB-10** | ±.001″ | ±.001" | 1.8N or less | ✔ | ✔ | ✔ |
| .001″ | .5″ | .1" | 0-50-0 | **2918S-10** | **2918SB-10** | ±.001″ | ±.001" | 1.8N or less | ✔ | ✔ | ✔ |

**Metric** Stem dia. 3/8" #4-48 UNF Thread, Yellow Dial Face — ANSI/AGD type

| Graduation | Range | Range /rev | Dial reading | Order No. w/lug | Order No. Flat-back | Accuracy First 2.5 Rev | Accuracy Overall | Measuring force | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.01mm | 10mm | 1mm | 0-100 | **2048S-11** | **2048SB-11** | ±13μm | ±0.013mm | 1.4N or less | ✔ | ✔ | ✔ |

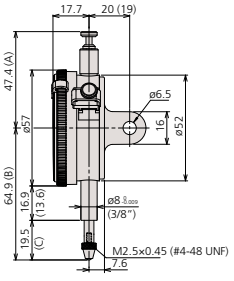
**Metric** Stem ø 8mm, M2.5 x 0.45 Thread — ISO/JIS type

| Graduation | Range | Range /rev | Dial reading | Order No. w/lug | Order No. Flat-back | Accuracy | Measuring force | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.01mm | 10mm | 1mm | 0-100 | **2048S-10** | **2048SB-10** | ±0.015mm | 1.4N or less | ✔ | ✔ | ✔ | |
| 0.01mm | 10mm | 1mm | 0-100 | **2046S-80** | **2046SB-80** | ±0.015mm | 5.0N or less | | | | ✔ |

## DIMENSIONS

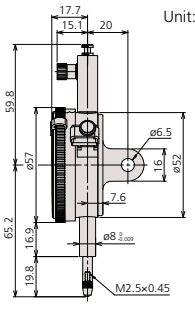
| Order No. | A | B | C |
|---|---|---|---|
| **2915S-10, 2918S-10** | 52.2 | 64.1 | 22 |
| **2048S-11** | 47.7 | 59.5 | 17.4 |

Unit: mm




( ): ANSI / AGD Type **2048S-10**

Unit: mm




**2046S-80**

# Dial Indicators

## SERIES 2 — Standard Type, Inch Reading




2416S



2803S-10

### Optional Accessories

———: Backs (See page F-33.)
———: Contact points (See page F-34.)

## SPECIFICATIONS

**Inch** Stem 3/8" dia. #4-48 UNF Thread ANSI/AGD type

| Graduation | Range | Range /Rev | Dial Reading | Order No. | | Accuracy | | Measuring force | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | w/lug | Flat-back | First 2.5 Rev | Overall | | | | |
| .0001″ | .025″ | .01″ | 0-10 | **2802S-10** | **2802SB-10** | ±.0001″ | ±.0001″ | 2.5N or less | ✔ | | ✔ |
| .0001″ | .025″ | .01″ | 0-5-0 | **2803S-10** | **2803SB-10** | ±.0001″ | ±.0001″ | 2.5N or less | ✔ | | ✔ |
| .0001″ | .05″ | .01″ | 0-10 | **2804S-10** | **2804SB-10** | ±.0001″ | ±.0002″ | 2.0N or less | ✔ | | ✔ |
| .0001″ | .05″ | .01″ | 0-5-0 | **2805S-10** | **2805SB-10** | ±.0001″ | ±.0002″ | 2.0N or less | ✔ | | ✔ |
| .0001″ | .05″ | .01″ | 10-0 | **2905S-10** | **2905SB-10** | ±.0001″ | ±.0002″ | 2.0N or less | ✔ | ✔ | ✔ |
| .0001″ | .05″ | .01″ | 0-5-0 | **2923S-10** | **2923SB-10** | ±.0001″ | ±.0002″ | 2.0N or less | ✔ | ✔ | ✔ |
| .0001″ | .25″ | .01″ | 0-10 | **2356S-10** | **2356SB-10** | ±.0001″ | ±.0005″ | 2.0N or less | | | ✔ |
| .0001″ | .5″ | .01″ | 0-10 | **2358S-10** | **2358SB-10** | ±.0001″ | ±.0008″ | 2.0N or less | | | ✔ |
| .0005″ | .125″ | .05″ | 0-50 | **2506S** | **2506SB** | ±.0005″ | ±.0005″ | 1.8N or less | | | |
| .0005″ | .125″ | .05″ | 0-25-0 | **2507S** | **2507SB** | ±.0005″ | ±.0005″ | 1.8N or less | | | |
| .0005″ | .125″ | .05″ | 0-25-0 | **2922S** | **2922SB** | ±.0005″ | ±.0005″ | 1.8N or less | | ✔ | |
| .0005″ | .5″ | .05″ | 0-50 | **2514S** | **2514SB** | ±.0005″ | ±.0015″ | 1.8N or less | | | |
| .0005″ | 1″ | .05″ | 0-50 | **2776S** | **2776SB** | ±.0005″ | ±.002″ | 2.5N or less | | | |
| .001″ | .5″ | .1″ | 0-100 | **2414S** | **2414SB** | ±.001″ | ±.001″ | 1.8N or less | | | |
| .001″ | .5″ | .1″ | 100-0 | **2914S** | **2914SB** | ±.001″ | ±.001″ | 0.4-1.8N | | ✔ | |
| .001″ | .5″ | .1″ | 0-50-0 | **2415S** | **2415SB** | ±.001″ | ±.001″ | 1.8N or less | | | |
| .001″ | 1″ | .1″ | 0-100 | **2416S** | **2416SB** | ±.001″ | ±.002″ | 1.8N or less | | | |
| .001″ | 1″ | .1″ | 0-100 | **2416S-06*** | **2416SB-06*** | ±.001″ | ±.002″ | 1.8N or less | | | |
| .001″ | 1″ | .1″ | 0-100 | **2416S-10** | **2416SB-10** | ±.001″ | ±.002″ | 1.8N or less | | | ✔ |
| .001″ | 1″ | .1″ | 0-50-0 | **2417S** | **2417SB** | ±.001″ | ±.002″ | 1.8N or less | | | |
| .001″ | 1″ | .1″ | 100-0 | **2904S** | **2904SB** | ±.001″ | ±.002″ | 1.8N or less | | ✔ | |
| .001″ | 2″ | 1″ | 0-100 | **2424S-19** | **2424SB-19** | ±.001″ | ±.003″ | 2.5N or less | ✔ | | ✔ |

* Black Face

Shockproof type  Reverse reading type  Jeweled bearing type

# Dial Indicators

## SERIES 2 — Standard Type, Inch Reading



2506S



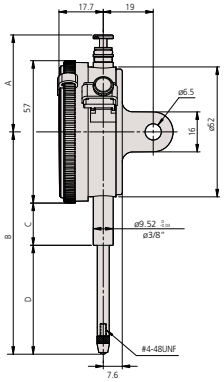
2923S-10



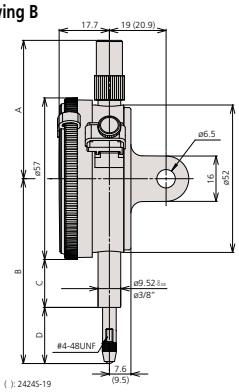
2424S-19

## DIMENSIONS

Drawing A



Drawing B



Unit: mm

### 2 Group Inch

| Order No. | A | B | C | D | Drawing |
|---|---|---|---|---|---|
| **2356S(B)-10** | 48.8 | 57.2 | 13.6 | 15.1 | B |
| **2358S(B)-10** | 38.9 | 63.6 | 13.6 | 21.5 | A |
| **2414S(B)** | 38.9 | 64.1 | 13.6 | 22 | A |
| **2415S(B)** | 38.9 | 64.1 | 13.6 | 22 | A |
| **2416S(B)** | 38.9 | 76.8 | 13.6 | 34.7 | A |
| **2416S(B)-06** | 38.9 | 76.8 | 13.6 | 34.7 | A |
| **2416S(B)-10** | 38.9 | 76.8 | 13.6 | 34.7 | A |
| **2417S(B)** | 38.9 | 76.8 | 13.6 | 34.7 | A |
| **2424S(B)-19** | 118.5 | 142.5 | 54.3 | 59.7 | B |
| **2506S(B)** | 48.8 | 54.3 | 13.6 | 12.2 | B |
| **2507S(B)** | 48.8 | 54.3 | 13.6 | 12.2 | B |
| **2514S(B)** | 38.9 | 64.1 | 13.6 | 22 | A |

| Order No. | A | B | C | D | Drawing |
|---|---|---|---|---|---|
| **2776S(B)** | 38.9 | 76.8 | 13.6 | 34.7 | A |
| **2802S(B)-10** | 48.8 | 51.4 | 13.6 | 9.3 | B |
| **2803S(B)-10** | 48.8 | 51.4 | 13.6 | 9.3 | B |
| **2804S(B)-10** | 48.8 | 51.7 | 13.6 | 9.6 | B |
| **2805S(B)-10** | 48.8 | 51.7 | 13.6 | 9.6 | B |
| **2904S(B)** | 38.9 | 76.8 | 13.6 | 34.7 | A |
| **2905S(B)-10** | 48.8 | 51.7 | 13.6 | 9.6 | B |
| **2914S(B)** | 38.9 | 64.1 | 13.6 | 22 | A |
| **2915S(B)-10** | 52.2 | 63.3 | 13.6 | 21.2 | A |
| **2918S(B)-10** | 52.2 | 63.3 | 13.6 | 21.2 | A |
| **2922S(B)** | 48.8 | 54.3 | 13.6 | 12.2 | B |
| **2923S(B)-10** | 48.8 | 51.7 | 13.6 | 9.6 | B |



2046S



2046S-60




# Dial Indicators

## SERIES 2 — Metric Standard Type

Series 2 dial indicators are Mitutoyo's most popular and have the widest application.

## FEATURES

- Standard 0.01mm graduation dial gages having an outer frame with an outside diameter of 57mm. All types come with limit pins and an outer-frame clamp as standard.
- The outer clamp and lifting lever (optional) can be attached to either the right or left side. These parts can be easily installed and removed without tools.
- Secured adhesion between the outer frame and crystal, as well as the use of an O-ring, protect against water and oil permeation via the front face.
- The stem spindle is made of high-strength quench-hardened stainless steel for longevity.
- A carbide contact point is used.
- The grand gear uses stainless steel that is resistant to wear and deformation.
- Application of a hard coating on the surface of the crystal makes the gage highly scratch- and chemical-resistant.

Shockproof type | Waterproof type | Long stem type | Jeweled bearing type

Double scale spacing type | w/ coaxial revolution counter | Reverse reading type | w/ damper at lowest rest point

## SPECIFICATIONS

Metric — Stem dia. ø8mm M2.5 x 0.45 Thread

ISO/JIS type

| Graduation | Range | Range / Rev | Dial reading | Order No. w/ lug | Order No. Flat-back | Accuracy | Measuring Force | Shockproof | Waterproof | Long stem | Jeweled bearing | Double scale spacing | w/ coaxial revolution counter | Reverse reading | w/ damper at lowest rest point |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.001mm | 1mm | (0.1mm) | 0-100 | **2110S-10** | **2110SB-10** | ±0.005mm | 1.5N or less | ✔ | | | ✔ | ✔ | | | |
| 0.001mm | 1mm | (0.1mm) | 0-100 | **2110S-70** | **2110SB-70** | ±0.005mm | 2.0N or less | ✔ | ✔ | | ✔ | ✔ | | | |
| 0.001mm | 1mm | (0.2mm) | 0-100-0 | **2109S-10** | **2109SB-10** | ±0.005mm | 1.5N or less | ✔ | | | ✔ | | | | |
| 0.001mm | 1mm | (0.2mm) | 0-100-0 | **2109S-70** | **2109SB-70** | ±0.005mm | 2.0N or less | ✔ | ✔ | | ✔ | | | | |
| 0.001mm | 2mm | (0.2mm) | 0-100-0 | **2113S-10** | **2113SB-10** | ±0.007mm | 1.5N or less | ✔ | | | ✔ | | | | |
| 0.001mm | 5mm | (0.2mm) | 0-100-100 | **2118S-10** | **2118SB-10** | ±0.010mm | 1.5N or less | | | | ✔ | | | | |
| 0.001mm | 5mm | (0.2mm) | 0-100-0 | **2119S-10** | **2119SB-10** | ±0.010mm | 1.5N or less | | | | ✔ | | | | |
| 0.005mm | 5mm | (0.5mm) | 0-50 | **2124S-10** | **2124SB-10** | ±0.012mm | 1.5N or less | | | | ✔ | | | | |
| 0.01mm | 5mm | (1mm) | 0-100 | **2044S** | **2044SB** | ±0.012mm | 1.4N or less | | | | | | | | |
| 0.01mm | 5mm | (1mm) | 0-100 | **2044S-09** | **2044SB-09** | ±0.013mm | 1.4N or less | ✔ | | | | | | | |
| 0.01mm | 5mm | (1mm) | 0-100 | **2044S-60** | **2044SB-60** | ±0.012mm | 2.5N or less | | ✔ | | | | | | |
| 0.01mm | 5mm | (1mm) | 0-50-0 | **2045S** | **2045SB** | ±0.012mm | 1.4N or less | | | | | | | ✔ | |
| 0.01mm | 10mm | (1mm) | 0-100 | **2046S** | **2046SB** | ±0.013mm | 1.4N or less | | | | | | | | |
| 0.01mm | 10mm | (1mm) | 0-100 | **2046S-09** | **2046SB-09** | ±0.015mm | 1.4N or less | ✔ | | | | | | | |
| 0.01mm | 10mm | (1mm) | 0-100 | **2046S-60** | **2046SB-60** | ±0.013mm | 2.5N or less | | ✔ | | | | | | |
| 0.01mm | 10mm | (1mm) | 0-100 | **2310S-10** | **2310SB-10** | ±0.015mm | 1.4N or less | | | | ✔ | | ✔ | | |
| 0.01mm | 10mm | (1mm) | 100-0 | **2902S** | **2902SB** | ±0.013mm | 1.4N or less | | | | | | | ✔ | |
| 0.01mm | 10mm | (1mm) | 0-50-0 | **2047S** | **2047SB** | ±0.013mm | 1.4N or less | | | | | | | | |
| 0.01mm | 20mm | (1mm) | 0-100 | **2050S** | **2050SB** | ±0.020mm | 2.0N or less | | | | | | | | ✔ |
| 0.01mm | 20mm | (1mm) | 0-100 | **2050S-60** | **2050SB-60** | ±0.020mm | 2.5N or less | | ✔ | | | | | | |
| 0.01mm | 20mm | (1mm) | 0-100 | **2050S-19** | **2050SB-19** | ±0.020mm | 2.0N or less | ✔ | | | ✔ | | | | ✔ |
| 0.01mm | 20mm | (1mm) | 0-100 | **2320S-10** | **2320SB-10** | ±0.020mm | 2.0N or less | | | | ✔ | | ✔ | | ✔ |
| 0.01mm | 30mm | (1mm) | 0-100 | **2052S** | **2052SB** | ±0.025mm | 2.5N or less | | | | | | | | ✔ |
| 0.01mm | 30mm | (1mm) | 0-100 | **2052S-19** | **2052SB-19** | ±0.025mm | 2.5N or less | ✔ | | | ✔ | | | | ✔ |
| 0.01mm | 30mm | (1mm) | 0-100 | **2330S-10** | **2330SB-10** | ±0.025mm | 2.5N or less | | | | ✔ | | ✔ | | ✔ |
| 0.01mm | 30mm | (1mm) | 100-0 | **2952S** | **2952SB** | ±0.025mm | 2.5N or less | | | | | | | ✔ | ✔ |

*Use in a vertical position only (contact point downward).



**2046S**
**2046S-09**



**2046S-60**



**2047S**



Mitutoyo

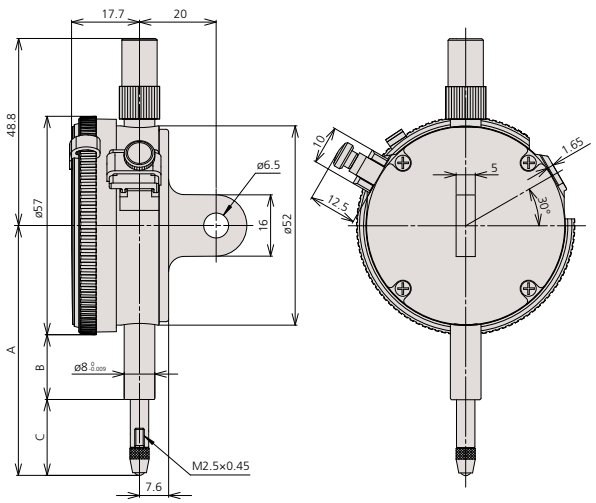
# Dial Indicators

## SERIES 2 — Metric Standard Type

### DIMENSIONS

ISO/JIS Type

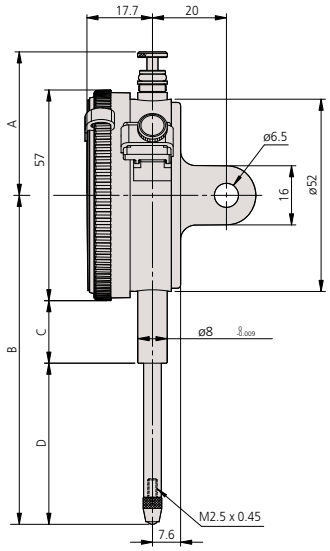
Unit: mm




| Order No. | A | B | C |
|---|---|---|---|
| 2124S-10 | 60.3 | 16.9 | 14.9 |
| 2110S-10 | 66.5 | 16.9 | 21.1 |
| 2110S-70 | 67.5 | 12.3 | 26.7 |
| 2109S-10 | 60.5 | 16.9 | 15.1 |
| 2109S-70 | 65.3 | 12.3 | 24.5 |
| 2113S-10 | 61 | 16.9 | 15.6 |
| 2118S-10 | 60.3 | 16.9 | 14.9 |
| 2119S-10 | 60.3 | 16.9 | 14.9 |
| 2044S | 65.2 | 16.9 | 19.8 |
| 2044S-09 | 65.2 | 16.9 | 19.8 |
| 2044S-60 | 70 | 12.3 | 29.2 |
| 2045S | 65.2 | 16.9 | 19.8 |
| 2046S | 65.2 | 16.9 | 19.8 |
| 2046S-09 | 65.2 | 16.9 | 19.8 |
| 2046S-60 | 70 | 12.3 | 29.2 |
| 2310S-10 | 65.2 | 16.9 | 19.8 |
| 2902S | 65.2 | 16.9 | 19.8 |
| 2047S | 65.2 | 16.9 | 19.8 |

ISO/JIS Type

Unit: mm




| Order No. | A | B | C | D |
|---|---|---|---|---|
| 2050S | 38.8 | 75.2 | 16.9 | 29.8 |
| 2050S-60 | 59.8 | 87.2 | 12.3 | 46.4 |
| 2050S-19 | 38.8 | 75.2 | 16.9 | 29.8 |
| 2320S-10 | 38.8 | 75.2 | 16.9 | 29.8 |
| 2052S | 38.8 | 88.7 | 16.9 | 43.3 |
| 2052S-19 | 38.8 | 88.7 | 16.9 | 43.3 |
| 2330S-10 | 38.8 | 88.7 | 16.9 | 43.3 |
| 2952S | 38.8 | 88.7 | 16.9 | 43.3 |

Mitutoyo guarantees the product quality.
PROPRIETARY INSPECTION CERTIFICATE
Mitutoyo guarantees the product quality.




2902S




2310S-10




2044S
2044S-60
2044S-09




2045S

### Optional Accessories

———: Backs (See page F-33.)
———: Contact points (See page F-34.)

# Dial Indicators

## SERIES 2 — ANSI / AGD Type Metric Dial Indicator

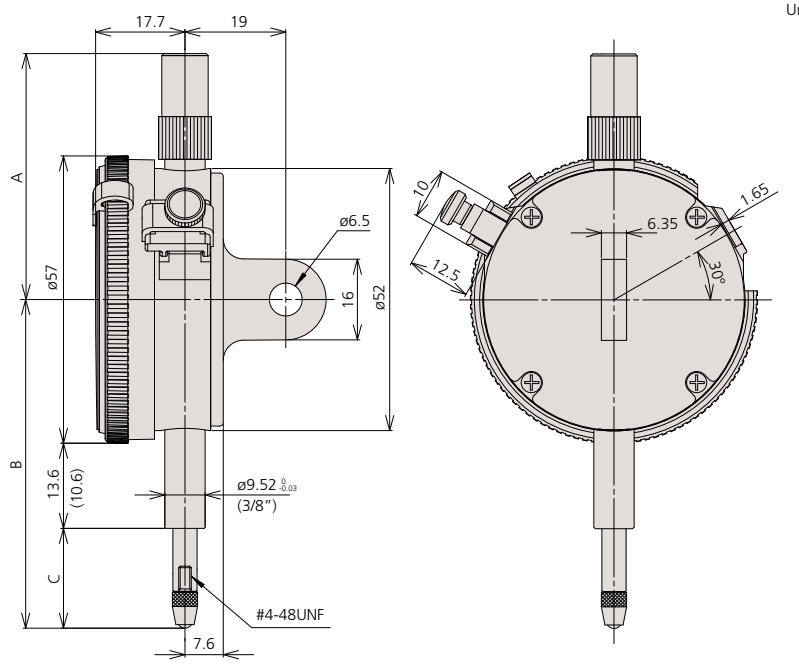
### SPECIFICATIONS

**Metric** Stem dia. 3/8", #4-48 UNF Thread Yellow Dial Face ANSI/AGD type

| Graduation | Range | Range / Rev | Dial reading | Order No. w/ lug | Order No. Flat-back | Accuracy First 2.5 Rev | Accuracy Overall | Measuring force | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.001mm | 1mm | 0.2mm | 0-100-0 | **2109S-11** | **2109SB-11** | ±0.003mm | ±0.004mm | 1.5N or less | ✔ | ✔ |
| 0.001mm | 5mm | 0.2mm | 0-100-0 | **2119S-11** | **2119SB-11** | ±0.007mm | ±0.01mm | 1.5N or less | ✔ | |
| 0.01mm | 2.5mm | 1mm | 0-100 | **2230S-01** | **2230SB-01** | ±0.01mm | ±0.01mm | 1.4N or less | | |
| 0.01mm | 2.5mm | 1mm | 0-50-0 | **2231S-01** | **2231SB-01** | ±0.01mm | ±0.01mm | 1.4N or less | | |
| 0.01mm | 10mm | 1mm | 0-100 | **2046S-01** | **2046SB-01** | ±0.01mm | ±0.013mm | 1.4N or less | | |
| 0.01mm | 10mm | 1mm | 0-100 | **2046S-11** | **2046SB-11** | ±0.01mm | ±0.013mm | 1.4N or less | ✔ | |
| 0.01mm | 10mm | 1mm | 0-50-0 | **2047S-01** | **2047SB-01** | ±0.01mm | ±0.013mm | 1.4N or less | | |
| 0.01mm | 10mm | 1mm | 0-50-0 | **2047S-11** | **2047SB-11** | ±0.01mm | ±0.013mm | 1.4N or less | ✔ | |
| 0.01mm | 10mm | 1mm | 100-0 | **2902S-01** | **2902SB-01** | ±0.01mm | ±0.013mm | 1.4N or less | | |
| 0.01mm | 20mm | 1mm | 0-100 | **2050S-01** | **2050SB-01** | ±0.01mm | ±0.02mm | 2.0N or less | | |
| 0.01mm | 20mm | 1mm | 0-100 | **2050S-11** | **2050SB-11** | ±0.01mm | ±0.02mm | 2.0N or less | ✔ | |
| 0.01mm | 25mm | 1mm | 0-100 | **2056S-01** | **2056SB-01** | ±0.01mm | ±0.025mm | 2.5N or less | | |

### DIMENSIONS

Unit: mm




( ): water proof type

| Order No. | A | B | C |
|---|---|---|---|
| **2109S-11** | 48.8 | 51.4 | 9.3 |
| **2119S-11** | 48.8 | 55.8 | 13.7 |
| **2230S-01** | 48.8 | 53.6 | 11.5 |
| **2231S-01** | 48.8 | 53.6 | 11.5 |
| **2046S-01** | 48.8 | 61.1 | 19.0 |
| **2046S-11** | 48.8 | 61.1 | 19.0 |
| **2047S-01** | 48.8 | 61.1 | 19.0 |
| **2902S-01** | 48.8 | 61.1 | 19.0 |
| **2050S-01** | 38.8 | 71.1 | 29.0 |
| **2050S-11** | 38.8 | 71.1 | 29.0 |
| **2056S-01** | 38.8 | 76.1 | 34.0 |

### Optional Accessories

———: Backs (See page F-33.)
———: Contact points (See page F-34.)



Mitutoyo

# Dial Indicators

## SERIES 3 — Large Dial Face and Long Stroke

- Dial gages with a large-diameter (78mm / 3.07") graduation face for easy reading.



3109S-10



3058S-19



3416S



3046S



3047S



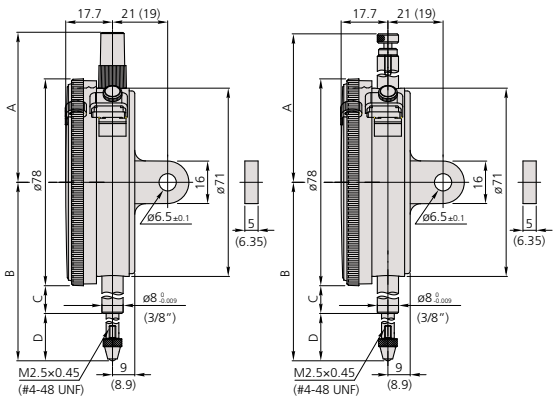
3050S



3052S-19

## DIMENSIONS

Unit: mm




( ): ANSI / AGD Type

| Order No. | A | B | C | D |
|---|---|---|---|---|
| 3052S(B)-11 | 72.9 | 102.4 | 25.9 | 37.5 |
| 3058S(B)-11 | 81.9 | 147.1 | 50.6 | 57.5 |
| 3414S(B) | 51.3 | 73.4 | 12.6 | 21.8 |
| 3415S(B) | 51.3 | 73.4 | 12.6 | 21.8 |
| 3416S(B) | 51.3 | 86.1 | 12.6 | 34.5 |
| 3417S(B) | 51.3 | 86.1 | 12.6 | 34.5 |
| 3424S(B)-19 | 84 | 149.3 | 50.6 | 59.7 |
| 3426S(B)-19 | 120.9 | 198.1 | 73.9 | 85.2 |
| 3428S(B)-19 | 141.9 | 243.9 | 94.9 | 110.0 |
| 3802S(B)-10 | 61.2 | 59.7 | 12.6 | 8.1 |
| 3803S(B)-10 | 61.2 | 59.7 | 12.6 | 8.1 |
| 3046S(B) | 61.2 | 75.5 | 15.9 | 20.6 |
| 3047S(B) | 61.2 | 75.5 | 15.9 | 20.6 |
| 3050S(B) | 52.6 | 94.0 | 25.9 | 29.1 |
| 3052S(B)-19 | 72.9 | 104.3 | 25.9 | 39.4 |
| 3060S(B)-19 | 120.9 | 202.3 | 73.9 | 89.4 |
| 3062S(B)-19 | 141.9 | 243.3 | 94.9 | 109.4 |
| 3109S(B)-10 | 61.2 | 79.3 | 25.9 | 14.1 |

# Dial Indicators

## SERIES 3 — Large Dial Face

### SPECIFICATIONS

**Inch** Stem 3/8" DIA. #4-48 UNF Thread ☐ ANSI/AGD type

| Graduation | Range | Range /rev | Dial reading | Order No. | | Accuracy | | Measuring Force | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | W/ lug | Flat-back | First 2.5 Rev | Overall Accuracy | | | | |
| .0001" | .025" | .01" | 0-10 | **3802S-10** | **3802SB-10** | ±.0001" | ±.0001" | 2.0N or less | ✔ | ✔ | |
| .0001" | .025" | .01" | 0-5-0 | **3803S-10** | **3803SB-10** | ±.0001" | ±.0001" | 2.0N or less | ✔ | ✔ | |
| .001" | .5" | .1" | ±0-100 | **3414S** | **3414SB** | ±.001" | ±.001" | 1.8N or less | | | |
| .001" | .5" | .1" | 0-50-0 | **3415S** | **3415SB** | ±.001" | ±.001" | 1.8N or less | | | |
| .001" | 1" | .1" | ±0-100 | **3416S** | **3416SB** | ±.001" | ±.002" | 1.8N or less | | | |
| .001" | 1" | .1" | 0-50-0 | **3417S** | **3417SB** | ±.001" | ±.002" | 1.8N or less | | | |
| .001" | 2" | .1" | ±0-100 | **3424S-19** | **3424SB-19** | ±.001" | ±.003" | 3.0N or less | ✔ | ✔ | ✔ |
| .001" | 3" | .1" | ±0-100 | **3426S-19** | **3426SB-19** | ±.001" | ±.005" | 3.0N or less | ✔ | ✔ | ✔ |
| .001" | 4" | .1" | ±0-100 | **3428S-19** | **3428SB-19** | ±.001" | ±.005" | 3.2N or less | ✔ | ✔ | ✔ |

**Metric** Stem 3/8" DIA. #4-48 UNF Thread, Yellow dial face ☐ ANSI/AGD type

| Graduation | Range | Range /rev | Dial reading | Order No. | | Accuracy | | Measuring Force | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | W/ lug | Flat-back | First 2.5 Rev | Overall Accuracy | | | | |
| 0.01mm | 30mm | 1mm | ±0-100 | **3052S-11** | **3052SB-11** | ±0.01mm | ±0.03mm | 2.5N or less | ✔ | ✔ | ✔ |
| 0.01mm | 50mm | 1mm | ±0-100 | **3058S-11** | **3058SB-11** | ±0.01mm | ±0.04mm | 3.0N or less | ✔ | ✔ | ✔ |

**Metric** Stem ø 8mm M2.5x0.45 Thread ☐ ISO/JIS type

| Graduation | Range | Range /rev | Dial reading | Order No. | | Accuracy | Measuring Force | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | W/ lug | Flat-back | | | | | | |
| 0.001mm | 1mm | 0.2mm | 0-10-0 | **3109S-10** | **3109SB-10** | ±0.005mm | 1.5N or less | ✔ | ✔ | | |
| 0.01mm | 10mm | 1mm | 0-100 | **3046S** | **3046SB** | ±0.015mm | 1.4N or less | | | | |
| 0.01mm | 10mm | 1mm | 0-50-0 | **3047S** | **3047SB** | ±0.015mm | 1.4N or less | | | | |
| 0.01mm | 20mm | 1mm | 0-100 | **3050S** | **3050SB** | ±0.020mm | 2.0N or less | | | | ✔ |
| 0.01mm | 30mm | 1mm | 0-100 | **3052S-19** | **3052SB-19** | ±0.025mm | 2.5N or less | ✔ | ✔ | ✔ | |
| 0.01mm | 50mm | 1mm | 0-100 | **3058S-19** | **3058SB-19** | ±0.035mm | 3.0N or less | ✔ | ✔ | ✔ | |
| 0.01mm | 80mm | 1mm | 0-100 | **3060S-19*** | **3060SB-19*** | ±0.045mm | 3.0N or less | ✔ | ✔ | ✔ | |
| 0.01mm | 100mm | 1mm | 0-100 | **3062S-19*** | **3062SB-19*** | ±0.050mm | 3.2N or less | ✔ | ✔ | ✔ | |

*use in a vertical position only

Shockproof type

w/ coaxial revolution counter

w/ damper at lowest rest point

Jeweled bearing type

### Optional Accessories

———: Backs (See page F-33.)
———: Contact points (See page F-34.)



Mitutoyo

# Dial Indicators

## SERIES 4 — Large Dial Face

- Dial gages with a large-diameter (92mm / 3.62″) graduation face for easy reading.
- All types come standard with limit pins and an outer frame clamp.



4046S



4887S-19

## SPECIFICATIONS

**Inch** Stem 3/8″ DIA. #4-48 UNF Thread — ANSI/AGD type

| Graduation | Range | Range /rev | Dial reading | Order No. | | Accuracy | | Measuring Force | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | W/ lug | Flat-back | First 2.5 Rev | Overall accuracy | | | | |
| .001″ | 3″ | .1″ | ±0-100 | **4887S-19** | **4887SB-19** | ±.001″ | ±.005″ | 3.0N or less | ✔ | ✔ | ✔ |

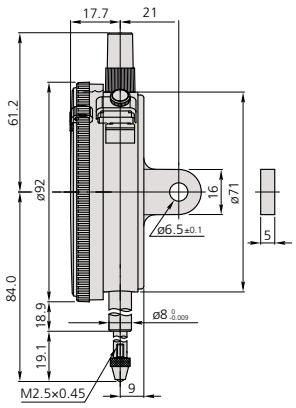
**Metric** Stem ø 8mm M2.5x0.45 Thread — ISO/JIS type

| Graduation | Range | Range /rev | Dial reading | Order No. | | Accuracy | | Measuring Force | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | W/ lug | Flat-back | First 2.5 Rev | Overall accuracy | | | |
| 0.01mm | 10mm | 1mm | 0-100 | **4046S** | **4046SB** | ± 0.01mm | ± 0.015mm | 1.4N or less | ✔ | ✔ |

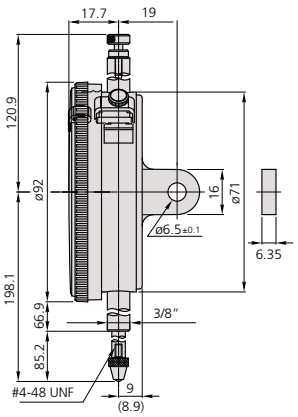
## DIMENSIONS

Unit: mm

**4046S(B)**




**4887S(B)-19**




## Optional Accessories

———: Backs (See page F-33.)
———: Contact points (See page F-34.)

# Back Plunger Dial Indicators

## SERIES 1 and 2

Mitutoyo's back-plunger dial indicators are built with the measuring spindles on the back of the units. This type of indicator offers the same precision and durability as all other Mitutoyo dial indicators, and operates effectively with optional holding bars.

- Back-plunger dial gages are suitable for mounting onto leveling machine tool tables or inspection jigs, and for use in small spaces where the graduations of standard dial gages are difficult to see.
- Model No. 1960T, which uses Mitutoyo's proprietary shock-proofing mechanism, has excellent durability and shock resistance.

One revolution type  Shockproof type  Jeweled bearing type

## SPECIFICATIONS

**Inch** Series 1 Stem 3/8" dia. , #4-48 UNF Thread  ANSI/AGD type

| Graduation | Range | Range / Rev | Dial reading | Order No. | Accuracy | Measuring Force | | | |
|---|---|---|---|---|---|---|---|---|---|
| .001″ | .04″ | .05″* | 20-0-20 | **1961T** | ±.001″ | 0.4 - 1.4N | ✔ | ✔ | |
| .001″ | .2″ | .05″ | 0-50 | **1166T** | ±.001″ | 0.4 - 1.4N | | | |
| .001″ | .2″ | .05″ | 0-25-0 | **1167T** | ±.001″ | 0.4 - 1.4N | | | |
| .001″ | .2″ | .05″ | 50-0 | **1168T** | ±.001″ | 0.4 - 1.4N | | | ✔ |

*Full stroke

**Metric** Series 1 Stem ø8mm, M2.5x0.45 Thread  ISO/JIS type

| Graduation | Range | Range / Rev | Dial reading | Order No. | Accuracy | Measuring Force | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.01mm | 1mm | 1.27mm* | 50-0-50 | **1960T** | ±0.014mm | 0.4 - 1.4N | ✔ | ✔ | | — |
| 0.01mm | 5mm | 1mm | 0-100 | **1160T** | ±0.016mm | 0.4 - 1.4N | | | | — |
| 0.01mm | 5mm | 1mm | 100-0 | **1162T** | ±0.016mm | 0.4 - 1.4N | | | ✔ | — |

*Full stroke

**Inch** Series 2 Stem 3/8" dia. , #4-48 UNF Thread  ANSI/AGD type

| Graduation | Range | Range/full stroke | Dial reading | Order No. | Accuracy | Measuring Force | | | |
|---|---|---|---|---|---|---|---|---|---|
| .0001″ | .008″ | .01″ | 4-0-4 | **2991T-10** | ±.0002″ | 0.4 - 1.5N | ✔ | ✔ | ✔ |
| .0005″ | .04″ | .05″ | 20-0-20 | **2961T** | ±.0005″ | 0.4 - 1.4N | ✔ | ✔ | |

**Metric** Series 2 Stem ø8mm, M2.5x0.45 Thread  ISO/JIS type

| Graduation | Range | Range/full stroke | Dial reading | Order No. | Accuracy | Measuring Force | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.001mm | 0.1mm | 0.14mm | 50-0-50 | **2990T-10** | ±0.005mm | 0.4 - 1.5N | ✔ | ✔ | ✔ |
| 0.01mm | 1mm | 1.27mm | 50-0-50 | **2960T** | ±0.014mm | 0.4 - 1.4N | ✔ | ✔ | |

### Optional Accessories

**136567**: Holding bar (ø6mm, L=81mm)
**136568**: Holding bar (ø8mm, L=81mm)
**124625**: Holding bar (.25″ DIA, L=3.19″)

———: Backs (See page F-31.)
———: Contact points (See page F-34.)

# Back Plunger Dial Indicators

## SERIES 1 and 2



2960T

Balanced scale



Graduation: 0.01mm,
Measuring range: 1mm

**2960T**
- One revolution
- Shockproof
- Back plunger



2990T-10

Balanced scale



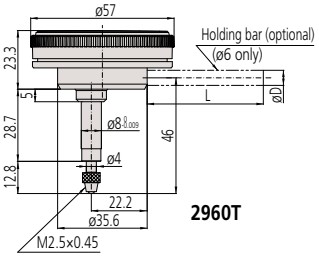
Graduation: 0.01mm,
Measuring range: 1mm

**2990T-10**
- One revolution
- Shockproof
- Back plunger
- Jeweled bearing

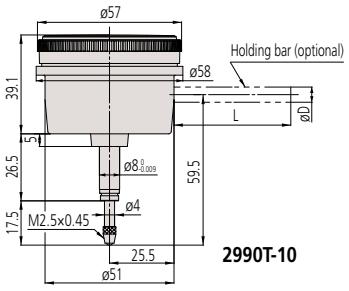
## DIMENSIONS

Unit: mm

**ISO/JIS Type**

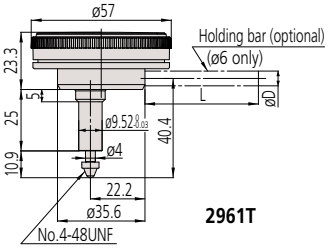



2960T

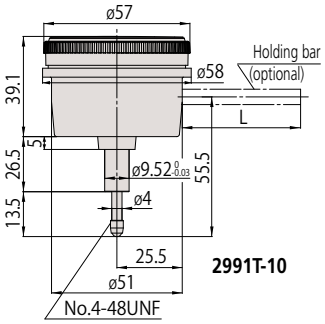



2990T-10

**ANSI/AGD Type**




2961T

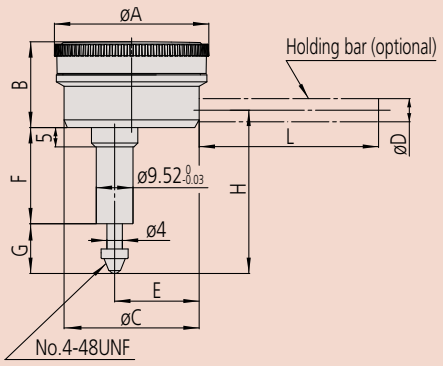



2991T-10

## DIMENSIONS

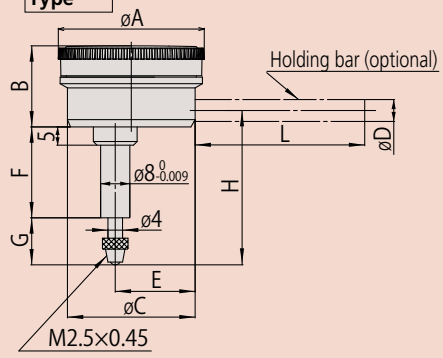
**ANSI/AGD Type**

Unit: mm




| Order No. | A | B | C | E | F | G | H |
|---|---|---|---|---|---|---|---|
| 1166T | 40 | 22.1 | 35.6 | 22.2 | 25 | 10.9 | 42 |
| 1167T | 40 | 22.1 | 35.6 | 22.2 | 25 | 10.9 | 42 |
| 1168T | 40 | 22.1 | 35.6 | 22.2 | 25 | 10.9 | 42 |
| 1961T | 40 | 22.1 | 35.6 | 22.2 | 25 | 10.9 | 40 |

**ISO/JIS Type**




| Order No. | A | B | C | E | F | G | H |
|---|---|---|---|---|---|---|---|
| 1160T | 40 | 22.1 | 35.6 | 22.2 | 25 | 13.8 | 43.3 |
| 1162T | 40 | 22.1 | 35.6 | 22.2 | 25 | 13.8 | 43.3 |
| 1960T | 40 | 22.1 | 35.6 | 22.2 | 28.7 | 12.8 | 46 |

Note 1: Refer to pages F-34 to F-35 for contact point details.
Note 2: Dimensions of the inch (ANSI/AGD Type) dial indicator partly differ from those of the metric (ISO/JIS Type) indicator.
Note 3: Inch (ANSI/AGD Type) dial indicators are provided with a stem of 3/8" dia. and #4-48UNF thread mount for the contact point.

## Holding bar (optional)

| Order No. | øD | L |
|---|---|---|
| 21AAA166 | ø6mm | 42mm |
| 136567 | ø6mm | 81mm |
| 124625 | ø6.35mm | 81mm |
| 21AAA167 | ø6.35mm | 42mm |
| 21AAA168 | ø8mm | 42mm |
| 136568 | ø8mm | 81mm |

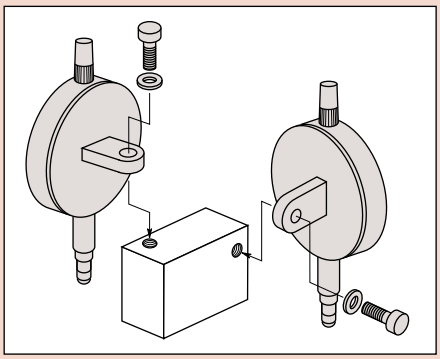
* øD and L: detail shown in drawing below.

# Backs

## Optional Accessory for Digimatic and Dial Indicators

There are two ways to support Digimatic and dial indicators--by either holding the stem or the lug on the back of the indicator. The back of the indicator may need to be replaced for special applications. A variety of backs are available for Mitutoyo Digimatic and dial indicators.

### Application



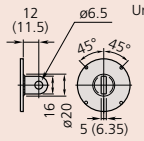
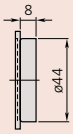
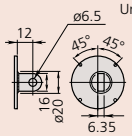
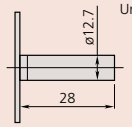
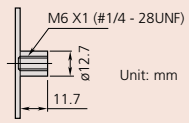
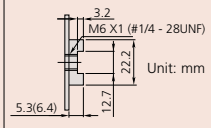
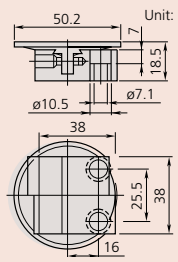
### ID-S (543-6xx only)*1

**02ACB420**: Lug-on-center back for ISO/JIS type
**02ACB430**: Lug-on-center back for AGD type
**02ACB440**: Flat back
**02ACB610**: Back with post
**02ACB620**: Adjustable back for AGD type
**02ACB630**: Adjustable back (ISO/JIS type)
**02ACB640**: Back with offset lug
**02ACB650**: Magnetic back
**02ACB660**: Back with screw mount for AGD type
**02ACB670**: Back with screw mount (ISO/JIS type)
**02ACB680**: Back with adjustable bracket

*1 Includes the required adapter.



## SPECIFICATIONS

| Description | | Order No. | | | |
|---|---|---|---|---|---|
| | | Series 0 (ø31mm) 1003 (ø36mm) | Series 1 (ø41mm) | Series 2 ID-C (all types), ID-F, ID-H ID-S (excludes 543-6xx) (Ø57mm) | Series 3, 4 (ø77, 91mm) |
| Flat Back  | Unit: mm   | **191559**: a=1.0 **137906**: for 1003 a=1.0 | **101211**: a=2.2 **136872**: for water-proof type **191559**: for 1911, 1913-10 | **101039**: a=2.5 **21AZB231**: for waterproof of S type | **100836**: a=3.0 |
| Lug-on-Center Back  | Unit: mm   | **190561**: Metric type **190139**: Inch type **137905**: for 1003 | **101210**: metric type **101307**: inch type **190561**: for 1911, 1913-10 | **101040**: metric type **101306**: inch type **21AZB230**: for waterproof of S type | **100691**: metric type **100797**: inch type |
| Magnetic Back  | Unit: mm   | — | **Special order** | **900928** | **900929** |
| Back with Offset Lug  | Unit: mm   | — | **Special order** | **101167** | **100837** |
| Back with Post  | Unit: mm   | — | **193172** | **101169** | **100839** |
| Back with Screw Mount  |   | — | **193173**: M6x1, **193174**: #1/4-28UNF, | **136023**: M6x1 **101170**: #1/4-28UNF | **136024**: M6x1 **100840**: #1/4-28UNF |
| Adjustable Back  |   | — | **136025**: M6x1 **129721**: #1/4-20UNC | **136026**: M6x1 **101168**: #1/4-20UNC | **136027**: M6x1 **100838**: #1/4-20UNC |
| Back with Adjustable Bracket  | Unit: mm   | — | — | **129902**: Dovetail Rack Back **901964**: Dovetail bracket for rack back | — |

( ): ANSI / AGD Type

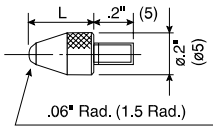


Mitutoyo

# Contact Points

## Optional Accessories for Digimatic and Dial Indicators and Linear Gages

### ø.118" (ø3mm) Ball point




**4-48UNF**

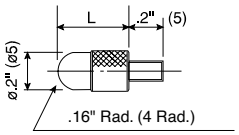
| L | Carbide | Sapphire | Ruby | Plastic |
|---|---|---|---|---|
| .25" | **21BZB005*** | — | — | — |
| .28" | — | — | — | **902018** |
| .3" | **131262** | **131263** | **131264** | — |
| .6" | **131265** | **131266** | **131267** | — |
| 1" | **131268** | **131269** | **131270** | — |

**M2.5 x 0.45mm**

| L | Carbide | Sapphire | Ruby | Plastic |
|---|---|---|---|---|
| 7.3mm | **901312*** | — | — | **901994** |
| 8mm | **120045** | **120046** | **120047** | — |
| 15mm | **120049** | **120050** | **120051** | — |
| 25mm | **120053** | **120054** | **120055** | — |

*Furnished with standard metric dial indicators.

### Shell point



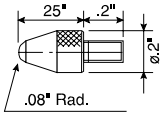

**4-48UNF**

| L | Order No. |
|---|---|
| 3/32"(.094") | **193697** |
| 5/32"(.156") | **101184** |
| 1/4"(.25") | **21AAA031** |
| 3/8"(.375") | **21AAA032** |
| 1/2"(.5") | **101185** |
| 5/8"(.625") | **21AAA033** |
| 3/4"(.75") | **101186** |
| 7/8"(.875") | **21AAA034** |
| 1" | **101187** |
| 1 1/4"(1.25") | **21AAA035** |
| 1 1/2"(1.5") | **21AAA036** |
| 1 3/4"(1.75") | **21AAA037** |
| 2" | **21AAA038** |
| 2 1/4"(2.25") | **21AAA039** |
| 2 1/2"(2.5") | **21AAA040** |
| 2 3/4"(2.75") | **21AAA041** |
| 3" | **21AAA042** |

**M2.5 x 0.45mm**

| L | Order No. |
|---|---|
| 5mm | **101386** |
| 10mm | **101118** |
| 15mm | **137393** |
| 20mm | **101387** |
| 25mm | **101388** |
| 30mm | **21AAA254** |

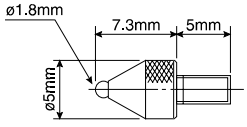
### ø.16 Ball Point




**4-48UNF**

| Order No. |
|---|
| **21BZB005** |

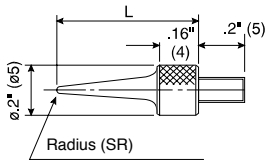
### ø1.8mm Ball Point




**M2.5 x 0.45mm**

| Order No. |
|---|
| **101122** |

### Needle point



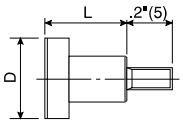

**4-48UNF**

| L | Order No. | SR |
|---|---|---|
| .6" | **21AAA030** | **.016"** |
| 1" | **21AAA046** | **.016"** |
| 11/2" | **21AAA047** | **.016"** |
| 2" | **21AAA048** | **.016"** |

**M2.5 x 0.45mm**

| L | Order No. | SR |
|---|---|---|
| 15mm | **101121** | **0.4** |
| 17mm | **137413** | **0.2** |

### Flat point



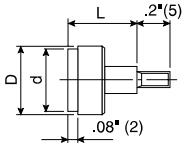

**4-48UNF**

| D | L | Order No. |
|---|---|---|
| Ø1/2" | 3/8" | **101188** |
| Ø3/8" | 3/8" | **101189** |

**M2.5 x 0.45mm**

| D | L | Order No. |
|---|---|---|
| Ø10mm | 10mm | **101117** |

### Flat-point, Carbide tip



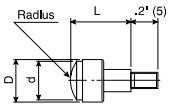

**4-48UNF**

| D | d | L | Order No. |
|---|---|---|---|
| Ø.2" | Ø.17" | .2" | **131259** |
| Ø.27" | Ø.25" | .4" | **131260** |
| Ø.41" | Ø.37" | .4" | **131261** |

**M2.5 x 0.45mm**

| D | d | L | Order No. |
|---|---|---|---|
| Ø5.2mm | Ø4.3mm | 5mm | **120041** |
| Ø7mm | Ø6.5mm | 10mm | **120042** |
| ,10.5mm | Ø9.5mm | 10mm | **120043** |

### Spherical-point, Carbide tip



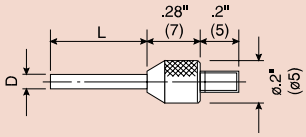

**4-48UNF**

| D | d | Radius | L | Order No. |
|---|---|---|---|---|
| ø.2" | ø.17" | .2" | .2" | **131273** |
| ø.27" | ø.16" | .16" | .4" | **131274** |
| ø.41" | ø.37" | .4" | .4" | **131275** |

**M2.5 x 0.45mm**

| D | d | Radius | L | Order No. |
|---|---|---|---|---|
| ø5.2mm | ø4.3mm | 5mm | 5mm | **120058** |
| ø7mm | ø6.5mm | 7mm | 10mm | **120059** |
| ø10.5mm | ø9.5mm | 10mm | 10mm | **120060** |

### Needle point, Carbide tipped



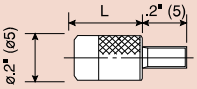

**4-48UNF**

| D | L | Order No. |
|---|---|---|
| ø.018" | .12" | **131281** |
| ø.04" | .12" | **131280** |
| ø.06" | .5" | **131279** |
| ø.078" | .04" | **131271** |

**M2.5 x 0.45mm**

| D | L | Order No. |
|---|---|---|
| ø0.45mm | 2.5mm | **120066** |
| ø1mm | 2.5mm | **120065** |
| ø1.5mm | 13mm | **120064** |
| ø2mm | 1mm | **120056** |
| ø2mm | 8mm | **137257** |

### ø.2" (ø5mm) Flat point



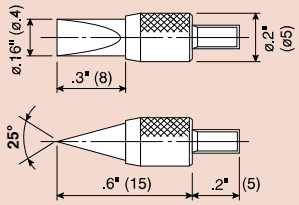

**4-48UNF**

| L | Order No. |
|---|---|
| 5/16" | **133017** |
| 1/2" | **21AAA043** |
| 3/4 | **21AAA044** |
| 1 | **21AAA045** |

**M2.5 x 0.45mm**

| L | Order No. |
|---|---|
| 8mm | **131365** |

### Knife-edge point, Carbide tipped



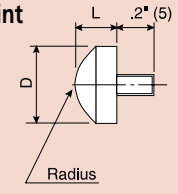

**4-48UNF**

| Order No. |
|---|
| **131282** |

**M2.5 x 0.45mm**

| Order No. |
|---|
| **120067** |

### Spherical point




**4-48UNF**

| D | L | Radius | Order No. |
|---|---|---|---|
| ø.5" | .125" | .28" | **101205** |
| ø.375" | .09375" | .35" | **101204** |

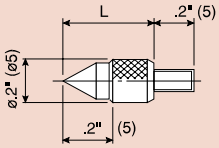
**M2.5 x 0.4 5mm**

| D | L | Radius | Order No. |
|---|---|---|---|
| ø10mm | 5mm | 7mm | **101119** |

# Contact Points

## Optional Accessories for Digimatic and Dial Indicators and Linear Gages

### 60˚ Conical point



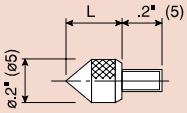

**4-48UNF**

| L | Order No. |
|---|---|
| 1/2" | 101190 |

**M2.5 x 0.45mm**

| L | Order No. |
|---|---|
| 10mm | 101120 |

### 90˚ Conical point



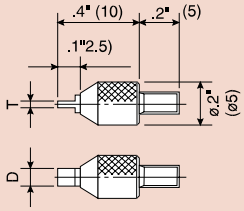

**4-48UNF**

| L | Order No. |
|---|---|
| 1/4" | 101191 |

**M2.5 x 0.45mm**

| L | Order No. |
|---|---|
| 5mm | 101385 |

### Blade point, Carbide tip



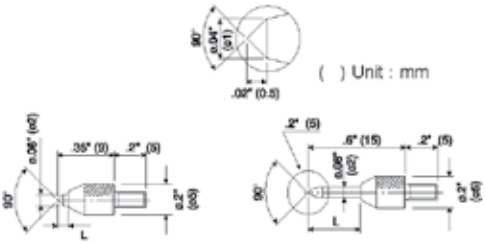

**4-48UNF**

| D | T | Order No. |
|---|---|---|
| .08" | .016" | 131276 |
| .08" | .024" | 131277 |
| .16" | .04" | 131278 |

**M2.5 x 0.45mm**

| D | T | Order No. |
|---|---|---|
| 2mm | 0.4mm | 120061 |
| 2mm | 0.6mm | 120062 |
| 4mm | 1mm | 120063 |

### 90˚ Conical point, Carbide tipped




**4-48UNF**

| L | Order No. |
|---|---|
| .08" | 131272 |

**4-48UNF**

| L | Order No. |
|---|---|
| .3" | 131283 |

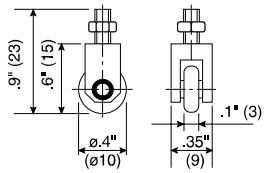
**M2.5 x 0.45mm**

| L | Order No. |
|---|---|
| 2mm | 120057 |

**M2.5 x 0.45mm**

| L | Order No. |
|---|---|
| 8mm | 120068 |

### Roller Point




**4-48UNF**

| Order No. |
|---|
| 901991 |

**M2.5 x 0.45mm**

| Order No. |
|---|
| 901954 |

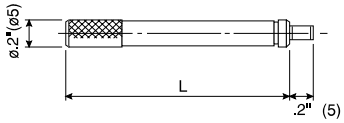
### Interchangeable Contact Point Set (M2.5x0.45)

Set Order No. **7822**



| Individual No. | Description |
|---|---|
| 131365 | Flat Point (ø5mm) |
| 101117 | Flat Point (ø10mm) |
| 101121 | Needle Point |
| 101119 | Spherical Point |
| 101118 | Shell Type Point |
| 101387 | Shell Type Point |

### Extension Rod



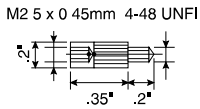

**4-48UNF**

| L | Order No. |
|---|---|
| 1/2" | 139167 |
| 1" | 301655 |
| 2" | 301657 |
| 4" | 301659 |

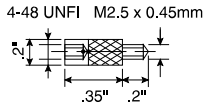
**M2.5 x 0.45mm**

| L | Order No. |
|---|---|
| 10mm | 303611 |
| 15mm | 21AAA259A |
| 20mm | 303612 |
| 25mm | 21AAA259B |
| 30mm | 303613 |
| 35mm | 21AAA259C |
| 40mm | 21AAA259D |
| 45mm | 21AAA259E |
| 50mm | 21AAA259F |
| 55mm | 21AAA259G |
| 60mm | 304146 |
| 65mm | 21AAA259H |
| 70mm | 21AAA259J |
| 75mm | 21AAA259L |
| 80mm | 21AAA259M |
| 90mm | 304147 |
| 100mm | 303614 |

### Point Conversion

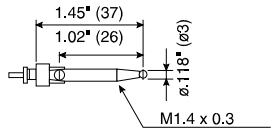



| Order No. |
|---|
| 21AAA011 |




| Order No. |
|---|
| 21AAA012 |

### Lever Point




**4-48UNF**

| Order No. |
|---|
| 900393 |

**M2.5 x 0.45mm**

| Order No. |
|---|
| 900391 |



Mitutoyo

# Spindle Lifting Lever and Cable

## Optional Accessories for Digimatic and Dial Indicators

### Spindle Lifting Lever

- The Spindle Lifting Lever is attached to the top end of the spindle for improved inspection efficiency when using a dial indicator mounted on a stand.

Applicable S-Type Thickness and Depth Gages

| Order No. | Description |
|---|---|
| **21AZB149** | Depth gages up to 12.7mm/.5" |
| **21AZB150** | Depth gages up to 25mm/1" |
| **21AZB151** | S-Type thickness gage |



Dove Tail Type Lever Assembly

| Order No. | Lever up to .5" / 12.7mm | Screw | Screw Thread |
|---|---|---|---|
| **21EZA198** | 21AZB149 | 101171 | M2.5 |
| **21EZA199** | 21AZB149 | 101047 | 4/48 UNF |



ANSI Screw **101047**
JIS Screw **101171**

### Spindle Lifting Cable

**901975**: with auto-stop function
**540774**: without auto-stop function
**971753**: With release-speed control
Lifting range: 1" / 25.4mm
Cable length: 300mm



### Spindle Lifting Pick

**137693**
Applicable spindle diameter; 4.8mm



Use for Series 1 Dial Indicators (up 5mm / .25")

| Set Order No. | Lever | Screw | Screw Thread |
|---|---|---|---|
| **21BZA610** | 900527 | 101047 | 4-48 UNF |
| **21BZA205** | 900527 | 101171 | M2.5 x 0.45 |



Use for Series 2 Dial Indicators (up to 10mm/.4")

| Set Order No. | Lever | Screw | Screw Thread |
|---|---|---|---|
| **902794** | 900525 | 101047 | 4-48 UNF |
| **902011** | 900525 | 101171 | M2.5 x 0.45 |



Use for Series 2 Dial Indicators (up to 10mm/.4") and 1 Group S-Type

| Set Order No. | Lever | Screw | Screw Thread |
|---|---|---|---|
| **21BZA613** | 21BZA612 | 101047 | 4-48 UNF |
| **902100** | 21BZA612 | 101171 | M2.5 x 0.45 |



Use for Series 2 Dial Indicators (up to 20mm/.8")
and Series 3 and 4 Dial Indicators (up to 10mm/.4")

| Set Order No. | Lever | Screw | Screw Thread |
|---|---|---|---|
| **903425** | 903307 | 192753 | 4-48 UNF |
| **903424** | 903307 | 192686 | M2.5 x 0.45 |

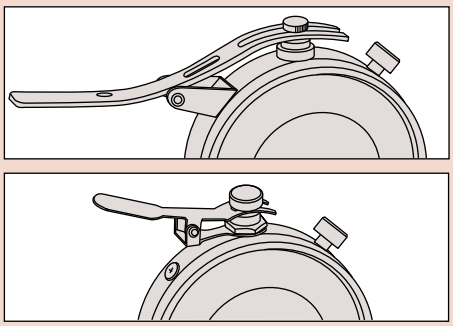


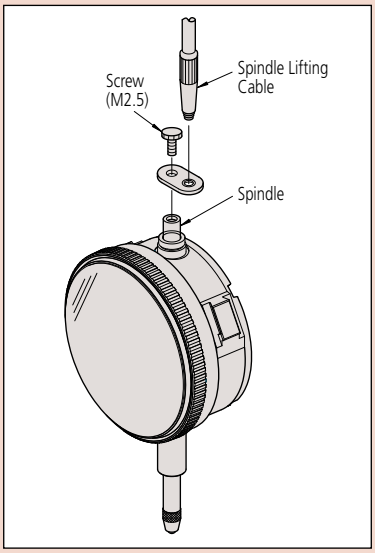
### Spindle Lifting Knob

| Set Order No. | Range |
|---|---|
| **21EZA197** | For 1" range |
| **21EZA200** | For 2" range |



### Application

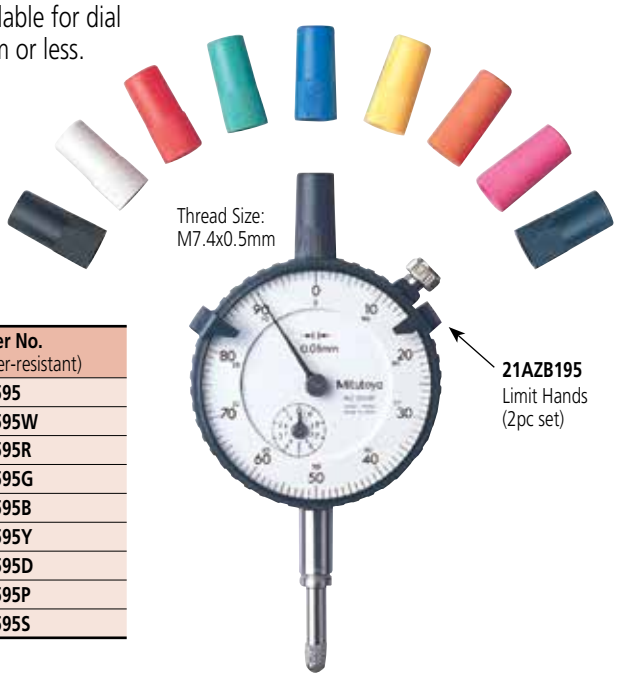




# Color Spindle Caps

## Optional Accessories for Digimatic and Dial Indicators

8 colors of spindle caps are available for dial indicators with a range of 10mm or less.




### SPECIFICATIONS

| Color | **Order No.** (normal) | **Order No.** (water-resistant) |
|---|---|---|
| Black | **193051** | **193595** |
| White | **193051W** | **193595W** |
| Red | **193051R** | **193595R** |
| Green | **193051G** | **193595G** |
| Blue | **193051B** | **193595B** |
| Yellow | **193051Y** | **193595Y** |
| Orange | **193051D** | **193595D** |
| Pink | **193051P** | **193595P** |
| Dark blue | **193051S** | **193595S** |

# Limit Stickers

## Optional Accessories for Digimatic and Dial Indicators



### FEATURES

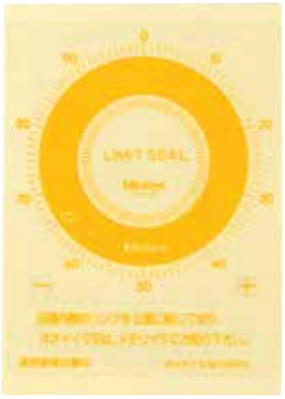
- Stuck on the dial face or crystal of a Series 2 dial indicator (55.6mm or 57mm bezel dia.) to indicate tolerance limits.




**136420**: Red (10-sheet/set)




**136421**: Green (10-sheet/set)



**136422**: Yellow (10-sheet/set)

# Dial Indicator Repair Tool Kit

## Optional Accessories for Digimatic and Dial Indicators

Mitutoyo offers a tool set designed to let you perform simple repairs to your Mitutoyo dial indicator, as well as a device that lets you reset the indicator crystals.




### SPECIFICATIONS

| Order No. | Description |
|---|---|
| 7823EU | Dial indicator repair tool kit |

**Order No. 7823U**

**Set Configuration**

| | | |
|---|---|---|
| (1) | **901173**: | Screwdriver (Phillips) |
| (2) | **901174**: | Screwdriver (Phillips/flat blade) |
| (3) | **129729**: | Tweezers |
| (4) | **901175**: | Pin-vise |
| (5) | **901176**: | Brush |
| (6) | **21JAA314**: | Stick |
| (7) | **901177**: | Brush |
| (8) | **901178**: | Hammer |
| (9) | **129730**: | Spindle rest |
| (10) | **129731**: | Pin rest |
| (11) | **901179**: | Nippers |
| (12) | **901180**: | Pliers |
| (13) | **126628**: | Hand remover (main unit) |
| | **126630**: | Interchangeable Pin, 0.8mm DIA. |
| | **126630B**: | Interchangeable Pin, 0.5mm DIA. |
| | **126630C**: | Interchangeable Pin, 1.6mm DIA. |
| | **100699:** | Nut |
| (14) | **129732**: | Pin remover |
| (15) | **129733**: | Punch |
| (16) | **129734**: | Bearing adjuster |
| (17) | **129735**: | Pinion rest |
| (18) | **129736**: | Reamer ø1 |
| | **193702**: | Reamer ø0.6 |
| | **21JAA273**: | Reamer ø0.5 |
| (19) | **901182**: | Case |

# Dial Crystal Setter

## Optional Accessories for Dial Indicators

### FEATURES

- Used for fitting a crystal on dial indicators, dial test indicators and dial calipers.




With 8 sizes of crystal setting pads

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| 7000 | Dial indicator crystal setter |

# Dial Test Indicators

## SERIES 513

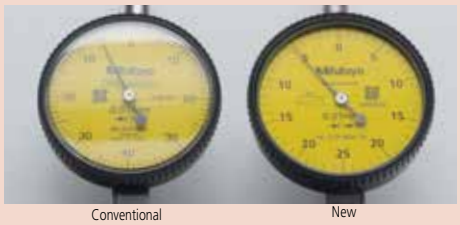
### FEATURES

- One piece movement for high-impact resistance and durability
- Contact point length is printed on dial face to avoid accuracy issues
- Scratch and smudge-resistant, anti-glare crystal for easy-to-read dial
- Newly designed contact point holder prevents backlash
- Includes NIST-traceable Certificate of Inspection - bidirectional
- Limit hands (optional) can be attached to the bezel, allowing easy identification of the upper and lower limits of tolerance.
- A ø8mm (ø0.315 in) plain stem (21CAB104) for the Metric models or a ø9.52mm (ø3/8 in) plain stem (21CAB105) for the Inch models that attaches to any dovetail on the frame is supplied as a standard accessory. Other sizes are available as optional accessories:
  ø4mm (ø0.157 in) stem: **21CAB106**
  ø6mm (ø0.236 in) stem: **21CAB103**
- Optional ruby tip has wear-resistance several times greater than a carbide tip and, since it is nonconductive, it can be used safely on an electrical discharge machine.
- Using universal fonts, changing dial face color and reviewing the relationship between pointer and scale marks have drastically improved readability.
- The O-ring seal on the bezel provides smooth rotation and prevents dust and oil from penetrating the dial face.
- Bonding the bezel and crystal eliminates a gap for cutting fluid or oil to penetrate the dial face.
- A flange prevents the bezel from unintentionally being removed during handling.
- Four models are available, each with a different orientation of the dial to allow the best visibility in any situation.
  – Standard - dial is on top of the frame.
  – Vertical: dial is on the end of the frame.
  – Standard (20° tilted face): dial is on top of the frame but tilted 20°.
  – Horizontal: dial is on the side of the frame.
- The conventional method of mounting the stylus pivot bearing screw in the frame is prone to loosen with prolonged use. A unique sub-plate structure has been incorporated in all models to eliminate this issue.

**Contact point length is printed on dial face to avoid accuracy issues**




**Scratch and smudge-resistant, anti-glare crystal for easy-to-read dial**



Conventional New

**Newly designed contact point holder prevents backlash**



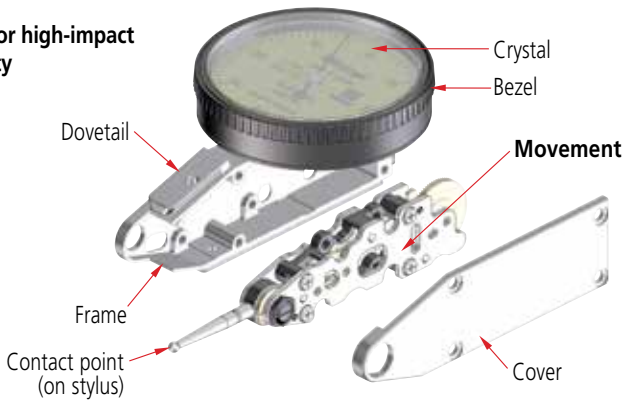
**Includes NIST-traceable Certificate of Inspection - bidirectional**






Impact-resistant bezel

**One piece movement for high-impact resistance and durability**




**Four models are available:**



Standard Vertical Standard (20° Tilted face) Parallel



Mitutoyo

# Dial Test Indicators

## SERIES 513 — Horizontal Type

### FEATURES

- Performs easy and accurate measurement of narrow or recessed areas, plus inside and outside diameters that dial indicators cannot access.
- No-clutch structure for automatic reversal of measuring direction.
- One-piece bezel and crystal design with O-ring provide resistance to water and dust.
- The glare-free flat crystal face has a scratch-resistant coating.
- High sensitivity and quick response because of jeweled bearings.
- Standard carbide contact point provide.



513-424-10E



513-414-10E

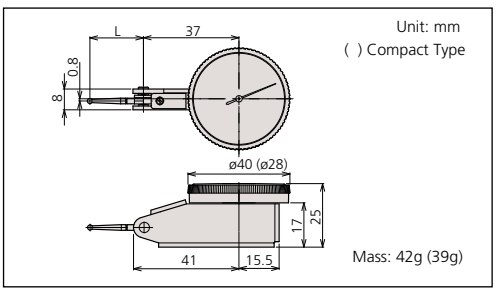


513-404-10E



513-402-10E

### DIMENSIONS AND MASS




### Optional Accessories

———: Swivel clamp
———: Holding bar
———: Stem
———: Contact points

**Special Set: No. 513-908-10E (mm)**

**513-404-10E**: Dial test indicator
**7014-10E**: Mini magnetic stand

**No. 513-907-10E (inch)**

**513-402-10E**: Dial test indicator
**7014E-10**: Mini magnetic stand





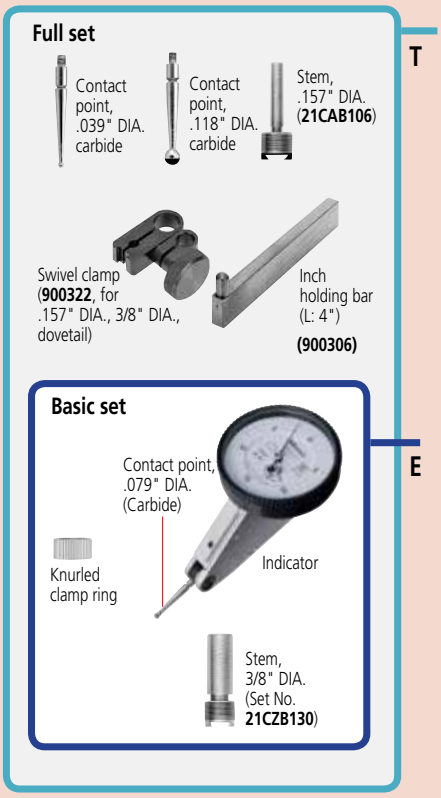
### Description of Icon

| Icon | Description |
|---|---|
| | With revolution counter |
| | Long contact point |
| | Jeweled bearing |
| | Double scale spacing, easy to read |
| | Compact |
| | Dustproof |
| | Anti-magnetic |

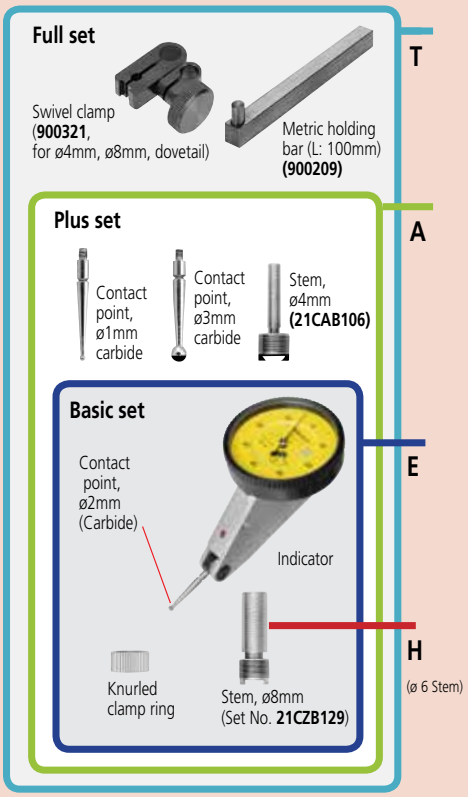
Anti-magnet type | Double scale spacing type | Long contact point type | Jeweled bearing type | Compact type | With revolution counter type

## Set Configuration: Test Indicators

### Inch




### Metric





513-466-10E


513-464-10E


513-463-10E

## SPECIFICATIONS

### Inch

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | L (mm) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .00005" | **513-407-10E** | **513-407-10T** | .008" | ±.0001" | 0-4-0 | 0.3N or less | 19 | ✔ | — | ✔ | — | — | — |
| .0005" | **513-402-10E** | **513-402-10T** | .03" | ±.0005" | 0-15-0 | 0.3N or less | 19.9 | ✔ | — | ✔ | — | — | — |
| .0005" | **513-472-10E*** | | .03" | ±.0005" | 0-15-0 | 0.3N or less | 19.9 | ✔ | — | ✔ | — | — | — |
| .0005" | **513-412-10E** | **513-412-10T** | .03" | ±.0005" | 0-15-0 | 0.2N or less | 33.9 | ✔ | ✔ | ✔ | — | — | — |
| .0005" | **513-479-10E*** | | .03" | ±.0005" | 0-15-0 | 0.2N or less | 33.9 | ✔ | ✔ | ✔ | — | — | — |
| .0005" | **513-462-10E** | | .03" | ±.0005" | 0-15-0 | 0.3N or less | 19.9 | ✔ | — | ✔ | ✔ | — | — |
| .0001" | **513-403-10E** | **513-403-10T** | .008" | ±.0001" | 0-4-0 | 0.3N or less | 19 | ✔ | — | ✔ | — | — | — |
| .0001" | **513-473-10E*** | | .008" | ±.0001" | 0-4-0 | 0.3N or less | 19 | ✔ | — | ✔ | — | — | — |
| .0001" | **513-463-10E** | | .008" | ±.0001" | 0-4-0 | 0.3N or less | 15 | ✔ | — | ✔ | ✔ | — | — |

*Provided with a ø2mm ruby contact point as a substitute for ø2mm carbide contact point.

### Metric

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | L (mm) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.01mm | **513-424-10E** | **513-424-10T** | 0.5mm | 5µm | 0-25-0 | 0.3N or less | 22.3 | ✔ | ✔ | — | ✔ | — | — |
| 0.01mm | **513-414-10E** | **513-414-10T** | 0.5mm | 10µm | 0-25-0 | 0.2N or less | 36.8 | ✔ | ✔ | ✔ | ✔ | — | — |
| 0.01mm | **513-466-10E** | - | 0.5mm | 5µm | 0-25-0 | 0.3N or less | 22.3 | ✔ | ✔ | — | ✔ | ✔ | — |
| 0.01mm | **513-478-10E*** | - | 0.5mm | 5µm | 0-25-0 | 0.3N or less | 22.3 | ✔ | — | — | ✔ | — | — |
| 0.01mm | **513-404-10E** | **513-404-10T** | 0.8mm | 8µm | 0-40-0 | 0.3N or less | 20.9 | ✔ | — | — | ✔ | — | — |
| 0.01mm | **513-474-10E*** | - | 0.8mm | 8µm | 0-40-0 | 0.3N or less | 20.9 | ✔ | — | — | ✔ | — | — |
| 0.01mm | **513-464-10E** | - | 0.8mm | 8µm | 0-40-0 | 0.3N or less | 20.9 | ✔ | — | — | ✔ | ✔ | — |
| 0.01mm | **513-415-10E** | **513-415-10T** | 1mm | 10µm | 0-50-0 | 0.2N or less | 44.5 | ✔ | — | ✔ | ✔ | — | — |
| 0.01mm | **513-477-10E*** | - | 1mm | 10µm | 0-50-0 | 0.2N or less | 44.5 | ✔ | — | ✔ | ✔ | — | — |
| 0.01mm | **513-426-10E** | - | 1.5mm | 16µm | 0-25-0 | 0.4N or less | 22.3 | ✔ | ✔ | — | ✔ | — | ✔ |
| 0.002mm | **513-405-10E** | **513-405-10T** | 0.2mm | 4µm | 0-100-0 | 0.3N or less | 14.7 | ✔ | — | — | ✔ | — | — |
| 0.002mm | **513-465-10E** | - | 0.2mm | 4µm | 0-100-0 | 0.3N or less | 14.7 | ✔ | — | — | ✔ | ✔ | — |
| 0.002mm | **513-475-10H*** | - | 0.2mm | 4µm | 0-100-0 | 0.3N or Less | 18.7 | ✔ | — | — | ✔ | — | — |
| 0.002mm | **513-425-10E** | - | 0.6mm | 7µm | 0-100-0 | 0.4N or less | 14.7 | ✔ | — | — | ✔ | — | ✔ |
| 0.001mm | **513-401-10E** | - | 0.14mm | 4µm | 0-70-0 | 0.3N or less | 12.8 | ✔ | — | — | ✔ | — | — |
| 0.001mm | **513-471-10E*** | - | 0.14mm | 4µm | 0-70-0 | 0.3N or less | 12.8 | ✔ | — | — | ✔ | — | — |

*Provided with a ø2mm ruby contact point as a substitute for ø2mm carbide contact point.

### Metric/inch

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | L (mm) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.002mm, .0001" | **513-409-10E** | **513-409-10T** | 0.2mm, .0075" | 3µm | 0-10-0, 0-38-0 | 0.3N or less | 14.7 | ✔ | ✔ | — | — | — | — |

### Inch/Metric

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | L (mm) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .0005", 0.01mm | **513-406-10E** | **513-406-10T** | .03", 0.7mm | ±.0005" | 0-15-0, 0-35-0 | 0.3N or less | 19.9 | ✔ | ✔ | — | — | — | — |



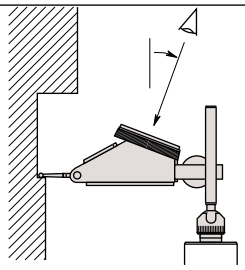
Mitutoyo

# Dial Test Indicators

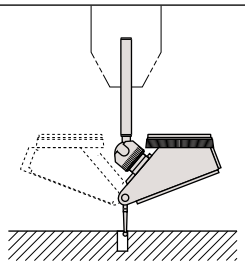
## SERIES 513 — Horizontal (20° Tilted Face), Vertical and Parallel

### FEATURES

- Specially designed for easy viewing of measurements.



- The dial face points upward, allowing users to read the graduations from the user's side. It is convenient when measuring on the side of a large workpiece and the workbench is high.



- Using the universal holder allows easy hole centering. The dial face always faces upward when the indicator is rotated for easy reading.



513-452-10E



513-482-10A



513-444-10E



513-455-10E



513-484-10E



513-442-10A



513-446-10A




513-444-10E




513-445-10E




513-454-10E
513-484-10E



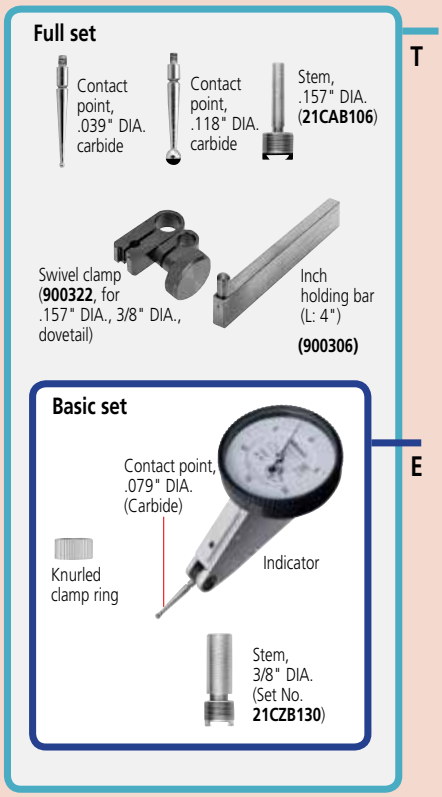

513-455-10E

### Optional Accessories

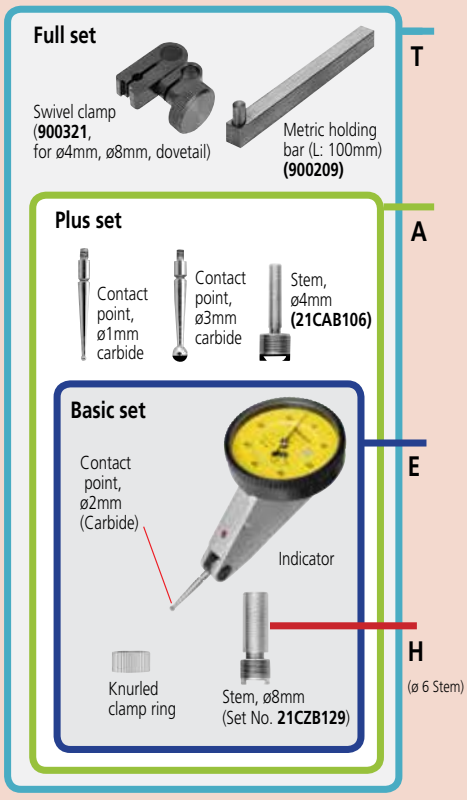
———: Swivel clamp
———: Holding bar
———: Stem
———: Contact points

## Set Configuration: Test Indicators

### Inch




### Metric




Anti-magnet type | With revolution counter type | Jeweled bearing type | Long contact point type

## SPECIFICATIONS

**Metric** Horizontal (20° tilted face) type

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | Mass (g) | L (mm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.01mm | **513-444-10E** | **513-444-10T** | 1.6mm | 10µm | 0-40-0 | 0.3N or less | 48 | 20.9 | ✔ | ✔ | ✔ |
| 0.002mm | **513-445-10E** | **513-445-10T** | 0.4mm | 5µm | 0-100-0 | 0.3N or less | 48 | 14.7 | ✔ | ✔ | ✔ |

**Inch** Horizontal (20° tilted face) type

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | Mass (g) | L (mm) | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .0005" | **513-442-10A** | **513-442-10T** | .06" | ±.0005" | 0-15-0 | 0.3N or less | 48 | 19.9 | ✔ | ✔ | ✔ | — | — |
| .0005" | **513-442-16A** | **513-442-16T** | .06" | ±.0005" | 0-15-0 | 0.3N or less | 48 | 19.9 | ✔ | ✔ | ✔ | — | Black dial |
| .0005" | **513-446-10A** | **513-446-10T** | .06" | ±.0005" | 0-15-0 | 0.2N or less | 48 | 33.9 | ✔ | ✔ | ✔ | ✔ | — |
| .0005" | **513-446-16A** | **513-446-16T** | .06" | ±.0005" | 0-15-0 | 0.2N or less | 48 | 33.9 | ✔ | ✔ | ✔ | ✔ | Black dial |
| .0001" | **513-443-10A** | **513-443-10T** | .016" | ±.0002" | 0-4-0 | 0.3N or less | 48 | 15 | ✔ | ✔ | ✔ | — | — |
| .0001" | **513-443-16A** | **513-443-16T** | .016" | ±.0002" | 0-4-0 | 0.3N or less | 48 | 15 | ✔ | ✔ | ✔ | — | Black dial |

**Metric** Vertical type

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | Mass (g) | L (mm) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.01mm | **513-454-10E** | **513-454-10T** | 0.8mm | 8µm | 0-40-0 | 0.3N or less | 50 | 20.9 | ✔ | ✔ |
| 0.002mm | **513-455-10E** | **513-455-10T** | 0.2mm | 3µm | 0-100-0 | 0.3N or less | 50 | 14.7 | ✔ | ✔ |

**Inch** Vertical type

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | Mass (g) | L (mm) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| .0005" | **513-452-10E** | **513-452-10T** | .03" | ±.0005" | 0-15-0 | 0.3N or less | 50 | 19.9 | ✔ | ✔ |
| .0001" | **513-453-10E** | **513-453-10T** | .008" | ±.0001" | 0-4-0 | 0.3N or less | 50 | 19 | ✔ | ✔ |

**Metric** Parallel type

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | Mass (g) | L (mm) | |
|---|---|---|---|---|---|---|---|---|---|
| 0.01mm | **513-484-10E** | **513-484-10T** | 0.8mm | 8µm | 0-40-0 | 0.3N or less | 68 | 20.9 | ✔ |

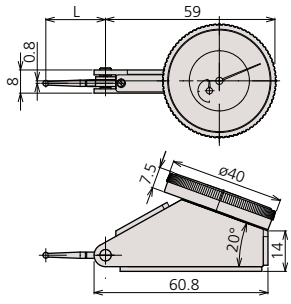
**Inch** Parallel type

| Graduation | Order No. Basic set | Order No. Full set | Range | Accuracy | Dial reading | Measuring force | Mass (g) | L (mm) | |
|---|---|---|---|---|---|---|---|---|---|
| .0005" | **513-482-10A** | **513-482-10T** | .03" | ±.0005" | 0-15-0 | 0.3N or less | 68 | 20 | ✔ |

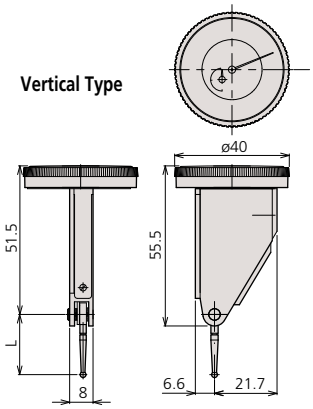
## DIMENSIONS

unit: mm

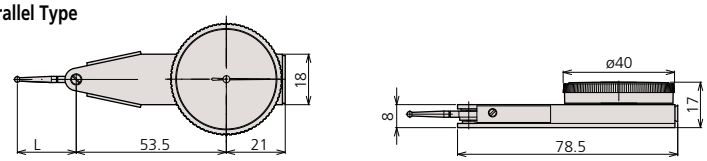
**Horizontal (20° Tilted Face) Type**




**Vertical Type**




**Parallel Type**






Mitutoyo

# Pocket Dial Test Indicators

## SERIES 513

### FEATURES

- Jeweled bearings ensure high sensitivity and accuracy.
- Reversible measuring direction.
- Two holding bars are supplied. (Full sets only.)
- Fully adjustable bezel/dial face.
- Contact point is adjustable within 220°.
- Bezel is sealed with on O-ring to keep out water / oil.


513-517E


513-514E


513-527E


513-501E


513-515T


513-503E


513-518


513-504


513-528


513-512


513-514E


513-517E
513-527E


513-515T


513-503E

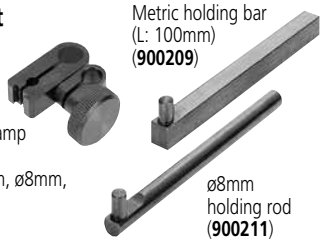

513-501E

### Optional Accessories

———: Swivel clamp
———: Holding bar
———: Stem
———: Contact points

## Set Configuration: Metric

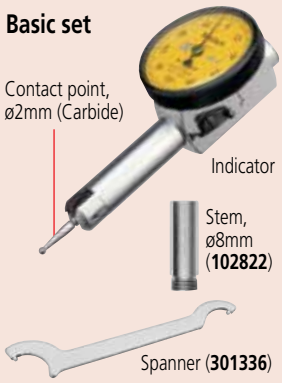
**Full set**





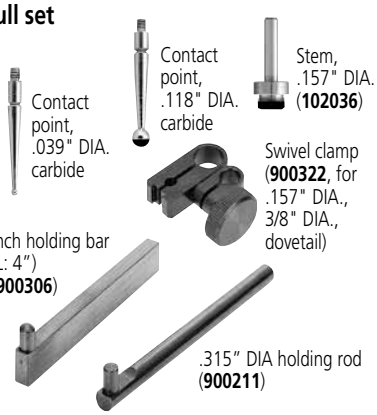


**Basic set**

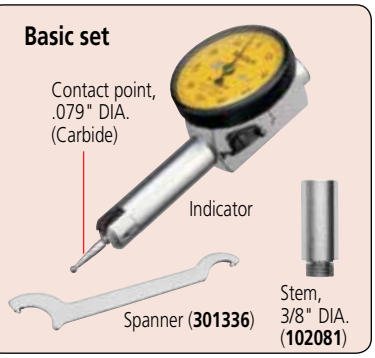



## Set Configuration: Inch

**Full set**




**Basic set**




Long contact point type | Jeweled bearing type | Compact type

## SPECIFICATIONS

### Metric

| Graduation | Order No. | | Range | Accuracy | Dial reading | Measuring force | L (mm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Basic set | Full set | | | | | | | | |
| 0.01mm | **513-514E** | **513-514T** | 0.5mm | 10µm | 0-25-0 | 0.3N or less | 36.8 | ✔ | ✔ | — |
| 0.01mm | **513-517E** | **513-517T** | 0.8mm | 8µm | 0-40-0 | 0.3N or less | 20.9 | — | ✔ | — |
| 0.01mm | **513-527E** | **513-527T** | 0.8mm | 8µm | 0-40-0 | 0.3N or less | 14.7 | — | ✔ | ✔ |
| 0.01mm | — | **513-515T** | 1mm | 10µm | 0-50-0 | 0.3N or less | 44.5 | ✔ | ✔ | — |
| 0.002mm | **513-503E** | **513-503T** | 0.2mm | 3µm | 0-100-0 | 0.3N or less | 14.7 | — | ✔ | — |
| 0.001mm | **513-501E** | **513-501T** | 0.14mm | 3µm | 0-70-0 | 0.4N or less | 12 | — | ✔ | — |

### Inch

| Graduation | Order No. | | Range | Accuracy | Dial reading | Measuring force | L (mm) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Basic set | Full set | | | | | | | | |
| .001" | **513-518** | **513-518T** | .04" | ±.001" | 0-20-0 | 0.3N or less | 26.5 | — | ✔ | — |
| .001" | **513-528** | **513-528T** | .04" | ±.001" | 0-20-0 | 0.3N or less | 18.7 | — | ✔ | ✔ |
| .0005" | **513-512** | **513-512T** | .02" | ±.0005" | 0-10-0 | 0.3N or less | 37.4 | ✔ | ✔ | — |
| .0001" | **513-504** | **513-504T** | .01" | ±.0002" | 0-5-0 | 0.3N or less | 18.7 | — | ✔ | — |

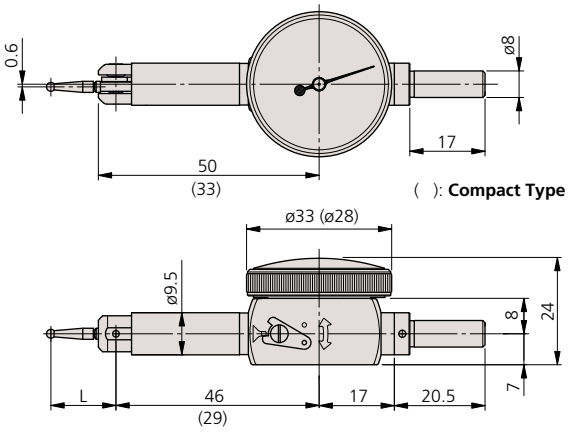
## Optional Contact Points

**Pocket Type**

| Order No. | | 1mm | 2mm | 3mm | 0.5mm | 0.7mm |
|---|---|---|---|---|---|---|
| **513-501E** | | 136756 | 136104 | 136758 | — | — |
| **513-503E** | **513-527E** | 103017 | 103010 | 103018 | 190547 | 190548 |
| **513-504** | **513-528** | 131314 | 103011 | 131315 | — | — |
| **513-512** | | 131316 | 131324 | 131317 | — | — |
| **513-514E** | | 137746 | 129949 | 137747 | — | — |
| **513-515T** | | 136235 | 136013 | 136236 | 190656 | 190655 |
| **513-517E** | | 103013 | 103006 | 103014 | 190549 | 190550 |
| **513-518** | | 103008 | 103007 | 103009 | — | — |

## DIMENSIONS AND MASS

unit: mm




Mass: 45g (40g)
( ): Compact Type



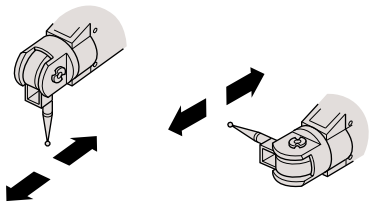
Mitutoyo

# Dial Test Indicators

## SERIES 513 — Universal Type

### FEATURES

- Universal application for all directions. Not only the direction of the measuring point, but also the direction of measurement itself can be adjusted 360 degrees without moving the indicator.





513-304GE

### SPECIFICATIONS

Jeweled bearing type

**Metric**

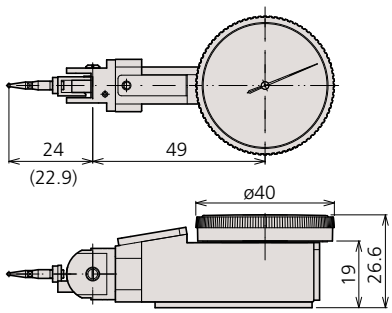
| Graduation | Order No. | | Range | Accuracy | Dial reading | Measuring force | |
|---|---|---|---|---|---|---|---|
| | Basic set | Full set | | | | | |
| 0.01mm | **513-304GE** | **513-304GT** | 0.8mm | 8μm | 0-40-0 | 0.3N or less | ✔ |

**Inch**

| Graduation | Order No. | | Range | Accuracy | Dial reading | Measuring force | |
|---|---|---|---|---|---|---|---|
| | Basic set | Full set | | | | | |
| .0005" | **513-302G** | **513-302GT** | .03" | ±.0005" | 0-15-0 | 0.3N or less | ✔ |

### DIMENSIONS AND MASS

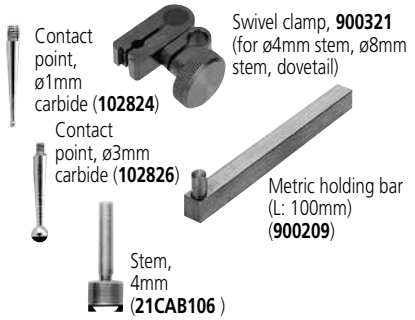
Unit: mm



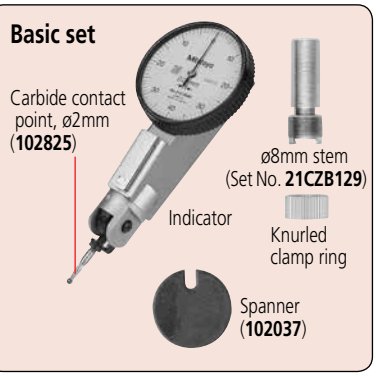

Mass: 80g
( ): 513-302G

### Set Configuration: Metric

**Full set**

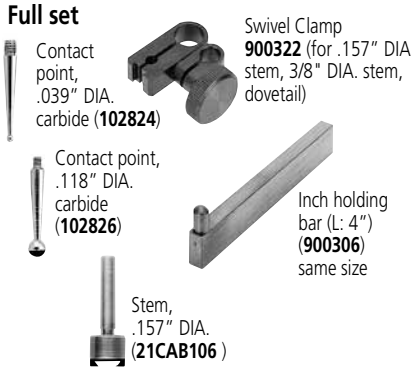



**Basic set**

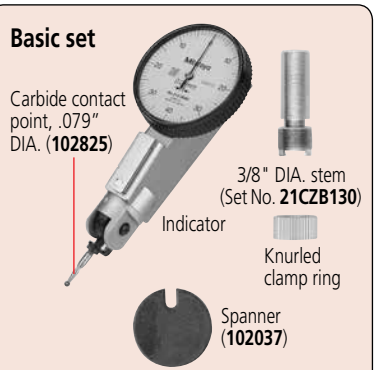



### Set Configuration: Inch

**Full set**




**Basic set**

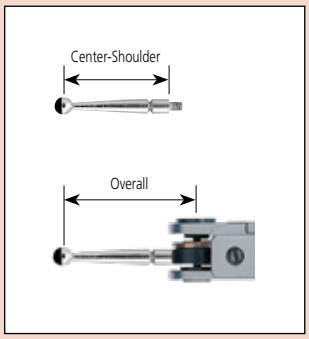



### Optional Accessories

———: Swivel clamp
———: Holding bar
———: Stem

# Contact Points and Clamp Holders

## Optional Accessories for Dial Test Indicator




### Inch

| Length (mm) | | Part No. | | | | | | Test Indicator Code No. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Center-Shoulder | Overall | ø0.5 | ø0.7 | ø1 | ø2 | ø3 | Ruby Ø2mm | | | |
| 11.5 | 15.0 | — | — | 136076 | 136075 | 136077 | 21CZA213 | **513-403-10E**<br>**513-453-10E** | **513-443-10A**<br>**513-463-10E** | **513-473-10E***3<br>**513-443-16A** |
| 16.4 | 19.9 | — | — | 133196 | 133195 | 133197 | 21CZA204 | **513-401-10E**<br>**513-406-10E**<br>**513-452-10E** | **513-442-10A**<br>**513-462-10E** | **513-472-10E***3<br>**513-442-16A**<br>**513-482-10A** |
| 30.4 | 33.9 | — | — | 136291 | 136290 | 136292 | 21CZA214 | **513-412-10E**<br>**513-446-16A** | **513-446-10A** | |
| 15.2 | 18.7 | — | — | 131314 | 103011 | 131315 | — | **513-504***1 | **513-528***1 | |
| 23.0 | 26.5 | — | — | 103008 | 103007 | 103009 | — | **513-518***1 | | |
| 33.9 | 37.4 | — | — | 131316 | 131324 | 131317 | — | **513-512***1 | | |

### Metric

| Length (mm) | | Part No. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9.4 | 12.9 | — | — | 21CZA044 | 21CZA036 | 21CZA045 | 21CZA212 | **513-401-10E** | **513-471-10E** | |
| 11.2 | 14.7 | 190547 | 190548 | 103017 | 103010 | 103018 | 21CZA209 | **513-405-10E**<br>**513-503E**<br>**513-527E** | **513-425-10E**<br>**513-455-10E**<br>**513-455-10E** | **513-445-10E** |
| 17.4 | 20.9 | 190549 | 190550 | 103013 | 103006 | 103014 | 21CZA201 | **513-404-10E**<br>**513-464-10E**<br>**513-484-10E** | **513-444-10E**<br>**513-517E***1 | **513-454-10E**<br>**513-474-10E***3 |
| 18.7 | 22.2 | 190654 | 190653 | 137558 | 137557 | 137559 | 21CZA210 | **513-424-10E**<br>**513-478-10H***3 | **513-426-10E** | **513-466-10E** |
| 41.0 | 44.5 | 190656 | 190655 | 136235 | 136013 | 136236 | 21CZA211 | **513-415-10E** | **513-515T***1 | |
| 33.3 | 36.8 | — | — | 137746 | 129949 | 137747 | — | **513-414-10E** | **513-514E***1 | |
| 8.6 | 12.0 | — | — | 136756 | 136104 | 136758 | — | **513-501E***1 | | |
| 6.5 | 24.0 | — | — | 102824 | 102825 | 102826 | — | **513-304GE***2 | **513-302G***2 | |

*1 Denotes Pocket Indicators
*2 Denotes Universal Indicator
*3 Indicator Ships with Ruby Contact

## Holding Bars (with 6mm mounting pin)

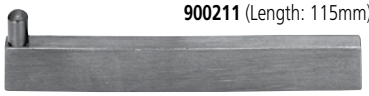


**9 x 9mm**

**953638** (Length: 50mm)
**900209** (Length: 100mm)



**900211** (Length: 115mm)



**.25" x .5"**
**ø8mm**

**953639** (Length: 2")
**900306** (Length: 4")



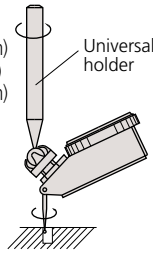
Spanner (**102037**)

## Universal Holder

- Allows the indicator to be set at a desired position.



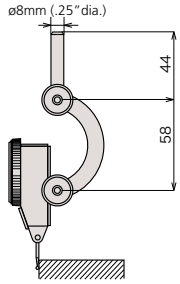
**21CZA233** (ø8mm stem, Length: 80mm)
**21CZA231** (.25" DIA. stem, Length: 3")
**21CZA229** (ø6mm stem, Length: 80mm)




## Centering Holder

- Allows large diameter cylinders or holes to be centered.





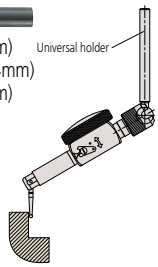

**901959** (ø8mm stem)
**901997** (.25" DIA. stem)

## Universal Holder (pocket type)

- Since the Dial Test Indicator can be swiveled to a desired angle, the holder is useful for centering workpieces and installing workpieces on a milling machine.



**21CZA234** (ø8mm stem, Length: 84mm)
**21CZA232** (.25" DIA. stem, Length: 84mm)
**21CZA230** (ø6mm stem, Length: 84mm)






Mitutoyo

# i-Checker

## SERIES 170 – Inspection Instrument for Dial Indicator

The i-Checker is specially designed to calibrate dial indicators, dial test indicators, and other electronic comparison gage heads with a stroke of up to 100mm (4").

- ±(0.1+0.4L/100) µm indication accuracy.
- Directly inspects an indicator with a stroke of up to 100mm (4"). The dial test indicator, bore gage and lever-type inductive head can be inspected with optional accessories.
- Adjustment of the measurement position is easily accomplished due to semi-automatic measurement and fully automatic measurement functions.
- Creates and prints out a simple inspection certificate.
- Saves inspection results as a CSV file for analysis by software.

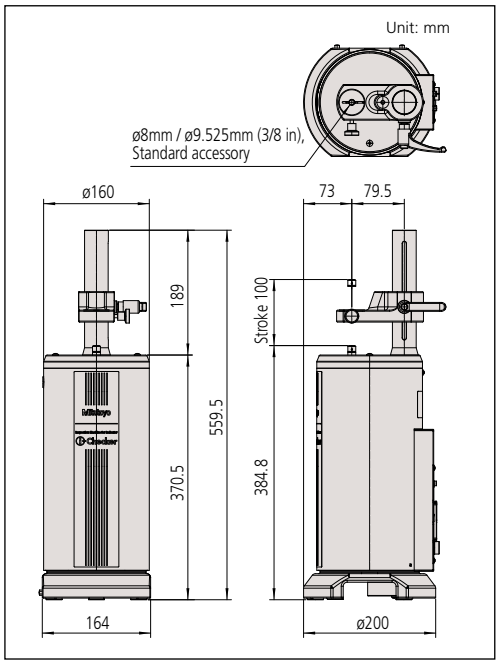


## SPECIFICATIONS

| Order No. | Remarks |
|---|---|
| **64PKA148** | comes with both 8mm and 3/8" bushing |

Recommended PC Part No. **64PKA149E**

## DIMENSIONS




## Applicable Indicators

- Dial indicator
- Hicator
- Digimatic indicator***
- Test indicator*
- Bore gage**
- Linear gage

* Requires optional test indicator attachment set.
* Contact the nearest Mitutoyo sales office for testable indicators.
** Requires optional bore gage accessory.
*** Requires optional SPC cable for fully automatic measurement.



Using test indicator attachment set (**02ASK000**)

## Technical Data

PROPRIETARY INSPECTION CERTIFICATE

| | |
|---|---|
| Measuring Range: | 100mm / 4" |
| Resolution: | 0.01µm / 0.4µin |
| Accuracy: | ±(0.1+0.4L/100) µm in vertical position |
| (at 20°C) | ±(0.15+0.6L/100) µm in lateral position |
| | L = measuring length (mm) |
| Drive method: | Motor direct drive |
| Measuring Unit: | "STVC-4Z" linear encoder |
| Thermal Expansion coefficient: 0.4 ppm / °C | |
| Measurement method: Semi / Full automatic* | |
| Dimensions: | 116 x 205.5 x 559.5mm (W x D x H) |
| Operating temperature range: 20°C ± 0.5°C | |
| Power supply: | 100 – 240VAC ±10%, 50/60 Hz |
| Mass: | 20kg / 44.1lbs |

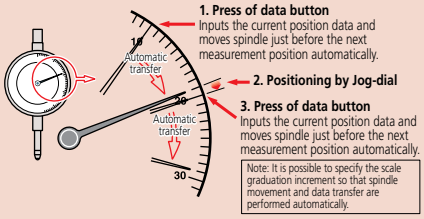
* Automatic measurement requires the indicator's connection cable. Additionally, some form of indicator, along with a connecting machine (the optional accessory for indicator as a Digimatic power-supply unit on EF counter), will be needed.

## Functions

**Semi-automatic inspection of analog indicator**

The pointer of the analog indicator is positioned just before the measuring point automatically via Mitutoyo's Semi-automatic Measurement function. After that, inspection begins simply by adjusting the pointer position with the jog-dial. Because of this function, measurement time is reduced and user fatigue is practically eliminated. Additionally all functions necessary for inspection are combined in the control box so that the operator need not rely on excessive eye movement to adjust the pointer.






**Fully automatic inspection of digital indicator**

The Automatic Measurement function, in tandem with a digital indicator, makes the spindle move so that measurement data is acquired automatically. Therefore, manual adjustment to the measurement position is unnecessary and the efficiency of every inspection is enhanced.



**Create and printout a simplified inspection certificate**

Create, edit and print your own inspection certificate. Data can be saved as a CSV file.

## Optional Accessories

**02ASK000**: Test indicator attachment set (ø6mm stem)
**02ASK180**: Test indicator attachment set (ø8mm stem)
**02ASK370**: Test indicator holder (ø6mm stem)
**02ASK380**: Test indicator holder (ø8mm stem)
**02ASU162**: CG accessory set (type C) for bore gages*
**21CZB128**: ø6mm dovetail grooved stem
**21CZB129**: ø8mm dovetail grooved stem
**02ASK040**: Stem bush ø6mm
**02ASJ856**: Stem bush ø8mm
**02ASK150**: Stem bush ø8mm, short
**02ASL150**: Stem bush ø10, short
**02ASK050**: Bush ø9.5 (Requires **02ASK070**)
**02ASK060**: Stem bush ø12mm
**02ASK070**: Stem bush ø15mm
**02ASK080**: Stem bush ø20mm
**02ASK710**: Stem bush ø28mm
**02ASK090**: Stem bush 3/8"
**02ASK130**: Stem bush case
**02ASK730**: Reflector
**937179T**: Foot switch

* Not compatible with IC1000 models

# UDT-2 Dial Gage Testers

## SERIES 170

The UDT-2 Dial Gage Tester consists of a specially designed 0-1″ / 0-25mm micrometer head, with a large disc, and rigid holding fixtures. Gage tester to calibrate measuring accuracy of dial indicators, dial test indicators and dial bore gage.



170-102-10

### FEATURES

- Clamping stem diameter—
  170-102-10: 6mm and 8mm,
  170-101-10: .25" and .375"
- With the optional stand (**12AAK824**), inspection of dial bore gages becomes possible.

### Optional Accessory

**12AKK824**: Stand for bore gage inspection



### SPECIFICATIONS

**Metric**

| Range | Order No. | Graduation | Accuracy |
|---|---|---|---|
| 0 - 25mm | **170-102-10** | 0.001mm | ±1μm |

**Inch**

| Range | Order No. | Graduation | Accuracy |
|---|---|---|---|
| 0 - 1" | **170-101-10** | .0001″ | ±.0001″ |

# Calibration Testers

## SERIES 521

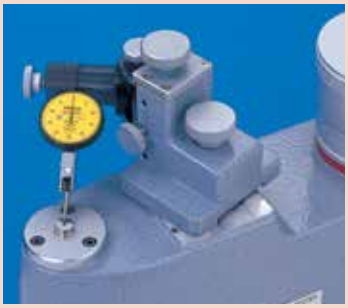
The Calibration Tester is specially designed to calibrate measuring accuracy of short-range dial indicators, dial test indicators, and other electronic comparison gage heads.



521-103

### FEATURES

- Universal bracket accepts any dial indicator, dial test indicator, and lever head of Mu-Checker without any additional accessory.
- Clamping capacity: ø4mm - ø10mm / .157″-.394″ dia.
- Dual color-indexed directional graduations to facilitate measurements.



Calibrating test indicator

### SPECIFICATIONS

**Metric**

| Range | Order No. | Graduation | Accuracy |
|---|---|---|---|
| 0 - 1mm | **521-103** | 0.0002mm | ±0.2μm |
| 0 - 5mm | **521-105** | 0.0002mm | ±0.8μm |

**Inch**

| Range | Order No. | Graduation | Accuracy |
|---|---|---|---|
| 0 - .05" | **521-104** | .00001″ | ±.00001″ |
| 0 - .2" | **521-106** | .00001″ | ±.00003″ |

# Thickness Gages

## SERIES 547, 7

Thickness Gages offer a quick and efficient means of inspection with a convenient grip handle, thumb trigger and spring-loaded spindle. The various models cover a range of applications.

### FEATURES

- Wide range of applications with various types of measuring faces (on the spindle and anvil).
- Digital models incorporate Mitutoyo's popular ID-C and ID-S Series Digimatic Indicators to provide error-free LCD readings, as well as data output for SPC analysis.
- **547-400S** is ideally suited for measuring thicknesses of paper, film, wire, sheet metal and similar materials.

## Flat-Anvil Type

### Standard Type / Digital




**547-300S**

### Deep-Throat Type / Digital




**547-320S**

### Deep-Throat Type / Dial



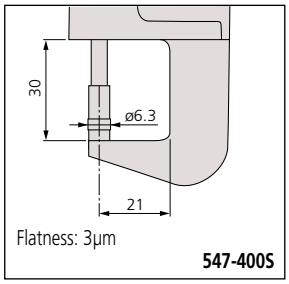

**7321**

### High-Accuracy Type / Digital



**547-400S**

### DIMENSIONS




Flatness: 3µm

**547-400S**

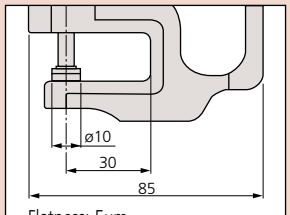
### Technical Data
### Function of Digital Models

IDS Types
- ON/OFF
- Inch / mm Conversion
- Origin
- ±Direction Changeover
- SPC Output
- Battery Life: 20,000 hrs
- Power Supply: Silver Oxide Cell (SR-44 1pc.)

IDC Types
- ON/OFF
- Inch / mm Conversion
- Zero / ABS
- ±Direction Changeover
- SPC Output
- Battery Life: 5,000 hrs
- Power Supply: Silver Oxide Cell (SR-44 1pc.)
- Preset
- Provides go/no-go judgment
- Face Rotates 330°

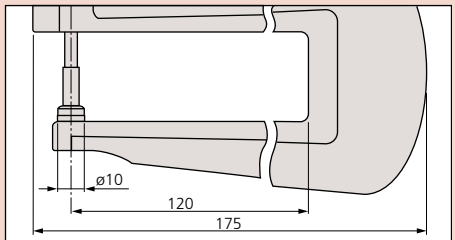
### DIMENSIONS

Unit: mm




Flatness: 5µm

**7301, 7305, 547-300S**




Flatness: 5µm

**7321, 7323, 547-320S**

# Thickness Gages

## SERIES 547, 7

### Flat Anvil

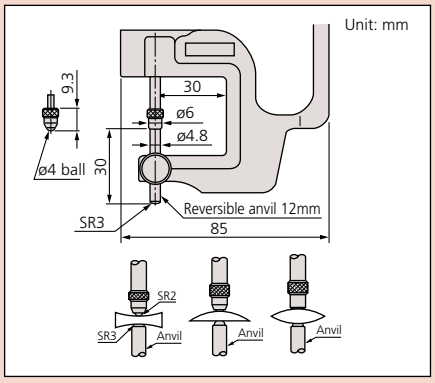
## Optional Accessories

**905338**: SPC cable (40" / 1m) for digital type
**905409**: SPC cable (80" / 2m) for digital type
**902794**: Spindle lifting lever for IDS digimatic type (stroke .5" / 12.7mm)

## Standard Accessories

**21AZB149**: Spindle lifting lever for digimatic and dial thickness gage (stroke .5" / 12.7mm)
**21AZB150**: Spindle lifting lever for dial indicator (stroke 1" / 25.4mm)

## DIMENSIONS




## SPECIFICATIONS

**Inch/Metric** Digital Type

| Range | Order No. | Resolution | Accuracy | Measuring Force | Indicator | Spindle/Anvil Material |
|---|---|---|---|---|---|---|
| 0 - .47" / 0 - 12mm | **547-500S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDS | Ceramic |
| 0 - .47" / 0 - 12mm | **547-520S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDS | Ceramic |
| 0 - .47" / 0 - 12mm | **547-526S** | .0001"/0.001mm | ±.0002" | 1.5N or less | Digimatic IDS | Ceramic |
| 0 - .4" / 0 - 10mm | **547-300S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDC | Ceramic |
| 0 - .4" / 0 - 10mm | **547-320S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDC | Ceramic |
| 0 - .47" / 0 - 12mm | **547-400S** | .00005"/0.001mm | ±.00015" | 3.5N or less | Digimatic IDC | Carbide |

**Inch** Dial Type

| Range | Order No. | Graduation | Accuracy | Measuring Force | Remarks |
|---|---|---|---|---|---|
| 0 - .05" | **7326S** | .0001" | ±.0002" | 1.4N or less | Fine dial reading, ceramic spindle/anvil |
| 0 - .5" | **7300S** | .001" | ±.001" | 1.4N or less | Standard, ceramic spindle/anvil |
| 0 - 1" | **7304S** | .001" | ±.002" | 2.0N or less | Standard, ceramic spindle/anvil |
| 0 - 1" | **7322S** | .001" | ±.002" | 2.0N or less | Deep throat, ceramic spindle/anvil |

**Metric** Dial Type

| Range | Order No. | Graduation | Accuracy | Measuring Force | Remarks |
|---|---|---|---|---|---|
| 0 - 1mm | **7327** | 0.001mm | ±5µm | 1.4N or less | Fine dial reading, ceramic spindle/anvil |
| 0 - 10mm | **7301** | 0.01mm | ±15µm | 1.4N or less | Standard, ceramic spindle/anvil |
| 0 - 20mm | **7305** | 0.01mm | ±20µm | 2.0N or less | Standard, ceramic spindle/anvil |
| 0 - 10mm | **7321** | 0.01mm | ±15µm | 1.4N or less | Deep throat, ceramic spindle/anvil |
| 0 - 20mm | **7323** | 0.01mm | ±22µm | 2.0N or less | Deep throat, ceramic spindle/anvil |

### Lens thickness measurement (reverse anvil)




547-312S



7313

## SPECIFICATIONS

**Inch/Metric** Digital Type

| Range | Order No. | Resolution | Accuracy | Measuring Force | Indicator |
|---|---|---|---|---|---|
| 0 - .47" / 0 - 12mm | **547-512S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDS |
| 0 - .4" / 0 - 10mm | **547-312S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDC |

**Inch** Dial Type

| Range | Order No. | Graduation | Accuracy | Measuring Force | Remarks |
|---|---|---|---|---|---|
| 0 - .5" | **7312S** | .001" | ±.001" | 1.4N or less | Lens thickness |

**Metric** Dial Type

| Range | Order No. | Graduation | Accuracy | Measuring Force | Remarks |
|---|---|---|---|---|---|
| 0 - 10mm | **7313** | 0.01mm | ±15µm | 1.4N or less | Lens thickness |

# Thickness Gages

## SERIES 547, 7

### Tube thickness measurement



547-361S



7360

## SPECIFICATIONS

**Inch/Metric** Digital Type

| Range | Order No. | Resolution | Accuracy | Measuring Force | Indicator |
|---|---|---|---|---|---|
| 0 - .47" / 0 - 12mm | **547-561S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDS |
| 0 - .4" / 0 - 12mm | **547-361S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDC |

**Inch** Dial Type

| Range | Order No. | Graduation | Accuracy | Measuring Force | Remarks |
|---|---|---|---|---|---|
| 0 - .5" | **7361S** | .001" | ±.001" | 1.4N or less | Tube thickness |

**Metric** Dial Type

| Range | Order No. | Graduation | Accuracy | Measuring Force | Remarks |
|---|---|---|---|---|---|
| 0 - 10mm | **7360** | 0.01mm | ±15µm | 1.4N or less | Tube thickness |

### Groove thickness measurement (Blade anvil)



547-316S



7315

## SPECIFICATIONS

**Inch/Metric** Digital Type

| Range | Order No. | Resolution | Accuracy | Measuring Force | Indicator |
|---|---|---|---|---|---|
| 0 - .47" / 0 - 12mm | **547-516S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDS |
| 0 - .47" / 0 - 10mm | **547-316S** | .0005"/0.01mm | ±.001" | 1.5N or less | Digimatic IDC |

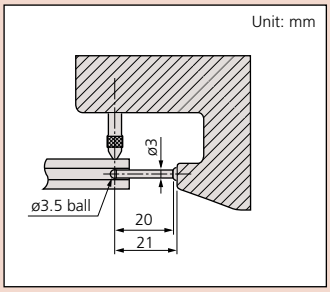
**Inch** Dial Type

| Range | Order No. | Graduation | Accuracy | Measuring Force | Remarks |
|---|---|---|---|---|---|
| 0 - .5" | **7316S** | .001" | ±.001" | 1.4N or less | Groove thickness |

**Metric** Dial Type

| Range | Order No. | Graduation | Accuracy | Measuring Force | Remarks |
|---|---|---|---|---|---|
| 0 - 10mm | **7315** | 0.01mm | ±15µm | 1.4N or less | Groove thickness |

## DIMENSIONS



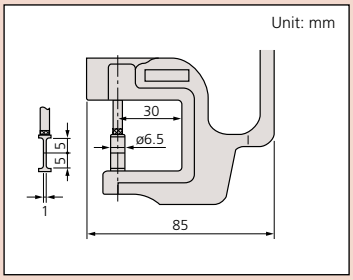

## Optional Accessories

**905338**: SPC cable (40" / 1m) for digital type
**905409**: SPC cable (80" / 2m) for digital type
**902794**: Spindle lifting lever for IDS digimatic type (stroke .5" / 12.7mm)

## Standard Accessories

**21AZB149**: Spindle lifting lever for digimatic and dial thickness gage (stroke .5" / 12.7mm)
**21AZB150**: Spindle lifting lever for dial indicator (stroke 1" / 25.4mm)

## DIMENSIONS



# Quick-Mini

## SERIES 700

A compact comparator designed for carrying convenience is suited for quick inspection of paper thickness, leather, wires, plastic parts, etc. The digital display provides error-free reading with 0.01mm / .0005" resolution.

### FEATURES

- Measuring force less than 2N.
- Notifications for:
  - Low battery voltage
  - Scale surface contamination
  - overflow
- Supplied in fitted plastic case.




**700-118-20**

### Technical Data

Accuracy: Refer to the list of specifications.
Resolution: 0.01mm or .0005"/0.01mm
Display: LCD
Battery: SR44 (1 pc.), **938882**
Battery life: Approx. 5 years under normal use

### Function

Zero-setting, Data hold, Power ON/OFF, inch/mm conversion (on inch/metric models only)



## SPECIFICATIONS

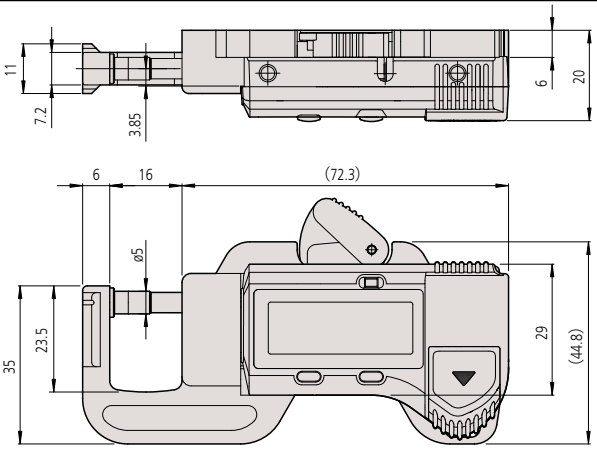
**Metric**

| Range | Order No. | Accuracy |
|---|---|---|
| 0 - 12mm | **700-119-30** | ±0.02mm |

**Inch/Metric**

| Range | Order No. | Accuracy |
|---|---|---|
| 0 - .5"/0 - 12.7mm | **700-118-30** | ±.001" |

## DIMENSIONS AND MASS




**700-118-20 / 700-119-20**
MASS: 70g

# Digimatic Caliper Gages

## SERIES 209 — Internal Tube Thickness Measurement

Versatile ID measuring gages for hole diameters, groove thickness, tube diameter and hard-to-reach dimensions. The Digimatic Caliper Gages provide error-free LCD readings, as well as data output for SPC analysis.

### Internal measurement type

209-552

IP67




### Technical Data

| | |
|---|---|
| Accuracy: | Refer to the list of specifications |
| Resolution: | .001", .0005", or .0002"<br>0.01mm, 0.02mm, or 0.005mm |
| Display: | LCD Analog / Digital |
| Power Supply: | AAA Battery (2 pcs.) |
| Battery life: | Approx. 350 hours |
| Measuring Force: | 0.9 - 1.8N |
| Dust/Water protection level: | IP67 |
| Provided with inspection certificate. | |

### Function

Zeroset, Preset, Auto power off, Inch/Metric, conversion Data hold, Max/Min value holding, Data output

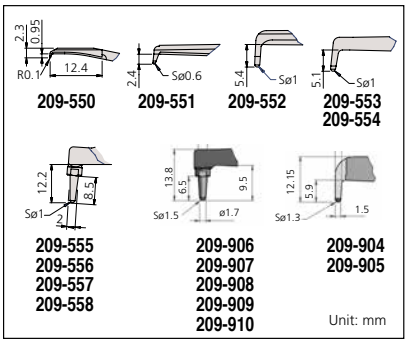
### Optional Accessories

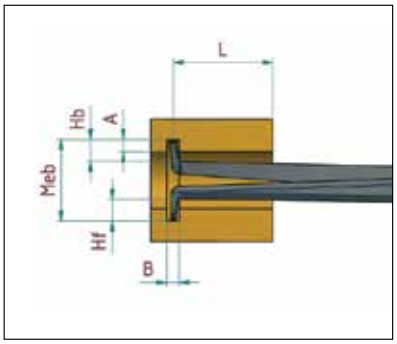
**KPL1961-09**: SPC Adapter
**937387** Digimatic cable (1m)
**965013** Digimatic cable (2m)
**KPL8004-50** Holder for stand

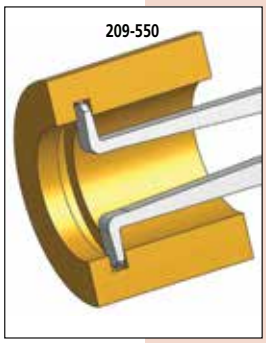
## SPECIFICATIONS

Inch / Metric

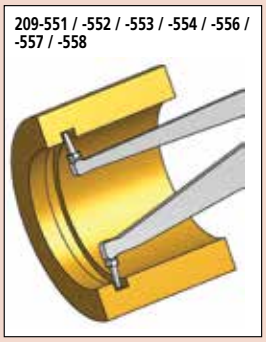
| Range | Order No. | Resolution | Accuracy | Max. Measuring Depth L | Max. Groove Depth A | Min. Groove Width B | Type of Measuring Contact | Mass(g) |
|---|---|---|---|---|---|---|---|---|
| .10 -.49"/ 2.5 -12.5mm | **209-550** | .0002"/ 0.005mm | .0008"/ 0.015mm | .47"/ 12mm | .027"/0.7mm | .023"/ 0.5mm | Chisel R .0039"/ 0.1mm | 225 |
| .20 -.59"/ 5 -15mm | **209-551** | .0002"/ 0.005mm | .0008"/ 0.015mm | 1.37"/ 35mm | .09"/ 2.3mm | .032"/ 0.8mm | Ball .024"/ 0.6mm dia. | 230 |
| .39 -1.18"/ 10-30mm | **209-552** | .0005"/ 0.01mm | .0015"/ 0.03mm | 3.3"/ 85mm | .19"/ 5.2mm | .06"/ 1.2mm | Ball .04"/ 1mm dia. | 250 |
| .79 -1.58"/ 20-40mm | **209-553** | .0005"/ 0.01mm | .0015"/ 0.03mm | 3.3"/ 85mm | .26"/ 7mm | .06"/ 1.2mm | Ball .04"/ 1mm dia. | 250 |
| 1.18 -1.97"/ 30-50mm | **209-554** | .0005"/ 0.01mm | .0015"/ 0.03mm | 3.3"/ 85mm | .26"/ 7mm | .06"/ 1.2mm | Ball .04"/ 1mm dia. | 255 |
| 1.58 -2.36"/ 40-60mm | **209-555** | .0005"/ 0.01mm | .0015"/ 0.03mm | 3.3"/ 85mm | .31"/ 8.3mm | .06"/ 1.2mm | Ball .04"/ 1mm dia. | 265 |
| 1.97 -2.75"/ 50-70mm | **209-556** | .0005"/ 0.01mm | .0015"/ 0.03mm | 3.3"/ 85mm | .31"/ 8.3mm | .06"/ 1.2mm | Ball .04"/ 1mm dia. | 265 |
| 2.36 -3.15"/ 60-80mm | **209-557** | .0005"/ 0.01mm | .0015"/ 0.03mm | 3.3"/ 85mm | .31"/ 8.3mm | .06"/ 1.2mm | Ball .04"/ 1mm dia. | 270 |
| 2.75 - 3.54"/ 70-90mm | **209-558** | .0005"/ 0.01mm | .0015"/ 0.03mm | 3.3"/ 85mm | .31"/ 8.3mm | .06"/ 1.2mm | Ball .04"/ 1mm dia. | 270 |
| 0.51 - 1.69"/13-43mm | **209-904** | .001"/0.02mm | .002"/0.04mm | 5.0"/127mm | .177"/4.5mm | .079"/2.0mm | Ball Ø.05"/1.3mm | 360 |
| 1.18 - 2.36"/ 30-60mm | **209-906** | .001"/0.02mm | .002"/0.04mm | 5.2"/132mm | .256"/6.5mm | .098"/2.5mm | Ball Ø.06"/1.5mm | 370 |
| 1.97 - 3.15"/ 50-80mm | **209-907** | .001"/0.02mm | .002"/0.04mm | 5.2"/132mm | .335"/8.5mm | .098"/2.5mm | Ball Ø.08"/2mm | 370 |
| 2.76 - 3.94"/ 70-100mm | **209-908** | .001"/0.02mm | .002"/0.04mm | 5.2"/132mm | .335"/8.5mm | .098"/2.5mm | Ball Ø.08"/2mm | 375 |
| 3.54 - 4.72"/ 90-120mm | **209-909** | .001"/0.02mm | .002"/0.04mm | 5.2"/132mm | .335"/8.5mm | .098"/2.5mm | Ball Ø.08"/2mm | 380 |
| 0.59 - 2.56"/ 15-65mm | **209-905** | .001"/0.02mm | .0024"/0.06mm | 7.4"/188mm | .196"/5mm | .087"/2.2mm | Ball Ø.06"/1.5mm | 415 |
| 1.57 - 3.54"/ 40-90mm | **209-910** | .001"/0.02mm | .0024"/0.06mm | 7.56"/192mm | .315"/8mm | .098"/2.5mm | Ball Ø.08"/2mm | 420 |




Edge R 0.1 mm




Ball ø 0.6mm, ø 1mm, ø 1.3mm ø 1.5mm and ø 2mm

# Digimatic Caliper Gages

## SERIES 209 — External Tube Thickness Measurement

Versatile OD measuring gages for groove thickness, tube thickness and hard-to-reach dimensions. Digimatic Caliper Gages provide error-free LCD readings, as well as data output for SPC analysis.

**External measurement type**

**209-572**



### Technical Data

| | |
|---|---|
| Accuracy: | Refer to the list of specifications |
| Resolution: | .001", .0005", or .0002"<br>0.01mm, 0.02mm, or 0.005mm |
| Display: | Analog / Digital |
| Power Supply: | AAA Battery (2 pcs.) |
| Battery life: | Approx. 350 hours |
| Measuring Force: | 0.8 - 1.7N |

Dust/Water protection level: IP67
Provided with inspection certificate.

### Function

Zeroset, Preset, Auto power off, Inch/Metric conversion, Data hold, Max/Min value holding, Data output
* Contact type 3, 4 does not have max. min. value hold.

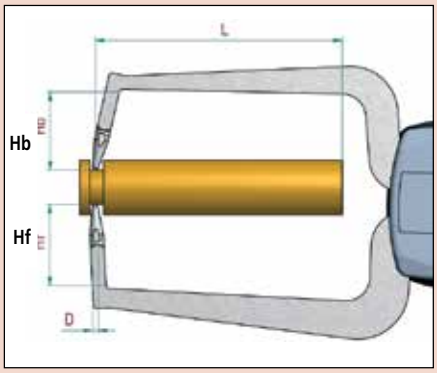
## SPECIFICATIONS

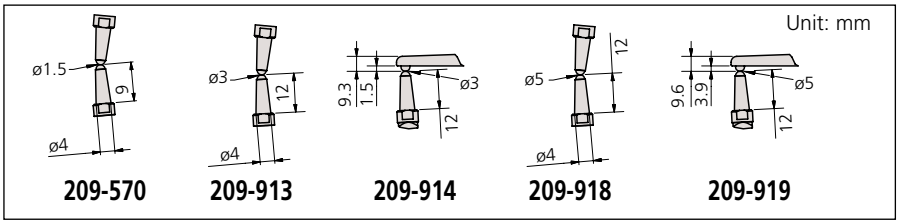
**Inch / Metric**

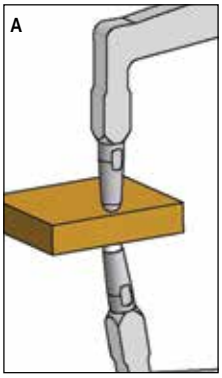
| Range | Order No. | Resolution | Accuracy | Max. Measuring Depth L | Measuring Contact length Hb | Measuring Contact length Hf | Type of Measuring Contact/type of set up | Mass(g) |
|---|---|---|---|---|---|---|---|---|
| 0 - .39"/ 0-10mm | **209-570** | .0002"/0.005mm | .0008"/ 0.05mm | 1.37"/35mm | .75" /19.1mm | .73"/ 18.6mm | Ball .059"/1.5mm dia. Both/ A | 240 |
| 0 - .39"/ 0-10mm | **209-571** | .0002"/0.005mm | .001"/ 0.02mm | 1.37"/35mm | .85"/21.7mm | .58"/ 14.8mm | Desc .24"/ 6mm dia. Both/ C | 175 |
| 0 - .78"/ 0-20mm | **209-572** | .0005"/0.01mm | .0015"/ 0.03mm | 3.2"/85mm | .97"/24.7mm | .97"/ 24.6mm | Ball .059"/1.5mm dia. Both/ A | 280 |
| 0 - .78"/ 0-20mm | **209-573** | .0005"/0.01mm | .0015"/ 0.03mm | 3.2"/80mm | .97"/24.7mm | .10"/ 2.5mm | Ball .059"/1.5mm dia. Both/ B | 270 |
| 0-1.18"/0-30mm | **209-913** | .001"/0.02mm | .002"/0.04mm | 4.5"/114mm | 1.17"/30mm | 1.17"/30mm | Ball Ø.12"/3mm A | 430 |
| 0-1.18"/0-30mm | **209-914** | .001"/0.02mm | .002"/0.04mm | 4.58"/116mm | 1.17"/30mm | .16"/4mm | Ball Ø.12"/3mm B | 410 |
| 0-1.18"/0-30mm | **209-915** | .001"/0.02mm | .002"/0.04mm | 4.56"/116mm | 1.42"/36mm | .94"/24mm | Disc Ø1.97"/50mm D | 430 |
| 0-1.97"/0-50mm | **209-918** | .001"/0.02mm | .002"/0.04mm | 6.57"/167mm | 1.17"/30mm | 1.17"/30mm | Ball Ø.12"/3mm A | 490 |
| 0-1.97"/0-50mm | **209-919** | .001"/0.02mm | .0024"/0.06mm | 6.57"/167mm | 1.17"/30mm | .18"/4.6mm | Ball Ø.12"/3mm B | 460 |
| 0-1.97"/0-50mm | **209-920** | .001"/0.02mm | .003"/0.08mm | 6.57"/167mm | 1.42"/36mm | .94"/24mm | Disc Ø1.97"/50mm both/D | 500 |

### Optional Accessories

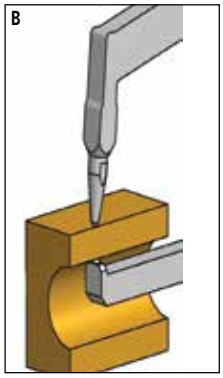
**KPL1961-09**: SPC Adapter
**937387** Digimatic cable (1m)
**965013** Digimatic cable (2m)
**KPL8004-50** Holder for stand



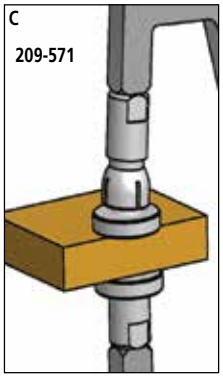



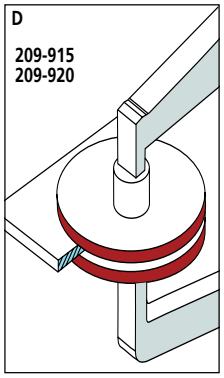

Ball ø 1.5 and 3mm for wall thickness




Ball ø 1.5 and 3mm for min. wall thickness ø3mm / 9mm




Disk ø6mm for flat surfaces




Disk ø50mm for flat surfaces

# Dial Caliper Gages

## SERIES 209 — Internal Measurement

The caliper is spring loaded and makes point contact at a constant measuring pressure.

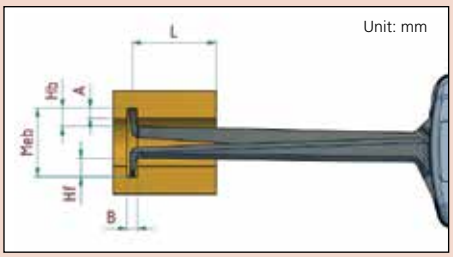






IP65

## DIMENSIONS




## SPECIFICATIONS

### Inch

| Measuring Range | Order No. | Graduation | Accuracy | Max. Measuring Depth L | Max. Groove Depth A | Min. Groove Width B | Measuring Contact Type | Size (mm) | Mass (g) |
|---|---|---|---|---|---|---|---|---|---|
| .10 - .50" | **209-350** | .0002" | ± .0008" | .47" | .027" | .023" | A | R0.1 | 200 |
| .20 - .60" | **209-351** | .0002" | ± .0008" | 1.37" | .09" | .032" | B | ø0.6 | 200 |
| .40 - 1.2" | **209-352** | .0005" | ± .0015" | 3.3" | .19" | .06" | B | ø1 | 200 |
| .80 - 1.6" | **209-354** | .0005" | ± .0015" | 3.3" | .26" | .06" | B | ø1 | 200 |
| 1.2 - 2" | **209-355** | .0005" | ± .0015" | 3.3" | .26" | .06" | B | ø1 | 200 |
| 1.6 - 2.4" | **209-356** | .0005" | ± .0015" | 3.3" | .31" | .06" | B | ø1 | 200 |
| 2 - 2.8" | **209-357** | .0005" | ± .0015" | 3.3" | .31" | .06" | B | ø1 | 200 |
| 2.4 - 3.2" | **209-358** | .0005" | ± .0015" | 3.3" | .31" | .06" | B | ø1 | 250 |
| 2.8 - 3.6" | **209-359** | .0005" | ± .0015" | 3.3" | .31" | .06" | B | ø1 | 250 |
| 3.2 - 4" | **209-360** | .0005" | ± .0015" | 3.3" | .31" | .06" | B | ø1 | 250 |
| 2 - 4" | **209-361*** | .0005" | ± .0015" | 3.3" | .31" | .06" | C | ø1 | 250 |
| 3.6 - 5.6" | **209-362*** | .0005" | ± .0015" | 3.3" | .31" | .06" | C | ø1 | 250 |
| 5.2 - 7.2" | **209-363*** | .0005" | ± .0015" | 3.3" | .31" | .06" | C | ø1 | 250 |

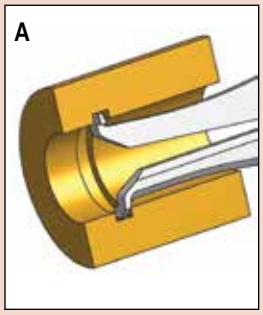
*Interchangeable contact points (additional anvil 4 pcs.) with ball point .04" dia. These Dial Caliper Gages are used only as comparison gages and should be used along with a setting ring or a micrometer.

### Metric

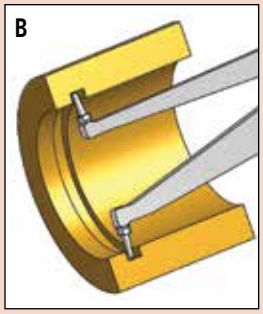
| Measuring Range | Order No. | Graduation | Accuracy | Max. Measuring Depth L | Max. Groove Depth A | Min. Groove Width B | Measuring Contact Type | Size (mm) | Mass(g) |
|---|---|---|---|---|---|---|---|---|---|
| 2.5 - 12.5mm | **209-300** | 0.005mm | ±0.015mm | 12mm | 0.7mm | 0.5mm | A | R0.1 | 155 |
| 5 - 15mm | **209-301** | 0.005mm | ±0.015mm | 35mm | 2.3mm | 0.8mm | B | ø0.6 | 160 |
| 10 - 30mm | **209-302** | 0.01mm | ±0.03mm | 85mm | 5.2mm | 1.2mm | B | ø1 | 180 |
| 20 - 40mm | **209-303** | 0.01mm | ±0.03mm | 85mm | 7mm | 1.2mm | B | ø1 | 180 |
| 30 - 50mm | **209-304** | 0.01mm | ±0.03mm | 85mm | 7mm | 1.2mm | B | ø1 | 185 |
| 40 - 60mm | **209-305** | 0.01mm | ±0.03mm | 85mm | 8.3mm | 1.2mm | B | ø1 | 195 |
| 50 - 70mm | **209-306** | 0.01mm | ±0.03mm | 85mm | 8.3mm | 1.2mm | B | ø1 | 195 |
| 60 - 80mm | **209-307** | 0.01mm | ±0.03mm | 85mm | 8.3mm | 1.2mm | B | ø1 | 200 |
| 70 - 90mm | **209-308** | 0.01mm | ±0.03mm | 85mm | 8.3mm | 1.2mm | B | ø1 | 200 |
| 80 - 100mm | **209-309** | 0.01mm | ±0.03mm | 85mm | 8.3mm | 1.2mm | B | ø1 | 200 |
| 50 - 100mm | **209-310*** | 0.01mm | ±0.03mm | 85mm | 8.3mm | 1.2mm | C | ø1 | 220 |
| 90 - 140mm | **209-311*** | 0.01mm | ±0.03mm | 85mm | 8.3mm | 1.2mm | C | ø1 | 230 |
| 130 - 180mm | **209-312*** | 0.01mm | ±0.03mm | 85mm | 8.3mm | 1.2mm | C | ø1 | 240 |
| 15-65mm | **209-901** | 0.05mm | ±0.05 | 188 | 5 | 1.9 | B | ø1.5mm | 355 |
| 40-90mm | **209-902** | 0.05mm | ±0.05 | 192 | 8.5 | 2.4 | B | ø2mm | 370 |
| 70-120mm | **209-903** | 0.05mm | ±0.05 | 192 | 8.5 | 2.4 | B | ø2mm | 380 |

*Interchangeable contact point (additional anvil 5pcs.) with ball point 1mm dia These Dial Caliper Gages are used only as comparison gages and should be used along with a setting ring or a micrometer.

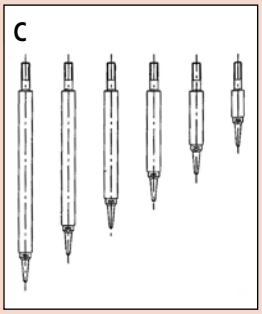
A



B



C



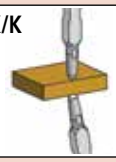
## Type of Contact Points

**S**



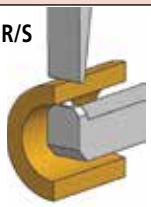
Upper / Lower contact point
R0.4 / R0.4: **209-454, 209-405**
R0.75 / R0.75: **209-921**

**K/K**



Upper / Lower contact point
ø2.0 / ø2.0 ball: **209-911, 209-916, 209-789**
ø1.5 / ø1.5 ball: **209-450, 209-455, 209-402, 209-404**

**R/S**



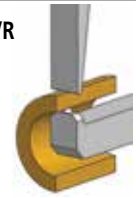
R0.4 / ø1.5 carbide ball: **209-406, 209-453**

**RK/K**



Upper / Lower contact point
ø1.5 / ø1.5 ball: **209-407, 209-452, 209-456**

**S/R**



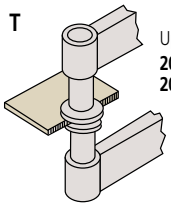
Upper / Lower contact point
R0.75 / ø2 ball: **209-922**

**R**



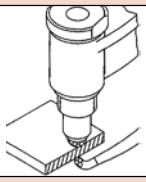
Upper / Lower contact point
ø2 / ø2.5 ball: **209-912, 209-917**

**T**



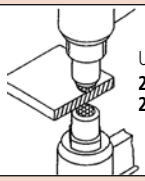
Upper / Lower contact point
**209-451**:
**209-403**:

**PR**



Upper / Lower contact point
ø2 / R0.5: **209-790, 209-603**

**PK**

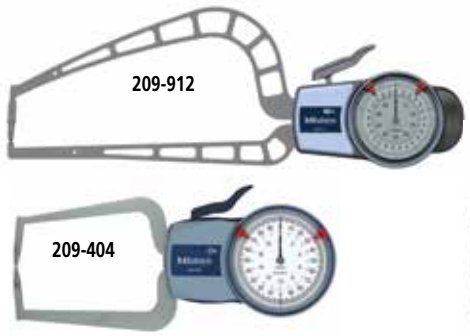


Upper / Lower contact point
**209-789:**
**209-843:**

# Dial Caliper Gages

## SERIES 209 — External Measurement

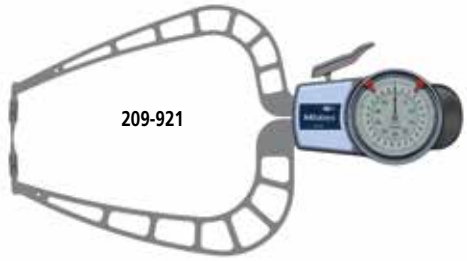
IP65



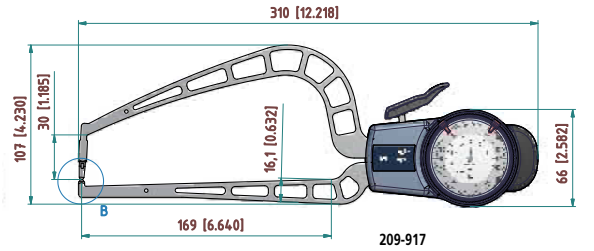




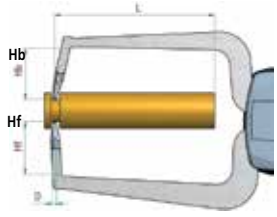



## DIMENSIONS




209-917




209-4XX

Unit: mm

## SPECIFICATIONS

### Inch

| Measuring Range | Order No. | Graduation | Accuracy | Max. Measuring Depth L | Length Hb | Length Hf | Measuring Contact Type | Size (mm) | Mass (g) |
|---|---|---|---|---|---|---|---|---|---|
| 0 - .40" | **209-450** | .0002" | ± .0008" | 1.37" | .75" | .75" | K/K | ø1.5 | 170 |
| 0 - .40" | **209-451** | .0002" | ±- .001" | 1.37" | .85" | .58" | T | ø6 | 175 |
| 0 - .40" | **209-452** | .0002" | ± .0008" | 1.37" | .75" | .035" | RK/K | ø1.5 | 165 |
| 0 - .40" | **209-453** | .0002" | ± .0008" | 1.37" | .75" | .035" | R/S | Chisel R0.4, ø1.5 | 165 |
| 0- .50" | **209-789** | .005" | ± .005" | 1.38" | - | - | PK | ø2, Chisel R0.5 | 40 |
| 0- .50" | **209-790** | .005" | ± .005" | 1.38" | - | - | PR | ø2 | 40 |
| 0 - .80" | **209-454** | .0005" | ±- .0015" | 3.2" | .97" | .97" | S | Chisel R0.4 | 210 |
| 0 - .80" | **209-455** | .0005" | ± .0015" | 3.2" | .97" | .97" | K/K | ø1.5 | 210 |
| 0 - .80" | **209-456** | .0005" | ± .0015" | 3.2" | .97" | .10" | RK/K | ø1.5 | 200 |
| 0 - .80" | **209-457** | .0005" | ± .0015" | 3.2" | .97" | .10" | R/S | Chisel R0.4, ø1.5 | 200 |
| 0 - 2.0" | **209-916** | .001" | ± .002" | 6.6" | 1.2" | 1.2" | K/K | ø3 | 430 |
| 0 - 2.0" | **209-917** | .001" | ± .002" | 6.6" | 1.2" | .18" | RK/K | ø3 | 400 |

### Metric

| Measuring Range | Order No. | Graduation | Accuracy | Max. Measuring Depth L | Length Hb | Length Hf | Measuring Contact | Size (mm) | Mass (g) |
|---|---|---|---|---|---|---|---|---|---|
| 0 - 10mm | **209-402** | 0.005mm | ±0.015mm | 35mm | 19.1mm | 18.6mm | K/K | ø1.5 | 240 |
| 0 - 10mm | **209-403** | 0.005mm | ±0.02mm | 35mm | 21.7mm | 14.8mm | T | ø6 | 175 |
| 0 - 20mm | **209-404** | 0.01mm | ±0.03mm | 85mm | 7mm | 24.6mm | K/K | ø1.5 | 210 |
| 0 - 20mm | **209-405** | 0.01mm | ±0.03mm | 85mm | 7mm | 24.6mm | S | R 0.4 | 210 |
| 0 - 20mm | **209-406** | 0.01mm | ±0.03mm | 80mm | 7mm | 2.5mm | R/S | Chisel R0.4, ø1.5 | 200 |
| 0 - 20mm | **209-407** | 0.01mm | ±0.03mm | 80mm | 7mm | 2.5mm | RK/K | ø1.5 | 200 |
| 0 - 10mm | **209-843** | 0.1mm | ±0.1mm | 36mm | - | - | PK | ø2, Chisel R0.5 | 40 |
| 0 - 10mm | **209-603** | 0.1mm | ±0.1mm | 33mm | - | - | PR | ø2 | 40 |
| 0 - 50mm | **209-911** | 0.05mm | ±0.05mm | 167mm | 30mm | 30mm | KK | Ball Ø3mm | 430 |
| 0 - 50mm | **209-912** | 0.05mm | ±0.05mm | 169mm | 30mm | 4.5mm | RK/K | Ball Ø3mm | 400 |
| 0 - 50mm | **209-921** | 0.05mm | ±0.05mm | 167mm | 30mm | 30mm | S | Chisel R0.75 | 490 |
| 0 - 50mm | **209-922** | 0.05mm | ±0.05mm | 169mm | 30mm | 4.5mm | R/S | ø3, Chisel R0.75 | 400 |



Mitutoyo

# Dial Tension Gages

## SERIES 546

### FEATURES

- Can measure dynamic tension in Newton (N) units.
- Dial Tension Gages are widely used to determine the contact force of other measuring instruments, as well as that of electrical relays, micro-switches, valves and precision springs.
- Convenient peak-hold type gages are also available.



**546-112**
Standard

**546-119**
Standard

**546-137**
Peak hold

### SPECIFICATIONS

**Standard**

| Range | Order No. | Minimum reading |
|---|---|---|
| 6mN - 50mN | **546-112** | 2mN |
| 10mN - 100mN | **546-113** | 5mN |
| 30mN - 300mN | **546-114** | 10mN |
| 0.06N - 0.5N | **546-115** | 0.02N |
| 0.1N - 1N | **546-116** | 0.05N |
| 0.15N - 1.5N | **546-117** | 0.05N |
| 0.3N - 3N | **546-118** | 0.1N |
| 0.6N - 5N | **546-119** | 0.2N |

**Peak hold**

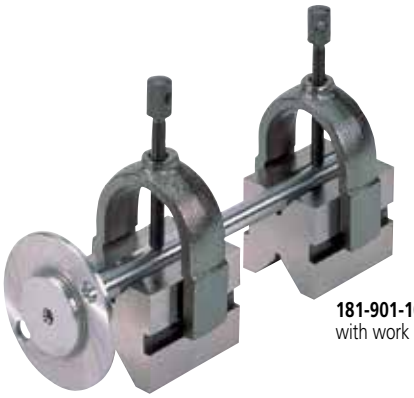
| Range | Order No. | Graduation |
|---|---|---|
| 10mN - 100mN | **546-133** | 5mN |
| 30mN - 300mN | **546-134** | 10mN |
| 0.06N - 0.5N | **546-135** | 0.02N |
| 0.1N - 1N | **546-136** | 0.05N |
| 0.15N - 1.5N | **546-137** | 0.05N |
| 0.3N - 3N | **546-138** | 0.1N |
| 0.6N - 5N | **546-139** | 0.2N |

# V-Block Sets

## SERIES 181

### FEATURES

- Two V-blocks per set.
- Magnetic type is available. (The magnetic V-block is not provided with a workpiece clamp.)



**181-901-10**
with work piece

### SPECIFICATIONS

**Inch**

| Max. workpiece dia. | Order No. | Thread Size | Remarks | Mass(g) |
|---|---|---|---|---|
| 1″ | **181-901-10** | UNC 1/4″-20 | With clamp | 750 |
| 2″ | **181-904-10** | 5/16″-18NC | With clamp | 3600 |

# Magnetic V-Block

## SERIES 181

### SPECIFICATIONS

**Metric**

| Max. workpiece dia. | Order No. | Magnetic Pull | Remarks |
|---|---|---|---|
| 50mm | **181-146** | 60 kg | 1 Piece |



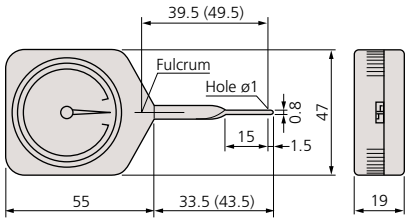
**181-146**

### Application

Measuring contact force of relay

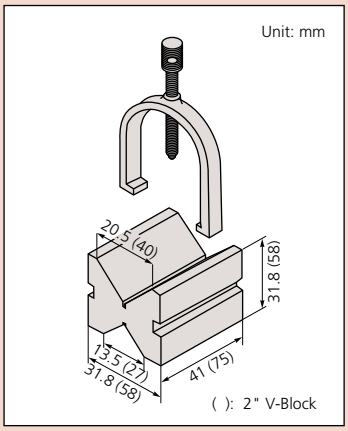


### DIMENSIONS



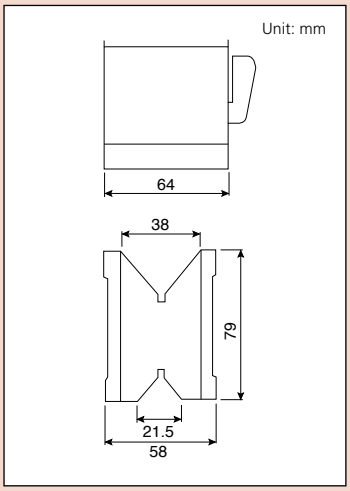

( ): **546-112, 546-113, 546-133**

### DIMENSIONS




( ): 2" V-Block

### DIMENSIONS



# Dial Snap Gages

## SERIES 201

### Technical Data

| | |
|---|---|
| Accuracy: | Refer to the list of specifications |
| Anvil retracting stroke: | .078″ / 2mm |
| Anvil positioning range: | 1″ / 25mm |
| Anvil flatness: | .00004″ / 1µm |

### FEATURES

- Designed for quick go/no-go judgment of diameters of cylinders and shafts in machining processes.
- Dial or Digital indicators are optional.
- Anvil retracting stroke: .078″ / 2mm
- Anvil positioning range: 1″ / 25mm
- Wide (.53 x .47″ / 13.5 x 12mm), flat carbide anvils
- Both front edges of the anvil are chamfered for easy insertion.



**201-101**
with optional dial indicator 2046SB

### SPECIFICATIONS

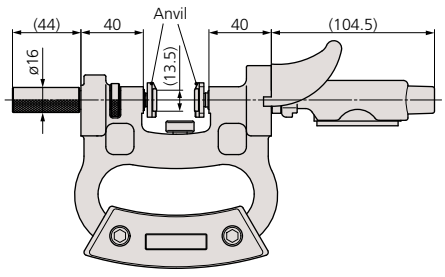
**Metric** Gage stem diameter 8mm

| Range | Order No. | Parallelism | Measuring force | Recommended dial indicator (optional) |
|---|---|---|---|---|
| 0 - 25mm | **201-101** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 25 - 50mm | **201-102** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 50 - 75mm | **201-103** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 75 - 100mm | **201-104** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 100 - 125mm | **201-105** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 125 - 150mm | **201-106** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 150 - 175mm | **201-107** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 175 - 200mm | **201-108** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 200 - 225mm | **201-109** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 225 - 250mm | **201-110** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 250 - 275mm | **201-111** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |
| 275 - 300mm | **201-112** | 5µm or less | 15N±3N | **2046SB** (0.01mm reading), **2109SB-10** (0.001mm reading) |

**Inch** Gage stem diameter 3/8"

| Range | Order No. | Parallelism | Measuring force | Recommended dial indicator (optional) |
|---|---|---|---|---|
| 0 - 1″ | **201-151** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 1 - 2″ | **201-152** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 2 - 3″ | **201-153** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 3 - 4″ | **201-154** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 4 - 5″ | **201-155** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 5 - 6″ | **201-156** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 6 - 7″ | **201-157** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 7 - 8″ | **201-158** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 8 - 9″ | **201-159** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 9 - 10″ | **201-160** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 10 - 11″ | **201-161** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |
| 11 - 12″ | **201-162** | .00025″ or less | 15N±3N | **2803SB-10** (.0001″ reading) |

### DIMENSIONS




Unit: mm



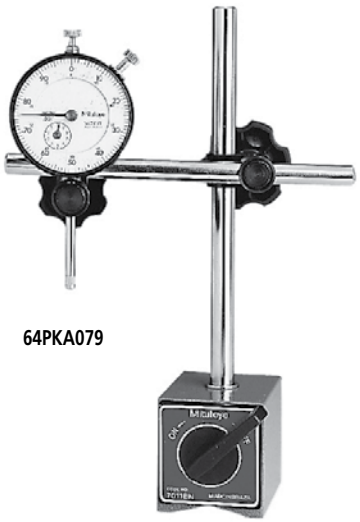
Mitutoyo

# Dial/Test Indicator & Magnetic Stand Sets

## SERIES 7



513-907



64PKA079

### SPECIFICATIONS

| Set No. | Included in set |
|---|---|
| **64PKA078*** | 2804S-10, 7010S |
| **64PKA079*** | 2416S, 7010S |
| **513-907-10E** | 513-402-10E, 7014E-10 |
| **513-908-10E** | 513-404-10E, 7014-10 |

*Supplied with collar **02AZC291**

# Magnetic Stands

## SERIES 7

Mitutoyo's Magnetic Stands accept all dial indicators and dial test indicators. The On-Off switch offers instant mounting and dismounting without any adverse effect to the indicators or workpiece surface.



7010S



7011BN



7031B



7032B



7033B



7012-10



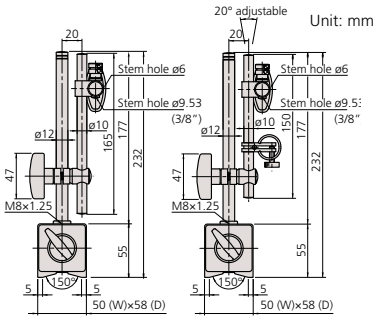
**7014-10 / 7014E-10**
No magnet force On/Off

### SPECIFICATIONS

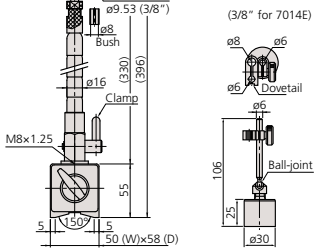
| Order No. | Description | Applicable holding stem dia. | Dovetail groove | Remarks |
|---|---|---|---|---|
| **7010S** | Magnetic stand | ø8mm*, ø9.53mm (3/8") | — | — |
| **7011BN** | Magnetic stand | ø6mm, ø8mm*, ø9.53mm (3/8") | — | With fine adjustment |
| **7011S-10** | Magnetic stand | ø4mm, ø8mm, ø9.53mm (3/8") | — | With fine adjustment |
| **7012-10** | Magnetic flexi-stand | ø6mm, ø8mm*, ø9.53mm (3/8") | — | For dial test indicator |
| **7014-10** | Mini magnetic stand | ø6mm, ø8mm | Provided | Without magnet ON/OFF |
| **7014E-10** | Mini magnetic stand | ø6mm, ø8mm*, ø9.53mm (3/8") | Provided | Without magnet ON/OFF |
| **7031B** | Universal magnetic stand | ø6mm, ø8mm, ø9.53mm (3/8") | Provided | With mechanical locking system |
| **7032B** | Universal magnetic stand | ø6mm, ø8mm, ø9.53mm (3/8") | Provided | With mechanical locking system |
| **7033B** | Universal magnetic stand | ø6mm, ø8mm, ø9.53mm (3/8") | Provided | With mechanical locking system |

*Supplied with collar **02AZC291**

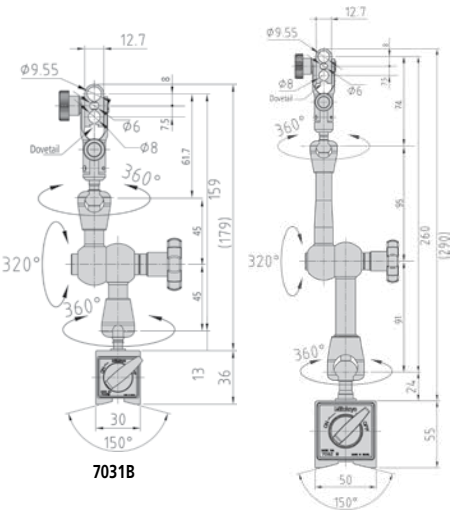
## DIMENSIONS



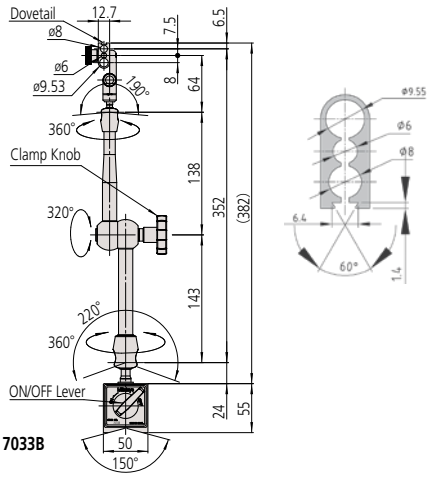

7010S 7011BN




7012-10 7014-10/7014E-10




7031B 7032B



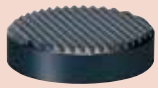

7033B

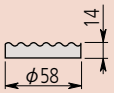
# Dial Gage Stands

## SERIES 7

### Optional Accessories

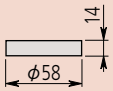
**101461**: Hardened-steel flat anvil
**101462**: Hardened-steel serrated anvil
**101463**: Hardened-steel domed anvil*
*Not available for **7007-10**.





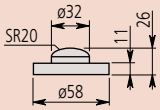

**No.101462**
Hardened steel






**No.101461**
Hardened steel






**No.101463**
Hardened steel

## FEATURES

- Dial Gage Stands are designed for comparison measurements of size using a dial indicator or Digimatic Indicator.
- Anvil of 7001-10 and 7002-10: ø58mm
  Anvil of 7007-10: 90mm square
- Vertical fine adjustment is available with one-touch control thanks to the parallel spring suspension.



**7001-10**
(with ø58mm serrated anvil)



**7002-10**
(with ø58mm flat anvil)



**7007-10**
(with 90mm square anvil)

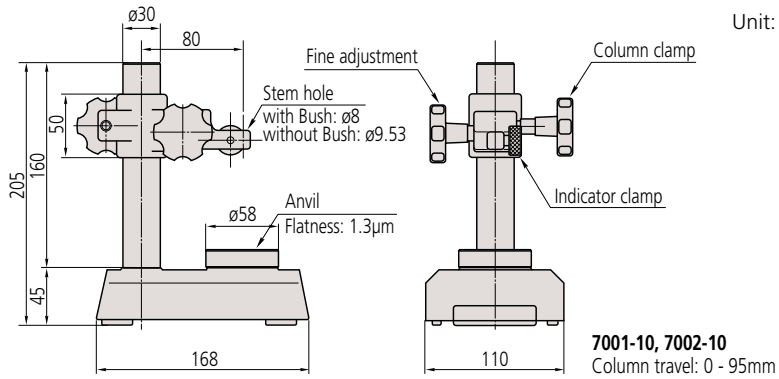
## SPECIFICATIONS

**Metric**

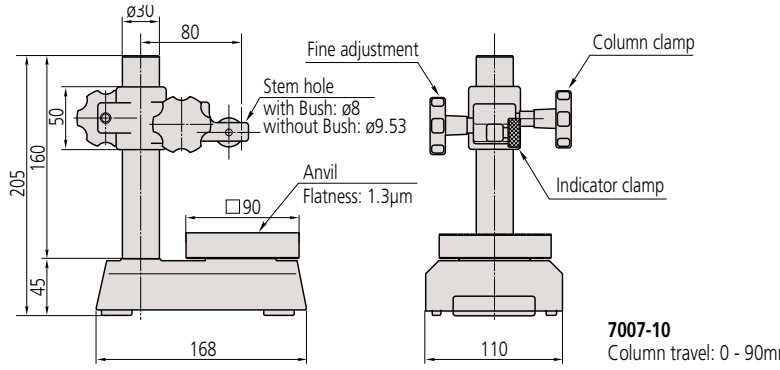
| Order No. | Stem hole | Remarks | Mass(g) |
|---|---|---|---|
| **7001-10** | ø8mm, ø9.53mm | With serrated anvil (**101462**) | 4 |
| **7002-10** | ø8mm, ø9.53mm | With flat anvil (**101461**) | 4 |
| **7007-10** | ø8mm, ø9.53mm | With square anvil | 5 |

## DIMENSIONS

Unit: mm




**7001-10, 7002-10**
Column travel: 0 - 95mm




**7007-10**
Column travel: 0 - 90mm



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# Transfer Stands

## SERIES 519

### FEATURES

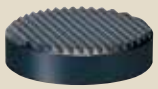
- Transfer Stands are designed for comparison measurements of size using a dial indicator or Digimatic Indicator.

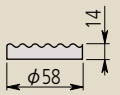


**519-109-10**
**(with a serrated anvil)**

### Optional Accessories

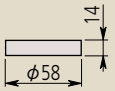
**101461**: Hardened-steel flat anvil
**101463**: Hardened-steel domed anvil





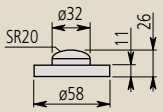

**No.101462**
Hardened steel






**No.101461**
Hardened steel






**No.101463**
Hardened steel

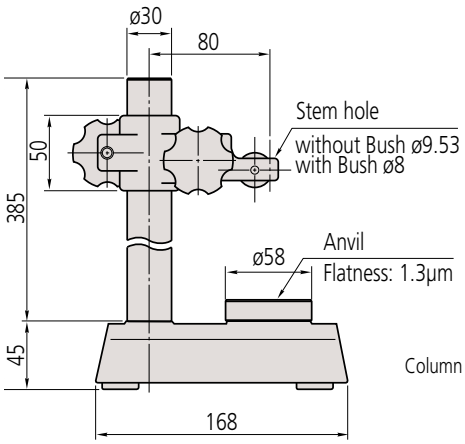
### SPECIFICATIONS

**Metric**

| Order No. | Stem hole | Remarks |
|---|---|---|
| **519-109-10** | ø8mm, ø9.53mm | With serrated anvil (**101462**) |

### DIMENSIONS

Unit: mm




Column travel: 0 - 320mm

# Granite Comparator Stands

## SERIES 215

### FEATURES

- Easy maintenance due to the non-rusting base.
- The rigid granite base is free from burrs and pileups due to its fine-grain composition and less viscousness compared with casting iron. The flatness is always accurate and the workpiece is free from damage.




215-151-10 215-153-10 215-156-10

### Optional Accessories

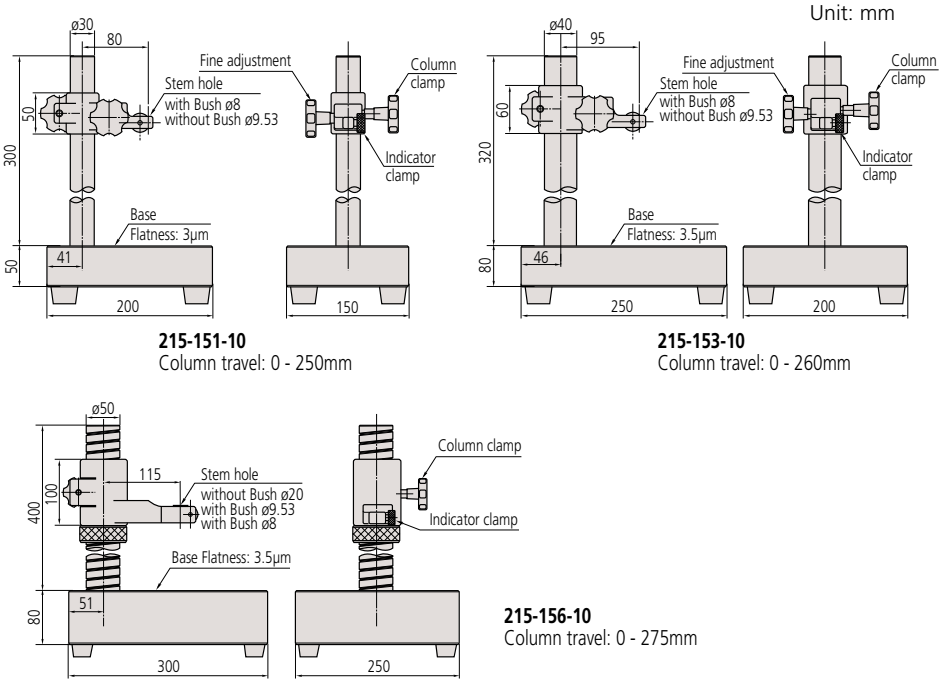
**21JAA329**: ø8mm bush
**21JAA330**: ø9.53mm bush
**21JAA331**: ø15mm bush
only available for **215-156-10**

### SPECIFICATIONS

| Order No. | Granite base size (W x D x H) | Column travel | Stem hole | Remarks |
|---|---|---|---|---|
| **215-151-10** | 150 x 200 x 50mm | 250mm | ø8mm, ø9.53mm | With fine adjustment of 1mm range |
| **215-153-10** | 200 x 250 x 80mm | 260mm | ø8mm, ø9.53mm | With fine adjustment of 1mm range |
| **215-156-10** | 300 x 250 x 80mm | 275mm | ø8mm, ø9.53mm, ø20mm | With fine adjustment over the entire travel |

### DIMENSIONS

Unit: mm




**215-151-10**
Column travel: 0 - 250mm

**215-153-10**
Column travel: 0 - 260mm

**215-156-10**
Column travel: 0 - 275mm



Mitutoyo

# Comparator Stands

## SERIES 215

### FEATURES

- Comparator Stands have a stable, cast-iron base which enables precise measurement.
- The partially serrated anvil prevents flat workpieces from wringing to it and the 2.3µm flatness (or better) promotes accurate measurement.
- The **215-505-10** model has a threaded column which enables easy and precise coarse adjustment.
- Serrated anvils 110×110mm are supplied with **215-405-10**, and 150×150mm with **215-505-10** models.



**215-405-10**



Application example using Digimatic Indicator ID-H.

### SPECIFICATIONS

| Order No. | Square anvil size (W x D) | Column travel | Stem hole | Remarks |
|---|---|---|---|---|
| **215-405-10** | 110 x 110mm | 235mm | ø8mm, ø9.53mm | With fine adjustment of 1mm range |
| **215-505-10** | 150 x 150mm | 275mm | ø8mm, ø9.53mm, ø20mm | With fine adjustment over the entire travel |

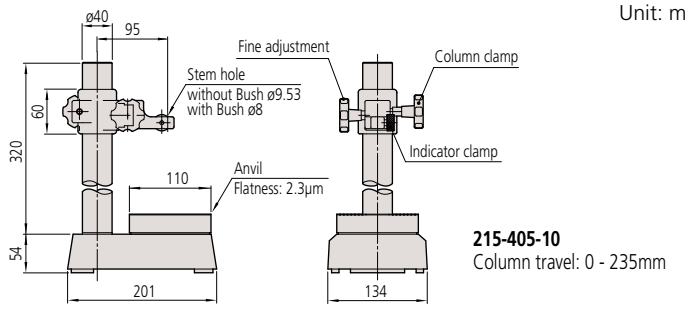
* Perpendicularity of the mounting hole to the anvil: less than 0.4mm/100mm

### Optional Accessories

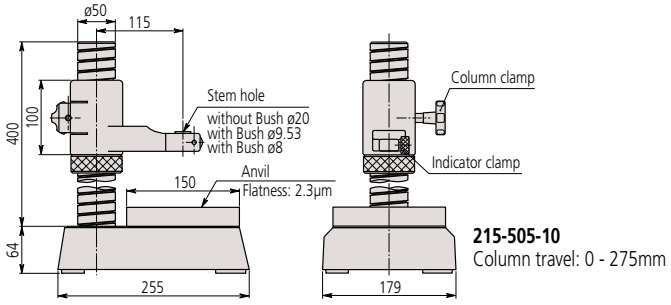
**21JAA329**: ø8mm bush*
**21JAA330**: ø9.53mm (3/8″) bush*
**21JAA331**: ø15mm bush*
* Only available for **215-505-10**.

### DIMENSIONS

Unit: mm




**215-405-10**
Column travel: 0 - 235mm




**215-505-10**
Column travel: 0 - 275mm

# Precision Granite Stands (with black granite bases)

## SERIES 517

### FEATURES

Mitutoyo's Granite Comparator Stands are basic building blocks for the assembly of special purpose, precision measuring equipment. By mounting precision measuring instruments such as Digimatic indicators, Mu-Checker Cartridge Heads and Linear Gages on the stands, it is possible to satisfy all manners of measuring assignment. The rigid granite base is free from burrs, pileups and rust, thereby preventing deterioration over time.

**Optional Accessories**

**012580**: Holder for Lug-Back indicator



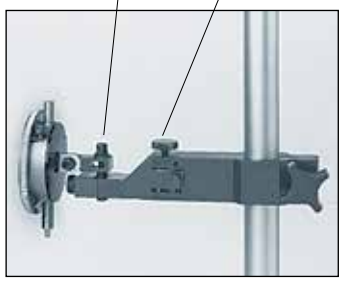
517-891



517-892

### SPECIFICATIONS

| Order No. | Base | Column Diameter | Column Height | Throat Clearance | Table Flatness | Table Thickness | Weight |
|---|---|---|---|---|---|---|---|
| **517-890** | 6 x 8″ | 1.181″ | 6″ | 4.375″ | .0001″ | 2″ | 18 lbs |
| **517-891** | 6 x 8″ | 1.181″ | 8″ | 4.375″ | .0001″ | 2″ | 19 lbs |
| **517-892** | 6 x 8″ | 1.181″ | 12″ | 4.375″ | .0001″ | 2″ | 20 lbs |
| **517-893** | 6 x 8″ | 1.181″ | 18″ | 4.375″ | .0001″ | 2″ | 21 lbs |
| **517-895** | 8 x 12″ | 1.181″ | 6″ | 5.8″ | .0001″ | 2″ | 29 lbs |
| **517-896** | 8 x 12″ | 1.181″ | 8″ | 5.8″ | .0001″ | 2″ | 30 lbs |
| **517-897** | 8 x 12″ | 1.181″ | 12″ | 5.8″ | .0001″ | 2″ | 31 lbs |
| **517-898** | 8 x 12″ | 1.181″ | 18″ | 5.8″ | .0001″ | 2″ | 32 lbs |
| **517-899** | 8 x 12″ | 1.181″ | 24″ | 5.8″ | .0001″ | 2″ | 35 lbs |






Mitutoyo

# MITUTOYO INSTITUTE OF METROLOGY








The Mitutoyo Institute of Metrology, the educational department of Mitutoyo America, provides unrivaled educational seminars, courses and on-demand resources for a wide variety of metrology and measurement-related topics such as basic inspection techniques, principles of dimensional metrology, calibration methods and GD&T. This comprehensive curriculum meets the educational needs of manufacturing, quality and measurement professionals. These popular courses are scheduled regularly throughout the year.

The calibration expertise of Mitutoyo America is now available on-demand for anybody through our On-Demand Portal. Here, you can access metrology educational materials that leverages the available American National Standards in dimensional metrology.

Mitutoyo now offers online courses introducing important concepts in general calibration of micrometers and calipers. Mitutoyo also offers the first certified credentials in dimensional calibration in the United States, addressing both theory (Level 1 credential) and hands-on performance skills (Level 2 credential). These credentials satisfy auditors' requirements.

If you have any questions or would like more information regarding Mitutoyo Institute of Metrology, contact: **MIM@Mitutoyo.com**

Mitutoyo
Institute of Metrology





## Linear Gages



## Mu-checker



## Laser Scan Micrometers



**Linear Gage LGK**



**Laser Scan Micrometer LSM-500S**

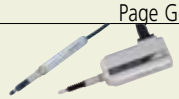
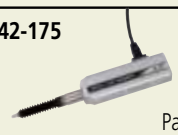
## INDEX

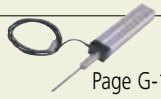
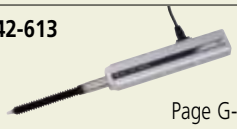
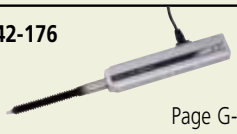
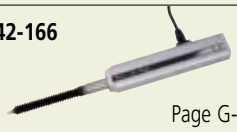
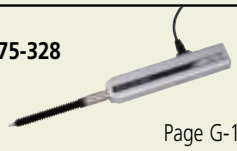

| | |
|---|---|
| **Linear Gage** | |
| Gage Heads / Display Units Selection Guide | G-2,3 |
| Linear Gage LGK | G-4 |
| Linear Gage LGF | G-5 |
| Linear Gage LGF-Z | G-6 |
| Linear Gage LGB-Slim | G-7 |
| Linear Gage LGB2-Slim | G-8,9 |
| Linear Gage LG-Long Range | G-10,11 |
| Linear Gage LGD | G-12,13 |
| Linear Gage LGS | G-14 |
| Linear Gage LGF-High Resolution | G-15 |
| Linear Gage LGB2-High Resolution | G-16 |
| Linear Gage LGH-High Resolution | G-17 |
| Laser Hologage LGH-High Resolution | G-18 |
| EH Counter-Multi Function | G-19 |
| EC Counter-Single-function | G-20 |
| EG Counter-Single-function | G-21 |
| EB Counter-Single-function | G-22 |
| EV Counter-Multi-function | G-23 |
| EV Counter System Configuration | G-24 |
| D-EV Display Unit | G-25 |
| Sensorpak Software | G-26 |
| Litematic G-27 | G-27 |
| Quick Guide to Precision Measuring Instruments-Linear Gages | G-28,29 |
| **Mu-checker** | |
| Mu-checker Probes | G-30,31 |
| Mu-checker | G-32,33 |
| **Laser Scan Micrometer** | |
| Laser Scan Micrometer Selection Guide | G-34,35 |
| Laser Scan Micrometer LSM-6902H | G-36 |
| Laser Scan Micrometer LSM-500S | G-37 |
| Laser Scan Micrometer LSM-501S | G-38 |
| Laser Scan Micrometer LSM-503S | G-39 |
| Laser Scan Micrometer LSM-506S | G-40 |
| Laser Scan Micrometer LSM-512S | G-41 |
| Laser Scan Micrometer LSM-516S | G-42 |
| Laser Scan Micrometer LSM-9506 | G-43 |
| LSM-6200 Display Unit | G-44 |
| LSM-5200 Display Unit | G-45 |
| Laser Scan Micrometer Optional Accessories | G-46-49 |
| Interface for LSM6200, LSM 6900 | G-48 |
| Quick Guide to Precision Measuring Instruments-Laser Scan Micrometers | G-51 |




Mitutoyo

# Gage Heads / Display Units

| Resolution | Gage Heads<br>Measuring range | 5mm / .2" | 10mm / .4" | 25mm / .1" | |
|---|---|---|---|---|---|
| 5nm (0.005µm)<br>10nm (0.01µm) | **Laser Hologage**<br>Page G-17<br>Page G-18 | | **542-715A,542-716A,542-720A,**<br>**542-721A,**<br>(Low measuring force)<br>  <br>Page G-17 and G-18 | | |
| 0.0001mm | **LGB** series (nut clamp)<br>Page G-8<br>**LGK** series Page G-4<br>**LGF** series<br>Page G-15 | **542-246**<br>Refer to page G-16 | **542-158**<br>**542-181**<br>  <br>Page G-4 and G-15 | **542-182**<br>  <br>Page G-15 | |
| | **LG** Long Stroke series<br>Page G-11 | | | | |
| 0.0005mm | **LGK** series Page G-4<br>**LGF** series<br>Page G-5 | | **542-171**<br>**542-157**<br>  <br>Page G-45 and G-5 | **542-172**<br>  <br>Page G-5 | |
| 0.001mm | **LGK** series Page G-4<br>**LGF** series • 0.5µm high-resolution type<br>Page G-5 | | **542-156**<br>**542-161**<br>  <br>Page G-4 and G-5 | **542-162**<br>  <br>Page G-5 | |
| | **LGB** series (ø8mm Straight)<br>Page G-7 | **542-204**<br>Refer to page G-7 | **542-222** (Sine-wave output)<br>**542-222H** (High-precision)<br>**542-224** (Low measuring force) **542-230** (air drive)<br>Page G-7 | | |
| | Long Stroke series (Motor-drive type)<br>Refer to page G-11 | | | | |
| | **LGB** series (nut clamp)<br>Page G-8 | **542-244**<br>Refer to page G-8 | **542-262**<br>**542-262H** (High accuracy)<br>**542-264** (Low measuring force)<br>**542-270** (Air drive)<br>Page G-8 | | |
| 0.005mm | **LGF** series<br>Page G-5 | | | **542-612**<br>  <br>Page G-5 | |
| 0.0005mm | **LGF** series<br>Series with reference point mark<br>Page G-6 | | **542-174**<br>  <br>Page G-6 | **542-175**<br>  <br>Page G-6 | |
| 0.001mm | **LGF** series<br>Series with reference point mark<br>Page G-6 | | **542-164**<br>  <br>Page G-6 | **542-165**<br>  <br>Page G-6 | |
| 0.01mm | **LGD** series<br>Page G-12 | | **575-326**<br>  <br>Page G-12 | **575-327**<br>  <br>Page G-12 | |
| | **LGS** series<br>Page G-14 | | **575-303**<br>  <br>Page G-14 | | |

| Gage Heads | | | Display unit | | |
|---|---|---|---|---|---|
| Measuring range | | | | | |
| | 50mm / 2" | 100mm / 4" | Point measurement | Calculation measurement (addition and subtraction) | Multi-point measurement |
| | | | **EH Counter** **542-074A**  Page G-19 | | |
| | | | **EG Counter** **542-015**  Page G-21 | | |
| | | **542-312** **542-316**  Page G-10 | | | |
| | **542-173**  Page G-5 | | **EB Counter** (LGH excluded) **542-092-2**  Page G-22 | **EH Counter** **542-071A**  Page G-19 | **EV Counter** (LGH excluded) **542-063**  Page G-23 and G-24 |
| | **542-163**  Page G-5 | | | | |
| | | | **EH Counter** **542-075A**  Page G-19 | | |
| | | **542-332** **542-336**  Page G-10 | | | |
| | | | **EG Counter** **542-015**  Page G-21 | | |
| | **542-613**  Page G-5 | | **EG Counter** **542-015**  Page G-21 | | |
| | **542-176**  Page G-6 | | **EG Counter** **542-017**  Page G-21 | **EH Counter** **542-073A**  Page G-19 | **EV Counter** **542-067**  Page G-23 and G-24 |
| | **542-166**  Page G-6 | | **EB Counter** **542-094-2**  Page G-22 | | |
| | **575-328**  Page G-12 | | **EC Counter** **542-007A**  Page G-20 | **EH Counter** **542-072A**  Page G-19 | **EV Counter** **542-064**  Page G-23 and G-24 |
| | | | **EG Counter** **542-016**  Page G-21 | | |
| | | | **EB Counter** **542-093-2**  Page G-22 | | |



Mitutoyo

# Linear Gage LGK – Slim, Robust

## Series 542 — Resolutions: 0.1µm, 0.5µm, 1µm

- Ideal for integration into harsh environments such as automation applications.
- Compact model offers the vibration/shock resistance of the proven LGF series at 1/5 the size compared to LGF-110L-B. Cross-sectional area is approx. 1/5 compared to LGF-110L-B.
- Resolution of each model can be selected from 0.1µm, 0.5µm, or 1µm.
- Excellent sliding durability improved to remain serviceable for at least 15 million cycles (in-house testing).
- Excellent shock resistance, 100g/11ms (IEC 60068-2-27).

**542-158**

IP66



**542-157**

IP66



**542 -156**

IP66



## SPECIFICATIONS

| Order No. | | 542-158 | 542-157 | 542-156 |
|---|---|---|---|---|
| Measuring range | | 10mm (.4") | | |
| Resolution | | 0.1µm (.000005") | 0.5µm (.000020") | 1µm (.000050") |
| Measuring accuracy (20°C) | | (0.8+L/50) µm (L=mm) | (1.5+L/50) µm (L=mm) | |
| Quantizing error | | ±1 count | | |
| Measuring force | Contact point upward | 0.7N or less | | |
| | Contact point horizontal | 0.75N or less | | |
| | Contact point downward | 0.8N or less | | |
| Position detection method | | Photoelectric linear encode | | |
| Response speed*1 | | 400mm/s | 1500mm/s | |
| Output signal | | 90° phase difference, differential square wave (RS-422A equivalent), minimum edge intervals: 200ns for 0.1µm model, 200ns for 0.5µm model, 400ns for 1µm model | | |
| Output signal pitch | | 0.4µm | 2µm | 4µm |
| Mass | | Approx. 175g | | |
| Dust/water resistance*2 | | Equivalent to IP66 (only gage head) | | |
| Contact point | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)×5), standard contact point **No.901312** | | |
| Stem dia. | | ø8mm | | |
| Bearing type | | Linear ball bearing | | |
| Output cable length | | 2m (directly from casing) | | |
| Connector | | Plug: RM12BPE-6PH (HIROSE), Compatible receptacle: RM12BRD-6S (HIROSE) | | |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) | | |
| Storage temperature (humidity) range | | –10 to 60°C (RH 20 to 80%, no condensation) | | |
| Standard Accessories | | Wrench for contact point: **No.538610** | | |
| Remarks | | Gold banded | Blue banded | Green banded |

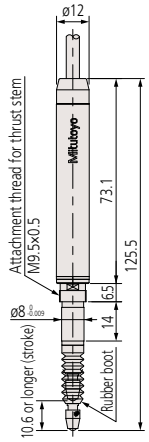
*1: When the spindle speed exceeds 1500mm/s (400mm/s for 0.1µm model), an alarm signal will be output. Also, if using Mitutoyo counter, an error message will be displayed. If using counters made by other companies, please inquire separately for the alarm signals. For the models of 0.1µm resolution, note that over-speed error may occur depending on the impact amount when releasing the contact point freely.

*2: IP Code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the kind of liquid.

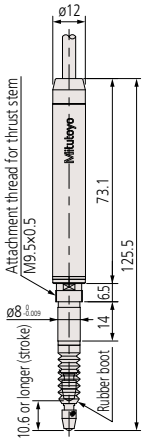
## DIMENSIONS

Unit: mm

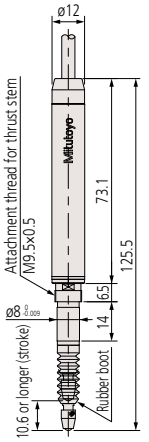
**542-158**



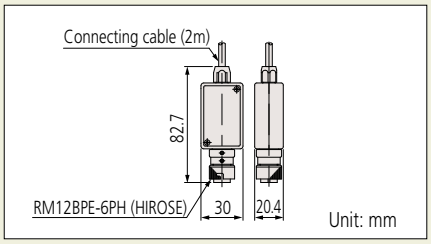

**542-157**




**542-156**




### Connector




### Optional Accessories

- Air lifter 10: **No.02ADE230**

* Required air pressure: 0.2 to 0.4MPa
* Spindle extends when air is supplied.



- Rubber boot: **No.238772** (spare)
  Thrust stem set: ***No.02ADB680**
  Thrust stem: **No.02ADB681**
  Clamp nut: **No.02ADB682**
  Spanner wrench: **No.02ADB683**

* A thrust stem set is a combination of thrust stem and a clamp nut. A special spanner is required for tightening. If using multiple gages, a thrust stem set for each gage and one special spanner are required.

Extension cable (5m): **902434**
Extension cable (10m): **902433**
Extension cable (20m): **902432**

### Applicable Counters

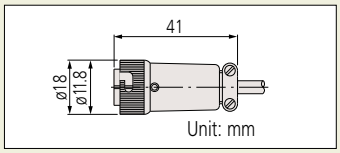
**542-075A** EH-101P
**542-071A** EH-102P
**64PKA131** EG-101P
**64PKA134** EB-11P
**64PKA137** EV-16P (not compatible with 542-158)

# Linear Gage LGF – Standard Dimensions, Robust

## Series 542 — Resolutions: 0.5µm, 1µm, 5µm

- Excellent vibration/shock resistance due to the design of the spindle guide section.
- Sliding durability improved to remain serviceable for at least 15 million cycles (in-house testing).
- Shock resistance, 100g/11ms (IEC 60068-2-27)
- LGF-Z series, which is equipped with reference point mark on the linear encoder (refer to page G-7), and 0.1µm resolution type (refer to page G-16) are also available.

### Connector




### Optional Accessories

- Air drive unit
  For 10mm range models: **No.02ADE230**
  For 25mm range models: **No.02ADE250**
  For 50mm range models: **No.02ADE270**

* Required air pressure: 0.2 to 0.4MPa
* Spindle extends when air is supplied.



- Rubber boot (spare)
  For 10mm range models: **No.238772**
  For 25mm range models: **No.962504**
  For 50mm range models: **No.962505**
- Thrust stem set
  For 10mm range models: **No.02ADB680**
  Thrust stem: **No.02ADB681**
  Clamp nut: **No.02ADB682**
  For 25/50mm range models: **No.02ADN370**
  Thrust stem: **No.02ADN371**
  Clamp nut: **No.02ADB692**

* External dimensions are described in the dimensional drawing of the product.
* A thrust stem set is a combination of thrust stem and a clamp nut. A special spanner is required for tightening. If using multiple gages, a thrust stem set for each gage and one special spanner are required.

- Spanner wrench
  For 10mm range models: **No.02ADB683**
  For 25/50mm range models: **No.02ADB693**

Extension cable (5m): **902434**
Extension cable (10m): **902433**
Extension cable (20m): **902432**

### Applicable Counters

**542-075A** EH-101P
**542-071A** EH-102P
**64PKA131** EG-101P
**64PKA134** EB-11P
**64PKA137** EV-16P (not compatible with 542-158)

**542-171, -161**



**542-172, -162**



**542-173, -163**



**542-612, -613**



## SPECIFICATIONS

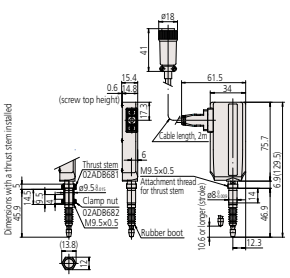
| Order No. | | 542-171 | 542-161 | 542-172 | 542-162 | 542-612 | 542-173 | 542-163 | 542-613 |
|---|---|---|---|---|---|---|---|---|---|
| Measuring range | | 10mm (.4") | | 25mm (1") | | | 50mm (2") | | |
| Resolution | | 0.5µm (.000020") | 1µm (.000050") | 0.5µm (.000020") | 1µm (.000050") | 5µm (.0002") | 0.5µm (.000020") | 1µm (.000050") | 5µm (.0002") |
| Measuring accuracy (20°C) L=arbitrary measuring length (mm) | | (1.5+L/50) µm | | | | (7.5+L/50) µm | (1.5+L/50) µm | | (7.5+L/50) µm |
| Quantizing error | | ±1 count | | | | | | | |
| Measuring force | Contact point upward | 1.0N or less | | 4.0N or less | | | 4.9N or less | | |
| | Contact point horizontal | 1.1N or less | | 4.3N or less | | | 5.3N or less | | |
| | Contact point downward | 1.2N or less | | 4.6N or less | | | 5.7N or less | | |
| Position detection method | | Photoelectric linear encoder | | | | | | | |
| Response speed*1 | | 1500mm/s | | | | | | | |
| Output | | 90° phase difference, differential square wave (**RS-422A** equivalent), minimum edge intervals: 1000ns for 5µm model, 500ns for 1µm model, 250ns for 0.5µm model | | | | | | | |
| Output square wave pitch | | 2µm | 4µm | 2µm | 4µm | 20µm | 2µm | 4µm | 20µm |
| Mass | | Approx. 260g | | Approx. 300g | | | Approx. 400g | | |
| Dust/water resistance | | Equivalent to IP66 (only gage head) | | | | | | | |
| Contact point | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)x5), standard contact point **No.901312** | | | | | | | |
| Stem dia. | | ø8mm | | ø15mm | | | | | |
| Bearing type | | Linear ball bearing | | | | | | | |
| Output cable length | | 2m (directly from casing) | | | | | | | |
| Connector | | Plug: RM12BPE-6PH (HIROSE), Compatible receptacle: RM12BRD-6S (HIROSE) | | | | | | | |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) | | | | | | | |
| Storage temperature (humidity) range | | –10 to 60°C (RH 20 to 80%, no condensation) | | | | | | | |
| Standard accessories | | Wrench for contact point: **No.538610** | | Wrench for contact point: **No.04GAA857** | | | | | |

*1: When the spindle speed exceeds 1500mm/s, an alarm signal will be output. Also, if using a Mitutoyo counter, an error message will be displayed. If using counters made by other companies, please inquire separately for the alarm signals. For the models using 50mm stroke gage, note over-speed speed error may occur depending on the impact amount when releasing the contact point freely.
*2: IP Code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the kind of liquid.

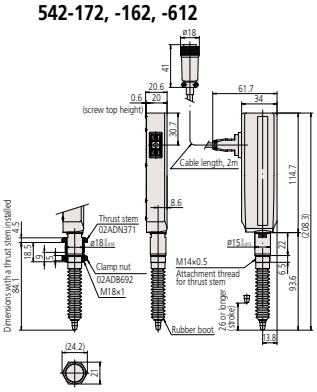
## DIMENSIONS

Unit: mm

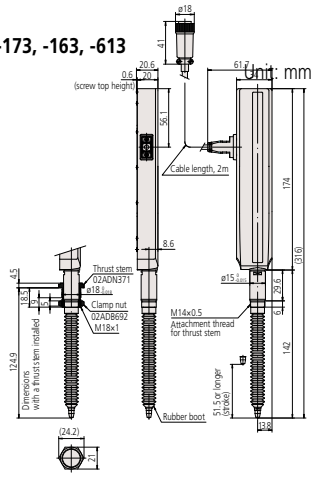
**542-171, -161**



**542-172, -162, -612**



**542-173, -163, -613**



# Linear Gage LGF-Z – with Reference Point, Standard Dimensions, Robust

## Series 542 — Resolutions: 0.5µm, 1µm

- LGF series with reference point signal output function.
  The master setting to use it, incorporated in the unit, is easy to operate. The origin point can be easily detected even when a fault, such as over-speed error, etc. occurs.
- Sliding durability improved to remain serviceable for at least 15 million cycles (in-house testing).
- Shock resistance, 100g/11ms (IEC 60068-2-27).
- Resolutions are available in 0.5µm or 1µm.

**542-174, -164**



**542-175, -165**



**542-176, -166**



## SPECIFICATIONS

| Order No. | | 542-174 | 542-164 | 542-175 | 542-165 | 542-176 | 542-166 |
|---|---|---|---|---|---|---|---|
| Measuring range | | 10mm (.4") | | 25mm (1") | | 50mm (2") | |
| Resolution | | 0.5µm (.000020") | 1µm (.000050") | 0.5µm (.000020") | 1µm (.000050") | 0.5µm (.000020") | 1µm (.000050") |
| Measuring accuracy (20°C) | | (1.5+L/50)µm (L= measuring length (mm)) | | | | | |
| Quantizing error | | ±1 count | | | | | |
| Measuring force | Contact point upward | 1.0N or less | | 4.0N or less | | 4.9N or less | |
| | Contact point horizontal | 1.1N or less | | 4.3N or less | | 5.3N or less | |
| | Contact point downward | 1.2N or less | | 4.6N or less | | 5.7N or less | |
| Position detection method | | Photoelectric linear encoder | | | | | |
| Reference mark position | | 3mm from contact point tip (lowest rest point) | | 5mm from contact point tip (lowest rest point) | | | |
| Reference mark repeatability (20°C): σ | | σ≤0.5µm (at a constant reference point passing speed less than 300mm/s in the same direction) | | | | | |
| Response speed*1 | | 1500mm/s | | | | | |
| Output signal | | 90° phase difference, differential square wave (RS-422A equivalent), minimum edge intervals: 250ns for 0.5µm model, 500ns for 1µm model | | | | | |
| Output square wave pitch | | 2µm | 4µm | 2µm | 4µm | 2µm | 4µm |
| Mass | | Approx. 260g | | Approx. 300g | | Approx. 400g | |
| Dust/water resistance*2 | | Equivalent to IP66 (only gage head) | | | | | |
| Contact point | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)×5), standard contact point **No.901312** | | | | | |
| Stem dia. | | ø8mm | | ø15mm | | | |
| Bearing type | | Linear ball bearing | | | | | |
| Output cable length | | 2m (directly extended from the main unit) | | | | | |
| Connector | | Plug: PRC05-P8M (TAJIMI), Compatible receptacle: PRC05-R8F (TAJIMI) | | | | | |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) | | | | | |
| Storage temperature (humidity) range | | –10 to 60°C (RH 20 to 80%, no condensation) | | | | | |
| Standard accessories | | Wrench for contact point: **No.538610** | | Wrench for contact point: **No.04GAA857** | | | |
| Remarks | | w/ origin point mark | | | | | |

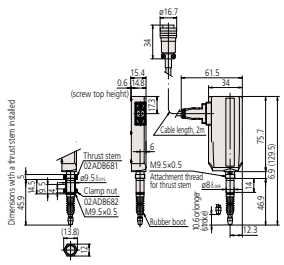
*1: When the spindle speed exceeds 1500mm/s, an alarm will signal. For use of alarm signals, please inquire separately. For models with 50mm stroke, note that over-speed error may occur depending on the impact amount when releasing the contact point freely.

*2: IP code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the kind of liquid.

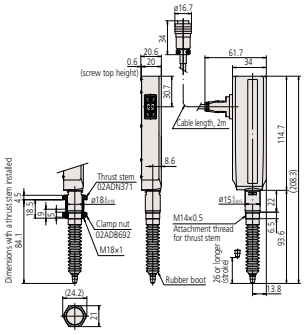
## DIMENSIONS

Unit: mm

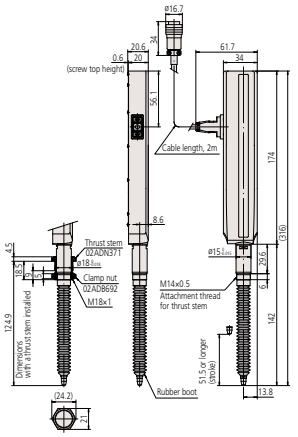
**542-174, -164**



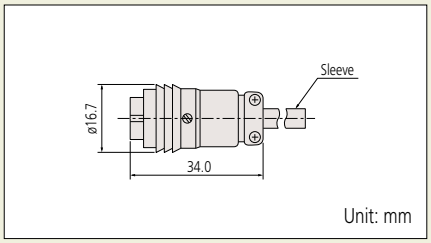
**542-175, -165**



**542-176, -166**



## Connector




Unit: mm

## Optional Accessories

- Air drive unit
  For 10mm range models: **No.02ADE230**
  For 25mm range models: **No.02ADE250**
  For 50mm range models: **No.02ADE270**

* Required air pressure: 0.2 to 0.4MPa
* Spindle extends when air is supplied.



- Rubber boot (spare)
  For 10mm range models: **No.238772**
  For 25mm range models: **No.962504**
  For 50mm range models: **No.962505**
- Thrust stem set
  For 10mm range models: **No.02ADB680**
  Thrust stem: **No.02ADB681**
  Clamp nut: **No.02ADB682**
  For 25/50mm range models: **No.02ADN370**
  Thrust stem: **No.02ADN371**
  Clamp nut: **No.02ADB692**

* External dimensions are described in the dimensional drawing of the product.
* Thrust stem set is a combination of thrust stem and a clamp nut. A special spanner is required for tightening. If using multiple gages, a thrust stem set for each gage and one special spanner are required.

- Spanner wrench
  For 10mm range models: **No.02ADB683**
  For 25/50mm range models: **No.02ADB693**

Extension cable (5m): **02ADF260**
Extension cable (10m): **02ADF280**
Extension cable (20m): **02ADF300**

## Applicable Counters

**542-073A** EH-102Z
**64PKA133** EG-101Z
**64PKA136** EB-11Z
**64PKA139** EV-16Z

# Linear Gage LGB - Slim

## Series 542 — Resolution: 1µm

- Compact form (ø8mm straight stem) is an optimal choice as a built-in type sensor.
- The spindle guide uses high-precision linear ball bearings for extremely smooth movement and exceptional durability.
- Nut clamp type is also available (LGB2: refer to page G-9).

**542-204**



**542-222, 542-222H, 542-224**



**542-230**



### Optional Accessories

- Rubber boot (spare)
  For 5mm range models: **No.238773**
  For 10mm range models: **No.238772**
- Extension cable (5m): **902434**
- Extension cable (10m): **902433**
- Extension cable (20m): **902432**

### Applicable Counters

| | |
|---|---|
| **542-075A** | EH-101P |
| **542-071A** | EH-102P |
| **64PKA131** | EG-101P |
| **64PKA134** | EB-11P |
| **64PKA137** | EV-16P |
| **542-074A** | EH-1025 (for sine wave gages only) |




Refer to No. (E13007) for more details.

## SPECIFICATIONS

| Type | | L-shaped | Straight | | Low measuring force | Air-driven contact point *1 |
|---|---|---|---|---|---|---|
| Order No. | | **542-204** | **542-222** | **542-222H** | **542-224** | **542-230***2 |
| Measuring range | | 5mm (.2") | 10mm (.4") | | | |
| Resolution | | 1µm (.000050") | | | | |
| Measuring accuracy (20°C) | | 2µm | | 1µm | 2µm | |
| Quantizing error | | ±1 count | | | | |
| Measuring force*4 | Contact point upward | Approx. 0.55N or less | Approx. 0.7N or less | | Approx. 0.5N or less | Approx. 0.7N or less |
| | Contact point horizontal | Approx. 0.6N or less | Approx. 0.75N or less | | Approx. 0.55N or less | Approx. 0.45N or less |
| | Contact point downward | Approx. 0.65N or less | Approx. 0.8N or less | | Approx. 0.6N or less | Approx. 0.8N or less |
| Protection level | | Equivalent to IP54 (only gage head) | | | | |
| Mass | | 145g | 150g | | | 165g |

*1: Required air pressure: 0.3 to 0.4MPa
*2: Spindle extends when air is supplied.
*3: Spindle retracts when air is supplied.
*4: Depends on the settings of the connected counter. Potential resolution down to 1µm.

### Slim-head low-measuring force series (made to order)

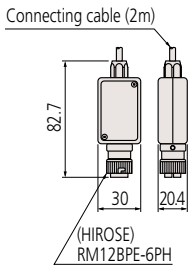
- Low measuring force, suitable for measurement of soft material workpieces.

| Model | | LGB-105L-1 | LGB-110A-1/LGB-110AR-1*2 |
|---|---|---|---|
| Measuring range | | 5mm | 10mm |
| Resolution | | 1µm | 1µm |
| Measuring force*1 | Contact point upward | Approx. 0.4N or less | Approx. 0.5N or less |
| | Contact point horizontal | Approx. 0.45N or less | Approx. 0.55N or less |
| | Contact point downward | Approx. 0.5N or less | Approx. 0.6N or less |

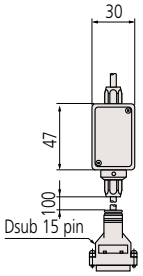
*1: Measuring force at the retraction of the spindle
*2: The "R" suffix indicates air retracted spindle

The LGB-□□□-1 is la low measuring force model. Depending on the operating method, the spindle forward speed may become slow compared to the standard model. Please check if this restriction is compatible with the application. Please contact Mitutoyo to verify the application.

### Connector




Unit: mm




Unit: mm

External dimensions: refer to page G-9.



Mitutoyo

# Linear Gage LGB2 – Slim, w/Clamp Nut

## Series 542 — Resolution: 1µm

- Slim design, nut clamp type (Stem dia. is ø9.5mm)
- The spindle guide uses high precision linear ball bearings for extremely smooth movement and exceptional durability.

**542-244**



**542-262/542-262H**
**542-264**



**542-270**



## SPECIFICATIONS

| Type | | L-shaped | Straight | | Low measuring force | Air-driven contact point*1 |
|---|---|---|---|---|---|---|
| Order No. | | **542-244** | **542-262** | **542-262H** | **542-264** | **542-270***2 |
| Measuring range | | 5mm (.2") | 10mm (.4") | | | |
| Resolution | | 1µm (.000050") | | | | |
| Measuring accuracy (20°C) | | 2µm | 1µm | | | 2µm |
| Maximum response speed | | 900mm/s | | | | |
| Measuring force | Contact point upward | Approx. 0.55N or less | Approx. 0.7N or less | | Approx. 0.5N or less | Approx. 0.7N or less |
| | Contact point horizontal | Approx. 0.6N or less | Approx. 0.75N or less | | Approx. 0.55N or less | Approx. 0.75N or less |
| | Contact point downward | Approx. 0.65N or less | Approx. 0.8N or less | | Approx. 0.6N or less | Approx. 0.8N or less |
| Protection level*4 | | IP54 | | | | |
| Mass | | 160g | 170g | | | 170g |

*1: Required air pressure: 0.3 to 0.4MPa
*2: Spindle extends when air is supplied.
*3: Depends on the settings of the connected counter. Potential resolution down to 1µm.
*4: IP code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the type of liquid.

### Slim head low measuring force series (made to order)

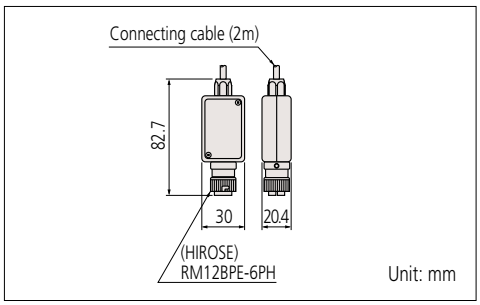
- Low measuring force, suitable for measurement of soft-material workpieces.

| Model | | LGB2-105L-1 | LGB2-110AR-1 |
|---|---|---|---|
| Measuring range | | 5µm | 10µm |
| Resolution | | 1µm | 1µm |
| Measuring force* | Contact point upwards | Approx. 0.4N or less | Approx. 0.5N or less |
| | Contact point horizontal/ Contact point upwards | Approx. 0.45N or less | Approx. 0.55N or less |
| | Contact point downwards | Approx. 0.5N or less | Approx. 0.6N or less |

* Measuring force at the retraction of the spindle

The LGB2-□□□-1 is a low measuring force model. Depending on the operating method, the spindle forward speed may become slow compared to the standard model. Please check if this restriction is compatible with the application. Please contact Mitutoyo to verify the application

### Connector




External dimensions: refer to page G-9.

### Optional Accessories

- Rubber boot (spare)
  For 5mm range models: **No.238773**
  For 10mm range models: **No.238772**
- Extension cable (5m): **902434**
- Extension cable (10m): **902433**
- Extension cable (20m): **902432**

### Applicable Counters

**542-075A** EH-101P
**542-071A** EH-102P
**64PKA131** EG-101P
**64PKA134** EB-11P
**64PKA137** EV-16P
**542-074A** EH-1025 (for sine wave gages only)

# Linear Gage LGB2 – Slim

## Series 542 — Resolution: 1µm

### Applicable Counters

**542-075A** EH-101P
**542-071A** EH-102P
**64PKA131** EG-101P
**64PKA134** EB-11P
**64PKA137** EV-16P
**542-074A** EH-1025 (for sine wave gages only)

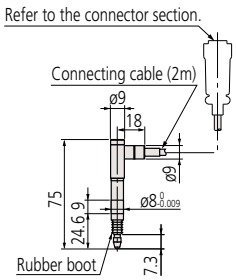



Refer to No. (E13007) for more details.

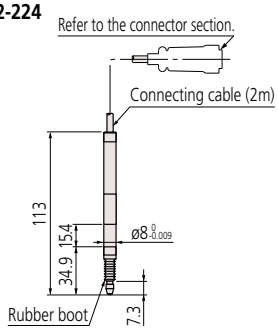
### DIMENSIONS

Unit: mm

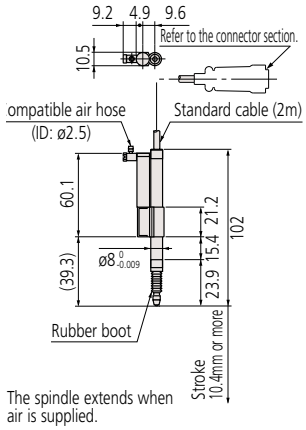
**542-204**




**542-222/No.542-222H**
**542-224**

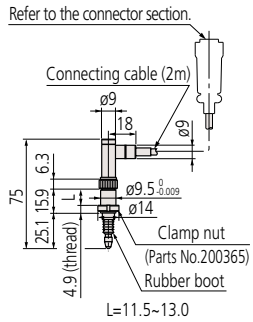



**542-230**

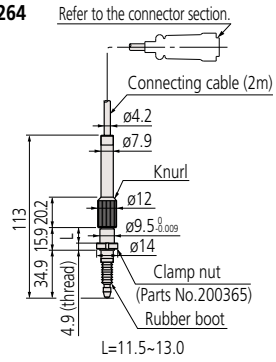



The spindle extends when air is supplied.

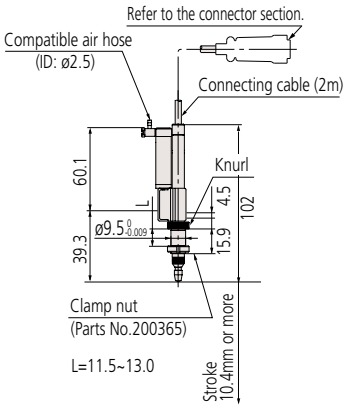
**542-244**




**542-262/542-262H**
**542-264**




**542-270**




The spindle extends when air is supplied.



Mitutoyo

# Linear Gage LG – Long Range

## Series 542 — Resolutions: 0.1µm, 1µm

- A series to cover maximum measuring range, 100mm.
- Three versions are available; standard model, low measuring force model, and rubber boot type (made to order).
- The resolution of each model can be selected from 0.1µm and 1µm.



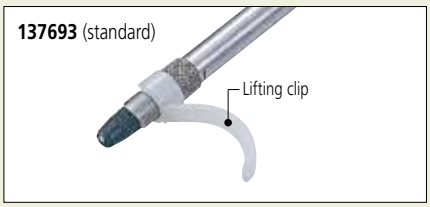

542-312

## SPECIFICATIONS

| Type | | Standard spar type | Low measuring force | Rubber boot type | Standard spar type | Low measuring force | Rubber boot type |
|---|---|---|---|---|---|---|---|
| Order No. | | **542-312** | **542-316** | **542-314** | **542-332** | **542-336** | **542-334** |
| Measuring range | | 100mm (4") | | | | | |
| Resolution | | 0.1µm (.000005") | | | 1µm (.000050") | | |
| Measuring accuracy (20°C) | | (2+L/100)µm≤2.5µm L= measuring length (mm) | | | (2.5+L/100) µm ≤ 3µm L= measuring length (mm) | | |
| Quantizing error | | ±1 count | | | | | |
| Measuring force | Contact point downward | Approx. 8.0N or less | Approx. 3.0N or less | Approx. 8.0N or less | Approx. 8.0N or less | Approx. 3.0N or less | Approx. 8.0N or less |
| | Contact point horizontal | Approx. 6.5N or less | — | Approx. 6.5N or less | Approx. 6.5N or less | — | Approx. 6.5N or less |
| | Contact point upward | Approx. 5.0N or less | — | Approx. 5.0N or less | Approx. 5.0N or less | — | Approx. 5.0N or less |
| Position detection method | | Photoelectric linear encoder | | | | | |
| Response speed*1 (max. electrical response speed) | | Approx. 400mm/s | | | Approx. 800mm/s | | |
| Output signal | | 90° phase difference, differential squarewave (RS-422A equivalent) | | | | | |
| Spindle drive | | Helical extension spring | | | | | |
| Spindle guide | | Bearing guide | | | | | |
| Stem diameter | | ø20mm | | | | | |
| Contact point | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)×5)<br>Standard contact point No.901312 | | | | | |
| Shock resistance | | 60g (in-house testing) | | | | | |
| Cable length | | Approx. 2m (directly extended from the gage unit) | | | | | |
| Spindle sealing method | | Scraper type | | Rubber boot type | Scraper type | | Rubber boot type |
| Dust/water resistance*2 | | Equivalent to IP54 | | Equivalent to IP66 | Equivalent to IP54 | | Equivalent to IP66 |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) | | | | | |
| Storage temperature (humidity) range | | –10 to 60°C (RH 20 to 80%, no condensation) | | | | | |
| Input/output connector | | For calculation: RM12BPE-6PH (HIROSE)<br>Compatible receptacle: RM12BRD-6S (HIROSE) | | | | | |
| Mass (including cables) | | Approx. 750g | | Approx. 780g | Approx. 750g | | Approx. 780g |
| Standard accessories | | Wrench for contact point: **No.04GAA857**<br>Hexagon socket head cap screw, M4×0.7×35, 2 pcs. (for gage fixing)<br>Round flat washer, nominal 4, 2 pcs. (for gage fixing)<br>Lifting clip: **No.137693**<br>Fixing holder: **02ADG181** (for fixing lifting lever) | | | | | |
| Remarks | | Standard | Low measuring force | w/ rubber boot | Standard | Low measuring force | w/ rubber boot |

*1: Note that over-speed error may occur depending on the indentation amount when releasing the contact point freely after indentation.
*2: IP code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the kind of liquid. (Only gage head)

### Lifting clip attachment




### Optional Accessories

- Rubber boot: **02ADA004** (for rubber boot type)

Extension cable (5m): **902434**
Extension cable (10m): **902433**
Extension cable (20m): **902432**

### Applicable Counters

For **542-312, 542-316, 542-314**

| | |
|---|---|
| **542-075A** | EH-101P |
| **542-071A** | EH-102P |
| **64PKA131** | EG-101P |
| **64PKA134*** | EB-11P |

For **542-332, 542-336, 542-334**

| | |
|---|---|
| **542-075A** | EH-101P |
| **542-071A** | EH-102P |
| **64PKA131** | EG-101P |
| **64PKA134*** | EB-11P |
| **64PKA137*** | EV-16P |

* Not for use with 0.1µm resolution gages.

# Linear Gage LG – Long Range

## Series 542 — Resolutions: 0.1µm, 1µm

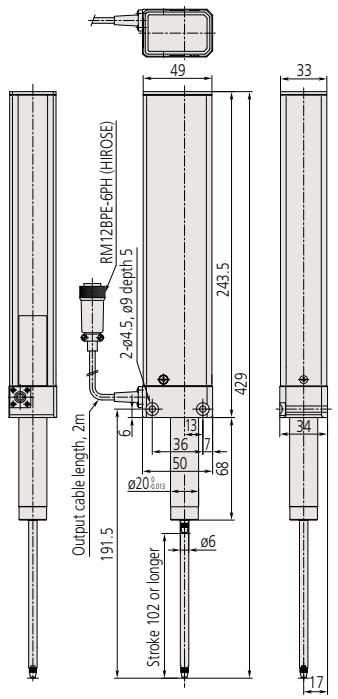



Refer to No. (E13007) for more details.

## DIMENSIONS

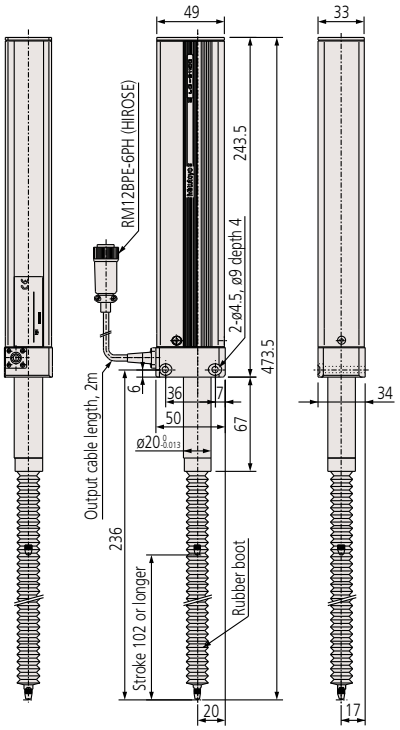
**542-312, -316, -332, -336**

Unit: mm




**542-314, -334**

Unit: mm






Mitutoyo

# Linear Gage LGD – Absolute, Standard Dimensions, Robust

## Series 575 — Resolution: 10µm

- Absolute position detection makes it possible to maintain the reference point even when the power is switched off.
- Excellent protection against dust and splashing water (IP66) on the factory floor.
- Ultra-compact design enables installation in very tight spaces.
- The spindle guide uses high-precision linear ball bearings for extremely smooth movement and exceptional durability.
- Sliding durability improved to remain serviceable for at least 15 million cycles (in-house testing).
- Shock resistance, 100g/11ms (IEC 60068-2-27)

**575-326** IP66



**575-327** IP66



**575-328** IP66



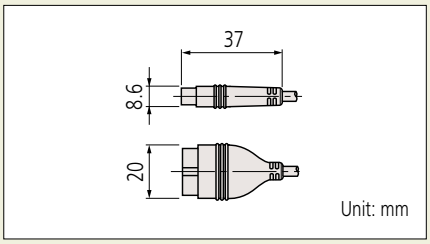
## SPECIFICATIONS

| Order No.*1 | | 575-326 | 575-327 | 575-328 |
|---|---|---|---|---|
| Measuring range | | .4" / 10mm | 1" / 25mm | 2" / 50mm |
| Resolution | | .0005" / 10µm | | |
| Measuring accuracy (20°C) | | .001" / 20µm | | 30µm |
| Quantizing error | | ±1 count | | |
| Measuring force | Contact point upward | 1.0N or less | 4.0N or less | 4.9N or less |
| | Contact point horizontal | 1.1N or less | 4.3N or less | 5.3N or less |
| | Contact point downward | 1.2N or less | 4.6N or less | 5.7N or less |
| Position detection method | | ABSOLUTE electrostatic capacitance-type linear encoder | | |
| Response speed | | Unlimited (not applicable to scanning measurement) | | |
| Output | | Digimatic output | | |
| External input | | Reference-setting signal (Absolute reference position*2) can be changed externally. | | |
| Mass*3 | | Approx. 260g | Approx. 300g | Approx. 400g |
| Contact point | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)×5), standard contact point No.901312 | | |
| Stem dia. | | ø8 | ø15 | |
| Bearing type | | Linear ball bearing | | |
| Dust/water resistance*4 | | Equivalent to IP66 (only gage head) | | |
| Output cable length (directly extended from the main unit) | | 2m, 3m, 5m, 7m | | |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) | | |
| Storage temperature(humidity) range | | –10 to 60°C (RH 20 to 80%, no condensation) | | |
| Standard Accessories | | Wrench for contact point: **No.538610** | Wrench for contact point: **No.04GAA857** | |

*1: The last number of the Code No. represents special cable length. (meters)
*2: The absolute reference point is near the lowest rest point at shipment.
*3: Mass including 2m cable.
*4: IP code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the type of liquid.

ABSOLUTE™

### Connector




### Optional Accessories

- Air drive unit
  For 10mm range models: **No.02ADE230**
  For 25mm range models: **No.02ADE250**
  For 50mm range models: **No.02ADE270**
  * Required air pressure: 0.2 to 0.4MPa
  * Spindle extends when air is supplied.
- Rubber boot (spare)
  For 10mm range models: **No.238772**
  For 25mm range models: **No.962504**
  For 50mm range models: **No.962505**
- Thrust stem set
  For 10mm range models: **No.02ADB680**
  Thrust stem: **No.02ADB681**
  Clamp nut: **No.02ADB682**
  For 25/50mm range models: **No.02ADN370**
  Thrust stem: **No.02ADN371**
  Clamp nut: **No.02ADB692**
  * External dimensions are described in the dimensional drawing of the product.
  * Thrust stem set is a combination of thrust stem and a clamp nut. A special spanner is required for tightening. If using multiple gages, a thrust stem set for each gage and one special spanner are required.
- Spanner wrench
  For 10mm range models: **No.02ADB683**
  For 25/50mm range models: **No.02ADB693**

SPC cable extension adapter: **02ADF640**
Extension cable (0.5m): **02ADD950**
Extension cable (1m): **936937**
Extension cable (2m): **965014**
*when connecting an extension cable, an SPC cable extension adapter is required (02ADF640)
Power supply and origin setter **21EZA345A**

**Digimatic cable extension adapter 02ADF640**



### Applicable Counters

| | |
|---|---|
| **542-007A** | EC-101D Counter, 120V |
| **64PKA132** | EG-101D |
| **64PKA135** | EB-11D |
| **542-072A** | EH-102D |
| **542-064** | EV-16D COUNTER |

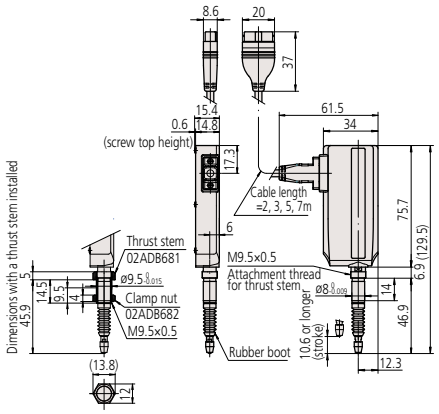
# Linear Gage LGD – Absolute, Standard Dimensions, Robust

## Series 575 — Resolution: 10µm

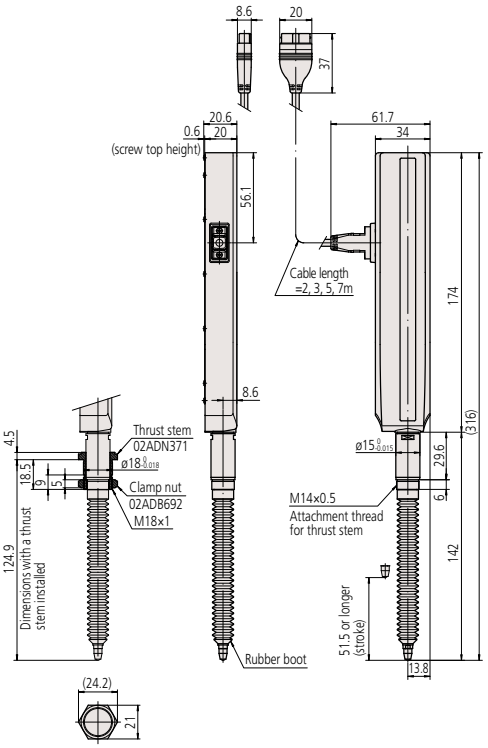
## DIMENSIONS

Unit: mm

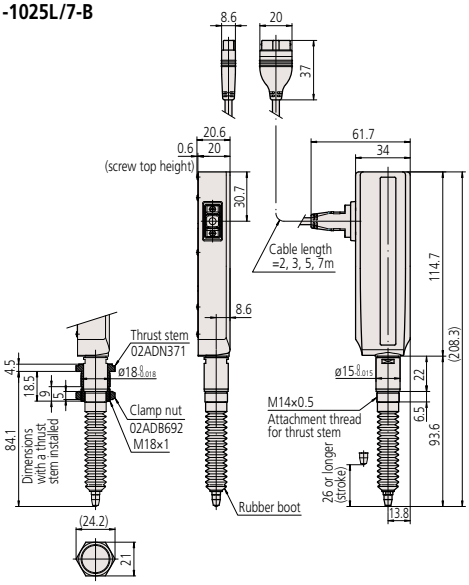
**575-326**




**575-328**




**575-327**
**LGD®-1025L-B, -1025L/3-B, -1025L/5-B, -1025L/7-B**




### Applicable Counters

| | |
|---|---|
| **542-007A** | EC-101D Counter, 120V |
| **64PKA132** | EG-101D |
| **64PKA135** | EB-11D |
| **542-072A** | EH-102D |
| **64PKA138** | EV-16D COUNTER |

**3D models available on request.**



Mitutoyo

# Linear Gage LGS – Absolute

## Series 575 — Resolution: 10µm




- ABSOLUTE electrostatic capacitance-type encoder makes it possible to maintain the reference point even when the power is switched off.
- Excellent protection against dust and splashing water (IP66) on the factory floor.

ABSOLUTE™

## SPECIFICATIONS

**Metric**

| Order No. | | **575-303** |
|---|---|---|
| Measuring range | | 12.7mm |
| Resolution | | 10µm |
| Measuring accuracy (20°C) | | 15µm |
| Quantizing error | | ±1 count |
| Measuring force | Contact point upward | 1.6N or less |
| | Contact point horizontal | 1.8N or less |
| | Contact point downward | 2N or less |
| Position detection method | | ABSOLUTE electrostatic capacitance-type linear encoder |
| Response speed | | Unlimited (not applicable to scanning measurement) |
| Output | | Digimatic output |
| Mass | | Approx. 190g |
| Contact point | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)×5)<br>Standard contact point **No.901312** |
| Stem dia. | | ø8mm |
| Bearing type | | Slide bearing |
| Dust/water resistance | | Equivalent to IP66 (only gage head) |
| Output cable length | | 2m (directly extended from the main unit) |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) |
| Storage temperature (humidity) range | | –10 to 60°C (RH 20 to 80%, no condensation) |

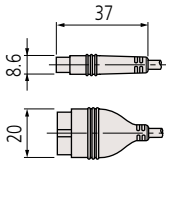
* IP code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the type of liquid.

**Inch**

| Order No. | | **575-313** |
|---|---|---|
| Measuring range | | .5" |
| Resolution | | .0005" |
| Measuring accuracy (20°C) | | .0008" |
| Quantizing error | | ±1 count |
| Measuring force | Contact point upward | 1.6N or less |
| | Contact point horizontal | 1.8N or less |
| | Contact point downward | 2N or less |
| Position detection method | | ABSOLUTE electrostatic capacitance-type linear encoder |
| Response speed | | Unlimited (not applicable to scanning measurement) |
| Output | | Digimatic output |
| Mass | | Approx. 190g |
| Contact point | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)×5)<br>Standard contact point **No.901312** |
| Stem dia. | | ø9.52=3/8" |
| Bearing type | | Slide bearing |
| Dust/water resistance | | Equivalent to IP66 (only gage head) |
| Output cable length | | 2m (directly extended from the main unit) |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) |
| Storage temperature (humidity) range | | –10 to 60°C (RH 20 to 80%, no condensation) |

* IP code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the type of liquid.

## Connector




Unit: mm

## Optional Accessories

- Rubber boot: **No.238774** (spare)
- Air drive unit (metric): **No.903594**
- Air drive unit (inch): **No.903598**
- SPC cable extension adapter: **No.02ADF640**
- Extension cable (0.5m): **No.02ADD950**
- Extension cable (1m): **No.936937**
- Extension cable (2m): **No.965014**
- Power supply and origin setter **21EZA345A**

* When connecting an extension cable, an SPC cable extension adapter is required. **(0ZADF640)**

**Digimatic cable extension adapter 02ADF640**

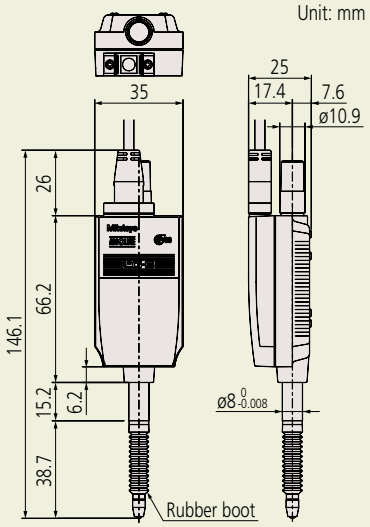


## Applicable Counters

| | |
|---|---|
| **542-007A** | EC-101D Counter, 120V |
| **64PKA132** | EG-101D |
| **64PKA135** | EB-11D |
| **542-072A** | EH-102D |
| **64PKA138** | EV-16D COUNTER |

## DIMENSIONS

Unit: mm



# Linear Gage LGF – High Resolution, Standard Dimensions, Robust

## Series 542 — Resolution: 0.1 µm

- 0.1µm resolution type of reliable LGF series gage.
- Excellent protection against dust and splashing water (IP66) on the factory floor.

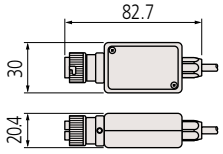
**542-181**



**542-182**



### Connector




RM12BPE-6PH (HIROSE)

Unit: mm

### Optional Accessories

- Rubber boot (spare)
  For 10mm range models: **No.238772**
  For 25mm range models: **No.962504**
  For 50mm range models: **No.962505**
- Thrust stem set
  For 10mm range models: **No.02ADB680**
  Thrust stem: **No.02ADB681**
  Clamp nut: **No.02ADB682**
  For 25mm range models: **No.02ADN370**
  Thrust stem: **No.02ADN371**
  Clamp nut: **No.02ADB692**

* External dimensions are described in the dimensional drawing of the product.

* Thrust stem set is a combination of thrust stem and a clamp nut. A special spanner is required for tightening. If using multiple gages, a thrust stem set for each gage and one special spanner are required.

- Wrench
  For 10mm range models: **No.02ADB683**
  For 25mm range models: **No.02ADB693**
- Extension cable (5m): **902434**
- Extension cable (10m): **902433**
- Extension cable (20m): **902432**
- Air drive unit
  For 10mm range models: **No.02ADE230**
  For 25mm range models: **No.02ADE250**
  For 50mm range models: **No.02ADE270**

* Required air pressure: 0.2 to 0.4MPa

* Spindle extends when air is supplied.

### Applicable Counters

**542-075A** EH-101P
**542-071A** EH-102P

## SPECIFICATIONS

| Order No. | | 542-181 | 542-182 |
|---|---|---|---|
| Measuring range | | 10mm (.4") | 25mm (1") |
| Resolution | | 0.1µm (.000005") | |
| Measuring accuracy (20°C) | | (0.8+L/50) µm (L=arbitrary measuring length (mm)) | |
| Quantizing error | | ±1 count | |
| Measuring force | Contact point upward | 1.0N or less | 4.0N or less |
| | Contact point horizontal | 1.1N or less | 4.3N or less |
| | Contact point downward | 1.2N or less | 4.6N or less |
| Position detection method | | Photoelectric linear encoder | |
| Response speed*1 | | 400mm/s | |
| Output signal | | 90° phase difference, differential squarewave (RS-422A equivalent)<br>Minimum edge-to-edge interval, 200ns | |
| Output signal pitch | | 0.4µm | |
| Mass | | Approx. 310g | Approx. 350g |
| Dust/water resistance*2 | | Equivalent to IP66 (only gage head) | |
| Stylus | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)×5), standard contact point **No.901312** | |
| Stem dia. | | ø8 | ø15 |
| Bearing type | | Linear ball bearing | |
| Output cable length | | 2m (directly extended from the main unit) | |
| Connector | | Plug: RM12BPE-6PH (HIROSE), Compatible receptacle: RM12BRD-6S (HIROSE) | |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) | |
| Storage temperature (humidity) range | | –10 to 60°C (RH 20 to 80%, no condensation) | |
| Standard accessories | | Wrench for contact point: **No.538610** | Wrench for contact point: **No.04GAA857** |

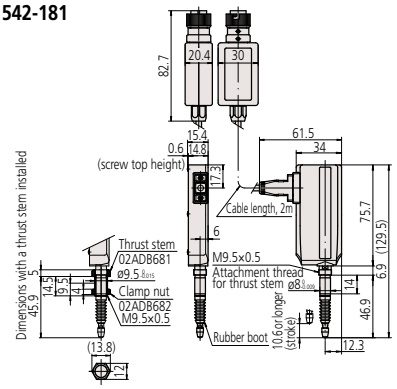
*1: When the spindle speed exceeds 400mm/s, an alarm will signal. Also, if using a Mitutoyo counter, an error message will be displayed. If using counters made by other companies, please consult your local Mitutoyo office. Note that over-speed error may occur depending on the impact amount when releasing the contact point freely.

*2: IP code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the type of liquid.

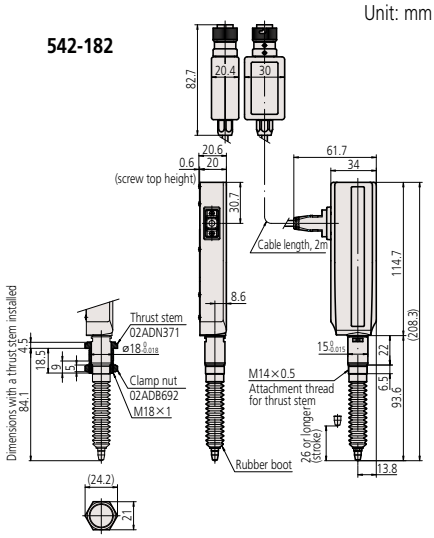
## DIMENSIONS

Unit: mm

**542-181**




**542-182**






Mitutoyo

# Linear Gage LGB2 – High Resolution, Slim, with Clamp Nut

## Series 542 (0.1µm resolution)

- Slim type high-precision linear gage with resolution of 0.1µm. It is an optimal choice as a built-in type sensor.
- High-precision linear ball bearings are used in the spindle guide for extremely smooth movement and exceptional durability.

**542-246**

IP54



### Optional Accessories

- Rubber boot: **No.238773** (spare)
- Extension cable (5m): **902434**
- Extension cable (10m): **902433**
- Extension cable (20m): **902432**

### Applicable Counters

| | |
|---|---|
| **542-075A** | EH-101P |
| **542-071A** | EH-102P |

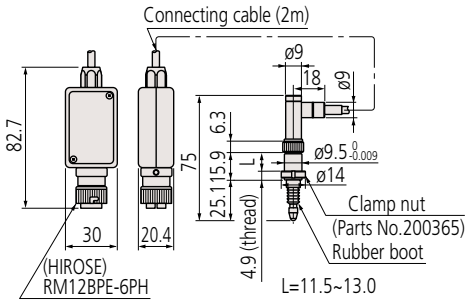
## SPECIFICATIONS

| Order No. | | **542-246** | |
|---|---|---|---|
| Measuring range | | 5mm (.2") | |
| Resolution | | 0.1µm (.000005") | |
| Measuring accuracy (20°C) | | 0.8µm | |
| Measuring force | Contact point upward | Approx. 0.55 or less | |
| | Contact point horizontal | Approx. 0.6N or less | |
| | Contact point downward | Approx. 0.65 or less | |
| Output signal | | 90° phase difference, differential square wave (RS-422A equivalent) | |
| Position detection method | | Photoelectric linear encoder | |
| Response speed | | 380mm/s | |
| Mass | | 160g | |
| Dust/water resistance* | | Equivalent to IP54 (only gage head) | |
| Contact point | | Carbide ball (M2.5x0.45) | Steel ball (4-48UNF) |
| Stem dia. | | ø9.5mm | |
| Bearing type | | Linear ball bearing | |
| Output cable length | | 2m | |
| Connector | | Plug: RM12BPE-6PH (HIROSE), Compatible receptacle: RM12BRD-6S (HIROSE) | |
| Operating temperature (humidity) range | | 10 to 30°C (RH 20 to 80%, no condensation) | |
| Standard accessories | | Wrench for contact point: **No.538610** | Wrench for contact point: **No.538610**, Stem bushing |

*1: IP code is a standard which classifies and rates the degree of protection provided against the intrusion of solid objects and water. This may not be applicable depending on the type of liquid.

## DIMENSIONS

Unit: mm



# Linear Gage LGH – High Resolution, High Accuracy

## SERIES 542 (0.01µm resolution)

- A gage head featuring a very accurate, ultra-high-resolution photoelectric linear encoder that approaches laser interferometer performance over its measuring range of 10mm. This head is suitable for measuring high-precision components and inclusion in high-accuracy positioning applications.
- Relatively long range, very high accuracy and extreme resolution enable the head to act as a master gage for measuring-instrument calibration in many instances.
- The compact design contributes to reducing measuring system costs and permits downsizing entire system configurations.
- Linear encoder is highly resistant to being affected by unfavorable environmental conditions, such as drafts and rapid atmospheric pressure, temperature and humidity changes.
- A low measuring force model is available (**542-716A**). As low as 0.12N can be selected, which enables measurement of easily-deformed workpieces or thickness of delicate films.
- Responsivity has been improved by 2.8 times (250mm/s => 700mm/s) compared to the previous model.
- Every **LGH** series gage is bundled with a dedicated counter.



**Gage Head**

**542-715A**



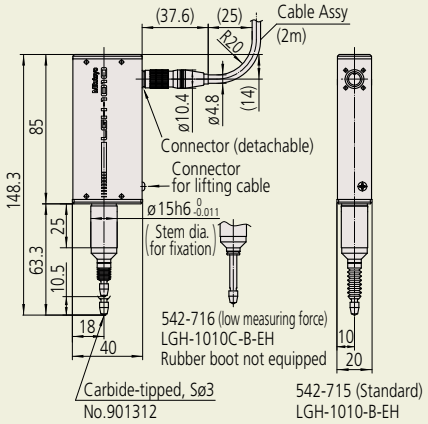
**Dedicated Counter**

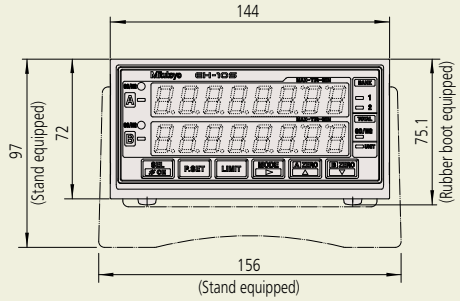
### Optional Accessories

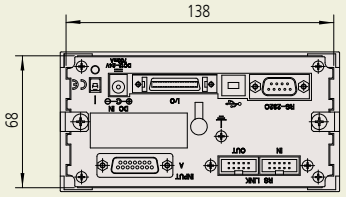
- LGH stand: **971750**
- Stem fixture for fixing to top surface: **971751**
- Stem fixture for fixing to bottom surface: **971752**
- Spindle lifting cable: **971753**
- Rubber boot: **238772** (spare for **542-715**)
- I/O output connector (with cover): **02ADB440**

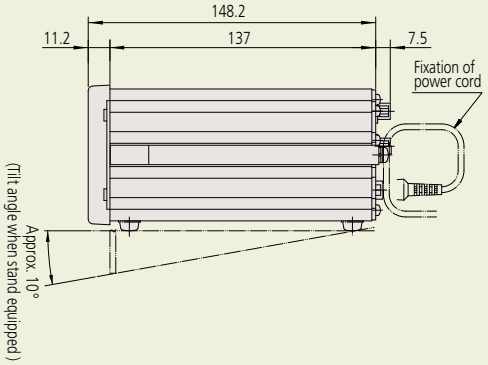
## DIMENSIONS

Unit: mm




## SPECIFICATIONS

| Linear gage | | Standard | Low measuring force |
|---|---|---|---|
| Order No. | | **542-715A** | **542-716A** |
| Measuring range | | 10mm | |
| Resolution | | 0.01µm (0.05µm, 0.1µm, 0.5µm, 1µm can be selected from the counter) | |
| Measuring accuracy (20°C)* | | 0.2µm | |
| Repeatability (20°C)* | | 0.1µm (2$\sigma$) | |
| Retrace error (20°C)* | | 0.1µm | |
| Measuring force | Contact point downwards | 0.65N or less | Approx. 0.12N |
| | Contact point horizontal | 0.55N or less | Not applicable |
| | Contact point upwards | 0.45N or less | Not applicable |
| Position detection method | | Photoelectric reflection type linear encoder | |
| Detectable operation speed | | In normal measurement: 700mm/sec; for peak detection: 120mm/sec | |
| Mass of gage head | | 220g (excluding cable of approx. 150g) | |
| Contact point | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)×5) | |
| Stem | | ø15mm | |
| Bearing | | Linear ball type | |
| Output cable length | | Approx. 2m | |
| Operating temperature/humidity | | 0 to 40°C/RH 20 to 80% (no condensation) | |
| Storage temperature | | -10 to 60°C/RH 20 to 80% (no condensation) | |
| **Counter** | | | |
| Quantizing error | | ±1 count | |
| Display range | | ±999.99999mm | |
| Functions | | Presetting, tolerance judgment, peak measurement, analog output | |
| Interface | | RS-232C/Digimatic/USB (only for SENSORPAK) | |
| Power supply | | Supplied AC Adapter, or +12 to 24 V DC, max. 700mA | |
| Current Consumption | | 8.4W (MAX 700mA)<br>(Ensure at least 1A power supply per unit.) | |
| External dimensions | | 144(W)×157(D)×75(H) | |
| Mass | | Approx. 900g (AC Adapter excluded) | |
| Standard accessories | | Wrench for contact point, rubber boot, stand, washer (for counter), AC Adapter, AC cord, DC plug, user's manual, inspection certificate | |

*Indication accuracy applies when used with counters.

# Laser Hologage LGH – High Resolution, High Accuracy

## Series 542 — Resolution: 0.005µm

- The Mitutoyo Laser Hologage is a high-end digital gaging system that employs laser beam interference to make highly accurate and repeatable measurements.
- The compact gage head reduces the cost required for assembling the laser scale unit for each device. The head can also contribute to downsizing the entire system. The master gage is the best tool available for measuring tools or for a length measurement sensor of the control unit, as well as for measuring high-precision components.



LGH-110

EH-102S

- High resolution and high accuracy.
  Highly accurate measurement due to an ultra-high resolution of 0.000005mm (0.005µm), which is close to the performance of laser interferometers.
- Excellent measuring stability.
  The design is also highly resistant to unfavorable environmental conditions such as air movement and atmospheric pressure changes.
- Low measuring force models are also available.
  Low measuring force models are available for easily deformed precision workpieces.
- High reliability and excellent durability.
  High-precision linear ball bearings are used in the spindle guide for extremely smooth movement and exceptional durability.
- 0.005µm resolution LGH is for use with counter EH-102S.

## SPECIFICATIONS

| Code No. | | 542-720A | 542-721A |
|---|---|---|---|
| Configuration | | Set of 1-axis gage head and display unit | Set of 1-axis gage head and display unit |
| Measuring range | | 10mm | |
| Resolution | | 0.005µm (.5 microinch) | |
| Measuring accuracy (20°C) | | 0.1µm*1 | |
| Repeatability (2σ) | | 0.02µm | |
| Retrace error | | 0.05µm | |
| Measuring force | Contact point upward | Approx. 0.65N or less | Approx. 0.12N |
| | Contact point horizontal | Approx. 0.55N or less | — |
| | Contact point downward | Approx. 0.45N or less | — |
| Stylus | | ø3mm carbide-tipped (fixing screw: M2.5 (P=0.45)×5), standard contact point No.120058 | |
| Output cable length | | 2m | |
| Display range | | ± 99.999995mm | |
| Minimum reading | | 0.01µm | |
| Operating temperature (humidity) range | | 15 to 25°C (RH 30-60%, no condensation) | |
| Storage temperature (humidity) range | | –10 to 60°C (RH 20 to 80%, (no condensation)<br>The temperature and humidity range for storage after unpacking is the same as that for operation. | |
| Standard accessories | | Wrench for contact point: **No. 538610**<br>AC adapter: **No. 357651**<br>AC cable (USA): **No.02ZAA010*** | |
| Mass (gage head + display unit) | | 1400g | |

*1: Indication accuracy applies when used with counters.

### Laser Beam Safety Precautions

This system uses a low-power invisible laser beam (780nm) which corresponds to a CLASS 1 (invisible radiation) of IEC60825-1 for measurement. The CLASS 1 laser warning label as shown below is attached to the main unit.

CLASS 1 LASER PRODUCT




Refer to Bulletin No. (2263) for more details.

PROPRIETARY INSPECTION CERTIFICATE

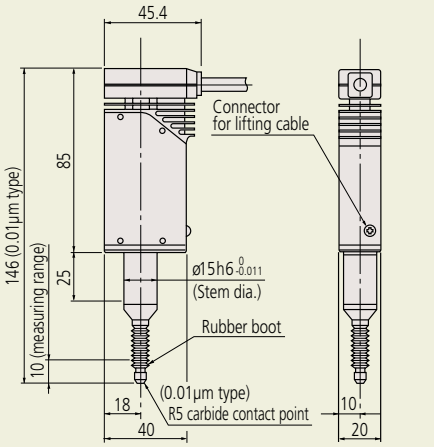
Mitutoyo guarantees the product specifications. Mitutoyo guarantees the product specifications.

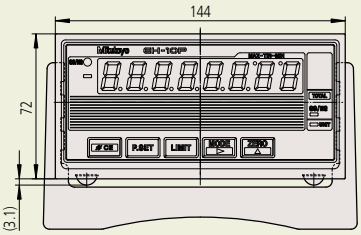
## Optional Accessories

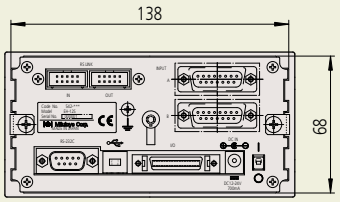
- Laser hologage stand: **No.971750**
- Stem fixture for fixing to top surface: **No.971751**
- Stem fixture for fixing to bottom surface: **No.971752**
- Spindle lifting cable: **No.971753**
- Rubber boot: **No.238772** (spare)

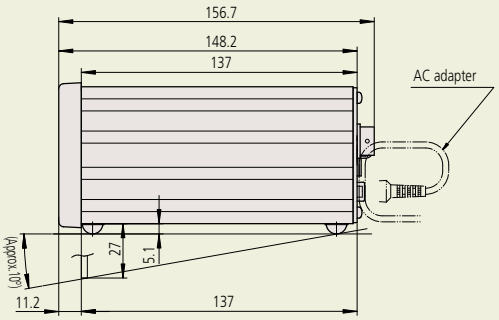
## DIMENSIONS

Unit: mm



# EH Counter – Multi-function Type

## Series 542 — Versatile, Multi-function Displays for all Linear Gage Formats

### Optional Accessories

- I/O output connector (with cover): **No.02ADB440**

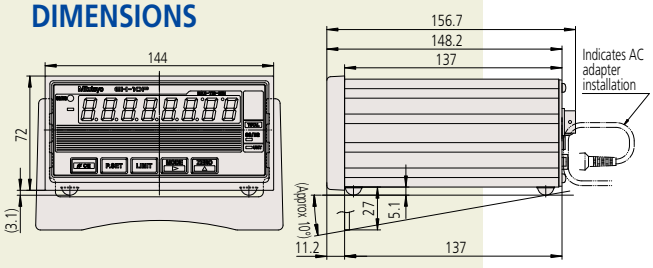
- Two types are available for this model: a 1-axis display and a 2-axis display, which enables addition or subtraction calculations between two gages.
- Multifunctional counter equipped with zero-setting, presetting and tolerance judgment.
- RS-232C and USB are equipped as standard. Data transfer to a PC is possible. (*USB is supported only by Mitutoyo SENSORPAK.)
- A multi-point (max. 12 points) measuring system can easily be configured with the built-in RS link networking function. Refer to "Quick Guide to Precision Measuring Instruments" on page G-32 for details of the RS link.
- Employs DIN size (144x72mm) and mount-on-panel configuration to facilitate system integration.
- Peak mode feature: Max, Min, and TIR (can be toggled)

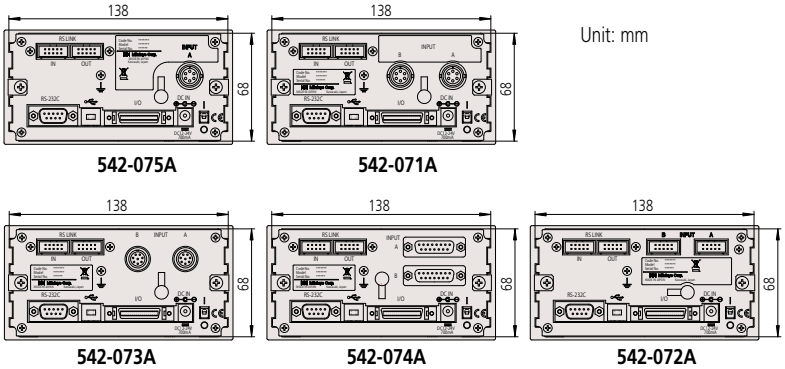


## SPECIFICATIONS

| Order No. | | 542-075A | 542-071A | 542-073A | 542-074A | 542-072A |
|---|---|---|---|---|---|---|
| Applicable gage head | | **LGE**, **LGF**, **LGK**, **LGB**, **LGM**, **LG**, **LGH** (not compatible with LGH-110, reference point, or sine wave models) | | **LGF** with reference point mark | **LGB** sine wave output / Linear scale sine wave output | **LGD**, **LGS**, **ID**, **SD** |
| Number of gage inputs | | 1 | 2 | | | |
| Number of axes to be displayed | | 1 axis | 2 axes | | | |
| Quantizing error | | ±1 count | | | | |
| Maximum input frequency | | 2.5MHz (2-phase square wave) | | | 1MHz (2-phase sine wave) | — |
| Resolution | | 0.01mm (±9999.99mm) / .0005" (±99.9995")<br>0.001mm (±999.999mm) / .00005" (±9.99995")<br>0.0001mm (±99.9999mm) / .000005" (±.999995") [Parameter set] | | | | Automatic setting by gage |
| | | — | | | 0.01 / 0.001µm | |
| Display | | Sign plus 8 digits (Green LED) | | | | |
| Tolerance judgment display | | LED display (3 steps: Amber, Green, Red/ 5 steps: Amber, Amber flashing, Green, Red flashing, Red) | | | | |
| Interface | | RS-232C/USB/parameter selection via digimatic (only DP-1VR, digimatic mini-processor can be connected)<br>(USB used only with SENSORPAK.)<br>Selection by parameter from 3-step, 5-step, or digit BCD<br>Total tolerance judgment output (when tolerance function is enabled)<br>Analog output (1V-4V) | | | | |
| Input/output | Control output | Normal operation signal (NOM): open collector | | | | |
| | Control input | Display BANK switching, peak mode, presetting, display hold, hold per axis:<br>open-collector or no-voltage contact signal (with/without contact point) | | | | |
| Rating | Power supply voltage | Supplied AC adapter, or 12 - 24V DC | | | | |
| | Power consumption | 8.4W (max. 700mA)<br>Ensure at least 1A is available per unit. | | | | |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) | | | | |
| Storage temperature (humidity) range | | –10 to 50°C (RH 20 to 80%, no condensation) | | | | |
| External dimensions | | 144 (W) ×72 (H) ×156.7 (D) mm | | | | |
| AC adapter / AC cable (standard accessory) | | AC adapter: **No. 357651** /<br>AC cable (USA): **No.02ZAA010***, | | | | |
| Applicable input | | Differential square-wave | | | Differential sine-wave | Digimatic code output |
| Mass | | Approx. 760g | Approx. 800g | Approx. 800g | Approx. 900g | Approx. 800g |

## DIMENSIONS




Unit: mm

# EC Counter – Single-function Type

## Series 542 — Simple Display for LGD, LGS, or other Digimatic Gages, Go/NG Judgment and Output

- Produces 3-step/5-step, 3 types of tolerance output and BCD output.
- Employs DIN size (96×48mm) and mount-on-panel configuration to facilitate system integration.




**542-007A**




### Function

- Preset
- Tolerance judgment (3/5-step, 3 types)
- Zero

### Optional Accessories

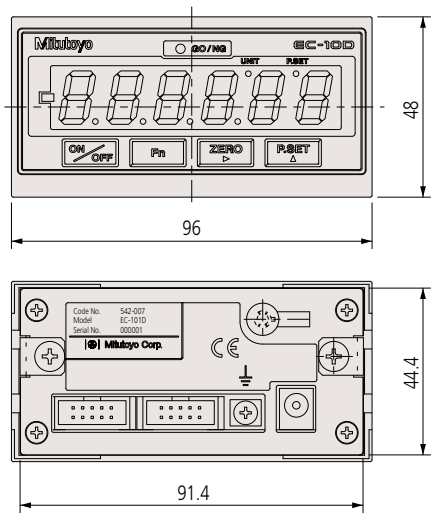
- Connecting cable for digimatic mini-processor: **No.936937** (1m), **No.965014** (2m)
- DC plug PJ-2: **No.214938**
- I/O cable (2m): **No.C162-155**

## SPECIFICATIONS

| Order No. | | **542-007A** |
|---|---|---|
| Applicable head/input | | **LGD**, **LGS**, **ID**, **SD,** Digimatic code (SPC) |
| Number of gage inputs | | 1 |
| Resolution | | 0.01mm (±9999.99) / .0005" (±99.9995") / .001" (±999.999")<br>0.001mm (±9999.999) / .00005" (±9.99995") / .0001" (±99.999")<br>[automatic setting by gage] |
| Display | | Sign plus 6 digits (Green LED) |
| Tolerance judgment display | | LED display (3 steps: Amber, Green, Red) |
| External output (switching type) | Tolerance judgment output | Go/No-Go (open-collector) |
| | Data output | Digimatic output |
| Control input | | External PRESET, external HOLD |
| Rating | Power supply voltage | Supplied AC adapter, or 9 - 12V DC |
| | Power consumption | 4.8W (max. 400mA)<br>Ensure at least 1A is available per unit. |
| Operation/storage temperature range | | Operation: 0 - 40°C / Storage: –10 to 50°C |
| External dimensions | | 96 (W) x 48 (H) x 84.6 (D) mm |
| Standard accessories | | AC adapter: **No.06AEG302JA** |
| Mass | | 220g |

## DIMENSIONS

Unit: mm



# EG Counter – Single-function Type

## Series 542 — Simple Display, Multi-Step Go/No Go Judgment and Output, BCD Output, Open Collector

### Function

- Preset
- Direction switch
- Tolerance judgment (3/5-step, 3 kinds)
- Peak (max., min., runout) measurement
- Constant number
- Smoothing
- Error display/output
- Key protection

### Optional Accessories

- I/O output connector (with cover): **No. 357651**
- AC adapter: **No.357651 ***
- AC cable (USA): **02ZAA010***
- Terminal connecting cable: **No.02ADD930***

* Included in package Order No.

- Produces 3-step/5-step, 7 types of tolerance output and limit value output independently for each of 7 channels.
- Comes with serial BCD output capability, for connection to a programmable controller or personal computer, etc.
- Employs DIN size (96×48mm) and mount-on-panel configuration to facilitate system integration.



**542-015**



**542-017**



**542-016**

## SPECIFICATIONS

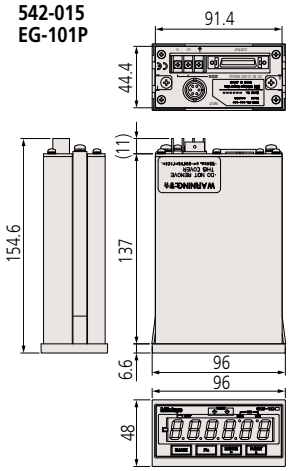
| Order No. (counter only) | | 542-015 | 542-017 | 542-016 |
|---|---|---|---|---|
| Package No. (counter w/AC adapter) | | 64PKA131A | 64PKA133A | 64PKA132A |
| Applicable gage head | | **LGE**, **LGF**, **LGK**, **LGB**, **LGM**, **LG**, **LGH** (Not compatible with LGH110, reference point or sine wave models) | **LGF** with reference point mark **(LGF-Z)** | **LGD**, **LGS**, **ID**, **SD** |
| Number of gage inputs | | 1 | | |
| Quantizing error | | ±1 count | | |
| Maximum input frequency | | 1.25MHz, response speed depends on gage specification. | | — |
| Resolution | | 0.01mm (±9999.99mm) / .0005" (±99.9995") / .001" (±999.999")<br>0.005mm (±9999.995mm) / .00005" (±9.99995") / .0001" (±99.999")<br>0.001mm (±999.999mm) / .00005" (±9.99995") / .0001"(±99.999")<br>0.0005mm (±99.9995mm) / .000005" (±.999995") / .00001" (±9.99999")<br>0.0001mm (±99.9999mm) / .000005" (±.999995") /.00001" (±9.99999")* | | 0.01mm (±9999.99mm) / .0005" (±99.9995") / .001" (±999.999")<br>0.001mm (±999.999mm) / .00005" (±9.99995") /.0001" (±99.999")<br>[Automatic setting by gage] |
| Display | | Sign plus 6 digits (Green LED) | | |
| Tolerance judgment display | | LED display (3 steps: Amber, Green, Red/ 5 steps: Amber, Amber flashing, Green, Red flashing, Red) | | |
| Tolerance judgment output | | L1 to L5 (Open-collector / Switchover between L1 to L5 and BCD output with parameter) | | |
| Control output | | Normal operation signal (NOM): open-collector | | |
| BCD output | | Open-collector / Switchover between 6-digit (positive/negative-true logic) and tolerance judgment output with parameter | | |
| Control input | | Presetting, display hold, peak value clear, tolerance judgment BANK switch | | |
| Rating | Power supply voltage | 12 - 24V DC | | |
| | Power consumption | 6W or less (500mA max.)<br>Ensure at least 1A is available per unit. | | |
| Operating temperature range | | 0 to 40°C (RH 20 to 80%, no condensation) | | |
| Storage temperature range | | –10 to 50°C (RH 20 to 80%, no condensation) | | |
| External dimensions | | 96 (W) × 48 (H) × 156 (D) mm | | |
| Applicable input | | Differential square-wave | Differential square-wave with origin point mark | Digimatic code (SPC) |
| Number of gage inputs | | 1 | | |
| Mass | | Approx. 400g | | |

* range is limited when using 0.0001 mm gages

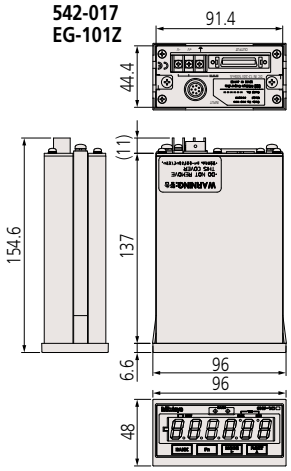
## DIMENSIONS

Unit: mm

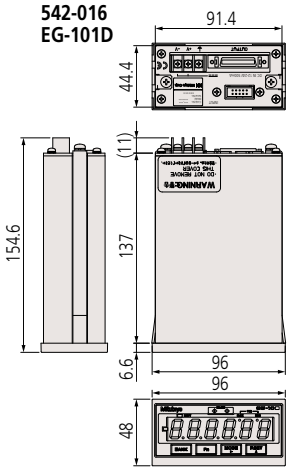
**542-015**
**EG-101P**




**542-017**
**EG-101Z**




**542-016**
**EG-101D**






Mitutoyo

# EB Counter – Single-function Type

## Series 542 — Simple Display, Multi-Step Go/No-Go Judgment, BCD Output and Analog Output

- Produces 3-step/5-step, 7 types of tolerance output and limit value output independently for each of 7 channels.
- Comes with serial BCD output capability, for connection to a programmable controller or personal computer, etc.
- Dynamic measurement possible with simplified analog output.
- Employs DIN size (96×48mm) and mount-on-panel configuration to facilitate system integration.



**542-092-2**



**542-094-2**



**542-093-2**

## SPECIFICATIONS

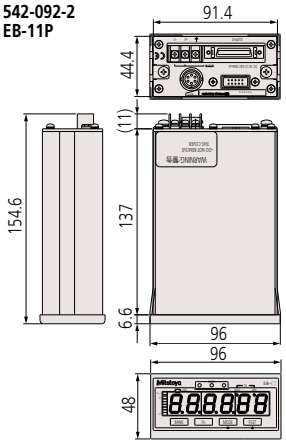
| Order No. (counter only) | | 542-092-2 | 542-094-2 | 542-093-2 |
|---|---|---|---|---|
| Package No. (counter w/AC Adapter) | | 64PKA134A | 64PKA136A | 64PKA135A |
| Applicable gage head | | **LGF**, **LGK**, **LGE**, **LGB** (not compatible with reference point or sine wave output type models) | **LGF** with reference point mark **(LGF-Z)** | **LGS**, **LGD**, **LGD-M** |
| Number of gage inputs | | 1 | | |
| Quantizing error | | ±1 count | | |
| Maximum input frequency | | 1.25MHz (2-phase square wave), response speed depends on gage specification. | | Response speed depends on gage specification. |
| Resolution | | 0.01mm (±9999.99mm) / .0005" (±99.9995")<br>0.005mm (±9999.995mm) / .00005" (±9.99995")<br>0.001mm (±999.999mm) / .00005" (±9.99995")<br>0.0005mm (±99.9995mm) / .000005" (±.999995")<br>0.0001mm (±99.9999mm) / .000005" (±.999995")* | | 0.01mm (±9999.99mm) / .0005" (±99.9995")<br>0.005mm (±9999.995mm) / .00005" (±9.99995")<br>0.001mm (±999.999mm) / .00005" (±9.99995")<br>0.0005mm (±99.9995mm) / .000005" (±.999995")<br>0.0001mm (±99.9999 mm) / .000005" (±.999995") |
| Display | | Sign plus 6 digits (Green LED) | | |
| Tolerance judgment display | | LED display (3 steps: Amber, Green, Red / 5 steps: Amber, Amber flashing, Green, Red flashing, Red) | | |
| Input/output | Tolerance judgment output | L1 to L5, open-collector | | |
| | Control output | Normal operation signal (NOM), open-collector | | |
| | Control input | Presetting, display hold, peak value clear, tolerance judgment BANK switch, open-collector or no-voltage contact signal (with/without contact point) | | |
| Interface | Serial BCD | Bit serial format, open-collector | | |
| | Analog output | 2.5V+Counting value× Voltage resolution (25mV/2.5mV): Full-scale 0 to 5V | | |
| | Digimatic input/output | • Connecting to the external switch box (**No.02ADF180**) makes it easy to enter tolerance limits and preset values. Note: This function is not available when the gage is connected to **DP-1VR**, Digimatic Mini-Processor.<br>• Can be connected to Digimatic peripherals that have Data (poll) button<br>• Number of tolerance steps can be expanded by assembling **EB-D** counters. | | |
| Rating | Power supply voltage | 12 - 24V DC | | |
| | Power consumption | 6W or less (50mA max.)<br>Ensure at least 1A is available per unit. | | |
| Operating temperature range | | 0 to 40°C (RH 20 to 80%, no condensation)/ –10 to 50°C (RH 20 to 80%, no condensation) | | |
| External dimensions | | 96(W)×48(H)×156(D)mm | | |
| Applicable input | | Differential square-wave | Differential square-wave with origin point mark | Digimatic code (SPC) |
| Mass | | Approx. 400g | Approx. 400g | Approx. 400g |

* range is limited when using 0.0001 mm gages

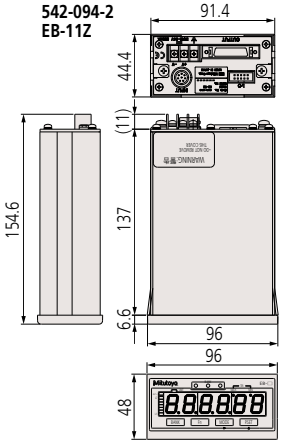
## DIMENSIONS

Unit: mm

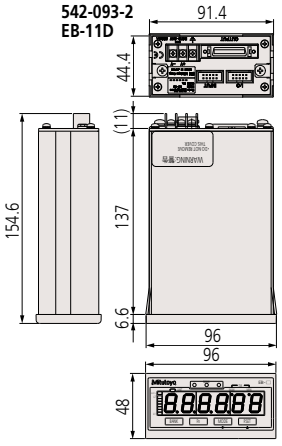
**542-092-2**
**EB-11P**




**542-094-2**
**EB-11Z**




**542-093-2**
**EB-11D**




## Function

- Preset
- Tolerance judgment output (3/5-step, 7 types)
- Limit value output (2 types independently for each of the 7 channels)
- Peak (max., min., runout) measurement
- Diverse data output

(Serial BCD, Simplified analog, Digimatic)

## Optional Accessories

- I/O output connector (with cover): **No.02ADB440**
- AC adapter: **No.357651** *
- AC cable (USA): **02ZAA010***
- Terminal connecting cable: **No.02ADD930***

* Included in package Order No.
The tolerance values or preset values can be easily input.
**No.02ADF180** (with 2m cable)



# EV Counter – Multi-function, Multiple Input Type

## Series 542 — Processor (Optional Display), Multi-function/output

- Up to six gages can be connected to one unit, extendable up to 10 units (60 gages at maximum) using the RS Link function* to facilitate the configuration of a multi-point measurement system.

* Refer to "Quick Guide to Precision Measuring Instruments" on page G-32 for details of the RS link.

- A range of output modes to choose from: I/O output for tolerance judgment and segment output, BCD data output and RS-232C output are available.
- Other than normal measurement, peak measurement or differential measurement between gages are available.



**542-063**



**542-067**



**542-064**

### Function

- External Control (Zero-set, Preset etc.)
- Direction switch
- Error display
- Tolerance judgment output
- Diverse data output (RS-232C, BCD, Segment)
- Peak measurement

Maximum value, minimum value, runout, and differential measurement between two gages
Addition, averaging, maximum value, minimum value, and maximum width

### Optional Accessories

- D-EV External display unit: **No.02ADD400**
- SPC cable (0.5m): **No.02ADD950**
- SPC cable (1m): **No.936937**
- SPC cable (2m): **No.965014**
- AC adapter: **No.357651** *
- AC cable (USA): **02ZAA010***
- Terminal connecting cable: **No.02ADD930***

* Included in package Order No.

## SPECIFICATIONS

| Order No. | | 542-063 | 542-067 | 542-064 |
|---|---|---|---|---|
| Pkg No.(counter w/AC adapter) | | 64PKA137A | 64PKA139A | 64PKA138A |
| Applicable gage head | | **LGE**, **LGF**, **LGK**, **LGB**, **LGM**, **LG** not compatible with reference point mark, sine wave output type or 0.1µm resolution models. | **LGF** with reference point mark **(LGF-Z)** | **LGD**, **LGS** |
| Number of input channels | | 6 | | |
| Maximum input frequency | | 1.25MHz (2-phase square wave), response speed depends on gage specification. Max. counting speed: 5MHz | 1.25MHz (2-phase square wave), response speed depends on gage specification. Max. counting speed: 5MHz | Response speed depends on gage specification. |
| Quantizing error | | ±1 count | | |
| Resolution | | 10µm (±999999.99mm) / .0005" (±9999.9995") 5µm (±999999.995mm) / .00005" (±999.99995") 0.5µm (±9999.9995mm) / .000005" (±.99.999995")*1 [Parameter set] | 10µm (±999999.99mm) / .0005" (±9999.9995") 5µm (±999999.995mm) / .00005" (±999.99995") 1µm (±99999.999mm) / .00005" (±999.99995") 0.5µm (±9999.9995mm) / .000005" (±.99.999995") [Parameter set] | Depends on gage specification. |
| LED display | | 8 digits for parameter display (displays settings), 1 for error display | | |
| Error message | | Overspeed, gage error etc. | | |
| External display | | Dedicated external display unit D-EV (optional) can be connected. | | |
| Number of input switches | | 4 | | |
| Function of input switches | | Measurement mode switching, parameter setting | | |
| Input/ output | Tolerance judgment output | 1 to 6 channels (L1, L2, L3), open-collector | | |
| | BCD output | Parallel BCD output (positive/negative-true logic), open-collector | | |
| | Segment output | Function to set on only the terminals corresponding to the counting values, open-collector | | |
| | Control output | Normal operation signal (NOM), open-collector | | |
| | Control input | Output channel designation (segment, in the BCD mode), presetting, peak value clear, range changeover (at segment output), holding counting value open-collector or no-voltage contact signal (with/without contact point) | | |
| Interface | RS-232C | Measurement data output and control input EIA RS-232C-compatible Use cross cables for home position, DTE (terminal definition). | | |
| | RS link | Max. connecting unit: 10 (6 when using EF counter) Connecting cable length: Max. 10m (sum of link cable length) Data transfer time: 1sec./60ch (when transmission rate is 19200bps) | | |
| Rating | Power supply voltage | 12 - 24V DC, terminal block (M3 screw) | | |
| | Power consumption | 8.4W or less (700mA max.) Ensure at least 1A is available per unit. | | |
| Operating temperature (humidity) range | | 0 to 40°C (RH 20 to 80%, no condensation) | | |
| Storage temperature (humidity) range | | –10 to 50°C (RH 20 to 80%, no condensation) | | |
| External dimensions | | 144 (W) x 72 (H) x139 (D) mm | | |
| Mass | | Approx. 910g | Approx. 910g | Approx. 830g |
| Standard accessories | | Fixing foot (4), connecting bracket (4), fixing screw M4×12 (8) | | |
| Applicable input | | Differential square-wave | | Digimatic code (SPC) |

*1: Available when using D-EV.
*2: D-EV is required when selecting 0.1µm resolution.



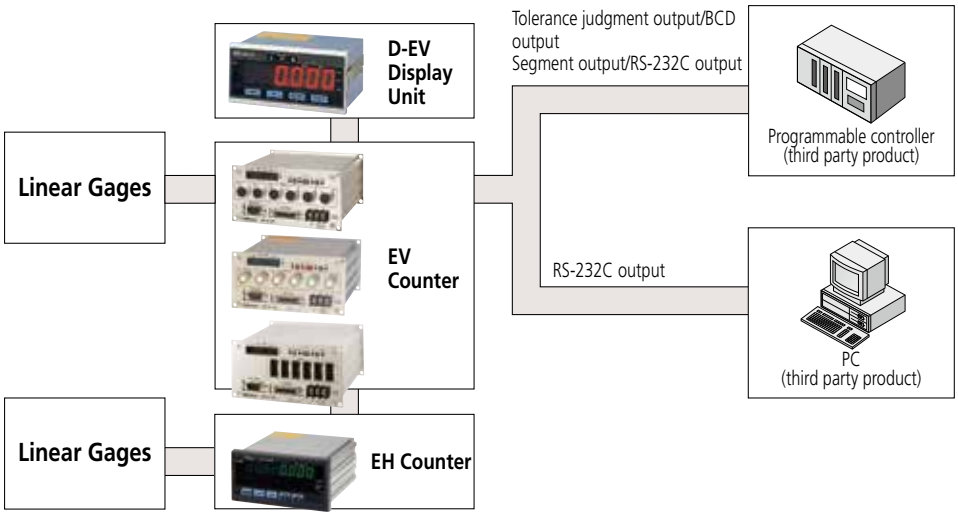
Mitutoyo

# EV Counter System Configuration

## Series 542 — Processor (Optional Display), Multi-function/output

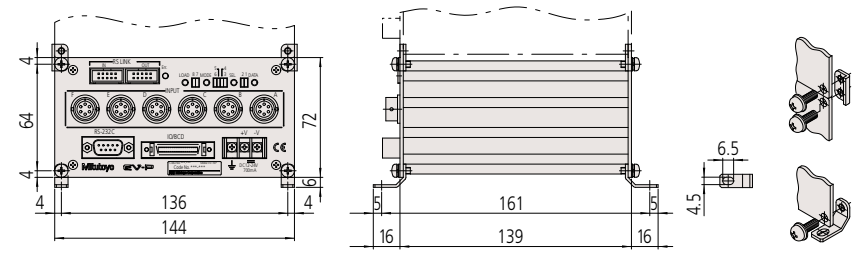
### System Configuration

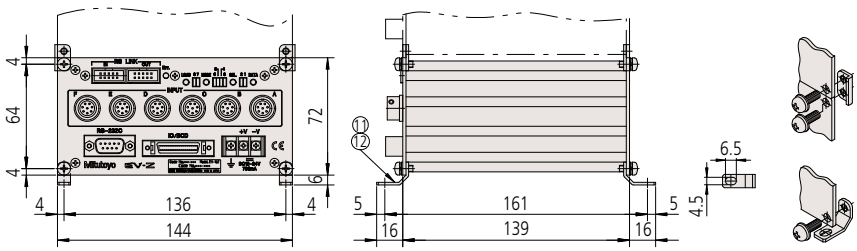
A counter system performs output and display for connected Mitutoyo linear gages.

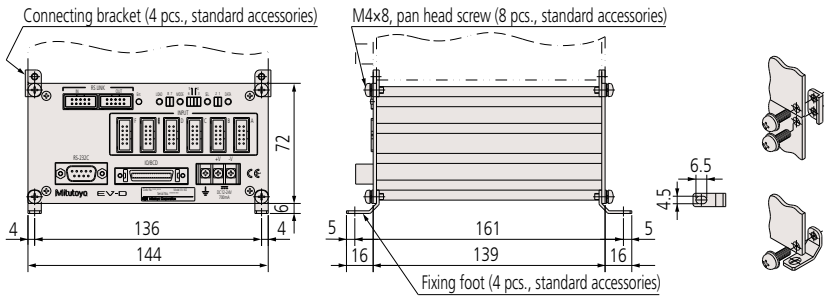



### DIMENSIONS

Unit: mm



# D-EV Display Unit for EV Counter

- Display unit for the EV counter.
- Allows set up of EV counter without a personal computer or other equipment.
- Able to display each gage measurement value and go/no-go judgment result, total go/no-go judgment result for all gages, setting details and errors.




**02ADD400**

## Function

- External Control (Zero-set, Preset etc.)
- Direction switch
- Error display
- Tolerance judgment output
- Data output
  (RS-232C, BCD, Segment)
- Peak measurement

Maximum value, minimum value, runout, and differential measurement between two gages
Addition, averaging, maximum value, minimum value, and maximum width

## Optional Accessories

- SPC cable (0.5m): **No.02ADD950**[*1]
- SPC cable (1mm): **No.936937**[*1]
- SPC cable (2m): **No.965014**[*1]
- AC adapter: **No.357651**
- AC cable (USA): **02ZAA010**[*2]
- Terminal connecting cable: **02ADD930**[*2]

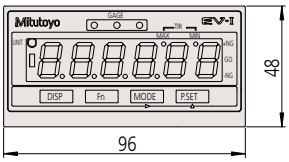
*1: Required when connecting with **EV-16P/D/Z**.
*2: Required when using AC adapter.
Note: AC adapters may not be needed if using power from EV counter to power the D-EV.

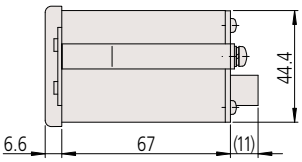
## SPECIFICATIONS

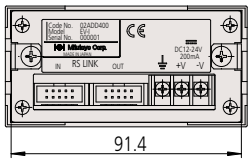
| Order No. | **02ADD400** |
|---|---|
| Number of connections | 1 EV counter per unit |
| Number of digits | Sign plus 6 digits (8 digits internal to EV counter) |
| LED | Channel display (also for judgment result display): 3 (3-color LED)<br>Measurement mode display (current data, maximum value, minimum value, runout): 2<br>Status display: 1 (2 colors) |
| Operation switches | 4 |
| Function of operation switch | Channel switching, measurement mode switching (current data, maximum value, minimum value, runout), parameter setting, presetting, tolerance setting |
| Input/output | RS Link connectors: 1 each for IN, OUT |
| Error message | Overspeed, gage error etc. |
| Power supply | Terminal block (M3 screw), 12 - 24V DC, 200mA |
| Operating temperature (humidity) range | 0 to 40°C (RH 20 to 80%, no condensation) |
| Storage temperature(humidity) range | –10 to 50°C (RH 20 to 80%, no condensation) |
| External dimensions | 96(W)×48(H)×84.6(D)mm |

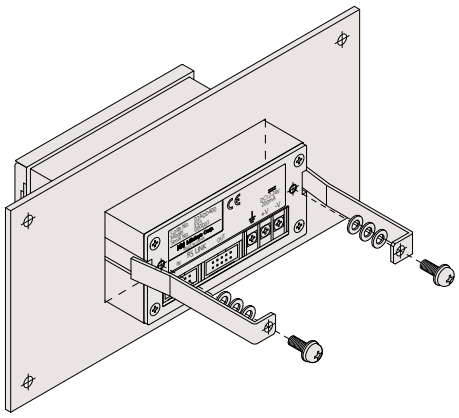
## DIMENSIONS

Unit: mm



# Sensorpak Software

## Dynamically Displays Positions, Tolerances and Calculations, and Acquires Basic Data from EH, EV Counters and Litematics

- This software facilitates loading measurement data onto a personal computer from a linear gage counter with RS-232C output (EH, EV), with USB output (EH), or from a Litematic display (VL).
- 60 channels (max.) of measurement data can be processed.
- Arithmetical calculations and maximum width calculations can be performed using the measurement data.
- Exporting measurement data into MS-Excel format is supported.
- Real-time graphical display by means of bar-graph or meter is provided.
- Any gage that can be connected to an EH or EV counter can be used in Sensorpak.

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
SENSOR



Meter screen

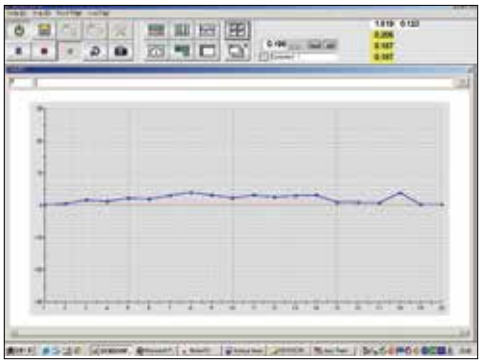


Chart screen




Measurement screen

## SPECIFICATIONS

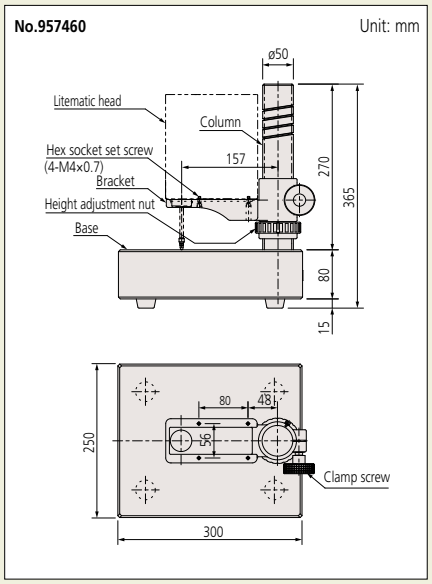
| Order No. | **02NGB073** (Software v 3.0 plus I/O cable) |
|---|---|
| Display function | Display type: Counter, bar graph, meter, chart (capable of simultaneous display)<br>Tolerance judgment result: Color display (green/red)<br>Connectable gages: max. 60 gages |
| Calculation functions | Calculation items: Sum, difference, total, average, maximum, minimum, range (maximum–minimum), calculation with a constant<br>Connectable gages: Max. 30 calculation functions (between two gages) |
| Total tolerance judgment | Go/No-go judgment (by specifying gages to be used for total tolerance judgment)<br>Go/No-go signal output with optional I/O cable |
| Input function | Trigger function: by means of key, timer or external TRG (with optional I/O cable)<br>Data input frequency: Max. 9999 times (with 60 gages connected) to 60000 times (with 6 gages connected) |
| Output function | Direct output to EXCEL spreadsheet, CSV file output (compatible with MeasurLink) |
| Connectable items | EF, EH, EV, Litematic (RS Link ready products) |
| System requirements | CPU: DOS/V PC (w/ RS-232C) 2GHz or more<br>OS: Windows 7(32/64 bit), Windows 8.1(32/64 bit), windows 10(64bit)<br>Memory: 2GB or more<br>USB Com: USB 2.0<br>Display: 1024 x 786 or more<br>Excel: 2007, 2010, 2013 |

Currently supported languages: English, German, French, Spanish
User's manual: English

### Optional Accessory

**21HZA137**: Connecting Cable
- Counter connection (9pin D-SUB)
- PC connection (9-pin D-SUB)
- PLC connection (5-pin DIN)

## Optional Stand for VL-50S-B




## Optional Accessories

- Foot switch: **No.937179T**
- Dedicated stand: **No.957460***4
- SPC cable (1m): **No.936937***5
- SPC cable (2m): **No.965014***5
- Weight set: **No.02AZE375***6
- Recommended contact point:
  Shell type
  Carbide-tipped spherical contact point, ø7.5
  Carbide-tipped spherical contact point, ø10.5
  Carbide-tipped needle contact point, ø0.45

*4: Only available for **VL-50S** models
*5: Refer to page G-32 for details of the RS link.
*6: Not applicable to **VL-50-100-B**, **VL-50S-100-B**.

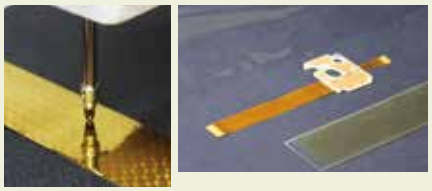
## Measurement Examples



Glass dimensional measurement



Thin sheet metal thickness



Thickness measurement of non-metallic sheet

### Laser Beam Safety Precautions

This system uses a low-power invisible laser beam (780nm) which corresponds to a CLASS 1 (invisible radiation) of IEC60825-1 for measurement. The CLASS 1 laser warning label as shown below is attached to the main unit.

CLASS 1 LASER PRODUCT

# Litematic – Low-Force Measurement

## Series 318 — Low Force, High-resolution, Motorized Measurement of Easily-deformed Parts

- The Litematic is designed for measuring easily deformed workpieces and high-precision parts, with extra-low measuring force of 0.01N.
- 0.15N and 1N types are capable of measuring at a certain measuring force by using a Litematic feature, while the 0.01N type is suitable for measuring delicate workpieces.

*0.15N, 1N types are factory-installed option.

- The motor-driven spindle moves up/down and stops when the contact point touches the workpiece. Then the maximum, minimum values and runout value are measured under a constant force.
- High resolution of 0.01µm, and wide measuring range of 50mm.
- Measuring system VL-50-B, integrated display type, and VL-50S-B, a separate display type, are available.
- The measuring table supplied with VL-50-B is ceramic and corrosion-free for easier maintenance and storage.
- The spindle is made of low thermal-expansion material.



**318-221A**



**318-226A**

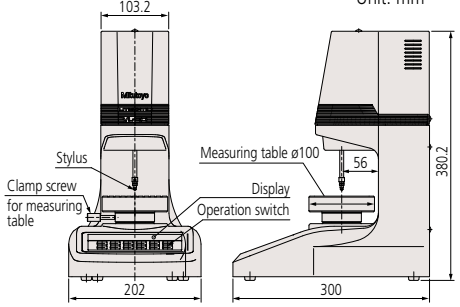
## SPECIFICATIONS

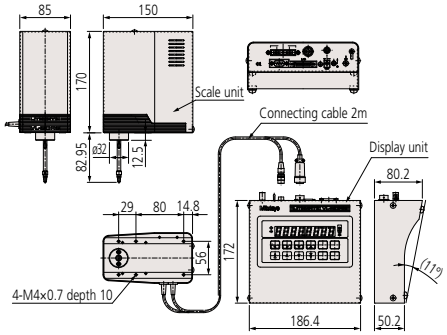
| Order No. | | 318-221A | 318-222A | 318-223A | 318-226A | 318-227A | 318-228A |
|---|---|---|---|---|---|---|---|
| Model | | VL-50-B | VL-50-15-B | VL-50-100-B | VL-50S-B | VL-50S-15-B | VL-50S-100-B |
| Measuring range | | 0 to 50mm (0-2") | | | | | |
| Resolution | | 0.01/0.1/1.0µm (.0000005"/.000005"/.00005") | | | | | |
| Display unit | | 8 digits/14mm (.6") character height (without signs) | | | | | |
| Detection method | | Reflection-type linear encoder | | | | | |
| Stroke | | 51.5mm (.2") (when using a standard contact point) | | | | | |
| Indication accuracy (20°C)*1 | | (0.5+L/100)µm L=arbitrary measuring length (mm) | | | | | |
| Accuracy guaranteed temperature*2 | | 20 ± 1°C | | | | | |
| Repeatability*1 | | σ=0.05µm | | | | | |
| Measuring force*1 | | 0.01 | 0.15N*3 | 1N*3 | 0.01N | 0.15N*3 | 1N*3 |
| Feed speed | Measurement | Approx. 2mm/s (.08"/s) or 4mm/s (.16"/s) (changeable by parameter) | | | | | |
| | Fast feed | Approx. 8mm/s (.3"/s) | | | | | |
| Standard contact point | | ø3mm carbide tipped (fixing screw: M2.5 (P=0.45)x5) **No.901312** | | | | | |
| Measuring table | | ø100 (ceramic, grooved, removable) | | | — | | |
| Input | | Foot switch input (when optional foot switch is used)<br>External control | | | | | |
| Output | | Digimatic output/RS-232C output (changeable by parameter) | | | | | |
| Rating | Power supply | 85 - 264V AC (depends on AC adapter) | | | | | |
| | Power consumption | Max. 12 W (12V, 1A) | | | | | |
| Standard accessories | | AC adapter: **No.357651**, Power cable/grounding wire: **No.02ZAA000**,<br>AC cable (USA): **No.02ZAA010***<br>Hex wrench (2 pcs, for fixing contact point and for removing fixing bracket) | | | | | |

*1: Normal measurement using standard contact point.
*2: Or less temperature change. Hot or cold direct air flow should be avoided.
*3: 0.15N, 1N types are factory-installed option.

## DIMENSIONS

Unit: mm



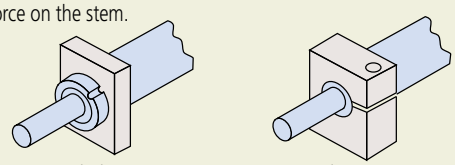



Mitutoyo

## Head

### Plain Stem and Stem with Clamp Nut

The stem used to mount a linear gage head is classified as a plain type or clamp nut type as illustrated below. The clamp nut stem allows fast and secure clamping of the linear gage head. The plain stem has the advantage of wider application and slight positional adjustment in the axial direction on final installation, although it does requires a split-fixture clamping arrangement or adhesive fixing. However, take care so as not to exert excessive force on the stem.



Stem locknut type　　Plain stem

### Measuring Force

This is the force exerted on a workpiece during measurement by the contact point of a linear gage head, at its stroke end, expressed in newtons.

### Comparative Measurement

A measurement method where a workpiece dimension is found by measuring the difference in size between the workpiece and a master gage representing the nominal workpiece dimension.

### Ingress Protection Code

IP54 protection code

| Type | Level | Description |
|---|---|---|
| Protects the human body and protects against foreign objects | 5: Dust protected | Protection against harmful dust |
| Protects against exposure to water | 4: Splash-proof type | Water splashing against the enclosure from any direction shall have no harmful effect. |

IP66 protection code

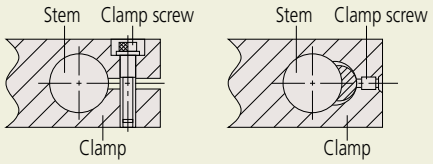
| Type | Level | Description |
|---|---|---|
| Protection against contact with the human body and foreign objects | 6: Dust tight | Protection from dust ingress<br>Complete protection against contact |
| Protects against exposure to water | 6: Water-resistant type | Water jets directed against the enclosure from any direction shall have no harmful effect. |

### Precautions in Mounting a Gage Head

- Insert the stem of the gage into the mounting clamp of a measuring unit or a stand and tighten the clamp screw.
- Notice that excessively tightening the stem can cause problems with spindle operation.
- Never use a mounting method in which the stem is clamped by direct contact with a screw.
- Never mount a linear gage by any part other than the stem.
- Mount the gage head so that it is in line with the intended direction of measurement. Mounting the head at an angle to this direction will cause an error in measurement.
- Exercise care so as not to exert a force on the gage through the cable.

### Precautions in Mounting a Laser Hologage

To fix the Laser Hologage, insert the stem into the dedicated stand or fixture.



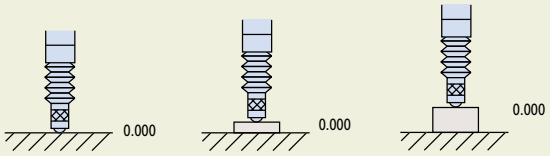

Recommended hole diameter on the fixing side: 15mm +0.034/-0.014

- Machine the clamping hole so that its axis is parallel with the measuring direction. Mounting the gage at an angle will cause a measuring error.
- When fixing the Laser Hologage, do not clamp the stem too tightly. Over-tightening the stem may impair the sliding ability of the spindle.
- If measurement is performed while moving the Laser Hologage, mount it so that the cable will not be strained and no undue force will be exerted on the gage head.

## Display Unit

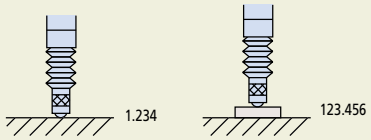
### Zero-setting

A display value can be set to 0 (zero) at any position of the spindle.



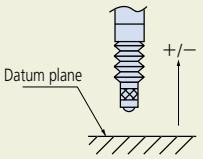

### Presetting

Any numeric value can be set on the display unit for starting the count from this value.



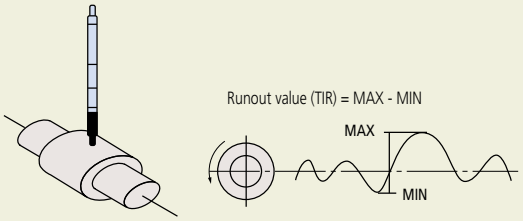

### Direction Changeover

The measuring direction of the gage spindle can be set to either plus (+) or minus (-) of count.




### MAX, MIN, TIR Settings

The display unit can hold the maximum (MAX) and minimum (MIN) values, and MAX - MIN value during measurement.




### Tolerance Setting

Tolerance limits can be set in various display units for automatically indicating if a measurement falls within those limits.

### Open Collector Output

An external load, such as a relay or a logic circuit, can be driven from the collector output of an internal transistor which is itself controlled by a tolerance judgement result, etc.

### Relay output

Contact signal that outputs the open/closed status.

### Digimatic Code

A communication protocol for connecting the output of measuring tools with various Mitutoyo data processing units. This allows output connection to a Digimatic Mini Processor DP-1VR for performing various statistical calculations and creating histograms, etc.

### BCD Output

A system for outputting data in binary-coded decimal notation.

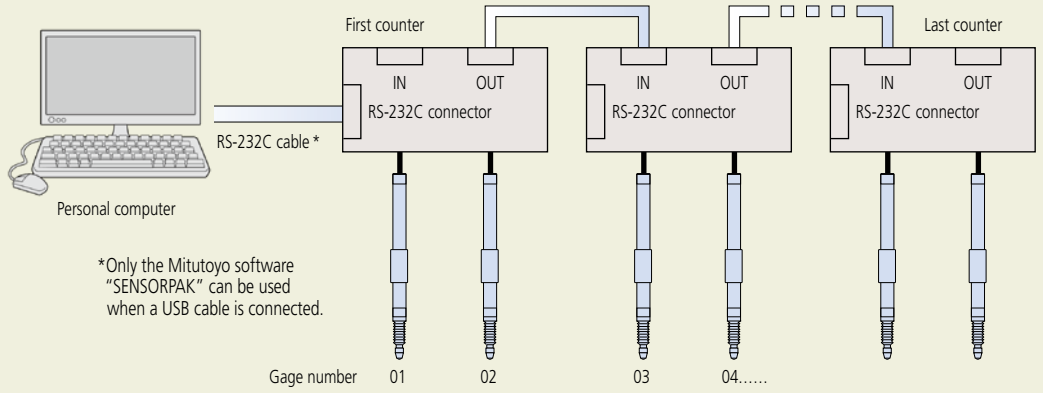
### RS-232C Output

A serial communication interface in which data can be transmitted bi-directionally under the EIA Standards.
For the transmission procedure, refer to the specifications of each measuring instrument.

## RS Link Function Multi-point measurement can be performed by connecting multiple EH or EV counters with RS Link cables.

### RS Link for EH Counter

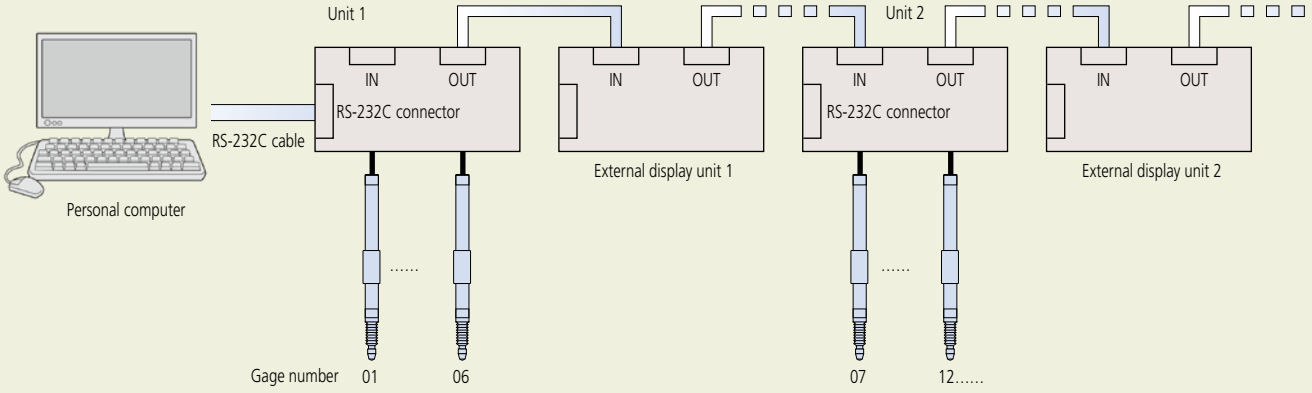
It is possible to connect a maximum of 10 counter units and handle up to 20 channels of multi-point measurement at a time.
For this connection use a dedicated RS Link cable **No.02ADD950** (0.5m), **No.936937** (1m) or **No.965014** (2m).
(The total length of RS Link cables permitted for the entire system is up to 10m.)




### RS Link for EV Counter

It is possible to connect a maximum of 10* counter units and handle up to 60 channels of multi-point measurement at a time.
For this connection use a dedicated RS Link cable **No.02ADD950** (0.5m), **No.936937** (1m) or **No.965014** (2m).
(The total length of RS Link cables permitted for the entire system is up to 10m.)

* The maximum number of counter units that can be connected is limited to 6 (six) if an EH counter is included in the chain.



# Mu-checker Probes

## SERIES 519 Mu-checker Probes (Lever head)

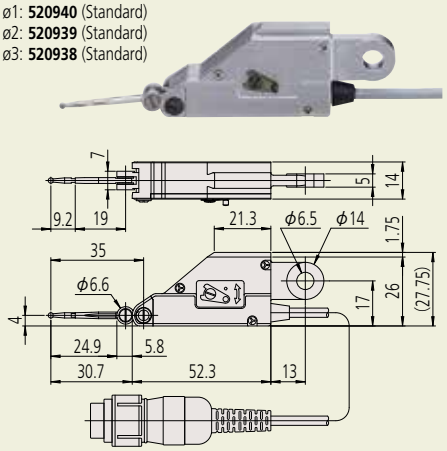
### SPECIFICATIONS
**Lever heads**

| Order No. | 519-521 | 519-522 | 519-326* | 519-327 |
|---|---|---|---|---|
| Measuring range (mm) | ±0.5 | | | |
| Stroke (mm) | ±0.6 | | | ±0.65 |
| Measuring force (N) | Approx. 0.2 | Approx. 0.02 | Approx. 0.15 | |
| Linearity (%) | ±0.3 | | | ±0.5 |
| Stylus support | Pivot bearing | Pivot bearing | Parallel-leaf spring | Pivot bearing |

Note: A ø2mm ball-ended stylus is supplied as standard with all probes.
* This model is immune to cosine error.

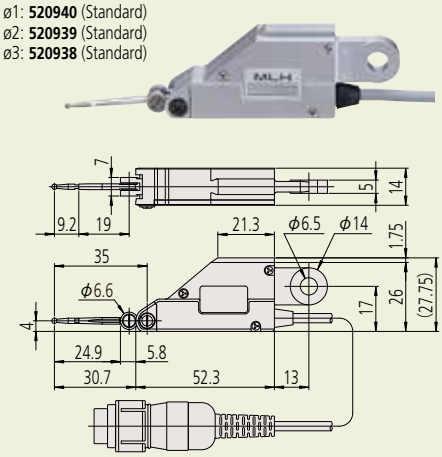
**519-521**

• Interchangeable styli:
ø1: **520940** (Standard)
ø2: **520939** (Standard)
ø3: **520938** (Standard)



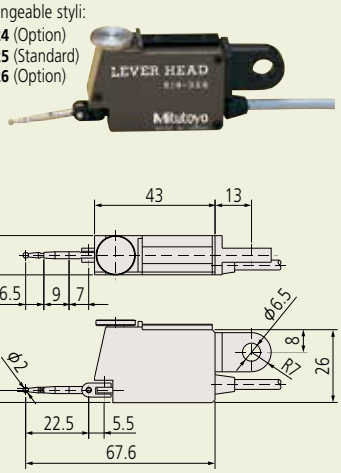

**519-522**

• Interchangeable styli:
ø1: **520940** (Standard)
ø2: **520939** (Standard)
ø3: **520938** (Standard)



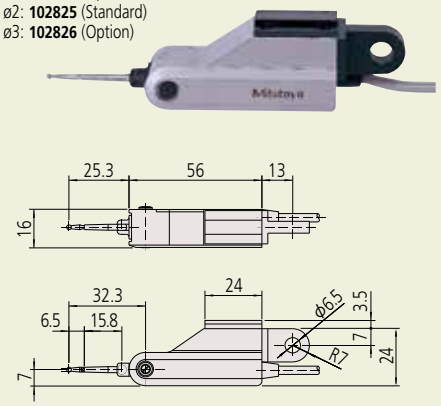

**519-326**

• Interchangeable styli:
ø1: **102824** (Option)
ø2: **102825** (Standard)
ø3: **102826** (Option)



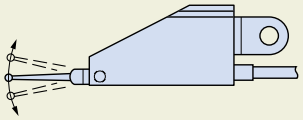

**519-327**

• Interchangeable styli:
ø1: **102824** (Option)
ø2: **102825** (Standard)
ø3: **102826** (Option)

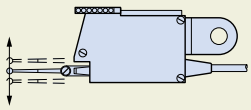



### Common specifications
- Connection: Half-bridge
- Cable length: 2m
- Connector type: **MAS-5100** (DIN5P) or equivalent

## Lever probes
Lever probes are available in two types. The most common type uses a pivoted stylus so the contact point moves in a circular arc; this type is subject to cosine effect and, therefore, measurements may require linearity correction if the direction of measurement is much different to the direction of movement of the contact point. The less common type uses a parallel translation leaf-spring mechanism so contact point movement is linear; this type requires no correction.



Pivoted stylus type
**519-521** (measuring direction can be switched with the up/down lever)
**519-522** (measuring direction is not switchable, low force)
**519-327** (Clutchless)



Parallel translation type
**519-326** (measuring direction can be switched with the upper dial)




Refer to Bulletin No. (2215) for more details.

## Lever-head mounting brackets (optional)

Optional accessories for Mitutoyo test indicators can be used.

### Stems



ø4 dovetail-grooved stem
**21CZB131**



ø6 dovetail-grooved stem
**21CZB128**



ø8 dovetail-grooved stem
**21CZB129**



ø3/8" dovetail-grooved stem
**21CZB130**

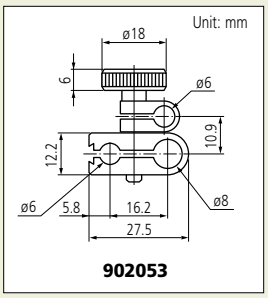
### Clamp



Clamp for ø6mm, 8 dovetail-grooved stem
**902053**



Clamp for ø6mm, 3/8" dovetail-grooved stem
**900320**




**902053**

### Holder



Holding arm (Square 9x9, Length 100)
**900209**



Holding arm (ø8, Length 115)
**900211**



Holding arm (.25" x .5", Length 4")
**900306**

## SERIES 519 Mu-checker Probes (Cartridge head)

## SPECIFICATIONS

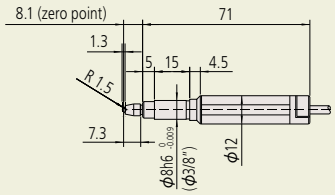
### Cartridge heads

| Order No. | 519-331 | 519-332 | 519-346 | 519-347 | 519-385 | 519-341 | 519-348 |
|---|---|---|---|---|---|---|---|
| Measuring range (mm) | ±0.5 | ±0.5 | ±0.25 | ±0.5 | ±1.5 | ±2.5 | ±1.0 |
| Stroke (mm) | ±0.65 | ±0.65 | +0.34 −0.26 | +0.85 −0.65 | +2.35 −1.65 | +3.2 −2.8 | +1.35 −1.15 |
| Measuring force (N) | Approx. 0.25 | Approx. 0.25 | Approx. 0.7 | Approx. 0.7 | Approx. 0.7 | Approx. 0.9 | Approx. 0.7 |
| Stem Dia. (mm) | ø8 | ø3/8" | ø8 | ø8 | ø8 | ø8 | ø8 |
| Linearity (%) | ±0.5 | ±0.5 | ±0.3 | ±0.3 | ±0.3 | ±0.5 | ±0.3 |
| Plunger support | Plain bearing | | Linear ball-bearing | | | | |

**519-331/(519-332)**

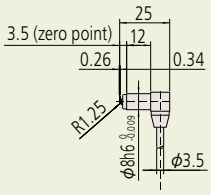
• M2.5×5 (4-48 UNF) interchangeable contact points for dial indicators can be used.





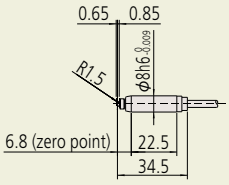

**519-346**






**519-347**

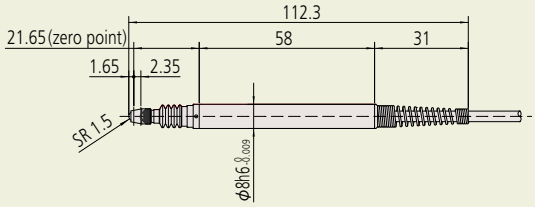





**519-385**

• M2.5×5 interchangeable contact points for dial indicators can be used.

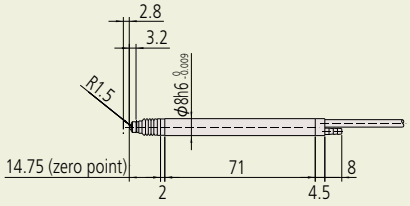





**519-341**

• M2.5×5 interchangeable contact points for dial indicators can be used.

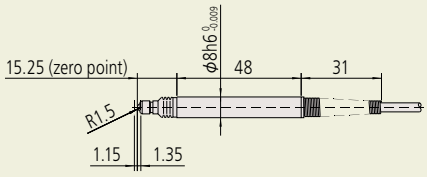





**519-348**

• M2.5×5 interchangeable contact points for dial indicators can be used.








Mitutoyo

# Mu-checker

## SERIES 519 Mu-checker
## (Analog/Digital electronic micrometer)

- Single touch zero-set function is standard.
- Switchable measurement ranges make the Mu-checker suitable for a range of applications.

### Analog Mu-checker



Standard type
**519-552A**



Differential type
**519-554A**

## SPECIFICATIONS

| Order No. | 519-552A | 519-554A |
|---|---|---|
| Type | Standard type (one probe required) | Differential type (one/two probes required) |
| Display range | ±5µm/±15µm/±50µm/±150µm/±500µm/±1500µm<br>±.00015"/±.0005"/±.0015"/±.005"/±.015"/±.05" | |
| Resolution | 0.1µm/0.5µm/1µm/5µm/10µm/50µm<br>.000005"/.00001"/.00005"/.0001"/.0005"/.001" | |
| Differential mode | ±A | ±A, ±B, ±A±B |
| Display accuracy (linearity) | ±1% / ±full scale | |
| Analog output | ±1V ±full scale | |
| Analog output accuracy | ±0.1% Within ±full scale (excluding probe) | |
| Zero-setting adjustment range | Manual Instant zero setting: 1/3 of full scale for each range | |
| External dimensions | 134(W) x 183(D) x 208(H) mm | |
| Mass | 2.4kg | |
| Power input | AC adapter 100, 120, 220, 240VAC 50/60Hz | |
| Probe | Various probes (refer to page G-33 and G-34) | |

### Digital Mu-checker

- Single touch zero-set function is standard.
- Switchable measurement ranges make the Mu-checker suitable for a range of applications.
- Dual input.



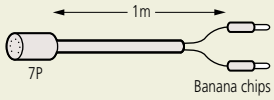
Digital Mu-checker
**519-562A**

## SPECIFICATIONS

| Order No. | 519-562A |
|---|---|
| Type | Differential type digital Mu-Checker (2 connecting heads) |
| Display range | ±2.000mm/±0.2000mm/±.08"/±.008" |
| Resolution | 0.001mm/0.0001mm/.00005"/.000005" |
| Differential mode | ±A, ±B, ±A±B |
| Measurement mode | ABS/CMP |
| Analog output | ±1V ±Full scale |
| Digital output | Digimatic code out |
| External dimension | 134(W) x 183(D) x 208(H) mm |
| Mass | Approx. 2.6kg |
| Power input | AC adapter 100, 120, 220, 240VAC 50/60Hz |
| Probe | Various probes (refer to page G-33 and G-34) |

## Optional Accessories

- SPC Cable for connecting digital Mu-checker (**936937**)
  Used for connecting to the digimatic mini-processor.
- Output cable A (**934795**)
  Used for connecting to external devices, such as data recorders, etc.




- Analog, limit out (7P) connector (**529035**)
  Used for output to external data recorders, sequencers, etc.

- Foot Switch: **937179T**
- SPC Cable, 1m: **936937**
- SPC Cable, 2m: **965014**
  Note: for Digital Mu-Checker only




Refer to Bulletin No. (2215) for more details.

# SERIES 519 6CH Mu-checker Counter EV-16A

## Main features

- External control (Zero-set, Preset etc.)
- Direction switching
- Error messaging
- Tolerance judgment output
- Each data output (RS-232C, BCD, segment)
- Peak measurement (maximum value, minimum value, runout) and arithmetic operation (addition, average, maximum value, minimum value, maximum width) between axes

## Optional Accessories

- I/O output connector: **02ADB440**
- D-EV external unit: **02ADD400**
- SPC cable, 0.5m: **02ADD950**
- SPC cable, 1m: **936937**
- SPC cable, 2m: **965014**

Note 1: To perform calibration a **D-EV (02ADD400)** display unit is required.
At least one **D-EV (02ADD400)** unit is required when using multiple **EV-16A (519-355)**.

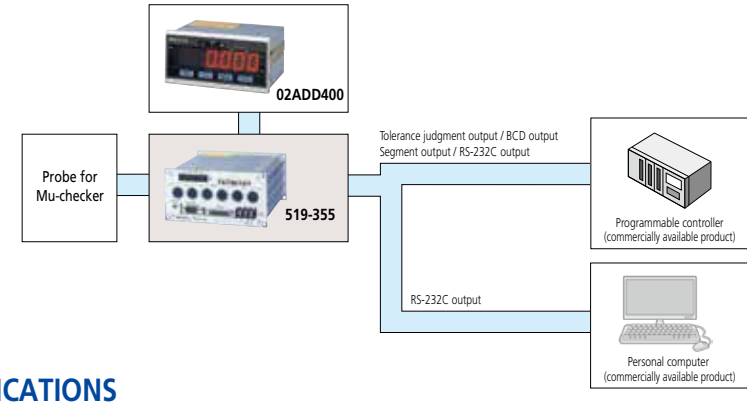
Note 2: As a power supply is not supplied as standard. An appropriate power supply with a current capacity of 1A or more must be provided for each **EV-16A (519-355)**.

- The EV-16A counter unit provides multi-channel electronic micrometer functionality but without a display of the measurement results, which must be purchased separately. (See below.)
- Up to six probes can be connected to one unit. Up to ten counters can be connected to one personal computer using the RS Link function to enable the configuration of a multi-point measurement system comprising a maximum of 60 gages.
- I/O outputs for RS-232C, BCD, tolerance judgment and segment output are available.
- Maximum, minimum and runout measurement between channels (in the same unit) is possible in addition to normal measurement on individual channels.

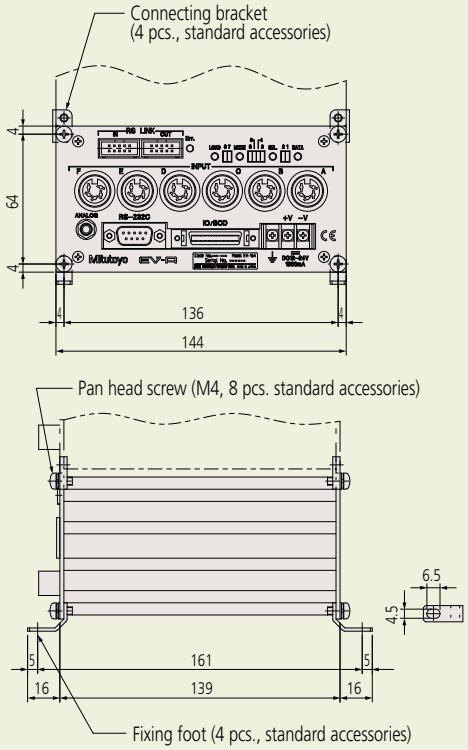



## SYSTEM CONFIGURATION

Mitutoyo probes, EV-16A counters and D-EV display units combined with commercial controllers and personal computers enable construction of a powerful, multi-channel system that can be built to meet the needs of almost any measurement application.




## DIMENSIONS




## SPECIFICATIONS

| Order No. | | 519-355 |
|---|---|---|
| Number of gage inputs | | Six |
| Display range (mm) | | ±2.000, ±0.200 |
| Resolution (mm) | | 0.001, 0.0001 |
| Display processing | | 8 digits for parameters (display setting), 1 for error display |
| Error messaging | | Power supply voltage error, Gage error, etc. |
| External display | | Dedicated external display unit D-EV (optional) can be connected |
| Number of input switches | | 4 |
| Input switch function | | Measurement mode switching, Parameter settings |
| I/O | Tolerance judgment output | 1 to 6 gages (L1, L2, L3), open-collector |
| | BCD output | Parallel BCD output (positive/negative-true logic), open-collector |
| | Segment output | A function to enable only output from the terminal corresponding to the counting values, open-collector |
| | Control output | Normal operation signal (NOM), open-collector |
| | Control input | Output channel designation (segment, in BCD mode), presetting, peak value clear, range changeover (at segment output), holding counting value, open-collector or no-voltage contact signal (with/without contact point) |
| Interface | RS-232C | Measurement data output and control input, EIA RS-232C-compatible<br>Use cross cables for home position DTE (terminal definition) |
| | RS link | Max. connected units: 10 (6 when using EF counter)<br>Connecting cable length: Max. 10m (sum of link cable length)<br>Data transfer time: 1.1 sec./60ch (when transmission rate is 19200 bps) |
| Rating | Power supply voltage | Terminal (M3 screw), 12-24VDC |
| | Current consumption | 1A |
| Operating temperature (humidity) range | | 0 to 40 °C (RH 20 to 80%, no condensation) |
| Storage temperature (humidity) range | | -10 to 50 °C (RH 20 to 80%, no condensation) |
| External dimensions | | 144(W) × 72(H) × 139(D) mm |
| Mass | | Approx. 1000 g |
| Standard accessories | | Fixing foot (4), connecting bracket (4), fixing screw M4 × 8 (8) |
| Applicable probes | | For probes, refer to 519 series Mu-checker probes |

# Laser Scan Micrometer Selection Guide

## MEASURING UNITS

| Appearance | Model | Laser Classification | Measuring Range | Resolution (Selectable) |
|---|---|---|---|---|
|  | **LSM-6902H*** | **Visible** (650nm), IEC Class 2/ FDA Class II | 0.1 - 25mm (.004" - 1.0") | 0.01µm - 10µm (.000001" - .0005") |
|  | **LSM-500S** | **Visible** (650nm), IEC Class 2/ FDA Class II | 0.005 - 2mm (.0002" - .08") | 0.01µm - 10µm (.000001" - .0005") |
|  | **LSM-501S** | **Visible** (650nm), IEC Class 2/ FDA Class II | 0.05 - 10mm (.002" - .4") | 0.01µm - 10µm (.000001" - .0005") |
|  | **LSM-503S** | **Visible** (650nm), IEC Class 2/ FDA Class II | 0.3 - 30mm (.012" - 1.18") | 0.02µm - 100µm (.000001" - .005") |
|  | **LSM-506S** | **Visible** (650nm), IEC Class 2/ FDA Class II | 1 - 60mm (.04" - 2.36") | 0.05µm - 100µm (.000002" - .005") |
|  | **LSM-512S** | **Visible** (650nm), IEC Class 2/ FDA Class II | 1 - 120mm (.04" - 4.72") | 0.1µm - 100µm (.000005" - .005") |
|  | **LSM-516S** | **Visible** (650nm), IEC Class 2/ FDA Class II | 1 - 160mm (.04" - 6.30") | 0.1µm - 100µm (.000005" - .005") |
|  With display unit | **LSM-9506** Measuring unit - display unit one-piece structure for bench-top use only | **Visible** (650nm), IEC Class 2/ FDA Class II | 0.5 - 60mm (.02" - 2.36") | 0.05µm - 100µm (.000002" - .005") |

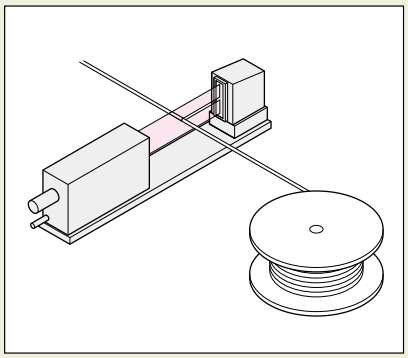
## DISPLAY UNITS

| Appearance | Model | Type | Application | Interface Units Equipped |
|---|---|---|---|---|
|  | **LSM-6200** **LSM-6902H*** | Multi-function type | Bench-top use | • RS-232C<br>• I/O<br>• Analog output |
|  | **LSM-5200**** | Compact type (Low cost) | Assembly/ bench-top use (DIN size) | • RS-232C<br>• I/O<br>• Analog output<br>• USB*** |

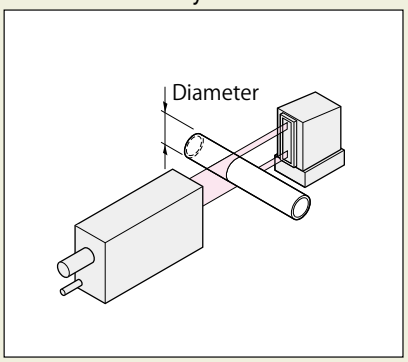
*LSM-902 and LSM-6902H are factory-set package.
**When connecting with the LSM-500S series, the scanning speed becomes 1600 scans/sec.
***USB connectivity for use with Quicktool and LSM Pak.

## Measurement Examples

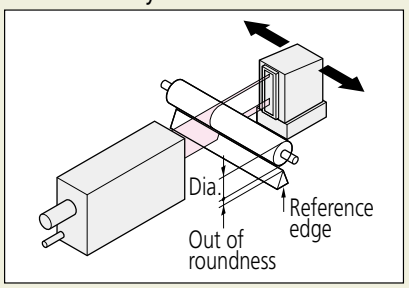
In-line measurement of glass fiber or fine wire diameter



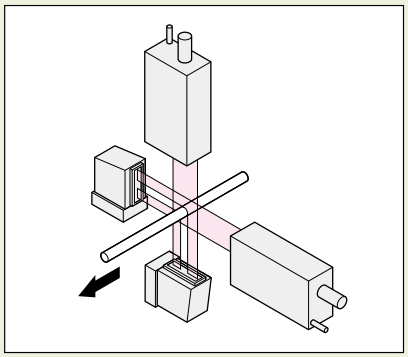
Measurement of outer diameter of cylinder



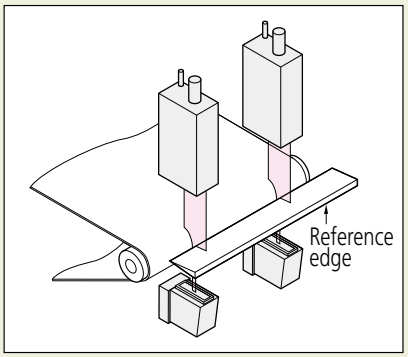

Measurement of outer diameter and roundness of cylinder



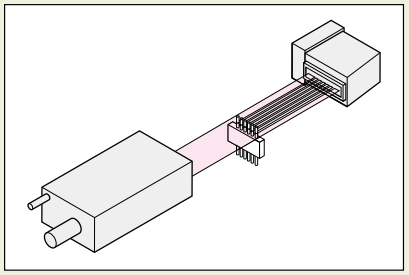

X- and Y-axis measurement of electric cables and fibers



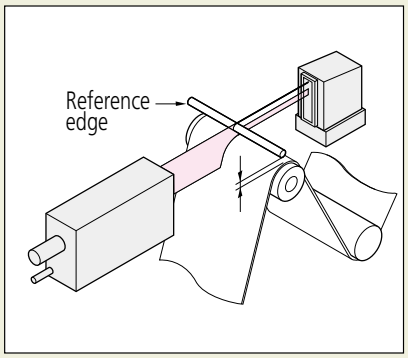
Measurement of thickness of film and sheet



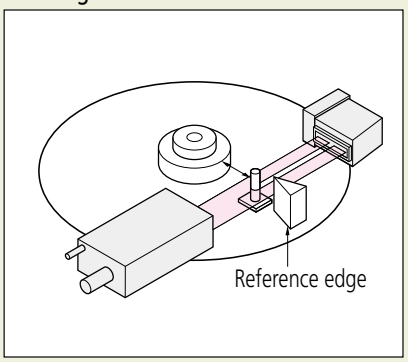

Measurement of spacing of IC chip leads



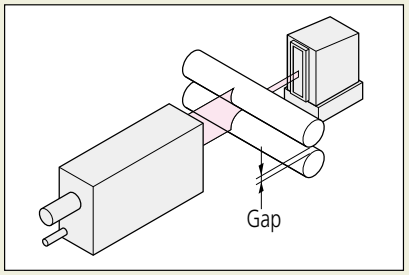
Measurement of film sheet thickness



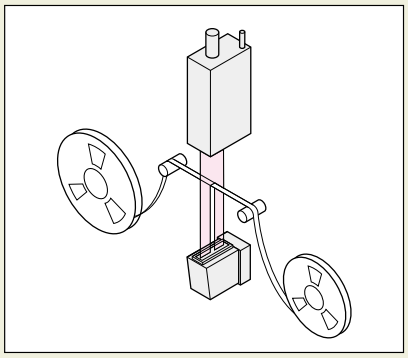

Measurement of laser disk and magnetic disk head movement



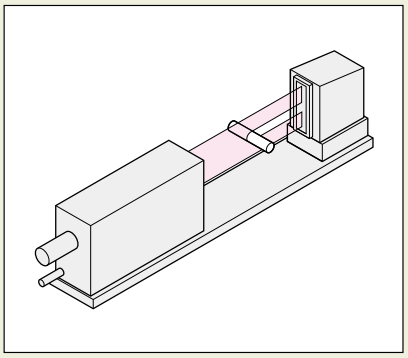

Measurement of gap between rollers



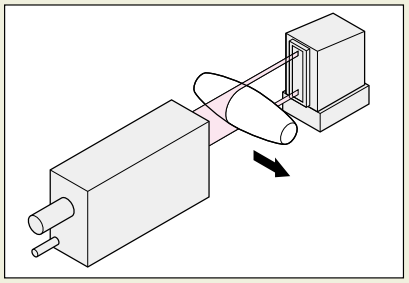

Measurement of tape width



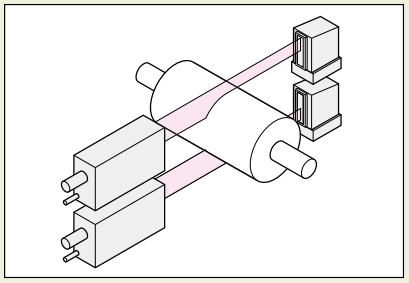
Measurement of outer diameter of optical connector and ferrule



Measurement of form



Dual system for measuring a large outside diameter





Mitutoyo

# Laser Scan Micrometer LSM-6902H

## SERIES 544 — Ultra-high Accuracy Non-contact Measuring System

- Non-contact laser-based measuring system, mainly for outside diameter measurement. Suitable for delicate or moving workpieces.
- Accuracy of ±0.5µm in the ø0.1 - ø25mm range can be achieved. It is suitable for pin gage measurement.
- Narrow range accuracy of ±(0.3+0.1ΔD)µm for high-precision measurement.
- Ultra-high repeatability of ±0.05µm.
- The system consists of a measuring unit and a display unit.



## SPECIFICATIONS

| Set Order No. | | 544-499A |
|---|---|---|
| Measuring unit | | |
| Type | | inch/mm |
| Measuring range | | 0.1 to 25mm (.004 - 1.0") |
| Resolution | | 0.01 to 10µm (selectable) (.000001 - .0005") |
| Repeatability*1 | Whole range | ±0.045µm (±0.0000018 in) (ø25mm) |
| | Narrow range | ±0.03µm (±0.0000012 in) (ø10mm) |
| Accuracy*2 (20°C) | Whole range | ±0.5µm (±.000020") |
| | Small range | ±(0.3+0.1ΔD) [D:mm]*5 ±(.000012+.001ΔD) [D:inch] |
| Positional error*3 | | ±0.5µm (±.000020") |
| Measuring area*4 | | ±1.5×25mm (±0.6x1.0") |
| Scanning rate | | 800 scans/s |
| Laser wavelength | | 650nm (Visible) |
| Laser scanning speed | | 56m/s (2240"/sec) |
| Operating environment | Temperature | 0 to 40°C |
| | Humidity | RH 35 to 85% (no condensation) |

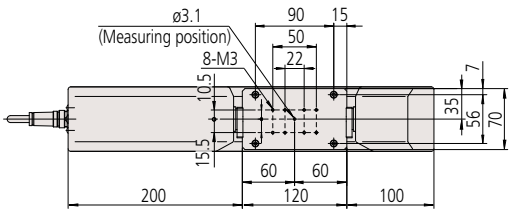
*1: Determined by the value of ±2σ (σ: standard deviation) when measuring ø25mm at the interval of 1.28 sec. (average 1024 times).
*2: At the center of the measuring range.
*3: An error due to variation in workpiece position either in the optical axis direction or in the scanning direction.
*4: The area given by [optical axis direction]×[scanning direction]
*5: ΔD=Difference in diameter between the master gage and workpiece (Unit: mm)

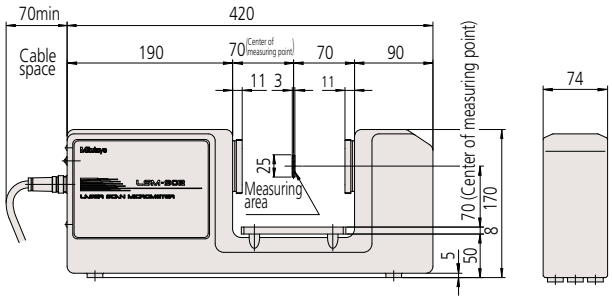
Display unit

| | |
|---|---|
| Display | 16-digit plus 11-digit fluorescent display, and guide message LED |
| Segment | 1 to 7 (1 to 3, transparent) or 1 to 255 edges |
| Averaging times | Arithmetic average: per 1 to 2048/ Moving average: per 32 to 2048 |
| Judgment | Selection from target value + tolerance, lower tolerance + upper tolerance, or 7 classes multi-limit tolerance zone. |
| Measurement mode | Standby, Single measurement, Continuous measurement |
| Statistical analysis | Maximum, Minimum, Average, Dispersion, σ(S.D) |
| External dimensions | 335 (W)×134 (H)×250 (D)mm |
| Power supply | 120 V AC ±10%, 50W, 60Hz |
| Standard I/F | RS-232C, Analog I/O |
| Optional I/F | Digimatic code output unit (2-ch), 2nd I/O analog I/F, BCD I/F |
| Operating environment | 0 to 40°C, RH 35 to 85% (no condensation) |
| Others | Nominal setting, sample setting, selection of unnecessary digits, transparent object measurement, automatic measurement in edge mode, output timer, abnormal data elimination, SHL change, group judgment, simultaneous measurement, statistical processing, mastering, buzzer function, automatic workpiece detection (dimension/position), zero-set/offset<br>* Measuring unit dual connection, extra-fine line measurement, and some of the communication commands are not available. |

## Measuring Unit External Dimensions

Unit: mm



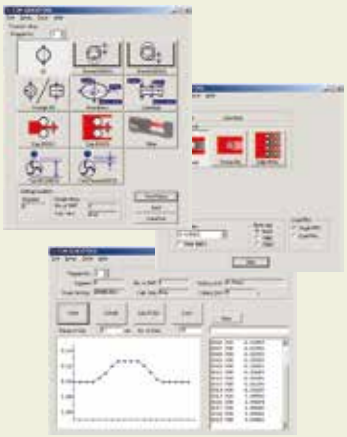

## Optional Accessories

(Refer to page G-46 for details.)

- Calibration gage set (ø1.0, ø25.0) : **No.02AGD180**
- Workstage : **No.02AGD270**
- Adjustable workstage : **No.02AGD280**
- Digimatic code output unit (2-ch) : **No.02AGC840**
- 2nd I/O analog interface unit : **No.02AGC880**
- BCD interface unit : **No.02AGC910**
- Printer & cable set (120V AC C-type plug) : **No.02AGD600B**
- Printing paper TP411-28CL / 1Pack = 10pcs : **No.223663**
- Foot switch : **No.937179T**

## QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



## Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 (2007) device. Warning and explanation labels, as shown below, are attached to the Laser Scan Micrometers as is appropriate.



# Laser Scan Micrometer LSM-500S

## SERIES 544 — High Accuracy Non-contact Measuring System

- Capable of measuring down to 5µm outside diameter*1.
- Provides ultra-high accuracy of ±0.3µm over the entire measuring range (5µm to 2mm).
- Ultra-high speed measurement of 3200 scan/sec.
  Suitable for high-speed lines or in applications subject to vibration.

IP64



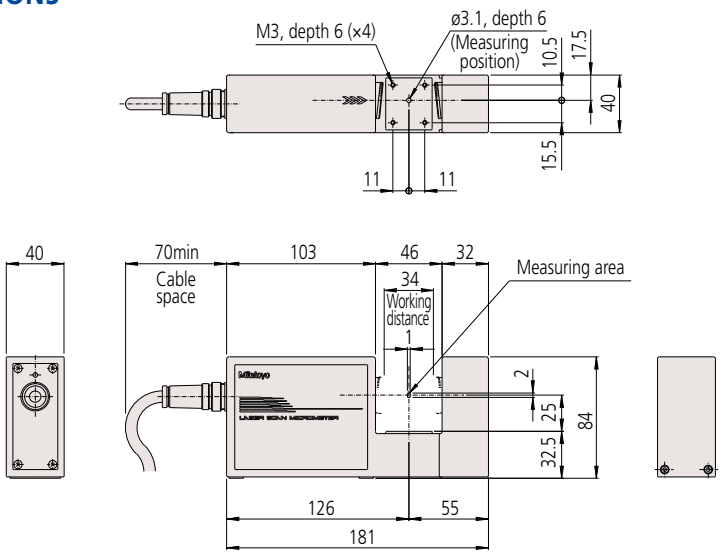
## SPECIFICATIONS

| | | |
|---|---|---|
| Order No. (Laser only) | | **544-532** |
| Package No. (with LSM 6200 Display) | | **64PKA117** |
| Applicable laser standards | | IEC, FDA |
| User's manual | | English version |
| Measuring range | | .0002" to .080" (0.005 to 2mm)*1 |
| Resolution | | .000001" to .0005" (0.01 to 10µm) (selectable) |
| Repeatability*2 | | ±0.03µm |
| Accuracy (20°C)*3 | | ±0.3µm |
| Positional error*4 | | ±0.4µm |
| Measuring area*5 | | 1×2mm (0.005 to 2mm) |
| Scanning rate | | 3200 scans/s |
| Laser wavelength | | 650nm (Visible) |
| Laser scanning speed | | 76m/s |
| Operating environment | Temperature | 0 to 40°C |
| | Humidity | RH 35 to 85% (no condensation) |
| Protection Level | | IP64*6 |

*1: The measuring range for the transparent object will be 0.05mm to 2mm. Please consult your local Mitutoyo office for objects smaller than 0.05mm.
The measuring range will be 0.1mm to 2mm in the 1 to 255 edge measurement mode or when activating the automatic workpiece detection.
If using the optional dual-connection unit for LSM-6200, the measuring range will be 0.05mm to 2mm.
*2: Determined by the value of ±2σ (σ: standard deviation) when measuring ø2mm at the interval of 0.32 sec. (average 1024 times).
*3: Center of the measuring range for cylindrical workpieces outside diameter.
*4: An error of the outside diameter due to variation in workpiece position either in the optical axis direction or in the scanning direction.
*5: The area given by [optical axis direction]×[scanning direction].
*6: If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.
Note: When using extra-fine line measurement function (FINE), guide messages for setting the following will not be displayed: dual-measurement, segment designation, automatic workpiece detection and group judgment.

## DIMENSIONS

Unit: mm




## Optional Accessories

- Multifunctional display unit, **LSM-6200***:

| Order No. | Display type | Remarks |
|---|---|---|
| **544-072A** | English mm/inch | English user's manual |

* Included in packages

- Easy-to-operate display unit, **LSM-5200**:

| Order No. | Remarks |
|---|---|
| **544-047*** | English user's manual |

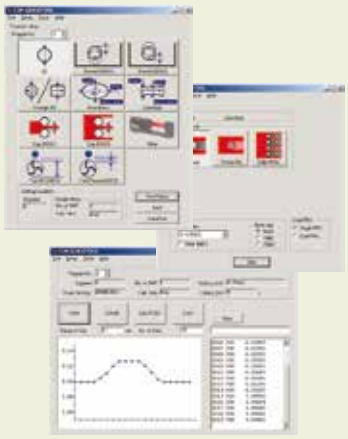
* AC adapter not included

- Calibration gage set (ø0.1, ø2.0)
- Guide pulley : **No.02AGD110**
- Air blower/purge : **No.02AGD200**
- Extension signal cables: : **No.02AGD220**

| Order No. | Cable length |
|---|---|
| **02AGN780A** | 5m |
| **02AGN780B** | 10m |
| **02AGN780C** | 15m |

## QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



## Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 (2007) device. Warning and explanation labels, as shown below, are attached to the Laser Scan Micrometers as is appropriate.






Mitutoyo

# Laser Scan Micrometer LSM-501S

## SERIES 544 — High-accuracy Non-contact Measuring System

- Provides ultra-high accuracy of ±0.5μm over the entire measuring range (0.05 to 10mm).
- Narrow range accuracy of ±(0.3+0.1ΔD)μm for high-precision measurement.
- Ultra-high speed measurement of 3200 scan/sec.
  Suitable for high-speed lines or in applications subject to vibration.



IP64

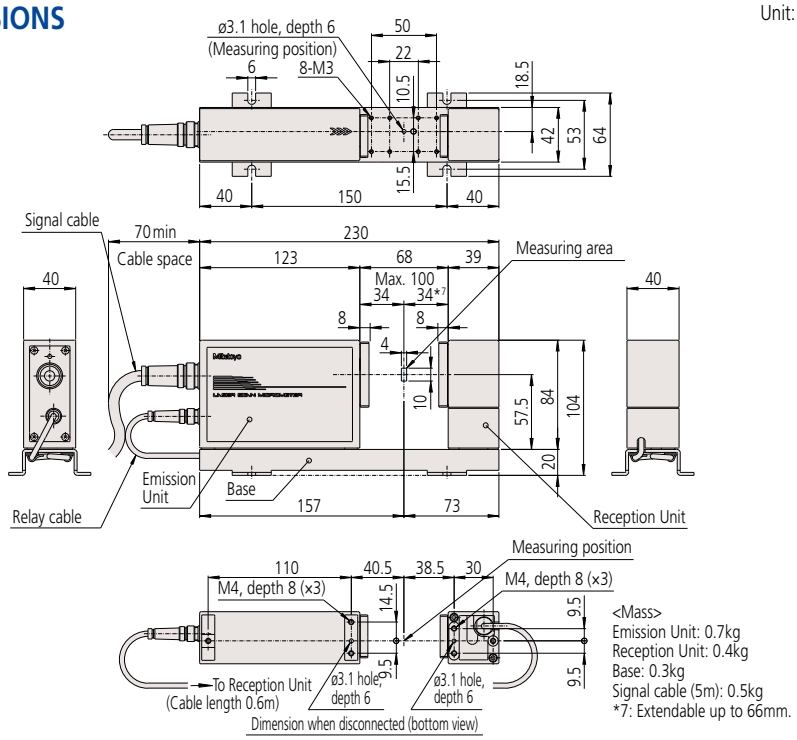
## SPECIFICATIONS

| Order No. (Laser only) | | 544-534 |
|---|---|---|
| Package No. (Laser w/LSM 6200 display) | | 64PKA118 |
| Applicable laser standards | | IEC, FDA |
| User's manual | | English version |
| Measuring range | | .002" to .4" (0.05 to 10mm) |
| Resolution | | .000001" to .0005" (0.01 to 10μm) (selectable) |
| Repeatability*1 | | ±0.04μm |
| Accuracy*2 (20°C) | Whole range | ±0.5μm |
| | Small range | ±(0.3+0.1ΔD)μm*3 |
| Positional error*4 | | ±0.5μm |
| Measuring area*5 | | 2×10mm (ø0.05 to ø0.1mm) 4×10mm (ø0.1 to ø10mm) |
| Scanning rate | | 3200 scans/s |
| Laser wavelength | | 650nm (Visible) |
| Laser scanning speed | | 113m/s |
| Operating environment | Temperature | 0 to 40°C |
| | Humidity | RH 35 to 85% (no condensation) |
| Protection Level | | IP64*6 |

*1: Determined by the value of ±2σ (σ: standard deviation) when measuring ø10mm at the interval of 0.32 sec. (average 1024 times).
*2: Center of the measuring range for cylindrical workpieces outside diameter.
*3: ΔD=Difference in diameter between the master gage and workpiece (Unit: mm)
*4: An error of the outside diameter due to variation in workpiece position either in the optical axis direction or in the scanning direction.
*5: The area given by [optical axis direction]×[scanning direction].
*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

## DIMENSIONS

Unit: mm




<Mass>
Emission Unit: 0.7kg
Reception Unit: 0.4kg
Base: 0.3kg
Signal cable (5m): 0.5kg
*7: Extendable up to 66mm.

## Optional Accessories

- Multifunctional display unit, **LSM-6200***:

| Order No. | Display type | Remarks |
|---|---|---|
| **544-072A** | English mm/inch | English user's manual |

* Included in packages

- Easy-to-operate display unit, **LSM-5200**:

| Order No. | Remarks |
|---|---|
| **544-047*** | English user's manual |

* AC adapter not included

- Calibration gage set (ø0.1, ø10.0) : **No.02AGD120**
- Wire guiding pulley : **No.02AGD210**
- Adjustable workstage : **No.02AGD400**
- Air blower/purge : **No.02AGD230**
- Workstage : **No.02AGD270**
- Extension signal cables

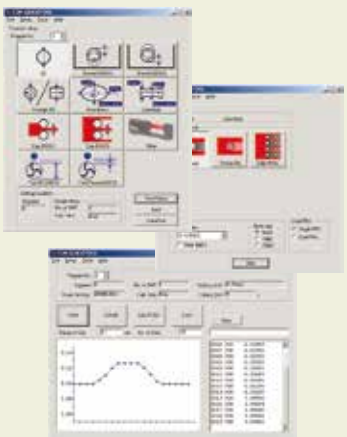
| Order No. | Cable length |
|---|---|
| **02AGN780A** | 5m |
| **02AGN780B** | 10m |
| **02AGN780C** | 15m |

- Extension relay cables

| Order No. | Cable length |
|---|---|
| **02AGC150A** | 1m |

## QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



## Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 (2007) device. Warning and explanation labels, as shown below, are attached to the Laser Scan Micrometers as is appropriate.



# Laser Scan Micrometer LSM-503S

## SERIES 544 — High-accuracy Non-contact Measuring System

- Ensures ±1.0μm accuracy over the entire measuring range (0.3 to 30mm).
- Narrow range accuracy of ±(0.6+0.1ΔD)μm for high-precision measurement.
- Ultra-high speed measurement of 3200 scan/sec.
  Suitable for high-speed lines or in applications subject to vibration.



IP64

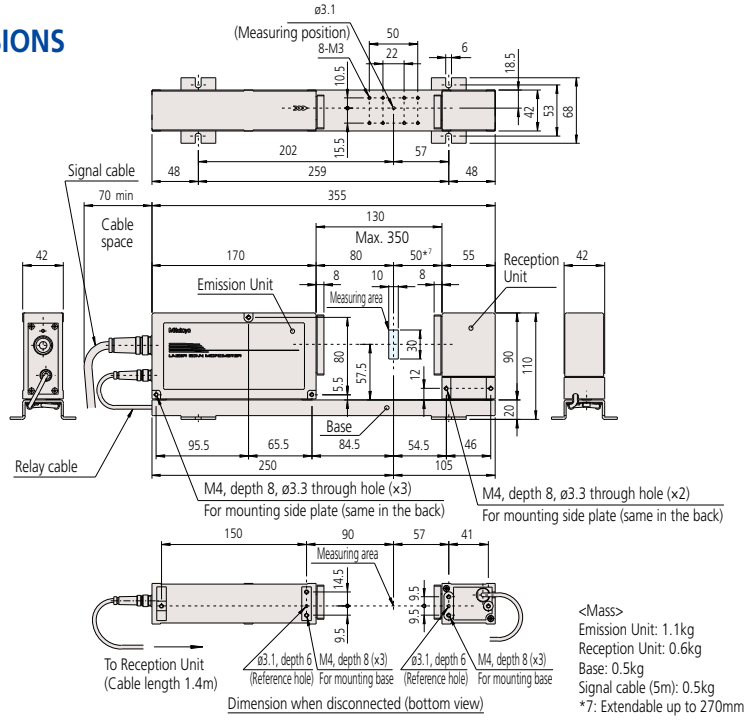
## SPECIFICATIONS

| Order No. (Laser only) | | 544-536 |
|---|---|---|
| Package No. (Laser w/LSM 6200 display) | | 64PKA119 |
| Applicable laser standards | | IEC, FDA |
| User's manual | | English version |
| Measuring range | | .012" to 1.18" (0.3 to 30mm) |
| Resolution | | .000001" to .005" (0.02 to 100μm) (selectable) |
| Repeatability*1 | | ±0.11μm |
| Accuracy*2 (20°C) | Whole range | ±1.0μm |
| | Small range | ±(0.6+0.1ΔD)μm*3 |
| Positional error*4 | | ±1.5μm |
| Measuring area*5 | | 10×30mm (0.3 to 30mm) |
| Scanning rate | | 3200 scans/s |
| Laser wavelength | | 650nm (Visible) |
| Laser scanning speed | | 226m/s |
| Operating environment | Temperature | 0 to 40°C |
| | Humidity | RH 35 to 85% (no condensation) |
| Protection Level | | IP64*6 |

*1: Determined by the value of ±2σ (σ: standard deviation) when measuring ø30mm at the interval of 0.32 sec. (average 1024 times).
*2: Center of the measuring range for cylindrical workpieces outside diameter.
*3: ΔD=Difference in diameter between the master gage and workpiece (Unit: mm).
*4: An error of the outside diameter due to variation in workpiece position either in the optical axis direction or in the scanning direction.
*5: The area given by [optical axis direction]×[scanning direction].
*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

## DIMENSIONS

Unit: mm




<Mass>
Emission Unit: 1.1kg
Reception Unit: 0.6kg
Base: 0.5kg
Signal cable (5m): 0.5kg
*7: Extendable up to 270mm

## Optional Accessories

• Multifunctional display unit, **LSM-6200***:

| Order No. | Display type | Remarks |
|---|---|---|
| **544-072A** | English mm/inch | English user's manual |

* Included in packages

• Easy-to-operate display unit, **LSM-5200**:

| Order No. | Remarks |
|---|---|
| **544-047*** | English user's manual |

* AC adapter not included

• Calibration gage set (ø0.1, ø30.0) : **No.02AGD130**
• Adjustable workstage : **No.02AGD490**
• Air blower/purge : **No.02AGD240**
• Workstage : **No.02AGD270**
• Extension signal cables

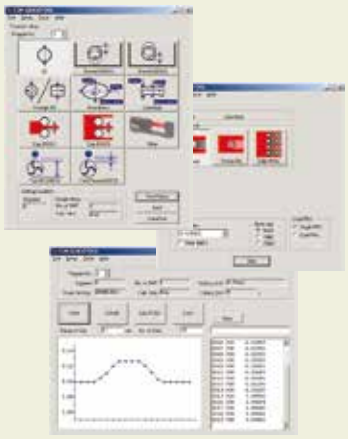
| Order No. | Cable length |
|---|---|
| **02AGN780A** | 5m |
| **02AGN780B** | 10m |
| **02AGN780C** | 15m |
| **02AGN780D** | 20m |

• Extension relay cables

| Order No. | Cable length |
|---|---|
| **02AGC150A** | 1m |
| **02AGC150B** | 3m |
| **02AGC150C** | 5m |

## QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



## Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 (2007) device. Warning and explanation labels, as shown below, are attached to the Laser Scan Micrometers as is appropriate.






Mitutoyo

# Laser Scan Micrometer LSM-506S

## SERIES 544 — High-accuracy Non-contact Measuring System

- Ensures ±3μm accuracy over the entire measuring range (1 to 60mm).
- Narrow range accuracy of ±(1.5+0.5ΔD)μm for high precision measurement.
- Ultra-high speed measurement of 3200 scan/sec. Suitable for high-speed lines or in applications subject to vibration.

IP64



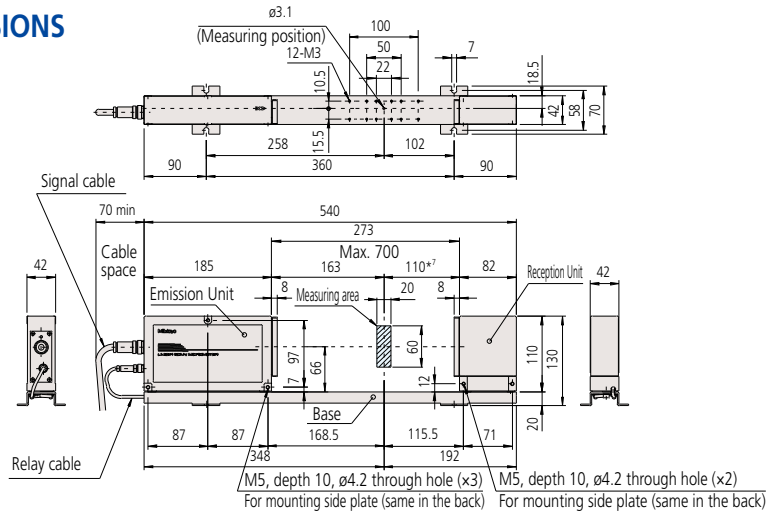
## SPECIFICATIONS

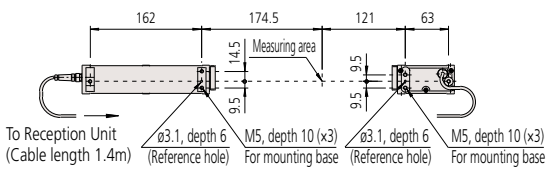
| Order No. (Laser only) | | 544-538 |
|---|---|---|
| Package No. (Laser w/ LSM 6200 display) | | 64PKA120 |
| Applicable laser standards | | IEC, FDA |
| User's manual | | English version |
| Measuring range | | .040" to 2.36" (1 to 60mm) |
| Resolution | | .000002" to .005" (0.05 to 100μm) (selectable) |
| Repeatability*1 | | ±0.36μm |
| Accuracy*2 (20°C) | Whole range | ±3μm |
| | Small range | ±(1.5+0.5ΔD)μm*3 |
| Positional error*4 | | ±4μm |
| Measuring area*5 | | 20×60mm (1 to 60mm) |
| Scanning rate | | 3200 scans/s |
| Laser wavelength | | 650nm (Visible) |
| Laser scanning speed | | 452m/s |
| Operating environment | Temperature | 0 to 40°C |
| | Humidity | RH 35 to 85% (no condensation) |
| Protection Level | | IP64*6 |

*1: Determined by the value of ±2σ (σ: standard deviation) when measuring ø60mm at the interval of 0.32 sec. (average 1024 times).
*2: Center of the measuring range for cylindrical workpieces outside diameter.
*3: ΔD=Difference in diameter between the master gage and workpiece (Unit: mm)
*4: An error of the outside diameter due to variation in workpiece position either in the optical axis direction or in the scanning direction.
*5: The area given by [optical axis direction]×[scanning direction].
*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

## DIMENSIONS

Unit: mm




Dimension when disconnected (bottom view)

<Mass>
Emission Unit: 1.4kg
Reception Unit: 0.8kg
Base: 0.8kg
Signal cable (5m): 0.5kg
*7: Extendable up to 537mm

## Optional Accessories

- Multifunctional display unit, **LSM-6200***:

| Order No. | Display type | Remarks |
|---|---|---|
| **544-072A** | English mm/inch | English user's manual |

* Included in packages

- Easy-to-operate display unit, **LSM-5200**:

| Order No. | Remarks |
|---|---|
| **544-047*** | English user's manual |

* AC adapter not included

- Calibration gage set (ø1.0, ø60.0) : **No.02AGD140**
- Adjustable workstage : **No.02AGD520**
- Air blower/purge : **No.02AGD250**
- Extension signal cables

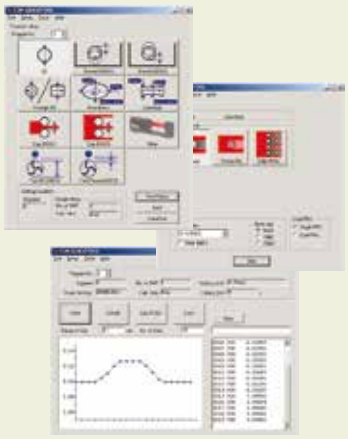
| Order No. | Cable length |
|---|---|
| **02AGN780A** | 5m |
| **02AGN780B** | 10m |
| **02AGN780C** | 15m |
| **02AGN780D** | 20m |

- Extension relay cables

| Order No. | Cable length |
|---|---|
| **02AGC150A** | 1m |
| **02AGC150B** | 3m |
| **02AGC150C** | 5m |

## QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



## Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 (2007) device. Warning and explanation labels, as shown below, are attached to the Laser Scan Micrometers as is appropriate.



# Laser Scan Micrometer LSM-512S

## SERIES 544 — High-accuracy Non-contact Measuring System

- Ensures ±6µm accuracy over the entire measuring range (1 to 120mm).
- Narrow range accuracy of ±(4.0+0.5ΔD)µm for high-precision measurement.
- Ultra-high speed measurement of 3200 scan/sec. Suitable for high speed-lines or in applications subject to vibration.

IP64



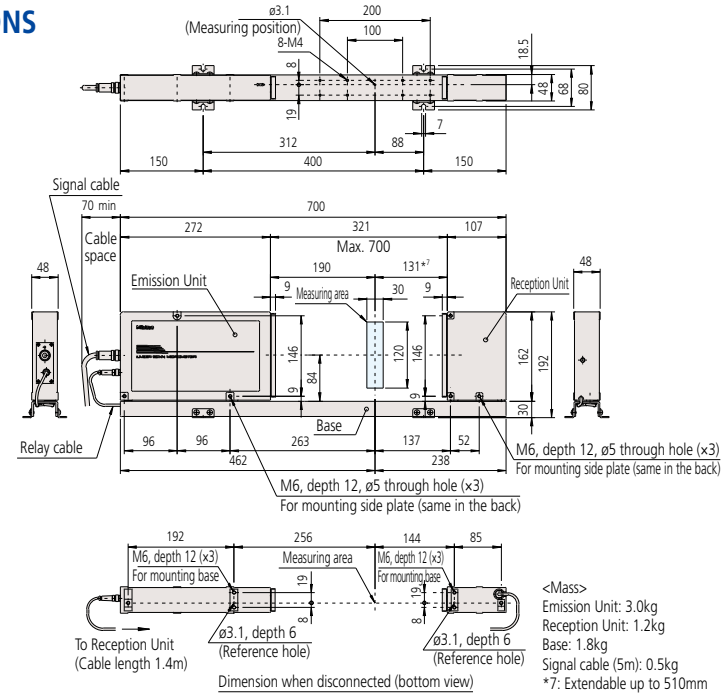
## SPECIFICATIONS

| Order No. (Laser only) | | 544-540 |
|---|---|---|
| Package No. (Laser w/ LSM 6200 display) | | 64PKA121 |
| Applicable laser standards | | IEC, FDA |
| User's manual | | English version |
| Measuring range | | .040" to 4.72" (1 to 120mm) |
| Resolution | | .000005" to .005" (0.1 to 100µm) (selectable) |
| Repeatability*1 | | ±0.85µm |
| Accuracy*2 (20°C) | Whole range | ±6µm |
| | Small range | ±(4.0+0.5ΔD)µm*3 |
| Positional error*4 | | ±8µm |
| Measuring area*5 | | 30×120mm (1 to 120mm) |
| Scanning rate | | 3200 scans/s |
| Laser wavelength | | 650nm (Visible) |
| Laser scanning speed | | 904m/s |
| Operating environment | Temperature | 0 to 40°C |
| | Humidity | RH 35 to 85% (no condensation) |
| Protection level | | IP64*6 |

*1: Determined by the value of ±2σ (σ: standard deviation) when measuring ø120mm at the interval of 0.32 sec. (average 1024 times).
*2: Center of the measuring range for cylindrical workpieces outside diameter.
*3: ΔD=Difference in diameter between the master gage and workpiece (Unit: mm)
*4: An error of the outside diameter due to variation in workpiece position either in the optical axis direction or in the scanning direction.
*5: The area given by [optical axis direction]×[scanning direction].
*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

## DIMENSIONS

Unit: mm




<Mass>
Emission Unit: 3.0kg
Reception Unit: 1.2kg
Base: 1.8kg
Signal cable (5m): 0.5kg
*7: Extendable up to 510mm

## Optional Accessories

• Multifunctional display unit, **LSM-6200***:

| Order No. | Display type | Remarks |
|---|---|---|
| **544-072A** | English mm/inch | English user's manual |

* Included in packages

• Easy-to-operate display unit, **LSM-5200**:

| Order No. | Remarks |
|---|---|
| **544-047*** | English user's manual |

* AC adapter not included

• Calibration gage set (ø20.0, ø120.0) : **No.02AGD150**
• Air blower/purge : **No.02AGD260**
• Extension signal cables

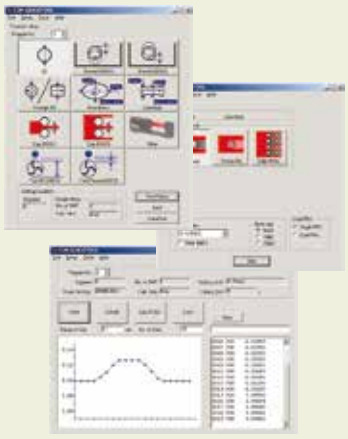
| Order No. | Cable length |
|---|---|
| **02AGN780A** | 5m |
| **02AGN780B** | 10m |
| **02AGN780C** | 15m |
| **02AGN780D** | 20m |

• Extension relay cables

| Order No. | Cable length |
|---|---|
| **02AGC150A** | 1m |
| **02AGC150B** | 3m |
| **02AGC150C** | 5m |

## QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



## Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 (2007) device. Warning and explanation labels, as shown below, are attached to the Laser Scan Micrometers as is appropriate.






Mitutoyo

# Laser Scan Micrometer LSM-516S

## SERIES 544 — High-accuracy Non-contact Measuring System

- Ensures ±7µm accuracy over the entire measuring range (1 to 160mm).
- Narrow range accuracy of ±(4.0+2.0ΔD)µm for high-precision measurement.
- Ultra-high speed measurement of 3200 scan/sec.
  Suitable for high-speed lines or in applications subject to vibration.

IP64



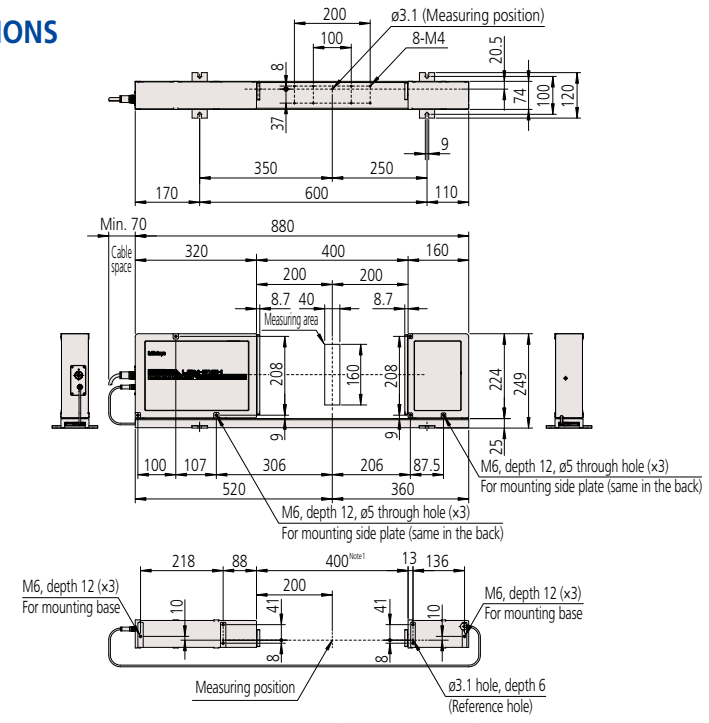
## SPECIFICATIONS

| Order No. (Laser only) | | **544-542** |
|---|---|---|
| Package No. (Laser w/ LSM 6200 display) | | **64PKA122** |
| Applicable laser standards | | IEC, FDA |
| User's manual | | English version |
| Measuring range | | .040" to 6.3" (1 to 160mm) |
| Resolution | | .000005" to .005" (0.1 to 100µm) (selectable) |
| Repeatability*1 | | ±1.4µm |
| Accuracy*2 (20°C) | Whole range | ±7µm |
| | Small range | ±(4.0+2.0ΔD)µm*3 |
| Positional error*4 | | ±8µm |
| Measuring area*5 | | 40×160mm (1 to 160mm) |
| Scanning rate | | 3200 scans/s |
| Laser wavelength | | 650nm (Visible) |
| Laser scanning speed | | 1206m/s |
| Operating environment | Temperature | 0 to 40°C |
| | Humidity | RH 35 to 85% (no condensation) |
| Protection level | | IP64*6 |

*1: Determined by the value of ±2σ (σ: standard deviation) when measuring ø160mm at the interval of 0.32 sec. (average 1024 times).
*2: Center of the measuring range for cylindrical workpieces outside diameter.
*3: ΔD=Difference in diameter between the master gage and workpiece (Unit: mm)
*4: An error of the outside diameter due to variation in cylinder position either in the optical axis direction or in the scanning direction.
*5: The area given by [optical axis direction]×[scanning direction].
*6: The protection level provided for the interior. If the workpiece or glass of the measuring unit window is soiled by water or dust, the unit may malfunction.

## DIMENSIONS

Unit: mm




Note1: Distance between emission unit and reception unit: 400mm to 800mm

## Optional Accessories

- Multifunctional display unit, **LSM-6200***:

| Order No. | Display type | Remarks |
|---|---|---|
| **544-072A** | English mm/inch | English user's manual |

* Included in packages

- Easy-to-operate display unit, **LSM-5200**:

| Order No. | Remarks |
|---|---|
| **544-047*** | English user's manual |

* AC adapter not included

- Calibration gage set (ø20, ø160) : **No.02AGM300**
- Extension signal cables

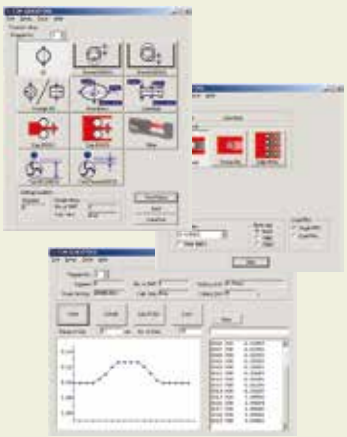
| Order No. | Cable length |
|---|---|
| **02AGN780A** | 5m |
| **02AGN780B** | 10m |
| **02AGN780C** | 15m |
| **02AGN780D** | 20m |

- Extension relay cables

| Order No. | Cable length |
|---|---|
| **02AGC150A** | 1m |
| **02AGC150B** | 3m |
| **02AGC150C** | 5m |

## QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



## Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 (2007) device. Warning and explanation labels, as shown below, are attached to the Laser Scan Micrometers as is appropriate.



# Laser Scan Micrometer LSM-9506

## SERIES 544 — Bench-top Type Non-contact Measuring System

- Bench-top type with integrated display unit includes many functions equivalent to the multi-function display unit.



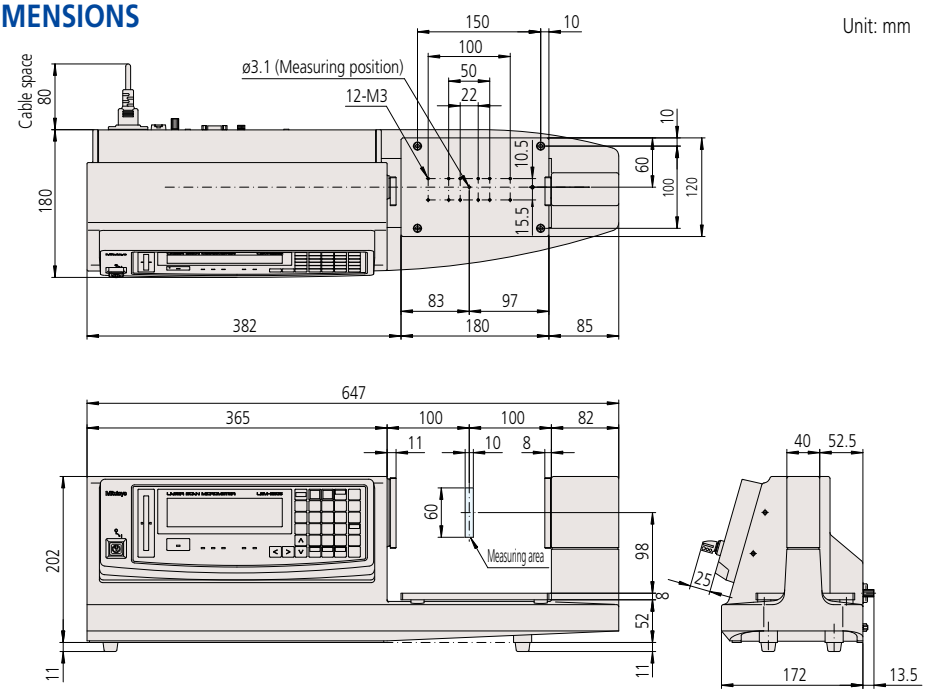
## SPECIFICATIONS

| Order No. | **544-116-1A** |
|---|---|
| Type | inch/mm |
| Measuring range | .02" - 2.36"/ 0.5 - 60mm |
| Resolution | .000002" - .005"/ 0.00005 - 0.1mm |
| Repeatability*1 | ±0.6µm (±.00003") |
| Accuracy*2 (20°C) | ±2.5µm (±.0001") |
| Positional error*3 (optical axis/scanning direction) | ±2.5µm (±.0001") L: Displacement between workpiece center and optical axis center |
| Measuring area*4 | ±5x60mm (±.2x2.36") |
| Scanning rate | 1600 scans/s |
| Laser wavelength | 650nm (Visible)*5 |
| Laser scanning speed | 226m/s (8900" / s) |
| Display unit | 16-digit dot matrix (upper column) + 7 segment 11-digit (lower column),guidance LEDs |
| Standard interface | RS-232C, Digimatic code output unit (1ch) |
| Optional interface | No |
| Power supply | 120 V AC ±10%, 40VA, 60Hz |
| Operating environment | 0 to 40°C, RH 35 to 85% (no condensation) |

*1: Determined by the value of ±2σ (σ: standard deviation) when measuring ø10mm at the interval of 0.32 sec. (average 1024 times).
*2: Center of the measuring range for cylindrical workpieces outside diameter.
*3: An error of the outside diameter due to variation in workpiece position either in the optical axis direction or in the scanning direction.
*4: The area given by [optical axis direction]×[scanning direction].
*5: FDA Class II (544-116-1A)/IEC Class 2 semiconductor laser for scanning. (Maximum power: 1.0mW)

## DIMENSIONS

Unit: mm




## Optional Accessories

**02AGD170**
Calibration gage set (ø1.0mm, ø60mm)



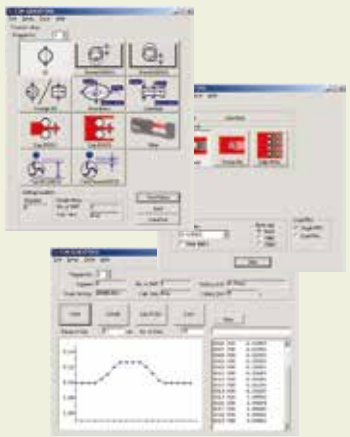
**02AGD680** Adjustable workstage
**02AGD580** Center support*
**02AGD590** Adjustable V-block*
**936937** SPC output cable (1m)
**937179T** Footswitch
**264-016** USB input tool for spreadsheets (SPC cable also required)

*Use with an adjustable workstage.

*1: Determined by the value for ±2σ at the measurement interval of 0.32 sec.
*2: At the center of the measuring region.
*3: An error due to workpiece shift either in the optical axis direction or in the scanning direction. L= Distance between the center of workpiece and the center of optical axis (in mm or inches).
*4: The area given by measuring range on the optical axis x measuring range in the scanning direction.
*5: FDA Class II (**544-116-1A**) semiconductor laser for scanning (Maximum power: 1.0mW)

## QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



## Laser safety

Mitutoyo Laser Scan Micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 (2007) device. Warning and explanation labels, as shown below, are attached to the Laser Scan Micrometers as is appropriate.



# LSM-6200 Display Unit

## SERIES 544 — Standard Display Unit for Laser Scan Micrometer

- 2-axis display unit enables 2 items to be displayed simultaneously.
- Capable of statistical analysis such as: average, maximum value, minimum value, range (max. - min.) and more.
- Segment measurement (7 points) or edge measurement (1 to 255 edge) can be selected.
- A function to eliminate abnormal values is standard.
- 100 tolerance values, preset values or settings can be stored.



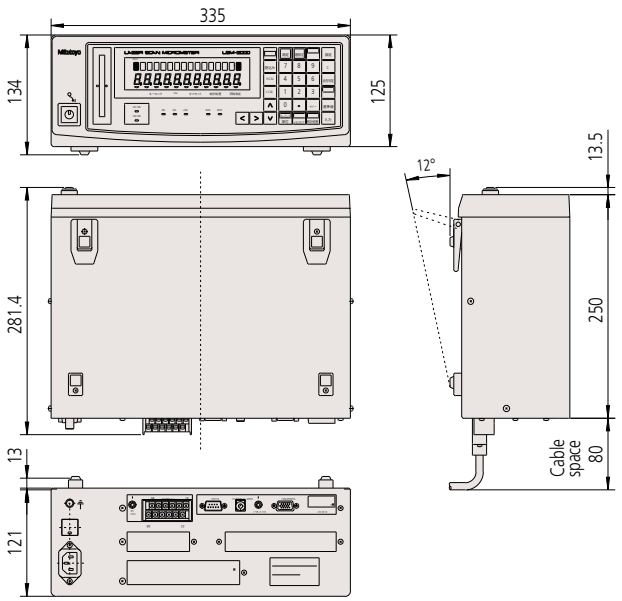
## SPECIFICATIONS

| Order No. | **544-072A** |
|---|---|
| Type | inch/mm |
| Display | 16-digit plus 11-digit fluorescent display and guide message LED |
| Segment | 1 to 7 (1 to 3, transparent) or 1 to 255 edges*1 |
| Averaging method | Arithmetic average: per 8 to 2048/ Moving average: per 32 to 2048 (Arithmetic average is per 16 to 2048 when using **544-531**, **544-532**) |
| Judgment | Selection from target value + tolerance, lower tolerance + upper tolerance, or 7 classes multi-limit tolerance zone. |
| Measurement mode | Standby, Single measurement, Continuous measurement |
| Statistical analysis | Maximum, Minimum, Average, Dispersion, σ (S.D) |
| Size | 335 (W)×134 (H)×250 (D)mm |
| Power supply | 120 V AC ±10%, 40VA, 60Hz |
| Standard I/F | RS-232C, Analog I/O |
| Optional I/F | Digimatic code output unit (2-ch), 2nd I/O analog I/F, BCD I/F |
| Operating environment | 0 to +45°C, RH 35 to 85% (no condensation) |
| Others | Nominal setting, sample setting, selection of unnecessary digits, transparent object measurement*2, measurement of odd fluted parts, automatic measurement in edge mode, output timer, abnormal data elimination, SHL change, group judgment, simultaneous measurement, statistical processing, mastering, buzzer function, automatic workpiece detection (dimension/position)*1, zero-set/offset, dual measurement (optional) |

*1: The measuring range will be 0.1mm to 2mm in the 1 to 255 edge measurement mode or when activating the automatic workpiece detection with **544-531**, **544-532**.
Each function has its combination limit.
*2: The measuring range is 50µm to 2mm when using **544-531**, **544-532**. For smaller range, contact your local Mitutoyo sales office.
** Cannot be connected to **544-499A** .
** Previous models such as **544-451** cannot be connected.

## DIMENSIONS

Unit: mm

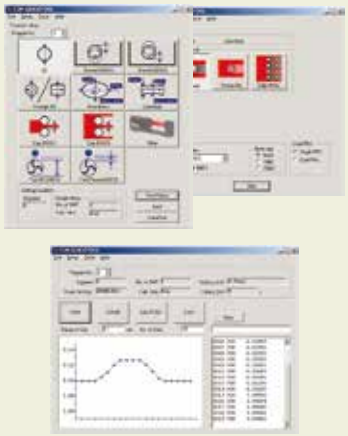



## Optional Accessories

**12AAA807** Serial cable (RS-232C null)
**937179T** Footswitch
**02AGN780A, B, C, D** Extension Signal Cables
**02AGC840** Digimatic output card
**02AGP150** Dual Input Card
**02AGC910** BCD output
**02AGC880** 2nd analog output card
**02AGD600B** Printer

## QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



# LSM-5200 Display Unit

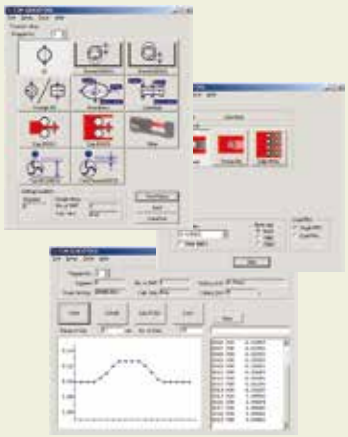
## SERIES 544 — Compact Display Unit for Real-time Multi-channel Measurement

- A compact controller which could be used for multi-unit system configurations.
- Capable of simple connection to a PC via USB.
- A panel-mount type display unit designed for the LSM-S series.
- Analog I/O and RS-232C is standard.
- Measurement of odd fluted parts, and simultaneous measurement / 2-program function included.



### QUICKTOOL

QUICKTOOL is a free downloadable software program that makes programming the LSM-6200 quick and easy.
Basic data acquisition is also possible.
(Connecting cables to PC are optional)



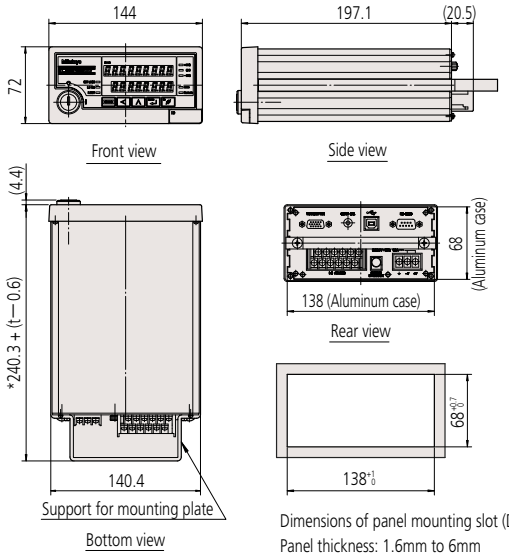
### SPECIFICATIONS

| Order No. | **544-047** |
|---|---|
| Display | 9 digits plus 8 digits LED, guide message LED |
| Segment | 1 to 7 (1 to 3, transparent) or 1 to 255 edges*1 |
| Averaging method | Arithmetic average: from 4 to 2048; Moving average: from 32 to 2048 (Arithmetic average is from 16 to 2048 when using LSM-500S.) |
| Judgment | Selecting from target value ± tolerance value or lower limit/upper limit. |
| Measurement mode | Standby, Single measurement, Continuous measurement |
| Statistical analysis | Calculation result is output via USB or RS-232C. |
| External dimensions | 144 (W)×72 (H)×197.1 (D)mm |
| Power supply*3 | 24V DC±10%, 1.3A or more (AC adapters are optional) |
| Standard I/F | USB2.0, RS-232C, I/O analog |
| Operating environment | 0 to 40°C, RH 35 to 85% (no condensation) |
| Preservation environments | –20 to 70°C, RH 35 to 85% (no condensation) |
| Others | Measurement of odd fluted parts, simultaneous measurement, nominal setting, sample setting, selection of unnecessary digits, transparent object measurement*2<br>Automatic workpiece detection (dimension/position detected)*1, abnormal data elimination, mastering, statistical processing (when using USB, RS-232C), output timer, automatic measurement in edge mode, presetting<br>note that every function is limited in its combination possibilities. See the user manual for details. |
| Mass | 1.4 kg |

*1: The measuring range will be 0.1mm to 2mm in the 1 to 255 edge measurement mode or when activating the automatic workpiece detection with **544-531**, **544-532**.
Each function has its combination limit.
*2: The measuring range is 50µm to 2mm when using **544-531**, **544-532**. For smaller ranges, contact your local Mitutoyo sales office.
*3: DC24V external power supply (commercial item) is required separately.
Note 1: Cannot be connected to **544-499A** .
Note 2: Previous models such as **544-451** cannot be connected.
Note 3: For USB communication with a PC, a dedicated device driver is required. For details, contact your local Mitutoyo sales office.

### DIMENSIONS

Unit: mm




Panel thickness: 1.6mm to 6mm

Dimensions of panel mounting slot (DIN 43 700-144x76)
Panel thickness: 1.6mm to 6mm
Mass: 1.4kg



Mitutoyo

# Laser Scan Micrometer

## SERIES 544 Optional Accessories

### Calibration Gage Set



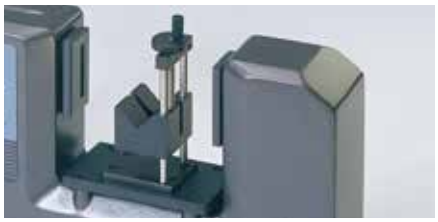
- Standard cylinder gage set suitable for calibration of Laser Scan Micrometers.
- Nominal gage diameters (1 to 160mm) are as given in specifications.




### SPECIFICATIONS

| For calibrating models | | 544-499A | 544-532 | 544-534 | 544-536 | 544-538 | 544-540 | 544-542 | 544-116-1A |
|---|---|---|---|---|---|---|---|---|---|
| | | LSM-6902H | LSM-500S | LSM-501S | LSM-503S | LSM-506S | LSM-512S | LSM-516S | LSM-9506 |
| Set No. | | 02AGD180 | 02AGD110 | 02AGD120 | 02AGD130 | 02AGD140 | 02AGD150 | 02AGM300 | 02AGD170 |
| Configuration (Order No.) | Stand | 02AGD181 | 02AGD111 | 02AGD121 | 02AGD131 | 02AGD141 | 02AGD151 | 02AGM320 | 02AGD171 |
| | Gages | ø1: 02AGD920<br>ø25: 02AGD963 | ø0.1: 958200<br>ø2 : 958202 | ø0.1: 958200<br>ø10: 229317 | ø1: 02AGD920<br>ø30: 02AGD961 | ø1: 02AGD920<br>ø60: 02AGD962 | ø20: 229730<br>ø120: 234072 | ø20: 229730<br>ø160: 02AGM303 | ø1: 02AGD920<br>ø60: 02AGD962 |
| | Carrying case | 02AGD190 | 958203 | 958203 | 02AGD980 | 02AGD980 | 02AGD990 | 02AGM310 | 02AGD970 |

### Workstage



Installation example



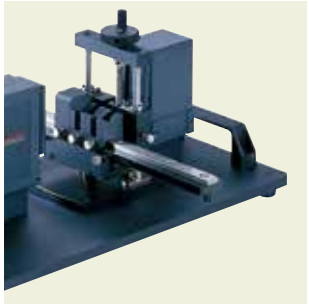
- Easy set-up and height adjustment enables high-precision measurement.

### SPECIFICATIONS

| Model | 544-534<br>544-536<br>544-499A |
|---|---|
| Order No. | 02AGD270 |

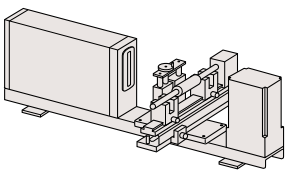
### Adjustable workstage

- Vertical/horizontal slide mechanism enables easy measurement of various workpiece diameters.
- Best suited for quality assurance of high-precision pin gages.

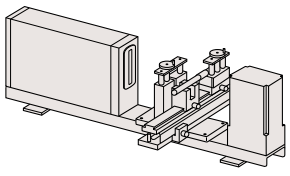


### Measurement Examples

- Roller of copying machine



- Pin gage or plug gage



### Basic configuration

| Basic set | Order No. | Applicable model | Standard accessories | Measuring range (mm) | Horizontal stroke (mm) | Vertical stroke (mm) |
|---|---|---|---|---|---|---|
| (1) Main unit<br>(2) V-block<br>(3) Stop | 02AGD280 | 544-499A | V-block (02AGD420), 2 pcs<br>Stopper (02AGD430), 1 pc | 0.1 - 25 | 130 | 47 |
| | 02AGD400 | 544-534 | | 0.05 - 10 | 130 | 32 |
| | 02AGD490 | 544-536 | | 0.3 - 30 | 200 | 35 |
| | 02AGD520 | 544-538 | V-block A (02AGD550), 2 pcs<br>V-block B (02AGD550), 1 pc<br>V-block C (02AGD570), 1 pc | 1 - 60 | 300 | 45 |
| | 02AGD370 | 544-116-1A | | 0.5 - 60 | 200 | 45 |
| | 02AGD680 | | | 0.5 - 60 | 300 | 45 |

* The stop is not included in the basic set for **544-538**, **544-116**.

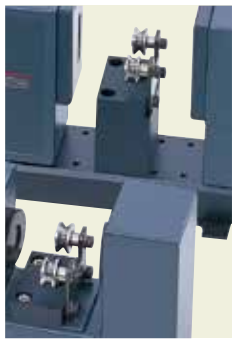
- Optional parts for the adjustable workstage, such as center support, adjustable V-block (up/down) etc., are available.

# Laser Scan Micrometer

## SERIES 544 Optional Accessories

### Guide pulley

- Used for supporting measurement of outside diameter of fine wire-like materials such as magnetic wire or fiber.



## SPECIFICATIONS

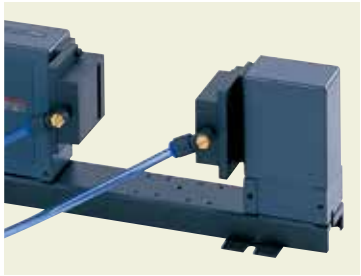
| Model | 544-532 | 544-534 |
|---|---|---|
| Order No. | 02AGD200 | 02AGD210 |

Each measurement range is as follows:
**544-532**: ø5µm to ø1.6mm
**544-534**: ø50µm to ø2mm

For calibration, the calibration gage set for **544-532** (**No.02AGD110**) is required.

### Air shield driven by air supply unit

- Air blows from the air outlet installed on the laser section to clear dust from adhering to the laser window.



## SPECIFICATIONS

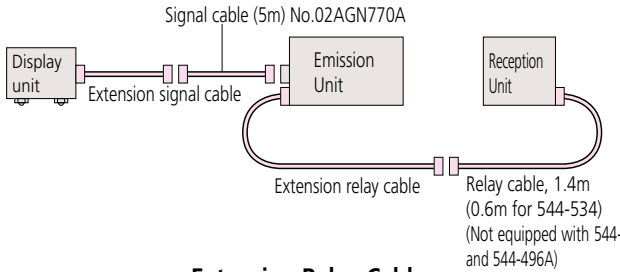
| Air supply unit | Air shield | Applicable models |
|---|---|---|
| No.957608 | **No.02AGD220** | **544-532** |
| | **No.02AGD230** | **544-534** |
| | **No.02AGD240** | **544-536** |
| | **No.02AGD250** | **544-538** |
| | **No.02AGD260** | **544-540** |

| Air shield | Quantity |
|---|---|
| **No.02AGD220/No.02AGD230** | 6 |
| **No.02AGD240** | 3 |
| **No.02AGD250/No.02AGD260** | 1 |

*1: Air shield and air supply unit are sold separately. An air supply unit includes a flow regulating valve and filter. Note, however, that clean air should be supplied.
*2: Air shield is supplied with 5m air tube (Outside diameter: 6mm).
*3: Air supply unit is compatible with air tube of 9mm internal diameter.

### Extension Signal Cable / Extension Relay Cable

- Extension signal cables are necessary when the measuring unit and display unit are separated in operation. Extension relay cables are necessary when the optical section is separated in operation.




## SPECIFICATIONS

### Extension Signal Cable

| Order No. | Cable length |
|---|---|
| **02AGN780A** | 5m |
| **02AGN780B** | 10m |
| **02AGN780C** | 15m |
| **02AGN780D** | 20m |

### Extension Relay Cable

| Order No. | Cable length |
|---|---|
| **02AGC150A** | 1m |
| **02AGC150B** | 3m |
| **02AGC150C** | 5m |

* For **544-532** and **544-534** the allowable maximum length for signal cable is 20m; relay cable is 2m.
* For **544-536**, **544-538**, **544-540** and **544-542** the allowable maximum length for signal cable is 30m; relay cable is 5m.
* The maximum extension length of the signal cable and relay cable is 32m in total.
* Cannot be used with **544-499A** .

# Laser Scan Micrometer

## SERIES 544 Optional Accessories

### Thermal printer DPU-414



- Measurement data can be printed.

#### SPECIFICATIONS

| Order No. | **02AGD600B** |
|---|---|
| Printing method | Thermal dot matrix |
| Printing capacity | 40 Columns (Normal) |
| Character configuration | 9×8 dot matrix |
| Printing direction | Bidirectional |
| Interface | RS-232C |
| Power supply | AC 100-240V 50/60Hz (AC adapter) |
| Standard accessories | Printer cable 2m (**02AGD620A**), Printer paper 1 roll, AC adapter |
| Printer paper (optional) | Order **No.223663** (10-roll set) |

### Foot switch

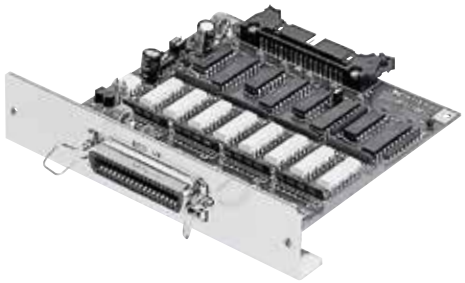


- **937179T**
- For LSM order **544-072A**, **544-499A** , **544-116-1A**

# Interface for LSM6200, 6900

## Optional Accessories

### BCD Interface



- Outputs measurement data in BCD output (7-digit) or HEX output.
- Data logic can be switched.
- Isolated I/O circuitry
- Available for **544-072A**, **544-499A** .

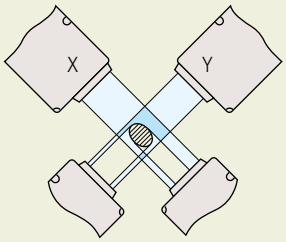
#### SPECIFICATIONS

| Order No. | **02AGC910** |
|---|---|
| Standard accessories | Connector (DDK) **57-30360** (**No.214188**) |

# Laser Scan Micrometer

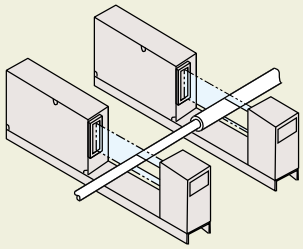
## SERIES 544 Optional Accessories

### XY Measurement

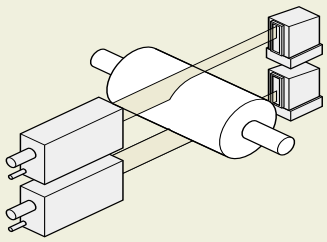



(X–Y): flatness
(X+Y)/2: average
* XY requires 10mm-interval.

### Parallel Measurement



### Large-diameter Measurement



### Digimatic Code Output Unit



- 2-channel digimatic code output
- In simultaneous measurement, measurement data are output as follows:
  Program No.0 to No.4 in OUTPUT-1
  Program No.5 - No.9 in OUTPUT-2 (10 programs operated)
- 10 pin MIL type connector.
- Output cable is not supplied.
  Connecting cable (optional) 1m (**No.936937**)
- Available for **544-072A**, **544-499A** .

* Output is 6 digits of measurement data.
* Displaying 6th and 7th digit after the decimal point is not supported.

#### SPECIFICATIONS

| Order No. | 02AGC840 |
|---|---|

### Dual Connection Unit



- Enables second unit connection to the **544-072A**. (both units must be the same model)

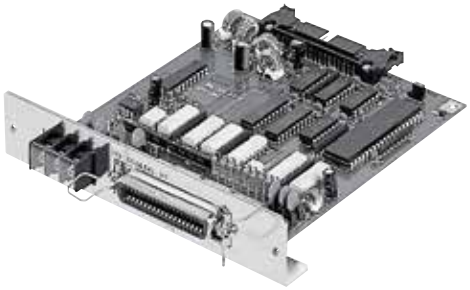
* Cannot be used for **544-499A** .

- Depending on the layout of the two measuring units, large-diameter measurement, XY measurement and parallel measurement are possible.
- Both of the measuring units and display units can be simultaneously operated.

#### SPECIFICATIONS

| Order No. | 02AGP150 |
|---|---|

### 2nd I/O Analog I/F



- I/O, analog output.
- Simultaneous measurement is supported by two pairs of go/no-go judgment outputs.
- Available for **544-072A**, **544-499A** .

#### SPECIFICATIONS

| Order No. | 02AGC880 |
|---|---|
| Standard accessories | Connector (DDK) **57-30360** (**No.214188**) |

### Cable for BCD and 2nd I/O Simultaneous Mount

- Both BCD (**No.02AGC910**) and 2nd I/O analog I/F (**No.02AGC880**) can be mounted on **544-072A**, **544-499A** using this cable.

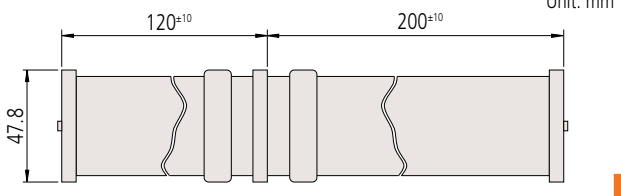
* If using this cable, the dual-connection unit (**No.02AGP150**) cannot be used.

#### SPECIFICATIONS

| Order No. | 02AGE060 |
|---|---|

#### DIMENSIONS

Unit: mm






Mitutoyo

## Compatibility

Your laser scan micrometer has been adjusted together with the ID unit, which is supplied with the measuring unit. The ID unit, which has the same code number and the same serial number as the measuring unit, must be installed in the display unit. This means that if the ID unit is replaced, the measuring unit can be connected to another corresponding display unit.

## The workpiece and measuring conditions

Depending on whether the laser is visible or invisible, the workpiece shape, and the surface roughness, measurement errors may result. If this is the case, perform calibration with a master workpiece which has dimensions, shape and surface roughness similar to the actual workpiece to be measured.
If measurement values show a large degree of dispersion due to the measuring conditions, increase the number of scans for averaging to improve the measurement accuracy.

## Electrical interference

To avoid operational errors, do not route the signal cable and relay cable of the laser scan micrometer alongside a high voltage line or other cables capable of inducing noise current in nearby conductors. Ground all appropriate units and cable shields.

## Connection to a computer

If the laser scan micrometer is to be connected to an external personal computer via the RS-232C interface, ensure that the cable connections conform to the specification.

## Laser safety

Mitutoyo laser scan micrometers use a low-power visible laser for measurement. The laser is a CLASS 2 EN/IEC60825-1 (2007) device. Warning and explanation labels, as shown below, are attached to the laser scan micrometers as appropriate.

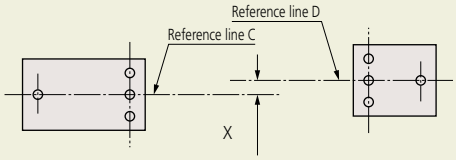



## Re-assembly after removal from the base

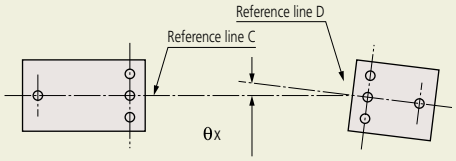
Observe the following limits when re-assembling the emission unit and reception unit to minimize measurement errors due to misalignment of the laser's optical axis with the reception unit.

### Alignment within the horizontal plane

a. Parallel deviation between reference lines C and D:
X (in the transverse direction)

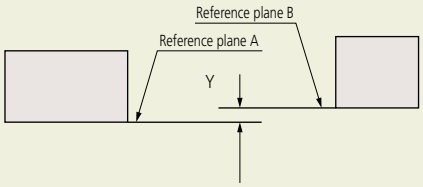



b. Angle between reference lines C and D: θx (angle)

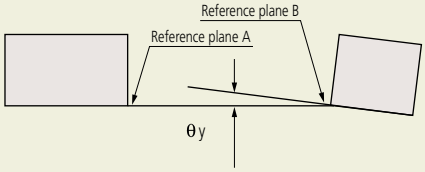



### Alignment within the vertical plane

c. Parallel deviation between reference planes A and B: Y (in height)




d. Angle between reference planes A and B: θy (angle)




### Allowable limits of optical axis misalignment

| Model | Distance between Emission Unit and Reception Unit | X and Y | θx and θy |
|---|---|---|---|
| 544-533, 544-534 | 68mm ( 2.68") or less | within 0.5mm (.02") | within 0.4° (7mrad) |
| | 100mm ( 3.94") or less | within 0.5mm (.02") | within 0.3° (5.2mrad) |
| 544-535, 544-536 | 130mm ( 5.12") or less | within 1mm (.04") | within 0.4° (7mrad) |
| | 350mm (13.78") or less | within 1mm (.04") | within 0.16° (2.8mrad) |
| 544-537, 544-538 | 273mm (10.75") or less | within 1mm (.04") | within 0.2° (3.5mrad) |
| | 700mm (27.56") or less | within 1mm (.04") | within 0.08° (1.4mrad) |
| 544-539, 544-540 | 321mm (12.64") or less | within 1mm (.04") | within 0.18° (3.6mrad) |
| | 700mm (27.56") or less | within 1mm (.04") | within 0.08° (1.4mrad) |
| 544-541, 544-542 | 800mm (31.50") or less | within 1mm (.04") | within 0.09° (1.6mrad) |

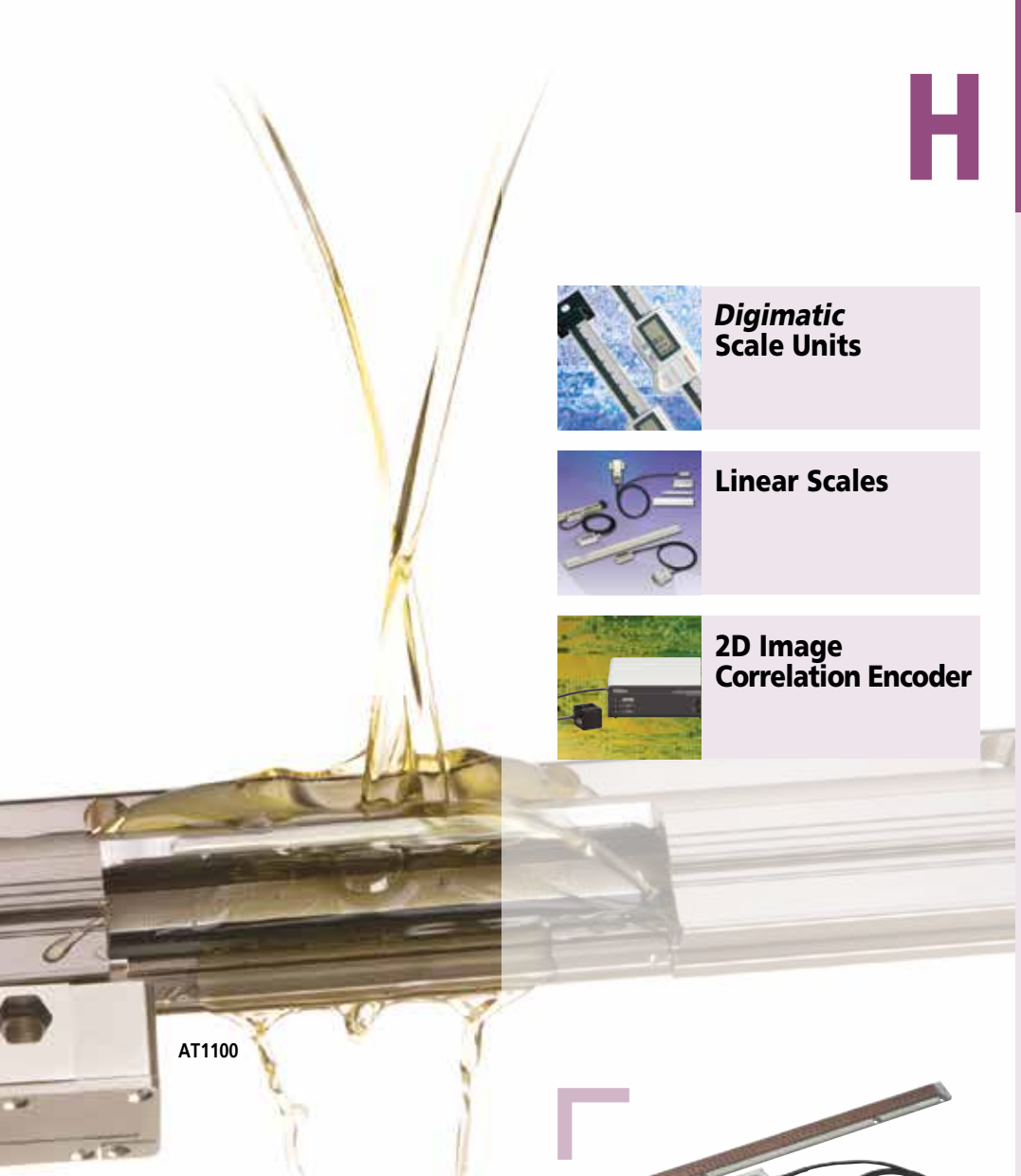
## *Digimatic* Scale Units



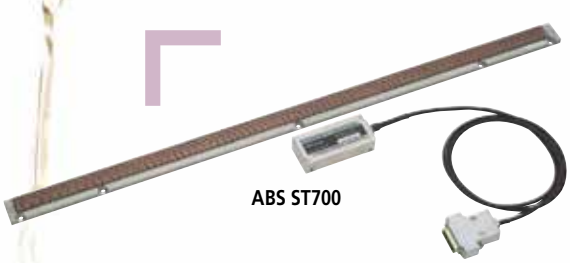
## Linear Scales



## 2D Image Correlation Encoder



AT1100



ABS ST700



MICSYS-SA1



ST-F11
Fiber Scale

## INDEX


| | |
|---|---|
| **Digimatic Scale Units** | |
| SD ABSOLUTE Digimatic Scale Units | H-2,3 |
| ABSOLUTE Digimatic Scale Units | H-4,5 |
| Quill Kit with Absolute Encoder | H-6 |
| KA-200 Counter | H-7 |
| KLD200 Counter | H-7 |
| **Linear Scales** | |
| Linear Scale Counter | H-8 |
| Digital Readout/ DRO packages 2-Axis/3-Axis Travels | H-9 |
| Linear Scales System Diagram | H-10,11 |
| Linear Scales ABS AT1100 | H-12 |
| Linear Scales ABS AT300 | H-13 |
| Linear Scales ABS AT715 | H-14 |
| Linear Scales ABS AT500 | H-15 |
| Linear Scales ABS ST700 | H-16 |
| Linear Scales ABS ST1300 | H-17 |
| MICSYS | H-18 |
| Linear Scales AT103 | H-19 |
| Linear Scales AT113 | H-20 |
| Linear Scales AT112-F | H-21 |
| Linear Scales AT116 | H-22 |
| Linear Scales AT402E | H-23 |
| Linear Scales AT203 | H-24 |
| Linear Scales AT216-T / AT217-TL | H-25 |
| AT211-A (Multipoint mounting), AT211-B (Double-end mounting) | H-26 |
| Linear Scales ST422 | H-27 |
| Linear Scales ST46-EZA | H-28 |
| Linear Scales ST36 | H-29 |
| Fiber Scale ST-F11 | H-30,31 |
| Pulse Signal Interface Unit PSU-200 | H-32 |
| Signal Conversion Adapter PSU-400E | H-33 |
| Quick Guide to Precision Measuring Instruments - Linear Scales | H-34,35 |




ABS AT500-S



ABS AT500-H



Mitutoyo

# SD ABSOLUTE Digimatic Scale Units

## SERIES 572



IP66 Horizontal single-function type (Water-proof type)
**572-602 SD-20G**



Horizontal single-function type
**572-202-20 SD-20DX**



Horizontal multi-function type
**572-461 SD-15E**



Vertical single-function type
**572-303-10 SDV-30D**



Vertical multi-function type
**572-561 SDV-15E**

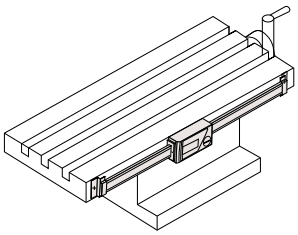
ABSOLUTE™

Mitutoyo guarantees the product quality. Mitutoyo guarantees the product safety.
PROPRIETARY INSPECTION CERTIFICATE

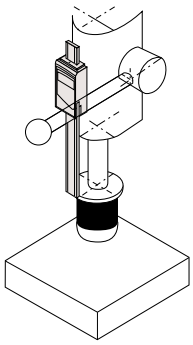
- **SD** series facilitates mounting on jigs, tools and small machine tools to enable accurate positioning.
- Built-in absolute scale including the ABS point requires no zero-set every time the power is turned on. In addition, reliability has improved thanks to elimination of overspeed errors.
- Horizontal or vertical display according to the scale mounting direction.
- The dust resistance and the environmental resistance of the display has improved. The **SD-G** series offers dust/water protection level IP66.
- Long battery life for easier maintenance.
- **EC** counters are available as external display units.
- Equipped with an output port to transfer measurement data. This allows implementation in control systems and gaging systems.

## Applications

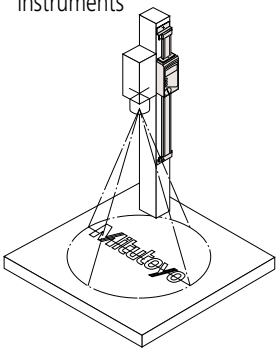
Machine table position



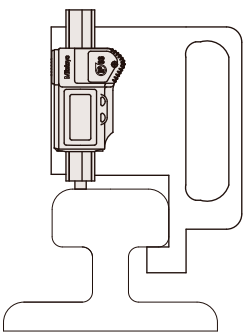
Drilling machine stroke position



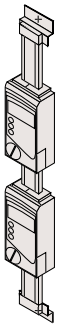
Focus setting on optical instruments



Special applications



As a measurement jig for outdoor use (SD-G)



Detector head mechanism

Please contact Mitutoyo for other special orders.

## Functions

- **ABS** (Absolute) measurement function
- **INC** (Incremental) measurement function
- Zero-setting function
- Presetting function (2 preset values can be set. Not available for **SD-G**, **SD-D**, **SDV-D**)
- Double reading function (Available only for **SD-F** or **SDV-F**)
- Direction switch function
  Not available for **SD-G**, **SD-D**, **SDV-D**, **SD-F**, **SDV-F**)
- Hold function*
- Measurement value composition error alarm
- Low-battery alarm
- Output function

* To activate the hold function when using **SD-D** or **SDV-D**, an optional hold unit is required. Simultaneous activation with the output function is not available. **SD-G** are also available to special order.

* These units use 1.5V silver oxide cells for the power supply. Therefore, when the units are directly fixed to the frame of a machine tool that requires a high voltage, malfunction such as display digit fluctuations and errors may occur. The countermeasure examples are described in the user manuals provided.

## System Diagram

**[Scale units]**

**Single-function type with high dust/water resistance**

**SD-G**



**Single-function type**

**SD-D (Horizontal)**



**SDV-D (Vertical)**



**Multi-function type**

**SD-E (Horizontal)**



**SDV-E (Vertical)**



**Multi-function type (double reading)**

**SD-F (Horizontal)**



**SDV-F (Vertical)**



*2

**[Display units]**

**EC Counter***3

**No. 542-007A**



Refer to page G-20 for details.

Tolerance judgment output*1

*3

Digimatic mini-processor

**DP-1VA**

**No. 264-505A**



Palm-sized printer for printing and statistical analysis

*3

Multiplexer

**MIG-4USB**

**No. 64AAB387**



Interface unit for the RS-232C/USB conversion and output RS-232C/USB output

RS-232C/USB output

*3

Input Tool (USB keyboard signal conversion model)

**No. 264-016-10**



USB Interface unit that converts and transfers data into spreadsheets

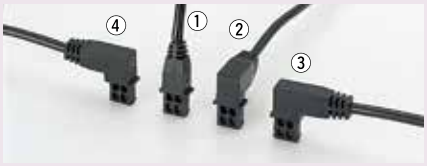
USB keyboard signal conversion

* Connection to an RS-232C conversion type (**IT-007R**) or a PS/2 keyboard signal conversion type (**IT-005D**) input tool is also available.

Connecting cable with the water-proof type output switch*2 40″/ 1m : **No.05CZA624**
80″/ 2m : **No.05CZA625**

Connecting cable with the output switch 1m : **No.959149**
2m : **No.959150**

Connecting cable with the output switch




① 40″/ 1m : **No.905338**
80″/ 2m : **No.905409**

② 40″/ 1m : **No.905689**
80″/ 2m : **No.905690**

③ 40″/ 1m : **No.905691**
80″/ 2m : **No.905692**

④ 40″/ 1m : **No.905693**
80″/ 2m : **No.905694**

Connecting cable 40″/ 1m : **No.936937**
80″/ 2m : **No.965014**

* 1: Select the tolerance judgment output or digimatic output when setting the parameters.
* 2: Connecting cable with the water-proof type output switch can be used only for **SD-G** or Water-proof Digital Caliper **CD-15/20/30PM** equipped with external output function.
* 3: Connecting of **SD** series and **DP-1VR/MIG-UUSB/IT-012U** is also available without passing through the EC counter.
In this case, connect these units and **SD** series with the cables used for the connection with the **EC** counter.



Mitutoyo

# ABSOLUTE Digimatic Scale Units

## SERIES 572

## SPECIFICATIONS

| Type | Unit spec. | Order No. | Model | Range | Resolution | Accuracy | Repeatability | Battery life |
|---|---|---|---|---|---|---|---|---|
| Horizontal single-function type (Water-proof type) | Metric | **572-600** | **SD-10G** | 0-100mm | 0.01mm | 0.03mm | .0005"/ 0.01mm | Approx. 13000 hours |
| | | **572-601** | **SD-15G** | 0-150mm | | | | |
| | | **572-602** | **SD-20G** | 0-200mm | | | | |
| | Inch/Metric | **572-613** | **SD-4"/10G** | 0-4"/0-100mm | 0.0005"/0.01mm | 0.03mm/.001" | | |
| | | **572-614** | **SD-6"/15G** | 0-6"/0-150mm | | | | |
| | | **572-615** | **SD-8"/20G** | 0-8"/0-200mm | | | | |
| Horizontal single-function type | Metric | **572-200-20** | **SD-10DX** | 0-100mm | 0.01mm | 0.03mm | | Approx. 20000 hours |
| | | **572-201-20** | **SD-15DX** | 0-150mm | | | | |
| | | **572-202-20** | **SD-20DX** | 0-200mm | | | | |
| | | **572-203-10** | **SD-30D** | 0-300mm | | 0.04mm | | |
| | Inch/Metric | **572-210-20** | **SD-4"DX** | 0-4"/0-100mm | 0.0005"/0.01mm | 0.03mm/.001" | | |
| | | **572-211-20** | **SD-6"DX** | 0-6"/0-150mm | | | | |
| | | **572-212-20** | **SD-8"DX** | 0-8"/0-200mm | | | | |
| | | **572-213-10** | **SD-12"D** | 0-12"/0-300mm | | 0.04mm/.002" | | |
| Horizontal multi-function type | Metric | **572-460** | **SD-10E** | 0-100mm | 0.01mm | 0.03mm | | Approx. 5000 hours |
| | | **572-461** | **SD-15E** | 0-150mm | | | | |
| | | **572-462** | **SD-20E** | 0-200mm | | | | |
| | | **572-463** | **SD-30E** | 0-300mm | | 0.04mm | | |
| | | **572-464** | **SD-45E** | 0-450mm | | | | |
| | | **572-465** | **SD-60E** | 0-600mm | | 0.05mm | | |
| | | **572-466** | **SD-80E** | 0-800mm | | 0.06mm | | |
| | | **572-467** | **SD-100E** | 0-1000mm | | 0.07mm | | |
| | Inch/Metric | **572-470** | **SD-4"E** | 0-4"/0-100mm | 0.0005"/0.01mm | 0.03mm/.001" | | |
| | | **572-471** | **SD-6"E** | 0-6"/0-150mm | | | | |
| | | **572-472** | **SD-8"E** | 0-8"/0-200mm | | | | |
| | | **572-473** | **SD-12"E** | 0-12"/0-300mm | | 0.04mm/.002" | | |
| | | **572-474** | **SD-18"E** | 0-18"/0-450mm | | | | |
| | | **572-475** | **SD-24"E** | 0-24"/0-600mm | | 0.05mm/.002" | | |
| | | **572-476** | **SD-32"E** | 0-32"/0-800mm | | 0.06mm/.0025" | | |
| | | **572-477** | **SD-40"E** | 0-40"/0-1000mm | | 0.07mm/.0025" | | |
| Horizontal multi-function type (equipped with double reading function) | Metric | **572-480-10** | **SD-10F** | 0-100mm | 0.01mm | 0.03mm | | Approx. 5000 hours |
| | | **572-481-10** | **SD-15F** | 0-150mm | | | | |
| | | **572-482-10** | **SD-20F** | 0-200mm | | | | |
| | | **572-483-10** | **SD-30F** | 0-300mm | | 0.04mm | | |
| | | **572-484-10** | **SD-45F** | 0-450mm | | | | |
| | | **572-485-10** | **SD-60F** | 0-600mm | | 0.05mm | | |
| | | **572-486-10** | **SD-80F** | 0-800mm | | 0.06mm | | |
| | | **572-487-10** | **SD-100F** | 0-1000mm | | 0.07mm | | |
| | Inch/Metric | **572-490-10** | **SD-4"F** | 0-4"/0-100mm | 0.0005"/0.01mm | 0.03mm/.001" | | |
| | | **572-491-10** | **SD-6"F** | 0-6"/0-150mm | | | | |
| | | **572-492-10** | **SD-8"F** | 0-8"/0-200mm | | | | |
| | | **572-493-10** | **SD-12"F** | 0-12"/0-300mm | | 0.04mm/.002" | | |
| | | **572-494-10** | **SD-18"F** | 0-18"/0-450mm | | | | |
| | | **572-495-10** | **SD-24"F** | 0-24"/0-600mm | | .002"/0.05mm | | |
| | | **572-496-10** | **SD-32"F** | 0-32"/0-800mm | | .0025"/0.06mm | | |
| | | **572-497-10** | **SD-40"F** | 0-40"/0-1000mm | | .0025"/0.07mm | | |
| Vertical single-function type | Metric | **572-300-10** | **SDV-10D** | 0-100mm | 0.01mm | 0.03mm | | Approx. 20000 hours |
| | | **572-301-10** | **SDV-15D** | 0-150mm | | | | |
| | | **572-302-10** | **SDV-20D** | 0-200mm | | | | |
| | | **572-303-10** | **SDV-30D** | 0-300mm | | 0.04mm | | |
| | Inch/Metric | **572-310-10** | **SD-4"D** | 0-4"/0-100mm | 0.0005"/0.01mm | 0.03mm/.001" | | |
| | | **572-311-10** | **SD-6"D** | 0-6"/0-150mm | | | | |
| | | **572-312-10** | **SD-8"D** | 0-8"/0-200mm | | | | |
| | | **572-313-10** | **SD-12"D** | 0-12"/0-300mm | | 0.04mm/.002" | | |
| Vertical multi-function type | Metric | **572-560** | **SDV-10E** | 0-100mm | 0.01mm | 0.03mm | | Approx. 5000 hours |
| | | **572-561** | **SDV-15E** | 0-150mm | | | | |
| | | **572-562** | **SDV-20E** | 0-200mm | | | | |
| | | **572-563** | **SDV-30E** | 0-300mm | | 0.04mm | | |
| | | **572-564** | **SDV-45E** | 0-450mm | | | | |
| | | **572-565** | **SDV-60E** | 0-600mm | | 0.05mm | | |
| | | **572-566** | **SDV-80E** | 0-800mm | | 0.06mm | | |
| | | **572-567** | **SDV-100E** | 0-1000mm | | 0.07mm | | |
| | Inch/Metric | **572-570** | **SDV-4"E** | 0-4"/0-100mm | 0.0005"/0.01mm | .001"/0.03mm | | |
| | | **572-571** | **SDV-6"E** | 0-6"/0-150mm | | | | |
| | | **572-572** | **SDV-8"E** | 0-8"/0-200mm | | | | |
| | | **572-573** | **SDV-12"E** | 0-12"/0-300mm | | .002"/0.04mm | | |
| | | **572-574** | **SDV-18"E** | 0-18"/0-450mm | | | | |
| | | **572-575** | **SDV-24"E** | 0-24"/0-600mm | | .002"/0.05mm | | |
| | | **572-576** | **SDV-32"E** | 0-32"/0-800mm | | .0025"/0.06mm | | |
| | | **572-577** | **SDV-40"E** | 0-40"/0-1000mm | | .0025"/0.07mm | | |
| Vertical multi-function type (equipped with double reading function) | Metric | **572-580-10** | **SDV-10F** | 0-100mm | 0.01mm | 0.03mm | | Approx. 5000 hours |
| | | **572-581-10** | **SDV-15F** | 0-150mm | | | | |
| | | **572-582-10** | **SDV-20F** | 0-200mm | | | | |
| | | **572-583-10** | **SDV-30F** | 0-300mm | | 0.04mm | | |
| | | **572-584-10** | **SDV-45F** | 0-450mm | | | | |
| | | **572-585-10** | **SDV-60F** | 0-600mm | | 0.05mm | | |
| | | **572-586-10** | **SDV-80F** | 0-800mm | | 0.06mm | | |
| | | **572-587-10** | **SDV-100F** | 0-1000mm | | 0.07mm | | |
| | Inch/Metric | **572-590-10** | **SDV-4"F** | 0-4"/0-100mm | 0.0005"/0.01mm | .001"/0.03mm | | |
| | | **572-591-10** | **SDV-6"F** | 0-6"/0-150mm | | | | |
| | | **572-592-10** | **SDV-8"F** | 0-8"/0-200mm | | | | |
| | | **572-593-10** | **SDV-12"F** | 0-12"/0-300mm | | .002"/0.04mm | | |
| | | **572-594-10** | **SDV-18"F** | 0-18"/0-450mm | | | | |
| | | **572-595-10** | **SDV-24"F** | 0-24"/0-600mm | | .002"/0.05mm | | |
| | | **572-596-10** | **SDV-32"F** | 0-32"/0-800mm | | .0025"/0.06mm | | |
| | | **572-597-10** | **SDV-40"F** | 0-40"/0-1000mm | | .0025"/0.07mm | | |



Note: Response speed is unlimited

Type

**Horizontal type example**



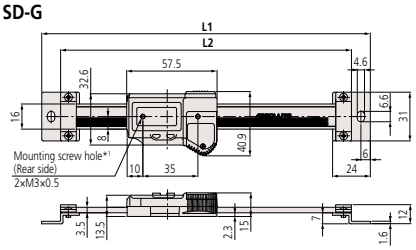
**Vertical type example**



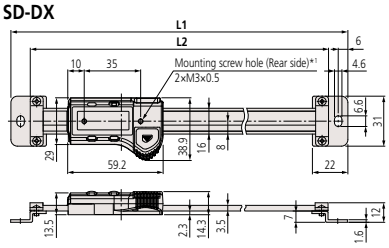
## DIMENSIONS

Unit: mm

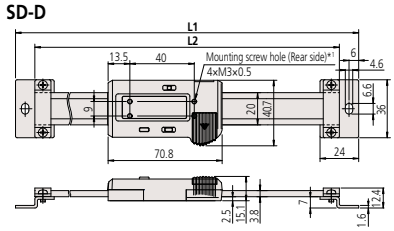
**SD-G**



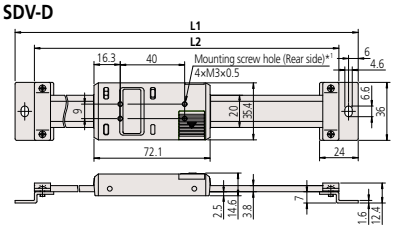

**SD-DX**



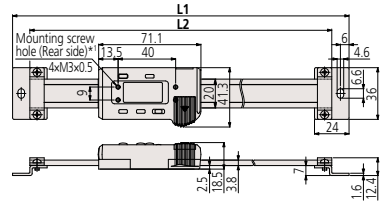

**SD-D**



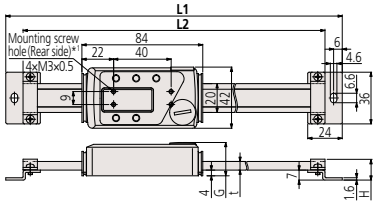

**SDV-D**



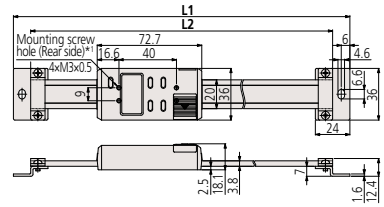

**SD-E** (to 300mm) / **SD-F** (to 300mm)



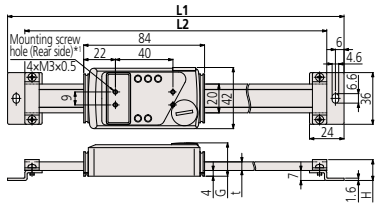

**SD-E** (450 to 1000mm) / **SD-F** (450 to 1000mm)




**SDV-E** (to 300mm) / **SDV-F** ( to 300mm)




**SDV-E** (450 to 1000mm) / **SDV-F** (450 to 1000mm)




*1: Inch/Metric models have 5-40 UNC threaded rear holes. Refer to the dimension table for details of the depth including the screw on the rear of the display.

## SPECIFICATIONS

| Model | Range (mm) | Dimensions(mm) | | | | | Depth including the screw on the rear of the display | Mass (g) |
|---|---|---|---|---|---|---|---|---|
| | | L1 | L2 | t | G | H | | |
| **SD-G** | 100 | 209 | 185 | — | — | — | Less than 2mm | 390 |
| | 150 | 259 | 235 | — | — | — | | 410 |
| | 200 | 311 | 287 | — | — | — | | 430 |
| **SD-DX** | 100 | 209 | 185 | — | — | — | | 230 |
| | 150 | 259 | 235 | — | — | — | | 250 |
| | 200 | 311 | 287 | — | — | — | | 270 |
| **SD-30D** | 300 | 444 | 420 | — | — | — | | 370 |
| **SD-E** **SD-F** | 100 | 244 | 220 | — | — | — | | 250 |
| | 150 | 294 | 270 | — | — | — | | 280 |
| | 200 | 344 | 320 | — | — | — | | 310 |
| | 300 | 444 | 420 | — | — | — | | 370 |
| | 450 | 594 | 570 | 6 | 23.2 | 14.6 | Less than 3mm | 760 |
| | 600 | 774 | 750 | | | | | 900 |
| | 800 | 974 | 950 | 10 | 27.2 | 18.6 | | 1710 |
| | 1000 | 1174 | 1150 | | | | | 2040 |
| **SDV-D** | 100 | 244 | 220 | — | — | — | Less than 2mm | 250 |
| | 150 | 294 | 270 | — | — | — | | 280 |
| | 200 | 344 | 320 | — | — | — | | 310 |
| | 300 | 444 | 420 | — | — | — | | 370 |
| **SDV-E** **SDV-F** | 100 | 244 | 220 | — | — | — | | 250 |
| | 150 | 294 | 270 | — | — | — | | 280 |
| | 200 | 344 | 320 | — | — | — | | 310 |
| | 300 | 444 | 420 | — | — | — | | 370 |
| | 450 | 594 | 570 | 6 | 23.2 | 14.6 | Less than 3mm | 760 |
| | 600 | 774 | 750 | | | | | 900 |
| | 800 | 974 | 950 | 10 | 27.2 | 18.6 | | 1710 |
| | 1000 | 1174 | 1150 | | | | | 2040 |



Mitutoyo

# Quill Kit with ABSOLUTE Encoder

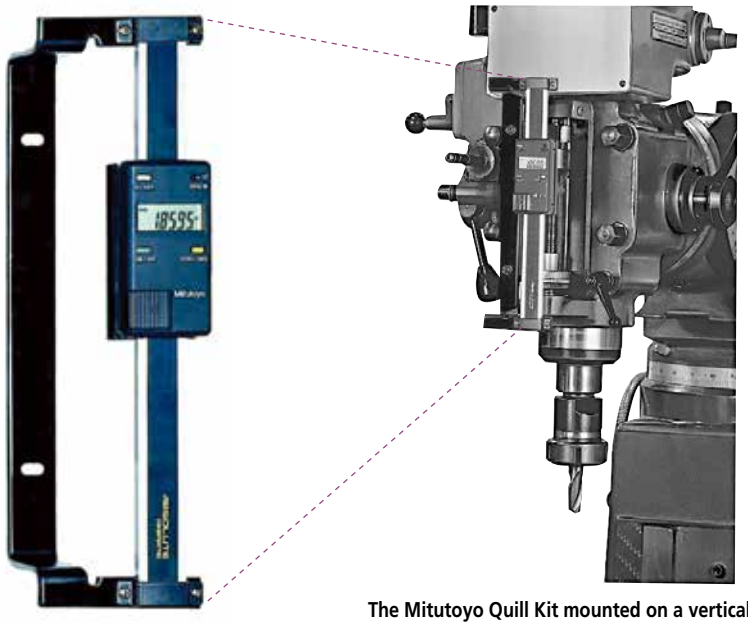
## Easy Installation Fits Most Vertical Knee Mills

### FEATURES

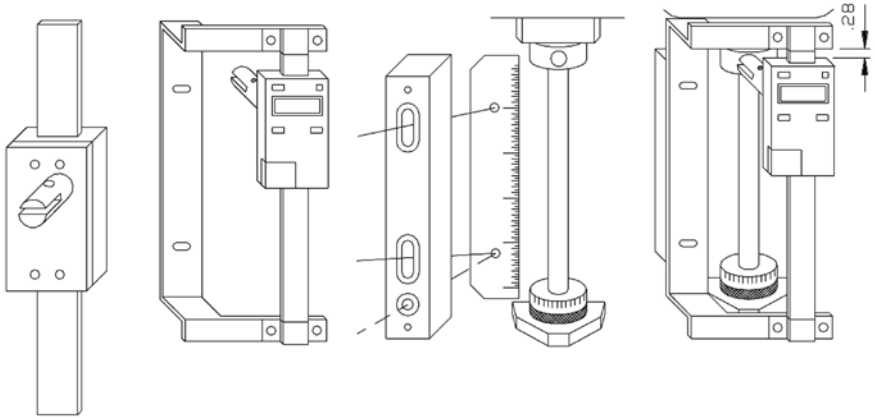
- Easy to read LCD with resolution of .0005"/0.01mm. 0 -5" travel inch/mm
- Push button controls for inch/mm, zero-set and on/off.
- Powered by a single SR-44 battery which lasts about 1 year with normal use.
- SPC Output for data transmission to data processors or a remote display.

### SPECIFICATIONS

| Order No. | Description |
|---|---|
| **053906B** | Digimatic Quill Kit complete with brackets & scale for Bridgeport-type machines. |



**The Mitutoyo Quill Kit mounted on a vertical mill.**




### Optional Accessories

**905338**: SPC cable (40" / 1m standard)
**905409**: SPC cable (80" / 2m standard)
**264-504-5A**: DP-1VR data processor, 120V AC
**02AZD810D**: U-Wave-R (wireless receiver)
**02AZD730D**: U-Wave-T/IP67 type (wireless transmitter)
**02AZD790F**: U-Wave connecting cable F
**02AZE200**: U-Wave-T installation brackets kit

# KA-200 Counter

## SERIES 174 — Standard Type

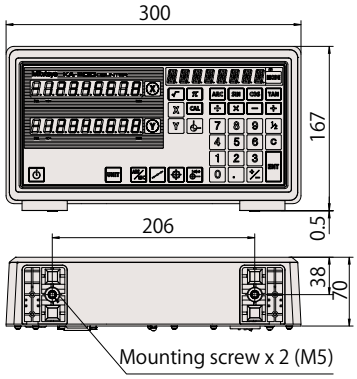
- High performance, low cost 2 & 3 axis counter
- Absolute and incremental modes (10 presets each)
- Non-linear and linear error compensation
- Adjustable high-brightness, high-refresh rate LED displays
- Calculator function
- Outputs data into spreadsheets (optional USB card)



174-183A

### DIMENSIONS

Unit: mm




### SPECIFICATIONS

| Order No. | 174-183A | 174-185A |
|---|---|---|
| Model | 2-axis KA-212 Counter | 3-axis KA-213 Counter |
| Resolution | With AT100 Series: 0.05 - 0.0001 mm, .02" - .000005"<br>With AT715: 0.01 - 0.0005 mm, .02" - .000020" | |
| Scale input ports | 2 or 3* | |
| Display type / digit | 7-segment, 8-digit + sign + 8-character alphabet LED display, 14.2mm character height | |
| Output (optional) | RS-232C / USB | |
| Macro functions | Rectangular drilling and round milling newly added | |
| Main features | Feed speed display; taper machining function; tool data; multi-point compensation; scale check function; calculation function | |
| Dimensions | Size (W×D×H) 30×168×70mm | |

*2nd and 3rd axis display can be disabled

### Standard Accessories

Power cable
Ground lead
Dust cover
Alternate button labels for lathe mode
Connector cap (Dsub-15)
User's manual
Warranty card

### Optional Accessories

| | |
|---|---|
| **06AET993** | Code out unit - USB output, RS232C output, Digimatic Input |
| **06ACB393** | Adapter for Linear gages with origin |
| **06ACB913** | Adapter for Linear gages without origin |
| **06ACB391** | Adapter for AT211 Linear Scales |
| **06ACB392** | Adapter for ST Series |
| **09CAB231** | Adapter for micrometer head |
| **09AAA207** | Adapter for previous model 6 pin linear scales |
| **937179T** | Foot switch to trigger USB output (06AET993 needed) |
| **64AAB336** | Foot switch to trigger RS-232C output (06AET993 needed) |
| **06ACF941** | Extension cable for remote load & zero (06AET993 needed) |
| **965004** | Foot switch to trigger RS-232C output (for 06ACF941 only) |
| **937328** | External load box (06AET993 & 06ACF941 needed) |
| **936553** | External zero box (06AET993 & 06ACF941 needed) |
| **09EAA094** | Counter cable RS232C for DP-1VR |
| **64AAB519** | RS232C output cable 6-ft. (25-9 pin) |

# KLD200 Counter

## SERIES 174 — Special Purpose Type with Limit Signal Output

- Counter designed to signal when a linear scale displacement value and a preset limit value coincide.
- Two types of limit settings are available: 2-step (**KLD-212**) and 4-step (**KLD-214**).

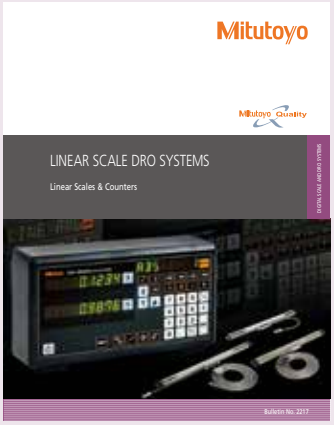


174-147A
KLD-214

### SPECIFICATIONS

| Order No. | 174-146A | 174-147A |
|---|---|---|
| Model | KLD-212 | KLD-214 |
| Number of axes to be displayed | 1 axis | |
| Number of limit values to be set | 2 | 4 |
| Resolution | (Changeable according to the parameter)<br>When **AT100** series is connected: 0.05 to 0.0001mm<br>When **AT715** is connected: 0.01 to 0.001mm | |
| Output | RS-232C (provided as standard) | |
| Display | 7-segment LCD/ 7 digit*1 | |
| Power supply voltage | 120V AC, 60Hz | |
| Power consumption | 25 VA | |
| Operating temperature/humidity range | 0 to 45°C/ 20 to 80% | |
| Dimensions | 13.1"(W)×6.42"(D)×8.1"(H) / 332 (W)×163 (D)×204 (H) mm | |
| Mass | 6.62 lb. / 3.0kg | 6.84 lb. / 3.1kg |

*1: Count range when the minimum reading is 0.001mm: 99999.999 to –9999.999
Count range when the minimum reading is 0.005mm: 99999.995 to –9999.995



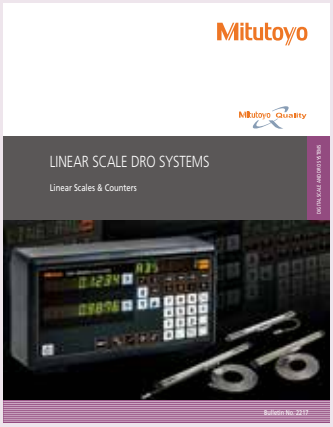

Refer to Bulletin No. (2217) for more details.

# Linear Scale Counter

## FUNCTIONS

| Function \ Counter | | KA-200 Counter | KLD-200 Counter |
|---|---|---|---|
| | |  |  |
| Zero-setting | ZERO | ● | ● |
| Preset | P.SET | ● | ● |
| Resolution setting | 0.0005 / 0.01 | ● | ● |
| Measurement direction setting | | ● | ● |
| mm/inch conversion | mm / E | ● | ● |
| Diameter display | DIA | ● | ● |
| Scale reference point setting[-1] | SET | ● | ● |
| 1/2 calculation | 1/2 | ● | ● |
| Coordinate system switching | N | ● | ● |
| Bolt-hole circle machining | | ●[-2] | — |
| Pitch machining | | ● | — |
| Zero approach machining (INC mode) | | ● | — |
| Addition of 2-scale data | Z1+Z2 | ●[-3] | — |
| Linearity error compensation | | ● | ● |
| Pitch error compensation | | ●[-1] | — |
| Smoothing | 1234 | ● | ● |
| Memory backup | | ● | ● |
| Expansion/contraction coefficient setting | | — | ● |
| Lower digit blanking out | 123 | ● | ● |
| External zero-setting | ZERO SET IN PUT | ▲[-4] | ● |
| RS-232C interface unit | RS-232C OUTPUT | ▲[-4] | ● |
| USB output | USB | ▲[-5] | — |
| Limit signal output | LIMIT OUTPUT | — | ● |
| Error message | Error | ● | ● |

●: Standard function, ▲: Optional function, —: Not available
-1: Only available when connecting with AT100 series.
-2: Not available in single-axis use
-3: Only available for 3-axis model
-4: Code out unit (**06AET993**) is required.
-5: Text can be output by interface unit and foot switch




Refer to Bulletin No. (2217) for more details.

## Adapter Cross Reference

(For adapting old linear scales to new counters, or new linear scales to old counters)

| | Linear Scale Series No's. | Adapter No. | Counters |
|---|---|---|---|
| Old linear scales with 6 pin round connectors | FOR AT2-N, AT2, AT-11N, AT11, AT12N (529 Series) | **09AAA207** | All KA, KS, KC, UDR Series Counters with 15 pin connectors. (All 174 Series) |
| New linear scales w/15 pin D-Sub connectors | FOR AT102, AT103, AT111, AT112, AT113, AT115, AT116, AT181 | **09AAA181** | For all .0001" resolution counters with seven pin round connectors |
| | | **09AAA181V*** | APL Counter **164-660***, **164-661***, **164-662*** MPK-2L **983-352** |
| | | **09AAA198** | For all .0005" resolution counters with six pin round connectors |
| | | **09AAA198V*** | APL Counter **164-660***, **164-661***, **164-662***, **164-563***, **164-664***, **164-665*** PL and PL Zero Output Counter **164-252A**, **164-254A**, **164-295A** |

* V = Vertical type
When only replacing one linear scale, you can use either horizontal or vertical type adapter.




**09AAA207**




**09AAA198**

# Digital Readout/DRO packages 2-Axis/3-Axis Travels

## For Milling, Lathes & Surface Grinding Systems

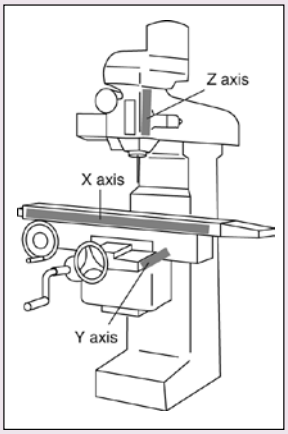


### 2-Axis, KA Counter Milling System

**Package includes:**
- KA-200 counter
- AT715 electromagnetic absolute linear scales
- Brackets for linear scales
- Display arm kit

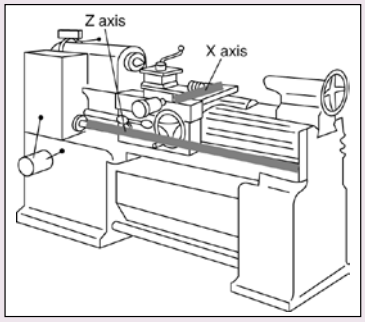



| X Axis Travel (AT715 Slim Electromagnetic) | Y Axis Travel (AT715 Slim Electromagnetic) | | | |
|---|---|---|---|---|
| | 12" (539-805) | 14" (539-806) | 16" (539-807) | 18" (539-808) |
| 30" (539-814) | **64PKA058A** | **64PKA060A** | – | – |
| 36" (539-816) | **64PKA059A** | – | **64PKA062A** | – |
| 40" (539-817) | – | **64PKA061A** | **64PKA063A** | **64PKA064A** |




### 3-Axis Milling Package (Z Axis: 6" Travel AT715)

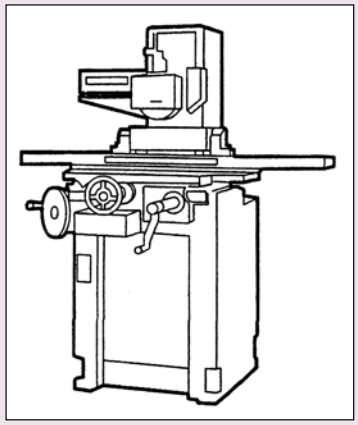
| Order No. | Description |
|---|---|
| **64PKA065A** | MILL pkg, 3-axis, ABS Scales, 12" x 30" x 6", w/3 axis KA Counter (174-185A) |
| **64PKA066A** | MILL pkg, 3-axis, ABS Scales, 12" x 36" x 6", w/3 axis KA Counter (174-185A) |
| **64PKA067A** | MILL pkg, 3-axis, ABS Scales, 16" x 36" x 6", w/3 axis KA Counter (174-185A) |




### 2-Axis Lathe Package

**Package includes:**
- KA-200 counter
- AT116 and AT715 linear scale combinations (with cables)
- Mounting bracket kit
- Counter tray
- Additional extension cable (2m) included in 60" and 72" packages

| Z-axis travel | X Axis Travel (AT116 Slim Glass Scale) | | | | | |
|---|---|---|---|---|---|---|
| | 6"(539-272-30) | 8"(539-273-30) | 10"(539-274-30) | 12"(539-275-30) | 14"(539-276-30) | 16"(539-277-30) |
| 28" (539-813) | **64PKA035A** | – | – | – | – | – |
| 30" (539-814) | **64PKA036A** | – | – | – | – | – |
| 36" (539-816) | **64PKA037A** | – | – | – | – | – |
| 40" (539-817) | **64PKA038A** | **64PKA039A** | **64PKA042A** | **64PKA046A** | **64PKA052A** | – |
| 44" (539-818) | – | **64PKA040A** | **64PKA043A** | **64PKA047A** | **64PKA053A** | – |
| 48" (539-819) | – | **64PKA041A** | **64PKA044A** | **64PKA048A** | **64PKA054A** | – |
| 52" (539-820) | – | – | – | **64PKA049A** | **64PKA055A** | – |
| 60" (539-822) | – | – | **64PKA045A** | **64PKA050A** | **64PKA056A** | **64PKA057A** |
| 72" (539-825) | – | – | – | **64PKA051A** | – | – |



### 2-Axis, KA Counter Grinder System

**Package includes:**
- KA-200 counter
- AT116 glass linear scales
- Mounting bracket kit
- Display arm kit

| Vertical | Cross Side (AT116 Slim Glass Scale) | | | |
|---|---|---|---|---|
| | 6" (539-272-30) | 8" (539-273-30) | 10" (539-274-30) | 12" (539-275-30) |
| 12"(539-275-30) | **64PKA026A** | **64PKA028A** | – | – |
| 14"(539-276-30) | **64PKA027A** | **64PKA029A** | – | – |
| 16"(539-277-30) | – | **64PKA030A** | – | – |
| 18"(539-278-30) | – | – | **64PKA031A** | **64PKA033A** |
| 20"(539-279-30) | – | – | – | **64PKA034A** |
| 24"(539-281-30) | – | – | **64PKA032A** | – |

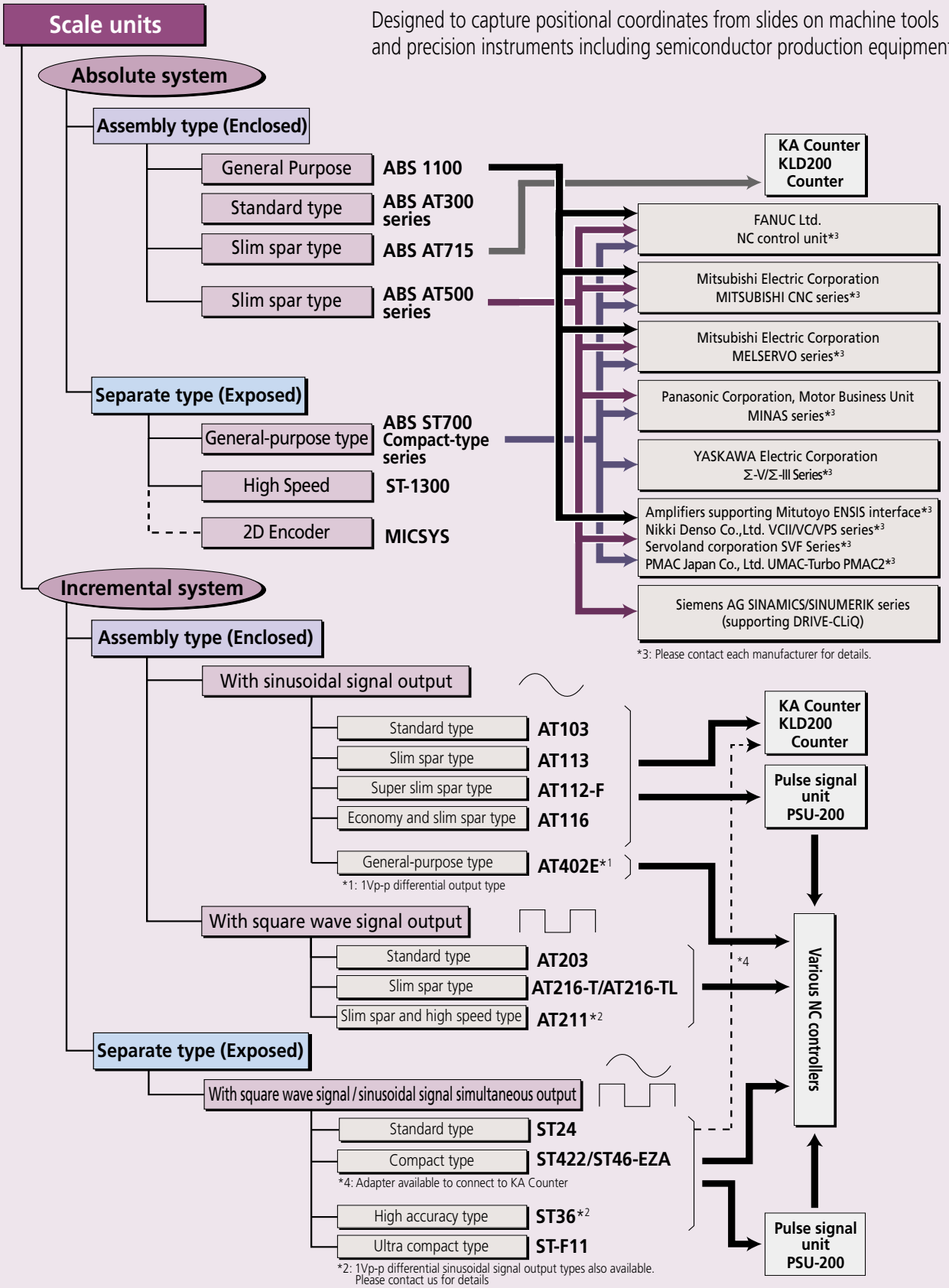


Mitutoyo

# Linear Scales

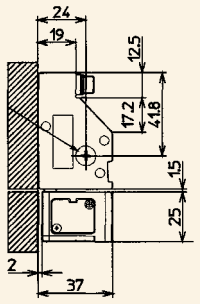
## Linear Scale System Diagram

Designed to capture positional coordinates from slides on machine tools and precision instruments including semiconductor production equipment.

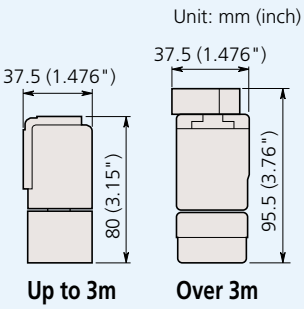


| Name | Type | Page |
|---|---|---|
| AT1100 | General-purpose Spar | H-12 |
| AT300 | Standard Spar | H-13 |
| AT-715 | Slim Spar (IP67) | H-14 |
| AT500 | Slim Spar | H-15 |
| ABS ST700 | General Purpose Compact type (Exposed) | H-16 |
| ST1300 | High Seep High Accuracy (Exposed) | H-17 |
| MICSYS | 2D Image Encoder (Exposed) | H-18 |
| AT103 | Standard | H-19 |
| AT113 | Slim Spar type | H-20 |
| AT112-F | Super Slim part type | H-21 |
| AT116 | Economy and Slim Spar | H-22 |
| AT402E | General-purpose | H-23 |
| AT203 | Standard type | H-24 |
| AT216T/AT217-TL | Slim Spar | H-25 |
| AT211 | Slim spar type high speed | H-26 |
| ST24 | Standard Type (Exposed) | H-27 |
| ST422/ST46-EZA | Compact type (Exposed) | H-28-29 |
| ST36 | High Accuracy type (Exposed) | H-30 |
| ST-F11 | Ultra Compact-Fiber scale (Exposed) | H-31-32 |

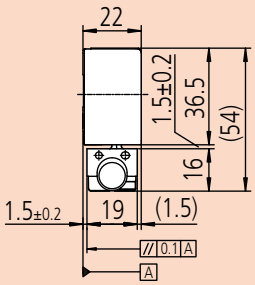
**AT1100**



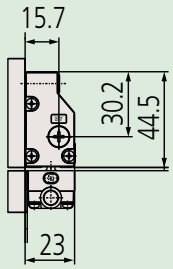

**AT103 / AT300 / AT203**



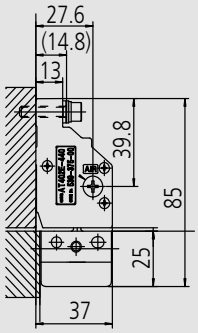

**AT715**



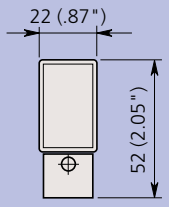

**AT500**



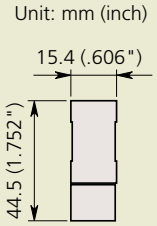

**AT402E**



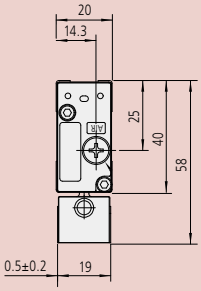

**AT113 / AT116 / AT216T / AT217TL**




**AT112F**




**AT211**



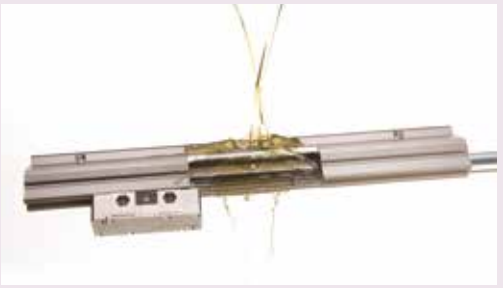



Mitutoyo

# Linear Scales ABS AT1100

## SERIES 539 — General Mount Type, robust dustproof / waterproof structure



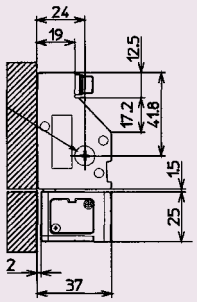


- Electromagnetic induction principle means scales are unaffected by most contamination.
- Absolute scales have eliminated the need for origin restoration and drastically reduced power consumption.
- Drawings are available on request.

## SPECIFICATIONS

| Model | ABS AT1100 |
|---|---|
| Detection method | Electromagnetic induction |
| Maximum effective range | 3040mm |
| Resolution | 0.05μm |
| Accuracy (at 20 °C) | (3+5L/1000)μm L= 140 to 2040mm<br>(5+5L/1000)μm L= 2240 to 3040mm |
| Maximum response speed | 3 m/s |
| Cross-section size | 85×37 (mm) |
| Thermal expansion coefficient | ≈ 8±1.5x10$^{-6}$ / K |
| Vibration resistance (at 55 to 2000Hz) | 20g |
| Impact resistance (at 11ms, 1/2sin) | 35g L=140 to 2040mm<br>30g L=2240 to 3040mm |
| Compatible interfaces *1 | FANUC Corporation's Serial αi Interface (AT1153) |
| | Mitsubishi Electric Corporation's High-speed Serial Interface (AT1143) |

*1: For details about connection of any applicable system, please be sure to contact each manufacturer for confirmation.




**AT1100 Mounting Dimensions**

| FANUC | | Mitsubishi | | Siemens | | Effective Range (mm) |
|---|---|---|---|---|---|---|
| Order No. | Model | Order No. | Model | Order No. | Model | |
| **559-100-53** | AT1153-140 | **559-100-43** | AT1143-140 | **559-100-23** | AT1123-140 | 140 |
| **559-101-53** | AT1153-240 | **559-101-43** | AT1143-240 | **559-101-23** | AT1123-240 | 240 |
| **559-102-53** | AT1153-340 | **559-102-43** | AT1143-340 | **559-102-23** | AT1123-340 | 340 |
| **559-103-53** | AT1153-440 | **559-103-43** | AT1143-440 | **559-103-23** | AT1123-440 | 440 |
| **559-104-53** | AT1153-540 | **559-104-43** | AT1143-540 | **559-104-23** | AT1123-540 | 540 |
| **559-105-53** | AT1153-640 | **559-105-43** | AT1143-640 | **559-105-23** | AT1123-640 | 640 |
| **559-106-53** | AT1153-740 | **559-106-43** | AT1143-740 | **559-106-23** | AT1123-740 | 740 |
| **559-107-53** | AT1153-840 | **559-107-43** | AT1143-840 | **559-107-23** | AT1123-840 | 840 |
| **559-108-53** | AT1153-940 | **559-108-43** | AT1143-940 | **559-108-23** | AT1123-940 | 940 |
| **559-109-53** | AT1153-1040 | **559-109-43** | AT1143-1040 | **559-109-23** | AT1123-1040 | 1040 |
| **559-110-53** | AT1153-1140 | **559-110-43** | AT1143-1140 | **559-110-23** | AT1123-1140 | 1140 |
| **559-111-53** | AT1153-1240 | **559-111-43** | AT1143-1240 | **559-111-23** | AT1123-1240 | 1240 |
| **559-112-53** | AT1153-1340 | **559-112-43** | AT1143-1340 | **559-112-23** | AT1123-1340 | 1340 |
| **559-113-53** | AT1153-1440 | **559-113-43** | AT1143-1440 | **559-113-23** | AT1123-1440 | 1440 |
| **559-114-53** | AT1153-1540 | **559-114-43** | AT1143-1540 | **559-114-23** | AT1123-1540 | 1540 |
| **559-115-53** | AT1153-1640 | **559-115-43** | AT1143-1640 | **559-115-23** | AT1123-1640 | 1640 |
| **559-116-53** | AT1153-1740 | **559-116-43** | AT1143-1740 | **559-116-23** | AT1123-1740 | 1740 |
| **559-117-53** | AT1153-1840 | **559-117-43** | AT1143-1840 | **559-117-23** | AT1123-1840 | 1840 |
| **559-118-53** | AT1153-2040 | **559-118-43** | AT1143-2040 | **559-118-23** | AT1123-2040 | 2040 |
| **559-119-53** | AT1153-2240 | **559-119-43** | AT1143-2240 | **559-119-23** | AT1123-2240 | 2240 |
| **559-120-53** | AT1153-2440 | **559-120-43** | AT1143-2440 | **559-120-23** | AT1123-2440 | 2440 |
| **559-121-53** | AT1153-2640 | **559-121-43** | AT1143-2640 | **559-121-23** | AT1123-2640 | 2640 |
| **559-122-53** | AT1153-2840 | **559-122-43** | AT1143-2840 | **559-122-23** | AT1123-2840 | 2840 |
| **559-123-53** | AT1153-3040 | **559-123-43** | AT1143-3040 | **559-123-23** | AT1123-3040 | 3040 |

# Linear Scales ABS AT300

## SERIES 539 — Standard Type

ABSOLUTE™

- ABSOLUTE linear encoder incorporates both our unique electrostatic capacity and photoelectric technology.
  *Refer to page H-34 "Quick Guide to Precision Measuring Instruments" for details of the principle of the absolute linear scale.
- Drastically reduced power consumption since there are no backup batteries.
- Easy operation because no recalibration is required at startup or after a power failure.
- Suitable for position feedback in machinery requiring high-accuracy, high-speed control.
- Improved environmental resistance against mechanical vibration and noise.




## SPECIFICATIONS

| Model | ABS AT353 | ABS AT343 | ABS AT343A | ABS AT303 | ABS AT303A |
|---|---|---|---|---|---|
| Applicable system | FANUC Ltd. NC Control unit | Mitsubishi Electric Corporation MITSUBISHI CNC series | Mitsubishi Electric Corporation MR-J3 | Amplifiers supporting Mitutoyo ENSIS interface | |
| Resolution | 0.05µm | | | | |
| Maximum response speed | 120m/min | | | | |
| Effective range | 4 to 120" / 100 to 3000mm | | | | |
| Accuracy (20°C)* | (3+3L0/1000)µm, (5+5L0/1000)µm when the effective range is 1600mm or more | | | | |
| Protection level | IP53 | | | | |

* The indication accuracy does not include quantizing error. L0: Effective range (mm)
* A wide variety of special orders are available.

## Dimensions

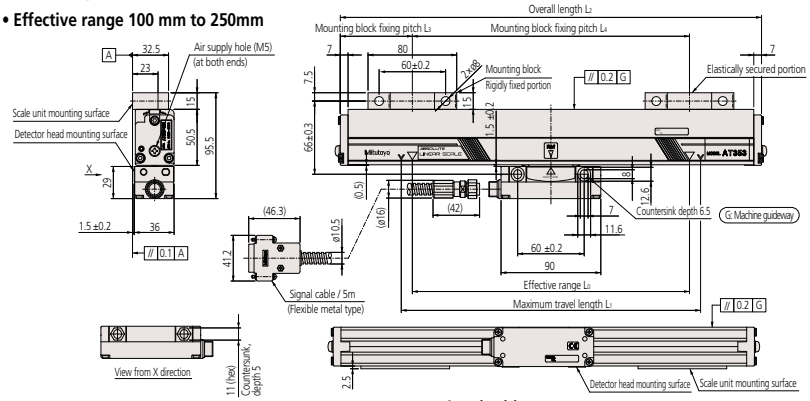
| Effective range L0 (mm) | Maximum travel length L1 (mm) | Overall length L2 (mm) | Mounting block pitch L3 (mm) | Mounting block pitch L4 (mm) | No. of mounting blocks |
|---|---|---|---|---|---|
| 100 | 120 | 230 | 65 | 100 | 2 |
| 150 | 170 | 280 | 65 | 150 | |
| 200 | 220 | 330 | 65 | 200 | |
| 250 | 270 | 380 | 65 | 250 | |
| 300 | 330 | 440 | 220 | 150 | 3 |
| 350 | 380 | 490 | 245 | 175 | |
| 400 | 430 | 540 | 270 | 200 | |
| 450 | 480 | 590 | 295 | 225 | |
| 500 | 540 | 650 | 325 | 250 | |
| 600 | 650 | 760 | 380 | 300 | |
| 700 | 760 | 870 | 435 | 350 | |
| 750 | 810 | 920 | 460 | 375 | |
| 800 | 860 | 970 | 485 | 400 | |
| 900 | 960 | 1070 | 535 | 450 | |
| 1000 | 1060 | 1170 | 585 | 500 | |

| Effective range L0 (mm) | Maximum travel length L1 (mm) | Overall length L2 (mm) | Mounting block pitch L3 (mm) | Mounting block pitch L4 (mm) | No. of mounting blocks |
|---|---|---|---|---|---|
| 1100 | 1160 | 1270 | 635 | 275 | 5 |
| 1200 | 1260 | 1370 | 685 | 300 | |
| 1300 | 1360 | 1470 | 735 | 325 | |
| 1400 | 1460 | 1570 | 785 | 350 | |
| 1500 | 1560 | 1670 | 835 | 375 | |
| 1600 | 1690 | 1800 | 900 | 400 | |
| 1700 | 1790 | 1900 | 950 | 425 | |
| 1800 | 1890 | 2000 | 1000 | 450 | |
| 2000 | 2100 | 2210 | 1105 | 335 | 7 |
| 2200 | 2300 | 2410 | 1205 | 370 | |
| 2400 | 2500 | 2610 | 1305 | 400 | |
| 2500 | 2600 | 2710 | 1355 | 315 | 9 |
| 2600 | 2700 | 2810 | 1405 | 325 | |
| 2800 | 2900 | 3010 | 1505 | 350 | |
| 3000 | 3050 | 3210 | 1605 | 375 | |

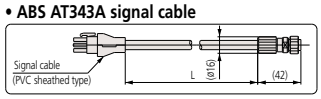
## Mounting dimensions [ABS AT353/AT343(A)/AT303(A)]

Unit: mm

**• Effective range 100 mm to 250mm**

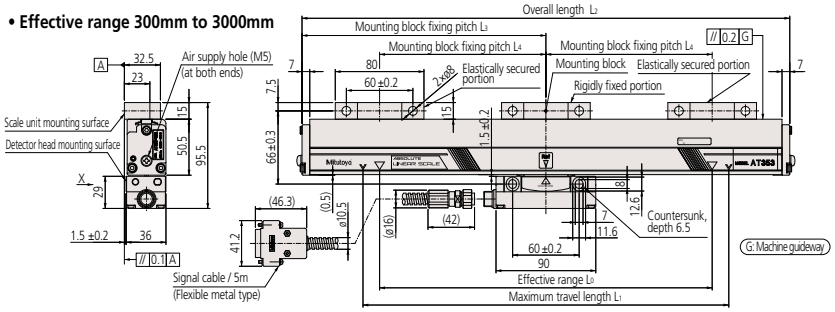



**• ABS AT343A signal cable**




*The signal cable has set options.
(Part No.09BAA598A - C: 0.2m, 2m, 3m)

**• Effective range 300mm to 3000mm**






Mitutoyo

# Linear Scales ABS AT715

## SERIES 539 — Slim Spar Type




ABSOLUTE™

PROPRIETARY INSPECTION CERTIFICATE

- Electromagnetic induction principle means scales are unaffected by contamination.
- Absolute scales have eliminated the need for origin restoration and drastically reduced power consumption.
- Suitable for milling machines, XY tables, jigs, etc.

## SPECIFICATIONS

| Model | ABS AT715 | |
|---|---|---|
| Detection method | Electromagnetic induction | |
| Resolution | .000020" - .001" (0.0005mm to 0.01mm)<br>(on the **KA/KLD200** counter) | |
| Effective range | 100 to 3000mm | |
| Accuracy (20°C) | ±5μm (Lo: 100 to 500mm), ±7μm (Lo: 600 to 1800mm), ±10μm (Lo: 2000 to 3000mm)<br>Lo: Effective range (mm) | |
| Maximum response speed | 50m/min | |
| Protection level | IP67 | |
| Sliding force | 5N or less | |
| Signal cable | Standard accessory<br>Refer to the dimension table shown below for the length. | |
| Extension cable (optional) | Length | Order No. |
| | 2m<br>5m<br>7m | **09AAB674A**<br>**09AAB674B**<br>**09AAB674C** |
| Connectable counter | **KA** Counter/ **KLD200** Counter | |

| AT715 | | Effective range Lo inch/mm | Signal cable length (m) |
|---|---|---|---|
| Order No. | Model | | |
| **539-801** | **ABS AT715-100** | 4" /100mm | 3.5 |
| **539-802** | **ABS AT715-150** | 6" /150mm | |
| **539-803** | **ABS AT715-200** | 8" /200mm | |
| **539-804** | **ABS AT715-250** | 10" /250mm | |
| **539-805** | **ABS AT715-300** | 12" /300mm | |
| **539-806** | **ABS AT715-350** | 14" /350mm | |
| **539-807** | **ABS AT715-400** | 16" /400mm | |
| **539-808** | **ABS AT715-450** | 18" /450mm | |
| **539-809** | **ABS AT715-500** | 20" /500mm | |
| **539-811** | **ABS AT715-600** | 24" /600mm | |
| **539-813** | **ABS AT715-700** | 28" /700mm | |
| **539-814** | **ABS AT715-750** | 30" /750mm | |
| **539-815** | **ABS AT715-800** | 32" /800mm | |
| **539-816** | **ABS AT715-900** | 36" /900mm | |
| **539-817** | **ABS AT715-1000** | 40" /1000mm | 5 |
| **539-818** | **ABS AT715-1100** | 44" /1100mm | |
| **539-819** | **ABS AT715-1200** | 48" /1200mm | |
| **539-820** | **ABS AT715-1300** | 52" /1300mm | |
| **539-821** | **ABS AT715-1400** | 56" /1400mm | |
| **539-822** | **ABS AT715-1500** | 60" /1500mm | |
| **539-823** | **ABS AT715-1600** | 64" /1600mm | |
| **539-824** | **ABS AT715-1700** | 68" /1700mm | |
| **539-825** | **ABS AT715-1800** | 72" /1800mm | |
| **539-860** | **ABS AT715-2000** | 80" /2000mm | |
| **539-861** | **ABS AT715-2200** | 88" /2200mm | |
| **539-862** | **ABS AT715-2400** | 96" /2400mm | 7*1 |
| **539-863** | **ABS AT715-2500** | 100" /2500mm | |
| **539-864** | **ABS AT715-2600** | 104" /2600mm | |
| **539-865** | **ABS AT715-2800** | 112" /2800mm | |
| **539-866** | **ABS AT715-3000** | 120" /3000mm | |

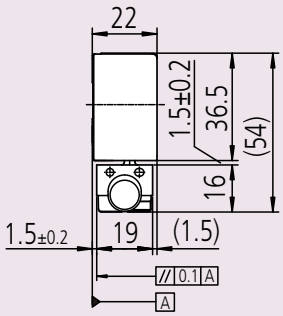
*1: Combination of a 5m signal cable and a 2m extension cable

### Optional Accessories

**09AAB674A** Extension cable 2m
**09AAB674B** Extension cable 5m
**09AAB674C** Extension cable 7m
**174-183A** 2-Axis KA Counter
**174-185A** 3-Axis KA Counter



**174-183A**



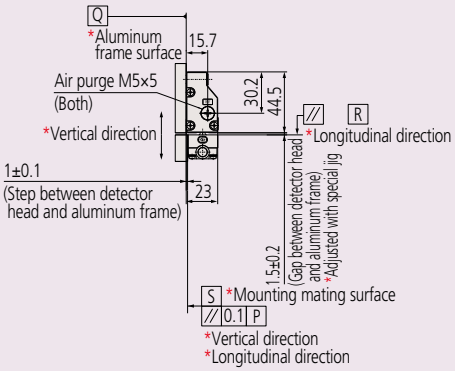
ABSOLUTE™

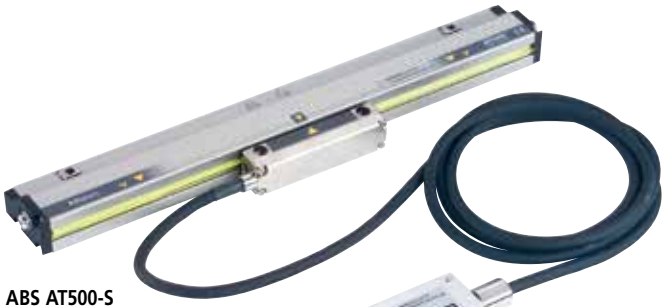
# Linear Scales ABS AT500

## SERIES 539 — Slim Spar Type

- Slim shape is suitable for space-saving designs.
- The high-rigidity **ABS AT500-S** series has vibration resistance, shock resistance and temperature control. The **ABS AT500-H** series offers excellent temperature control and high accuracy.
- Scale alarm display LED allows for easy maintenance.
- Supports the interfaces of various manufacturers, allowing a variety of system configurations.

### SC Type



ABS AT500-S

IP53



ABS AT500-H

## SPECIFICATIONS

| | High-rigidity type | High-accuracy type | |
|---|---|---|---|
| Model | **ABS AT500-SC** | **ABS AT500-HC** | **ABS AT500-HL/HR** |
| Resolution | 0.005μm*1/0.05μm | | |
| Maximum response speed | 150m/min (72m/min for the H series whose resolution is 0.005μm) | | |
| Effective range | 100 to 2200mm | 100 to 1000mm | 100 to 350mm |
| Accuracy (20°C)*2 | (3+3L0/1000)μm | (2+2L0/1000)μm | |
| Reference point of expansion influenced by the temperature fluctuation | Center of the effective measuring length | | Edge of the effective measuring length<br>HL: "+" side of the absolute value<br>HR: "−" side of the absolute value |
| Protection level | IP53 | | |

*1: The exact value is 0.0048828125μm since the 20μm signal is divided by 4096.

## Meaning of Model No.

**ABS AT5**□□□ - □□□ - □□

Resolution/Applicable system

Effective range

| Model | Resolution | Applicable system |
|---|---|---|
| **ABS AT553** | 0.05μm | FANUC Ltd. NC Control unit |
| **ABS AT555** | 0.005μm | |
| **ABS AT543** | 0.05μm | Mitsubishi Electric Corporation MITSUBISHI CNC series |
| **ABS AT545** | 0.005μm | |
| **ABS AT543A** | 0.05μm | Mitsubishi Electric Corporation MELSERVO series |
| **ABS AT545A** | 0.005μm | |
| **ABS AT573A** | 0.05μm | Panasonic Corporation, Motor Business Unit MINAS series*1 |
| **ABS AT503** | 0.05μm | Amplifiers supporting Mitutoyo ENSIS interface*1 (Nikki Denso Co., Ltd., Servoland corporation, PMAC Japan Co., Ltd.) |
| **ABS AT503A** | | |
| **ABS AT505** | 0.005μm | |
| **ABS AT505A** | | |
| **ABS AT524** | 0.01μm | Siemens AG SINAMICS/SINUMERIK series (supporting DRIVE-CLiQ) |
| **ABS AT527** | 0.001μm | |

Reference point of expansion on the scale unit influenced by temperature fluctuation*
**C**: Center of the effective range
**L**: "+" side of the absolute value
**R**: "−" side of the absolute value
* "**L**" or "**R**" is marked only for the high accuracy type.

Type of the scale unit
**S**: High rigidity type
**H**: High accuracy type
Note: "Reference point of expansion"
The scale unit expands or contracts influenced by the temperature fluctuation.
The mechanical reference point of expansion is defined as the reference point.

*ABS AT5 □□□
Transmission method
Nothing: Full duplex communication
**A**: Half-duplex communication

*1: Please contact each manufacturer for details.



Mitutoyo

# Linear Scales ABS ST700

## SERIES 579 — General-purpose Type



Scale base type

ABSOLUTE™

PROPRIETARY INSPECTION CERTIFICATE

- Absolute measurement with exposed scales.
- Non-contact detection is optimal for high-speed and high-acceleration devices such as linear motors.
- Electromagnetic induction principle means scales are unaffected by water and oil contamination.
- The detector head is approximately 1/3 the previous model size: 50mm (W) × 28mm (D) × 11mm (H).
- Cable outlets can be in four directions, with mounting holes on the top and sides.
- Accuracy (5+5L/1000)µm, glass scale: (3+3L/1000)µm (previous models: (8+5L/1000)µm) L: Effective range (mm).
- Compatible with servo amplifiers from a range of companies (high-speed serial interfaces).
- Signal adjustment at installation is automatically performed with dedicated software.

## SPECIFICATIONS

| Model | **ABS ST700** |
|---|---|
| Scale type | Scale base type |
| Resolution | 0.1µm (0.05µm to special order) |
| Detection method | Electromagnetic induction ABS linear encoder |
| Max. effective range | 6000mm |
| Accuracy (20°C) | 5+(5L/1000)µm L: Effective range (mm) |
| Maximum response speed | 5m/s |
| Linear expansion coefficient | $(12.0\pm1.5)\times10^{-6}$/°C<br>(When the material of the mounting components is steel or equivalent.) |
| Power supply voltage | 5V±10% (at the detection head)<br>(Ripple + spike noise component should be less than 100mV.) |
| Operating temperature/humidity range | 0 to 50°C, RH 20 to 80% |
| Storage temperature/humidity range | –20 to 70°C, RH 20 to 80% |

## Meaning of Model No.

**ABS ST7 0 8 A L - 100 A - R**

Absolute type

**Series name**
Separate Type ABSOLUTE Linear Scale
**ABS ST700 Compact-type series** (Effective range ≤ 3m)
**ABS ST700 Compact-type series** (3.2m ≤ Effective range ≤ 6m)

**Interface specification**[*1]
**0**:Supports Mitutoyo ENSIS high-speed interface
**ABS ST708A**, **ST708AL**
**4**:Supports Mitsubishi Electric Corporation high-speed serial interface
**ABS ST748**, **ST748AL**, **ABS ST748**, **ST748L**
**5**:Supports FANUC Ltd. high-speed serial interface
**ABS ST758**, **ST758L**
**7**:Supports Panasonic Corporation, Motor Business Unit high-speed serial interface
**ABS ST778A**, **ST778AL**
**8**:Supports YASKAWA Electric Corporation high-speed serial interface
**ABS ST788A**, **ST788AL**

**Detection head form and resolution**
**8**: Form: 50mm (W)×28mm (D)×11mm (H)
**Resolution**: 0.1µm
**9**: 0.05µm resolution (to special orders)

**Transmission method**
**A**: 2-wire system
**Nothing**: 4-wire system

**Nothing**: 100mm to 3000mm
**L**: 3200mm to 6000mm

**Effective range**: 100mm to 6000mm

**A**: Scale base type

**Head cable outlet direction**
**R**: Right side
**L**: Left side
**U**: Upper side
**D**: Lower side

## Available Interfaces[*1]

| |
|---|
| FANUC Ltd. FS-i Series, Power Mate i Series |
| Mitsubishi Electric Corporation MELSERVO MR-J4/MR-J3 Series |
| Mitsubishi Electric Corporation CNC Series, MDS-D/MDS-DH Series |
| YASKAWA Electric Corporation Σ-V,Σ-III Series |
| Panasonic Corporation, Motor Business Unit MINAS-A5, A5L, A5N, A5NL, MINAS-A4, A4P, A4N, A4NL Series |
| Mitutoyo ENSIS[*2]<br>Nikki Denso Co.,Ltd. VCII/VC/VPS series<br>Servoland Corporation SVF Series<br>PMAC Japan Co. Ltd. UMAC-Turbo PMAC2 |

*1 Be sure to contact each manufacturer for details of the applicable systems (availability of connection).
*2 ENSIS is a registered trademark of Mitutoyo Corporation.

### Feedback cable

- Yaskawa Electric Corporation serial cable can be used as the feedback cable to connect to a Yaskawa Electric Corporation servo amplifier.
  Cable model number : JZSP-CLP- (03, 05, 10, 15, 20)
- For the feedback cable to connect to a Mitsubishi Electric Corporation MR-J2S/MR-J3, contact Mitutoyo with the following code numbers.

| | | |
|---|---|---|
| For the MR-J2S | 5m : | No.06ACF116A |
| | 10m : | No.06ACF116B |
| For the MR-J3 | 5m : | No.06ACF117A |
| | 10m : | No.06ACF117B |

ABSOLUTE™

# Linear Scale ABS ST1300

## SERIES 579 — High-speed, High-resolution Absolute Tape Scale

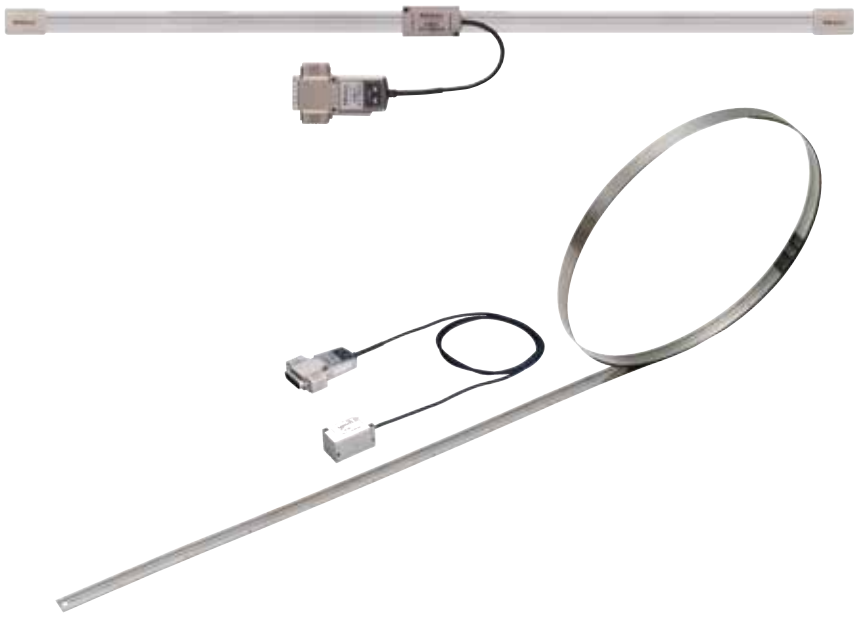
- 12m maximum effective length, 8-m/s max. response speed and 1nm minimum resolution.
- Extensive interface compatibility. See specifications below.
- Outstanding robustness against contamination compared to earlier photoelectric types by using a new detection principle.
- Choice between double-sided tape and tension mounting methods.
- Signal validation program facilitates mounting adjustment and maintenance.
- Applicable Interfaces: FANUC; Mitsubishi Electric; Yaskawa Electric; Panasonic; Mitutoyo ENSIS standard interface

- Any scale size drawings are available on request.

**Double-end tension version**



**Double-sided adhesive mounting version**



## SPECIFICATIONS

| Model | ABS ST1300 |
|---|---|
| Range | max. 12 m |
| Accuracy | 10 µm/m (± 5µm) |
| Max. Response Speed | 8 m/s (Varies according to the interface) |
| Min. Resolution | 1 nm / 10 nm |
| Scale Specifications | Metal tape |
| Applicable Interfaces | FANUC; Mitsubishi Electric; Yaskawa Electric; Panasonic; Mitutoyo ENSIS standard Interface |



Mitutoyo

# MICSYS

## SERIES 549 High-accuracy, Non-contact 2D Encoder

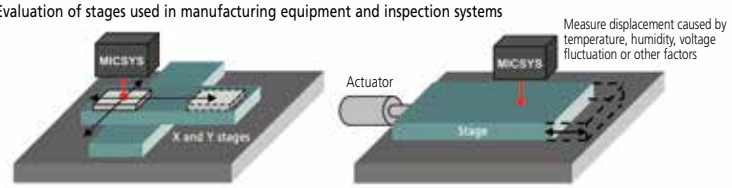


## SPECIFICATIONS

| Order No. | **549-701A** |
|---|---|
| Model | **MICSYS-SA1** |
| Detection method | Laser speckle image correlation |
| Effective range | ±100μm (2D) |
| Resolution | 1 nm |
| Accuracy (20°C) | ±100 nm |
| Data update period | 20Hz |

## Applications

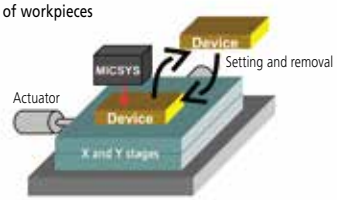
1. Evaluation of stages used in manufacturing equipment and inspection systems



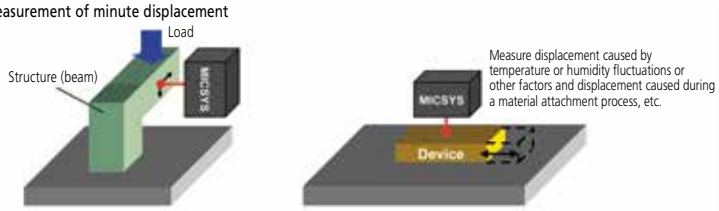

a) Evaluation of position repeatability

b) Evaluation of standstill stability and drift

2. Highly accurate positioning of workpieces




3. Measurement of minute displacement

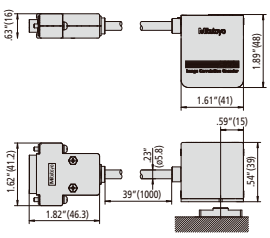


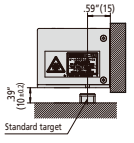

a) Measurement of minute displacement of a structure

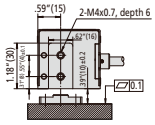
b) Measurement of minute displacement of a workpiece

## DIMENSIONS

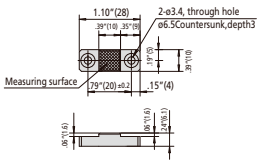
**Detector** Mass : 300g



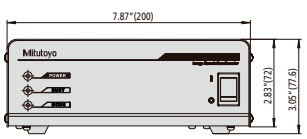



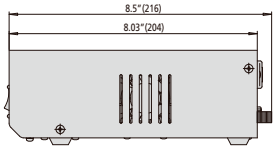




**Standard target** Mass : 10g




**I/F unit** Mass : 1700g




## FEATURES

- Simultaneous, non-contact measurement of X-Y position.
- Nano-resolution measurement.
- Suitable for applications such as stage position repeatability, strain measurement, deflection measurement, etc.
- Applies the image correlation of a speckle pattern.
- No scales needed—can detect on any optically rough surface.
- Detector can be completely removed from surface and replaced to continue reading.
- Drawings are available on request.

# Linear Scales AT103

## SERIES 539 — Standard Type

IP53



## FEATURES

- Enhanced vibration-resistance and durability.
- The innovative rubber lips keep out contaminants.
- An armored signal cable is used to connect the scale unit to the DRO counter for safe operation in harsh shop environments.
- The signal cable outlet can be positioned on either side of the detector head, allowing the signal cable to be connected from either direction.
- A wide variety of measuring ranges are available in this standard type scale unit.
- Connectable to the **KA** counter, **KLD** counter, or **PSU-200**.

### Optional Accessories

**09AAA033A**: Extension cable (80" / 2m)
**09AAA033B**: Extension cable (200" / 5m)
**09AAA033C**: Extension cable (280" / 7m)

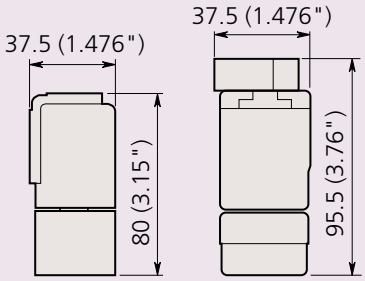


**174-183A** 2-Axis KA Counter
**174-185A** 3-Axis KA Counter



**174-183A**

Unit: mm (inch)




**Up to 3m** **Over 3m**

## SPECIFICATIONS

| Model | AT103 |
|---|---|
| Effective range | 4" to 240" / 100 to 6000mm (42 models) |
| Resolution | .001" to .000005" / 0.01 to 0.0001mm |
| Accuracy (20°C) | Effective range 100 to 3000: (5+5L₀/1000)µm<br>Effective range 3250 to 6000: (5+8L₀/1000)µm |
| Output signal | Two 90° phase-shifted sinusoidal signals |
| Maximum response speed | 120m/min (50m/min when the effective measuring length is 3250 to 6000mm) |
| Signal output pitch | 20µm |
| Scale reference point | Output in 50mm pitch |
| Protection level | IP53 |
| Operating temperature | 0 to 45°C |

*High-precision model **AT103F** (JIS Class 0, (3+3L₀/1000)µm) is also available to special order for the effective range of 100 to 2000mm.
*Ultrahigh-precision model **AT103S** (2+2L₀/1000)µm is also available to special order for the effective range of 100 to 500mm.

| AT103 | | | | Effective range L₀ inch / mm | Signal cable length (m) |
|---|---|---|---|---|---|
| Order No. (standard) | Model (standard) | Order No. (high accuracy) | Model (high accuracy) | | |
| **539-111-30** | **AT103-100** | **539-111-40** | **AT103-100F** | 4" /100mm | 3 |
| **539-112-30** | **AT103-150** | **539-112-40** | **AT103-150F** | 6" /150mm | |
| **539-113-30** | **AT103-200** | **539-113-40** | **AT103-200F** | 8" /200mm | |
| **539-114-30** | **AT103-250** | **539-114-40** | **AT103-250F** | 10" /250mm | |
| **539-115-30** | **AT103-300** | **539-115-40** | **AT103-300F** | 12" /300mm | |
| **539-116-30** | **AT103-350** | **539-116-40** | **AT103-350F** | 14" /350mm | |
| **539-117-30** | **AT103-400** | **539-117-40** | **AT103-400F** | 16" /400mm | |
| **539-118-30** | **AT103-450** | **539-118-40** | **AT103-450F** | 18" /450mm | |
| **539-119-30** | **AT103-500** | **539-119-40** | **AT103-500F** | 20" /500mm | |
| **539-121-30** | **AT103-600** | **539-121-40** | **AT103-600F** | 24" /600mm | |
| **539-123-30** | **AT103-700** | **539-123-40** | **AT103-700F** | 28" /700mm | |
| **539-124-30** | **AT103-750** | **539-124-40** | **AT103-750F** | 30" /750mm | |
| **539-125-30** | **AT103-800** | **539-125-40** | **AT103-800F** | 32" /800mm | |
| **539-126-30** | **AT103-900** | **539-126-40** | **AT103-900F** | 36" /900mm | |
| **539-127-30** | **AT103-1000** | **539-127-40** | **AT103-1000F** | 40" /1000mm | 5 |
| **539-128-30** | **AT103-1100** | **539-128-40** | **AT103-1100F** | 44" /1100mm | |
| **539-129-30** | **AT103-1200** | **539-129-40** | **AT103-1200F** | 48" /1200mm | |
| **539-130-30** | **AT103-1300** | **539-130-40** | **AT103-1300F** | 52" /1300mm | |
| **539-131-30** | **AT103-1400** | **539-131-40** | **AT103-1400F** | 56" /1400mm | |
| **539-132-30** | **AT103-1500** | **539-132-40** | **AT103-1500F** | 60" /1500mm | |
| **539-133-30** | **AT103-1600** | **539-133-40** | **AT103-1600F** | 64" /1600mm | |
| **539-134-30** | **AT103-1700** | **539-134-40** | **AT103-1700F** | 68" /1700mm | |
| **539-135-30** | **AT103-1800** | **539-135-40** | **AT103-1800F** | 72" /1800mm | |
| **539-136-30** | **AT103-2000** | **539-136-40** | **AT103-2000F** | 80" /2000mm | |
| **539-137-30** | **AT103-2200** | — | **AT103-2200F** | 88" /2200mm | |
| **539-138-30** | **AT103-2400** | — | **AT103-2400F** | 96" /2400mm | 7 |
| **539-139-30** | **AT103-2500** | — | **AT103-2500F** | 100" /2500mm | |
| **539-140-30** | **AT103-2600** | — | **AT103-2600F** | 104" /2600mm | |
| **539-141-30** | **AT103-2800** | — | **AT103-2800F** | 112" /2800mm | |
| **539-142-30** | **AT103-3000** | — | **AT103-3000F** | 120" /3000mm | |
| **539-143-30** | **AT103-3250** | — | **AT103-3250F** | 130" /3250mm | 10 |
| **539-144-30** | **AT103-3500** | — | **AT103-3500F** | 140" /3500mm | |
| **539-145-30** | **AT103-3750** | — | **AT103-3750F** | 150" /3750mm | |
| **539-146-30** | **AT103-4000** | — | **AT103-4000F** | 160" /4000mm | |
| **539-147-30** | **AT103-4250** | — | **AT103-4250F** | 170" /4250mm | |
| **539-148-30** | **AT103-4500** | — | **AT103-4500F** | 180" /4500mm | |
| **539-149-30** | **AT103-4750** | — | **AT103-4750F** | 190" /4750mm | 15 |
| **539-150-30** | **AT103-5000** | — | **AT103-5000F** | 200" /5000mm | |
| **539-151-30** | **AT103-5250** | — | **AT103-5250F** | 210" /5250mm | |
| **539-152-30** | **AT103-5500** | — | **AT103-5500F** | 220" /5500mm | |
| **539-153-30** | **AT103-5750** | — | **AT103-5750F** | 230" /5750mm | |
| **539-154-30** | **AT103-6000** | — | **AT103-6000F** | 240" /6000mm | |

# Linear Scales AT113

## SERIES 539 — Slim Spar Type

- Slim spar type with unit sectional dimensions of 22×35mm.
- Connectable to the **KA** counter, **KLD** counter or **PSU-200**.
- Dimensionally compatible with **AT116** linear scale units.



## SPECIFICATIONS

| Model | AT113 |
|---|---|
| Effective range | 4" to 60" / 100 to 1500mm (20 models) |
| Resolution | .001" to .000005" / 0.01 to 0.0001mm |
| Accuracy (20°C) | Standard: (5+5L₀/1000)μm, High accuracy: (3+3Lo/1000) |
| Output signal | Two 90° phase-shifted sinusoidal signals |
| Maximum response speed | 120m/min |
| Signal output pitch | 20μm |
| Scale reference point | Output in 50mm pitch |
| Protection level | IP53 |
| Operating temperature | 0 to 45°C |

* High-precision model **AT113F** (JIS Class 0, 3+3L₀/1000)μm is also available to special order.
* Ultrahigh-precision model **AT113S** (2+2L₀/1000)μm is also available to special order for the effective range 100 to 500mm.

| AT113 | | | | Effective range | Signal cable length(m) |
|---|---|---|---|---|---|
| Order No. (standard) | Model | Order No. (High accuracy) | Model | L₀ inch / mm | |
| **539-201-30** | **AT113-100** | **539-201-40** | **AT113-100F** | 4" /100mm | 3 |
| **539-202-30** | **AT113-150** | **539-202-40** | **AT113-150F** | 6" /150mm | |
| **539-203-30** | **AT113-200** | **539-203-40** | **AT113-200F** | 8" /200mm | |
| **539-204-30** | **AT113-250** | **539-204-40** | **AT113-250F** | 10" /250mm | |
| **539-205-30** | **AT113-300** | **539-205-40** | **AT113-300F** | 12" /300mm | |
| **539-206-30** | **AT113-350** | **539-206-40** | **AT113-350F** | 14" /350mm | |
| **539-207-30** | **AT113-400** | **539-207-40** | **AT113-400F** | 16" /400mm | |
| **539-208-30** | **AT113-450** | **539-208-40** | **AT113-450F** | 18" /450mm | |
| **539-209-30** | **AT113-500** | **539-209-40** | **AT113-500F** | 20" /500mm | |
| **539-211-30** | **AT113-600** | **539-211-40** | **AT113-600F** | 24" /600mm | |
| **539-213-30** | **AT113-700** | **539-213-40** | **AT113-700F** | 28" /700mm | |
| **539-214-30** | **AT113-750** | **539-214-40** | **AT113-750F** | 30" /750mm | |
| **539-215-30** | **AT113-800** | **539-215-40** | **AT113-800F** | 32" /800mm | |
| **539-216-30** | **AT113-900** | **539-216-40** | **AT113-900F** | 36" /900mm | |
| **539-217-30** | **AT113-1000** | **539-217-40** | **AT113-1000F** | 40" /1000mm | 5 |
| **539-218-30** | **AT113-1100** | **539-218-40** | **AT113-1100F** | 44" /1100mm | |
| **539-219-30** | **AT113-1200** | **539-219-40** | **AT113-1200F** | 48" /1200mm | |
| **539-220-30** | **AT113-1300** | **539-220-40** | **AT113-1300F** | 52" /1300mm | |
| **539-221-30** | **AT113-1400** | **539-221-40** | **AT113-1400F** | 56" /1400mm | |
| **539-222-30** | **AT113-1500** | **539-222-40** | **AT113-1500F** | 60" /1500mm | |

PROPRIETARY INSPECTION CERTIFICATE

### Optional Accessories

**09AAA033A**: Extension cable (80" / 2m)
**09AAA033B**: Extension cable (200" / 5m)
**09AAA033C**: Extension cable (280" / 7m)

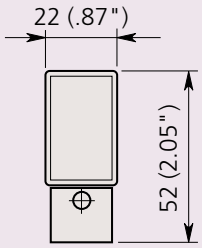


**174-183A** 2-Axis KA Counter
**174-185A** 3-Axis KA Counter



**174-183A**

Unit: mm (inch)



# Linear Scales AT112-F

## SERIES 539 — Super Slim Spar Type

- Super slim spar type with unit sectional dimensions of 15.4×30mm.
- Connectable to the **KA** counter, **KLD** counter or **PSU-200**.



### Optional Accessories

**09AAA033A**: Extension cable (80" / 2m)
**09AAA033B**: Extension cable (200" / 5m)
**09AAA033C**: Extension cable (280" / 7m)

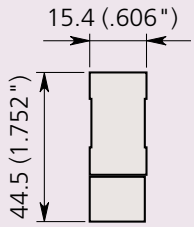


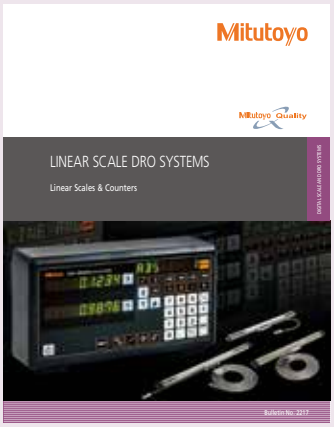
**174-183A** 2-Axis KA Counter
**174-185A** 3-Axis KA Counter



**174-183A**

Unit: mm (inch)




Refer to Bulletin No. (2217) for more details.

## SPECIFICATIONS

| Model | **AT112-F** (High Accuracy) |
|---|---|
| Effective range | 1.5" to 40" / 50 to 1020mm (19 models) |
| Resolution | .001 to .000005" / 0.01mm to 0.0001mm |
| Accuracy (20°C) | (3+3L₀/1000)µm |
| Output signal | Two 90° phase-shifted sinusoidal signals |
| Maximum response speed | 50m/min |
| Signal output pitch | 20µm |
| Scale reference point | Output in 50mm pitch*1 |
| Protection level | IP53 |
| Operating temperature | 0 to 45°C |

* Ultra-high precision model **AT112S** (2+2L₀/1000)µm is also available to special order for the effective range 50 to 320mm.
*1: Models whose effective range is 50mm or 70mm: Center point
Models whose effective range is 120mm or more: 50mm pitch starting at a point 35mm from the "▼" mark on the left seen from the front.

| AT112-F | | Effective range L₀ inch / mm | Signal cable length (m) |
|---|---|---|---|
| Order No. | Model | | |
| **539-251-10** | **AT112-50F** | 1.5" /50mm | |
| **539-252-10** | **AT112-70F** | 2.5" /70mm | |
| **539-253-10** | **AT112-120F** | 4.5" /120mm | |
| **539-254-10** | **AT112-170F** | 6.5" /170mm | |
| **539-255-10** | **AT112-220F** | 8.5" /220mm | |
| **539-256-10** | **AT112-270F** | 10.5" /270mm | |
| **539-257-10** | **AT112-320F** | 12.5" /320mm | |
| **539-258-10** | **AT112-370F** | 14.5" /370mm | |
| **539-259-10** | **AT112-420F** | 16.5" /420mm | |
| **539-260-10** | **AT112-470F** | 18.5" /470mm | 3 |
| **539-261-10** | **AT112-520F** | 20" /520mm | |
| **539-262-10** | **AT112-570F** | 22" /570mm | |
| **539-263-10** | **AT112-620F** | 24" /620mm | |
| **539-264-10** | **AT112-670F** | 26" /670mm | |
| **539-265-10** | **AT112-720F** | 28" /720mm | |
| **539-266-10** | **AT112-770F** | 30" /770mm | |
| **539-267-10** | **AT112-820F** | 32" /820mm | |
| **539-268-10** | **AT112-920F** | 36" /920mm | |
| **539-269-10** | **AT112-1020F** | 40" /1020mm | |

# Linear Scales AT116

## SERIES 539 — Economy and Slim Spar Type

### FEATURES

- Suitable for milling machines, XY tables, jigs, etc.
- Dimensionally compatible with **AT113** linear scale units.
- Connectable to the **KA** counter, **KLD** counter or **PSU-200**.



### SPECIFICATIONS

| Model | AT116 |
|---|---|
| Effective range | 4" to 60" / 100 to 1500mm (20 models) |
| Resolution | 0.01 to 0.0001mm (.001" to .000005") |
| Accuracy (20°C) | (5+5L₀/1000)µm |
| Output signal | Two 90° phase-shifted sinusoidal signals |
| Maximum response speed | 50m/min |
| Signal output pitch | 20µm |
| Scale reference point | Output in 50mm pitch |
| Protection level | IP53 |
| Operating temperature | 0 to 45°C |

| AT116 | | Effective range L₀ inch / mm | Signal cable length (m) |
|---|---|---|---|
| Order No. | Model | | |
| **539-271-30** | **AT116-100** | 4" /100mm | 3.5 |
| **539-272-30** | **AT116-150** | 6" /150mm | |
| **539-273-30** | **AT116-200** | 8" /200mm | |
| **539-274-30** | **AT116-250** | 10" /250mm | |
| **539-275-30** | **AT116-300** | 12" /300mm | |
| **539-276-30** | **AT116-350** | 14" /350mm | |
| **539-277-30** | **AT116-400** | 16" /400mm | |
| **539-278-30** | **AT116-450** | 18" /450mm | |
| **539-279-30** | **AT116-500** | 20" /500mm | |
| **539-281-30** | **AT116-600** | 24" /600mm | |
| **539-283-30** | **AT116-700** | 28" /700mm | |
| **539-284-30** | **AT116-750** | 30" /750mm | |
| **539-285-30** | **AT116-800** | 32" /800mm | |
| **539-286-30** | **AT116-900** | 36" /900mm | |
| **539-287-30** | **AT116-1000** | 40" /1000mm | 5 |
| **539-288-30** | **AT116-1100** | 44" /1100mm | |
| **539-289-30** | **AT116-1200** | 48" /1200mm | |
| **539-290-30** | **AT116-1300** | 52" /1300mm | |
| **539-291-30** | **AT116-1400** | 56" /1400mm | |
| **539-292-30** | **AT116-1500** | 60" /1500mm | |

PROPRIETARY INSPECTION CERTIFICATE

### Optional Accessories

**09AAB674A:** Extension cable (2m / 80")
**09AAB674B**: Extension cable (5m / 200")
**09AAB674C**: Extension cable (7m / 280")

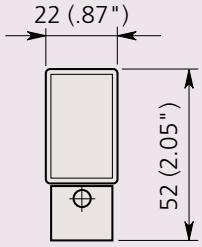


**174-183A** 2-Axis KA Counter
**174-185A** 3-Axis KA Counter



**174-183A**

Unit: mm (inch)



# Linear Scales AT402E

## SERIES 539 — General-purpose Type

- Ideal for machine tools for heavy cutting, as well as linear motors.
- Multi-point elastic fixing for excellent vibration resistance (200m/s$^2$), shock resistance (400m/s$^2$) and temperature characteristics.
- The Absolute Interval Code allows for a simplified, low-cost ABS system.
- High accuracy of ±2µm (up to 540mm)



## SPECIFICATIONS

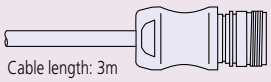
| Model | AT402E |
|---|---|
| Effective range | 5.6" to 121.6" / 140 to 3040mm (24 models) |
| Accuracy (20°C) | Effective range: 140 to 540mm: ±2µm<br>Effective range: 640 to 940mm: ±3µm<br>Effective range: 1040 to 3040mm: ±3µm/m |
| Output signal | Signal: 1Vp-p differential sinusoidal signal<br>Differential reference point pulse: **Absolute Interval Code** compatible |
| Maximum response speed | 120m/min (With sinusoidal signal amplitude of –3dB) |
| Signal output pitch | 20µm |
| Protection level | IP53 |
| Operating temperature | 0 to 45°C |
| Cable configuration | Type A: 3m flying lead cable<br>Type B: 3m cable with European CNC connectors<br>Type C: 3m cable with FANUC connectors |

Cable A: Lead wires type



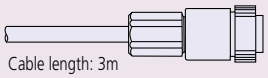
Cable length: 3m

Cable B: Connectable to Euro controller



Cable length: 3m

Cable C: Connectable to FANUC serial board C



Cable length: 3m

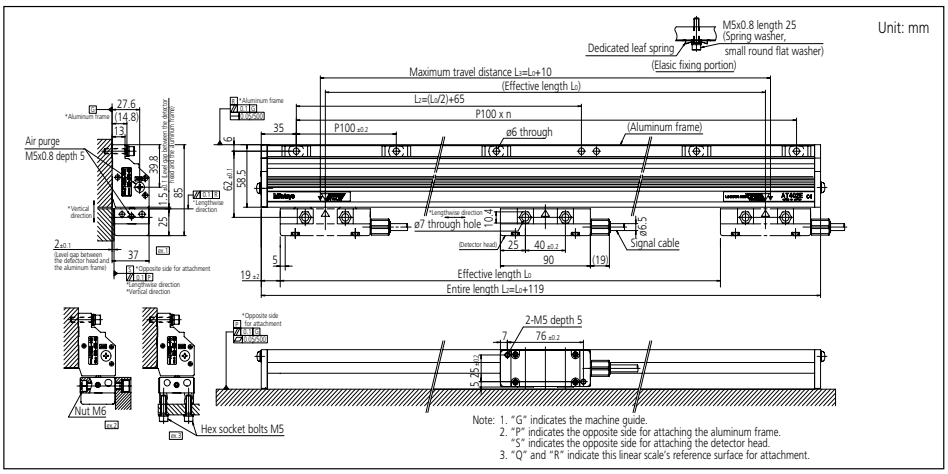
| AT402E | | Effective range |
|---|---|---|
| Order No. | **Model** | $L_0$ inch / mm |
| **539-371-** □□ | **AT402E-140** | 5.6" /140mm |
| **539-373-** □□ | **AT402E-240** | 9.6" /240mm |
| **539-374-** □□ | **AT402E-340** | 13.6" /340mm |
| **539-375-** □□ | **AT402E-440** | 17.6" /440mm |
| **539-376-** □□ | **AT402E-540** | 21.6" /540mm |
| **539-377-** □□ | **AT402E-640** | 25.6" /640mm |
| **539-378-** □□ | **AT402E-740** | 29.6" /740mm |
| **539-379-** □□ | **AT402E-840** | 33.6" /840mm |
| **539-380-** □□ | **AT402E-940** | 37.6" /940mm |
| **539-381-** □□ | **AT402E-1040** | 41.6" /1040mm |
| **539-382-** □□ | **AT402E-1140** | 45.6" /1140mm |
| **539-383-** □□ | **AT402E-1240** | 49.6" /1240mm |

| AT402E | | Effective range |
|---|---|---|
| Order No. | **Model** | $L_0$ inch / mm |
| **539-384-** □□ | **AT402E-1340** | 53.6" /1340mm |
| **539-385-** □□ | **AT402E-1440** | 57.6" /1440mm |
| **539-386-** □□ | **AT402E-1540** | 61.6" /1540mm |
| **539-387-** □□ | **AT402E-1640** | 65.6" /1640mm |
| **539-388-** □□ | **AT402E-1740** | 69.6" /1740mm |
| **539-389-** □□ | **AT402E-1840** | 73.6" /1840mm |
| **539-390-** □□ | **AT402E-2040** | 81.6" /2040mm |
| **539-391-** □□ | **AT402E-2240** | 89.6" /2240mm |
| **539-392-** □□ | **AT402E-2440** | 97.6" /2440mm |
| **539-393-** □□ | **AT402E-2640** | 105.6" /2640mm |
| **539-394-** □□ | **AT402E-2840** | 113.6" /2840mm |
| **539-395-** □□ | **AT402E-3040** | 121.6" /3040mm |

Signal cable length: 3m

* The indication of " □□ " in the code numbers will be **01** for Type A, **02** for Type B, **03** for Type C, and **00** for no cable

## DIMENSIONS




Note: 1. "G" indicates the machine guide.
2. "P" indicates the opposite side for attaching the aluminum frame.
"S" indicates the opposite side for attaching the detector head.
3. "Q" and "R" indicate this linear scale's reference surface for attachment.

# Linear Scales AT203

## SERIES 539 — Standard Type



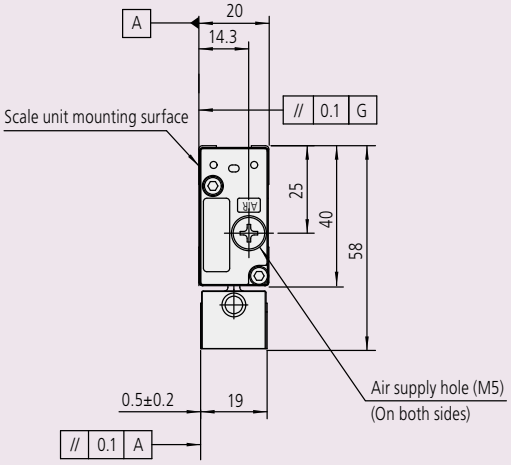
PROPRIETARY INSPECTION CERTIFICATE

- The travel length of the linear scale is output with 2-phase square wave signals, which can be used as a feedback signal for NC machine tools.
- The pulse signal unit (PSU) is no longer needed, and the **AT203** can be directly connected to an NC machine tool.

## SPECIFICATIONS

| Model | AT203 |
|---|---|
| Effective range | 4" to 240" / 100 to 6000mm (42 models) |
| Accuracy (20°C) | Effective range: 100 to 1500mm (3+3L₀/1000)µm<br>Effective range: 1600 to 3000mm (5+5L₀/1000)µm<br>Effective range: 3250 to 6000mm (5+8L₀/1000)µm |
| Output signal | Two 90° phase-shifted square wave signals |
| Maximum response speed | 120m/min (50m/min when the effective range is 3250 to 6000mm) |
| Resolution | 0.1/0.5/1µm (Switchable by the DIP switches) |
| Scale reference point | Output in 50mm pitch |
| Protection level | IP53 |
| Operating temperature | 0°C to 45°C |

| AT203 | | Effective range | Signal cable length |
|---|---|---|---|
| Order No. | Model | L₀ inch / mm | (m) |
| **539-411-30** | **AT203-100** | 4" /100mm | 5 |
| **539-412-30** | **AT203-150** | 6" /150mm | |
| **539-413-30** | **AT203-200** | 8" /200mm | |
| **539-414-30** | **AT203-250** | 10" /250mm | |
| **539-415-30** | **AT203-300** | 12" /300mm | |
| **539-416-30** | **AT203-350** | 14" /350mm | |
| **539-417-30** | **AT203-400** | 16" /400mm | |
| **539-418-30** | **AT203-450** | 18" /450mm | |
| **539-419-30** | **AT203-500** | 20" /500mm | |
| **539-421-30** | **AT203-600** | 24" /600mm | |
| **539-423-30** | **AT203-700** | 28" /700mm | |
| **539-424-30** | **AT203-750** | 30" /750mm | |
| **539-425-30** | **AT203-800** | 32" /800mm | |
| **539-426-30** | **AT203-900** | 36" /900mm | |
| **539-427-30** | **AT203-1000** | 40" /1000mm | |
| **539-428-30** | **AT203-1100** | 44" /1100mm | |
| **539-429-30** | **AT203-1200** | 48" /1200mm | |
| **539-430-30** | **AT203-1300** | 52" /1300mm | |
| **539-431-30** | **AT203-1400** | 56" /1400mm | |
| **539-432-30** | **AT203-1500** | 60" /1500mm | |
| **539-433-30** | **AT203-1600** | 64" /1600mm | |
| **539-434-30** | **AT203-1700** | 68" /1700mm | |
| **539-435-30** | **AT203-1800** | 72" /1800mm | |
| **539-436-30** | **AT203-2000** | 80" /2000mm | |
| **539-437-30** | **AT203-2200** | 88" /2200mm | |
| **539-438-30** | **AT203-2400** | 96" /2400mm | |
| **539-439-30** | **AT203-2500** | 100" /2500mm | |
| **539-440-30** | **AT203-2600** | 104" /2600mm | |
| **539-441-30** | **AT203-2800** | 112" /2800mm | |
| **539-442-30** | **AT203-3000** | 120" /3000mm | |
| **539-443-30** | **AT203-3250** | 130" /3250mm | |
| **539-444-30** | **AT203-3500** | 140" /3500mm | |
| **539-445-30** | **AT203-3750** | 150" /3750mm | |
| **539-446-30** | **AT203-4000** | 160" /4000mm | |
| **539-447-30** | **AT203-4250** | 170" /4250mm | |
| **539-448-30** | **AT203-4500** | 180" /4500mm | |
| **539-449-30** | **AT203-4750** | 190" /4750mm | |
| **539-450-30** | **AT203-5000** | 200" /5000mm | |
| **539-451-30** | **AT203-5250** | 210" /5250mm | |
| **539-452-30** | **AT203-5500** | 220" /5500mm | |
| **539-453-30** | **AT203-5750** | 230" /5750mm | |
| **539-454-30** | **AT203-6000** | 240" /6000mm | |




- Any scale size drawings are available on request.

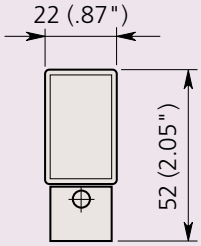
# Linear Scales AT216-T / AT217-TL

## SERIES 529 — Slim, Sealed Type



- Slim, sealed type incremental linear scales suitable for feedback systems in NC machine tools.
- Direct connection with NC machine tools is possible.
- Square wave RS-422A, 1µm/0.5µm & 5µm resolution.
- Armored cable included (unless otherwise specified)

Unit: mm (inch)




- Any scale size drawings are available on request.

**5µm resolution**

| AT216-T | | Effective range Lo inch / mm | Signal cable length (m) |
|---|---|---|---|
| Order No. | Model | | |
| **529-431-3** | **AT216-100T** | 4" /100mm | 5 |
| **529-432-3** | **AT216-150T** | 6" /150mm | |
| **529-433-3** | **AT216-200T** | 8" /200mm | |
| **529-434-3** | **AT216-250T** | 10" /250mm | |
| **529-435-3** | **AT216-300T** | 12" /300mm | |
| **529-436-3** | **AT216-350T** | 14" /350mm | |
| **529-437-3** | **AT216-400T** | 16" /400mm | |
| **529-438-3** | **AT216-450T** | 18" /450mm | |
| **529-439-3** | **AT216-500T** | 20" /500mm | |
| **529-441-3** | **AT216-600T** | 24" /600mm | |
| **529-443-3** | **AT216-700T** | 28" /700mm | |
| **529-444-3** | **AT216-750T** | 30" /750mm | |
| **529-445-3** | **AT216-800T** | 32" /800mm | |
| **529-446-3** | **AT216-900T** | 36" /900mm | |
| **529-447-3** | **AT216-1000T** | 40" /1000mm | |
| **529-448-3** | **AT216-1100T** | 44" /1100mm | |
| **529-449-3** | **AT216-1200T** | 48" /1200mm | |
| **529-450-3** | **AT216-1300T** | 52" /1300mm | |
| **529-451-3** | **AT216-1400T** | 56" /1400mm | |
| **529-452-3** | **AT216-1500T** | 60" /1500mm | |

**1µm/0.5µm resolution**

| AT217-TL | | Effective range Lo inch / mm | Signal cable length (m) |
|---|---|---|---|
| Order No. | Model | | |
| **529-461-5 (-7)** | **AT217-100TL** | 4" /100mm | 5 |
| **529-462-5 (-7)** | **AT217-150TL** | 6" /150mm | |
| **529-463-5 (-7)** | **AT217-200TL** | 8" /200mm | |
| **529-464-5 (-7)** | **AT217-250TL** | 10" /250mm | |
| **529-465-5 (-7)** | **AT217-300TL** | 12" /300mm | |
| **529-466-5 (-7)** | **AT217-350TL** | 14" /350mm | |
| **529-467-5 (-7)** | **AT217-400TL** | 16" /400mm | |
| **529-468-5 (-7)** | **AT217-450TL** | 18" /450mm | |
| **529-469-5 (-7)** | **AT217-500TL** | 20" /500mm | |
| **529-471-5 (-7)** | **AT217-600TL** | 24" /600mm | |
| **529-473-5 (-7)** | **AT217-700TL** | 28" /700mm | |
| **529-474-5 (-7)** | **AT217-750TL** | 30" /750mm | |
| **529-475-5 (-7)** | **AT217-800TL** | 32" /800mm | |
| **529-476-5 (-7)** | **AT217-900TL** | 36" /900mm | |
| **529-477-5 (-7)** | **AT217-1000TL** | 40" /1000mm | |
| **529-478-5 (-7)** | **AT217-1100TL** | 44" /1100mm | |
| **529-479-5 (-7)** | **AT217-1200TL** | 48" /1200mm | |
| **529-480-5 (-7)** | **AT217-1300TL** | 52" /1300mm | |
| **529-481-5 (-7)** | **AT217-1400TL** | 56" /1400mm | |
| **529-482-5 (-7)** | **AT217-1500TL** | 60" /1500mm | |

( -7) : option for unarmored cable

# Linear Scales AT211

**AT211-A (Multipoint mounting), AT211-B (Double-end mounting)**

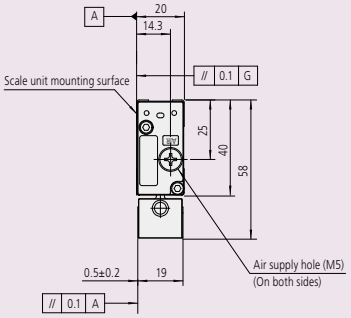
**SERIES 539 — Slim Spar and High-speed Type**

## FEATURES

- High-resolution, high-accuracy sealed type linear scales. Ideal for feedback control in positioning a semiconductor manufacturing system, CNC machine tool, etc.
- Two types of models are available: the AT211-A, the multiple-point installation type designed for improved resistance against vibration and shock; and the AT211-B, which attaches to a machine at both ends. The AT211-B is compatible with the AT113/AT116 slim type in size.




- This is a slim, sealed, 2-phase, square-wave scale that can be directly connected to a control unit.
- Scale alarm display LED allows for easy maintenance.
- A wide range of specifications to best suit your application.
- Suitable for the control of semiconductor manufacturing systems and NC machine tools.




- Any scale size drawings are available on request.

## Common specification

| Model | AT211 |
|---|---|
| Effective range* | 4 to 60" / 100 to 1500mm (20 models) |
| Accuracy (20°C)* | (3+3L₀/1000)μm L₀: effective range (mm) |
| | (2+2L₀/1000)μm (L₀≤500mm) |
| Output signal | Two 90° phase-shifted square wave signals |
| Maximum response speed* | 5.4 to 120m/min (varies depending on the resolution or minimum edge interval) |
| Resolution* | 0.1/ 0.2/ 0.5/ 1.0/ 2.5/ 5.0μm |
| Scale reference point* | 50mm/Center point/Left-edge point/Right-edge point |
| Protection level | IP53 |
| Operating temperature | 0 to 45°C |

* Desired specification is selectable.

## Meaning of Model No.

**AT211 - 0100 A 1 S - P 1 - A B**

- Effective range: 100 to 1500mm
- Mounting method: Multipoint mounting/Double-end mounting
- Scale reference point: 50mm/ Center point/ Left edge point/ Right edge point
- Indication accuracy: (3+3L₀/1000)μm / (2+2L₀/1000)μm
- Resolution/ Minimum edge-to-edge interval: 0.1 to 5μm / 125 to 1000ns, 22 types
- Direction: PA/PB phase
- Head cable: 0.3 to 9m, 9 types
- Signal cable: 3 to 7m / None, 10 types

# Linear Scales ST422

## SERIES 579 — Compact Type



*1:

| Effective range | Accuracy |
|---|---|
| 300mm or less | ±1µm |
| 500mm or less | ±2µm |
| 1000mm or less | ±3µm |
| 3000mm or less | ±3µm/m |

- The maximum response speed is 5000mm/s. (When resolution is 1µm and the minimum edge interval is 125ns.)
- Ultra-compact detector control unit allows use in applications where space-saving design is important.
- The maximum effective measurement length of 3000mm enables use on large machines.
- Simultaneous output of 2-phase square wave signals (maximum resolution: 0.2µm) and 2-phase sinusoidal wave signals (main signal: 40µm) is available.
- LED function for indicating signal errors.
- Equipped with scale reference point output.

## SPECIFICATIONS

| Model | ST422 |
|---|---|
| Detection method | Reflective photoelectric linear encoder |
| Output signal | 2-phase sinusoidal signals, 2-phase square wave signals |
| Main scale grating pitch | 40µm |
| Signal output pitch | 40µm |
| Effective range | 10 to 3000mm |
| Accuracy (20°C)*1 | ±1µm, ±2µm, ±3µm(/m) |
| Resolution | 0.2µm/ 0.5µm/ 1µm/ 5µm (Selectable with internal switch) |
| Scale reference point | Center point (10 to 75mm)/ 50mm pitch (100mm or more) |
| Maximum response speed | 5000mm/s (varies depending on the setting) |
| Minimum edge-to-edge interval | 125ns/ 250ns/ 500ns/ 1µs (selectable with internal switch) |
| Operating temperature/ humidity range | 0 to 40°C, RH 20 to 80% (no condensation) |
| Storage temperature/ humidity range | –20 to 60°C, RH 20 to 80% (no condensation) |
| Head cable length | 1m |

## Dimensions of scale units

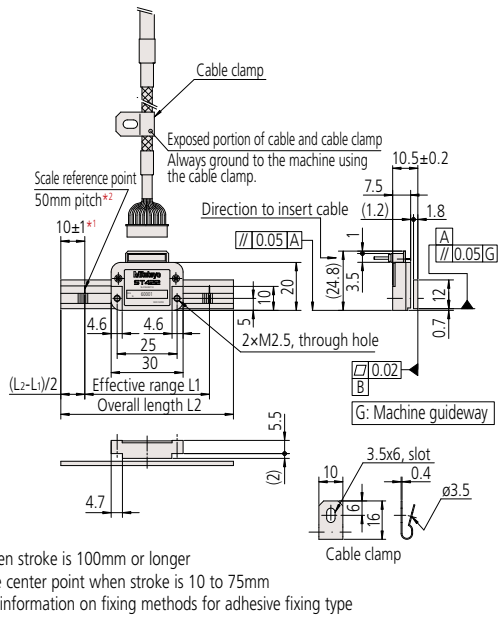
| Order No. | Code | Effective range $L_1$ (mm) | Overall length $L_2$ (mm) | Scale fixing pitch $L_3$ (mm) | Retaining spring A | Retaining spring B |
|---|---|---|---|---|---|---|
| 579-631 | ST422-10 | 10 | 30 | — | — | — |
| 579-632 | ST422-25 | 25 | 45 | — | — | — |
| 579-633 | ST422-50 | 50 | 70 | — | — | — |
| 579-634 | ST422-75 | 75 | 95 | — | — | — |
| 579-635 | ST422-100 | 100 | 120 | — | — | — |
| 579-636 | ST422-150 | 150 | 170 | — | — | — |
| 579-637 | ST422-200 | 200 | 220 | — | — | — |
| 579-638 | ST422-250 | 250 | 270 | — | — | — |
| 579-639 | ST422-300 | 300 | 320 | — | — | — |
| 579-640 | ST422-350 | 350 | 370 | — | — | — |
| 579-641 | ST422-400 | 400 | 440 | 100 | 1 pc. | 4 pcs. |
| 579-642 | ST422-450 | 450 | 490 | 75 | 1 pc. | 6 pcs. |
| 579-643 | ST422-500 | 500 | 540 | 80 | 1 pc. | 6 pcs. |
| 579-644 | ST422-600 | 600 | 640 | 100 | 1 pc. | 6 pcs. |
| 579-645 | ST422-700 | 700 | 740 | 85 | 1 pc. | 8 pcs. |
| 579-646 | ST422-800 | 800 | 840 | 100 | 1 pc. | 8 pcs. |
| 579-647 | ST422-900 | 900 | 940 | 90 | 1 pc. | 10 pcs. |

| Order No. | Code | Effective range $L_1$ (mm) | Overall length $L_2$ (mm) | Scale fixing pitch $L_3$ (mm) | Retaining spring A | Retaining spring B |
|---|---|---|---|---|---|---|
| 579-648 | ST422-1000 | 1000 | 1040 | 100 | 1 pc. | 10 pcs. |
| 579-649 | ST422-1100 | 1100 | 1140 | 90 | 1 pc. | 12 pcs. |
| 579-650 | ST422-1200 | 1200 | 1240 | 100 | 1 pc. | 12 pcs. |
| 579-651 | ST422-1300 | 1300 | 1340 | 130 | 1 pc. | 10 pcs. |
| 579-652 | ST422-1400 | 1400 | 1440 | 100 | 1 pc. | 14 pcs. |
| 579-653 | ST422-1500 | 1500 | 1540 | 125 | 1 pc. | 12 pcs. |
| 579-654 | ST422-1600 | 1600 | 1640 | 100 | 1 pc. | 16 pcs. |
| 579-655 | ST422-1700 | 1700 | 1740 | 120 | 1 pc. | 14 pcs. |
| 579-656 | ST422-1800 | 1800 | 1840 | 100 | 1 pc. | 18 pcs. |
| 579-657 | ST422-2000 | 2000 | 2040 | 100 | 1 pc. | 20 pcs. |
| 579-658 | ST422-2200 | 2200 | 2240 | 100 | 1 pc. | 22 pcs. |
| 579-659 | ST422-2400 | 2400 | 2440 | 100 | 1 pc. | 24 pcs. |
| 579-660 | ST422-2500 | 2500 | 2540 | 95 | 1 pc. | 26 pcs. |
| 579-661 | ST422-2600 | 2600 | 2640 | 100 | 1 pc. | 26 pcs. |
| 579-662 | ST422-2800 | 2800 | 2840 | 100 | 1 pc. | 28 pcs. |
| 579-663 | ST422-3000 | 3000 | 3040 | 100 | 1 pc. | 30 pcs. |

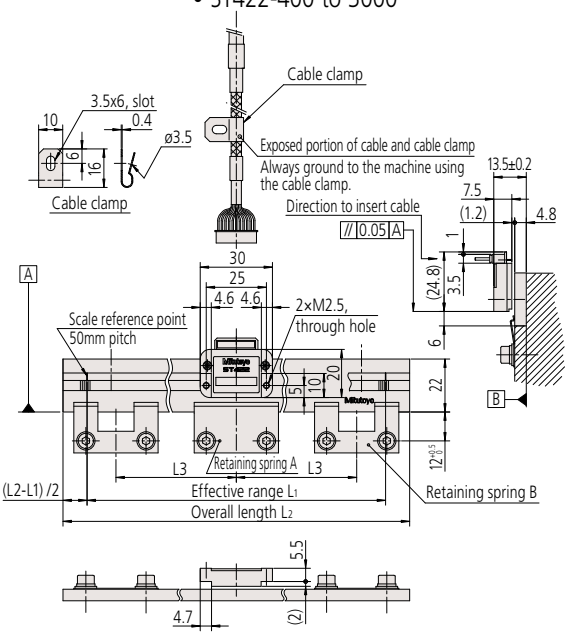
## ST422 Scale unit mounting dimensions

Unit: mm

• ST422-10 to 350 (Adhesive fixing type) *3




• ST422-400 to 3000

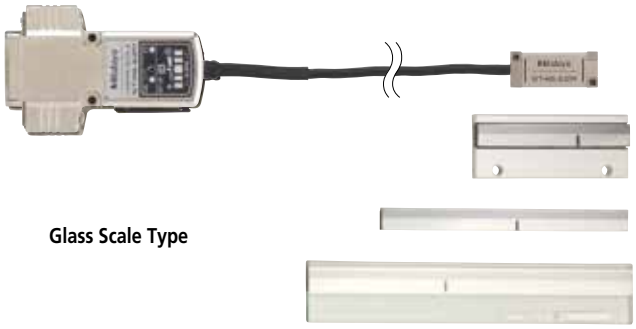



*1 When stroke is 100mm or longer
*2 One center point when stroke is 10 to 75mm
*3 For information on fixing methods for adhesive fixing type

• Any scale size drawings are available on request.

# Linear Scales ST46-EZA

## SERIES 579 — Compact Type



**Glass Scale Type**

**Metal Tape Scale Type**

•Double-end fixing tentioned design

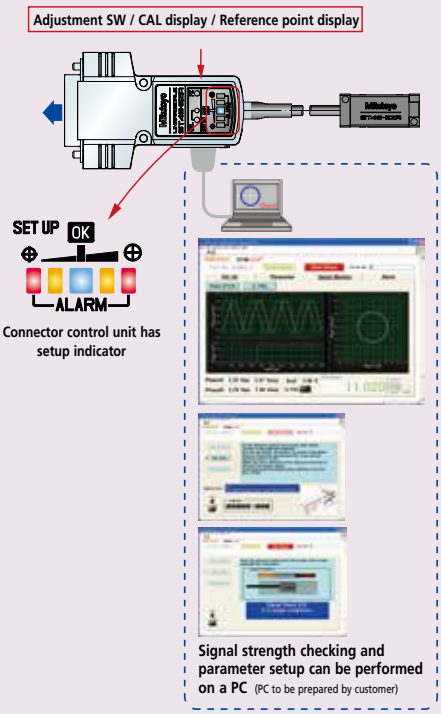


•Double-sided adhesive tape fixing design



**NC side**

- Includes an automatic adjusting function for the signal (EZA function) at the push of a button.
- Detector head mounting and signal adjustment possible without oscilloscope or PC.
- A setup indicator for checking signal strength is included.
- I/F circuit integrated in connector shell reduces volume to 60% compared to conventional interface.
- Self-diagnosis function with USB connectivity facilitates signal strength checking and parameter setup.
- Glass and metal tape scales are available.
- The thickness of the detector head is only 7.5 mm. The metal tape scale type has a mounting surface area of 12.5 by 9.325 mm, allowing use in applications where a space-saving design is important.
- Drawings are available on request




## SPECIFICATIONS

| Model | ST46-EZA | |
|---|---|---|
| Detection method | Reflective photoelectlic linear encoder | |
| Scale type | Glass | Metal tape |
| Main scale grating pitch | 20µm | |
| Output signal | Type B: 2-phase square wave signals, reference point pulse, external reset input.<br>Type C: 2-phase square wave signals, reference point pulse, 2-phase sinusoidal signals. | |
| Effective range | 10 to 3000mm | |
| Resolution | 0.05µm to 5 µm | |
| Accuracy (20°C) | Effective range 10 to 300mm: ±1µm<br>Effective range 350 to 500mm: ±2µm<br>Effective range 600 to 1000mm: ±3µm<br>Effective range 1100 to 3000mm: ±3µm/m | Effective range 10 to 1000mm: ±5µm<br>Effective range 1100 to 3000mm: ±5µm/m<br>(The above accuracy applies to individual scales. For double-end fixing designs, perform point-to-point correction after ensuring the metal tape is tensioned correctly.) |
| Maximum response speed | 2.6m/s (With sinusoidal signal amplitude of -3dB) | |
| Scale reference point | 50mm pitch, 10 to 80mm: Center point | |
| Power supply voltage | 5VDC±5% | |
| Operating temperature/humidity range | 0 to 40°C, RH 20 to 80% (no condensation) | |
| Storage temperature/humidity range | –20 to 60°C, RH 20 to 80% (no condensation) | |

# Linear Scales ST36

## SERIES 579 — High-accuracy Type



- Outputs two-phase sinusoidal wave signal, two-phase pulse signal, and 1Vp-p at 4µm pitch.
- High-accuracy type, 0.5µm class (effective range up to 300mm)
- Has a thinner detector head (thickness 11.5mm).
- The maximum effective measurement range of 3000mm allows use on large machines.
- Four types available for each signal output specification.
- LED function for indicating signal errors.
- Along with the output specifications of 2-phase sinusoidal wave and 2-phase square wave, the output specification of 1Vp-p wave is available.

- Any scale size drawings are available on request.

## SPECIFICATIONS

| Model | ST36 |
|---|---|
| Detection method | Reflective photoelectric linear encoder |
| Output signal | **ST36A**: 2-phase sinusoidal signals<br>**ST36B**: 2-phase square wave signals, alarm reset input<br>**ST36C**: 2-phase square wave signals, 2-phase sinusoidal signals<br>**ST36D**: 1Vp-p differential sinusoidal signals |
| Main scale grating pitch | 8µm |
| Signal output pitch | 4µm |
| Effective range | 10 to 3000mm |
| Resolution | 0.01, 0.02, 0.05, 0.1µm |
| Accuracy (20°C)*1 | ±0.5µm, ±1µm, ±2µm(/m) |
| Maximum response speed*2 | 1200mm/s |
| Scale reference point | Center point (10 to 80mm)<br>50mm pitch (100 to 3000mm) |
| Power supply voltage | DC5V ±5% |
| Operating temperature/humidity range | 0 to 40°C/ 20 to 80% (no condensation) |
| Storage temperature/ humidity range | –20 to 60°C/ 20 to 80% (no condensation) |
| Head cable length | 1m (high-flex connecting cable) |

*1:

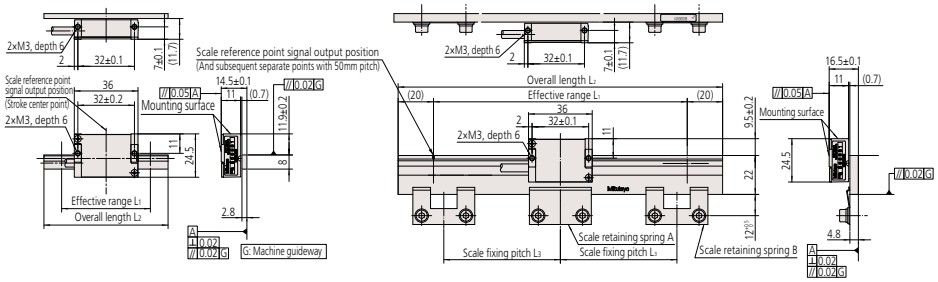
| Effective range | Accuracy |
|---|---|
| 300mm or less | ±0.5µm |
| 500mm or less | ±1µm |
| 1000mm or less | ±2µm |
| 3000mm or less | ±2µm/m |

*2: Maximum response speed when the sinusoidal signals are output

## Mounting dimensions

Unit: mm

- 10 to 80mm (Adhesive fixing type)
- 100 to 3000mm




## Dimensions of scale units

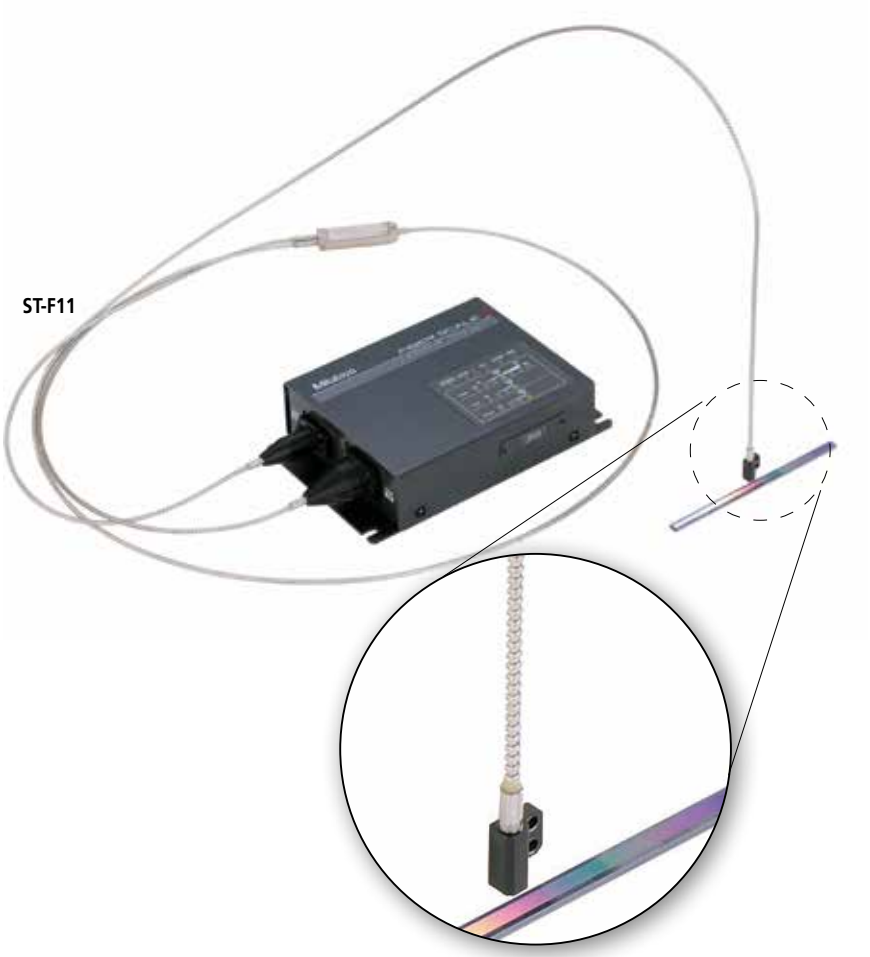
| Order No.* | Code* | Effective range L1 (mm) | Overall length L2 (mm) | Scale fixing pitch L3 (mm) | Retaining spring A | Retaining spring B |
|---|---|---|---|---|---|---|
| 579-501-0□ | ST36◇-10 | 10 | 30 | – | – | – |
| 579-502-0□ | ST36◇-25 | 25 | 45 | – | – | – |
| 579-503-0□ | ST36◇-50 | 50 | 70 | – | – | – |
| 579-504-0□ | ST36◇-75 | 75 | 90 | – | – | – |
| 579-505-0□ | ST36◇-80 | 80 | 100 | – | – | – |
| 579-506-0□ | ST36◇-100 | 100 | 140 | 50 | 1 pc. | 2 pcs. |
| 579-507-0□ | ST36◇-150 | 150 | 190 | 75 | 1 pc. | 2 pcs. |
| 579-508-0□ | ST36◇-200 | 200 | 240 | 100 | 1 pc. | 2 pcs. |
| 579-509-0□ | ST36◇-250 | 250 | 290 | 60 | 1 pc. | 4 pcs. |
| 579-510-0□ | ST36◇-300 | 300 | 340 | 75 | 1 pc. | 4 pcs. |
| 579-511-0□ | ST36◇-350 | 350 | 390 | 85 | 1 pc. | 4 pcs. |
| 579-512-0□ | ST36◇-400 | 400 | 440 | 100 | 1 pc. | 4 pcs. |
| 579-513-0□ | ST36◇-450 | 450 | 490 | 75 | 1 pc. | 6 pcs. |
| 579-514-0□ | ST36◇-500 | 500 | 540 | 80 | 1 pc. | 6 pcs. |
| 579-515-0□ | ST36◇-600 | 600 | 640 | 100 | 1 pc. | 6 pcs. |
| 579-516-0□ | ST36◇-700 | 700 | 740 | 85 | 1 pc. | 8 pcs. |
| 579-517-0□ | ST36◇-800 | 800 | 840 | 100 | 1 pc. | 8 pcs. |

| Order No.* | Code* | Effective range L1 (mm) | Overall length L2 (mm) | Scale fixing pitch L3 (mm) | Retaining spring A | Retaining spring B |
|---|---|---|---|---|---|---|
| 579-518-0□ | ST36◇-900 | 900 | 940 | 90 | 1 pc. | 10 pcs. |
| 579-519-0□ | ST36◇-1000 | 1000 | 1040 | 100 | 1 pc. | 10 pcs. |
| 579-520-0□ | ST36◇-1100 | 1100 | 1140 | 90 | 1 pc. | 12 pcs. |
| 579-521-0□ | ST36◇-1200 | 1200 | 1240 | 100 | 1 pc. | 12 pcs. |
| 579-522-0□ | ST36◇-1300 | 1300 | 1340 | 130 | 1 pc. | 10 pcs. |
| 579-523-0□ | ST36◇-1400 | 1400 | 1440 | 100 | 1 pc. | 14 pcs. |
| 579-524-0□ | ST36◇-1500 | 1500 | 1540 | 125 | 1 pc. | 12 pcs. |
| 579-525-0□ | ST36◇-1600 | 1600 | 1640 | 100 | 1 pc. | 16 pcs. |
| 579-526-0□ | ST36◇-1700 | 1700 | 1740 | 120 | 1 pc. | 14 pcs. |
| 579-527-0□ | ST36◇-1800 | 1800 | 1840 | 100 | 1 pc. | 18 pcs. |
| 579-528-0□ | ST36◇-2000 | 2000 | 2040 | 100 | 1 pc. | 20 pcs. |
| 579-529-0□ | ST36◇-2200 | 2200 | 2240 | 100 | 1 pc. | 22 pcs. |
| 579-530-0□ | ST36◇-2400 | 2400 | 2440 | 100 | 1 pc. | 24 pcs. |
| 579-531-0□ | ST36◇-2500 | 2500 | 2540 | 95 | 1 pc. | 26 pcs. |
| 579-532-0□ | ST36◇-2600 | 2600 | 2640 | 100 | 1 pc. | 26 pcs. |
| 579-533-0□ | ST36◇-2800 | 2800 | 2840 | 100 | 1 pc. | 28 pcs. |
| 579-534-0□ | ST36◇-3000 | 3000 | 3040 | 100 | 1 pc. | 30 pcs. |

* The above code numbers are for recommended items marked with ● / ◎ symbols.
If recommended specifications meet your requirements, use these code numbers to order.
* The □ and ◇ symbols in the tables above have the following meanings:
◇→A (2-phase sinusoidal signals): □→1
◇→B (2-phase square wave signals + reset input): □→2
◇→C (2-phase sinusoidal signals + 2-phase square wave signals): □→3
◇→D (1Vp-p differential): □→4

# Fiber Scale ST-F11

## SERIES 579 — Ultra Compact Linear Scale




## FEATURES

- Ultra-compact detector head: 5mm width (S-Type)
- High resolution: 100 nm (0.1µm), 50 nm (0.05µm), 10 nm (0.01µm)
- Isolated heat source. No heat source at the detector head.
- Immune to EMI.
- Easy installation. LEDs on the processor indicate which direction to adjust the detector head when mounting.

### Processor LED Indicators




## SPECIFICATIONS

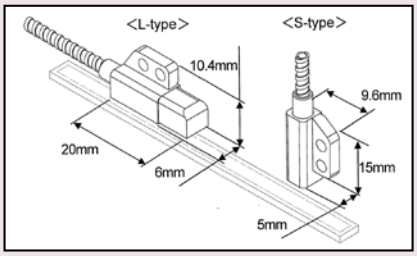
| Model | ST- F11B | ST- F11C |
|---|---|---|
| Detection method | Diffraction interference , reflection-type linear encoder | |
| Grating pitch for the main scale | 4 µm | |
| Signal output pitch | 2 µm | |
| Output signal | 2-phase-shifted square wave (+ reset input) | 2-phase-shifted square wave 2-phase-shifted sine wave |
| Resolution | 10 nm / 50 nm / 100 nm (switchable) | |
| Effective length | 4" / 100 mm | |
| Accuracy at 20°C | ±1 µm, ±2 µm (custom-holder type) | |
| Maximum response speed | 800 mm/s (For the sine wave) | |
| Read head size (Selectable) | Perpendicular (S-Type) 5x9.6x12<br>Parallel (L-Type) 6x17x10 | |
| Main scale material (Selectable) | Quartz glass (expansion coefficient: 0.5 x$10^{-6}$)<br>(LTE) Low thermal expansion glass (expansion coefficient: 0±0.02 x$10^{-6}$) | |
| Fiber length (Selectable) | 2, 3, 5, 10 m (20, 30m: custom-order) | |
| Maximum consumption current / operating voltage | 350 mA / DC5V±5% | |
| Operating temperature and humidity | 0~40°C 20~80%RH (no condensation) | |
| Storage temperature and humidity | -20~60°C 20~80%RH (no condensation) | |
| Functions | Alarm output, read-head attitude confirmation, signal-confirmation function | |

- Any scale size drawings are available on request.

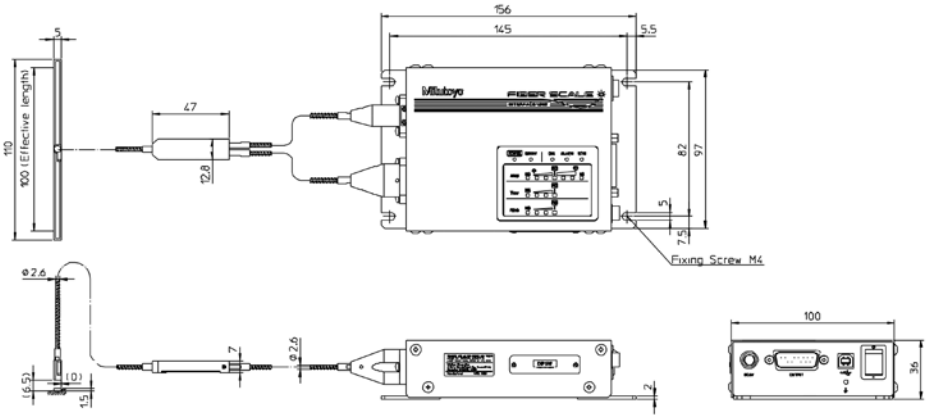
# Fiber Scale ST-F11

## SERIES 579 — Ultra Compact Linear Scale

### Dimensions of Detector Heads




### Dimensions of Processor




### SPECIFICATIONS

| Order Number | Model Number | Output Signal | Scale Material | Detector Orientation to Scale | Fiber Length |
|---|---|---|---|---|---|
| **579-701-11** | ST-F11B-100A-S02 | 2 Phase Square | Quartz Glass | Parallel | 2m |
| **579-702-11** | ST-F11B-100A-S03 | 2 Phase Square | Quartz Glass | Parallel | 3m |
| **579-703-11** | ST-F11B-100A-S05 | 2 Phase Square | Quartz Glass | Parallel | 5m |
| **579-704-11** | ST-F11B-100A-S10 | 2 Phase Square | Quartz Glass | Parallel | 10m |
| **579-701-12** | ST-F11B-100B-S02 | 2 Phase Square | LTE Glass | Parallel | 2m |
| **579-702-12** | ST-F11B-100B-S03 | 2 Phase Square | LTE Glass | Parallel | 3m |
| **579-703-12** | ST-F11B-100B-S05 | 2 Phase Square | LTE Glass | Parallel | 5m |
| **579-704-12** | ST-F11B-100B-S10 | 2 Phase Square | LTE Glass | Parallel | 10m |
| **579-701-21** | ST-F11C-100A-S02 | 2 Phase Square / 2 phase sine | Quartz Glass | Parallel | 2m |
| **579-702-21** | ST-F11C-100A-S03 | 2 Phase Square / 2 phase sine | Quartz Glass | Parallel | 3m |
| **579-703-21** | ST-F11C-100A-S05 | 2 Phase Square / 2 phase sine | Quartz Glass | Parallel | 5m |
| **579-704-21** | ST-F11C-100A-S10 | 2 Phase Square / 2 phase sine | Quartz Glass | Parallel | 10m |
| **579-701-22** | ST-F11C-100B-S02 | 2 Phase Square / 2 phase sine | LTE Glass | Parallel | 2m |
| **579-702-22** | ST-F11C-100B-S03 | 2 Phase Square / 2 phase sine | LTE Glass | Parallel | 3m |
| **579-703-22** | ST-F11C-100B-S05 | 2 Phase Square / 2 phase sine | LTE Glass | Parallel | 5m |
| **579-704-22** | ST-F11C-100B-S10 | 2 Phase Square / 2 phase sine | LTE Glass | Parallel | 10m |
| **579-711-11** | ST-F11B-100A-L02 | 2 Phase Square | Quartz Glass | Perpendicular | 2m |
| **579-712-11** | ST-F11B-100A-L03 | 2 Phase Square | Quartz Glass | Perpendicular | 3m |
| **579-713-11** | ST-F11B-100A-L05 | 2 Phase Square | Quartz Glass | Perpendicular | 5m |
| **579-714-11** | ST-F11B-100A-L10 | 2 Phase Square | Quartz Glass | Perpendicular | 10m |
| **579-711-12** | ST-F11B-100B-L02 | 2 Phase Square | LTE Glass | Perpendicular | 2m |
| **579-712-12** | ST-F11B-100B-L03 | 2 Phase Square | LTE Glass | Perpendicular | 3m |
| **579-713-12** | ST-F11B-100B-L05 | 2 Phase Square | LTE Glass | Perpendicular | 5m |
| **579-714-12** | ST-F11B-100B-L10 | 2 Phase Square | LTE Glass | Perpendicular | 10m |
| **579-711-21** | ST-F11C-100A-L02 | 2 Phase Square / 2 phase sine | Quartz Glass | Perpendicular | 2m |
| **579-712-21** | ST-F11C-100A-L03 | 2 Phase Square / 2 phase sine | Quartz Glass | Perpendicular | 3m |
| **579-713-21** | ST-F11C-100A-L05 | 2 Phase Square / 2 phase sine | Quartz Glass | Perpendicular | 5m |
| **579-714-21** | ST-F11C-100A-L10 | 2 Phase Square / 2 phase sine | Quartz Glass | Perpendicular | 10m |
| **579-711-22** | ST-F11C-100B-L02 | 2 Phase Square / 2 phase sine | LTE Glass | Perpendicular | 2m |
| **579-712-22** | ST-F11C-100B-L03 | 2 Phase Square / 2 phase sine | LTE Glass | Perpendicular | 3m |
| **579-713-22** | ST-F11C-100B-L05 | 2 Phase Square / 2 phase sine | LTE Glass | Perpendicular | 5m |
| **579-714-22** | ST-F11C-100B-L10 | 2 Phase Square / 2 phase sine | LTE Glass | Perpendicular | 10m |

# Pulse Signal Interface Unit PSU-200

## SERIES 539

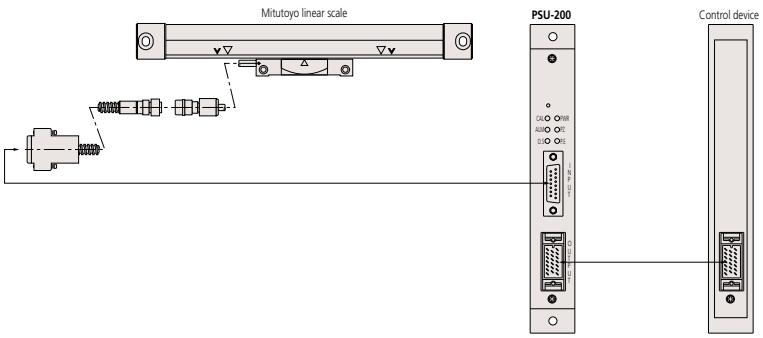
- The **PSU-200** splits the sinusoidal signal output by Mitutoyo linear scales into a minimum of four and a maximum of 200 divisions, and converts the signal to a square-wave signal so that NC feedback systems, measurement control devices, etc., can be used with linear scales in order to achieve highly accurate positioning.



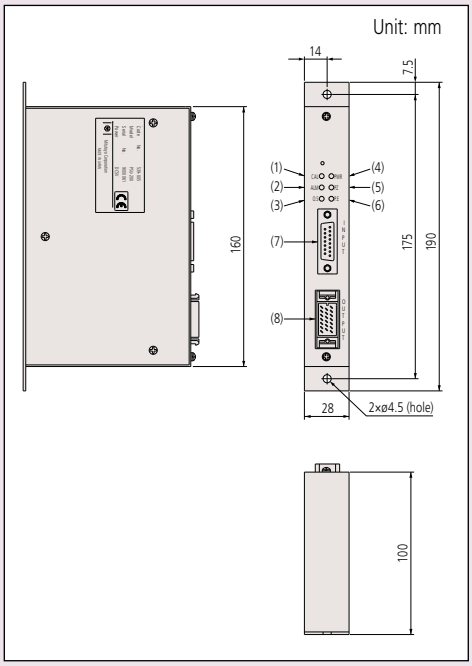
## SPECIFICATIONS

| Order No. | **539-005** |
|---|---|
| Model | **PSU-200** |
| Number of axes | 1 axis |
| Input | Input connector DA-15S-N (JAE) or equivalent<br>Input signal: 2-phase sinusoidal and the reference voltage, reference point, scale alarm |
| Output | Output connector: MR-20RMA (HONDA TSUSHIN KOGYO CO., LTD.)<br>Output signal: 2-phase square wave signals (PA, PB), reference point (PZ), alarm, alarm reset, photo-coupler |
| Number of splits | 4, 8, 10, 20, 40, 80, 100, 200 (Selectable with the switch) |
| Function | Setting the number of slits, setting the minimum edge interval, and maximum response speed. Detection of broken wires or short circuits and abnormalities (alarm), detection of signal errors (alarm). Power supply voltage low-alarm (warning light only), switching between high-impedance mode and alarm-signal output mode. Reference position detection light, hysteresis width settings (directly linked to No. of divisions), external alarm reset input (photocoupler), switching directions |
| Power supply voltage | 5VDC ±5% |
| Current consumption | 200mA |
| Storage temperature range | –20°C to 70°C |
| Operating temperature range | 0°C to 40°C |
| Dimensions | 160(W)×100(D)×28(H)mm |
| Mass | Approx. 620g |

## System configuration




## DIMENSIONS



# Signal Conversion Adapter PSU-400E

## SERIES 539 — Interface Unit (Optional accessories)




## FEATURES

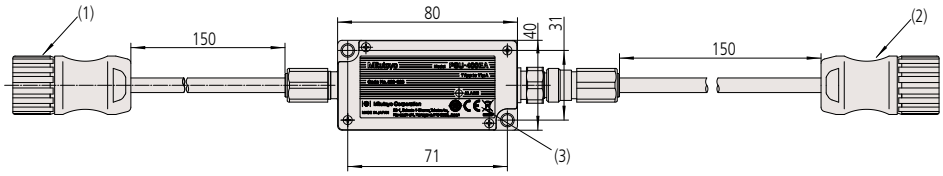
- The PSU-400E series interface unit converts the 1Vp-p differential signal output by AT402E, so that NC feedback systems or measurement control devices can be used with linear scales in order to achieve highly accurate positioning.
- PSU-400EA interface unit converts the 1Vp-p differential signal output by AT402E to the 11µA differential signal.
- PSU-400EV interface unit splits the 1Vp-p differential signal output by AT402E into a minimum of 20 and a maximum of 4000 divisions, and converts the signal to a square wave.

## SPECIFICATIONS

| Order No. | 539-008 | 539-009 |
|---|---|---|
| Items | PSU-400EA | PSU-400EV |
| Input signal | 1Vpp differential Sinusoidal signal (AT402E) | |
| Output signal | 11µA sine wave signal | TTL signal (RS422) |
| Output signal: Division number (Resolution) | — | TTL X5 (1µm), TTL X10 (0.5µm), TTL X20 (0.25µm), TTL X25 (0.2µm), TTL X50 (0.1µm), TTL X100 (0.05µm), TTL X250 (0.1µm), TTL X500 (0.01µm), TTL X1000 (0.005µm) |
| Minimum edge intervals | — | 62.5,125,250,500,1000,2000 [ns] |
| Maximum current consumption | 60mA | 130mA |
| Power supply | DC5V±5% | |
| Storage temperature | -20 to 70°C 20 to 80%RH | |
| Operating temperature | 0 to 50°C 20 to 80%RH | |
| External dimension | 80(W)×40(D)×20(H) | |
| Status LED | Simple error display (without error output) | Error display (with error output) |
| Response speed | 120m/min (100kHz) | It depends on number of interpolation and minimum edge intervals (Max: 100kHz) |

TIP: Signal cable Type B is connectable.

## DIMENSIONS




| No. | Name | |
|---|---|---|
| (1) | INPUT connector | Connector for connecting with Linear Scale AT402E |
| (2) | OUTPUT connector | Connector for connecting with external device |
| (3) | ALM lamp | Lights red when alarming (Normally lights green) |

## Tests for Evaluating Linear Scales

**1. Testing within the service temperature range**
Confirms that there is no performance abnormality of a unit within the service temperature range and that data output is according to the standard.

**2. Temperature cycle (dynamic characteristics) test**
Confirms that there is no performance abnormality of a unit during temperature cycling while operating and that data output is according to the standard.

**3. Vibration test (Sweep test)**
Confirms that there is no performance abnormality of a unit while subject to vibrations of a frequency ranging from 30Hz to 300Hz with a maximum acceleration of 29.42m/s$^2$.

**4. Vibration test (Acceleration test)**
Confirms that there is no performance abnormality of a unit subject to vibrations at a specific, non-resonant frequency. (Approx. 98.07m/s$^2$)

**5. Noise test**
The noise test conforms to EMC Directive EN61326-1+A1:1998.

**6. Package drop test**
This test conforms to JIS Z 0200 (Heavy duty material drop test)

## Glossary

### Absolute system
A measurement mode in which every point measurement is made relative to a fixed origin point.

### Incremental system
A measurement mode in which every point measurement is made relative to a certain stored reference point.

### Origin offset
A function that enables the origin point of a coordinate system to be translated to another point offset from the fixed origin point. For this function to work, a system needs a permanently stored origin point.

### Restoring the origin point
A function that stops each axis of a machine accurately in position specific to the machine while slowing it with the aid of integrated limit switches.

### Sequence control
A type of control that sequentially performs control steps according to a prescribed order.

### Numerical control
A way of controlling the movements of a machine by encoded commands created and implemented with the aid of a computer (CNC). A sequence of commands typically forms a 'part program' that instructs a machine to perform a complete operation on a workpiece.

### Binary output
Refers to output of data in binary form (ones and zeros) that represent numbers as integer powers of 2.

### RS-232C
An interface standard that uses an asynchronous method of serial transmission of data over an unbalanced transmission line for data exchange between transmitters located relatively close to each other. It is a means of communication mainly used for connecting a personal computer with peripherals.

### Line driver output
This output features fast operating speeds of several tens to several hundreds of nanoseconds and a relatively long transmission distance of several hundreds of meters. A differential-voltmeter line driver (RS422A compatible) is used as an I/F to the NC controller in the linear scale system.

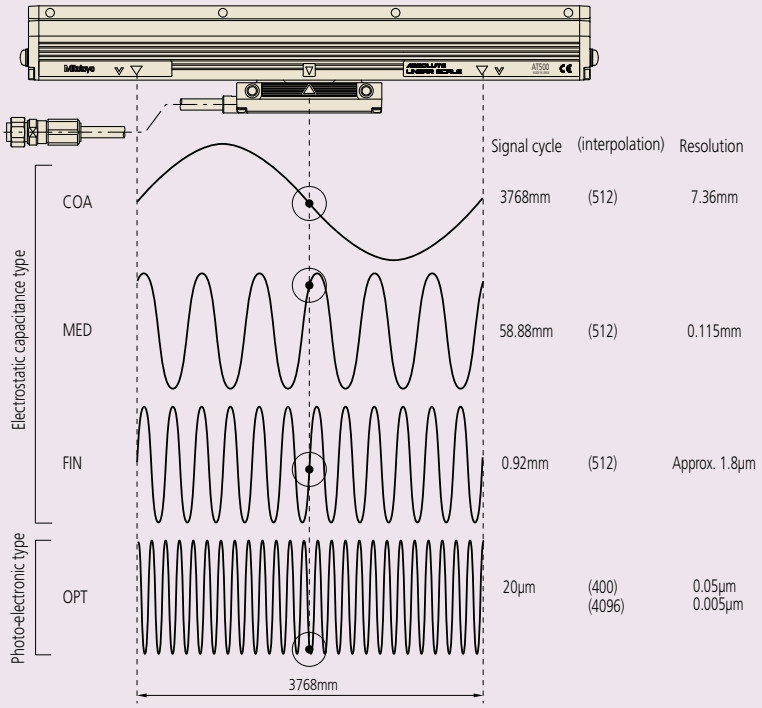
### BCD
A notation of expressing the numerals 0 through 9 for each digit of a decimal number by means of four-bit binary sequence. Data transmission is one-way output by means of TTL or open collector.

### RS-422
An interface standard that uses serial transmission of bits in differential form over a balanced transmission line. RS-422 is superior in its data transmission characteristics and in its capability of operating with only a single power supply of +5V.

### Accuracy
The accuracy specification of a scale is given in terms of the maximum error to be expected between the indicated and true positions at any point, within the range of that scale, at a temperature of 20ºC. Since there is no international standard defined for scale units, each manufacturer has a specific way of specifying accuracy. The accuracy specifications given in our catalog have been determined using laser interferometry.

### Narrow range accuracy
Scale gratings on a scale unit normally adopt 20µm pitch though it varies according to the kind of scale. The narrow range accuracy refers to the accuracy determined by measuring one pitch of each grating at the limit of resolution (1µm for example).

## Principle of the Absolute Linear Scale (Example: ABS AT300, 500-S/H)

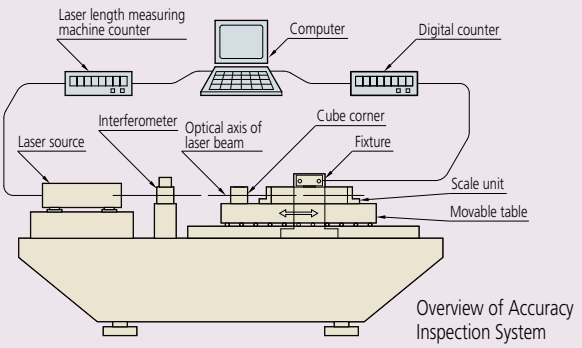



Upon supply of power to a linear scale, position readings from three capacitance-type sub-scales (COArse, MEDium and FINe) and one from a photoelectric sub-scale (OPTical) are taken. These sub-scales use such a combination of pitches, and are so positioned relative to each other, that the readings at any one position form a unique set and allow a microprocessor to calculate the position of the read head on the scale to a resolution of 0.05µm (0.005µm).

## Specifying Linear Scale Accuracy

### Positional Indication accuracy

The accuracy of a linear scale is determined by comparing the positional value indicated by the linear scale with the corresponding value from a laser length measuring machine at regular intervals using the accuracy inspection system as shown in the figure below. As the temperature of the inspection environment is 20˚C, the accuracy of the scale applies only in an environment at this temperature. Other inspection temperatures may be used to comply with internal standards.




Overview of Accuracy Inspection System

The accuracy of the scale at each point is defined in terms of an error value that is calculated using the following formula:

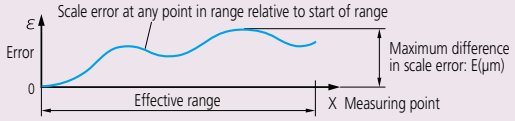
Error = Value indicated by laser inspection system
– Corresponding value indicated by the linear scale

A graph in which the error at each point in the effective positioning range is plotted is called an accuracy diagram.
There are two methods used to specify the accuracy of a scale, unbalanced or balanced, described below.

### (1) Unbalanced accuracy specification - maximum minus minimum error

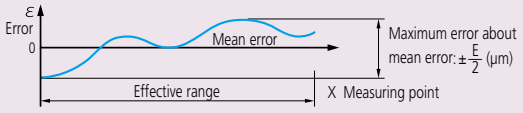
This method simply specifies the maximum error minus the minimum error from the accuracy graph, as shown below. It is of the form: $E = (\alpha + \beta L)$µm. L is the effective range (mm), and $\alpha$ and $\beta$ are factors specified for each model.

For example, if a particular type of scale has an accuracy specification of $(3 + \frac{3L}{1000})$µm and an effective range of 1000mm, E is 6µm.



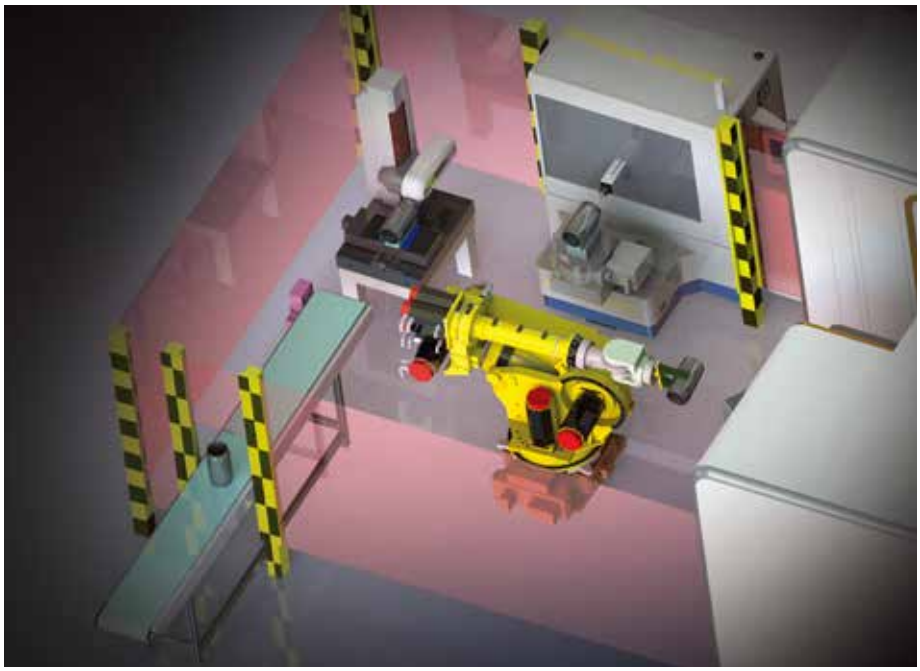

### (2) Balanced accuracy specification - plus and minus about the mean error

This method specifies the maximum error relative to the mean error from the accuracy graph. It is of the form: $e = \pm \frac{E}{2}$ (µm). This is mainly used in separate-type (retrofit) scale unit specifications.




A linear scale detects displacement based on graduations of constant pitch. Two-phase sinusoidal signals with the same pitch as the graduations are obtained by detecting the graduations. Interpolating these signals in the electrical circuit makes it possible to read a value smaller than the graduations by generating pulse signals that correspond to the desired resolution. For example, if the graduation pitch is 20µm, interpolated values can generate a resolution of 1µm. The accuracy of this processing is not error-free and is called interpolation accuracy. The linear scale's overall positional accuracy specification depends both on the pitch error of the graduations and interpolation accuracy.

# MITUTOYO CUSTOM SOLUTIONS







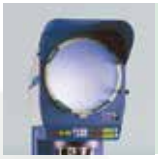
Mitutoyo Custom Solutions helps businesses in a wide range of industries achieve higher quality products, parts and machines with custom precision measurement tools and equipment.

Mitutoyo's highly skilled engineers specialize in designing and building custom measurement systems, applications and software to bring value-added solutions to resolve nearly every measurement need for customers with unique applications.

## Custom Solutions & Services Include:

- Inline/near line part inspection and gaging
- Factory automation
- Data management
- Fixture design/build
- 3D CAD concepts/renderings
- Turnkey capital projects
- Product implementation
- Custom styli/accessories
- "Green button" technology

If you have any questions or would like more information regarding Mitutoyo Custom Solutions, contact: **solutions@mitutoyo.com**



## Profile Projectors



## Microscopes






MF-B3017D



MF-UB4020D

## INDEX


| | |
|---|---|
| **Profile Projectors** | |
| PJ-A3000-Vertical | I-2,3 |
| PJ-H30-High Accuracy | I-4,5 |
| PV-5110 | I-6,7 |
| PH-A14 | I-8,9 |
| PH-3515F | I-10,11 |
| Accessories for Profile Projectors | I-12 |
| Micrometer Heads for Profile Projectors and Toolmakers' Microscopes | I-12 |
| Workpiece Fixtures for Profile Projectors and Measuring Microscopes | I-13 |
| Overlay Chart Set | I-14 |
| Quick Guide to Precision Measuring Instruments - Profile Projectors | I-15 |
| **Microscopes** | |
| TM-505B/1005B Toolmakers' Microscopes | I-16 |
| MF Measuring Microscopes | I-17,18 |
| MF Motorized Type | I-19 |
| MF-U High-power Multi-function | I-20,21 |
| MF-U Motorized Type Universal | I-22 |
| Accessories for Measuring Microscope | I-23,24 |
| QM-Data200 2-D Processing Unit | I-25,26 |
| Vision Unit System Retrofit | I-27 |
| FS-70 For Semiconductor Inspection | I-28 |
| VMU Video Microscope Unit | I-29 |
| Eyepieces | I-30 |
| Objectives | I-30-34 |
| MSM-400 Stereo Microscopes | I-35-38 |
| Pocket Magnifiers | I-39 |
| Pocket Comparators | I-39 |
| Zoom Loupe | I-39 |
| Clear Loupe | I-39 |
| Quick Guide to Precision Measuring Instruments - Microscopes | I-40,41 |




WIDE VMU-V



VMU-LB



VMU-L4B



Mitutoyo

# PJ-A3000

## SERIES 302 — Vertical Profile Projectors

### FEATURES

- The PJ-A3000 Series vertical profile projectors are medium-size 11.8″ (300mm) models that feature high versatility and easy operation.
- Easy-to-read digital XY counter is located near the projection screen to minimize eye movement.
- Digital readout protractor screen facilitates angle measurement.




**PJ-A3010F-200**



**PJ-A3005D-50**



**PJ-A3010F-100**



**PJ-A3005F-150**

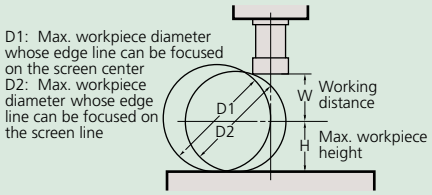


**PJ-A3010F-200**




Refer to Bulletin No. (2021) for more details.

### Projection Capacity




| | | Magnification | | | |
|---|---|---|---|---|---|
| | | 10X | 20X | 50X | 100X |
| View field | | ø31.5 | ø15.7 | ø6.3 | ø3.1 |
| W | | 66 (20) | 32.5 (2) | 12.6 | 5 |
| H | -50 models* | 123.5 | 123.5 | 123.5 | 123.5 |
| | -100 models | 91 | 91 | 91 | 91 |
| | -150 models | 103.5 | 103.5 | 103.5 | 103.5 |
| | 200 models | 92.5 | 92.5 | 92.5 | 92.5 |
| D1 | -50 models* | 224 (198) | 87 (61) | 27 | 10 |
| | -100 models | 182 | 87 (61) | 27 | 10 |
| | -150 models | 207 (198) | 87 (61) | 27 | 10 |
| | 200 models | 185 | 87 (61) | 27 | 10 |
| D2 | | 154 (120) | 69 (23) | 25 | 10 |

( ): When using surface illumination

## Optional Accessories

**172-202**: 10X projection lens set (Standard accessory)
**172-203**: 20X projection lens set
**172-223**: 10X projection lens
**172-224**: 20X projection lens
**172-204**: 50X projection lens
**172-207**: 100X projection lens
**172-229**: Oblique illumination mirror for 10X lens
**172-230**: Oblique illumination mirror for 20X lens
**172-116**: Standard scale (50mm)
**172-117**: Standard scale (2")
**172-118**: Reading scale (200mm)
**172-161**: Reading scale (300mm)
**172-119**: Reading scale (8")
**172-162**: Reading scale (12")
**172-160-2**: Green filter (for PJ-A3000, -50 models)
**172-160-3**: Green filter (for -100, -150, -200 models)
**512305**: Halogen bulb (24V, 150W)
**383876**: Vinyl cover (standard accessory)

**Fixture and Stage Accessories**
**176-106**: Rotary table (Effective diameter: 66mm)
**172-196**: Rotary table (Effective diameter: 100mm)
**172-198**: Rotary table with fine feed wheel (Effective diameter: 4" / 100mm)
**176-105**: Swivel center support (Max. workpiece dia.: 2.7" / 70mm)
**172-197**: Swivel center support (Max. workpiece dia.: 3.1" / 80mm)
**176-107**: Holder with clamp
**172-378**: V-block with clamp (Max. workpiece dia.: 1" / 25mm)
**176-317**: Stage adapter C
**64PMI167**: Stand 22.4 x 20 x 32" (WxDxH)

| Availability | PJ-A3005D-50 | PJ-A3005F-150 | PJ-A3010F-100<br>PJ-A3010F-200 |
|---|---|---|---|
| **176-106** | ✔ | ✔ | |
| **172-196** | | ✔ | ✔* |
| **172-198** | | ✔ | ✔* |
| **176-105** | ✔ | | |
| **172-197** | | ✔ | ✔* |
| **176-107** | ✔ | ✔ | ✔* |
| **172-378** | ✔ | ✔ | ✔* |

* Stage adapter C (**176-317**) is required for PJ-3010F-200



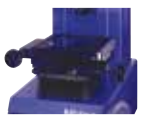
**QM-Data200**
**264-155A**: Stand-mount type
**264-156A**: Arm-mount type
2-D data processing unit.
(Refer to page I-25 for more details.)



**332-151**: Optoeye
Edge detection system for QM-Data200
**12AAE671**: Detector Attachment

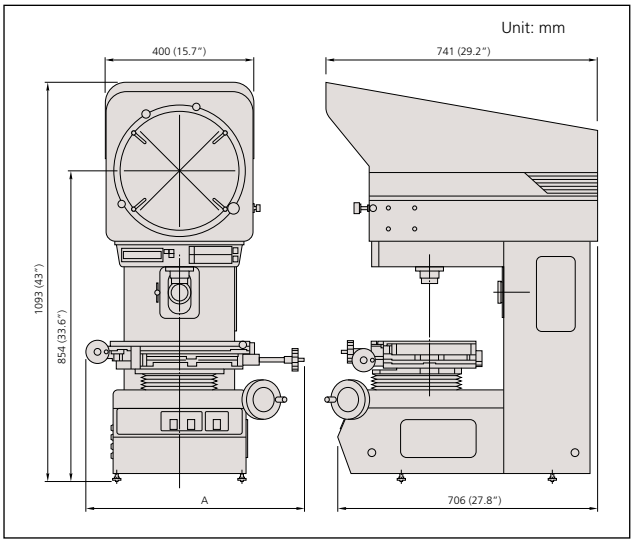
## SPECIFICATIONS






| | | PJ-A3010F-200 | PJ-A3005F 150 | PJ-A3010F-100 | PJ-A3005D-50 |
|---|---|---|---|---|---|
| | **Order No.** | **302-701A** | **302-702A** | **302-703A** | **302-704A** |
| Projected image | | Inverted image | | | |
| Protractor screen | Effective diameter | 12.4" / 315mm | | | |
| | Screen material | Fine ground glass | | | |
| | Reference line | Cross hair line | | | |
| | Angle display (LED) | Resolution: 1° or 0.01° (switchable), Range: ±360°<br>Functions: Absolute/incremental mode switching, Zero Set | | | |
| Projection lens | | Standard Accessory 10X (**172-202**) | | | |
| Magnification accuracy | Contour illumination | ±0.1% or less | | | |
| | Surface illumination | ±0.15% or less | | | |
| Contour illumination | Light source | Halogen bulb (24V, 150W) | | | |
| | Optical system | Telecentric system | | | |
| | Functions | 2-stage brightness switch, Heat-absorbing filter | | | |
| Surface illumination | Light source | Halogen bulb (24V, 150W) | | | |
| | Optical system | Vertical illumination with a half-reflection mirror | | | |
| | XY range | 8" x 4"<br>(200 x 100mm) | 6" x 2"<br>(150 x 50mm) | 4"x 4<br>" (100x100mm) | 2" x 2"<br>(50 x 50mm) |
| | Resolution | .0001" / 0.001mm | .0001" / 0.001mm | .0001" / 0.001mm | .0001"/0.001mm |
| | Measuring Unit | Built-in linear scales | Built-in linear scales | Built-in linear scales | Digimatic mic heads |
| | Table size | 14.96x9.84"<br>(380x250mm) | 11.02x5.98"<br>(280x152mm) | 9.84x9.84"<br>(250x250mm) | 5.98x5.98"<br>(152x152mm) |
| | Effective table area | 10.47x6.69"<br>(266x170mm) | 7.24x3.23"<br>(184x82mm) | 5.6x5.6"<br>(142x142mm) | 3.23x3.23"<br>(82x82mm) |
| | Max. workpiece height | 3.64"<br>(92.5mm) | 4.07"<br>(103.5mm) | 3.58"<br>(91mm) | 4.86"<br>(123.5mm) |
| | Functions | ± direction switching, SPC output zero-setting | Zero-setting, ± direction switching, SPC output | Zero-setting, ± direction switching, SPC output | ± direction switching, SPC output zero-setting |
| Power supply | | 120V AC, 50/60Hz | | | |
| Mass | | 308 lbs. (140kg) | 255 lbs. (116kg) | 246 lbs. (112kg) | 235 lbs. (107kg) |
| Standard accessories | | 10X projection lens set, masking shield, power cord, halogen bulb, fuse, grounding wire, allen wrench, vinyl cover | | | |

## DIMENSIONS




| Model | PJ-A3005D-50 | PJ-A3010F-100 | PJ-A3005F-150 | PJ-A3010F-200 |
|---|---|---|---|---|
| **A** | 17.9" / 455mm | 16.8" / 427mm | 17.6" / 446mm | 23.3" / 593mm |

# PJ-H30

## SERIES 303 — High-Accuracy Profile Projectors

By separating axial motion, and stabilizing the XY measuring table in the vertical direction, high measuring accuracy of (3+0.02L)µm has been achieved on the PJ-H30 Series Profile Projectors. Focusing is accomplished by moving the screen head itself up and down with the hand wheel or motorized unit. The power focusing (PJ-H30D type) provides higher performance.

### FEATURES

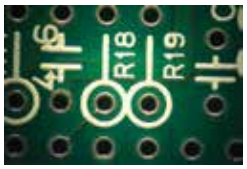
- Newly designed optical system with high NA lenses provides drastically brighter and clearer screen images during surface illumination.
- The three-lens mounting turret includes a 10X lens as standard. Four types of projection lenses (5X, 20X, 50X, 100X) are available.



Switchable surface illumination: vertical or oblique



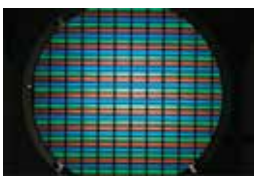
Vertical illumination

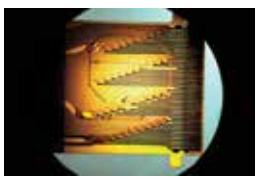
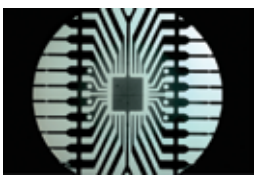



Oblique illumination



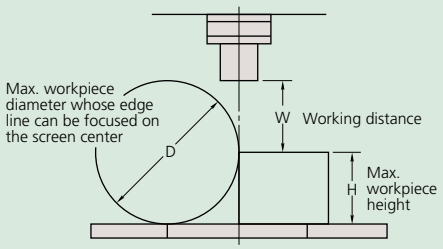
**PJ-H30A3017B**
XY stage travel range: 12x7" / 300x170mm





### Projection Capacity




Unit: mm

| | Magnification | | | | |
|---|---|---|---|---|---|
| | 5X | 10X | 20X | 50X | 100X |
| View field | ø61.2 | ø30.6 | ø15.3 | ø6.12 | ø3.06 |
| H | 105 | 105 | 105 | 105 | 105 |
| W | 66 | 70.5 | 56.5 | 50 | 50 |
| D | 148 | 197 | 137 | 114 | 114 |

## Optional Accessories

**172-271**: 5X projection lens
**172-472**: 10X projection lens (standard accessory)
**172-473**: 20X projection lens
**172-474**: 50X projection lens
**172-475**: 100X projection lens
**172-116**: Standard scale (50mm)
**172-117**: Standard scale (2")
**172-118**: Reading scale (200mm)
**172-161**: Reading scale (300mm)
**172-119**: Reading scale (8")
**172-162**: Reading scale (12")
**12AAG981**: Green filter
**172-269**: Machine stand
**512305**: Halogen bulb (24V, 150W) (standard accessory)
**383876**: Vinyl cover (standard accessory)

**Fixture and Stage Accessories**

**172-198**: Rotary table (Effective diameter: 4" / 100mm)
**176-305**: Rotary table (Effective diameter: 7.2" / 183mm)
**176-306**: Rotary table (Effective diameter: 9.4" / 240mm)
**176-105**: Swivel center support (Max. workpiece dia.: 2.8" / 70mm)
**172-197**: Swivel center support (Max. workpiece dia.: 3.1" / 80mm)
**176-107**: Holder with clamp
**172-378**: V-block with clamp (Max. workpiece dia.: 1" / 25mm)
**176-317**: Fixture mount adapter C
**176-304**: Fixture mount adapter A

| Availability | Models | |
|---|---|---|
| | PJ-H30A1010B | PJ-H30A2017B |
| | PJ-H30D1010B | PJ-H30D2017B |
| | PJ-H30A2010B | PJ-H30A3017B |
| | PJ-H30D2010B | PJ-H30D3017B |
| **172-198** | ✔** | ✔**** |
| **176-305** | ✔** | |
| **176-306** | | ✔**** |
| **176-107 *** | ✔** | ✔**** |
| **172-378 *** | ✔** | ✔**** |
| **172-197 *** | ✔** | ✔**** |
| **176-105** | ✔*** | ✔*** |

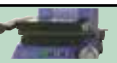
*: Able to attach to a Rotary table 172-198 or 176-305 (172-197 can only attach to 176-305).
**: Fixture mount adapter C (176-317) is required.
***: Rotary table (172-198) is required.
****: Fixture mount adapter A (176-304) is required.



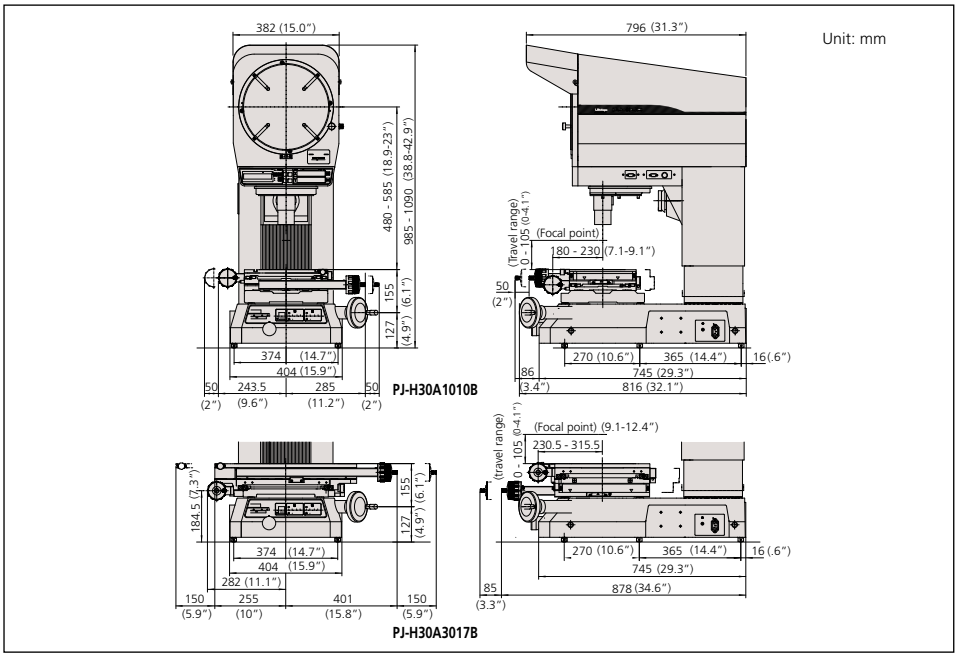
**QM-Data200**
**264-155A**: Stand-mount type
**264-156A**: Arm-mount type*
*Attachment stand (12AAG982) is required.
2-D data processing unit.
(Refer to page I-25 for more details.)



**332-151**: Optoeye
Edge detection system for QM-Data200
**12AAE671**: Detector Attachment

| | | | | | |
|---|---|---|---|---|---|
| | |  |  |  |  |
| Manual Focus type | Model No. | PJ-H30A1010B | PJ-H30A2010B | PJ-H30A2017B | PJ-H30A3017B |
| | **Order No.** | **303-712-1A** | **303-713-1A** | **303-714-1A** | **303-715-1A** |
| Power Focus, built-in OPTOEYE type | Model No. | PJ-H30D1010B | PJ-H30D2010B | PJ-H30D2017B | PJ-H30D3017B |
| | **Order No.** | **303-732-1A** | **303-733-1A** | **303-734-1A** | **303-735-1A** |
| Projected Image | | Erect image | | | |
| Protractor screen | Effective diameter | 12" / 306mm | | | |
| | Screen material | Fine ground glass | | | |
| | Reference line | Cross hair line | | | |
| | Screen rotation | ±360°, fine feed and clamp | | | |
| | Angle display (LED) | Resolution: 1° or 0.01° (switchable), Range: ±370°, Functions: Absolute/incremental mode switching, Zero set | | | |
| Projection lens | | Standard accessory: 10x (172-472), Optional accessories: 2X, 5X, 20X, 50X, 100X | | | |
| Lens mount | | 3-lenses mounting turret | | | |
| Magnification accuracy | Contour illumination | ±0.1% or less | | | |
| | Surface illumination | ±0.15% or less | | | |
| Contour illumination | Light source | Halogen bulb (24V 150W) | | | |
| | Optical system | Zoom telecentric system | | | |
| | Functions | Brightness adjustment, Heat-absorbing filter, Cooling fan | | | |
| Surface illumination | Light source | Halogen bulb (24V 150W) | | | |
| | Optical system | Vertical / Oblique illumination with an adjustable condenser lens | | | |
| | Functions | Non-stepped brightness adjustment, Heat-absorbing filter, Cooling fan | | | |
| | XY Range | 4 x 4" 100 x 100mm | 8 x 4" 200 x 100mm | 8 x 6.7" 200 x 170mm | 12 x 6.7" 300 x 170mm |
| | Resolution | .0001" / 0.001mm | | | |
| | Measuring unit | Built-in Linear scale | | | |
| | Table size | 11.8 x 9.4" 300 x 240mm | 13.8 x 11" 350 x 280mm | 16.1 x 13.5" 410 x 342mm | 20 x 13.5" 510 x 342mm |
| | Effective table area | 7.1 x 5.9" 180 x 150mm | 9.8 x 5.9" 250 x 150mm | 10.6 x 9.4" 270 x 240mm | 14.6 x 9.4" 370 x 240mm |
| | Max. workpiece ht. | 4.1" / 105mm | | | |
| | Max. workpiece load | 22lbs / 10kg | 22lbs / 10kg | 44 lbs / 20kg | 44 lbs / 20kg |
| Power supply | | 120V AC, 50/60Hz | | | |
| Mass | | 391lbs / 176kg | 396lbs / 178kg | 556lbs / 205kg | 471lbs / 212kg |
| Standard accessories | | 10X projection lens set, masking shield, power cord, halogen bulb, tube fuse, grounding wire, allen wrench, vinyl cover | | | |

## DIMENSIONS



# PV-5110

## SERIES 304 — Profile Projectors

### FEATURES

- Large 500mm screen
- Floor model uses a downward illumination system.
- Digital readout protractor screen (including zero-setting, ABS/INC coordinate switching functions) for easy and error-free angle measurement.
- Angled screen allows projected images to be easily traced or compared with a template.
- The oblique surface illumination system provides clear and bright images, allowing easy inspection of non-reflective workpieces such as plastic parts or printed materials.

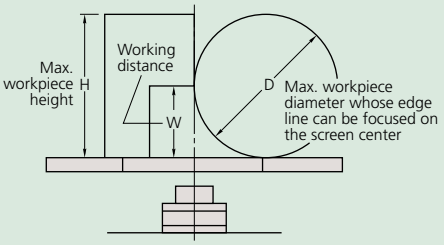



PV-5110



PV-5110

### Projection Capacity




Unit: mm

| | Magnification | | | | |
|---|---|---|---|---|---|
| | 5X | 10X | 20X | 50X | 100X |
| View field | ø101.6 | ø50.8 | ø25.4 | ø10.16 | ø5.08 |
| H | 125 | 181 | 206 | 87 | 87 |
| W | 60 (27) | 60 | 60 | 32.4 | 22.5 |
| D | 120 | 120 | 120 | 64.8 | 45 |

( ): When using surface illumination

## Optional Accessories

**172-401**: 5X projection lens set
**172-406**: 5X projection lens
**172-402**: 10X projection lens set (standard accessory)
**172-409**: 10X projection lens
**172-403**: 20X projection lens set
**172-411**: 20X projection lens
**172-404**: 50X projection lens set
**172-413**: 50X projection lens
**172-405**: 100X projection lens set
**172-415**: 100X projection lens
**172-422**: Surface illumination unit (standard accessory)
**172-116**: Standard scale (50mm)
**172-117**: Standard scale (2")
**172-118**: Standard scale (200mm)
**172-119**: Standard scale (8")
**172-161**: Reading scale (300mm)
**172-329**: Reading scale (600mm)
**172-162**: Reading scale (12")
**172-160-2**: Green filter (standard accessory)
**172-319**: Canopy
**512305**: Halogen bulb (24V, 150W) (standard accessory)
**510189**: Vinyl cover

**Fixture and Stage Accessories**

**172-196**: Rotary table*
(Effective diameter: 4" / 100mm)
**172-198**: Rotary table with fine feed wheel*
(Effective diameter: 4" / 100mm)
**172-197**: Swivel center support*
(Max. workpiece dia.: 3.1" / 80mm)
**176-107**: Holder with clamp*
**172-378**: V-block with clamp*
(Max. workpiece dia.: 1" / 25mm)
*Stage adapter C (**176-317**) is required.



**KA Counter (174-183A)**
(Refer to page H-7 for more details.)



**QM-Data200**
**264-155A**: Stand-mount type
**264-156A**: Arm-mount type
2-D data processing unit.
(Refer to page I-25 for more details.)



**332-151**: **Optoeye**
Edge detection system for QM-Data200
**12AAE672**: Detector Attachment (B)

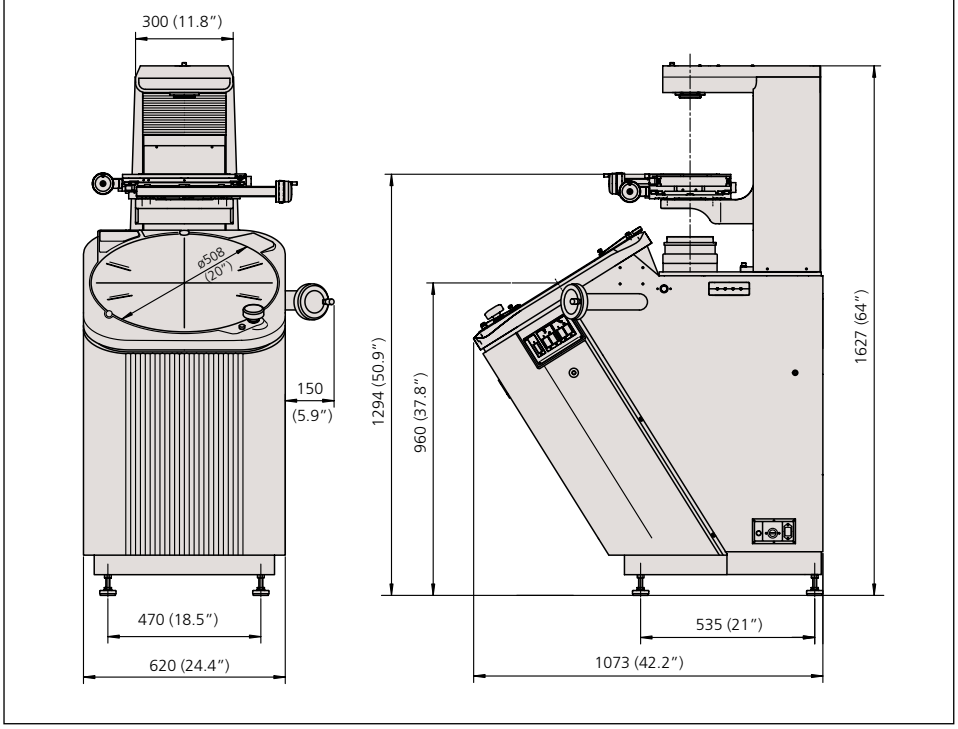
## SPECIFICATIONS

| Model No. | | PV-5110 |
|---|---|---|
| **Order No.** | | **304-919A*** |
| Projected image | | Invert image |
| Protractor screen | Effective diameter | 20" / 508mm |
| | Screen material | Fine ground glass |
| | Reference line | Cross hair line |
| | Screen rotation | ±360°, fine feed and clamp |
| | Angle display (LED) | Resolution: 1' or 0.01°(switchable), Range: ±370°, Functions: Absolute/incremental mode switching, Zero set |
| Projection lens | | Standard accessory: 10x(172-472), Optional accessories: 5X, 20X, 50X, 100X |
| Magnification accuracy | Contour illumination | ±0.1% or less |
| | Surface illumination | ±0.15% or less |
| Contour illumination | Light source | Halogen bulb (24V 150W) |
| | Optical system | Telecentric system |
| | Functions | 2-step brightness switch, Heat-absorbing filter, Cooling fan |
| Surface illumination | Light source | Halogen bulb (24V 150W) |
| | Optical system | Vertical illumination |
| | Functions | Adjustable condenser lens. Oblique illumination (for 5X, 10X, and 20X), 2-step brightness switch, Heat-absorbing filter, Cooling fan |
| | XY Range | 8 x 4" / 200 x 100mm |
| | Resolution | .0001" / 0.001mm* |
| | Measuring unit | Built-in Linear scale |
| | Table size | 15 x 9.8" / 380 x 250mm |
| | Effective table area | 10.5 x 6.7" / 266 x 170mm |
| | Max. workpiece height | See (H) on page I-6 |
| | Max. workpiece load | 17.6 lbs / 8kg |
| Power supply | | 120V AC, 50/60Hz |
| Mass | | 467lbs / 210kg |
| Standard accessories | | 200x100mm (8" x 4") stage, 10X projection lens set, Surface illumination unit. Counter stand for KA counter, power cord, halogen bulb, fuse, grounding wire, allen wrench |

* Counter not included

## DIMENSIONS

Unit: mm



# PH-A14

## SERIES 172 — Profile Projector

### FEATURES

- Benchtop model uses a horizontal optical system.
- Suitable for thread pitch measurements—blurred or distorted images will not be produced when workpiece is angled.
- Inverted image on the day-bright screen.
- 14" (356mm) diameter vernier protractor screen with solid line cross-hairs for easy alignment.
- Heavy-duty workpiece table incorporates linear scales for fast, accurate measurement.

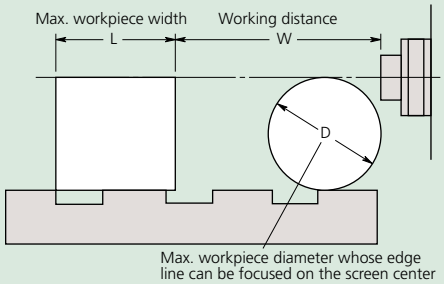



**PH-A14**



**PH-A14 with touch screen M2 geometric measurement display**

### Projection Capacity




**PH-A14** Unit: mm

| | Magnification | | | |
|---|---|---|---|---|
| | 10X | 20X | 50X | 100X |
| View field | 35.6 | 17.8 | 7.12 | 3.56 |
| L | 235 | 235 | 109 | 109 |
| W | 93 | 40 | 14.6 | 9.5 |
| D | 130 | 116 | 31.3 | 19.2 |



**KA Counter (174-183A)**
(Refer to page H-7 for more details.)
**64AAB149**: Counter stand



**QM-Data200**
2-D data processing unit.
**264-155A**: Stand mount type
**264-156A**: Arm mount type
(Refer to page I-25 for more details.)

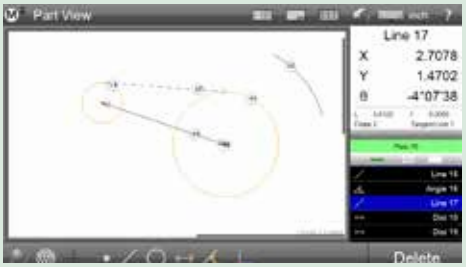


**332-151**: **Optoeye**
Edge detection system for QM-Data 200
**12AAE671**: Detector attachment (A)

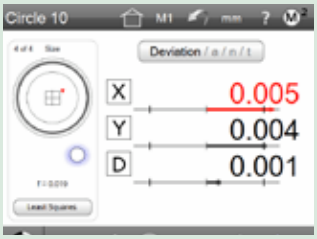
## Optional Accessories

**172-011**: 10X projection lens (standard accessory)
**172-012**: 20X projection lens
**172-013**: 50X projection lens set
**172-014**: 100X projection lens set
**172-116**: Standard scale (50mm)
**172-117**: Standard scale (2")
**172-118**: Reading scale (200mm)
**172-161**: Reading scale (300mm)
**172-119**: Reading scale (8")
**172-162**: Reading scale (12")
**172-286**: Green filter
**512305**: Halogen bulb (24V, 150W) (standard accessory)

Fixture and Stage Accessories
**172-142**: Center support
**172-143**: Center support riser
**172-144**: Rotary vise
(Max. workpiece dia.: 2.4" / 60mm)
**172-234**: V-block with clamp
(Max. workpiece dia.: 2" / 50mm)
**172-132**: Vertical holder
**64AAA129B**: Machine stand 23"W x 45" D x 20"H




**Graphics-based "Part View"constructions**
Generate popular construction types, like Distances and Tangent Lines, from within the graphical part view.




**Geometric tolerancing**
Measure features, set nominals, apply tolerances and view deviation results with only a few quick clicks.



**Reports** Flexibility for report contents and formatting allows for full customization of the data format, header information, and header and footer graphics.

## SPECIFICATIONS

| Model No. | | PH-A14 |
|---|---|---|
| **Order No.** | | **172-810-10A*** |
| Package No. | | **64PKA087** PH-A14 with QM Data Arm Mount |
| | | **64PKA086A** PH-A14 with KA Counter and Tray |
| Projected image | | Inverted image |
| Protractor screen | Effective diameter | 14" /356mm |
| | Screen material | Fine ground glass |
| | Reference line | Cross hair line |
| | Screen rotation | ±360°, fine feed and clamp |
| | Angle display | Vernier reading, Resolution: 2' |
| Projection lens | | Standard accessory: 10X (172-011), Optional accessories: 20X, 50X, 100X |
| Magnification accuracy | Contour illumination | ±0.1% or less |
| | Surface illumination | ±0.15% or less |
| Contour illumination | Light source | Halogen bulb (24V 150W) |
| | Optical system | Telecentric system |
| | Functions | Heat-absorbing filter, Cooling fan |
| Surface illumination | Light source | Halogen bulb (24V 150W) |
| | Optical system | Twin fiber optic illumination |
| XY Stage | Table travel (X-axis) | 8" / 203.2mm |
| | Table size (X, Z) | 16 x 6" / 407 x 153mm |
| | Vertical travel (Y-axis) | 4" / 101.6mm |
| | Resolution | .00005" / 0.001mm* |
| | Measuring unit | Built in Linear scale |
| | Max. workpiece width | See (L) on page I-10 |
| | Max. workpiece load | 100lbs / 45kg |
| Power supply | | 120V AC, 50/60Hz |
| Mass | | 308lbs / 140kg |
| Standard accessories | | 10x projection lens set, work stage, power cord, halogen bulb, fuse, grounding wire, allen wrench |

*Counter not included

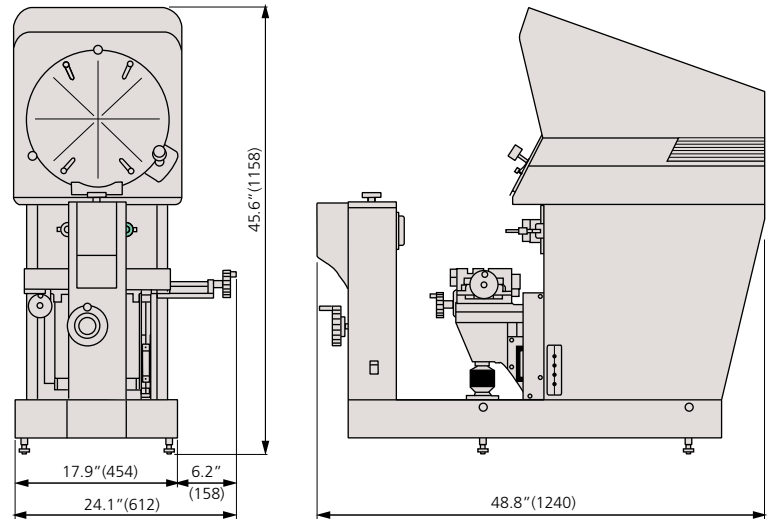
| PH-A14 Packages with M2 Geomentric Display | |
|---|---|
| **Order No.** | **Description** |
| **64PKA154A** | PH-A14 PROFILE PROJECTOR - WITH TOUCH SCREEN M2 GEOMETRIC DISPLAY |
| **64PKA155A** | PH-A14 PROFILE PROJECTOR - WITH OPTICAL EDGE DETECTION AND TOUCH SCREEN M2 GEOMETRIC DISPLAY |

| M2 Geometric Display Retrofit Packages | |
|---|---|
| **Order No.** | **Description** |
| **64PKA156A** | M2 2D Data Processing Unit with software and hardware including a tablet PC. Also includes installation and calibration on the customer's existing PH-A14 |
| **64PKA157A** | M2 2D Data Processing Unit with Edge Detection software and hardware including a tablet PC. Also includes installation and calibration on the customer's existing PH-A14 |

## DIMENSIONS

**PH-A14**

Unit: mm



# PH-3515F

## SERIES 172 — Profile Projector

### FEATURES

- Benchtop model uses a horizontal optical system.
- Suitable for thread pitch measurements—blurred or distorted images will not be produced when workpiece is angled.
- Erect image on the day-bright screen.
- Standard twin fiber-optic illumination.
- 14" (353mm) diameter protractor screen with cross-hairs and staggered lines for easy alignment.
- Digital angle measurement to 1' or 0.01°.
- Heavy-duty workpiece table incorporates linear scales for fast, accurate measurement.
- Built-in linear scales for use with optional display counters.

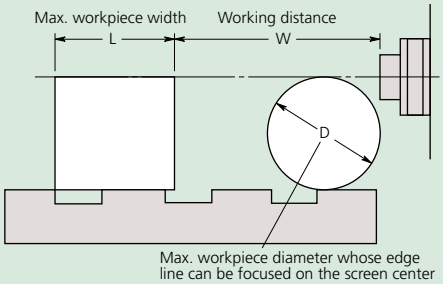



**PH-3515F**




Refer to Bulletin No. (2210) for more details.

### Projection Capacity




PH-3515F Unit: mm

| | Magnification | | | | |
|---|---|---|---|---|---|
| | 5X | 10X | 20X | 50X | 100X |
| View field | 70.6 | 35.3 | 17.65 | 7.06 | 3.5 |
| L | 175 | 235 | 235 | 80 | 109 |
| W | 160 (64) | 93 (41) | 40 | 14.6 | 9.5 |
| D | 152.4 | 152.4 | 116 | 30.4 | 19 |

( ): When using surface illumination

## Optional Accessories

**172-145**: 5X projection lens set
**172-175**: 5X projection lens
**172-184**: 10X projection lens set (standard accessory)
**172-011**: 10X projection lens
**172-173**: 20X projection lens set
**172-165**: 50X projection lens set
**172-174**: 50X projection lens
**172-166**: 100X projection lens set
**172-116**: Standard scale (50mm)
**172-117**: Standard scale (2")
**172-118**: Reading scale (200mm)
**172-161**: Reading scale (300mm)
**172-119**: Reading scale (8")
**172-162**: Reading scale (12")
**172-286**: Green filter
**515530**: Halogen bulb (24V, 150W) (standard accessory)
**172-423** Twin surface illumination
**12BAA637** Halogen reflector lamp (standard accessory)
**64AAB176** Machine stand
**383228:** Vinyl cover (standard accessory)

Fixture and Stage Accessories*
**172-142**: Center support
**172-143**: Center support riser
**172-144**: Rotary vise (Max. workpiece dia.: 2.3" / 60mm)
**172-234**: V-block with clamp
(Max. workpiece dia.: 2" / 50mm)
**172-132**: Vertical holder
**172-001**: Tipped-saw support stand
**172-002**: Cutter support stand
* See page I-13 for details



**KA Counter (174-183A)**
(Refer to page H-7 for more details.)
**64AAB149**: Counter stand



**QM-Data200**
2-D data processing unit.
**264-155A**: Stand mount type
**264-156A**: Arm mount type
(Refer to page I-25 for more details.)



**332-151**: **Optoeye**
Edge detection system for QM-Data200
**12AAE671**: Detector attachment (A)

## SPECIFICATIONS

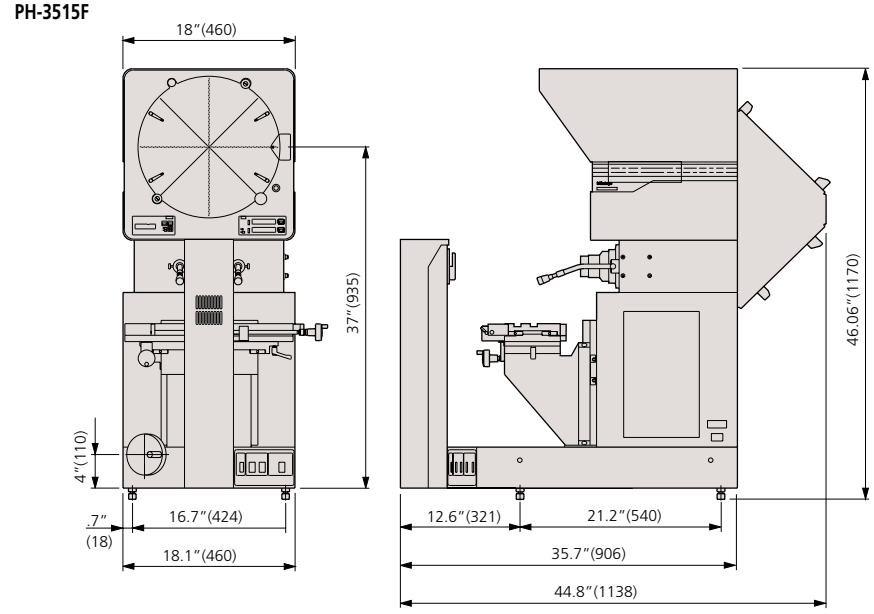
| Model No. | | PH-3515F |
|---|---|---|
| **Order No.** | | **172-868A*** |
| Projected image | | Erect image |
| Protractor screen | Effective diameter | 14" / 353mm |
| | Screen material | Fine ground glass |
| | Reference line | Cross hair line |
| | Screen rotation | ±360°, fine feed and clamp |
| | Angle display (LED) | Resolution: 1' or 0.01° (switchable), Range: ±370°, Functions: Absolute/ incremental mode switching, Zero set |
| Projection lens | | Standard accessory: 10X (172-184), Optional accessories: 5X, 20X, 50X, 100X |
| Magnification accuracy | Contour illumination | ±0.1% or less |
| | Surface illumination | ±0.15% or less |
| Contour illumination | Light source | Halogen bulb (24V 150W) |
| | Optical system | Telecentric system |
| | Functions | 2-step brightness switch, Heat-absorbing filter, Cooling fan |
| Surface illumination (Optional accessories) | Light source | Halogen bulb (24V 150W) |
| | Functions | Adjustable condenser lens. Heat-absorbing filter, Cooling fan |
| XY Stage | Table travel (X-axis) | 10" / 254mm |
| | Table size (X, Z) | 17.7"x5.7" / 450x146mm |
| | Vertical travel (Y-axis) | 6" / 152mm |
| | Resolution | 0.001mm/.00005"* |
| | Measuring Unit | Built-in Llnear scale |
| | Max. workpiece width | See (L) on page I-10 |
| | Max. workpiece load | 100lbs / 45kg |
| Power supply | | 120V AC, 50/60Hz |
| Mass | | 333lbs / 150kg |
| Standard accessories | | 10X projection lens set, work stage, power cord, halogen bulb, tube fuse, grounding wire, allen wrench, Vinyl cover |

* Counter not included

## DIMENSIONS

Unit: mm

**PH-3515F**



# Accessories for Profile Projectors

## SERIES 172 — Profile Projector

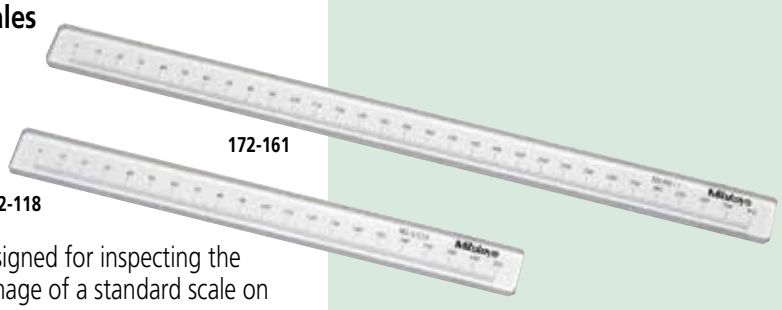
### Standard Scales



172-116

- Used for checking magnification accuracy.

### Reading Scales



172-161

172-118

- Specially designed for inspecting the magnified image of a standard scale on the projection screen.

### SPECIFICATIONS

**Metric**

| Graduation | Range | Order No. | Accuracy (20°C)* |
|---|---|---|---|
| 0.1mm | 50mm | **172-116** | (3+5L/1000)µm |
| 0.1mm | 80mm | **172-330** | (3+5L/1000)µm |

*L = Measured length (mm)

**Inch**

| Graduation | Range | Order No. | Accuracy (20C) |
|---|---|---|---|
| .01" | 2" | **172-117** | .00013" |

### SPECIFICATIONS

**Metric**

| Graduation | Range | Order No. | Accuracy |
|---|---|---|---|
| 0.5mm | 200mm | **172-118** | 18µm (15+15L/1000)µm |
| 0.5mm | 300mm | **172-161** | 19.5µm (15+15L/1000)µm |
| 0.5mm | 600mm | **172-329** | 24µm (15+15L/1000)µm |

**Inch**

| Graduation | Range | Order No. | Accuracy |
|---|---|---|---|
| .02" | 8" | **172-119** | .00071" |
| .02" | 12" | **172-162** | .00077" |

# Micrometer Heads

## for Profile Projectors and Toolmakers' Microscopes

### Micrometer Heads for XY Stage

#### FEATURES

- Non-rotating device is provided.
- The thimble reading can be zero-set at any spindle position.
- Black and red figures of the bi-directional graduation allow easy reading in both directions.
- Clamping stem diameter: 18mm

#### SPECIFICATIONS

**Metric**

| Graduation | Range | Order No. | Accuracy | Remarks |
|---|---|---|---|---|
| 0.005mm | 25mm | **152-390** | ±2µm | for X-axis |
| 0.005mm | 25mm | **152-389** | ±2µm | for Y-axis |

**Inch**

| Graduation | Range | Order No. | Accuracy | Remarks |
|---|---|---|---|---|
| .0001" | 1" | **152-391** | ±.0001" | for X-axis |
| .0001" | 1" | **152-392** | ±.0001" | for Y-axis |

### Adjustable Micrometer Heads for XY Stages

#### FEATURES

- The adjustable spindle can be fed under the thimble clamped at any reading, allowing easy reference point setting.
- The spherical measuring face is carbide-tipped.
- Clamping stem diameter: 18mm

#### SPECIFICATIONS

**Metric**

| Graduation | Range | Order No. | Accuracy | Remarks |
|---|---|---|---|---|
| 0.001mm* | 25mm | **152-402** | ±2µm | for X-axis |
| 0.001mm* | 25mm | **152-401** | ±2µm | for Y-axis |

*Obtained using vernier.



152-390

### Digimatic Micrometer Heads

#### FEATURES

- Large LCD digits for error-free reading.
- The display rotates 330° for easy viewing.
- The spindle does not rotate.
- With SPC data output.

#### SPECIFICATIONS

**Inch/Metric**

| Resolution | Range | Order No. | Accuracy |
|---|---|---|---|
| .00005"/0.001mm | 2" (50mm) | **164-164** | ±.00015" |

#### Optional Accessories

**959149**: SPC cable for series 164 (1m)
**959150**: SPC cable for series 164 (2m)

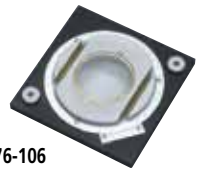


164-164

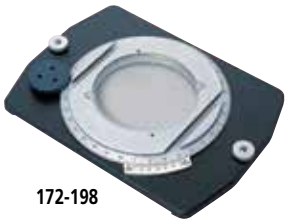
# Workpiece Fixtures

## for Profile Projectors and Measuring Microscopes

### Rotary Tables



176-106



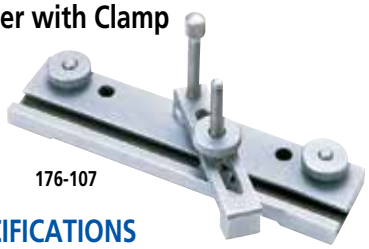
172-198

#### SPECIFICATIONS

| Order No. | 176-106 | 172-198 |
|---|---|---|
| Effective glass dia. | 66mm | 100mm |
| Angle reading | 6' | 2' (w/ fine adjustment) |
| Mass | 1.7kg | 2.5kg |

Note: Holder with clamp (**176-107**) can be mounted.

### Holder with Clamp

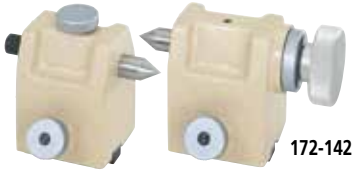


176-107

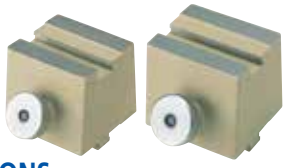
#### SPECIFICATIONS

| Order No. | 176-107 |
|---|---|
| Max. workpiece height | 35mm |
| Mass | 0.42kg |

### Center Support



172-142



172-143

#### SPECIFICATIONS

| Order No. | 172-142 |
|---|---|
| Max. workpiece height | 120mm (240mm)* |
| Mass | 3.3kg |

*When using a center support riser (**172-143**)

### Rotary Vise



172-144

#### SPECIFICATIONS

| Order No. | 172-144 |
|---|---|
| Max. workpiece height | 60mm |
| Width of jaw | 40mm |
| Angle reading | 5° |
| Mass | 2.5kg |

### Swivel Center Supports



176-105



172-197

#### SPECIFICATIONS

| Order No. | 176-105 | 172-197 |
|---|---|---|
| Max. workpiece dia. | 70mm (45mm)* | 80mm (65mm)* |
| Max. workpiece length | 140mm | 140mm |
| Swivel range | ±10° | ±10° |
| Mass | 2.4kg | 2.5kg |

*When swiveled 10°

### V-Block with Clamp



172-234



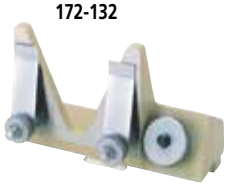
172-378

#### SPECIFICATIONS

| Order No. | 172-234 | 172-378 |
|---|---|---|
| Max. workpiece dia. | 50mm | 25mm |
| Width of block | 60mm | 41mm |
| Mass | 1.24kg | 0.8kg |

### Vertical Holder

172-132



#### SPECIFICATIONS

| Order No. | 172-132 |
|---|---|
| Mass | 1.3kg |

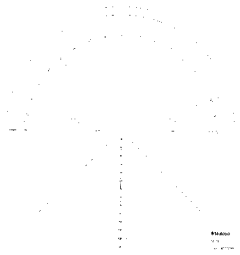


Mitutoyo

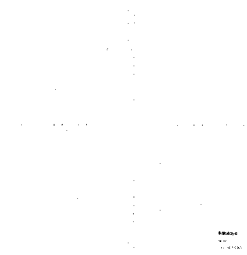
# Overlay Chart Set

- Makes inspection of projected images an easy process.
- Twelve different patterns are available in the set.
- Designed for use with profile projectors whose screen diameter is 300mm or larger.

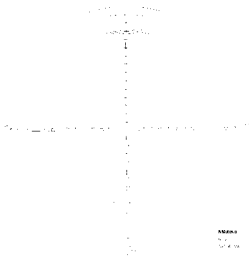
**Overlay chart set (12 sheets)**
**Order No.: 12AAM027**



**12AAM587**
Protractor (1°-grad. radial index) and radius (1mm-radius increment concentric semicircles)



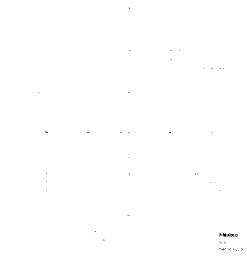
**12AAM588**
Radius (0.1cm-reading scales and 5mm-radius increment concentric circles)



**12AAM589**
Radius (1X, 10X, 20X, 50X)



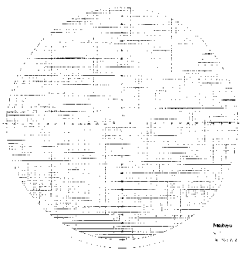
**12AAM590**
1mm-reading scales (20X, 50X)



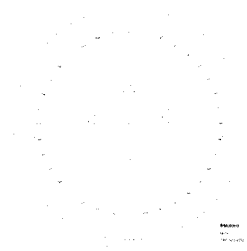
**12AAM591**
10x10mm sections



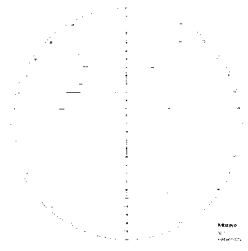
**12AAM592**
0.5mm-reading scales



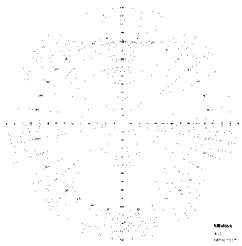
**12AAM593**
1x1mm sections



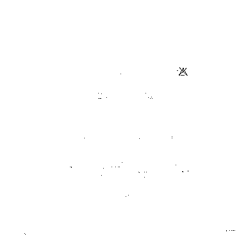
**12AAM594**
Protractor (1°-grad. diametral index)



**12AAM595**
1mm-reading vertical scale



**12AAM596**
Protractor (1°-grad. diametral index) and radius (1mm-radius increment concentric circles)



**12AAM597**
Metric, Unified, and Whitworth screw threads (20X)



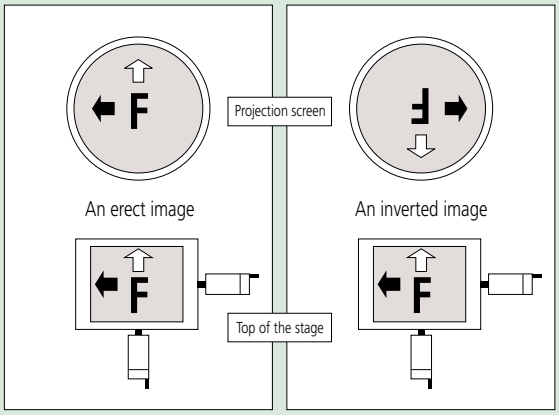
**12AAM598**
Metric screw thread (100X) and 20° and 14.5° gear teeth (20X)

# Quick Guide to Precision Measuring Instruments

## Profile Projectors

### Erect Image and Inverted Image

An image of an object projected onto a screen is erect if it is orientated the same way as the object on the stage. If the image is reversed top to bottom, left to right and by movement with respect to the object on the stage (as shown in the figure below) it is referred to as an inverted image (also known as a reversed).




F Workpiece
X-axis movement
Y-axis movement

### Magnification Accuracy

The magnification accuracy of a projector when using a certain lens is established by projecting an image of a reference object and comparing the size of the image of this object, as measured on the screen, with the expected size (calculated from the lens magnification, as marked) to produce a percentage magnification accuracy figure, as illustrated below. The reference object is often in the form of a small, graduated glass scale called a `stage micrometer' or `standard scale', and the projected image of this is measured with a larger glass scale known as a `reading scale'.

(Note that magnification accuracy is not the same as measuring accuracy.)

$$\Delta M(\%) = \frac{L - \ell M}{\ell M} \times 100$$

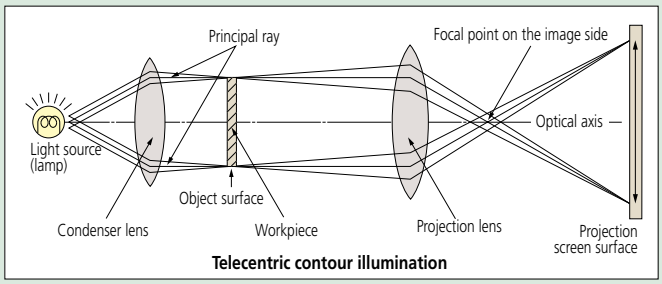
ΔM(%): Magnification accuracy expressed as a percentage of the nominal lens magnification
L : Length of the projected image of the reference object measured on the screen
ℓ : Length of the reference object
M : Magnification of the projection lens

### Type of Illumination

- Contour illumination: An illumination method to observe a workpiece by transmitted light and is used mainly for measuring the magnified contour image of a workpiece.
- Coaxial surface illumination: An illumination method whereby a workpiece is illuminated by light transmitted coaxially to the lens for the observation/measurement of the surface. (A half-mirror or a projection lens with a built-in half-mirror is needed.)
- Oblique surface illumination: A method of illumination by obliquely illuminating the workpiece surface. This method provides an image of enhanced contrast, allowing it to be observed three-dimensionally and clearly. However, note that an error is apt to occur in dimensional measurement with this method of illumination.
  (An oblique mirror is needed. Models in the PJ-H30 series are supplied with an oblique mirror.)

### Telecentric Optical System

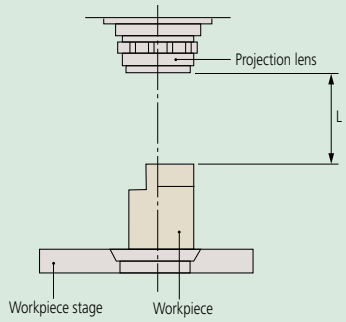
An optical system based on the principle that the primary ray is aligned parallel to the optical axis by placing a lens stop on the focal point on the image side. Its functional feature is that the image will not vary in size even though the image blurs as the object is shifted along the optical axis.
For measuring projectors and measuring microscopes, an identical effect is obtained by placing a lamp filament at the focal point of a condenser lens instead of a lens stop so that the object is illuminated with parallel beams. (See the figure below.)




Telecentric contour illumination

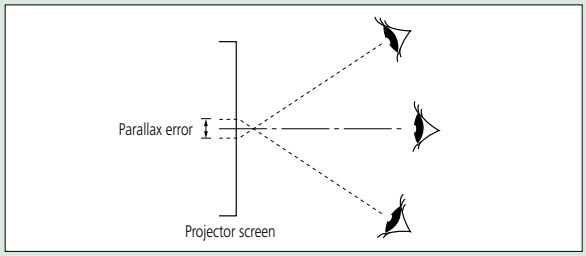
### Working distance

Refers to the distance from the face of the projection lens to the surface of a workpiece in focus. It is represented by L in the diagram below.




### Parallax error

This is the displacement of an object against a fixed background caused by a change in the observer's position and a finite separation of the object and background planes.




### Field of view diameter

The maximum diameter of the workpiece that can be projected using a particular lens.

$$\text{Field of view diameter (mm)} = \frac{\text{Screen diameter of profile projector}}{\text{Magnification of projection lens used}}$$

Example: If a 5X magnification lens is used for a projector with a screen of ø500mm:
Field of view diameter is given by $\frac{500\text{mm}}{5} = 100\text{mm}$



Mitutoyo

# TM-505B/1005B

## SERIES 176 — Toolmakers' Microscopes

The Mitutoyo TM Series is a toolmakers' microscope well suited for measuring dimensions and angles of machined metals. It also can be used to check the shape of screws and gears by attaching an optional reticle. The compact body makes it ideal for use on shop floors with limited space.

## FEATURES

- Angle measurement is performed easily by turning the angle scale disc to align the cross-hair reticle with the workpiece image.
- Illumination intensity can be adjusted.
- Included standard accessories create an overall magnification of 30X. Magnifications can be changed from 20 - 200X by using optional objectives and/or eyepieces.



TM-A505B

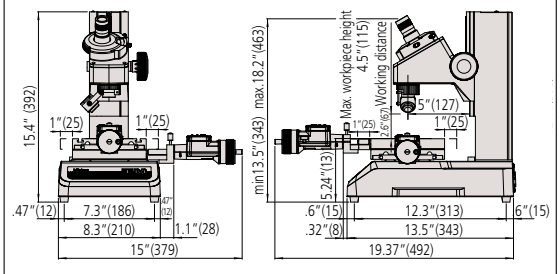
## SPECIFICATIONS

| Model No. | | TM-505B | TM-A505B | TM-1005B | TM-A1005B |
|---|---|---|---|---|---|
| Order No. | | 176-818A | 176-820A | 176-819A | 176-821A |
| Objective lens | | Standard accessory: 2X, Options: 5X, 10X | | | |
| Microscope head | Maximum height of workpiece | 4.53" / 115mm | | 4.21" / 107mm | |
| Illumination unit | Transmitted illumination | Stepless brightness adjustment, White LED light source, With green filter | | | |
| | Surface illumination | Oblique single-source type, Stepless brightness adjustment, White LED light source | | | |
| Cross-travel stage | Measuring range | 2" x 2" / 50×50mm | | 4" x 2" / 100×50mm (An optional 2"/50mm gauge block is required to cover full range. A CERA block is recommended.) | |
| | Table size | 6" x 6" / 152×152mm | | 9.44" x 6" / 240×152mm | |
| | Usable area of the stage glass | 3.8" x 3.8" / 96×96mm | | 6" x 3.8" / 154×96mm | |
| Linear measurement method | | Micrometer heads optional | Micrometer heads included | Micrometer heads optional | Micrometer heads included |
| Resolution | | N/A | .00005"/1µm | N/A | .00005"/1µm |
| Micrometer head travel range | | N/A | 2"/50mm | N/A | 2"/50mm |

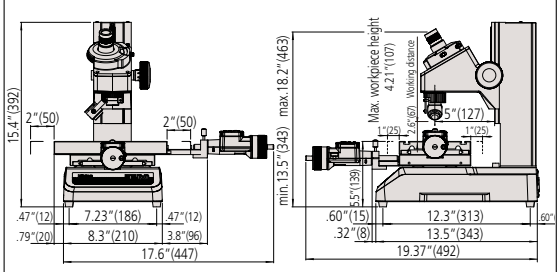
## DIMENSIONS

Unit: Inch(mm)

**TM-505B**




**TM-1005B**




## Technical Data

| | |
|---|---|
| Optical tube | • Monocular with 30° depression angle<br>• 90° broken cross-hair reticle (176-126)<br>• Erect image<br>• Diopter adjustable |
| Eyepiece protractor | • Graduation: 1°<br>• Protractor range: 360°<br>• Minimum reading by vernier: 6′ |
| Eyepiece (176-116) | • Magnification: 15X<br>• Field number: 13 |
| Objective (176-138) | • Magnification: 2X<br>• Working distance: 2.638" (67mm)<br>• Numerical aperture: 0.07 |
| Total magnification | • 30X |
| Transmitted illumination | • 3W LED<br>• GIF (green) filter<br>• Stepless intensity adjustment |
| Reflected illumination | • 3W LED<br>• Stepless intensity adjustment<br>• Adjustable position |
| Power supply | 120 V AC, 50/60Hz |
| Power consumption | 4.2W |
| Mass | TM-505B: Approx. 30.8 lbs. (14kg)<br>TM-1005B: Approx. 33 lbs. (15kg) |

## Optional Accessories

**176-115**: 10X eyepiece (field number: 13mm)
**176-116**: 15X projection lens set (standard accessory)
**176-117**: 20X eyepiece (field number: 10mm)
**176-138:** Objective, 2X (W.D. 67mm, N.A. 0.07) (standard accessory)
**176-139**: Objective, 5X (W.D.: 33mm, N.A.: 0.10)
**176-137**: Objective, 10X (W.D.: 14mm, N.A.: 0.14)
**164-163**: Digimatic micrometer head (range: 50mm, reading: 0.001mm)
**164-164**: Digimatic micrometer head (range: 2"/50mm, reading: .00005"/0.001mm)
**152-390**: Micrometer head for X-axis (range: 25mm, reading: 0.005mm)
**152-389**: Micrometer head for Y-axis (range: 25mm, reading: 0.005mm)
**152-392**: Micrometer head for Y-axis (range: 1", reading: .0001")
**152-391**: Micrometer head for X-axis (range: 1", reading: .0001")
**611201-531**: Rectangular gauge block (1")
**611202-531**: Rectangular gauge block (2")
**176-204**: Dial indicator attachment for Z-axis measurement
**959149**: SPC cable (2m) for Digimatic micrometer head

Fixture and Stage Accessories
**990561**: Workpiece clip (2pcs./set)
**176-106**: Rotary table for TM-505B (effective dia.: 66mm)
**172-196**: Rotary table for TM-1005B (effective dia.: 100mm)
**176-105**: Swivel center support for TM-505B (max. workpiece dia.: 2.7" / 70mm)
**172-197**: Swivel center support for TM-1005B (max. workpiece dia.: 3.1" / 80mm)
**172-378**: V-block with clamp (max. workpiece dia.: 1" / 25mm)
**176-107**: Holder with clamp

Illumination Units
**176-344A:** Bifurcated fiber illuminator
**64AAB214**: LED variable ring light
**176-208A**: LED circular illumination

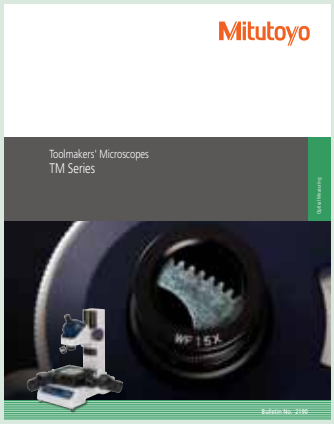
Reticles
**176-126**: Broken cross-hair (90°) (standard accessory)
**176-111**: Concentric circles (up to ø4mm, 0.05mm increment)
**176-135**: Concentric circle (up to ø.2", .01" increment)
**176-114**: 60° angle

**Protractor eyepiece**



**LED ring light 64AAB214**






Refer to Bulletin No. (2190) for more details.

# MF

## SERIES 176 — Measuring Microscopes

The MF measuring microscopes can be combined with Mitutoyo's vision unit to boost its performance and data management on a PC, further improving measuring efficiency and productivity.

## FEATURES

- Observation with a crisp and high-resolution erect image and a wide field of view
- Measuring accuracy that is highest in its class (and conforms to JIS B 7153)
- ML series, high-NA objectives that are specially designed for the MF series (long working distance type)
- Illumination unit (reflected/transmitted) selectable from a high-intensity LED or halogen bulb (selection required)
- Variable aperture diaphragm (reflected/transmitted) allows observation measurement while suppressing light diffraction
- Variety of standardized stages in sizes up to 400×200mm
- Quick-release mechanism useful for moving the stage quickly when measuring workpieces that are large in size or quantity
- Coarse/fine feed handles equipped as standard on both sides allow precise focus and observation measurement regardless of handedness
- High-magnification eyepiece observation up to 2000×
- Standard measuring microscope has a wide variety of optional accessories including a vision unit and various digital CCD cameras



**MF-B2017D**
XY stage travel range: 8 x 6.6" / 200 x 170mm
(with optional binocular tube)



Using optional slide-type nosepiece with 2-lens mount (factory set option)

## Technical Data

| | |
|---|---|
| Optical tube | • Monocular or Binocular **(Must Choose)**<br>• 25° depression angle<br>• 90° broken cross-hair reticle (12AAG836)<br>• Erect image<br>• TV Mount 50/50 |
| Observation image | • Erect Image |
| Observation type | • Bright Field |
| Eyepiece lens | • 10x (Included w/Tube)<br>• 15x (Optional)<br>• 20x (Optional) |
| Objective | • Magnification: 3X (Included)<br>• W.D.: 3.03" (77mm); N.A.: .09<br>• Optional: 1x, 5x, 10x, 20x, 50x, 100x |
| Light source | • Halogen or LED **(Must Choose)**<br>• Adjustable aperture diaphragms<br>• Light intensity infinitely adjustable |
| Transmitted illumination | • Telecentric illumination |
| Reflected illumination | • Koehler illumination |
| **Display Unit** | |
| Number of axis | • 2 axes (MF-A Type) or 3 axes (MF-B Type) |
| Resolution | • 0.0001" / 0.00005" / 0.00001"<br>(0.001 mm / 0.0005 mm / 0.0001 mm) |
| Functions | •Data output, Axis linear compensation, Metric or English Units, and more |
| Stage | • Precision travel (2.2+0.02L)µm accuracy<br>• High-accuracy linear glass scales<br>• Quick-release floating mode<br>• Zero-set button |
| Power consumption | 45W LED, 160W Halogen, 120V AC, 50/60 Hz |
| Mass | • 1010D - 148 lbs. / 67 kg<br>• 2010D - 157 lbs. / 71 kg<br>• 2017D - 326 lbs. / 148 kg<br>• 3017D - 344 lbs./ 156 kg<br>• 4020D - 357 lbs. / 162 kg |

**LED and Halogen Light Options for Transmitted and Reflected Illumination**
**(Common to MF D and MF-U D)**



Transmitted LED illumination unit (Common to MF/MF-U Series) | Reflected LED illumination unit (for MF Series) | Reflected LED illumination unit (for MF-U Series)



LED illumination | Halogen illumination

**High Visibility Digital Display**
**(Common to MF D and MF-U D)**



Front of display | Rear of display

## Selection of XY stage by travel range

**1010D**: 4 x 4" / 100 x 100mm



**2010D**: 8 x 4" / 200 x 100mm



**2017D:** 8 x 6.7" / 200 x 170mm



**3017D**: 12 x 6.6" / 300 x 170mm



**4020D**: 16 x 8" / 400 x 200mm





Mitutoyo

# MF

## SERIES 176 — Measuring Microscopes

## SPECIFICATIONS

| Model No. (XY stage size) | | 1010D | 2010D | 2017D | 3017D | 4020D |
|---|---|---|---|---|---|---|
| **Order No.** | MF-A | **176-861-10** | **176-862-10** | **176-863-10** | **176-864-10** | **176-865-10** |
| | MF-B | **176-866-10** | **176-867-10** | **176-868-10** | **176-869-10** | **176-870-10** |
| XY stage travel range | | 4 x 4"<br>100 x 100mm | 8 x 4"<br>200 x 100mm | 8 x 7"<br>200 x 170mm | 12 x 7"<br>300 x 170mm | 16 x 8"<br>400 x 200mm |
| Z-axis travel range | | 6" / 150mm | | 8.7" / 220mm | | |
| Focusing method | | Manual focusing (Coarse focusing: 30mm/rev., Fine focusing: 0.2mm/rev.) | | | | |
| Measurement method | | Linear encoder (2-axis model: X / Y-axis, 3-axis model: X / Y / Z-axis) | | | | |
| Resolution (switchable) | | .0001" / .00005" / .00001" (0.001mm / 0.0005mm / 0.0001mm) | | | | |
| Measuring accuracy (at 20˚C) | | XY-axis: (2.2+0.02L)µm, L = Measuring length (mm) when not loaded, JIS B 7153 | | | | |
| Indication accuracy (at 20˚C) | | Z-axis: (5+0.04L)µm, L = Measuring length (mm), (MF-B type) | | | | |
| Floating function | | X and Y axes with Quick-release mechanism | | | | |
| XY stage top size | | 11 x 11"<br>280 x 280mm | 14 x 11"<br>350 x 280mm | 16.1 x 13.4"<br>410 x 342mm | 20.07 x 13.4"<br>510 x 342mm | 24" x 13.4"<br>610 x 342mm |
| Effective glass size | | 7 x 7"<br>180 x 180mm | 10 x 6"<br>250 x 150mm | 10.6 x 9.4"<br>270 x 240mm | 14.5 x 9.4"<br>370 x 240mm | 17.3 x 9.4"<br>440 x 240mm |
| Swivel function | | — | | ±5˚ (left) | | ±3˚ (left) |
| Max. stage loading | | 22lbs / 10kg | | 44lbs / 20kg | | 33lbs / 15kg |
| Max. workpiece height | | 6" / 150mm | | 8.7" / 220mm | | |

## MF Selection of Machine Type (must select)

| ↓ | 1010 | 2010 | 2017 | 3017 | 4020 | Counter | Motorized stage | Optics |
|---|---|---|---|---|---|---|---|---|
| A | **176-861-10** | **176-862-10** | **176-863-10** | **176-864-10** | **176-865-10** | X,Y | Manual | BF |
| B | **176-866-10** | **176-867-10** | **176-868-10** | **176-869-10** | **176-870-10** | X,Y,Z | Manual | BF |
| J | - | - | **176-891A** | **176-892A** | **176-893A** | X,Y,Z | Z only | BF |

Example: MF-A1010D results in part number 176-861-10

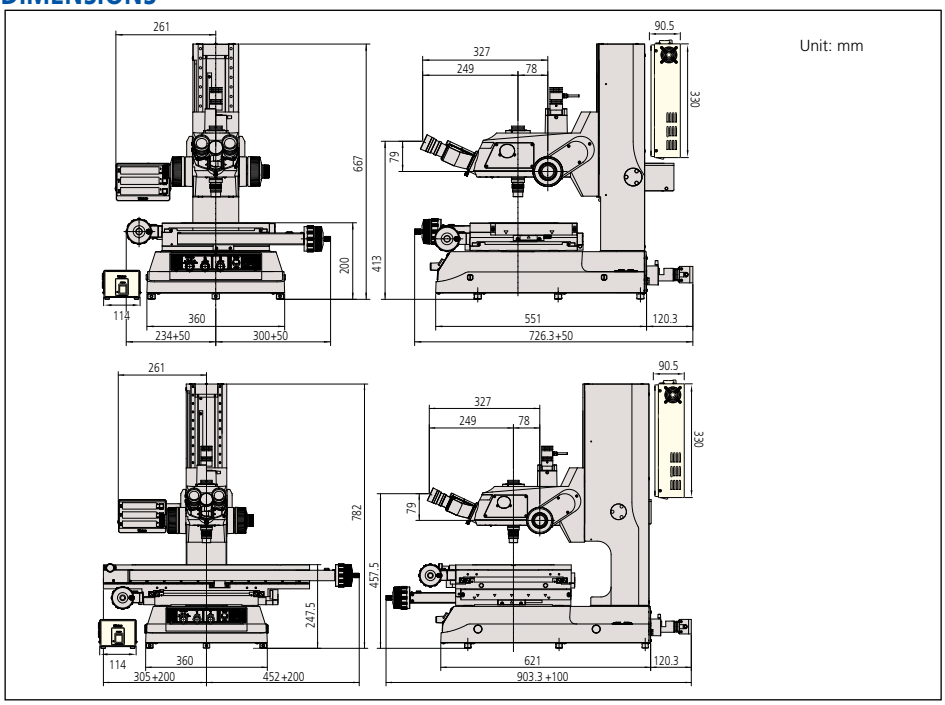
### Illumination Unit (must select)

| Applicable Illumination Unit | LED | Halogen |
|---|---|---|
| Order No. | 176-445A | 176-447A |

### Eye Tube Selection (must select)

| | |
|---|---|
| Monocular with 10X eyepiece | 176-392 |
| Binocular with 10X eyepiece | 176-393 |

## DIMENSIONS




## Optional Accessories

**176-392**: Monocular tube with 10X eyepiece
**176-393**: Binocular tube with 10X eyepiece set
**378-866**: 10X eyepiece set (view field dia.: 24mm)
**378-857**: 15X eyepiece set (view field dia.: 16mm)
**378-858**: 20X eyepiece set (view field dia.: 12mm)
**375-043**: Protractor eyepiece (10X)
**176-313**: Digital protractor eyepiece (10X)
**375-036-2**: 1X objective (W.D.: 61mm, N.A.: 0.03)
**375-037-1**: 3X objective (W.D.: 77mm, N.A.: 0.09) (std. accessory)
**375-034-1**: 5X objective (W.D.: 61mm, N.A.: 0.13)
**375-039**: 10X objective (W.D.: 51mm, N.A.: 0.21)
**375-051**: 20X objective (W.D.: 20mm, N.A.: 0.42)
**375-052**: 50X objective (W.D.: 13mm, N.A.: 0.55)
**375-053**: 100X objective (W.D.: 6mm, N.A.: 0.7)
**176-370-1**: Slide-type nosepiece (2-mount, parfocal)
**176-370-2**: Slide-type nosepiece (2-mount, mag. adjusted)
**12AAA643**: ND2 color filter (transmitted / surface)
**12AAA644**: ND8 color filter (transmitted / surface)
**12AAA645**: GIF filter (transmitted / surface) (std. accessory)
**12AAA646**: LB80 color filter (transmitted / surface)
**375-054**: 0.5X camera adapter (with C-mount adapter)
**970441**: C-mount adapter
**513667**: Halogen bulb (12V, 50W)
**12BAB345**: Halogen bulb (long life type, 12V, 50W)
**176-308**: Vibration damping stand
**176-309**: Mounting stand
**375-056**: Stage micrometer
**12AAA165**: Lens cleaning kit
**12AAA846**: Foot switch
**382951**: Vinyl cover (standard accessory) 2010 or less
**12BAM841**: Vinyl cover 2017 or greater

Illumination Units
**176-367-2A**: LED ring illuminator
**176-343A**: Twin fiber-optics illuminator
**176-366A**: Ring fiber-optics illuminator
**12AAG806**: GIF color filter (for fiber-optics illuminator)
**12AAG807**: LB80 color filter (for fiber-optics illuminator)

Fixture and Stage Accessories
**176-107**: Holder with clamp
**172-378**: V-block with clamp (max. workpiece dia.: 1" / 25mm)
**172-197**: Swivel center support[1] (max. workpiece dia.: 3.1" / 80mm)
**176-305**: Rotary stage with fine feed knob for 1010D/2010D models
**176-306**: Rotary stage with fine feed knob for 2017D/3017D/4020D models

[1] Fixture mount adapter (**176-310**) is required for 2010D models.
Fixture mount adapter (**176-304**) is required for 2017D/3017D/4020D models.



**QM-Data200**
2-D data processing unit
**264-155A**: Stand-mount type
**12AAA807**: Connecting cable set



**Focus pilot FP-05**
Focus assisting system



**Vision Unit**
PC-based vision measuring system
**359-763**

# MF Motorized

## SERIES 176 — Motorized Type Measuring Microscopes




Refer to No. (E14003) for more details.

- Motorized model of the MF Series. The Z-axis is motorized, and the stage can be operated using a remote box.
- Using the optional vision unit enables the image AF function.
- Illumination unit (reflected/transmitted) can be selected from a high-intensity LED or halogen bulb (selection required).
- Variable aperture diaphragm (reflected/transmitted) allows observation measurement while suppressing light diffraction.
- A wide variety of optional accessories are offered.
- ML series, high-NA objectives that are specially designed for the MF series (long-working distance type).
- High-magnification observation up to 2000X.



**MF-J2017D**

* The binocular tube, eyepieces, and LED illumination unit are optional accessories.

## SPECIFICATIONS

| | Model No. | MF-J2017D | MF-J3017D | MF-J4017D |
|---|---|---|---|---|
| | Order No. | **176-891A** | **176-892A** | **176-893A** |
| Observation image | | BF (Bright field)/Erect image | | |
| Eyepiece | Diopter adjustment | 10X (field number: 24), 15X, 20X<br>Note: Monocular unit: a 10X eyepiece (standard accessory), Binocular tube: two 10X eyepieces (standard accessory) | | |
| Objective lens | | ML series 3X objective lens (standard accessory), 1X, 5X, 10X, 20X, 50X, 100X | | |
| Illumination unit (One of the two options must be selected.) | LED illumination unit | Transmitted illumination: Telecentric system, Built-in aperture diaphragm, White LED light source, stepless light intensity control, with cooling fan<br>Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, White LED light source, stepless light intensity control<br>Control unit: Power ON/OFF switch (main switch), 100 - 240V AC power input connector | | |
| | Halogen illumination unit | Transmitted illumination: Telecentric system, Built-in aperture diaphragm, Halogen bulb (12V, 50W), stepless light intensity control, with cooling fan<br>Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, Halogen bulb (12V, 50W), stepless light intensity control, with cooling fan<br>Control unit: Power ON/OFF switch (main switch), 100 - 240V AC power input connector | | |
| Vision AF *1 | | Available Option | | |
| XY-axis Vision | Measuring range | 200×170mm | 300×170mm | 400×200mm |
| Z-axis | Measuring range | 220mm | | |
| Measuring accuracy *2 | (When no load is put on the X- or Y-axis) | (2.2+0.02L) μm L: Measuring length (mm) | | |
| Digital counter | Resolution | 1/0.5/0.1μm .0001"/.00005"/.00001" switchable | | |

*1: Vision Unit **359-763** and an image AF cable **12AAN358** are sold separately.
*2: Measuring method complies with JIS B7153.

Bulb replacement for transmitted/reflected illumination Standard: Halogen bulb (12V, 50W) (**No.513667**)
Bulb life: 1,100 hours

# MF-U

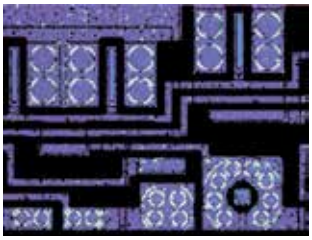
## SERIES 176 — High-power Multi-function Measuring Microscopes

### FEATURES

- Observation with a clear and flareless erect image and a wide field of view
- Measuring accuracy that is highest in its class (and conforms to JIS B 7153)
- Proven high-NA objectives from the FS optical system (long-working distance type)
- Integration of metallurgical and measurement microscope functions provides high-resolution observation and high-accuracy measurement solution
- Illumination unit (reflected/transmitted) selectable from a high-intensity LED or halogen bulb (required)
- Variable aperture diaphragm (reflected/transmitted) allows for contrast adjustment
- Variety of standardized stages in sizes up to 400 × 200 mm
- Quick-release mechanism useful for moving the stage quickly when measuring workpieces that are large in size or quantity
- High-magnification eyepiece observation up to 4000X



**MF-UB3017D**
XY stage travel range: 12 x 6.7″ / 300 x 170mm
(with optional turret, objective and fiber illumination)



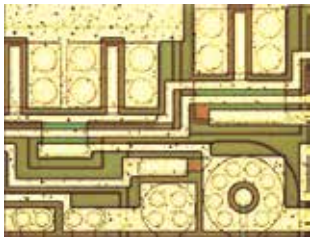
**Polarized light observation:**
Observing only the filtered light that vibrates in one direction. Used for observing materials with special optical characteristics, such as mineral and liquid crystal.



**Differential interference contrast (DIC) observation:**
Effective in detecting fine scratches and steps on the surface of metal, liquid crystal, and semiconductors.



**Dark field (DF) observation:**
Observing only the scattered light by shutting down the direct light to the objectives. The scratches and dust that cannot be viewed in the bright view field can be observed by this method in high-contrast.



**Bright field (BF) observation:**
Most common method of observation. Observing directly the light reflected from the surface of the workpiece.

### Technical Data

| | |
|---|---|
| Observation image: | Erect image |
| Optical tube: | Siedentoph type (pupil distance adjustment: 51 - 76mm), 1X tube lens, Binocular tube (depression: 30˚), Reticle projection method, with TV mount, Optical path ratio (eyepiece/TV mount: 50/50) |
| Eyepiece lens: | 10X (field No.: 24mm), Optional: 15X, 20X |
| Turret (optional): | Manual or power |
| Objective (optional): | M / BD Plan Apo objective from 1X to 200X |
| Transmitted illumination | |
| • Light source: | Halogen bulb (12V, 50W) or LED |
| • Optical system: | Telecentric illumination with adjustable aperture diaphragms |
| • Functions: | Light intensity adjustable, Non-stepped brightness adjustment |
| Surface illumination | |
| • Light source: | Optional halogen illumination unit (fiber-optic cold light illumination) or LED |
| • Optical system: | Koehler illumination with adjustable aperture diaphragms |
| • Functions: | Light intensity adjustable, Non-stepped brightness adjustment |
| Display unit: | |
| • No. of axis: | 2 axes or 3 axes |
| • Resolution: | .0001″ / .00005″ / .00001″ / 0.001mm / 0.0005mm / 0.0001mm |
| • Functions: | Zero-setting, Direction switching, Data output (via RS-232C interface) |
| Power supply: | 120V AC, 50/60Hz |
| Mass: | 148lbs/67kg (1010D) / 157lbs/71kg (2010D) / 326lbs/148kg (2017D) / 344lbs/156kg (3017D) / 357lbs/162kg (4020D) |

### Selection of XY stage by travel range



**1010D**: 4 x 4″ / 100 x 100mm



**2010D**: 8 x 4″ / 200 x 100mm



**2017D**: 8 x 6.7″ / 200 x 170mm



**4020D**: 16″ x 8″ / 400 x 200mm

# MF-U

## SERIES 176 — High-Power Multi-Function Measuring Microscopes

### Optional Accessories

**378-866**: 10X eyepiece set (view field dia.: 24mm) (standard accessory)
**378-857**: 15X eyepiece set (view field dia.: 16mm)
**378-858**: 20X eyepiece set (view field dia.: 12mm)

Turret (Nosepiece) **must select**
**378-018**: Adjustable manual BF turret (4 port)
**378-216A**: Adjustable power BF turret (5 port)
**176-211**: Adjustable manual BF/DF turret (4 port)
**176-212A**: Adjustable power BF/DF turret (4 port)

Objectives
See page I-28 for objective selection

### Manual and Power Turrets



Filters
**378-092**: Polarization unit
**378-076**: DIC unit for 100X, SL80X, SL50X objective
**378-078**: DIC unit for 50X, SL20X objective
**378-079**: DIC unit for 20X objective
**378-080**: DIC unit for 10X, 5X objective
**12AAA643**: ND2 color filter (for halogen illuminator, **176-448A**)
**12AAA645**: GIF filter (standard accessory)
**12AAA646**: LB80 color filter (for halogen illuminator, (**176-448A**)

Camera Mounts
**375-054**: 0.5X camera adapter (with C-mount adapter)
**970441**: C-mount adapter

Bulbs
**513667**: Halogen bulb (12V, 50W)
**12BAB345**: Halogen bulb (long life type, 12V, 50W)
**517181**: Halogen bulb (12V, 100W)
**12BAD602**: High intensity halogen bulb (12V, 100W)

Illumination Units
**176-315A**: Halogen illumination unit (12V, 100W)
**176-316A**: Halogen illumination unit (12V, 150W)
**176-343A**: Twin fiber-optics illuminator
**12AAG806**: GIF color filter (for **176-315A** and **176-343A**)
**12AAG807**: LB80 color filter (for **176-315A** and **176-343A**)

Fixture and Stage Accessories
**176-107**: Holder with clamp
**172-378**: V-block with clamp (max. workpiece dia.: 1" / 25mm)
**172-197**: Swivel center support* (max. workpiece dia.: 3.1" / 80mm)
**176-305**: Rotary stage with fine feed knob for 1010D/2010D models
**176-306**: Rotary stage with fine feed knob for 2017D/3017D/4020D models
*Fixture mount adapter (**176-310**) is required for 2010D models.
Fixture mount adapter (**176-304**) is required for 2017D/3017D/4020D models.

Misc.
**176-308**: Vibration damping stand
**176-309**: Mounting stand
**375-056**: Stage micrometer
**937179T**: Foot switch
Reticle See page I-21

## SPECIFICATIONS

| Model No. (XY stage size) | | 1010D | 2010D | 2017D | 3017D | 4020D |
|---|---|---|---|---|---|---|
| **Order No.** | MF-UA | **176-871-10** | **176-872-10** | **176-873-10** | **176-874-10** | **176-875-10** |
| | MF-UB | **176-876-10** | **176-877-10** | **176-878-10** | **176-879-10** | **176-880-10** |
| | MF-UC | **176-881-10** | **176-882-10** | **176-883-10** | **176-884-10** | **176-885-10** |
| | MF-UD | **176-886-10** | **176-887-10** | **176-888-10** | **176-889-10** | **176-890-10** |
| XY stage travel range | | 4 x 4" 100 x 100mm | 8 x 4" 200 x 100mm | 8 x 6.7" 200 x 170mm | 12 x 6.7" 300 x 170mm | 16 x 8" 400 x 200mm |
| Z-axis travel range | | 6" / 150mm | | 8.7" / 220mm | | |
| Focusing method | | Manual focusing (coarse focusing: 10mm/rev., fine focusing: 0.1mm/rev.) | | | | |
| Measurement method | | Linear encoder (2-axis model: X / Y-axis, 3-axis model: X / Y / Z-axis) | | | | |
| Resolution (switchable) | | .0001" / .00005" / .00001" (0.001mm / 0.0005mm / 0.0001mm) | | | | |
| Measuring accuracy (at 20˚C) | | XY-axis: (2.2+0.02L)µm, L = Measuring length (mm) when not loaded, JIS B 7153 | | | | |
| Indication accuracy (at 20˚C) | | Z-axis: (5+0.04L)µm, L = Measuring length (mm) | | | | |
| Floating function | | X and Y axes with Quick-release mechanism | | | | |
| XY stage top size | | 11 x 11" 280 x 280mm | 14 x 11" 350 x 280mm | 16 x 13.6" 410 x 342mm | 20 x 13.6" 510 x 342mm | 24 x 13.6" 610 x 342mm |
| Effective glass size | | 7.1 x 7.1" 180 x 180mm | 10 x 6" 250 x 150mm | 10.6 x 9.6" 270 x 240mm | 14.6 x 9.6" 370 x 240mm | 17.3 x 9.6" 440 x 240mm |
| Swivel function | | — | | ±5˚ (left) | | ±3˚ (left) |
| Max. stage loading | | 22lbs / 10kg | | 44lbs / 20kg | | 33lbs / 15kg |

### Selection of machine type

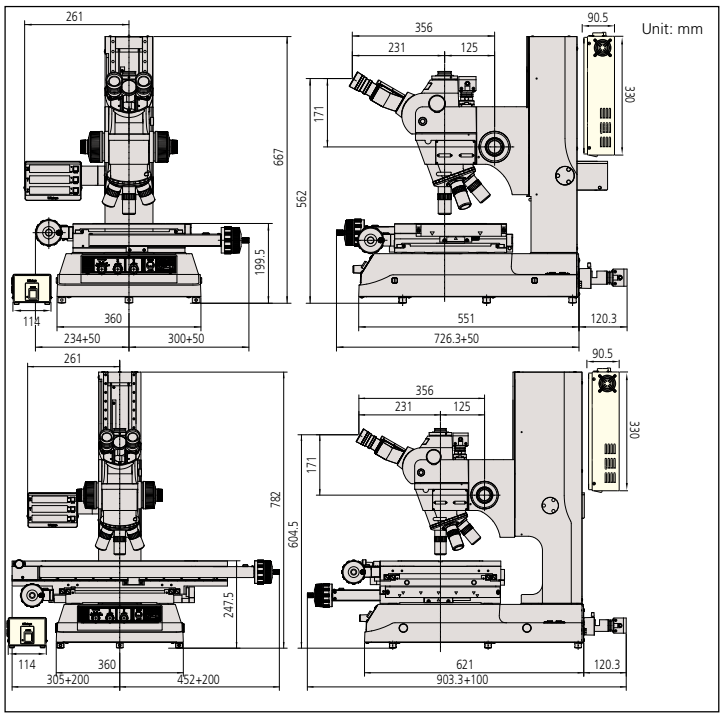
| Machine type | MF-UA | MF-UB | MF-UC | MF-UD |
|---|---|---|---|---|
| Observation type | Bright field (BF) | Bright field (BF) | Bright / Dark field (BF/DF) | Bright / Dark field (BF/DF) |
| Measurement system | X and Y-axis (2 axes) | X, Y and Z-axis (3 axes) | X and Y-axis (2 axes) | X, Y and Z-axis (3 axes) |

### Illumination Unit (must select LED or Halogen illumination unit)

| Applicable Illumination Unit | LED | Halogen |
|---|---|---|
| **Order No.** | **176-446A** (transmitted & reflected) | **176-448A** (transmitted) |
| | | **176-316A** (reflected) |

Note: illumination unit not included. If halogen transmitted illumination is selected, then either 176-315A or 176-316A must be chosen.

## DIMENSIONS



# MF-U Motorized

## SERIES 176 — Motorized-Type Universal Measuring Microscopes

- Motorized model of the MF-U Series. The Z-axis is motorized, and can be operated using a remote box.
- Using the optional vision unit enables the image AF function.
- Illumination unit (reflected/transmitted) can be selected from a high-intensity LED or halogen bulb (required).
- Variable aperture diaphragm (reflected/transmitted) allows observation measurement while suppressing light diffraction.
- A wide variety of optional accessories are offered.
- Proven high-NA objectives from the FS optical system (long working distance type).
- Integration of metallurgical and measurement microscope functions provide high-resolution observation and a high-accuracy measurement solution.
- High-magnification observation up to 4000X.



**MF-UJ2017D**

* The turret, objectives, and LED illumination unit are sold separately.

### MF-U Selection of Machine Type

| ↓ | 2017 | 3017 | 4020 | Counter | Motorized stage | Optics |
|---|---|---|---|---|---|---|
| J | 176-894A | 176-895A | 176-896A | X,Y,Z | Z only | BF |
| K | 176-897A | 176-898A | 176-899A | X,Y,Z | Z only | BF/DF |

### SPECIFICATIONS

| | | | | |
|---|---|---|---|---|
| BF (Bright field) | Model No. | **MF-UJ2017D** | **MF-UJ3017D** | **MF-UJ4020D** |
| | Order No. | **176-894A** | **176-895A** | **176-896A** |
| BD (Bright / Dark field) | Model No. | **MF-UK2017D** | **MF-UK3017D** | **MF-UK4020D** |
| | Order No. | **176-897A** | **176-898A** | **176-899A** |
| Observation image | | BF (Bright field), DF (Dark field) , Polarization, Differential Interference Contrast (DIC) / Erect image | | |
| Eyepiece | Diopter adjustment | 10X (standard accessory) (Field number: 24), 15X, 20X | | |
| Objective lens (optional) | BF (Bright field) | M Plan Apo, M Plan Apo HR, M Plan Apo SL, G Plan Apo | | |
| | BD (Bright / Dark field) | BD Plan Apo, D Plan Apo HR, BD plan Apo SL | | |
| Illumination unit (One of the two options must be selected.) | LED illumination unit | Transmitted illumination: Telecentric system, Built-in aperture diaphragm, White LED light source, stepless light intensity control, with cooling fan<br>Reflected illumination: Koehler illumination, Variable aperture diaphragm mechanism, White LED light source, Non-step light intensity control<br>Control unit: Power ON/OFF switch (main switch), 100 - 240V AC power input connector | | |
| | Halogen illumination unit | Transmitted illumination: Telecentric system, Built-in aperture diaphragm, Halogen bulb (12V, 50W), stepless light intensity control, with cooling fan<br>Reflected: BF/BD Kohler illumination with adjustable aperture diaphragm, 12V100W or 12V15W halogen lamp (selectable), external fiber illumination, stepless brightness adjustment<br>Control unit: Power ON/OFF switch (main switch), 100 - 240V AC power input connector | | |
| Vision AF *1 | | ✓ | | |
| XY-axis | Measuring range | 8×6.7" / 200×170mm | 12×6.7" / 300×170mm | 16×8" / 400×200mm |
| Z-axis | Measuring range | 8.7" / 220mm | | |
| Measuring accuracy | (When no load is put on the X- or Y-axis) | (2.2+0.02L) μm L: Measuring length (mm) | | |
| Digital counter | Resolution | 1/0.5/0.1μm .0001"/.00005"/.00001" switchable | | |

*1: Vision unit and an image AF cable are separately required.
*2: Measuring method complies with JIS B7153.

Bulb replacement for transmitted illumination Standard: Halogen bulb (12V, 50W) (**No.513667**), Bulb life: 1,100 hours
For replacement for reflected illumination (from separate light source) Standard: Halogen bulb (12V, 100W) (**No.517181**),
High-intensity bulb (12V, 100W) (**No.12BAD602**)
*At the time of purchase, a standard bulb and a high-intensity bulb are provided. (Only for the reflected illumination models.)

# Accessories for Measuring Microscope

## Stage Micrometer



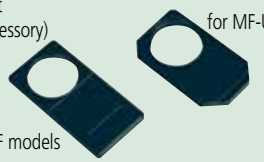

### SPECIFICATIONS

| Order No. | 375-056 |
|---|---|
| Range | 1mm |
| Graduations | 0.01mm |
| Accuracy (at 20˚C) | (1+L)µm, L = Measuring length (mm) |
| Dimensions (WxD) | 3" x 1" / 76 x 26mm |
| Mass | 16g |

### Optional Reticles

**12AAG838 (12AAG878)**: Cross-hair (7µm width)
**12AAG836 (12AAG877)***: Cross-hair (5µm width)
**12AAG873 (12AAG876)**: Cross-hair (3µm width)
**12AAG839 (12AAG879)**: Cross-hair and 45˚ angle
**12AAG840 (12AAG880)**: Broken cross-hair and 60˚ angle
**12AAG841 (12AAG881)**: Zeiss type chart
**12AAG842**: 20mm scale (0.1mm reading)
**12AAG843**: Concentric circle (ø1.2 - ø18mm)
**12AAG844**: 10mm scale (0.1mm reading)
**12AAG845**: 5mm scale (0.05mm reading)
**12AAG846**: 10x10mm section (1mm min.)
**12AAG847**: Metric screw thread (P = 0.25-1.0)
**12AAG848**: Metric screw thread (P = 1.25-2.0)
**12AAG849**: Involute gear tooth (14.5˚), module = 0.1 - 1.0
**12AAG850**: Involute gear tooth (20˚), module = 0.1 - 1.0
**12AAG851**: Unified screw thread (80 - 28TPI)
**12AAG852**: Unified screw thread (24 - 14TPI)
**12AAG853**: Unified screw thread (13 - 10TPI)
**12AAG854**: Concentric circle (ø.01" - ø.2")
( ): for MF-U models,
* Standard accessory

Reticle mount
(standard accessory)



for MF-U models

for MF models

Cross-hair and 90˚ angle
(standard accessory)

## Focus Pilot FP-05

### FEATURES

- By installing this system on the camera mount of an MF series measuring microscope and projecting the focusing chart onto the workpiece surface, the focal point can be detected with high accuracy and high repeatability.
- The brightness of the chart can be adjusted.
- A wide view field observation on the monitor is made possible with the use of a CCD camera (C-mount adapter is included.)
- Four types of chart patterns are available.* The pattern should be selected in accordance with the type of workpiece surface texture.

* Factory installed option



Concentric circle



Slit

### SPECIFICATIONS

| Order No. | 375-057A | 375-058A | 375-067A | 375-068A |
|---|---|---|---|---|
| Applicable microscopes | MF D models | | MF-U D models | |
| Light source | Green LED | Red LED | Green LED | Red LED |
| Magnification | 0.5X, Accuracy: 0.1%** | | | |
| Camera adapter | C-mount (provided) | | | |
| Applicable CCD camera | Up to 2/3-inch | | | |
| Mass | 4lbs / 1.8kg | | | |

** Within 2/3 area from the center of view field



## Manual and Power Turrets



### SPECIFICATIONS

| Order No. | 176-211 | 378-018 | 176-212A | 378-016A | 378-216A |
|---|---|---|---|---|---|
| Observation type | BD | BF | BD | BF | BF |
| No. of objective mounts | 4-mount | 4-mount | 4-mount | 4-mount | 5-mount |
| Driving method | Manual | | Motor | | |
| Dimensions (W x D x H) | — | — | Turret: 6.5 x 2.6 x 5.4" 164 x 65 x 137 | | |
| | | | Control Box: 4.1 x 3 x 7.6" 108 x 72 x 193 | | |



Mitutoyo

# Accessories for Measuring Microscope

## Twin fiber-optics illuminator



### SPECIFICATIONS

| Order No. | 176-343A |
|---|---|
| Applicable microscopes | MF, MF-U models |
| Length of fiber cable | 28" / 700mm |
| Light source | Halogen bulb (12V, 100W) (**517181**: halogen bulb) |
| Dimensions (W x D x H) | Light unit: 9.3 x 3 x 4.7" 235 x 76 x 120mm |

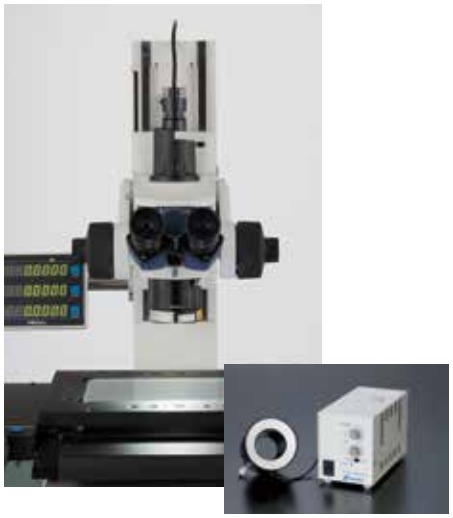
## Ring fiber-optics illuminator



### SPECIFICATIONS

| Order No. | 176-366A |
|---|---|
| Applicable microscopes | MF models (ML 10X or lower) |
| Length of fiber cable | 40" x 1000mm |
| Light source | Halogen bulb (12V, 100W) (**517181**: halogen bulb) |
| Dimensions (W x D x H) | Light unit: 9.3 x 3 x 4.7" 235 x 76 x 120mm |

## LED Ring Illuminator



### SPECIFICATIONS

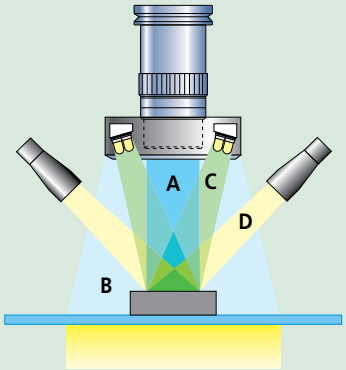
| Order No. | 176-367-2A |
|---|---|
| Applicable microscopes | MF models with 1X/3X/5X/10X objective |
| Light source | White LED |
| Length of LED cable | 59" / 1500mm |

## LED Ring Light (for sliding nosepiece)



### SPECIFICATIONS

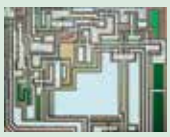
| Order No. | 176-371A |
|---|---|
| Applicable microscopes | MF models with 1X/3X/5X/10X objective |
| Light source | LED |




### A: Vertical surface illumination (Halogen)


PCB


HDD suspension


IC circuit

### B: Ring fiber optics illumination


Flexible PCB


PCB


Electric parts

### C: LED ring illumination


HDD suspension


PCB


Black resin molded parts

### D: Twin fiber-optics illumination



IC package


Garnet


PCB

# QM-Data200

## SERIES 264 — 2-D Data Processing Unit

### Technical Data

| | |
|---|---|
| Resolution: | 0.0001mm |
| Program functions: | Part program creation, execution, editing |
| Statisical processing: | Number of data, maximum value, minimum value, mean value, standard deviation, range, histogram |
| Element memory: | Maximum of 1000 elements |
| Element recall: | Point, line, circle, distance, ellipse, rectangular hole, slotted hole, intersection and intersecting angle |
| Element key-in: | Point, line, circle |
| Display system: | Monographic LCD (320 x 240 dots, with back light) |
| Measurement result file output: | RS-232C/USB output (CSV format, MUX-10F format) |
| Display language: | Japanese/English/German/French/ Italian/Spanish/Portuguese/Swedish/ Polish/Dutch/Hungarian |
| Data input: | RS-232C/USB, X/Y/Z-axis signal, Footswitch |
| Data output: | RS-232C/USB |
| Power supply | 120V AC, 50/60Hz |
| Mass | 2.2kg (stand-mount type) 2.1kg (arm-mount type) |

**QM-Data200**
**Order No.: 264-155A (stand-mount type)**
**Order No.: 264-156A (arm-mount type)**

The QM-Data200 is a geometric readout/ analysis unit for optical instruments like profile projectors. This features powerful 2-D coordinate measurement capabilities with unmatched simple key operation. The QM-Data200 improves operator productivity, minimizes errors, and saves measurement time and production cost.

### FEATURES

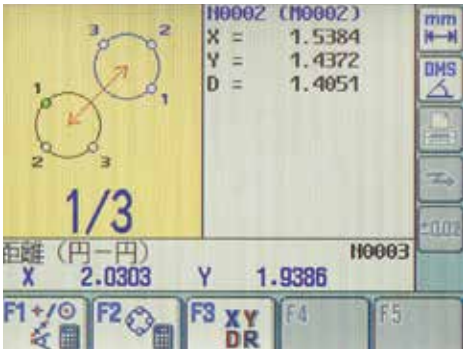
- Various graphic displays on the large colored LCD screen for easy measurement operations.
- One-key operation for combined measurements that are often used (circle-circle distance, etc.)
- The AI measurement function (automatic identification of measuring item) eliminates switching between the measurement command keys.
- Equipped with the measurement procedure teaching function and the measuring position navigation in Repeat mode.
- The user menu function allows user to register measurement commands or part programs to create his own menu.
- Tolerance zone measurement of data processing result and various statistical processing for each item is available.
- Measurement result output to "MS-Excel" in spreadsheet (CSV) format.
- The measurement procedure and measurement result can be saved, using a USB drive.
- Two models available: a stand-alone type with tilt system and a flexible-arm type that can be mounted on a profile projector.




**QM-Data 200**
**Stand-mount type**

**• Intuitive panel design**
The QM-Data200 employs Geometry Keys to accelerate the measurement process. The probing routine of standard geometric features and combinations are designed with Geometry Keys on the front panel. Click the key you need and capture features to complete the measurement quickly and accurately. This improves operator productivity, reduce errors, and saves operation time and cost.

**• Graphic display**
Measurement information and data are visualized on the back-lit colored LCD with graphical interfaces. The geometric feature selected is displayed with the probing navigator. The measurements map and blink indication show the probing points and sequences. This improves operation accuracy and reduces errors and time.

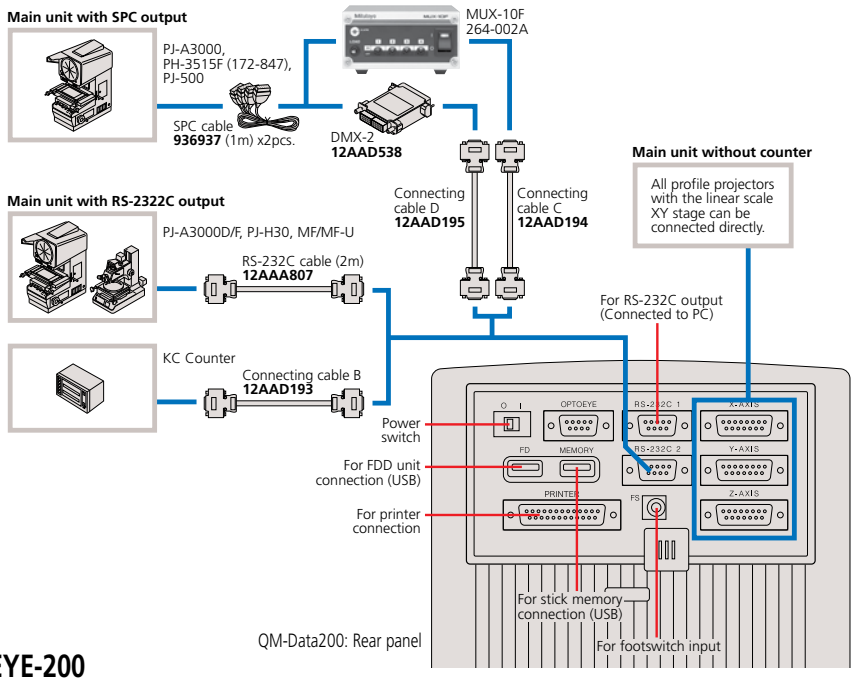





# QM-Data200

## SERIES 264 — 2-D Data Processing Unit

## SYSTEM DIAGRAM




### OPTOEYE-200

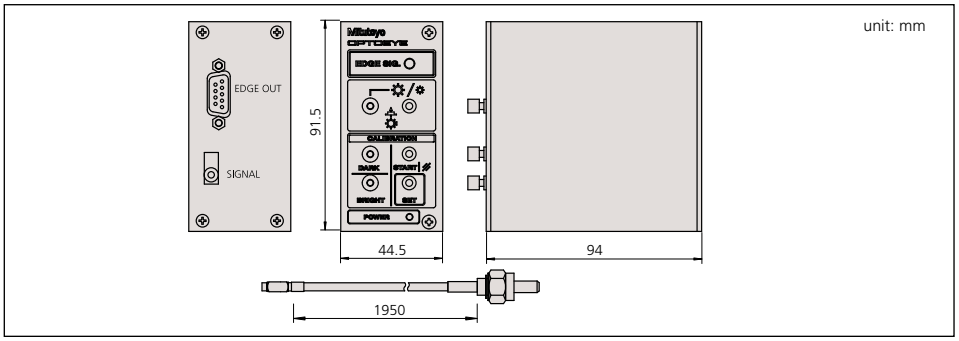
The OPTOEYE-200 Image Edge Sensor eliminates human errors, ensuring speedy, accurate and consistent measurements, regardless of operator's skill.

### FEATURES

- OPTOEYE-200 adopts a thin fiber-optic cable for detector connection for easy set-up and smart operation without obstructing your view.
- Bright and dark buttons allow easy calibration.
- OPTOEYE can be powered by QM-Data200 via the connecting cable. No AC adapter is required.
- The brightness of the chart can be adjusted.




## DIMENSIONS




## Optional Accessories

**12AAD034**: Receipt printer (for 120V)
**223663**: Printer paper for receipt printer
**12AAA804**: Printer cable (2m)
**937179T**: Foot switch
**12AAD193**: Connection cable B
**12AAD194**: Connection cable C
**12AAD195**: Connection cable D
**12AAA807**: RS-232C cable (2m)
**12AAA808**: RS-232C cable (4m)

## Technical Data

Image detection
- Directivity: Non-direction
- Min. diameter: ø2mm on the screen
- Min. width: 1mm on the screen
- Max. moving speed: 1000mm/s

Applicable illumination
- Type: Surface / Contour illumination
- Range: 30Lx to 1500Lx on the screen
  Bright-Dark field difference: 20Lx

Repeatability: 1µm in contour illumination
Function: Error in detection of illumination change
Supporting a contour illumination
brightness selector switch of projector

## Optional Accessories

**12AAE671**:
Detector attachment (A)
PJ-A3000, PJ-H30, PH-3515, PH-A14 series
(Adaptation diameter of a screen:
10" / ø250 to 14" / ø350mm)

**12AAE672**:
Detector attachment (B)
PJ-500, PV-5110, PV-600A series
(Adaptation diameter of a screen:
20" / ø500 to 24" / ø600mm)






Refer to Bulletin No. (2222) for more details.

# Vision Unit

## SERIES 359 — Vision System Retrofit for MF and MF-U Microscopes

## SPECIFICATIONS

| | |
|---|---|
| Projected Image | Inverted Image |
| Onscreen Magnification | 19x-1900x (22" Monitor) |
| **Camera Unit** | |
| Image Sensor Size | 1/2" Color CMMOS |
| Image Sensor Resolution | 3 MP |
| Interface | USB 2.0 |
| Dimensions (WxDxH) | 2.28 x 2.32 x 3.27"<br>58 x 59 x 83mm |
| **Adapter Unit** | |
| Measurement Software | QSPak VUE (optional) |
| Dimensions (DXH) | 1.77 x 4.84" / 45 x 123mm |
| Magnification | 0.5x |
| Optional Accessory: | Foot Switch **(12AAJ088)** |

## QSPAK, optional software

### For observation/comparison of form

- Template matching function
- Manual pattern matching function

### For simple measurement

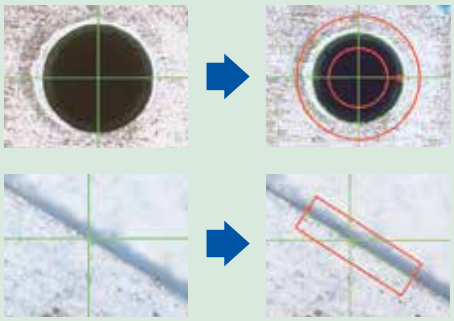
- One-click edge detection tool function
- Smart tool function
- User macro function

### For repeated measurement/ auto-measurement

- Quick navigation function
- Playback function
- Graphic function
- External data output function
- Statistical calculation function

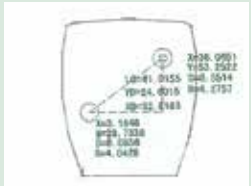
### One-click Edge Detection

By clicking the mouse near the edge of a workpiece, QSPAK automatically scans the edge and detects it, showing its coordinates. This function also works with the point tool, box tool, circle tool and auto-focus tool.



### Graphic Window

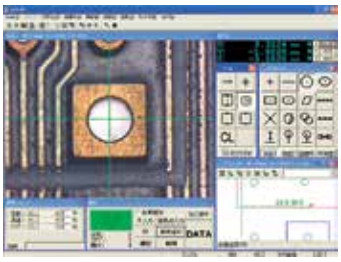
The measurement results and measured elements are plotted in the graphic window in real-time. By using this function, the user can check the current measuring position at a glance. The graphic window can be used for geometrical calculation.



## FEATURES

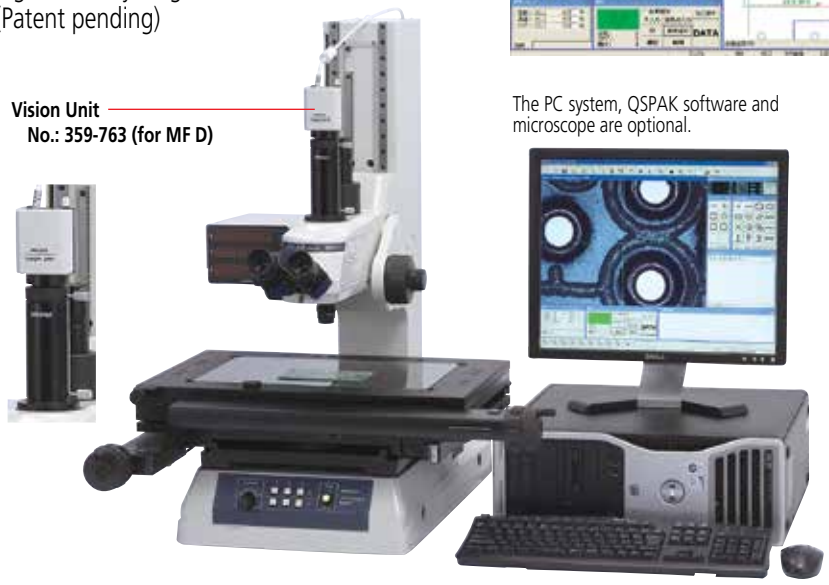
- The automatic edge-detection tools and various macro icons allow measurement in one easy step.
- The graphics and measurement navigation functions facilitate operation.
- Image data input/storage function.
- Measurement results are output in CVS format. This lets the user generate an inspection table in MS-Excel®.
- Allows the tolerance zone measurement of measurement results and various types of statistical processing for each item.
- Combined use with the focus pilot provides high-accuracy height measurements. (Patent pending)
- A series of measuring operations can be performed using just one screen display.
- The auto-brightness control function reproduces the type and degree of illumination required. (This function is limited to the MF/MF-U series.)

### QSPAK Measurement Window

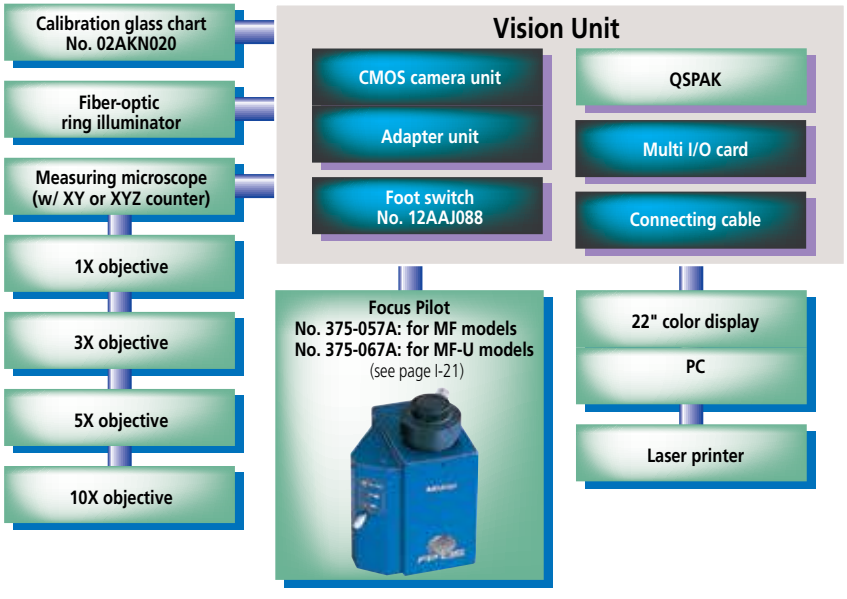


Vision Unit
No.: 359-763 (for MF D)

The PC system, QSPAK software and microscope are optional.



: Optional accessory






Mitutoyo

# FS-70

## SERIES 378 — Microscope Unit for Semiconductor Inspection

### FEATURES

- The optical system that was developed for the best-selling FS 60 models was further enhanced for the FS70 models. It is ideal as a microscope unit of a prober station for semiconductors. (All models CE marked.)
- The FS70L supports three types of YAG laser wavelength ranges (1064nm, 532nm and 355nm), while the FS70L4 supports two types of wavelength ranges (532nm and 266nm), thus expanding a scope of laser applications, allowing laser-cutting of thin-films used in semiconductors and liquid crystal substrates. However, Mitutoyo assumes no responsibility for the performance and/or safety of the laser system used with Mitutoyo microscopes. Careful examination is recommended in selecting a laser-emission unit.
- Bright field, differential interference contrast (DIC) and polarized observations are optional with FS70Z and FS70. The FS70L and FS70L4 do not support the DIC method.
- By employing an inward revolver, the long working distance objectives provide excellent operability.
- An ergonomic design with superb operability: the FS70 employs the erect-image optical system (the image in the field of view has the same orientation as the specimen) and enlarged fine focus adjustment wheel with rubber-grip coarse adjustment knob.



FS70Z



FS70L



FS70L4

### SPECIFICATIONS

| Model No.<br>**Order No.** | FS70<br>**378-184-1** | FS70-TH<br>**378-184-3** | FS70Z<br>**378-185-1** | FS70Z-TH<br>**378-185-3** | FS70L<br>**378-186-1** | FS70L-TH<br>**378-186-3** | FS70L4<br>**378-187-1** | FS70L4-TH<br>**378-187-3** |
|---|---|---|---|---|---|---|---|---|

| Short base model No.<br>**Order No.** | FS70-S<br>**378-184-2** | FS70-THS<br>**378-184-4** | FS70Z-S<br>**378-185-2** | FS70Z-THS<br>**378-185-4** | FS70L-S<br>**378-186-2** | FS70L-THS<br>**378-186-4** | FS70L4-S<br>**378-187-2** | FS70L4-THS<br>**378-187-4** |
|---|---|---|---|---|---|---|---|---|
| Focus adjustment | 50mm travel range with concentric coarse (3.8mm/rev) and fine (0.1mm/rev) focusing wheels (right / left) | | | | | | | |
| Image | Erect image | | | | | | | |
| Pupil distance | Siedentopf type, adjustment range: 2 - 3" / 51 - 76mm | | | | | | | |
| Field number | 24 | | | | | | | |
| Tilt angle | — | 0° - 20° | — | 0° - 20° | — | 0° - 20° | — | 0° - 20° |
| Optical pass ratio | 50/50 | 100/0 or 0/100 | 50/50 | 100/0 or 0/100 | 100/0 or 0/100 | | 100/0 or 0/100 | |
| Protective filter | — | | — | | Built-in laser beam filter | | Built-in laser beam filter | |
| Tube lens | 1X | | 1X - 2X zoom | | 1X | | 1X | |
| Applicable laser | — | | — | | 1064/532/355nm | | 532/266nm | |
| Camera mount | C-mount (using optional adapter B) | | | | Use a laser with TV port. | | C-mount receptacle (with green filter switch) | |
| Illumination system, optional | Reflective illumination for bright field (Koehler illumination, with aperture diaphragm)<br>12V 100W fiber optics, non-stepped adjustment, light guide length: 1.5m, power consumption 150W | | | | | | | |
| Objective, optional (for observation) | M Plan Apo, M Plan Apo SL, G Plan Apo | | | | | | | |
| Objective, optional (for laser-cutting) | — | | | | M/LCD Plan NIR, M/LCD Plan NUV | | M Plan UV | |
| Loading weight* | 32lbs/14.5kg | 30lbs/13.6kg | 31lbs/14.1kg | 29lbs/13.2kg | 31lbs/14.2kg | 30lbs/13.5kg | 31lbs/13.9kg | 29lbs/13.1kg |
| Mass (main unit) | 13lbs/6.1kg | 15.5lbs/7.1kg | 14.5lbs/6.6kg | 16.5lbs/7.5kg | 14lbs/6.4kg | 15.5lbs/7.2kg | 14.5lbs/6.7kg | 16.5lbs/7.5kg |

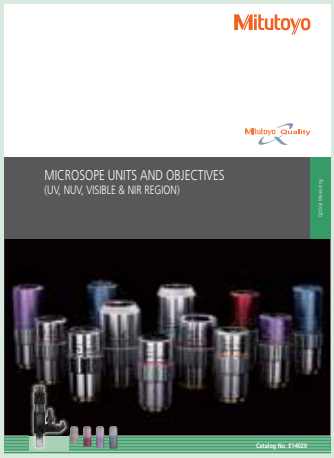
*Loading weight on optical tube excluding weight of objective lenses and eyepieces.

### Technical Data

| | |
|---|---|
| Focus Adjustment Method: | With concentric coarse and fine focusing wheels (right and left) |
| Range: | 50mm travel range<br>0.1mm/rev. for fine adjustment,<br>3.8mm/rev. for coarse adjustment |
| Trinocular tube Image: | Erect image |
| Pupil distance: | Siedentopf type,<br>adjustment range:<br>2-3" / 51-76mm |
| Field number: | 24 |
| Tilt angle: | 0° - 20° (only -TH, -THS models) |
| Illumination system: | Reflective illumination for bright field (Koehler illumination, with aperture diaphram) |
| Light source (optional): | 12V100W fiber optics,<br>non-stepped adjustment,<br>light guide length 1.5m,<br>power consumption 150W |
| Objectives (optional): | M Plan Apo, M Plan Apo SL,<br>G Plan Apo |

### Optional Accessories

For a complete listing of accessories see Microscope Units and Objectives brochure, E4191-378




Refer to No. (E14020) for more details.

# VMU

## SERIES 378 — Video Microscope Unit

The VMU is a compact, light-weight, and easy-to-install microscope unit for CCD camera monitoring in semiconductor fabrications.

### FEATURES

- The rigidity and general performance of the VMU-LB & VMU-L4B have been enhanced compared to previous models.
- The optical system features ultra-long working distance objectives and correction for the wide range of radiation.
- The fiber-optic reflected illumination keeps the workpiece free from thermal expansion caused by heat. The fiber-optic illuminator is required for the light source.
- Also available with a laser mount or revolving nosepiece (objective mount).

### SPECIFICATIONS

| | | |
|---|---|---|
| Magnification of tube | | 1X |
| Applicable wavelength | 378-505, 378-506 | Near-infrared and visible radiation |
| | 378-507 378-513 | Near-infrared —visible— near-ultraviolet radiation |
| | 378-508 | Visible and ultraviolet radiation |
| | 378-514 | Near-infrared to ultraviolet |
| Objective | | (Optional) see pg. I-28 thru I-32 |
| Reflected illumination | | • Telecentric system with aperture stop system.<br>• Fiber-optic illuminator (optional) is required. |
| Light source | | Halogen bulb (21V, 150W) (optional) |
| Mass | | **378-505**: 570g<br>**378-506**: 590g<br>**378-507**: 980g<br>**378-508**: 1010g<br>**378-513**: 1300g<br>**378-514**: 1300g |

### Selection Guide of System Configuration

| **Order No.** (Depends on each system configuration) | VMU-V **378-505** | VMU-H **378-506** | VMU-L **378-507** | VMU-L4 **378-508** | VMU-LB **378-513** | VMU-L4B **378-514** |
|---|---|---|---|---|---|---|
| Vertical CCD camera mount | ● | | ● | ● | ● | ● |
| Horizontal CCD camera mount | | ● | | | | |
| YAG laser mount | | | ● | ● | ● | ● |
| Fiber-optic illumination unit | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ |
| M Plan Apo, M Plan Apo SL, G Plan Apo objectives for bright field observation | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ |
| M Plan Apo NIR, LCD Plan Apo NIR, M Plan Apo NUV and LCD Plan Apo NUV objectives for laser cutting | | | ▲ | | ▲ | ▲ |
| M Plan UV objectives for laser machining | | | | ▲ | | ▲ |

●: Provided, ▲: Available as optional accessory

### Wide VMU:

### FEATURES

- Offers approximately 7 times larger inspection area.
- Increases throughput by allowing for batch measurements.
- BD models can accommodate darkfield optics.

**378-515** WIDE VMU-V
**378-516** WIDE VMU-H
**378-517** WIDE VMU-BDV
**378-518** WIDE VMU-BDH

### Technical Data

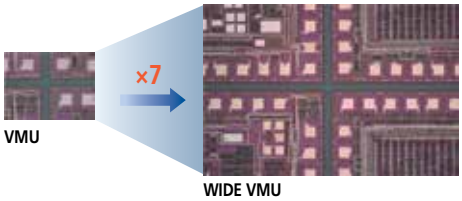
| | |
|---|---|
| FOV in Camera Port | 30mm Diameter |
| Camera Mount | F Mount (with C mount Adapter) |
| Example Sensor Size | APS-C format (2 inches) |

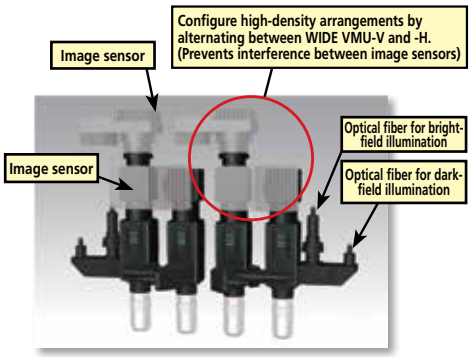
### Wide VMU Accessories

| | |
|---|---|
| **378-724** | BF Revolver |
| **378-725** | BD Revolver |
| **378-726** | BF Motorized Revolver |
| **378-727** | BD Motorized Revolver |



WIDE VMU-V WIDE VMU-H












Mitutoyo

# Eyepieces
## SERIES 378

### FEATURES
- The field of view is extra wide.
- Optional reticles are available.



378-866



378-857



378-858

### SPECIFICATIONS

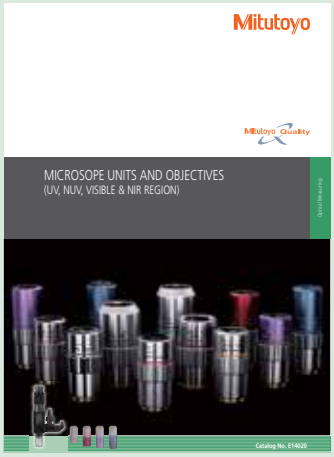
| Order No. (2pcs. set) | Magnification | Field number | Mass | Individual order No. |
|---|---|---|---|---|
| **378-866** | 10X | 24 | 85g | **378-856-5** |
| **378-857** | 15X | 16 | 40g | **378-857-5** |
| **378-858** | 20X | 12 | 55g | **378-858-5** |

### Reticles (optional)
**516848**: Cross-hair
**516576**: Broken cross hair (90° and 60°)
**516578**: Concentric circle (Diametric increment: 1.2mm)
**516577**: 20mm scale (Minimum reading: 0.1mm) with cross hair
**516849**: 10mm scale (Minimum reading: 0.1mm)
**516850**: 5mm scale (Minimum reading: 0.05mm)

# Objectives
## SERIES 378

The Mitutoyo 378 Series objectives have the world's longest working distance and an infinity correction optical system. These objectives provide flexible observation at high magnifications and independent correction of chromatic aberration.

### FEATURES
- The long working distance objectives provide excellent clearance between the lens surface and the workpiece surface in focus, making it possible to observe workpieces which are usually hard-to-focus because of awkward projections.
- The metallurgical plan apochromatic (M Plan Apo) objective provides a flat, chromatic aberration-free image throughout the field of view, making it suitable for any type of microscope.
- Specially designed objectives also are available with correction for near-infrared radiation, near-ultraviolet radiation, and ultraviolet radiation, or various thicknesses of LCD screen glasses.
- The mounting screw threads of objectives are designed to conform to JIS B-7141-1988.




Refer to No. (E14020) for more details.



**M Plan Apo and M Plan Apo SL objectives for bright field observation**



**BD Plan Apo and BD Plan Apo SL objectives for bright/dark field observation**



**Near-infrared radiation corrected M Plan Apo NIR objectives**



**Near-ultraviolet radiation corrected M Plan Apo NUV objectives**



**Ultraviolet radiation corrected M Plan UV objectives**

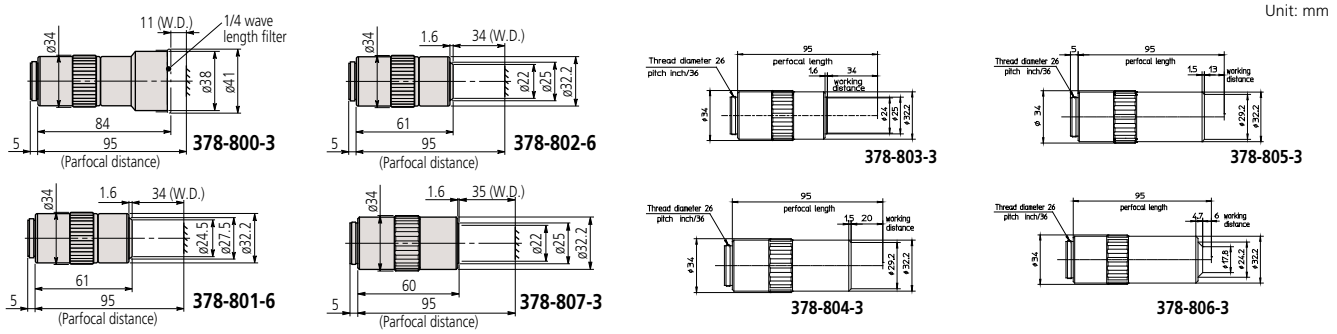


## M Plan Apo for Bright Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| **378-800-3** | 1X | 0.025 | 11.0mm | 200mm | 11.0μm | 440μm | ø24mm | 4.8x6.4mm | 300g |
| **378-801-6** | 2X | 0.055 | 34.0mm | 100mm | 5.0μm | 91μm | ø12mm | 2.4x3.2mm | 220g |
| **378-802-6** | 5X | 0.14 | 34.0mm | 40mm | 2.0μm | 14.0μm | ø4.8mm | 0.96x1.28mm | 230g |
| **378-807-3** | 7.5X | 0.21 | 35.0mm | 26.67mm | 1.3μm | 6.2μm | ø3.6mm | 0.64x0.85mm | 240g |
| **378-803-3** | 10X | 0.28 | 34.0mm | 20mm | 1.0μm | 3.5μm | ø2.4mm | 0.48x0.64mm | 240g |
| **378-804-3** | 20X | 0.42 | 20.0mm | 10mm | 0.7μm | 1.6μm | ø1.2mm | 0.24x0.32mm | 270g |
| **378-805-3** | 50X | 0.55 | 13.0mm | 4mm | 0.5μm | 0.9μm | ø0.48mm | 0.10x0.13mm | 290g |
| **378-806-3** | 100X | 0.70 | 6.0mm | 2mm | 0.4μm | 0.6μm | ø0.24mm | 0.05x0.06mm | 320g |

## DIMENSIONS

Unit: mm



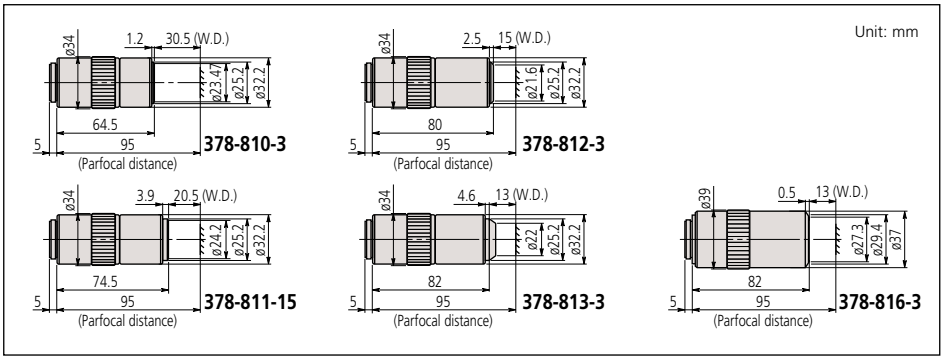

Note:
These objectives offer extra-long working distance.

## M Plan Apo SL for Bright Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| **378-810-3** | 20X | 0.28 | 30.5mm | 10mm | 1.0μm | 3.5μm | ø1.2mm | 0.24x0.32mm | 240g |
| **378-811-15** | 50X | 0.42 | 20.5mm | 4mm | 0.7μm | 1.6μm | ø0.48mm | 0.10x0.13mm | 280g |
| **378-812-3** | 80X | 0.50 | 15.0mm | 2.5mm | 0.6μm | 1.1μm | ø0.3mm | 0.06x0.08mm | 280g |
| **378-813-3** | 100X | 0.55 | 13.0mm | 2mm | 0.5μm | 0.9μm | ø0.24mm | 0.05x0.06mm | 290g |
| **378-816-3** | 200X | 0.62 | 13.0mm | 1mm | 0.4μm | 0.7μm | ø0.12mm | 0.025x0.03mm | 490g |

## DIMENSIONS

Unit: mm





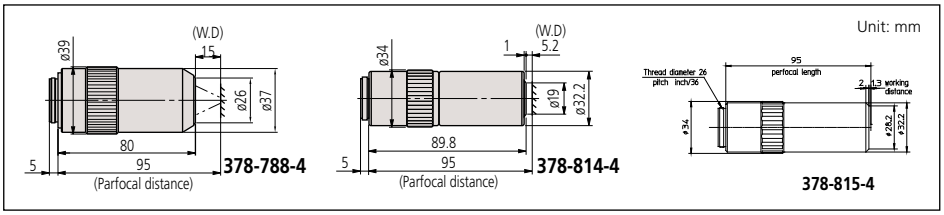

Note:
These objectives offer extra-high resolving power.

## M Plan Apo HR for Bright Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| **378-787-4** | 5X | 0.21 | 25.5mm | 40mm | 1.3μm | 6.2μm | ø4.8mm | 0.96x1.28mm | 285g |
| **378-788-4** | 10X | 0.42 | 15mm | 20mm | 0.7μm | 1.6μm | ø2.4mm | 0.48x0.64mm | 460g |
| **378-814-4** | 50X | 0.75 | 5.2mm | 4mm | 0.4μm | 0.49μm | ø0.48mm | 0.10x0.13mm | 400g |
| **378-815-4** | 100X | 0.90 | 1.3mm | 2mm | 0.3μm | 0.34μm | ø0.24mm | 0.05x0.06mm | 410g |

## DIMENSIONS

Unit: mm




Mag.: Magnification
N.A.: Numerical aperture
W.D.: Working distance
f: Focal distance
R: Resolving power
D.F.: Focal depth
View field 1:
Field of view when using ø24mm eyepiece
View field 2:
Field of view when using 1/2" CCD camera



Mitutoyo

## Glass Thickness (t = 3.5mm) Corrected
## G Plan Apo for Bright Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| **378-847** | 20X | 0.28 | 29.42mm* | 10mm | 1.0μm | 3.5μm | ø1.2mm | 0.24x0.32mm | 270g |
| **378-848-3** | 50X | 0.50 | 13.89mm* | 4mm | 0.6μm | 1.1μm | ø0.48mm | 0.10x0.13mm | 320g |

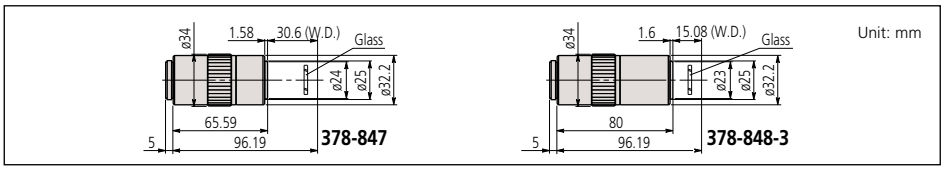
*In air



Note:
The G Plan Apo Series are designed for observing a workpiece through BK-7 glass (thickness = 3.5mm).

## DIMENSIONS

Unit: mm



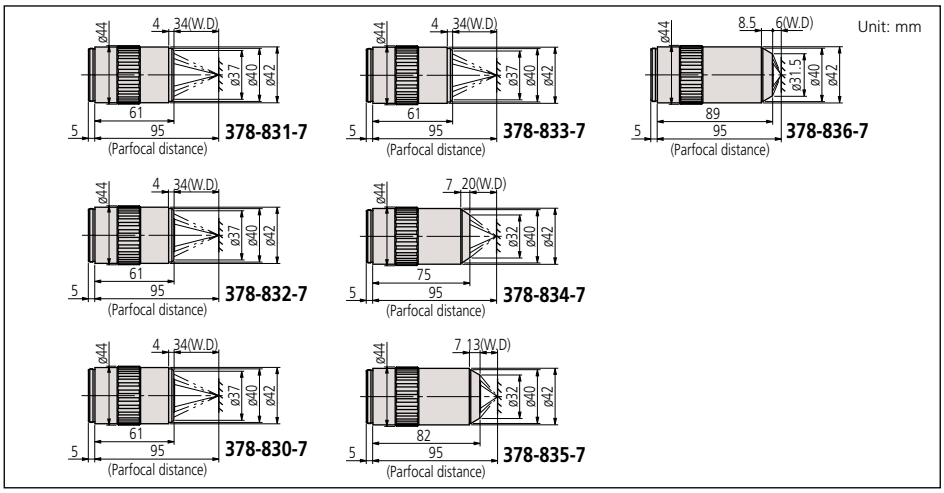

## BD Plan Apo for Bright/Dark Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| **378-831-7** | 2X | 0.055 | 34.0mm | 100mm | 5.0μm | 91μm | ø12mm | 2.4x3.2mm | 340g |
| **378-832-7** | 5X | 0.14 | 34.0mm | 40mm | 2.0μm | 14.0μm | ø4.8mm | 0.96x1.28mm | 350g |
| **378-830-7** | 7.5X | 0.21 | 34.0mm | 26.67mm | 1.3μm | 6.2μm | ø3.6mm | 0.64x0.85mm | 350g |
| **378-833-7** | 10X | 0.28 | 34.0mm | 20mm | 1.0μm | 3.5μm | ø2.4mm | 0.48x0.64mm | 350g |
| **378-834-7** | 20X | 0.42 | 20.0mm | 10mm | 0.7μm | 1.6μm | ø1.2mm | 0.24x0.32mm | 400g |
| **378-835-7** | 50X | 0.55 | 13.0mm | 4mm | 0.5μm | 0.9μm | ø0.48mm | 0.10x0.13mm | 440g |
| **378-836-7** | 100X | 0.70 | 6.0mm | 2mm | 0.4μm | 0.6μm | ø0.24mm | 0.05x0.06mm | 460g |



## DIMENSIONS

Unit: mm




## BD Plan Apo SL for Bright/Dark Field Observation

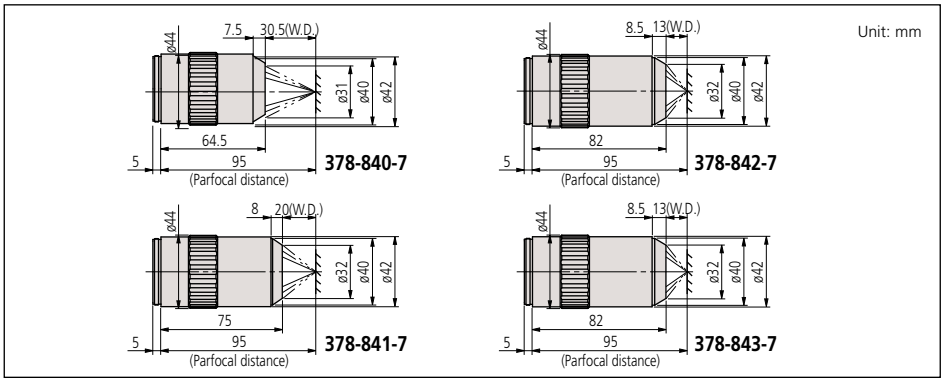
| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| **378-840-7** | 20X | 0.28 | 30.5mm | 10mm | 1.0μm | 3.5μm | ø1.2mm | 0.24x0.32mm | 350g |
| **378-841-7** | 50X | 0.42 | 20.0mm | 4mm | 0.7μm | 1.6μm | ø0.48mm | 0.10x0.13mm | 410g |
| **378-842-7** | 80X | 0.50 | 13.0mm | 2.5mm | 0.6μm | 1.1μm | ø0.3mm | 0.06x0.08mm | 430g |
| **378-843-7** | 100X | 0.55 | 13.0mm | 2mm | 0.5μm | 0.9μm | ø0.24mm | 0.05x0.06mm | 440g |



Note:
These objectives offer extra-long working distance.

## DIMENSIONS

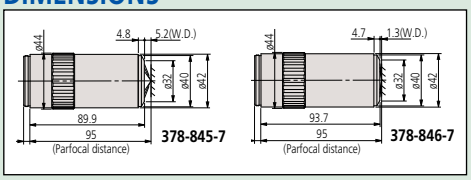
Unit: mm




Mag.: Magnification
N.A.: Numerical aperture
W.D.: Working distance
f: Focal distance
R: Resolving power
D.F.: Focal depth
View field 1: Field of view when using ø24mm eyepiece
View field 2: Field of view when using 1/2" CCD camera

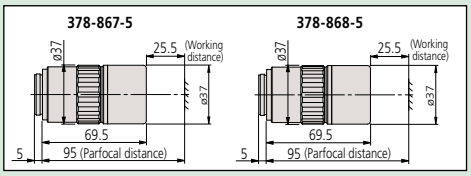
## DIMENSIONS

Unit: mm




## DIMENSIONS

Unit: mm






Note:
These objectives are designed so that a workpiece's image can be focused within the focal depth even when the wavelength is changed anywhere from the visible range (l = 480nm) up to near-infrared range (l = 1800nm). Therefore, the M Plan NIR Series are suitable for laser repair. However, when the wavelength used exceeds 1100nm, the focusing position may slightly deviate from that in the visible range due to changes in glass dispersion and refractive index.



Note:
These objectives are designed so that a workpiece's image can be focused within the focal depth even when the wavelength is changed anywhere from the visible range (l = 620nm) to the near-ultraviolet range (l = 355nm). Therefore The M Plan NUV Series are suitable for laser repair using a high frequency laser beam.

Mag.: Magnification
N.A.: Numerical aperture
W.D.: Working distance
f: Focal distance
R: Resolving power
D.F.: Focal depth
View field 1: Field of view when using ø24mm eyepiece
View field 2: Field of view when using 1/2" CCD camera

### BD Plan Apo HR for Bright/Dark Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| 378-845-7 | 50X | 0.75 | 5.2mm | 4mm | 0.4µm | 0.49µm | ø0.48mm | 0.10x0.13mm | 530g |
| 378-846-7 | 100X | 0.90 | 1.3mm | 2mm | 0.3µm | 0.34µm | ø0.24mm | 0.05x0.06mm | 545g |

Note: These objectives offer extra-high resolving power.

### M Plan Apo NIR B

| Order No. | Mag. | N.A. | W.D. (mm) | f (mm) (λ=550nm) | R (µm) (λ=550nm) | ±DOF (µm) | View field 1 | View field 2 | Mass (g) |
|---|---|---|---|---|---|---|---|---|---|
| 378-867-5 | 20X | 0.40 | 25.5 | 10 | 0.7 | 1.7 | 1.2 | 0.24×0.32 | 350 |
| 378-868-5 | 50X | 0.42 | 25.5 | 4 | 0.7 | 1.6 | 0.48 | 0.10×0.13 | 375 |

> A high-transmission laser type objective suited to the fundamental and second harmonic of the YAG laser. Corrected over the visible (420nm) to near-infrared (1064nm) spectrum.
> This series of objective has greatly improved in operability thanks to the achievement of an ultra-long working distance of 25.5mm while maintaining the NA of the NIR series 20X/50X.

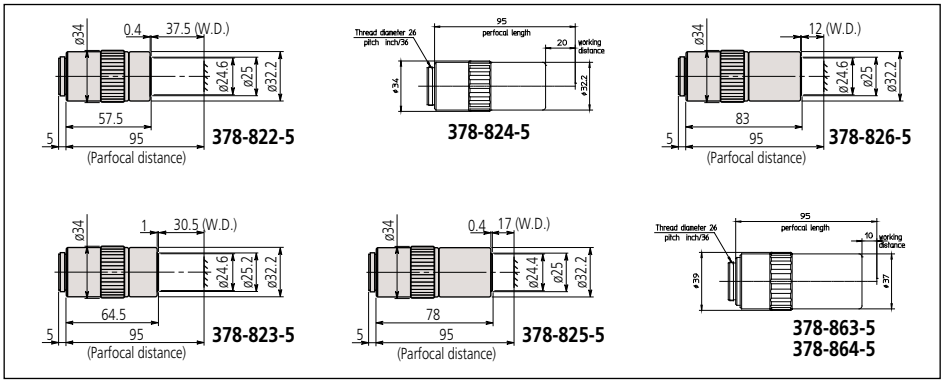
### Near-infrared Radiation Corrected M Plan Apo NIR for Bright Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| 378-822-5 | 5X | 0.14 | 37.5mm | 40mm | 2.0µm | 14.0µm | ø4.8mm | 0.96x1.28mm | 220g |
| 378-823-5 | 10X | 0.26 | 30.5mm | 20mm | 1.1µm | 4.1µm | ø2.4mm | 0.48x0.64mm | 250g |
| 378-824-5 | 20X | 0.40 | 20.0mm | 10mm | 0.7µm | 1.7µm | ø1.2mm | 0.24x0.32mm | 300g |
| 378-825-5 | 50X | 0.42 | 17.0mm | 4mm | 0.7µm | 1.6µm | ø0.48mm | 0.10x0.13mm | 315g |
| 378-826-15 | 100X | 0.50 | 12.0mm | 2mm | 0.6µm | 1.1µm | ø0.24mm | 0.05x0.06mm | 335g |
| 378-863-5* | 50X | 0.65 | 10mm | 4mm | 0.4µm | 0.7µm | ø0.48mm | 0.10x0.13mm | 450g |
| 378-864-5* | 100X | 0.70 | 10mm | 2mm | 0.4µm | 0.6µm | ø0.24mm | 0.05x0.06mm | 450g |

* High Resolution (HR objectives)

## DIMENSIONS

Unit: mm



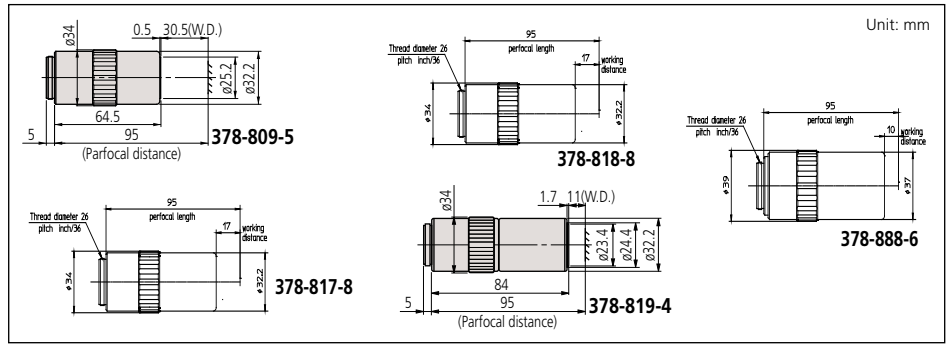

### Near-ultraviolet Radiation Corrected M Plan Apo NUV for Bright Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| 378-809-5 | 10X | 0.28 | 30.5mm | 20mm | 1µm | 3.5µm | ø2.4mm | 0.48x0.64mm | 255g |
| 378-817-8 | 20X | 0.42 | 17.0mm | 10mm | 0.7µm | 1.7µm | ø1.2mm | 0.24x0.32mm | 340g |
| 378-818-8 | 50X | 0.44 | 15.0mm | 4mm | 0.7µm | 1.6µm | ø0.48mm | 0.10x0.13mm | 350g |
| 378-819-4 | 100X | 0.50 | 11.0mm | 2mm | 0.6µm | 1.1µm | ø0.24mm | 0.05x0.06mm | 380g |
| 378-888-6* | 50X | 0.65 | 10.00mm | 4mm | 0.42µm | 0.65µm | ø0.48mm | 0.10x0.13mm | 500g |

*High resolution (HR objective)

## DIMENSIONS

Unit: mm






Mitutoyo

## Near-Infrared Radiation and LCD Glass Thickness (t = 1.1mm or 0.7mm) Corrected LCD Plan Apo NIR for Bright Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| **378-821-5** | 20X (t0.7) | 0.40 | 19.98mm* | 10mm | 0.7µm | 1.7µm | ø1.2mm | 0.24x0.32mm | 305g |
| **378-827-5** | 20X (t1.1) | 0.40 | 19.98mm* | 10mm | 0.7µm | 1.7µm | ø1.2mm | 0.24x0.32mm | 305g |
| **378-828-5** | 50X (t1.1) | 0.42 | 17.13mm* | 3.9mm | 0.7µm | 1.6µm | ø0.48mm | 0.10x0.13mm | 320g |
| **378-829-5** | 50X (t0.7) | 0.42 | 17.26mm* | 3.9mm | 0.7µm | 1.6µm | ø0.48mm | 0.10x0.13mm | 320g |
| **378-752-15** | 100X (t1.1) | 0.50 | 12.13mm* | 2mm | 0.6µm | 1.1µm | ø0.24mm | 0.05x0.06mm | 335g |
| **378-754-15** | 100X (t0.7) | 0.50 | 12.06mm* | 2mm | 0.6µm | 1.1µm | ø0.24mm | 0.05x0.06mm | 335g |

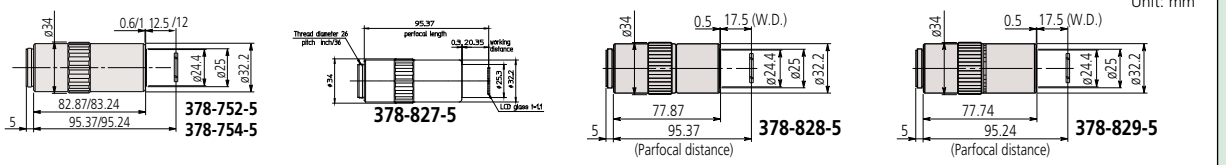
*In air



Note:
These near-infrared (l = 1800nm) corrected objectives are designed for observing a workpiece through LCD glass (thickness = 1.1mm (**378-827-5**, **378-828-5, 378-752-5**) or 0.7mm (**378-829-5**, **378-754-5**) and for laser repair.

## DIMENSIONS

Unit: mm




## Near-ultraviolet Radiation and LCD Glass Thickness (t = 0.7mm) Corrected LCD Plan Apo NUV for Bright Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| **378-890-8** | 20X (t0.7) | 0.42 | 16.96mm* | 10mm | 0.7µm | 1.7µm | ø1.2mm | 0.24x0.32mm | 340g |
| **378-891-6**** | 50X (t0.7) | 0.65 | 9.76mm* | 4mm | 0.42µm | 0.65µm | ø0.48mm | 0.10x0.13mm | 500g |
| **378-820-6** | 50X (t0.7) | 0.44 | 14.76mm* | 4mm | 0.7µm | 1.6µm | ø0.48mm | 0.10x0.13mm | 310g |
| **378-753-8** | 50X (t1.1) | 0.42 | 14.53mm | 4mm | 0.7µm | 1.6µm | ø0.48mm | 0.10x0.13mm | 310g |
| **378-751-4** | 100X(t1.1) | 0.50 | 11.03mm | 2mm | 0.6µm | 1.1µm | ø0.24mm | 0.05x0.06mm | 380g |

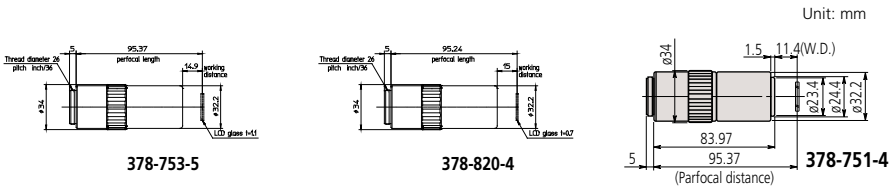
* In air
** High-Resolution (HR Objectives)



Note:
These near ultraviolet corrected objectives are designed for observing a workpiece through LCD glass (thickness = 1.1mm (**378-753-6, 378-751-4**) or 0.7mm (**378-820-6**) and for laser repair.

## DIMENSIONS

Unit: mm

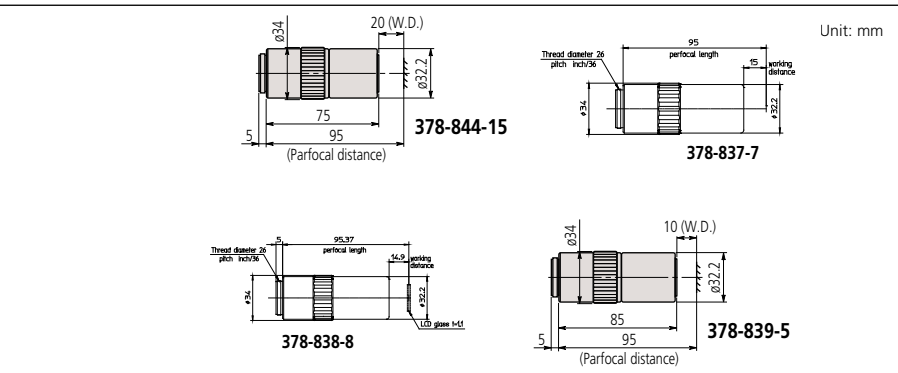



## Ultraviolet Radiation Corrected M Plan UV for Bright Field Observation

| Order No. | Mag. | N.A. | W.D. | f | R | D.F. | View field 1 | View field 2 | Mass |
|---|---|---|---|---|---|---|---|---|---|
| **378-844-15** | 10X | 0.25 | 20mm | 20mm | 1.1µm | 4.4µm | ø2.4mm | 0.48x0.64mm | 310g |
| **378-837-7** | 20X | 0.37 | 15.0mm | 10mm | 0.8µm | 2.1µm | ø1.2mm | 0.24x0.32mm | 330g |
| **378-838-8** | 50X | 0.41 | 12.0mm | 4mm | 0.7µm | 1.7µm | ø0.48mm | 0.10x0.13mm | 400g |
| **378-839-5** | 80X | 0.55 | 10.0mm | 2.5mm | 0.5µm | 0.9µm | ø0.3mm | 0.06x0.08mm | 380g |

## DIMENSIONS

Unit: mm






Note:
These ultraviolet corrected objectives are designed so that a workpiece's image can be focused within the focal depth even when the wavelength is changed anywhere from the visible range (l = 550nm) to the ultraviolet range (l = 266nm). Therefore the M Plan UV Series are suitable for laser repair using a high-frequency laser beam.

Mag.: Magnification
N.A.: Numerical aperture
W.D.: Working distance
f: Focal distance
R: Resolving power
D.F.: Focal depth
View field 1: Field of view when using ø24mm eyepiece
View field 2: Field of view when using 1/2" CCD camera

# MSM-400

## SERIES 377 — Stereo Microscopes

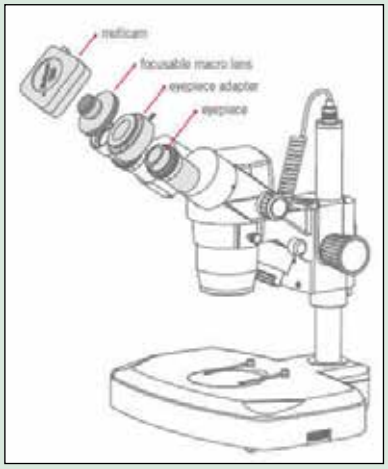
### Digital Imaging with Software

| Order No. | Description |
|---|---|
| 64AAB429 | MOTICAM 2, 2.0 MEGAPIXEL-1/3" CMOS, USB |
| 64AAB529 | MOTICAM 3+, 3.0 MEGAPIXEL-1/2" CMOS, USB |
| 64AAB431 | MOTICAM 5, 5.0 MEGAPIXEL-1/2.5" CMOS, USB |
| 64AAB526 | MOTICAM 1080, 2.0 MEGAPIXEL-1/2.8" CMOS, USB/HDMI |




### Optional Accessories

| Order No. | Description |
|---|---|
| 64AAB214 | LED Variable Ring Light |





Motic Images Plus 2.0 - Measurements

### FEATURES

- Continuous 1X - 4X magnification
- Image always in focus throughout zoom range
- Crisp, erect images with high resolution and excellent stereoscopic effect
- Stereo-tube can be rotated a full 360°, for viewing at any angle
- Bilateral zoom control knob adds convenience and increases operator efficiency
- Diopter adjustment for both eyepieces
- Binocular tube inclination: 45°
- Focusing range: 1.46" (37mm)
- Interpupillary adjustable range: 2.12" - 2.99" (54mm - 76mm)
- Optional zoom ranges from 2.5X - 10X to 30X - 120X

The MSM-414L is a traditional binocular stereo microscope for industrial, medical and classroom applications. It is ideal for electrical small part inspection, assembly, and medical/ biological dissection.

### Optional Accessories

**Illuminated Stand**

| Order No. | Description |
|---|---|
| 377-412 | Pole-Type Stand (top: 12V/10W flat filament tungsten, bottom: 5W fluorescent |
| 377-413* | Pole-Type Stand (top: 12V/10W flat filament tungsten, bottom: 12V/10W halogen with intensity control) |
| 377-414 | Fixed-Arm Stand (top: 12V/10W flat filament tungsten, bottom: 5W fluorescent) |
| 377-415 | Fixed-Arm Stand (top: 12V/10W flat filament tungsten, bottom: 12V/10W halogen with intensity control) |
| 377-416 | Fixed-Arm Stand (top: 5W fluorescent, bottom: 5W fluorescent) |

*Standard Accessory



377-972A

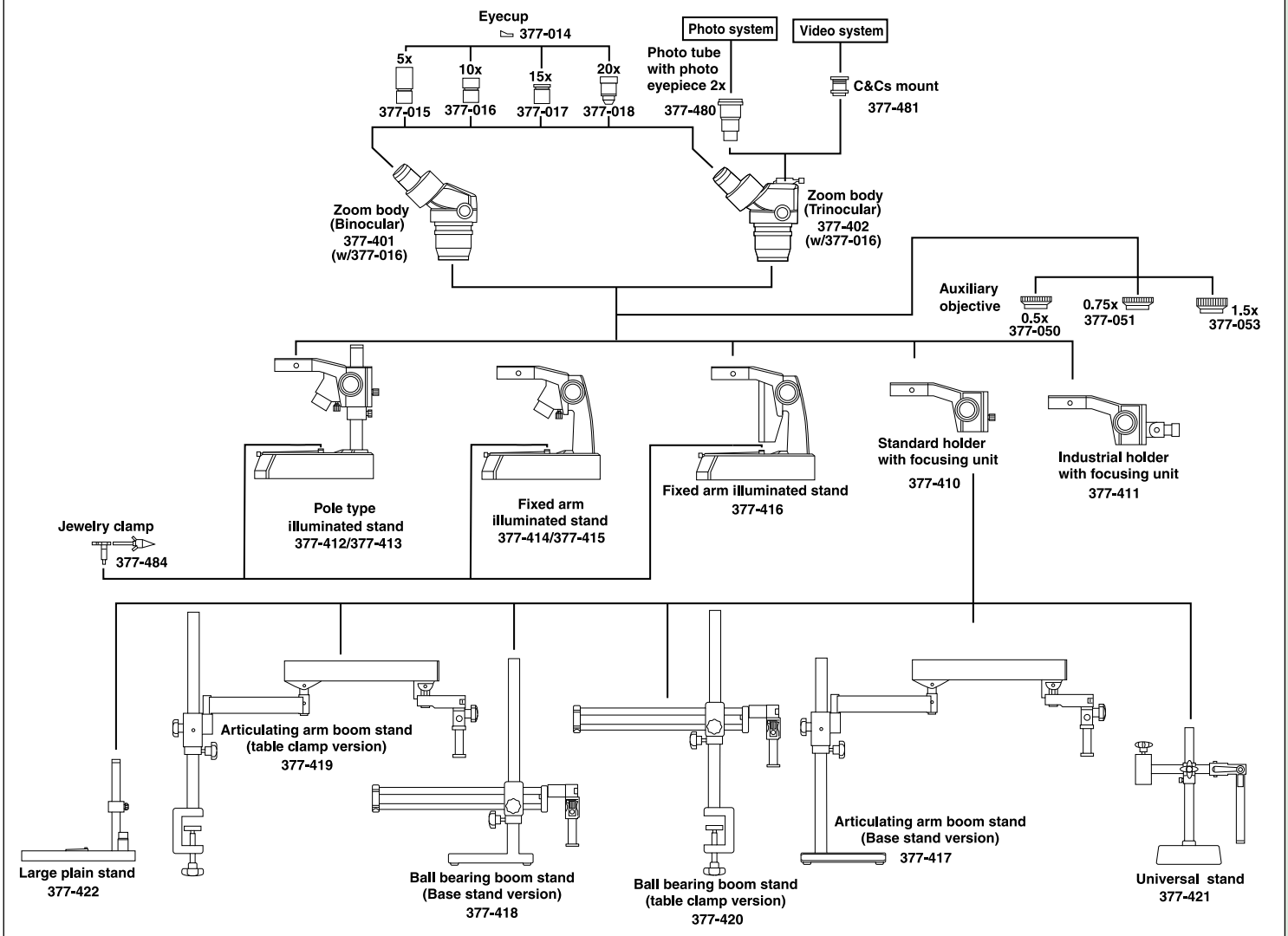
### SPECIFICATIONS

| Model. | MSM-414L | MSM-414TL |
|---|---|---|
| **Order No.** | **377-972A** | **377-974A** |
| Optical tube | Binocular | Trinocular |
| Total magnification | 10X - 40X | |
| Eyepiece | 10X (377-016) | |
| Objective | 1X - 4X | |
| Working distance | 80mm | |
| Field of view | 20mm - 5mm | |
| Dimensions | H=13.2"x W=6.7"x D=9.3" | |
| Mass | 13.2 lbs (6kg) | |

# Stereo Microscopes

## SERIES 377

### 377-972A/377-974A SYSTEM DIAGRAM



# MSM-400

## SERIES 377 — Stereo Microscopes

## FEATURES

- Superior quality optics provide high-resolution
- Crystal sharp, high-color contrast image with excellent depth of field
- Always in sharp focus at all magnifications
- The Parfocal Optical System allows relaxed strain-free viewing
- Long working distance
- Extreme large field of view (23mm diameter)

The MSM-465L, Order No. 377-990A, is a high-accuracy four-step magnification stereo microscope. With a horizontal changer allowing 6X, 12X, 25X, and 50X magnifications with a standard 1X objective and 10X eyepieces, the MSM-465L has limitless capabilities for electrical small part inspection.

The MSM-464L, Order No. 377-991A, with its vertical five-step magnification changer is ideal for small part assembly. This stereo microscope with standard 6.4X, 10X, 16X, 25X, and 40X magnifications, has flexibility from 3.2X to 160X magnifications.




MSM-465L
377-990A




MSM-464L
377-991A

## Optional Accessories

### Video System

| Order No. | Description |
|---|---|
| 377-488 | Video System* for 377-990A |
| 377-489 | Video System* for 377-991A |

* Converts Binocular to Trinocular

## Accessories

| Order No. | Description |
|---|---|
| 64AAB214 | LED variable ring light |

## Digital Imaging with Software

| Order No. | Description |
|---|---|
| 64AAB429 | MOTICAM 2, 2.0 MEGAPIXEL-1/3" CMOS, USB |
| 64AAB529 | MOTICAM 3+, 3.0 MEGAPIXEL-1/2" CMOS, USB |
| 64AAB431 | MOTICAM 5, 5.0 MEGAPIXEL-1/2.5" CMOS, USB |
| 64AAB526 | MOTICAM 1080, 2.0 MEGAPIXEL-1/2.8" CMOS, USB/HDMI |

## SPECIFICATIONS

| Model.<br>Order No. | MSM-465L<br>377-990A | MSM-464TL<br>377-991A |
|---|---|---|
| Optical tube | Binocular* | Binocular* |
| Total magnification | 6X - 50X | 6.4X - 40X |
| Eyepiece | 10X (377-456) | 10X (377-456) |
| Objective | .6X, 1.2X, 2.5X, 5X | .6X, 1X, 1.6X, 2.5X, 4X |
| Working distance | 89mm | 89mm |
| Field of view | 23mm (w/377-456) | 23mm (w/377-456) |
| Dimensions | H=14.6"x W=13"x D=11" | H=14.3"x W=13"x D=11" |
| Mass | 15.5 lbs (7kg) | 15.5 lbs (7kg) |
| Stand | Transmitted Light Stand (377-428) | Transmitted Light Stand (377-428) |

* For Video System, see upper left table (optional accessories)

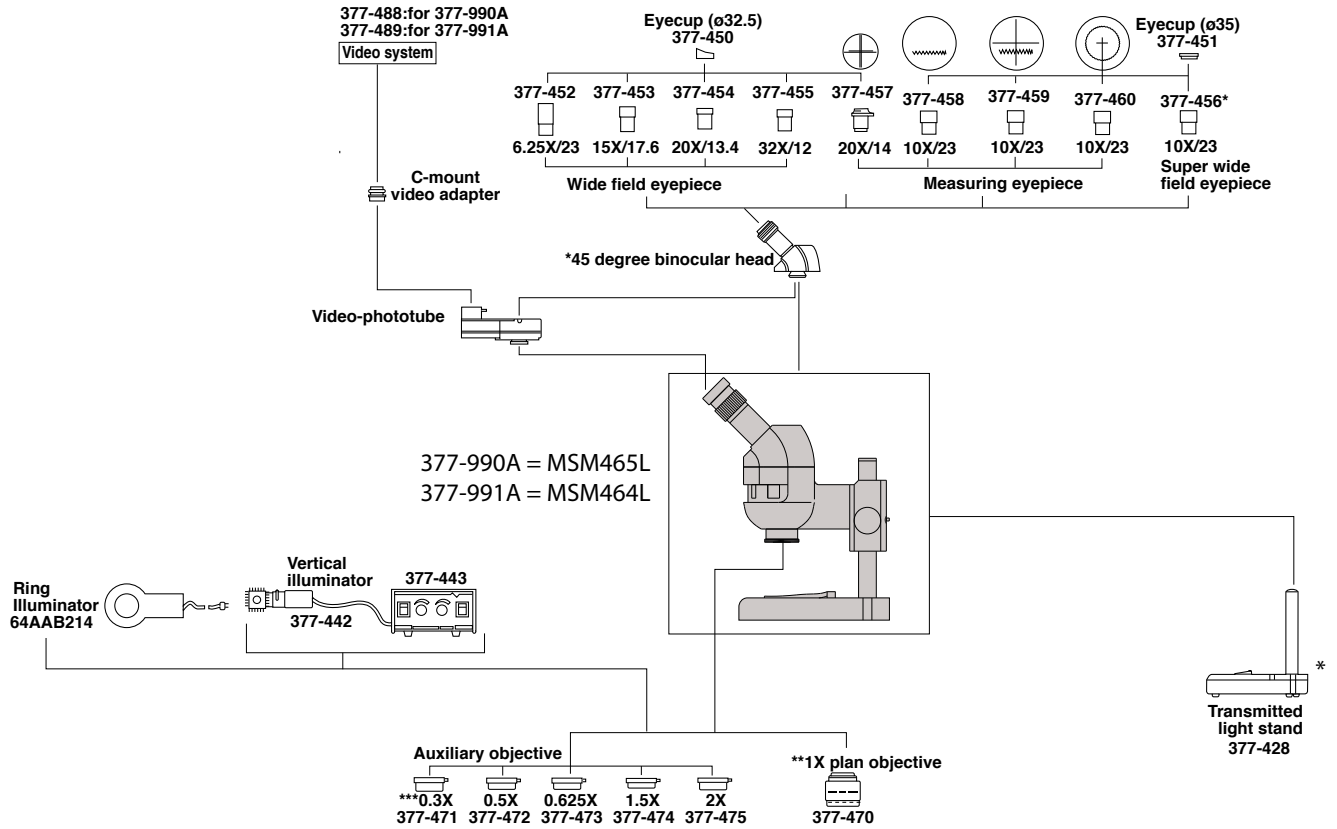


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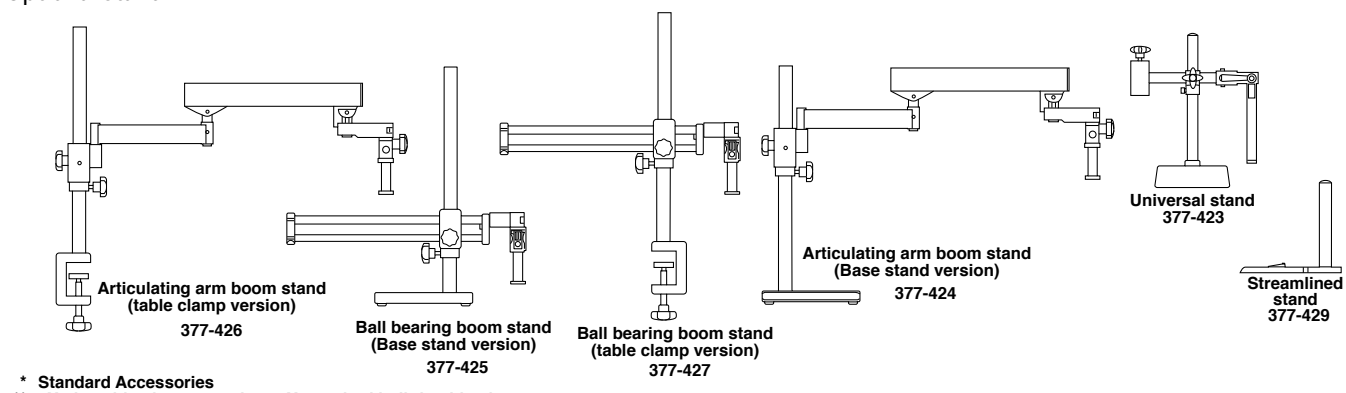
# Stereo Microscopes

## SERIES 377

### 377-990A/377-991A SYSTEM DIAGRAM




Optional Stand




* Standard Accessories
** 1X plan objective can replace 1X standard built-in objective
*** 350mm long stand post is required. (377-431)

# Pocket Magnifiers

## SERIES 183

### FEATURES

- Suitable for inspecting metal surfaces.

### SPECIFICATIONS

| Magnification | Order No. | Remarks |
|---|---|---|
| 25X | **183-201** | Pen type |
| | **183-202** | With stand |
| 50X | **183-203** | With stand |



**183-201**



**183-202**



**183-203**

# Pocket Comparators

## SERIES 183

### FEATURES

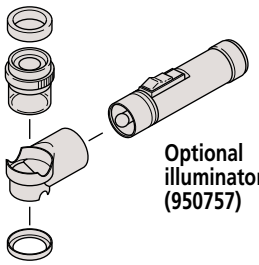
- By replacing optional reticles, dimensional, angle and other types of measurements can be performed.
- Illuminator (**950757**) is available.

### SPECIFICATIONS

| Magnification | Order No. | Remarks |
|---|---|---|
| 8X | **183-101** | Optional reticles available |
| 10X | **183-131** | Optional reticles available |

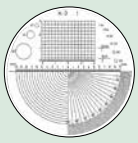


**183-101**



**Optional illuminator (950757)**

### Optional Reticles for Pocket Comparators



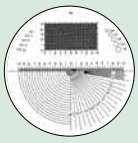
**183-102**



**183-103**



**183-104**



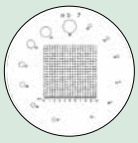
**183-105**



**183-106**



**183-107**



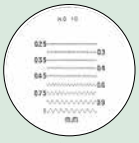
**183-108**



**183-109**



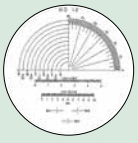
**183-110**



**183-111**



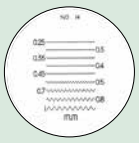
**183-112**



**183-113**



**183-114**



**183-115**

**Pocket Comparator 8X with Reticles Set**

| Set No. | |
|---|---|
| **183-901** | 183-101, 183-106 |
| **183-902** | 183-101, 183-102, 183-106, 183-107, 183-112, 183-113, 183-114 |
| **183-903** | 183-101, 183-102, 183-106, 183-107, 183-109, 183-113, 183-115 |
| **183-904** | 183-101, 183-102 |

# Zoom Loupe

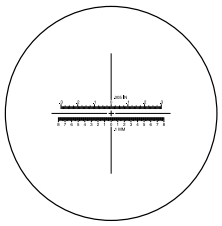
## SERIES 183

### FEATURES

- Allows the user 8X - 16X zoom observation.
- Magnification indicator is provided for 8X, 10X, 12X, 14X and 16X observation.
- Metric and inch scales are provided for measuring.
- Comes with a carrying case.




**183-304**



**Reticle provided**

### SPECIFICATIONS

| Magnification | Order No. | Remarks |
|---|---|---|
| 8X - 16X | **183-304** | With reticle (Scale graduation: 0.1mm, .005" |

# Clear Loupe

## SERIES 183




**183-301**




**183-302**




**183-303**

### SPECIFICATIONS

| Magnification | Order No. | Remarks |
|---|---|---|
| 7X | **183-301** | Drawtube removable |
| 10X | **183-302** | Drawtube removable |
| 15X | **183-303** | Drawtube removable |



Mitutoyo

# Quick Guide to Precision Measuring Instruments

## Microscopes

### Numerical Aperture (NA)

The NA figure is important because it indicates the resolving power of an objective lens. The larger the NA value the finer the detail that can be seen. A lens with a larger NA also collects more light and will normally provide a brighter image with a narrower depth of focus than one with a smaller NA value.

$$NA = n \cdot \sin\theta$$

The formula above shows that NA depends on n, the refractive index of the medium that exists between the front of an objective and the specimen (for air, n=1.0), and angle θ, which is the half-angle of the maximum cone of light that can enter the lens.

### Resolving Power (R)

The minimum detectable distance between two image points, representing the limit of resolution. Resolving power (R) is determined by numerical aperture (NA) and wavelength (λ) of the illumination.

$$R = \frac{\lambda}{2 \cdot NA} \ (\mu m)$$

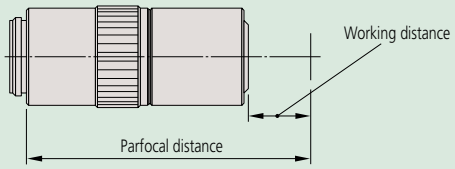
λ = 0.55μm is often used as the reference wavelength

### Working Distance (W.D.)

The distance between the front end of a microscope objective and the surface of the workpiece at which the sharpest focusing is obtained.

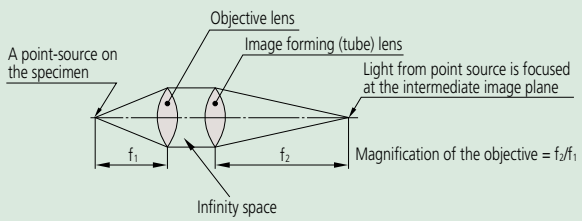
### Parfocal Distance

The distance between the mounting position of a microscope objective and the surface of the workpiece at which the sharpest focusing is obtained. Objective lenses mounted together in the same turret should have the same parfocal distance so that when another objective is brought into use the amount of refocusing needed is minimal.



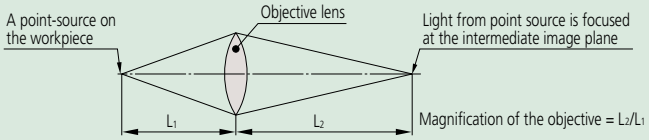

### Infinity Optical System

An optical system where the objective forms its image at infinity and a tube lens is placed within the body tube between the objective and the eyepiece to produce the intermediate image. After passing through the objective the light effectively travels parallel to the optical axis to the tube lens through what is termed the infinity space within which auxiliary components can be placed, such as differential interference contrast (DIC) prisms, polarizers, etc., with minimal effect on focus and aberration corrections.




### Finite Optical System

An optical system that uses an objective to form the intermediate image at a finite position. Light from the workpiece passing through the objective is directed toward the intermediate image plane (located at the front focal plane of the eyepiece) and converges in that plane.




### Focal Length (f)

unit: mm

The distance from the principal point to the focal point of a lens: if f1 represents the focal length of an objective and f2 represents the focal length of an image forming (tube) lens then magnification is determined by the ratio between the two. (In the case of the infinity-correction optical system.)

$$\text{Objective magnification} = \frac{\text{Focal length of the image-forming (tube) lens}}{\text{Focal length of the objective}}$$

Example: $1X = \frac{200}{200}$ Example: $10X = \frac{200}{20}$

### Focal Point

Light rays traveling parallel to the optical axis of a converging lens system and passing through that system will converge (or focus) to a point on the axis known as the rear focal point, or image focal point.

### Depth of Focus (DOF)

unit: mm

Also known as depth of field, this is the distance (measured in the direction of the optical axis) between the two planes which define the limits of acceptable image sharpness when the microscope is focused on an object. As the numerical aperture (NA) increases, the depth of focus becomes shallower, as shown by the expression below:

$$DOF = \frac{\lambda}{2 \cdot (NA)^2}$$ λ = 0.55μm is often used as the reference wavelength

Example: For an **M Plan Apo 100X** lens (**NA = 0.7**)
The depth of focus of this objective is

$$\frac{0.55\mu m}{2 \times 0.7^2} = 0.6\mu m$$

### Bright-field Illumination and Dark-field Illumination

In brightfield illumination a full cone of light is focused by the objective on the specimen surface. This is the normal mode of viewing with an optical microscope. With darkfield illumination, the inner area of the light cone is blocked so that the surface is only illuminated by light from an oblique angle. Darkfield illumination is good for detecting surface scratches and contamination.

### Apochromat and Achromat Objectives

An apochromat objective is a lens corrected for chromatic aberration (color blur) in three colors (red, blue, yellow).
An achromat objective is a lens corrected for chromatic aberration in two colors (red, blue).

## Magnification

The ratio of the size of a magnified object image created by an optical system to that of the object. Magnification commonly refers to lateral magnification although it can mean lateral, vertical, or angular magnification.

## Principal Ray

A ray considered to be emitted from an object point off the optical axis and passing through the center of an aperture diaphragm in a lens system.

## Aperture Diaphragm

An adjustable circular aperture which controls the amount of light passing through a lens system. It is also referred to as an aperture stop and its size affects image brightness and depth of focus.

## Field Stop

A stop which controls the field of view in an optical instrument.

## Telecentric System

An optical system where the light rays are parallel to the optical axis in object and/or image space. This means that magnification is nearly constant over a range of working distances, therefore, almost eliminating perspective error.

## Erect Image

An image in which the orientations of left, right, top, bottom and moving directions are the same as those of a workpiece on the workstage.

## Field number (FN), real field of view, and monitor display magnification

unit: mm

The observation range of the sample surface is determined by the diameter of the eyepiece's field stop. The value of this diameter in millimeters is called the field number (FN). In contrast, the real field of view is the range on the workpiece surface when actually magnified and observed with the objective lens.
The real field of view can be calculated with the following formula:

### (1) The range of the workpiece that can be observed with the microscope (diameter)

$$\text{Real field of view} = \frac{\text{FN of eyepiece}}{\text{Objective lens magnification}}$$

Example: The real field of view of a 1X lens is $24 = \frac{24}{1}$

The real field of view of a 10X lens is $2.4 = \frac{24}{10}$

### (2) Monitor observation range

$$\text{Monitor observation range} = \frac{\text{The size of the camera image sensor (diagonal length)}}{\text{Objective lens magnification}}$$

• Size of image sensor

| Format | Diagonal length | Length | Height |
|---|---|---|---|
| 1/3″ | 6.0 | 4.8 | 3.6 |
| 1/2″ | 8.0 | 6.4 | 4.8 |
| 2/3″ | 11.0 | 8.8 | 6.6 |

### (3) Monitor display magnification

$$\text{Monitor display magnification} = \text{Objective lens magnification} \times \frac{\text{Display diagonal length on the monitor}}{\text{Diagonal length of camera image sensor}}$$

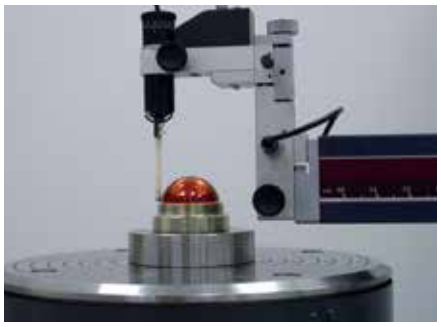


Mitutoyo

# MITUTOYO CALIBRATION SERVICES







Mitutoyo America has expanded three-dimensional calibration and inspection services at our new precision measurement facility located in our corporate headquarters in Aurora, IL. Equipped with multiple Mitutoyo Legex CMMs, along with high-accuracy vision and form measuring instruments, our laboratory offers accredited dimensional measurement services with uncertainty as low as 0.25 µm (10 µinches). And for form measurement, our uncertainty goes as low as 5 nanometers (0.2 µinches).

Our experienced staff is ready for your challenges – we specialize in specialty gage calibration, complex prototype or master parts, specialty and custom-built 3D gages, and long length standards such as ball bars, step gages and gage blocks. We can also assist you in the validation of your measurement processes by providing accredited reference values on your parts.

Mitutoyo America calibration and inspection services are accredited to ISO/IEC 17025 by A2LA (Certificate 0750.01). We welcome customer tours of our laboratory.

If you have any questions or would like more information regarding Mitutoyo Calibration Services, contact: **mim@mitutoyo.com**

Mitutoyo
CALIBRATION
SERVICES





**Surftest**



**Formtracer**



**Contracer**



**Roundtest**



**SV-C3200 / SV-C4500**



**CV-2100**



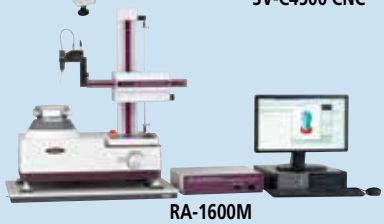
**SJ-410**

## INDEX


| | |
|---|---|
| **Surftest** | |
| Surftest SJ-210 | J-2 |
| Surftest SJ-310 | J-3 |
| Surftest SJ-210/310 Optional Accessories | J-4,5 |
| Surftest SJ-410 | J-6,7 |
| Surftest SJ-500/P, SV-2100 | J-8,9 |
| Surftest SV-3200 | J-10,11 |
| Surftest Extreme SV-3000CNC | J-12 |
| Surftest Extreme SV-M3000CNC | J-13 |
| **Formtracer** | |
| Formtracer SV-C3200 / SV-C4500 | J-14,15 |
| Formtracer Extreme SV-C4500CNC | J-16,17 |
| Formtracer CS-3200 | J-18,19 |
| Formtracer Extreme CS-5000CNC / CS-H5000CNC | J-20,21 |
| Optional Styli for Surface Roughness Measurement | J-22,23 |
| Optional Accessories for Automatic Measurement | J-24 |
| Optional Accessories for Surftest / Formtracer | J-25 |
| Quick Guide to Precision Measuring Instruments–Surftest | J-26,27 |
| **Contracer** | |
| Contracer CV-2100 | J-28,29 |
| Contracer CV-3200 / CV-4500 | J-30,31 |
| Optional Arms and Styli for Contour Measurement | J-32-34 |
| Optional Accessories for Automatic Measurement | J-35 |
| Optional Accessories for Contracer / Formtracer | J-36 |
| Quick Guide to Precision Measuring Instruments–Contracer | J-37,38 |
| **Roundtest** | |
| Roundtest RA-120 / 120P | J-39,40 |
| Roundtest RA-1600 / RA-1600M | J-41,42 |
| Roundtest RA-2200AS / DS / AH / DH | J-43,44 |
| Roundtest RA-H5200AS / AH | J-45,46 |
| Roundtest Extreme RA-2200CNC / RA-H5200CNC | J-47,48 |
| Optional Styli for Roundtest | J-49,50 |
| Optional Accessories for Roundtest | J-51 |
| Eco-Fix Kit Form-S & L | J-52 |
| Quick Guide to Precision Measuring Instruments–Roundtest | J-53,54 |




**SV-C4500 CNC**



**RA-1600M**



Mitutoyo

# Surftest SJ-210/SJ-310

## SERIES 178 — Portable Surface Roughness Tester



Surftest SJ-210





## FEATURES

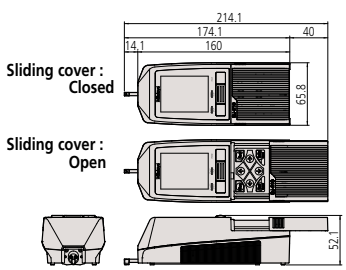
- The 2.4-inch color graphic LCD provides excellent readability and an intuitive display that is easy to use. The LCD also includes a backlight for improved visibility in dark environments.
- The Surftest SJ-210 can be easily operated using the buttons on the front of the unit and under the sliding cover.
- Up to 10 measurement conditions and one measured profile can be stored in the internal memory.
- An optional memory card can be used as an extended memory to store large quantities of measured profiles and conditions.
- Access to each feature can be password-protected, which prevents unintended operations and allows you to protect your settings.
- The display interface supports 16 languages, which can be freely switched.
- An alarm warns you when the cumulative measurement distance exceeds a preset limit.
- The Surftest SJ-210 complies with the following standards: JIS (JIS-B0601-2001, JIS-B0601-1994, JIS B0601-1982), VDA, ISO-1997, and ANSI.
- In addition to calculation results, the Surftest SJ-210 can display sectional calculation results and assessed profiles, load curves, and amplitude distribution curves.

## SPECIFICATIONS/CONFIGURATION

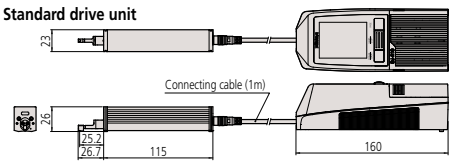
| Model No. | SJ-210 | | | | | |
|---|---|---|---|---|---|---|
| **Order No.** (inch/mm) | **178-561-01A** | **178-561-02A** | **178-563-01A** | **178-563-02A** | **178-565-01A** | **178-565-02A** |
| Drive unit | Standard type (**178-230-2**) | | Retractable type (**178-235**) | | Transverse tracing type (**178-233-2**) | |
| Detector | 0.75mN type (**178-296**) | 4mN type (**178-390**) | 0.75mN type (**178-296**) | 4mN type (**178-390**) | 0.75mN type (**178-387**) | 4mN type (**178-386**) |
| Display unit | Compact type (178-253A) | | | | | |
| Detector: Tip angle | 60° | 90° | 60° | 90° | 60° | 90° |
| Stylus tip radius | 2µm | 5µm | 2µm | 5µm | 2µm | 5µm |
| Detector measuring force | 0.75mN | 4mN | 0.75mN | 4mN | 0.75mN | 4mN |
| Standard accessories | **12BAA303** Connecting cable<br>**178-602** Roughness specimen (Ra 3.00µm)<br>**12BAK699** Carrying case<br>**12BAK700** Calibration stage<br>**12BAK820** Protective sheets for display<br>AC Adapter<br>Operation manual<br>Quick reference manual<br>Warranty | | | | **12BAA303** Connecting cable<br>**178-606** Roughness specimen (Ra 1.00µm)<br>**12AAE643** Point-contact adapter<br>**12AAE644** V-type adapter<br>**12BAK699** Carrying case<br>**12BAK700** Calibration stage<br>**12BAK820** Protective sheets for display<br>AC Adapter, Operation manual<br>Quick reference manual, Warranty | |

## DIMENSIONS Display unit, Drive unit

**Drive unit inside display unit (Standard detector installed in drive unit) SJ-210 series**



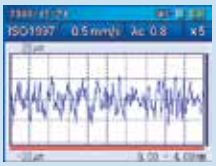

**Standard drive unit**




**Drive unit not stored inside display unit (Standard detector installed in drive unit) SJ-210 series Standard drive unit**

*** For Retractable and Transverse type drive units, please see pg. J-3.**

Unit: mm






## Technical Data: SJ-210

X axis (drive unit)
- Measuring range: .70"(17.5mm) .22"(5.6mm) Transverse type
- Measuring speed: .01, .02, .03"/s (0.25, 0.5, 0.75mm/s) .039"/s (1mm/s) (Returning))

Detector:
- Range / Resolution: Auto / depending on the measurement range 14400 µin / .8 in (360 µm / 0.02 µm) 4000 µin / .2 µin (100 µm / 0.006 µm) 1000 µin / .08 µin (25 µm / 0.002 µm)
- Measuring method: skidded
- Measuring force: 4mN (0.75mN)
- Stylus tip: Diamond, 90° / 5µmR (60° / 2µmR)
- Skid radius of curvature: 40mm
- Skid force: less than 400mN
- Type: Differential inductance

Power supply: Two-way power supply: battery (rechargeable Ni-MH battery) and AC adapter
- Charging time: about 4 hours (may vary due to ambient temperature)
- Endurance: about 1000 measurements (differs slightly due to use conditions/ environment)

External I/O: USB I/F, Digimatic Output, Printer Output, RS-232C I/F, Foot SW I/F

Data storage: Micro SD card w/ adapter (4GB) (option **12AAL069**)

Dimensions (W x D x H)
- Display unit: 2.05x2.59x6.3"(52.1 x 65.8 x 160mm)
- Drive Unit: 4.5x.9x1"(115 x 23 x 26mm)

Mass: About 1.1lb (0.5kg) (Display unit + Drive unit + Standard detector)

## Evaluation Capability: SJ-210

Applicable standards:
JIS'82, JIS'94, JIS'01, ISO'97, ANSI, VDA

Assessed profiles:
Primary profile, Roughness profile, DF profile, Roughness profile-Motif

Evaluation parameters:
Ra, Rc, Ry, Rz, Rq, Rt, Rmax, Rp, Rv, R3z, Rsk, Rku, Rc, RPc, Rsm, Rz1max, S, HSC, RzJIS, Rppi, RΔa, RΔq, Rlr, Rmr, Rmr(c), RδC, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, Rpm, tp, Htp, R, Rx, AR, Possible Customize

Analysis graphs: Bearning area curve / Amplitude distribution curve

Digital filters: Gaussian , 2CR75 , PC75

Cut off length: λc: .003, .01, .03, .1" (0.08, 0.25, 0.8, 2.5mm) λs: .1, .3"(2.5, 8µm)

Sampling length: .003, .01, .03, .1" or arbitrary (0.08, 0.25, 0.8, 2.5mm) or arbitrary

Number of sampling lengths (x n):
x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to16.0mm: 0.01mm interval)
x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 5.6mm: 0.01mm interval)*
* Only for Transverse tracing drive unit type

## Function: SJ-210

Customization: Desired parameters can be selected for calculation and display.

Go/no-go judgment: By max value / 16% / Standard dev.
Storage of measurement condition: Save the conditions at power OFF

Storage: Internal memory: Measurement condition (10 sets), Measured profile (1set)
Memory card (Option): 500 measurement conditions, 10,000 measured profiles, 500 display images
Text file (Measurement conditions / Measured profile / Assessed profile / Bearing area curve / Amplitude distribution curve)

Calibration: Auto-calibration with the entry of numerical value / Average calibration with multiple measurement (Max.5 times) is available

## Technical Data: SJ-310

X axis (drive unit)
- Measuring range: .70"(17.5mm) .22"(5.6mm) Transverse type
- Measuring speed: .01, .02, .03"/s (0.25, 0.5, 0.75mm/s) .039"/s(1mm/s) Returning

Detector:
- Range / Resolution: Auto / depending on the measurement range 14400 µin / .8 in (360 µm / 0.02 µm) 4000 µin / .2 µin (100 µm / 0.006 µm) 1000 µin / .08 µin (25 µm / 0.002 µm)
- Measuring method: skidded
- Measuring force: 4mN (0.75mN)
- Stylus tip: Diamond, 90° / 5µmR (60° / 2µmR)
- Skid radius of curvature: 40mm
- Skid force: less than 400mN
- Type: Differential inductance

Power supply: Two-way power supply: battery (rechargeable Ni-MH battery) and AC adapter

Battery
- Charging time: 4 hours maximum
- Recharge cycles: Approximately 1500 times (slightly varies with the usage and environmental conditions)

External I/O: USB I/F, Digimatic Output, RS-232C I/F, External SW I/F

Data storage: Micro SD card w/ adapter (4GB) (option **12AAA841**)

Dimensions (W x D x H)
- Control unit: 10.8x4.29x7.8" (275 x 109 x 198mm)
- Drive unit: 4.5x.9x1"(115 x 23 x 26mm)

Mass
- Display unit: Approx. 3.7lb (1.7kg)
- Drive unit: .4lb (0.2kg)

## Evaluation Capability: SJ-310

Applicable standards:
JIS'82, JIS'94, JIS'01, ISO'97, ANSI, VDA

Assessed profiles:
P (primary profile), R (roughness profile), DIN4776, roughness motif, waviness motif

Evaluation parameters:
Ra, Ry, Rz, Rt, Rp, Rq, Rv, Rsk, Rku, Rc, RSm, S, RPc, R3z, Rmr(c), Rpk, Rvk, Rδc,, Rk, Mr1, Mr2, Lo, Rppi, R, AR, Rx, A1, A2, Vo, HSC, Rmr, SK, Ku, RΔa, RΔq, Rlr, λa, λq, Rpm, RzJIS (JIS'01), tp (ANSI), Htp (ANSI), Wte, Wx, W, AW, Rz1max (ISO), Rmax (VDA, ANSI, JIS'82), Possible Customize

Analysis graphs:
Bearing Area Curve (BAC), Amplitude Distribution Curve (ADC)

Digital filter: 2CR, PC75, Gaussian

Cutoff length: λc: .003, .01, .03, .1, .3" (0.08, 0.25, 0.8, 2.5, 8mm) λs: .1, .3"(2.5, 8µm)

Sampling length: .003, .01, .03, .1, .3" or arbitrary (0.08, 0.25, 0.8, 2.5, 8mm) or arbitrary

Number of sampling lengths (x n):
x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to16.0mm: 0.01mm interval)
x1, x2, x3, x4, x5, x6, x7, x8, x9, x10 arbitrary length (0.3 to 5.6mm: 0.01mm interval)*
* Only for Transverse tracing drive unit type

Printer: Thermal type

Printing width: 48mm (paper width: 58mm)

Recording magnification:
Vertical magnification: 10X to 100,000X, Auto
Horizontal magnification: 1X to 1,000X, Auto

## Function: SJ-310

Customization: Desired parameters can be selected for calculation and display.

Statistical processing: Maximum value, minimum value, mean value, standard deviation, pass rate, histogram of each parameter

Go/no-go judgment: maximum value rule, 16% rule, average value rule, standard deviation (1σ, 2σ, 3σ)

Storage: Internal memory: Measurement condition (10 sets)

Memory card (Option): 500 measurement conditions, 10,000 measured profiles, 500 display images, Text file (Measurement conditions / Measured profile / Assessed profile / Bearing area curve / Amplitude distribution curve), 500 statistical data, etc.

Calibration: Auto-calibration with the entry of numerical value / Average calibration with multiple measurement (Max.12 times) is available.

Power-saving function: Auto-sleep-function, Auto light-off of Backlight by ECO mode.

# Surftest SJ-210/SJ-310

## SERIES 178 — Portable Surface Roughness Tester



Surftest SJ-310

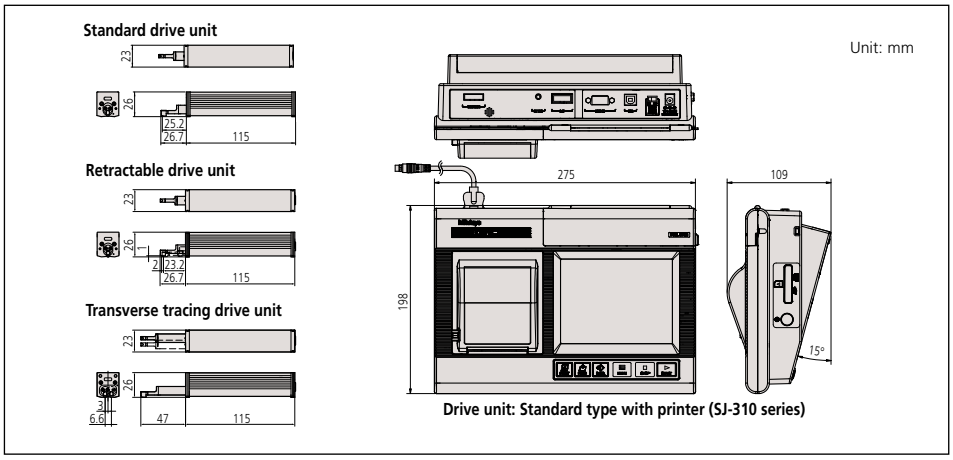
## FEATURES

- The data processing unit offers large 5.7-inch color graphic LCD touch-panel for superior readability and operability. The LCD also includes a backlight for improved visibility in dark environments.
- The excellent user interface provides intuitive and easy-to-understand operability.
- Complies with the following standards: JIS (JIS-B0601-2001, JIS-B0601-1994, JIS B0601-1982), VDA, ISO- 1997, and ANSI.
- The Measure-Start and other frequently used buttons are strengthened to resist wear and the detrimental effects of workshop contaminants.
- Equipped with a large-capacity battery allowing approximately 1500 measurements when fully charged.
- Includes convenient carrying case for protection in the field.
- A high-speed printer is built into the main unit. Either landscape or portfolio mode can be selected according to the application. Paper saving mode is supported.
- The display interface supports 16 languages, which can be easily switched.
- 10 sets of measurement conditions can be saved in the measurement unit–an optional memory card can save measurement conditions and the measured profile.

## SPECIFICATIONS/CONFIGURATION

| Model No. | SJ-310 | | | | | |
|---|---|---|---|---|---|---|
| **Order No.** (inch/mm) | **178-571-01A** | **178-571-02A** | **178-573-01A** | **178-573-02A** | **178-575-01A** | **178-575-02A** |
| Drive unit | Standard type (**178-230-2**) | | Retractable type (**178-235**) | | Transverse tracing type (**178-233-2**) | |
| Detector | 0.75mN type (**178-296**) | 4mN type (**178-390**) | 0.75mN type (**178-296**) | 4mN type (**178-390**) | 0.75mN type (**178-387**) | 4mN type (**178-386**) |
| Display unit | Standard type with printer | | | | | |
| Detector: Tip angle | 60° | 90° | 60° | 90° | 60° | 90° |
| Stylus tip radius | 2µm | 5µm | 2µm | 5µm | 2µm | 5µm |
| Detector measuring force | 0.75mN | 4mN | 0.75mN | 4mN | 0.75mN | 4mN |
| Standard accessories | **12AAM475** Connecting cable<br>**12AAA217** Nosepiece for plane surface<br>**12AAA218** Nosepiece for cylinder<br>**12AAA216** Supporting leg<br>**12BAK700** Calibration stage<br>**12BAG834** Stylus pen<br>**12BAL402** Protection sheet<br>**270732** Printer paper (5 pieces)<br>**12BAL400** Carrying case<br>**178-602** Roughness reference specimen (Ra 3µm), AC adapter, Philips screwdriver, Strap for stylus pen, Operation manual, Quick reference manual, Warranty | | | | **12AAM475** Connecting cable<br>**12AAE643** Point-contact adapter<br>**12AAE644** V-type adapter<br>**12BAK700** Calibration stage<br>**12BAG834** Stylus pen<br>**12BAL402** Protection sheet<br>**270732** Printer paper (5 pieces)<br>**12BAL400** Carrying case<br>**178-606** Roughness reference specimen (Ra 1µm), AC adapter, Philips screwdriver, Strap for stylus pen, Operation manual, Quick reference manual, Warranty | |

## DIMENSIONS Display unit, Drive unit




Drive unit: Standard type with printer (SJ-310 series)



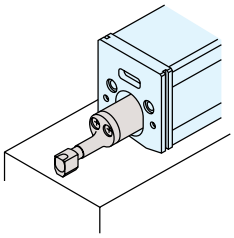
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# Surftest SJ-210 / SJ-310

## SERIES 178 — Optional Accessories

### Detectors

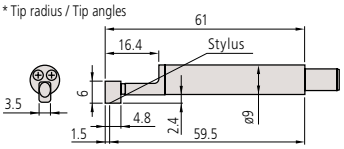
Unit: mm

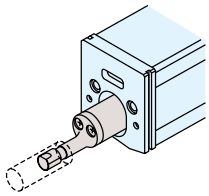


#### Standard detectors

| Order No. | Measuring force | Stylus profiles* | Remarks column |
|---|---|---|---|
| **178-296** | 0.75mN | 2µmR/60° | Dedicated to the standard/ retractable drive unit |
| **178-390** | 4 mN | 5µmR/90° | |
| **178-387** | 0.75mN | 2µmR/60° | Dedicated to the transverse tracing drive unit |
| **178-386** | 4 mN | 5µmR/90° | |
| **178-395** | 0.75mN | 2µmR/90° | Dedicated to the standard/ retractable drive unit |
| **178-391** | 4 mN | 10µmR/90° | |

* Tip radius / Tip angles

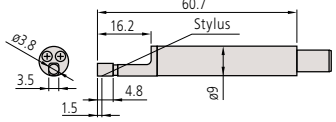


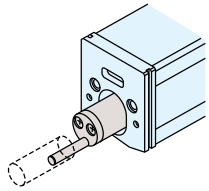



#### Small hole detectors

| Order No. | Measuring force | Stylus profiles* | Remarks column |
|---|---|---|---|
| **178-383** | 0.75mN | 2µmR/60° | Minimum measurable hole diameter: ø4.5mm |
| **178-392** | 4 mN | 5µmR/90° | |

* Tip radius / Tip angles

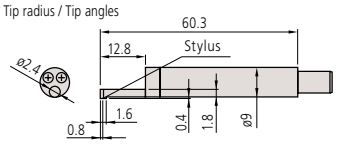


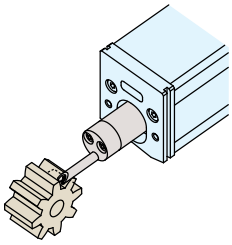



#### Extra small hole detectors

| Order No. | Measuring force | Stylus profiles* | Remarks column |
|---|---|---|---|
| **178-384** | 0.75mN | 2µmR/60° | Minimum measurable hole diameter: ø2.8mm |
| **178-393** | 4 mN | 5µmR/90° | |

* Tip radius / Tip angles

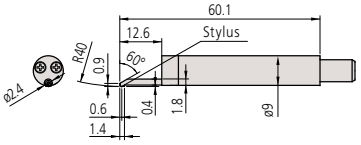


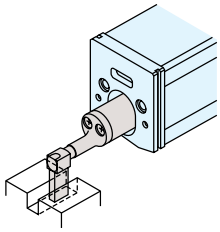



#### Gear-tooth surface detectors

| Order No. | Measuring force | Stylus profiles* |
|---|---|---|
| **178-388** | 0.75mN | 2µmR/60° |
| **178-398** | 4 mN | 5µmR/60° |

* Tip radius / Tip angles

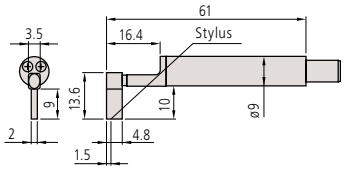


#### Deep groove detectors

| Order No. | Measuring force | Stylus profiles* | Remarks column |
|---|---|---|---|
| **178-385** | 0.75mN | 2µmR/60° | Not available for the transverse tracing drive unit |
| **178-394** | 4 mN | 5µmR/90° | |

* Tip radius / Tip angles




## SJ-Printer for SJ-210

Assessed profiles and calculation results and curves can be printed out by connecting the SJ-210-dedicated printer, which is palm sized (W x D x H: 93x125x70mm) and can run on an internal battery.

- Power supply can be selected. (AC adapter or battery pack)
- Printable items: Measurement conditions, calculation results, assessed profile, bearing area curve (BAC), amplitude distribution curve (ADC), and environment settings.



**178-421A**

*Not compatible with older **SJ-201** models.



Example of the connection with **SJ-210**

Durable Printer paper (25m, 5 rolls/set): **12AAA876**

Printer paper (5 packs): **270732**

RS-232C cable: **12AAL067**

## DP-1VA

It is possible to process Digimatic data output from the Surftest SJ series with the DP-1VA. This compact, hand-held device can provide printouts of measurement data and various statistical analyses results such as histograms, D-charts, and Xbar-R control charts. With optional output cables, DP-1VA is also capable of RS-232C output of measurement data to a PC (cable **09EAA084**) and go/no-go condition output (cable **965516**).



**264-505A**

Connecting cable: **936937** 40"(1m)
Connecting cable: **965014** 80" (2m)
AC adapter: **06AEG180JA**
Printer paper: **09EAA082**



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## Free Communication Software

**SJ-Tools**

**This program can be downloaded for FREE from the Mitutoyo website. http:www.mitutoyo.com**

Output software based on Microsoft-Excel* for controlling the devices and reproducing and storing the measurement data.

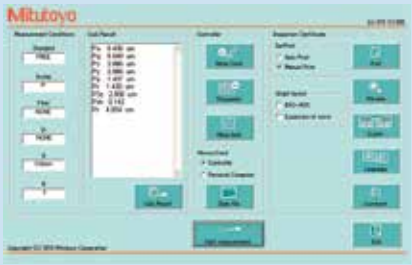
* Microsoft-Excel is not included in the scope of supply.

Complete with exclusive accessories.

- Measurement device control
- Definition of measurement variables
- Graphic representation of the profile
- Storage of measurement records
- Documentation of measurement results
- Connecting cable

Optional cables (Required for software communication)

**12AAL068:** USB PC connecting cable (USB cable) for SJ-210
**12AAD510:** USB PC connecting cable (USB cable) for SJ-310/410
**12AAL067:** RS-232C cable for SJ-210
**12AAA882:** RS-232C cable for SJ-310/410
**12AAH490:** USB PC connecting cable for SJ-500/SV-2100

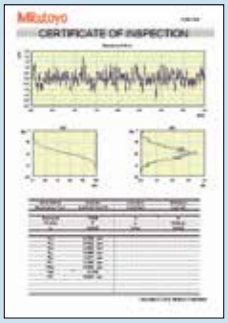


SJ-Tools input mask for Surftest SJ series

Required environment*:

- OS:
  Windows XP-SP3
  Windows Vista
  Windows 7/8/10
- Spreadsheet software:
  Microsoft Excel 2000/2002/2003/2007/2010/2013/2016

* Windows OS and Microsoft Excel are products of Microsoft Corporation.



SJ-Tools output record from MS-Excel

## Optional Accessories

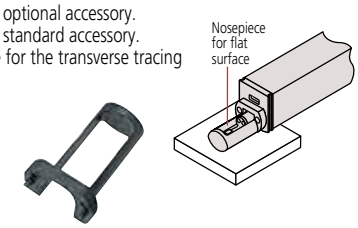
**12AAL272:** SJ-210 Replacement Battery Pack
**12AAN046:** SJ-310 Replacement Battery Pack
**12BAK820:** SJ-210 Display Protection Sheet (1pc.)
**12AAL066:** SJ-210 Display Protection Sheet (5pcs.)
**12BAL402:** SJ-310 Display Protection Sheet (1pc.)
**12AAN040:** SJ-310 Display Protection Sheet (10pcs.)
**178-601:** Precision Reference Specimen (Ra 3.00 µm)
**178-602:** Precision Reference Specimen (Ra 119 µin / 3.00 µm)
**178-603:** Precision Reference Specimen – 2 values (GAR)
**178-604:** Precision Reference Specimen – 2 Values (MIT)
**178-606:** Precision Reference Specimen for Transverse Drive (Ra 39.5 µin /1.0 µm)
**178-029:** Manual Column Stand, must use adapter 12AAA221 to mount SJ drive unit.

## Nosepiece, Adapter

### Nosepiece for flat surfaces

**12AAA217**

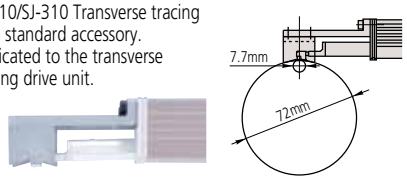
- SJ-210/210R optional accessory.
- SJ-310/310R standard accessory.
- Not available for the transverse tracing drive unit.




### V-type adapter

**12AAE644**

- SJ-210/SJ-310 Transverse tracing type standard accessory.
- Dedicated to the transverse tracing drive unit.

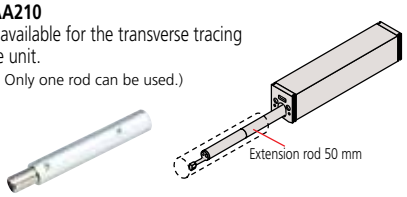



### Extension rod (50mm)

**12AAA210**

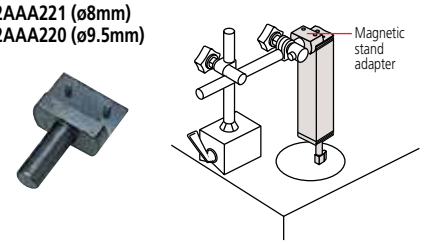
- Not available for the transverse tracing drive unit.

(Note: Only one rod can be used.)




### Magnetic stand adapter

**12AAA221 (ø8mm)**
**12AAA220 (ø9.5mm)**




### Extension cable (1m)

**12BAA303**

- Only one cable can be used.

### Nosepiece for cylindrical surfaces

**12AAA218**

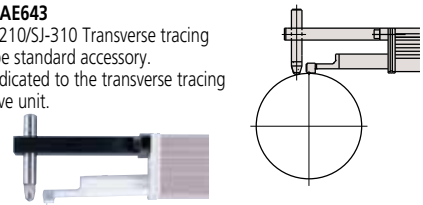
- SJ-210/210R optional accessory.
- SJ-310/310R standard accessory.
- Not available for the transverse tracing drive unit.
- ø30mm or smaller workpiece




### Point-contact adapter

**12AAE643**

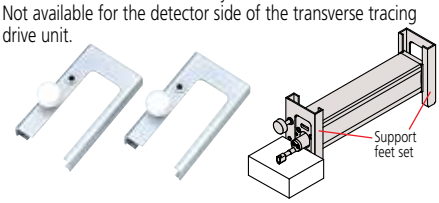
- SJ-210/SJ-310 Transverse tracing type standard accessory.
- Dedicated to the transverse tracing drive unit.



### Support feet set

**12AAA216**

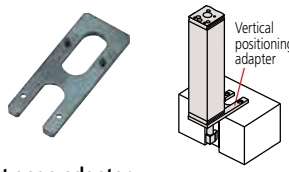
- SJ-210/210R optional accessory.
- SJ-310/310R standard accessory.
- Not available for the detector side of the transverse tracing drive unit.




### Vertical positioning adapter

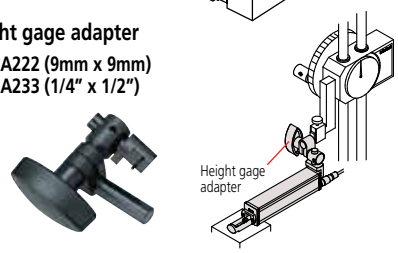
**12AAA219**

- Not available for the transverse tracing drive unit.




### Height gage adapter

**12AAA222 (9mm x 9mm)**
**12AAA233 (1/4" x 1/2")**




## Setting attachments

* Not available for the transverse tracing drive unit

Improves measurement efficiency by allowing the setup of workpieces of the same type and the positioning of hard-to-access features of a workpiece.

**No. 178-033**

V-type for measuring in the cylinder axis direction



The V-width is adjustable to the cylinder diameter facilitating axial measurement of a wide range of cylinder diameters.

- Adjustable range: ø 5 - 150mm

**No. 178-034**

Setting attachment: Magnetic slider type



Best suited for measurement of the flat surface of a workpiece that has partial indentions and steps and that is hard to set the drive unit. Combination use with the magnet type specimen holder (Option No. 12AAA910) further improves the ease of operation.

**No. 178-035**

Setting attachment: Inside diameter type



Greatly facilitates measurement of internal wall surfaces of, for example, cylinder-block bores.

- Applicable diameter: ø75 - ø95mm
- Accessible depth: 30 - 135mm



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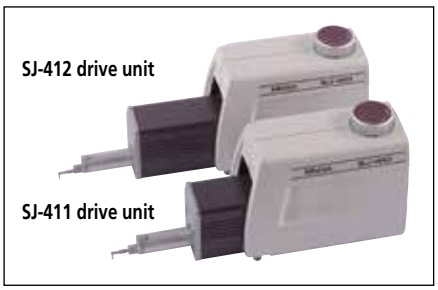
# Surftest SJ-410

## SERIES 178 — Portable Surface Roughness Tester

## FEATURES

- Both skidded and skidless measurement are possible with this series. Equipped with 46 roughness parameters that conform to the latest ISO, DIN, ANSI, and JIS standards.
- A wide-range, high-resolution detector and a drive unit provide superior high-accuracy measurement in its class.

Detector
Measuring range: 800µm
Resolution: 0.000125µm (at 8µm range)
Drive unit
Straightness/traverse length
SJ-411: 0.3µm/25mm
SJ-412: 0.5µm/50mm




- A skidless detector and a curved surface compensation function provide efficient evaluation of cylinder surface roughness.
- Ultra-fine steps, straightness and waviness can be measured by using the skidless measurement function.
- The handheld data processing unit and the 5.7-inch color graphic LCD touch-panel provides superior readability and operability. The LCD also includes a backlight for improved visibility in dark environments.
- The excellent user interface provides intuitive and easy-to-understand operability.
- Measured data can be output to a PC with optional RS-232C or USB cable.
- Digital filter function for non-distorted roughness profiles.
- Go/no-go judgment function.
- Auto-calibration function.
- The display interface supports 16 languages, which can be freely switched.
- Simplified contour analysis function supports the four types of measurement: step, level change, area and coordinate difference.
- Access to each feature can be password-protected, which prevents unintended operations and allows you to protect your settings.
- The optional attachments for mounting on a column stand significantly increase the operability.

### Skidless measurement






Surftest SJ-411

## SPECIFICATIONS

| Model No. | | SJ-411 | SJ-411 | SJ-412 | SJ-412 |
|---|---|---|---|---|---|
| **Order No.** (inch/mm) | | **178-581-01A** | **178-581-02A** | **178-583-01A** | **178-583-02A** |
| Detector measuring force | | 0.75mN | 4mN | 0.75mN | 4mN |
| Evaluation range | | 25mm | 25mm | 50mm | 50mm |
| Stylus tip | Tip angle | 60° | 90° | 60° | 90° |
| | Tip radius | 2µm | 5µm | 2µm | 5µm |

## Technical Data: X axis (drive unit)

Measuring range: 1"(25mm) (SJ-411), 2"(50mm) (SJ-412)
Measuring speed: .002, .004, .008, .02, .04"/s (0.05, 0.1, 0.5, 1.0mm/s)
Return speed: .02, .04, .08"/s (0.5, 1.0, 2.0mm/s)
Traversing direction: Backward
Traverse linearity: 12 µin / 1"(0.3µm/25mm) (SJ-411), 20 µin / 2"(0.5µm/50mm) (SJ-412)
Positioning: ±1.5° (tilting), 10mm (up/down)
Detector Range / resolution: 800µm / 0.0125µm, 80µm / 0.00125µm, 8µm / 0.000125µm (up to 2400µm with an optional stylus)
Measurement method: Skidless / skidded
Measuring force: 0.75mN (4mN)
Stylus tip: Diamond, 60° / 2µmR (90° / 5µmR)
Skid radius of curvature: 40mm
Type: Differential inductance
Power supply: Via AC adapter / rechargeable battery
Battery life: Max. app. 1000 measurements (w/o printing)
Recharge time: 4 hours Data output Via USB interface / RS-232C interface / SPC output
Storage:Internal memory: Measurement condition (10 sets)
Memory card (Option): 500 measurement conditions, 10,000 measured profiles, 500 display images, Text file (Measurement conditions / Measured profile / Assessed profile / Bearing area curve / Amplitude distribution curve), 500 statistical data, etc.
Dimensions (W x D x H)
Display unit: 10.8x4.3x7.8"(275x109 x198mm)
Height-tilt adjustment unit: 5.16x2.48x3.9"(131x63x99mm)
Drive unit: 5.04x1.41x1.83"(128x36x47mm)(SJ-411), 6.1x1.41x1.83"(155x36x47mm) (SJ-412)
Mass Control unit: Approx. 3.75lb (1.7kg)
Height-tilt adjustment unit: Approx. .9lb (0.4kg)
Drive unit: 1.3lb(0.6kg) (SJ-411), 1.5lb(0.7kg)(SJ-412)

## Evaluation Capability

Applicable standards: JIS'82, JIS'94, JIS'01, ISO'97, ANSI, VDA, Free
Assessed profiles: P (primary profile), R (roughness profile), DF (DF profile), W (filtered waviness profile), roughness motif, waviness motif
Evaluation parameters: Ra, Rq, Rz, Ry, Rp, Rv, Rt, R3z, Rsk, Rku, Rc, RPc, RSm, Rmax(VDA, ANSI), Rz1max(ISO'97), S, HSC, RzJIS(JIS'01), Rppi, RΔa, RΔq, Rlr, Rmr, Rmr(c), Rδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, λq, Lo, Rpm, tp(ANSI), Htp(ANSI), R, Rx, AR, W, AW, Wx, Wte
Analysis graphs: Bearing Area Curve (BAC), Amplitude Distribution Curve (ADC)
Digital filter: 2CR, PC75, Gaussian
Cutoff length: λc: .003, .01, .03, .1, .3" (0.08, 0.25, 0.8, 2.5, 8mm)
λs: 100, 320, 1000µin (2.5, 8, 25µm)(Availability of switching depends of the selected standard.)
Sampling length: 0.08, 0.25, 0.8, 2.5, 8, 25*mm; or arbitrary length in range 0.1 to 25mm (0.1 to 50mm: SJ-412) in 0.01mm increments
Number of sampling lengths: 1, 2, 3, ~20 (limited by traverse range)
Printer: Thermal type
Printing width: 48mm (paper width: 58mm)
Recording magnification
Vertical magnification: 10X to 100,000X, Auto
Horizontal magnification: 1X to 1,000X, Auto
Function
Customize: Selection of display/evaluation parameter
Data compensation: R-surface, Tilt compensation
Ruler function: Step, level change, area and coordinate difference
D.A.T. function: Helps to level workpiece prior to skidless measurement displacement detection mode enables the stylus displacement to be input while the drive unit is stopped.
Statistical processing: Max. value, Min. value, Mean value, Standard deviation (s), Pass ratio, Histogram
GO/NG judgement: Maximum value rule, 16% rule, average value rule, standard deviation (1σ, 2σ, 3σ)
Calibration: Auto-calibration with the entry of numerical value /average calibration with multiple measurement (Max.12 times) is available.
Power saving function: Auto-sleep-function, Auto light-off of Backlight by ECO mode.

* Only for SJ-412

# Surftest SJ-410

## SERIES 178 — Portable Surface Roughness Tester

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
FORM

### Free Communication Software

**SJ-Tools**

**This program can be downloaded for FREE from the Mitutoyo website. http:www.mitutoyo.com**

Output software based on Microsoft-Excel* for controlling the devices and reproducing and storing the measurement data.
*Microsoft-Excel is not included in the scope of supply.

Complete with exclusive accessories.
- Measurement device control
- Definition of measurement variables
- Graphic representation of the profile
- Storage of measurement results
- Documentation of measurement results

Optional cables (Required for software communication)
**12AAD510**: USB PC connecting cable (USB cable)
**12AAA882**: RS-232C connecting cable

### Optional Accessories

**178-611**: Step gage (2µm, 10µm)
**178-612**: Step gage (2µm, 10µm, 79µin, 394µin)
**178-610**: Step gage (step: 1µm, 2µm, 5µm, 10µm)
**12AAM556**: Height/tilt adjustment unit for SJ-410
**178-039**: Manual column stand (granite base) (vertical travel: 250mm)
**178-010**: Auto-set unit for **178-039**
**178-020**: X axis adjustment unit for **178-039**
**178-030**: Tilting adjustment unit (Inclination adjustment unit) for **178-039**
**12AAB358**: Cylindrical surface adapter (workpiece dia.: 15 - 60mm)
**178-016**: Leveling table (tilting: ±1.5°, max. loading: 15kg)
**178-048**: Leveling table with D.A.T function (mm) (tilting: ±1.5°, max. loading: 15kg)
**178-058**: Leveling table with D.A.T function (inch) (tilting: ±1.5°, max. loading: 15kg)
**178-043-1**: XY leveling table (25 x 25mm) (tilting: ±1.5°, max. loading: 15kg, swiveling: ±3°)
**178-053-1**: XY leveling table (1" x 1") (tilting: ±1.5°, max. loading: 15kg, swiveling: ±3°)
**178-042-1**: Digital XY leveling table (25 x 25mm) (tilting: ±1.5°, max. loading: 15kg, swiveling: ±3°)
**178-052-1**: Digital XY leveling table (1" x 1") (tilting: ±1.5°, max. loading: 15kg, swiveling: ±3°)
**178-049**: Digital XY leveling table (25 x 25mm) (max. loading: 15kg)
**178-059**: Digimatic XY leveling table (1" x 1") (max. loading: 15kg)
**178-019**: Precision vise for XY leveling table (jaw opening: 36mm)
**998291**: Precision V-block for XY leveling table (workpiece dia.: 1 - 160mm)
**12AAL069**: Micro SD card w/adapter (4GB)
**965014**: SPC cable (2m)
**264-012-10**: Input tool (USB type)
**264-505A**: DP-1VA
———: Detectors, Styli, and nosepieces (See pg. J-22/23.)

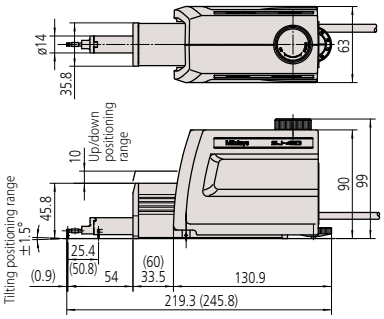
### Consumables

**12AAN040**: LCD protective sheet (10 sheets/set)
**12AAA876**: Durable printer paper (25m, 5 rolls/set)
**270732**: Printer paper (5 pack)
**12AAN046**: Replacement battery
**12AAJ088**: Footswitch

## DIMENSIONS

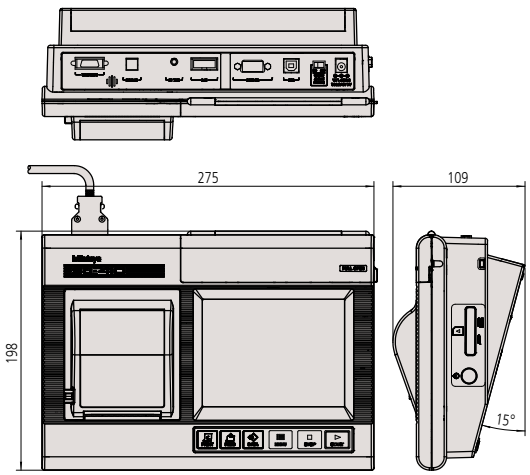
Unit: mm

**Drive unit**

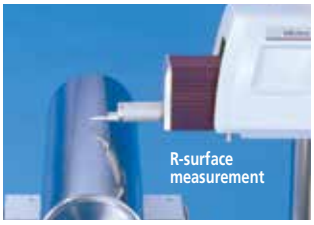


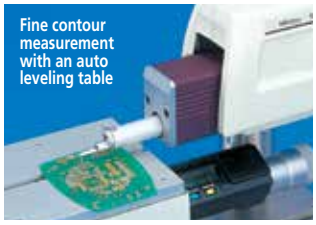

( ): Referring to dimensions when a 50mm drive is mounted to SJ-412.

**Display unit**



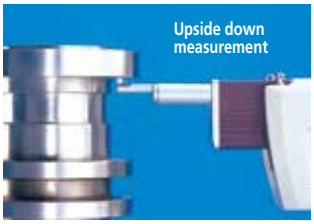

## MEASUREMENT APPLICATIONS

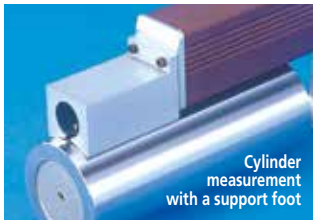











Carrying case is a standard accessory.




Manual column stand **178-039**

With optional accessories.

**178-010:** Auto-set unit
**178-020:** X-axis adjustment unit
**178-030:** Tilting adjustment unit



Mitutoyo

# Surftest SJ-500/P, SV-2100

## SERIES 178 — with Dedicated Control / PC System / Display Unit

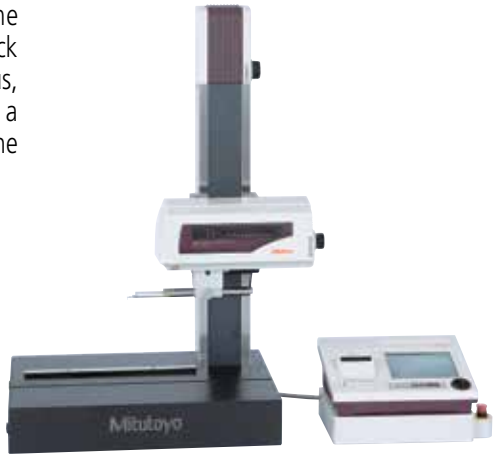
High-precision and high-performance surface roughness tester with a dedicated control unit, achieving user-friendly display and simple operation.

### FEATURES

- User-friendly display and simple operation equipped with a highly visible color 7.5-inch TFT LCD.
- Easy positioning. A joy stick built in the dedicated control unit allows easy and quick positioning. Fine positioning of a small stylus, required for measuring the inner side of a small hole, easily can be made using the manual knob.
- Easy setting of measuring conditions for surface roughness. Equipped with simple input function allows inputs according to drawing instruction symbols of ISO/JIS roughness standards. Troublesome measuring condition settings can be easily input by directly selecting a drawing instruction symbol for surface roughness from the menu.



SJ-500

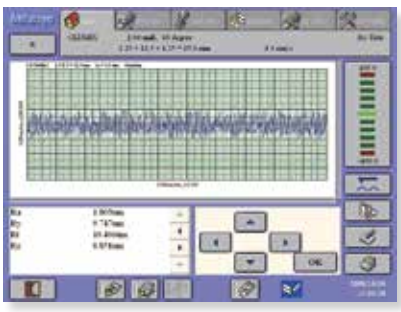


SV-2100S4



SJ-500P

## SURFPAK-EZ: Easy-to-use task-focused software



Measurement and results display screen

User-friendly graphical display and button layout allows intuitive operation. Simplified fine-contour analysis provided as standard, including step, area, angle, and circle calculation.

### Technical Data: SJ-500

X-axis (drive unit)
- Measuring range: 1.97" (50mm)
- Resolution: 1.97µin (0.05µm)
- Measurement method: Linear encoder
- Drive speed: 0 - .78"/s (0 - 20mm/s)
- Measuring speed: .00078 - .2"/s (0.02 - 5mm/s)
- Traversing direction: Backward
- Traverse linearity: 7.8µin/1.97" (0.2µm / 50mm)
- Positioning: ±1.5° (tilting, with DAT function)
  1.18" (30mm) (up/down)

Detector
- Resolution / Range: .4µin/32000µin, .04µin/3200µin, .004µin/320µin
  0.01µm (800µm), 0.001µm (80µm), 0.0001µm (8µm)
- Detecting method: Skidless / skid measurement
- Measuring force: 4mN (0.75mN) (low force type)
- Stylus tip: Diamond, 90° / 5µmR
  (60° / 2µmR: low force type)
- Skid radius of curvature: 1.57" (40mm)
- Detecting method: Differential inductance

Control unit
- Display: 7.5" color TFT with backlight
- Printer: Built-in thermal printer
- Magnification: Horizontal: X10 to X500,000, Auto
  Vertical: X0.5 to X10,000, Auto
- Drive unit control: Joystick operation with manual knob

### Technical Data: SV-2100

X-axis (drive unit)
- Measuring range: 3.94" (100mm)
- Resolution: 1.97µin (0.05µm)
- Measurement method: Linear encoder
- Drive speed: 0 - 1.57"/s (0 - 40mm/s)
- Measuring speed: .00078 - .197"/s (0.02 - 5mm/s)
- Traversing direction: Pull
- Traverse linearity: 6µin/4" (0.15µm / 100mm)

Z2-axis (column)
- Type: Manual operation or power drive
- Vertical travel: 13.8" or 21.6" (350mm or 550mm*)
- Resolution*: 1µm
- Measurement method*: Rotary encoder
- Drive speed*: 0 - .78"/s (0 - 20mm/s)

*Only for power-drive type

Detector
- Resolution / Range : .4µin/32000µin, .04µin/3200µin, .004µin/320µin
  0.01µm / 800µm , 0.001µm / 80µm, 0.0001µm / 8µm
- Detecting method: Skidless / skid measurement
- Measuring force: 4mN or 0.75mN (low force type)
- Stylus tip: Diamond, 90° / 5µmR
  (60° / 2µmR: low force type)
- Skid radius of curvature: 1.57" (40mm)
- Detecting method: Differential inductance

Control unit
- Display: 7.5" color TFT with backlight
- Printer: Built-in thermal printer
- Magnification: Horizontal: X10 to X500,000, Auto
  Vertical: X0.5 to X10,000, Auto
- Drive unit control: Joystick operation with manual knob

### Evaluation Capability

Cutoff length
ls: 0.25µm, 0.8µm, 2.5µm, 8µm, 25µm, 250µm, no filter
lc*: 0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm
lf: 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm, no filter

Sampling length (L)*
0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm, 80mm (SV-2100 only)

Data compensation functions
Parabola compensation, hyperbola compensation, ellipse compensation, R-plane (curved surface) compensation, conic compensation, tilt compensation

*Arbitrary length can be specified in the range from 0.02mm to 50mm.

**12AAA876:** High durable printer paper (5 Rolls/set)
**270732:** Standard type printer paper (5pcs.)
**12AAA841:** Compact Flash memory card (128 MB)

# Surftest SJ-500/P, SV-2100

## SERIES 178 — with Dedicated Control / PC System / Display Unit

## SPECIFICATIONS

| Model no. | SJ-500P | SJ-500 | SV-2100M4 | SV-2100S4 | SV-2100H4 | SV-2100W4 |
|---|---|---|---|---|---|---|
| Type of Data processing | PC System | Dedicated Data Processor | Dedicated Data Processor | | | |
| Order No. (inch) | **178-531-02A** | **178-533-02A** | **178-637-01A** | **178-681-01A** | **178-683-01A** | **178-685-01A** |
| Measuring force of detector | 4mN | 4mN | 0.75mN | | | |
| X-axis measuring range | 2″ (50mm) | | 4″ (100mm) | | | |
| Vertical travel | Optional stand | | 13.8″ (350mm) manual column | 13.8″ (350mm) power column | 21.6″ (550mm) power column | |
| Granite base size (WxD) | Optional stand | | 23.6 x 17.7″ (600 x 450mm) | | | 39.4 x 17.7″ (1000 x 450mm) |
| PC I/F Unit | 13.7 x 10.4 x 3.4″ (350 x 263 x 86mm) | NA | NA | NA | NA | NA |
| Dimensions (main unit, WxDxH) | 16.7 x 3.7 x 6.3″ (425 x 94 x 160mm) | | 28.2 x 17.7 x 34″ (716 x 450 x 863mm) | 28.2 x 17.7 x 38″ (716 x 450 x 966mm) | 28.2 x 17.7 x 46″ (716 x 450 x 1166mm) | 44 x 17.7 x 46.3″ (1116 x 450 x 1176mm) |
| Main unit Mass | 5.9 lbs. (2.7 kg) | | 308.6 lbs. (140 kg) | 308.6 lbs. (140 kg) | 330 lbs. (150 kg) | 485 lbs (220 kg) |
| Assessed profiles | Dedicated data processor type: P (primary profile), R (roughness profile), WC, envelope residual profile, roughness motif, waviness motif<br>PC system type: P (primary profile), R (roughness profile), WC, WCA, WE, WEA, DIN4776 profile, E (envelope residual profile), roughness motif, waviness motif | | | | | |
| Evaluation parameters | Dedicated data processor type: Ra, Rc, Ry, Rz, Rq, Rt, Rmax, Rp, Rv, R3z, Sm, S, Pc, mr (c),δc, mr, tp, Htp, Lo, lr, Ppi, HSC, Δa, Δq, Ku, Sk, Rpk, Rvk, Rk, Mr1, Mr2, A1, A2, Vo, λa, λq, R, AR, Rx, W, AW, Wx, Wte, (43 parameters), Customization<br>PC system type: Pa, Pq, Psk, Pku, Pp, Pv, Pz, Pt, Pc, PSm, PΔq, Pmr (c), Pmr, Pδc, Ra, Rq, Rsk, Rku, Rp, Rv, Rz, Rt, Rc, RSm, RΔq, Rmr (c), Rmr, Rδc, Wa, Wq, Wsk, Wku, Wp, Wv, Wz, Wt, Wc, WSm, WΔq, Wmr (c), Wmr, Wδc, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Rx, AR, R, Wx, AW, W, Wte, Ry, RyDIN, RzDIN, R3y, R3z, S, HSC, Lo, lr, Δa, λa, λq, Vo, Htp, NR, NCRX, CPM, SR, SAR, NW, SW, SAW | | | | | |
| Analysis graphs | Dedicated data processor type: ADC, BAC, power spectrum graph<br>PC system type: ADC, BAC Graph, power spectrum graph, auto-correlation graph, Walsh power spectrum graph, Walsh auto-correlation graph, slope distribution graph, local peak distribution graph, parameter distribution graph | | | | | |
| Curved surface compensation | Dedicated data processor type: Parabolic compensation, Hyperbolic compensation, Elliptical compensation, Circular compensation Conic compensation, Inclination (Entire, Arbitrary)<br>PC system type: Parabolic compensation, Hyperbolic compensation, Elliptical compensation, Circular compensation, Conic compensation, Inclination (Entire, Arbitrary), Polynomial compensation | | | | | |
| Contour analysis | Dedicated data processor type: Area, Circle, Angle, Coordinate difference, Step, Inclination<br>PC system type (SURFPAK-EZ): Area, Circle, Angle, Coordinate difference, Step, Inclination | | | | | |
| Filters | Dedicated data processor type: 2CR-75%, 2CRPC-75%, Gaussian, Robust-spline<br>PC system type: 2CR-75%, 2CR-50%, 2CRPC-75%, 2CRPC-50%, Gaussian, Robust-spline | | | | | |

## Manual column stand options: 178-085 and 178-089 (for SJ-500)

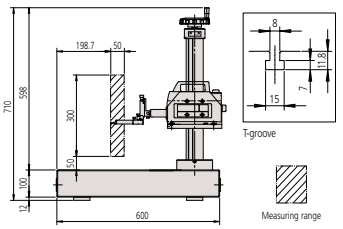
Suitable for desktop use in inspection rooms and such.



**No.178-085*** Does not include measuring unit
Vertical adjustment range: 11.8" (300mm)
Dimension (W × D × H): 23.6" x 17.7" x 28"
(600 × 450 × 710mm)
Weight: 242 lbs (110kg)

**No.178-089*** Does not include measuring unit
Vertical adjustment range: 9.8" (250mm)
Dimension (W × D × H): 15.7 x 9.8 x 2.4"
(400 × 250 × 60mm)
Weight: 44 lbs (20kg)

Dimensions of SJ-500 w/ manual column stand **178-085**




Unit: mm

## Auto-leveling table: 178-081 (for SJ-500 / SV-2100M4), 178-083 (for SV-2100S4 / H4 / W4)

This is a stage that performs fully automatic leveling as measurement starts, freeing the user from this tedious operation. Fully automatic leveling can be done quickly by anyone. In addition, the operation is easy and reliable.



| | |
|---|---|
| Inclination adjustment angle | ±2° |
| Maximum load | 15.4 lbs (7kg) |
| Table dimensions | 5.12 x 3.94"(130x100mm) |
| Mass | 7.7lbs (3.5kg) |





Mitutoyo

# Surftest SV-3200

## SERIES 178 — Surface Roughness Testers



SV-3200L4 (with options)

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
FORM



*Shown with optional accessories.

SV-3200H4 with PC

The Surftest SV-3200 Series provide high-accuracy, high-level analysis and multi-functionality in measurement of surface roughness.

## FEATURES

- Mitutoyo's Surftest SV-3200 Series provides high-accuracy, high-level analysis and multi-functionality in three-dimensional analysis and measurement of fine contour, as well as the conventional type surface roughness measurement.
- Peripheral devices such as the auto-leveling table are available to enhance operability and to enable automatic measurement.
- FORMTRACEPAK V5, dedicated data-analyzing software, is installed. This software allows data management in a consistent format, from the work site to the laboratory.
- Ceramic, which is known for its superb anti-abrasive property, is used as the X-axis drive unit guide. No lubrication of the guide is required.
- High-accuracy glass scales are built-in on X-axis (resolution: 1.97µin (0.05µm) and Z2-axis (column, resolution: 39.4µin (1µm) to ensure high-accuracy positioning.

The SV-3200 series manifest high-reliability especially in the horizontal roughness parameters (S, Sm), that require high-accuracy of the X-axis travel.

- When equipped with high accuracy Y-axis table and 3D surface analysis software MCubeMap, this offers CNC type capabilities usually performed on Extreme series machines.
- Various optional detector holders such as Crank Rotary type and Manual Rotary type make this versatile for many different applications.
- New optional Digital Automatic Tilt (DAT) function is best suited for workpieces that are too large for leveling tables.

## Technical Data

X-axis
- Measuring range: 4" or 8" (100mm or 200mm)
- Resolution: 1.97µin (0.05µm)
- Measurement method: Linear encoder
- Drive speed: 0 - 3.1"/s (0 - 80mm/s)
- Measuring speed: .00078 - .78"/s (0.2 - 20mm/s)**
- Traversing direction: Backward
- Traverse linearity: 4": (2+L)µin (0.05+0.001L)µm*
  8": 20µin / 8"(0.5µm/200mm)

Z2-axis (column)
- Vertical travel: 12", 20"or 27.6" (300mm, 500mm or 700mm) power drive
- Resolution: 39.4µin (1µm)
- Measurement method: ABSOLUTE linear encoder
- Drive speed: 0 - 1.2"/s (0 - 30mm/s)

Detector
- Range / resolution: 32000 µin / .4 µin, 3200µin / .04µin, 320 µin / .004µin (up to 96000 µin with an optional stylus) {(800µm / 0.01µm, 80µm / 0.001µm, 8µm / 0.0001µm) (up to 2400µm with an optional stylus)}
- Detecting method: Skidless / skid measurement
- Measuring force: 0.75mN (low force type)
- Stylus tip: Diamond, 60°/2µmR (low-force type)
- Skid radius of curvature: 1.57" (40mm)
- Detecting method: Differential inductance

Base size (W x H): 23.6 x 17.7" (600 x 450mm) or 39.4 x 17.7" (1000 x 450mm)

Base material: Granite

*L = Measured length inch (mm)
**Recommended speed: under 5mm/s
If using higher speed, stylus tip may be chipped and/or accuracy may be worse, depending on surface condition.

## Evaluation Capability: FORMTRACEPAK V5

Assessed profiles
P (primary profile), R (roughness profile), WC, WCA, WE, WEA, DIN4776 profile, envelope residual profile, roughness motif, waviness motif

Evaluation parameters
Ra, Rq, Rz, Ry, Rz(JIS), Ry(DIN), Rc, Rp, Rpmax, Rpi, Rv, Rvmax, Rvi, Rt, Rti, R3z, R3zi, R3y, S, Pc (Ppi), Sm, HSC, mr, δc, plateau ratio, mrd, Rk, Rpk, Rvk, Mr1, Mr2, Δa, Δq, λa, λq, Sk, Ku, Lo, Lr, A1, A2
Roughness motif parameters: Rx, R, AR, SR, SAR, NR, NCRX, CPM
Waviness motif parameters: Wte, Wx, W, AW SW, SAW, NW

Analysis graphs
ADC, BAC1, BAC2, power spectrum chart, auto-correlation chart, Walsh power spectrum chart, Walsh auto-correlation chart, slope distribution chart, local peak distribution chart, parameter distribution chart

Digital filter 2CR-75%, 2CR-50%, 2CR-75% (phase corrected), 2CR-50% (phase corrected), Gaussian-50%

Cutoff length*
λc: .001, .003, .01, .03, .1, .3, 1"
(0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm)
fl: .001, .003, .01, .03, .1, .3, 1"
(0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm)
fh: .001, .003, .01, .03, .1, .3, 1"
(0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm)

Sampling length (L)*.001, .003, .01, .03, .1, .3, 1"
(0.025mm, 0.08mm, 0.25mm, 0.8mm, 2.5mm, 8mm, 25mm)

Data compensation functions
Tilt compensation, R-plane (curved surface) compensation, ellipse compensation, parabola compensation, hyperbola compensation, quadric curve automatic compensation, polynomial compensation, polynomial automatic compensation

*Arbitrary length can be specified in the range from .001" (0.025mm) to the maximum traverse length.

# Surftest SV-3200

## SERIES 178 — Surface Roughness Testers

## SPECIFICATIONS

Models without X-axis inclination function

| Model No. | SV-3200S4 | SV-3200H4 | SV-3200W4 | SV-3200L4 |
|---|---|---|---|---|
| **Order No.** (inch) | **178-424-11A** | **178-425-11A** | **178-426-11A** | **178-464-11A** |
| **Order No.** (inch) | **178-444-11A** | **178-445-11A** | **178-446-11A** | **178-484-11A** |
| Measuring force of detector | 0.75mN | 0.75mN | 0.75mN | 0.75mN |
| X-axis measuring range | 4" (100mm) | 4" (100mm) | 4" (100mm) | 4" (100mm) |
| Vertical travel | 12" (300mm) power column | 20" (500mm) power column | 20" (500mm) power column | 27.6" (700mm) power column |
| Granite base size (WxD) | 23.6 x 17.7" (600 x 450mm) | 23.6 x 17.7" (600 x 450mm) | 39.4 x 17.7" (1000 x 450mm) | 39.4 x 17.7" (1000 x 450mm) |
| Dimensions (main unit, WxDxH) | 29.8 x 19.0 x 38.0" (756 x 482 x 966mm) | 29.8 x 19.0 x 45.9" (756 x 482 x 1166mm) | 45.5 x 19.0 x 46.3" (1156 x 482 x 1176mm) | 45.5 x 19.0 x 56.5" (1156 x 482 x 1436mm) |
| Mass (main unit) | 308 lbs (140kg) | 330 lbs (150kg) | 485 lbs (220kg) | 595 lbs (270kg) |

| Model No. | SV-3200S8 | SV-3200H8 | SV-3200W8 | SV-3200L8 |
|---|---|---|---|---|
| **Order No.** (inch) | **178-427-11A** | **178-428-11A** | **178-429-11A** | **178-465-11A** |
| **Order No.** (inch) | **178-447-11A** | **178-448-11A** | **178-449-11A** | **178-485-11A** |
| Measuring force of detector | 0.75mN | 0.75mN | 0.75mN | 0.75mN |
| X-axis measuring range | 8" (200mm) | 8" (200mm) | 8" (200mm) | 8" (200mm) |
| Vertical travel | 12" (300mm) power column | 20"(500mm) power column | 20" (500mm) power column | 27.6" (700mm) power column |
| Granite base size (WxD) | 23.6 x 17.7" (600 x 450mm) | 23.6 x 17.7" (600 x 450mm) | 39.4 x 17.7"(1000 x 450mm) | 39.4 x 17.7"(1000 x 450mm) |
| Dimensions (main unit, WxDxH) | 30.2 x 19.0 x 38.0" (766 x 482 x 966mm) | 30.2 x 19.0 x 45.9" (766 x 482 x 1166mm) | 45.9 x 19.0 x 46.3" (1166 x 482 x 1176mm) | 45.5 x 19.0 x 56.5" (1156 x 482 x 1436mm) |
| Mass (main unit) | 308 lbs (140kg) | 330 lbs (150kg) | 485 lbs (220kg) | 595 lbs (270kg) |

### Optional Accessories

**178-602-1**: Reference Specimen (Supports ISO)

**178-611**: Reference Step Specimen (2µm, 10µm)
**178-612**: Reference Step Specimen (2µm, 10µm, 79µin, 394µin)
**178-610**: Step gage (1µm, 2µm, 5µm, 10µm)
**178-047**: Three-axis adjustment table (including 998291 precision V-block.)
**178-016**: Leveling table
**178-042-1**: Digimatic XY leveling table (25 x 25mm)
**178-052-1**: Digimatic XY leveling table (1 x 1")
**178-043-1**: XY leveling table (25 x 25mm)
**178-053-1**: XY leveling table (1 x 1")
**178-019**: Precision vise*
**998291**: Precision V-block*
**181-902-10**: V-block set with clamp (Max. workpiece dia.: 25mm)
**181-901-10**: V-block set with clamp (Max. workpiece dia.: 1")

(See page J-22/23.) Detectors, styli, and nosepieces
*Use with an XY leveling table

### Optional Accessories

A wide range of peripherals are available to support various challenging measurement needs.



Y-axis Table
**178-097** for multiple workpiece measurement
**178-096** for 3D measurement
*Not a measuring axis, only for positioning.



3D-Auto Leveling Table
**178-077**
*Used together with **178-096**



Digital Advanced Tilting Unit
**178-040**
*Contact Sales Rep for details. Recommend to be installed in manufacturer's facility.

(See page J-25 for more accessories.)



**178-071** (S-3000)
Standard Detector Holder



**178-075** (S-3000CR)
Crank Rotary Type Detector Holder



**178-074** (S-3000C)
Crank Type Detector Holder



**178-076** (S-3000MR)
Manual Rotary Type Detector Holder



Mitutoyo

# Surftest Extreme SV-3000CNC

## SERIES 178 — CNC Surface Measuring Instruments

## FEATURES

- High-accuracy CNC surface roughness measuring instrument allows surface roughness measurement in both axes.
- Each axes has the maximum drive speed of 200 mm/s, which permits high-speed positioning that may result in a large increase in the throughput of multiple-profile/multiple-workpiece measurement tasks.
- For models with the α-axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by power-tilting the drive unit.
- For models with the Y-axis table, it is possible to expand the measuring range for multiple workpieces, etc., through positioning in the Y-axis direction.
- Using optional rotary table θ1 and θ2 designed to use with the CNC models enables it to expand the CNC measurement application range.
- Inclined plane measurements is possible through 2-axis simultaneous control in the X- and Y-axis directions.
- Since the detector unit incorporates an anti-collision safety device, the detector unit will automatically stop even if its main body collides with a workpiece or fixture.
- Supplied with an easy-to-operate Remote Box. The user can make any movement by selecting the required axis using the two joysticks. The current axis selection is easily identified by the icon on the key top.
- Communication with the data processing/analysis section is via USB.




**SV-3000CNC w/ PC system and software**
PC stand is not included, isolation stand is optional

## SPECIFICATIONS

| Model No. | SV-3000CNC | | SV-3000CNC | |
|---|---|---|---|---|
| **Order No.** (100V - 120V) | **178-508-13** | **178-528-13** | **178-509-13** | **178-529-13** |
| X1-axis measuring range | 8" (200mm) | 8" (200mm) | 8" (200mm) | 8" (200mm) |
| Z2-axis vertical travel | 12" (300mm) | 20" (500mm) | 12" (300mm) | 20" (500mm) |
| Y-axis table unit | Installed | Installed | Installed | Installed |
| α-axis unit | — | — | Installed | Installed |

## Technical Data: SV-3000CNC

X1-axis
- Measuring range: 8" (200mm)
- Resolution: 1.97µin (0.05µm)
- Measurement method: Reflective-type linear encoder
- Drive speed: 7.87"/s (200mm/s) (CNC, max.)
  0 - 2.0"/s (0 - 50mm/s) (joystick)
- Measuring speed: .00078 - .078"/s (0.02 - 2mm/s)
- Traversing direction: Backward
- Traverse linearity: 20 µin/8" (0.5µm/200mm)

α-axis**
- Inclination angle: -45° to +10°
- Resolution: 0.000225°
- Rotating speed: 1rpm

Z2-axis (column)
- Vertical travel: 12" (300mm) 20"*(500mm)
- Resolution: 1.97µin (0.05µm)
- Measurement method: Reflective-type linear encoder
- Drive speed: 7.87"/s (200mm/s) (max., CNC)
  0 - 2.4"/s (0 - 60mm/s) (joystick)
- Base size (W x H): 29.5 x 23.6" (750 x 600mm)
- Base material: Granite

Detector
- Range / resolution: 32000 µin / .4 µin, 3200µin / .04µin,
  320 µin / .004µin
  (up to 96,000 µin with an optional stylus)
  {(800µm / 0.01µm, 80µm / 0.001µm,
  8µm / 0.0001µm)
  (up to 2400µm with an optional stylus)}
- Measuring force: 4mN (0.75mN) (low-force type)
- Stylus tip: Diamond, 90°/5µmR
  (60°/2µmR: low-force type)

Dimension (W x D x H): 31.5 x 24.4 x 39.4"
(800 x 620 x 1000mm)
31.5 x 24.4 x 47.2"
(800 x 620 x 1200mm)*

Mass 529 lbs (240kg) 551lbs (250kg)*
*High-column model

Y-axis table unit**
- Measuring range: 8" (200mm)
- Minimum reading : 1.97µin (0.05µm)
- Scale unit: Reflective-type Linear Encoder
- Drive speed: 7.87"/s (200mm/s) (max., CNC)
  0 - 2.4"/s (0 - 60mm/s) (joystick)

Maximum loading capacity: 44 lbs (20kg)
Traverse linearity 20µin/8" (0.5µm/200mm)
Linear displacement accuracy (at 20°C):
± (80+2L/4)µin {± (2+2L/100) µm}
L: Dimension between two measured points (mm)
- Table size: 7.87 x 7.87" (200 x 200mm)
- Dimensions (W x D x H): 12.6 x 25.4 x 4.1"
  (320 x 646 x 105mm)
- Mass: 77 lbs (35kg)

**Y-axis table included only as a factory installed option.

## Optional Accessories

Vibration isolation stand
Vibration isolation mechanism: Diaphragm air spring
- Natural frequency : 2.5 - 3.5Hz
- Damping mechanism: Orifice
- Leveling mechanism: Automatic control with mechanical valves
- Air supply pressure: 0.4MPa

Allowable loading capacity: 772 lbs (350kg)
- Dimensions (W x D x H): 39.4 x 35.2 x 28.1"
  (1000 x 895 x 715mm)
- Mass: 617 lbs (280kg)

# Surftest Extreme SV-M3000CNC

## SERIES 178 — CNC Surface Measuring Instruments

### Technical Data: SV-M3000CNC

X1-axis
- Measuring range: 8" (200mm)
- Resolution: 1.97µin (0.05µm)
- Measurement method: Reflective-type linear encoder
- Drive speed: 7.87"/s (200mm/s) (max., CNC)
  0 - 1.97"/s (0 - 50mm/s) (joystick)
- Measuring speed: .00078 - .08"/s (0.02 - 2mm/s)
- Traverse linearity: 20µin/8" (0.5µm/200mm)
  28µin/8" (0.7µm/200mm) (long-type detector)
  20µin/8" (0.5µm/200mm) (rotary-type detector, up/down direction)
  28µin/8" (0.7µm/200mm) (long-type detector, foward/backward direction)

α-axis
- Inclination angle: -45° to +10°
- Resolution: 0.000225°
- Rotating speed: 1rpm

Z2-axis (column)
- Vertical travel: 20"(500mm)
- Resolution: 1.97µin (0.05µm)
- Measurement method: Reflective-type linear encoder
- Drive speed: 7.87"/s (200mm/s) (CNC, max.)
  0 - 1.97"/s (0 - 50mm/s) (joystick)

Y-axis
- Measuring range: 32" (800mm)
- Resolution: 1.97µin (0.05µm)
- Measurement method: Reflective-type linear encoder
- Drive speed: 7.87"/s (200mm/s) (max., CNC)
  0 - 1.97"/s (0 - 50mm/s) (joystick)
- Measuring speed: .00078- .08"/s (0.02 - 2mm/s)
- Traverse linearity: 20µin/2" (0.5µm/50mm), 80µin/32" (2µm/800mm) 28µin/2" (0.7µm/50mm), 120µin/32" (3µm/800mm) (long-type detector) 28µin/2" (0.7µm/50mm), 120µin/32" (3µm/800mm) (rotary-type detector, up/down direction)

Base unit
- Size (W x H): 23.6 x 59.1" (600 x 1500mm)
- Material: Steel
- Loading capacity: 661 lbs (300kg)

Detector
- Range / resolution: 32000 µin / .4 µin, 3200µin / .04µin, 320 µin / .004µin (up to 96,000 µin with an optional stylus) {800µm / 0.01µm, 80µm / 0.001µm, 8µm / 0.0001µm (up to 2400µm with an optional stylus)}
- Detecting method: Skidless / skid measurement
- Measuring force: 4mN or 0.75mN (low-force type)
- Stylus tip: Diamond, 90°/5µmR (60°/2µmR: low-force type)
- Skid radius of curvature: 1.57" (40mm)
- Detecting method: Differential inductance

Dimension (W x D x H): 42.7 x 66.7 x 75.7" (1085 x 1695 x 1922mm)

Mass: 3527 lbs (1600Kg ) (including vibration isolating unit)

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### Software

**FORMTRACEPAK V5**

Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. You can also perform contour evaluation that allows free analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, analysis results can be saved in the "html","mhtml" or pdf format which allows Internet Explorer or MS-Word compatibility, allowing PC without layout editing programs to view analysis results.



Contour Measurement & Surface Roughness Measurement Screen



Report Layout Screen



**SV-M3000CNC with personal computer system and software**

* PC stand not included

### FEATURES

- CNC Surface Roughness Tester covers measurement of large/heavy workpieces such as engine blocks, crankshafts, etc.
- In combination with the surface roughness detector rotating unit, S-3000AR (optional), it can perform continuous measurement over the bottom, top and side surfaces of a workpiece.
- Compatible with the optional large table for supporting a load of 220 lbs (100 kg) or a large θ2 table. Enables continuous automatic measurement of large-size workpieces.
- Suitable for automatic surface roughness measurement on large and heavy workpieces.
- Employs the column-moving type configuration that is not restricted by workpiece size. This is advantageous for measuring heavy workpieces, such as engine blocks, crankshafts, etc.
- Provides 31.5" (800mm) of Y-axis stroke. This makes it possible to measure multiple profiles on large workpieces.
- Load table has a self-contained structure to ensure that various size workpieces, jigs, auto-feed devices, etc., are easily accommodated and can be specified, if required, by special order.

### SPECIFICATIONS

| Model No. | SV-M3000CNC |
|---|---|
| **Order No.** (100V - 120V) | **178-549-1** |
| X1-axis measuring range | 8" (200mm) |
| Z2-axis column travel range | 20" (500mm) |
| Y-axis travel range | 32" (800mm) |
| α-axis inclination angle | -45° (CCW), +10° (CW) |



Mitutoyo

# Formtracer SV-C3200 / SV-C4500

## SERIES 525 — Surface Roughness / Contour Measuring System



**SV-C3200L4 (with options)**



**SV-C3200S4** with personal computer system and software

## FEATURES

- Dramatically increased drive speed (X axis: 3.1"/s (80mm/s), Z2 axis column: 1.2"/s (30mm/s) further reduces total measurement time.
- In order to maintain the traverse linearity specification for an extended period of time, Mitutoyo has adopted highly rigid ceramic guides that combine the characteristics of smallest secular change and remarkable resistance to abrasion.
- The drive unit (X-axis) and column (Z2-axis) are equipped with a high-accuracy linear encoder (ABS type on Z2-axis). This improves reproducibility of continuous automatic measurement of small holes in the vertical direction and repeated measurement of parts which are difficult to position.

## Automatic Measurement

- A wide range of optional peripherals are available to support quick and easy CNC operation.



Y-axis Table



Rotary Table θ1



Rotary Table θ2

## Surface Roughness Measurement



- Traverse linearity: (2+1L)µin (±(0.05+0.001L) µm*)
  Designed to handle workpieces calling for high accuracy.
  *S4, H4, W4 types, L = Drive length inch (mm)
- Compliant with JIS '82/'94/'01, ISO, ANSI, DIN, VDA, and other international surface roughness standards.
- Equipped with a standard high accuracy detector (0.75mN/4mN measuring force) providing a resolution down to 0.004µin (0.0001µm).

## Contour Drive Measurement



- X axis accuracy: ± (31.5+10L)µin (±(0.8+0.01L)µm*)
  Z1-axis accuracy: ± (31.5+l20Hl)µin (±(0.8+l2Hl/100)µm*)
  Designed to handle workpieces calling for high accuracy.
  * SV-C4500S4, H4, W4 types, L = Drive length, H = Measurement height inch (mm)
- The contour drive unit of SV-C4500 series instruments can continuously measure in the upward and downward directions without the need to change the arm orientation or reset the workpiece, when combined with the double cone-end stylus (a new product with contact points in the upward and downward directions).

## Technical Data: Common

| | |
|---|---|
| Power supply: | 100 – 240VAC ±10%, 50/60Hz |
| Power consumption: | 400W (main unit only) |

## Technical Data: Contour Measurement

X-axis

| | |
|---|---|
| Measuring range: | 4" (100mm) or 8" (200mm) |
| Resolution: | 1.97µin (0.05µm) |
| Measurement method: | Reflective-type linear encoder |
| Drive speed: | 3.1"/s (80mm/s) and manual |
| Measuring speed: | .00078 - .78"/s (0.02 - 20mm/s)* |

*Recommended speed: under 5mm/s
If using higher speed, stylus tip may be chipped and/or accuracy may be worse, depending on surface condition.

| | |
|---|---|
| Measuring direction: | Forward/backward |
| Traverse linearity: | 32µin/4"(0.8µm/100mm)<br>79µin/8" (2µm/200mm)<br>*with the X axis in horizontal orientation |
| Linear displacement: | ±(32+10L)µin (±0.8+0.01L) µm (SV-C3200S4, H4, W4) |
| accuracy (at 20°C) | ±(32+10L)µin (±0.8+0.01L)µm (SV-C4500S4, H4, W4)<br>±(32+20L)µin (±0.8+0.02L)µm (SV-C3200S8, H8, W8)<br>±(32+20L)µin (±0.8+0.02L)µm SV-C4500S8, H8, W8)<br>* L = Drive length inch (mm) |
| Inclination range: | ±45° |

Z2-axis (column)

| | |
|---|---|
| Vertical travel: | 12"(300mm) or 20"(500mm) |
| Resolution: | 39.4µin (1µm) |
| Measurement method: | ABSOLUTE linear encoder |
| Drive speed: | 0 - 1.2"/s (0 - 30mm/s) and manual |

Z1-axis (detector unit)

| | |
|---|---|
| Measuring range: | ±1.2" (±30mm) |
| Resolution: | 1.57µin (0.04µm) (SV-C3200 series),<br>.78µin (0.02µm) (SV-C4500 series) |
| Measurement method: | Linear encoder (SV-C3200 series),<br>Laser hologage (SV-C4500 series) |
| Linear displacement: | ±(63+l20lH) µin (±(1.4+l2Hl/100)µm) (SV-C3200 series) |
| accuracy (at 20°C) | ±(31.5+l20Hl) µin (±(0.8+l2Hl/100)µm) (SV-C4500 series)<br>*H: Measurement height from the horizontal position (mm) |
| Stylus up/down operation: | Arc movement |
| Face of stylus: | Upward/downward (SV-C3200)<br>Upward/downward (Direction switch by Formtracepak) (SV-C4500) |
| Measuring force: | 30mN (SV-C3200)<br>10, 20, 30, 40, 50mN (SV-C4500)<br>* As for SV-C4500, set the measurement force with Formtracepak. |
| Traceable angle: | Ascent: 77°, descent: 83°<br>(using the standard stylus provided and depending on the surface roughness) |
| Stylus tip | Radius: 25µm, carbide tip |

## Technical Data: Surface Roughness Measurement

X1-axis

| | |
|---|---|
| Measuring range: | 4" (100mm) or 8" (200mm) |
| Resolution: | 1.97µin (0.05µm) |
| Measurement method: | Linear encoder |
| Drive speed: | 3.1"/s (80mm/s) |
| Traversing direction: | Backward |
| Traverse linearity: | (2+1L) µin (0.05+1L/1000)µm (S4, H4, W4 types)<br>20µin/8"(0.5µm/200mm) (S8, H8, W8 types) |

Z2-axis (column)

| | |
|---|---|
| Vertical travel: | 12" (300mm) or 20" (500mm) |
| Resolution: | 39.4 µin (1µm) |
| Measurement method: | ABSOLUTE linear encoder |
| Drive speed: | 0 - 1.2"/s (0 - 30mm/s) and manual |

Detector

| | |
|---|---|
| Range / resolution: | 32000 µin / .4 µin, 3200µin / .04µin, 320 µin / .004µin (up to 96000 µin with an optional stylus) {800µm / 0.01µm, 80µm / 0.001µm, 8µm / 0.0001µm (up to 2400µm with an optional stylus)} |
| Detecting method: | Skidless / skid measurement |
| Measuring force: | 0.75mN (low force type) |
| Stylus tip: | Diamond 60°/2µmR (low force type) |
| Skid radius of curvature: | 1.57" (40mm) |
| Detecting method: | Differential inductance |

# Formtracer SV-C3200 / SV-C4500

## SERIES 525 — Surface Roughness / Contour Measuring System

### SPECIFICATIONS

| Model No. | SV-C3200S4 | SV-C3200H4 | SV-C3200W4 | SV-C3200L4 |
|---|---|---|---|---|
| **Order No.** (inch) | **525-491-11A** | **525-492-11A** | **525-493-11A** | **525-494-11A** |
| Model No. | SV-C4500S4 | SV-C4500H4 | SV-C4500W4 | SV-C4500L4 |
| **Order No.** (inch) | **525-451-11A** | **525-452-11A** | **525-453-11A** | **525-454-11A** |
| X1-axis measuring range | 4" (100mm) | 4" (100mm) | 4" (100mm) | 4" (100mm) |
| Measuring force of detector | 0.75mN | 0.75mN | 0.75mN | 0.75mN |
| Vertical travel | 12" (300mm) power column | 20" (500mm) power column | 20" (500mm) power column | 27.6" (700mm) power column |
| Granite base size (WxD) | 23.6 x 17.7" (600 x 450mm) | 23.6 x 17.7" (600 x 450mm) | 39.4 x 17.7" (1000 x 450mm) | 39.4 x 17.7" (1000 x 450mm) |
| Dimensions (main unit, WxDxH) | 39.2 x 22.6 x 38.0" (996 x 575 x 966mm) | 39.2 x 22.6 x 46.3" (996 x 575 x 1176mm) | 55.4 x 22.6 x 46.3" (1396 x 575 x 1176mm) | 55.4 x 22.6 x 56.1" (1396 x 575 x 1426mm) |
| Mass (main unit) | 308 lbs (140kg) | 330 lbs (150kg) | 485 lbs (220kg) | 595 lbs (270kg) |

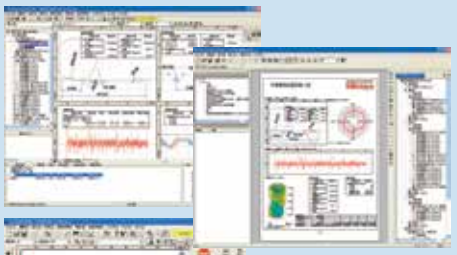
| Model No. | SV-C3200S8 | SV-C3200H8 | SV-C3200W8 | SV-C3200WL8 |
|---|---|---|---|---|
| **Order No.** (inch) | **525-496-11A** | **525-497-11A** | **525-498-11A** | **525-499-11A** |
| Model No. | SV-C4500S8 | SV-C4500H8 | SV-C4500W8 | SV-C4500L8 |
| **Order No.** (inch) | **525-456-11A** | **525-457-11A** | **525-458-11A** | **525-459-11A** |
| X1-axis measuring range | 8" (200mm) | 8" (200mm) | 8" (200mm) | 4" (100mm) |
| Measuring force of detector | 0.75mN | 0.75mN | 0.75mN | 0.75mN |
| Vertical travel | 12" (300mm) power column | 20" (500mm) power column | 20" (500mm) power column | 27.6" (700mm) power column |
| Granite base size (WxD) | 23.6 x 17.7" (600 x 450mm) | 23.6 x 17.7" (600 x 450mm) | 39.4 x 17.7" (1000 x 450mm) | 39.4 x 17.7" (1000 x 450mm) |
| Dimensions (main unit, WxDxH) | 39.6 x 22.6 x 38.0" (1006 x 575 x 966mm) | 39.6 x 22.6 x 46.3" (1006 x 575 x 1176mm) | 55.4 x 22.6 x 46.3" (1406 x 575 x 1176mm) | 55.4 x 22.6 x 56.1" (1396 x 575 x 1426mm) |
| Mass (main unit) | 308 lbs (140kg) | 330 lbs (150kg) | 485 lbs (220kg) | 595 lbs (270kg) |

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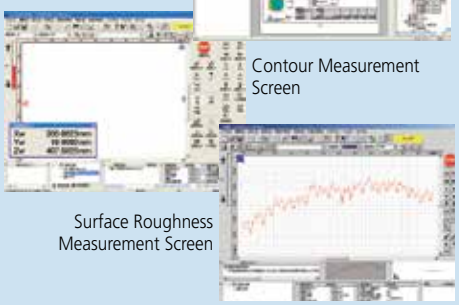
### Software

**FORMTRACEPAK V5**

Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. You can also perform contour evaluation that allows free analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, analysis results can be saved in the "html", "mhtml" or pdf format which allows Internet Explorer or MS-Word compatibility, allowing PC without layout editing programs to view analysis results.



Contour Measurement Screen



Surface Roughness Measurement Screen

### Optional Accessories

A wide range of peripherals are available to support various challenging measurement needs.



Y-axis Table
**178-097** for multiple workpiece measurement
**178-096** for 3D measurement
*Not a measuring axis, only for positioning.



3D-Auto Leveling Table
**178-077**
*Used together with **178-096**

(See page J-25 for more accessories.)



**178-071** (S-3000)
Standard Detector Holder



**178-091** (S-3000CR)
Crank Rotary Type Detector Holder



**178-074** (S-3000C)
Crank Type Detector Holder



**178-092** (S-3000MR)
Manual Rotary Type Detector Holder



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# Formtracer Extreme SV-C4500CNC

## SERIES 525 — Surface Roughness/Form Measuring Instrument





**SV-C4500CNC with recommended machine vibration stand**

* PC stand not included

**Surface roughness detector**



**Contour Z-axis detector**



## FEATURES

- High-accuracy CNC surface roughness/form measuring instrument allows both measurement of surface roughness and form/contour with one unit.
- Each axes has the maximum drive speed of 7.87"/s (200 mm/s), which permits high-speed positioning that may result in a large increase in the throughput of multiple-profile/multiple-workpiece measurement tasks.
- For models with the α axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by power-tilting the detector unit.
- For models with the Y-axis table, it is possible to expand the measuring range for multiple workpieces, etc., through positioning in the Y-axis direction.
- When combined with the double cone-end stylus (a new product with diametrically opposed contact points), the instrument can continuously measure in the upward and downward directions without the need to change the arm orientation or reset the workpiece fixturing.
- The measuring force can be switched among five levels (upward and downward) from the data-processing program (Formtracepak).
- Enables inclined plane measurements through 2-axis simultaneous control in the X- and Y-axis directions.
- When the detector for form/contour measurement is replaced with that for surface roughness measurement, or vice versa, it is a simple, one-touch replacement without re-routing of the connecting cables.
- Since the Z1-axis detector incorporates an anti-collision safety device, the detector unit will automatically stop even if its main body collides with a workpiece or fixture.
- Supplied with an easy-to-operate Remote Box. The user can make any movement by selecting the required axis using the two joysticks. The current axis selection is easily identified by the icon on the key top.
- Communication with the Data Processing/Analysis section is via USB.

## Technical Data: Common

| | |
|---|---|
| Base size (W x H): | 31 x 39.4" (800 x 1000mm) Type S<br>34 x 47.2" (800 x 1200mm) Type H |
| Base material: | Granite |
| Mass: | 529 lbs (240kg) Type S<br>551 lbs (250kg) Type H |
| Power supply: | 100 – 120VAC ±10%, 50/60Hz |
| Power consumption: | 500W (main unit only) |

## Technical Data: Contour Measurement

X1-axis

| | |
|---|---|
| Measuring range: | 8" (200mm) |
| Resolution: | 1.97µin (0.05µm) |
| Measurement method: | Reflective-type linear encoder |
| Drive speed: | 7.87"/s (200mm/s) (max., CNC)<br>0 - 2"/s (0 - 50mm/s) (joystick) |
| Measuring speed: | .00078 - .08"/s (0.02 - 2mm/s) |
| Measuring direction: | Forward / Backward |
| Traverse linearity: | 80µin / 8"(2µm/200mm)<br>*with the X axis in horizontal orientation |
| Linear displacement accuracy (at 20°C): | ±(0.8+4L/200)mm<br>* L = Drive length (mm) |

α-axis* Depends on Code #

| | |
|---|---|
| Inclination angle: | -45° to +10° |
| Resolution: | 0.000225° |
| Rotating speed: | 1rpm |

Z2-axis (column)

| | |
|---|---|
| Vertical travel: | 12" or 20" (300mm or 500mm) |
| Resolution: | 1.97µin (0.05µm) |
| Measurement method: | Reflective-type linear encoder |
| Drive speed: | 7.87"/s (200mm/s) (max., CNC)<br>0 - 2."/s (0 - 50mm/s) (joystick) |

Z1-axis (detector unit)

| | |
|---|---|
| Measuring range: | ±1.2" (±30mm) |
| Resolution: | .787µin (0.02µm) |
| Measurement method: | Reflective Type detector unit |
| Linear displacement: | |
| Accuracy (at 20°C) | ±(32+110H)µin (±(0.8+I2HI/100)µm)<br>*H: Measurement height from the horizontal position (mm) w/o α-axis: ±(1.5+10HI/1000)µm |
| Stylus up/down operation: | Arc movement |
| Face of stylus: | Downward |
| Measuring force: | 10, 20, 30, 40, 50mN |
| Traceable angle: | Ascent: 70°, descent: 70°<br>(using the standard stylus provided and depending on the surface roughness) |
| Stylus tip | Radius: 25µm, carbide tip |

## Technical Data: Surface Roughness Measurement

X1-axis

| | |
|---|---|
| Measuring range: | 8" (200mm) |
| Resolution: | 1.97µin (0.05µm) |
| Measurement method: | Reflective-type linear encoder |
| Drive speed: | 7.87"/s (200mm/s) (max., CNC)<br>0 - 2"/s (0 - 50mm/s) (joystick) |
| Measuring speed: | .00078 - .08"/s (0.02 - 2mm/s) |
| Traversing direction: | Pulling |
| Traverse linearity: | 20µin/8" (0.5µm/200mm) |

α-axis* Depends on Code #

| | |
|---|---|
| Inclination angle: | -45° to +10° |
| Resolution: | 0.000225° |
| Rotating speed: | 1rpm |

Z2-axis (column)

| | |
|---|---|
| Vertical travel: | 12" or 20" (300mm or 500mm) |
| Resolution: | 1.97µin (0.05µm) |
| Measurement method: | Reflective-type linear encoder |
| Drive speed: | 7.87"/s (200mm/s) (max., CNC)<br>0 - 2"/s (0 - 50mm/s) (joystick) |

Detector (optional)

| | |
|---|---|
| Range / resolution: | 32000 µin / .4 µin, 3200µin / .04µin, 320 µin / .004µin<br>(up to 96000 µin with an optional stylus)<br>{800µm / 0.01µm, 80µm / 0.001µm, 8µm / 0.0001µm (up to 2400µm with an optional stylus)} |
| Detecting method: | Skidless / skid measurement |
| Measuring force: | 0.75mN |
| Stylus tip: | 60°/2µmR |
| Skid radius of curvature: | 1.57" (40mm) |
| Detecting method: | Differential inductance |

# Formtracer Extreme SV-C4500CNC

## SERIES 525 — Surface Roughness/Form Measuring Instrument

### Y-axis table unit**

Measuring range: 8" (200mm)
Minimum reading : 1.97µin (0.05µm)
Scale unit: Reflective-type linear encoder
Drive speed: 200mm/s (max., CNC)
0 - 2"/s (0 - 50mm/s) (joystick)
Maximum loading capacity: 44 lbs (20kg)
Traverse linearity 20µin/8" (0.5µm/200mm) Surface roughness
80µin/8" (2µm/200mm) contour
Linear displacement accuracy (at 20°C):
± (80+20L)µin{± (2+2L/100) µm}
contour mode
L: Dimension between two measured points (mm)
Table size: 7.8 x 7.8"(200 x 200mm)
Dimensions (W x D x H): 2.6 x 25.4 x 4.1"
(320 x 646 x 105mm)
Mass: 77 lbs (35kg)

**Y-axis table included only as a factory installed option.

### Optional Accessories

**Machine vibration stand: 12AAE032**

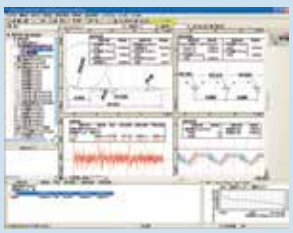
Vibration isolation mechanism: Diaphragm air spring
Natural frequency : 2.5 - 3.5Hz
Damping mechanism: Orifice
Leveling mechanism: Automatic control with mechanical valves
Air supply pressure: 0.4Mpa
Allowable loading capacity: 772 lbs (350kg)
Dimensions (W x D x H): 39.4 x 35.2 x 28.1"
(1000 x 895 x 715mm)
Mass: 617 lbs (280kg)

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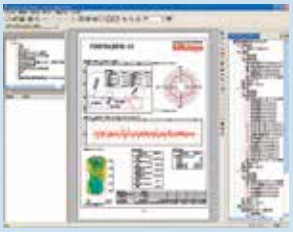
### Software

**FORMTRACEPAK V5**

Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. You can also perform contour evaluation that allows free analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, analysis results can be saved in the "html", "mhtml" or pdf format which allows Internet Explorer or MS-Word compatibility, allowing PC without layout editing programs to view analysis results.



Contour Measurement and Surface Roughness Measurement Screen



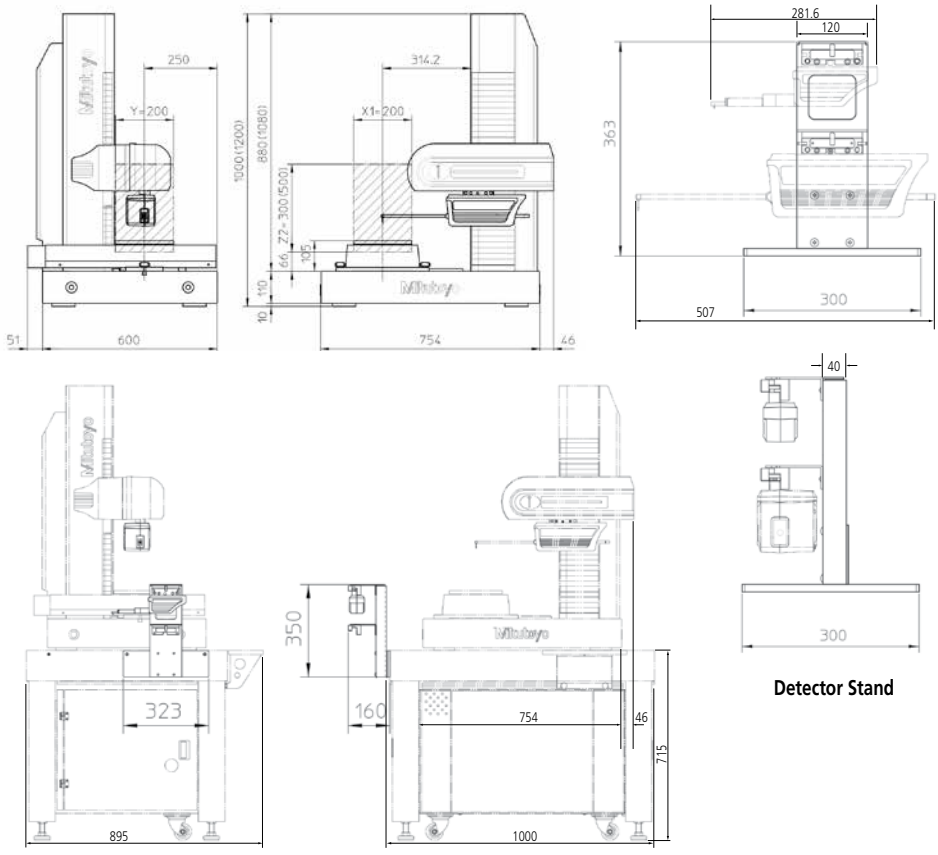
Report Layout Screen

### SPECIFICATIONS

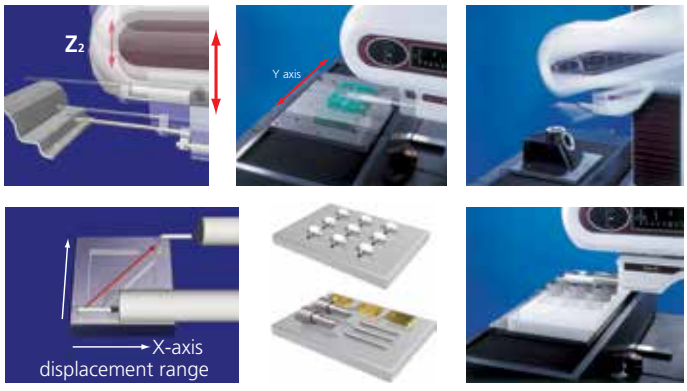
| Model No. | SV-C4500S CNC | SV-C4500H CNC |
|---|---|---|
| **Order No.** (100V - 120V) | **525-674-1** | **525-694-1A** |
| X1-axis measuring range | 8" (200mm) | 8" (200mm) |
| Z2-axis vertical travel | 12" (300mm) | 20"(500mm) |
| Y-axis table unit | Installed | Installed |
| α-axis unit | Installed | Installed |
| Granite base size (WxD) | 29.5 x 23.6"(750 x 600mm) | 29.5 x 23.6"(750 x 600mm) |
| Dimensions (main unit, WxDxH) | 31.5 x 24.4 x 39.4"(800 x 620 x 1000mm) | 31.5 x 24.4 x 47.2"(800 x 620 x 1200mm) |
| Mass (main unit) | 529 lbs (240kg) | 551 lbs (250kg) |

### DIMENSIONS

Unit: mm




Detector Stand






Mitutoyo

# Formtracer CS-3200

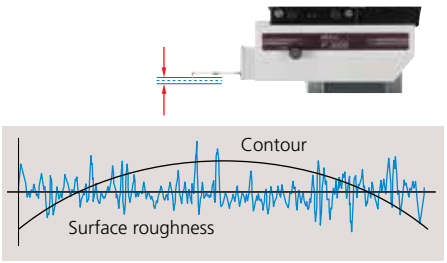
## SERIES 525 — Form Measuring Instruments



**CS-3200S4 with personal computer system and software**
* PC stand not included.

## FEATURES

- Highest measurement accuracy in its class.
  X axis: ±(1+0.01L)µm
  Z1 axis: ±(1.5+l2Hl/100)µm
- To detect surface roughness and contour in a single measurement the Z1-axis detector unit of CS-3200S4 has a wide measuring range and high resolution of 5mm / 0.08µm to 0.05mm / 0.0008µm.




- In order to maintain the traverse linearity specification for an extended period of time, Mitutoyo has adopted highly rigid ceramic guides that combine the characteristics of smallest secular change and remarkable resistance to abrasion.
- Drastically increased drive speed further reduces total measurement time.
  X axis: 80mm/s, Z2 axis: 20mm/s
- To enhance safety during fast traverse, the Z-axis detector unit incorporates a safety device (Automatic Stop-On-Collision Mechanism).
- The detector unit can be extended to avoid interference between the drive unit and workpiece. The measuring range is shifted to the left by 2.76" (70mm).



- Incorporation of an ABS scale in the Z2 axis eliminates the need for origin point re-setting conventionally required for every step of repeated measurements over step or multiple sections.
- Small holes and inclined planes can be efficiently measured using the inclined X-axis drive unit and fine-feed handles on the X and Z2 axes.
- All detector and drive unit cables are housed inside the main unit to eliminate any risk of abrasion and guarantee trouble-free, high-speed operation.
- Orientation of the drive unit can be inclined by ±45°. This allows CS-3200 to measure an inclined surface quickly.

ABSOLUTE®
Absolute System Patented by MITUTOYO

## Technical Data: Contour Measurement

X1-axis
- Measuring range: 4" (100mm)
- Resolution: 1.97µin (0.05µm)
- Measurement method: Reflective-type linear encoder
- Drive speed: 0 - 3.1"/s (0 - 80mm/s) and manual
- Measuring speed: .00078 - .00787"/s (0.02 - 0.2mm/s) (surface roughness) 0.00078 - 0.0787"/s (0.02 - 2mm/s) (contour)
- Measuring direction: Forward / Backward
- Traverse linearity: 8µin/4" (16µin/4") [0.2µm/100mm (0.4µm/100mm)] ( ): at the protruded detector position *with the X axis in horizontal orientation
- Linear displacement accuracy (at 20°C): ± (32+10L)µin {±(0.8+0.01L)µm} * L = Drive length (mm)
- Inclination range: ±45°

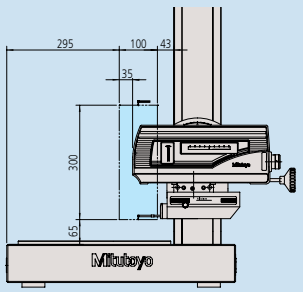
Z2-axis (column)
- Vertical travel: 12" (300mm)
- Resolution: 39.4µin (1µm)
- Measurement method: ABSOLUTE linear encoder
- Drive speed: 0 - .78"/s (0 - 20mm/s) and manual

Z1-axis (detector unit)
- Measuring resolution / range: 3µin/.2", .3µin/.02", .03µin/.002" (0.08µm/5mm, 0.008µm/0.5mm, 0.0008µm/0.05mm)
- Measurement method: Differential inductance method
- Linear displacement Accuracy (at 20°C): ±(60+20H)µin ±(1.5+2H/100)µm *H: Measurement height from the horizontal position (mm)
- Stylus up/down operation: Arc movement
- Face of stylus: Downward
- Measuring force: 0.75mN
- Traceable angle: Ascent: 65°, descent: 65° (using the standard stylus provided and depending on the surface roughness)
- Stylus tip: Radius: 2µm, diamond
- Base size (W x H): 23.6 x 17.7" (600 x 450mm)
- Base material: Granite
- Mass: 309 lbs (140kg) (main unit)
- Power supply: 100 – 240VAC ±10%, 50/60Hz
- Power consumption: 400W (main unit only)

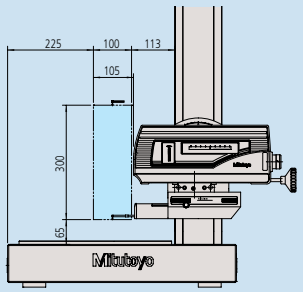
## Protrusion of Detector Position

**Normal detector position**

Unit: mm




**When detector is maximally extended**
**(Extended by 70mm from normal position)**



# Formtracer CS-3200

## SERIES 525 — Form Measuring Instruments

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
FORM

### Software

**FORMTRACEPAK6000**

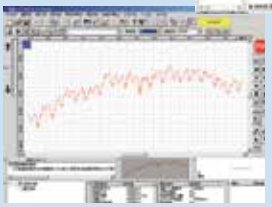
Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. You can also perform contour evaluation that allows free analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, you can create an original inspection certificate by setting the print format to suit your particular requirements.



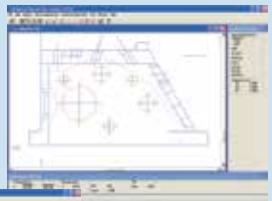
Measuring instrument control



Contour analysis



Surface roughness analysis



Design data creation (CAD file import)



Contour verification



Inspection certificate creation

**Main Unit Startup System**

This machine incorporates a startup system (relocation detection system), which disables operation when an unexpected vibration is applied or the machine is relocated. Be sure to contact your nearest Mitutoyo prior to relocating this machine after initial installation.

## SPECIFICATIONS

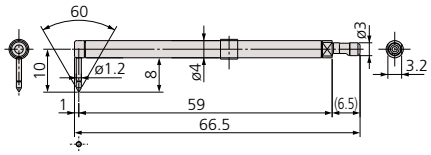
| Model No. | CS-3200S4 |
|---|---|
| **Order No.** (inch) | **525-411A** |
| X1-axis measuring range | 4" (100mm) |
| Z2-axis vertical travel | 12" (300mm) |

### Stylus

(Unit: inch (mm))

**Standard stylus: No. 12AAD554**

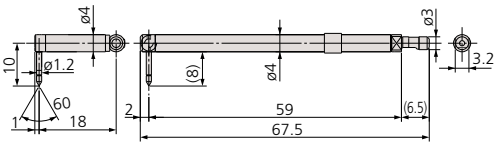
Tip radius: 2 µm
Tip angle: 60° cone
Tip material: Diamond




For contour/surface roughness measurement
Measurable depth: .28" (7mm) max.

**Eccentric stylus: No. 12AAD558**

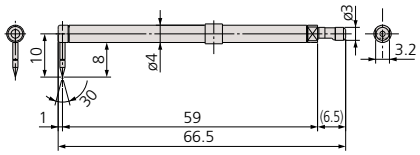
Tip radius: 2 µm
Tip angle: 60° cone
Tip material: Diamond




For contour/surface roughness measurement
Measurable offset length: .60" (15mm)

**Cone stylus: No. 12AAD552**

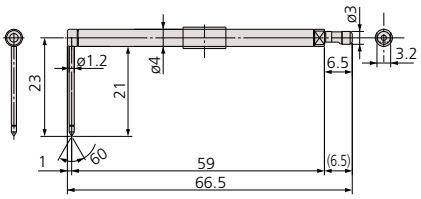
Tip radius: 25 µm
Tip angle: 30° cone
Tip material: Sapphire




For contour measurement
Measurable depth: .28" (7mm) max.

**Deep Groove stylus: No. 12AAD560**

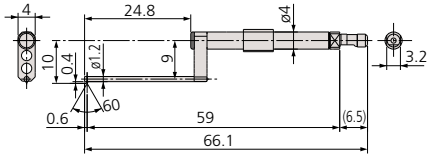
Tip radius: 2 µm
Tip angle: 60° cone
Tip material: Diamond




For contour/surface roughness measurement
Measurable depth: .79" (20mm) max.

**Small hole stylus: No. 12AAD556**

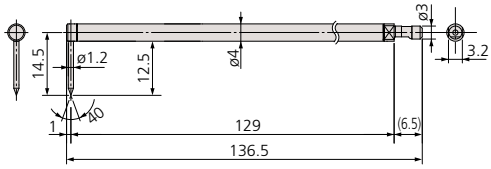
Tip radius: 2 µm
Tip angle: 60° cone
Tip material: Diamond



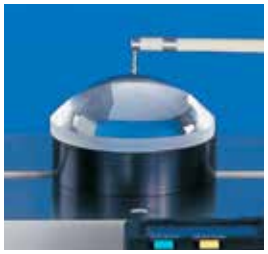

For contour/surface roughness measurement
Applicable hole: ø.08" (ø2mm) min.

**2x-long stylus: No. 12AAD562**

Tip radius: 5 µm
Tip angle: 40° cone
Tip material: Diamond




For contour/surface roughness measurement
Measurable depth: .39" (10mm) max.



**Measuring lens**



**Measuring ball screw**



**Measuring bearing ring**



Mitutoyo

# Formtracer Extreme CS-5000CNC / CS-H5000CNC

## SERIES 525 — CNC Form Measuring Instruments



**CS-H5000CNC with personal computer system and software**

* PC stand not included

**Remote box**



**Wide range detector employing active control technology**



## FEATURES

- High-accuracy stylus-type CNC surface measuring instrument allows simultaneous measurement of surface roughness and form/contour.
- The X1 axis has a maximum drive speed of 1.57"/s (40 mm/s) and Z2 axis has a maximum drive speed of 7.87"/s (200 mm/s). This permits high-speed positioning that may result in a large increase in the throughput of multiple-profile / multiple-workpiece measurement tasks.
- A Mitutoyo Laser Holoscale is incorporated in the X1 axis and Z1 axis so that high resolution (X1 axis: 6.25nm, Z1 axis: 4nm/8nm) is achieved and batch measurement of form / contour and surface roughness can be made.
- The active control method is employed for the Z1-axis detector to implement a wide-range measurement capability wherein the variation in dynamic measuring force is restricted.
- Since the Z1-axis detector incorporates an anti-collision safety device, the detector unit will automatically stop even if its main body collides with a workpiece or fixture.
- For models with the α-axis, it is possible to perform continuous measurement over horizontal and inclined surfaces by power-tilting the X1 axis.
- For models with the Y-axis table, it is possible to expand the measuring range for multiple workpieces, etc., through positioning in the Y-axis direction.
- Supplied with the easy-to-operate Remote Box, the user can make any movement by selecting the required axis using the two joysticks. The current axis selection is easily identified by the icon on the key top.
- Uses USB for communicating with the Data Processing / Analysis Unit (optional).

## Technical Data:

X1 axis

| | |
|---|---|
| Measuring range: | 8" (200mm) |
| Resolution: | 0.25µin (0.00625µm) |
| Measurement method: | Laser Holoscale |
| Drive speed: | Max. 1.57"/s (40mm/s) (in CNC mode)<br>0 - 1.57"/s (0 - 40mm/s)<br>(in joystick control mode) |
| Measuring speed: | .0008 - .008"/s (0.02 - 0.2mm/s)<br>(surface roughness)<br>.0008 - .08"/s (0.02 - 2mm/s)<br>(form/contour) |
| Measuring direction: | Forward / Backward |
| Traverse linearity: | (4+1.5L)µin {(0.1+0.0015L)µm}<br>with standard stylus<br>(8+1.5L)µin {(0.2+0.0015L)µm}<br>with 2X-long stylus |
| *Traverse linearity: | (2+3L)µin {(0.05+0.0003L)}µm with standard stylus<br>(4+1.5L)µin {(0.1+0.0015L)}µm with 2X-long stylus |
| Linear displacement accuracy ±(20°C): | ±(12+2L)µin<br>{±(0.3+0.002L)µm} |
| *Linear displacement accuracy ±(20°C): | ±(2.8+6.3+L)µin<br>{±(0.16+0.001L)µm}<br>L = Measured length inch (mm) |

Z1 axis

| | |
|---|---|
| Measuring range: | .47" (12mm) (with standard stylus)<br>.94" (24mm) (with 2X-long stylus) |
| Resolution: | .16µin (0.004µm) (with standard stylus)<br>.32µin (0.008µm) (with 2X-long stylus) |
| *Resolution: | .03µin (0.0008µm) (with standard stylus)<br>.06µin (0.0016µm) (with 2X-long stylus) |
| Stylus up/down: | Arc movement |
| Measurement method: | Transmission-type laser linear encoder |
| Linear displacement accuracy (20°C): | ±(12+120H)µin<br>{±(0.3+I0.02HI)µm} |
| *Linear displacement accuracy (20°C): | ±(2.8+120H)µin<br>{±(0.07+I0.02HI)µm}<br>H = Measured height inch (mm) |
| Measuring force: | 4mN (with standard stylus)<br>0.75mN (with 2X-long stylus) |
| Traceable angle: | 60° for ascent, 60° for descent<br>(Depending on the workpiece surface condition) |
| Stylus tip: (ball stylus) | Radius: 5µm, angle: 40°, diamond<br>(Radius: 0.25mm, sapphire) |
| Face of stylus: | Downward |

Z2 axis (column unit)

| | |
|---|---|
| Measuring range: | 12" (300mm) (20" (500mm) high column type) |
| Resolution: | 1.97µin (0.05µm) |
| Measurement method: | Reflective-type linear encoder |
| Drive speed: | Max. 7.87"/s (200mm/s) (in CNC mode)<br>0 - 1.97"/s (0 - 50mm/s)<br>(in joystick control mode) |
| Base size (W x D): | 29.5 x 23.6" (750 x 600mm) |
| Base material: | Granite |
| Dimension (W x D x H): | 31.5 x 24.4 39.4" (800 x 620 x 1000mm)<br>31.5 x 24.4 x 47.2"<br>(800 x 620 x 1200mm: high column type) |
| Mass: | 529 lbs (240kg) 551 lbs (250kg): high column type)) |

*CS-H5000CNC model in red.

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
FORM

# Formtracer Extreme CS-5000CNC / CS-H5000CNC

## SERIES 525 — CNC Form Measuring Instruments

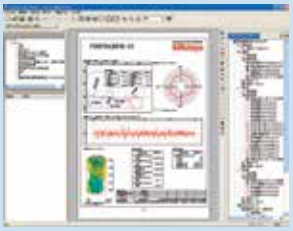
## Software

**FORMTRACEPAK V5**
Enables control of the optional motor-driven Y-axis table and rotary table for realizing efficient measurement automation. You can also perform contour evaluation that allows free analysis of level differences, angle, pitch, area and other characteristics based on surface roughness data. In addition, analysis results can be saved in the "html", "mhtml" or pdf format which allows Internet Explorer or MS-Word compatibility, allowing PC without layout editing programs to view analysis results.



Contour Measurement and Surface Roughness Measurement Screen

Report Layout Screen



**ASLPAK (optional software)**
Aspherical lens analysis program recommended to be used with CS-H5000CNC and CS-5000CNC models. To make full use of software functions, optional accessories such as y-axis table, 3DALT and theta θ-1 table are required. The functions can be restricted without the optional accessories.



## SPECIFICATIONS

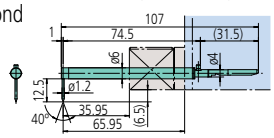
| Model No. | CS-5000CNC | CS-5000CNC |
|---|---|---|
| **Order No.** (100V - 120V) | **525-727-13** | **525-729-13** |
| X1-axis measuring range | 8" (200mm) | 8" (200mm) |
| Z2-axis vertical travel | 12" (300mm) | 12" (300mm) |
| Y-axis table unit | — | Installed |
| α-axis unit | Installed | Installed |

| Model No. | CS-5000CNC | CS-5000CNC |
|---|---|---|
| **Order No.** (100V - 120V) | **525-747-13** | **525-749-13** |
| X1-axis measuring range | 8" (200mm) | 8" (200mm) |
| Z2-axis vertical travel | 20" (500mm) | 20" (500mm) |
| Y-axis table unit | — | Installed |
| α-axis unit | Installed | Installed |

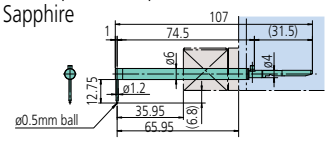
| Model No. | CS-H5000CNC | CS-H5000CNC | CS-H5000HCNC | CS-H5000HCNC |
|---|---|---|---|---|
| **Order No.** (100V - 120V) | **525-776-13** | **525-777-13** | **525-706-13** | **525-707-13** |
| X1-axis measuring range | 8" (200mm) | 8" (200mm) | 8" (200mm) | 8" (200mm) |
| Z2-axis vertical travel | 12" (300mm) | 12" (300mm) | 20" (500mm) | 20" (500mm) |
| Y-axis table unit | — | Installed | — | Installed |

## Stylus

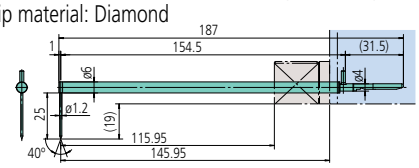
**12AAD543***1**:** Standard-length stylus (tip radius: 5µm)
**12AAJ037***2**:** For CS-H5000CNC (tip radius: 5µm)
Tip material: Diamond



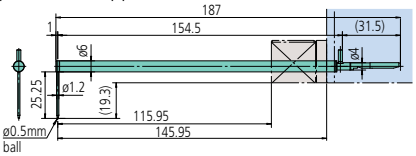

**12AAD544***1*2**:** Standard-length ball stylus (tip radius: 5µm)
Tip material: Sapphire



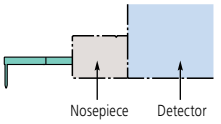

**12AAD545***1**:** Double-length stylus (tip radius: 5µm)
**12AAJ039***2**:** For CS-H5000CNC (tip radius: 5µm)
Tip material: Diamond



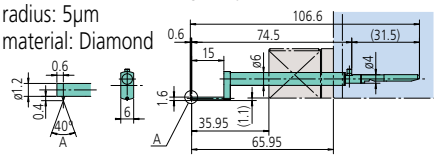

**12AAD546***1*2**:** Double-length ball stylus
Tip material: Sapphire



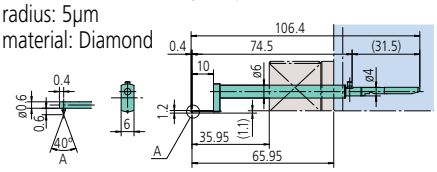

*1: Standard accessory of CS-5000CNC
*2: Standard accessory of CS-H5000CNC



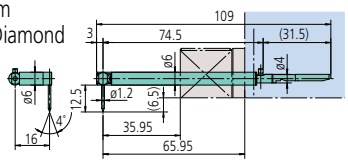

**12AAD651:** Standard-length stylus for small hole
Tip radius: 5µm
Tip material: Diamond



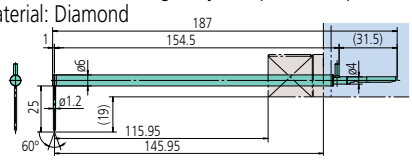

**12AAD652:** Standard-length stylus for extra-small hole
Tip radius: 5µm
Tip material: Diamond




**12AAD653:** Standard-length eccentric stylus
Tip radius: 5µm
Tip material: Diamond




**12AAJ041***2**:** Double-length stylus (tip radius: 2µm)
Tip material: Diamond

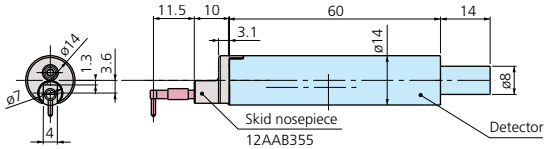




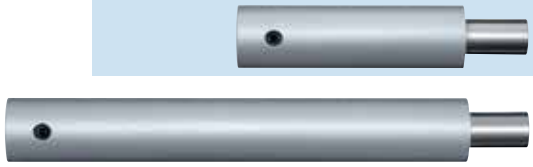

Mitutoyo

# Optional Styli for Surface Roughness Measurement

## Compatible with SJ-410, SJ-500, SV-2100, SV-3100, SV-3000CNC, SV-M3000CNC, SV-C3200, SV-C4500 Series




Detector (0.75mN): **178-396-2**
Detector (4mN): **178-397-2**

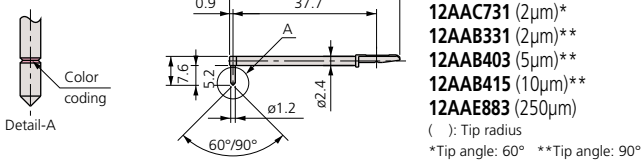


Extension rods
(12AAG202: 50mm, 12AAG203: 100mm)

## Styli

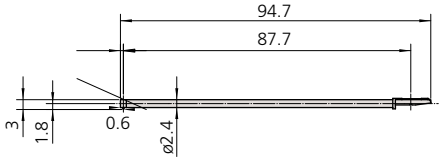
Unit: mm

### Standard stylus



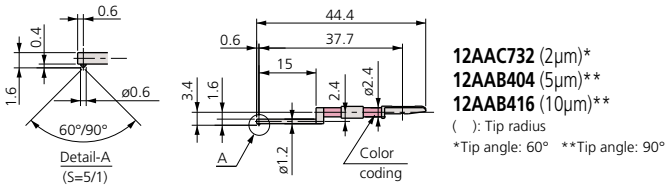

**12AAE882** (1µm)*
**12AAE924** (1µm)**
**12AAC731** (2µm)*
**12AAB331** (2µm)**
**12AAB403** (5µm)**
**12AAB415** (10µm)**
**12AAE883** (250µm)
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### 2X long for deep hole



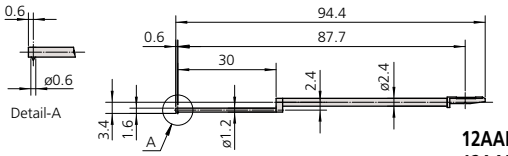

**12AAE898** (2µm)*
**12AAE914** (5µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For small hole



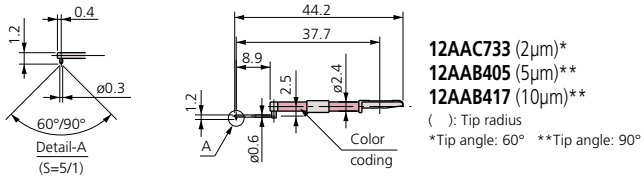

**12AAC732** (2µm)*
**12AAB404** (5µm)**
**12AAB416** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For small hole/2X long for deep hole



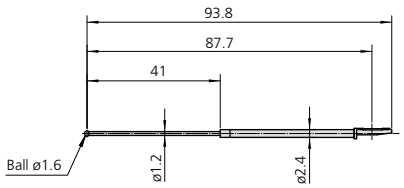

**12AAE892** (2µm)*
**12AAE908** (5µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For extra-small hole



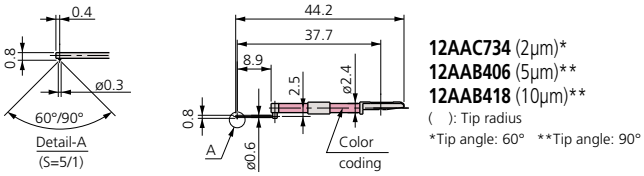

**12AAC733** (2µm)*
**12AAB405** (5µm)**
**12AAB417** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For small hole*2



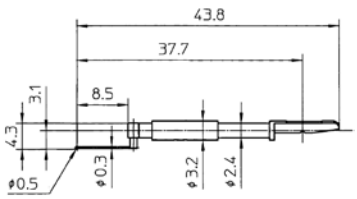

**12AAE884** (0.8mm)
( ): Tip radius

### For extra-minute hole



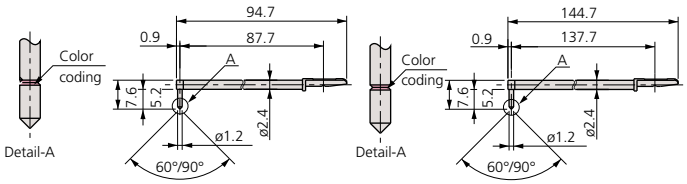

**12AAC734** (2µm)*
**12AAB406** (5µm)**
**12AAB418** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For ultra-small hole *1*2




**12AAJ662** (0.25mm)
( ): Tip radius

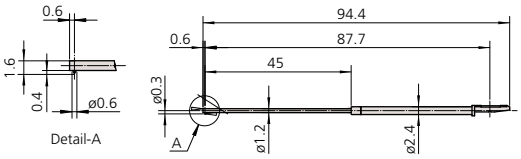
### For deep hole (2X long and 3X long)




2X stylus
**12AAC740** (2µm)*
**12AAB413** (5µm)**
**12AAB425** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

3X stylus
**12AAC741** (2µm)*
**12AAB414** (5µm)**
**12AAB426** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For small-slotted hole




**12AAE938** (2µm)*
**12AAE940** (5µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

*1: For downward-facing measurement only
*2: Used for calibration, a standard step gauge (No.178-611, option) is also required.

| Tip radius | 1µm | 2µm | 5µm | 10µm | 250µm |
|---|---|---|---|---|---|
| Color coding | White | Black | No color | Yellow | No notch or color |

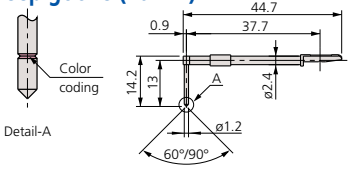
# Optional Styli for Surface Roughness Measurement

## Compatible with SJ-410, SJ-500, SV-2100, SV-3200, SV-3000CNC, SV-M3000CNC, SV-C3200, SV-C4500 Series

## Styli

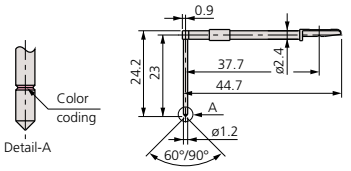
Unit: mm

### For deep goove (10mm)



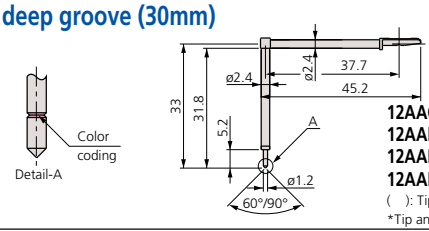

**12AAC735** (2µm)*
**12AAB409** (5µm)**
**12AAB421** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For deep groove (20mm)



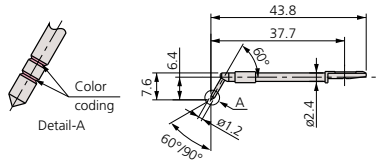

**12AAC736** (2µm)*
**12AAB408** (5µm)**
**12AAB420** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For deep groove (30mm)



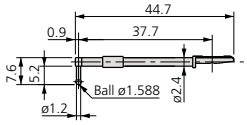

**12AAC737** (2µm)*
**12AAB335** (2µm)**
**12AAB407** (5µm)**
**12AAB419** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For gear tooth



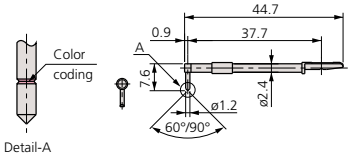

**12AAB339** (2µm)*
**12AAB410** (5µm)**
**12AAB422** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For rolling circle waviness surface*2



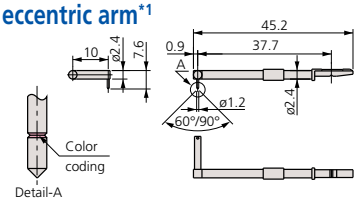

**12AAB338** (0.8mm)
( ): Tip radius

### For knife-edge detector



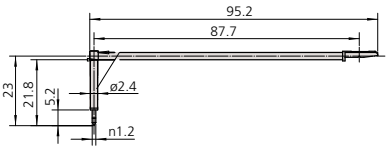

**12AAC738** (2µm)*
**12AAB411** (5µm)**
**12AAB423** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For eccentric arm*1



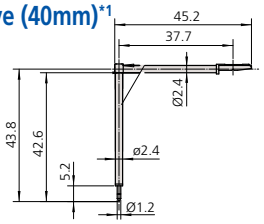

**12AAC739** (2µm)*
**12AAB412** (5µm)**
**12AAB424** (10µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For deep groove (20mm)*1/2X Long for deep hole



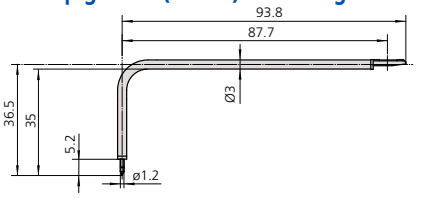

**12AAE893** (2µm)*
**12AAE909** (5µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For deep groove (40mm)*1



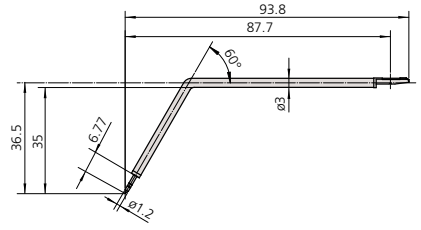

**12AAE895** (2µm)*
**12AAE911** (5µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For deep groove (30mm)*1/2X Long for deep hole



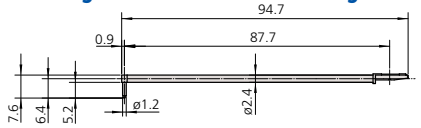

**12AAE894** (2µm)*
**12AAE910** (5µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For gear tooth*1/2X Long for deep hole



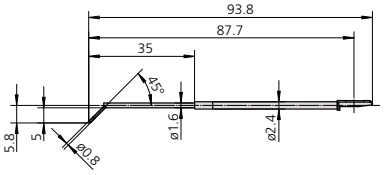

**12AAE896** (2µm)*
**12AAE912** (5µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For rolling circle waviness*1/2X Long for deep hole*2



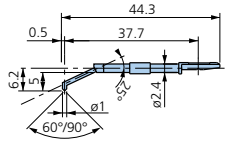

**12AAE886** (0.25mm)
( ): Tip radius

### For corner hole*1/2X Long for deep hole




**12AAM601** (2µm)*
**12AAM603** (5µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

### For bottom surface




**12AAE899** (2µm)*
**12AAE915** (5µm)**
( ): Tip radius
*Tip angle: 60° **Tip angle: 90°

| Tip radius | 1µm | 2µm | 5µm | 10µm | 250µm |
|---|---|---|---|---|---|
| Color coding | White | Black | No color | Yellow | No notch or color |

*1: For downward-facing measurement only
*2: Used for calibration, a standard step gauge (No.178-611, option) is also required.



Mitutoyo

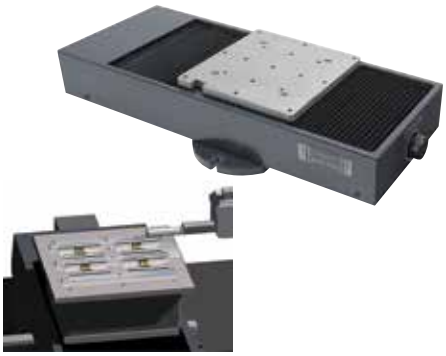
# Optional Accessories for Automatic Measurement

## Compatible with SV-3200, SV-C3200, SV-C4500, CS-3200 and CNC Models

### Y-axis table*: 178-097

A Y-axis table for both positioning and capable of 3D surface roughness measurement when used withoptional software FTPK-PRO or MCubeMap.**

* Not supporting Y-axis measurements. ** Only for **178-096**



| | 178-097 | 178-096 |
|---|---|---|
| Travel range | 8" (200mm) | 4" (100mm) |
| Resolution | 1.97µin (0.05µm) | 1.97µin (0.05µm) |
| Positioning accuracy | ±3µm | ±1µm |
| Drive speed | Max. 3.15"/s (80mm/s) | Max. .78"/s (20mm/s) |
| Maximum load | 110 lbs (50kg) | 33 lbs (50kg) |
| Mass | 62 lbs (28kg) | 68 lbs (31kg) |

### θ2-axis table: 178-078*

You can measure multiple points on a cylindrical workpiece and automate front/rear-side measurement.

* θ2-axis mounting plate (**12AAE718**) is required when directly installing on the base of the SV-3100.



| | |
|---|---|
| Displacement | 360° |
| Resolution | 0.0072° |
| Maximum load (loading moment) | 8.8 lbs (4kg) (343 N•cm or less) |
| Rotational speed | Max. 18°/s |
| Mass | 11 lbs (5kg) |

### Quick chuck: 211-032

This chuck is useful when measuring small workpieces. You can easily clamp them with its knurled ring.

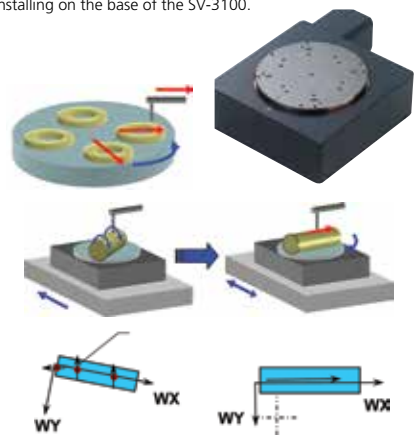


| | | |
|---|---|---|
| Retention range | Inner latch | OD: ø.04 - 1.42" (1 - 36mm) |
| | Inner latch | ID: ø.55 - 2.76" (14 - 70mm) |
| | Outer latch | OD: ø.04 - 2.95" (1 - 75mm) |
| Dimensions | | ø 4.65 x 1.61" (118 x 41mm) |
| Mass | | 2.6 lbs (1.2kg) |

### θ1-axis table: 12AAD975*

For efficient measurement in the axial/transverse directions. When measuring a cylindrical workpiece, automatic alignment can be performed in combination with the Y-axis table.

* θ1-axis mounting plate (**12AAE630**) is required when directly installing on the base of the SV-3100.




| | |
|---|---|
| Displacement | 360° |
| Resolution | 0.004° |
| Maximum load | 26.5 lbs (12kg) |
| Rotational speed | Max. 10°/s |
| Mass | 15 lbs (7kg) |

### Auto-leveling table: 178-087

This is a stage that performs fully automatic leveling as measurement starts, freeing the user from this troublesome operation. Fully automatic leveling can be done quickly by anyone. In addition, the operation is easy and reliable.



| | |
|---|---|
| Inclination adjustment angle | ±2° |
| Maximum load | 15 lbs (7kg) |
| Table dimensions | 5.1 x 3.9"(130 x 100mm) |
| Mass | 7.7 lbs (3.5kg) |

### Micro-chuck: 211-031

This chuck is suitable for clamping extra-small diameter workpieces (ø1mm or less), which cannot be retained with the centering chuck.

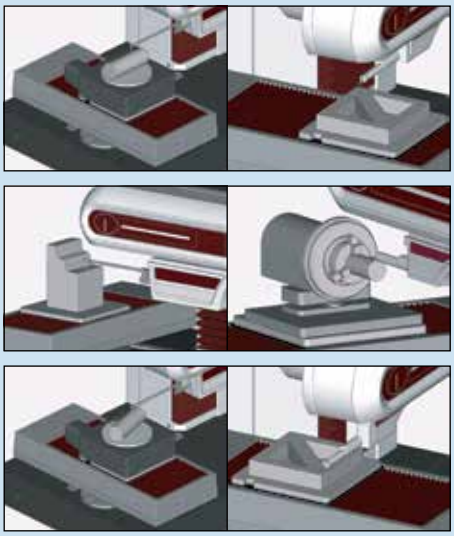


| | |
|---|---|
| Retention range | OD: ø 0 - .06" (0 - 1.5mm) |
| Dimensions | ø 4.65 x 1.9" (118 x 48.5mm) |
| Mass | 1.3 lbs (0.6kg) |

### Examples of optimal combinations of accessories for CNC models

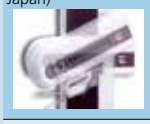
| Function \ Optional accessory | Y-axis Table | θ1 Table | θ2 Table |
|---|---|---|---|
| Automatic leveling | — | — | — |
| Automatic alignment (Patent registered: Japan) | ● | ● | — |
| Multiple workpiece batch measurement | ▲ | — | — |
| Measurement in the Y-axis direction | ● | — | — |
| Oblique measurement of XY plane ** | ● | — | — |
| Outside 3D surface roughness measurement/evaluation ** | ● | — | — |
| Multiple-piece measurement in the Y-axis direction (Positioning in the Y-axis direction) | ● | — | — |
| Multiple-piece measurement in the radius direction (Positioning in the rotating direction of XY plane) | ▲ | ● | — |
| Tracking measurement in the Z-axis direction * | — | — | — |
| Inclined surface measurement in the X-axis direction | ▲ | — | — |
| Inclined hole inside measurement in the X-axis direction | ▲ | — | — |
| Multiple cylinder generatrix line measurement | ▲ | — | ● |
| Measurement of both top and bottom surfaces | ▲ | — | ● |
| Rotary positioning of large workpiece *** | — | — | — |
| Upward/downward and frontward/backward measurement of large workpiece *** | — | — | — |

* : Applicable only to form/contour measurement
** : Applicable only to surface roughness measurement
*** : Applicable only for SV-M3000CNC

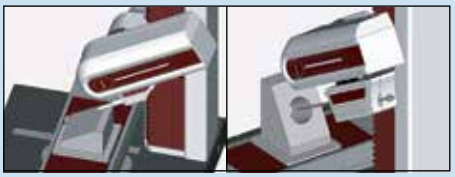


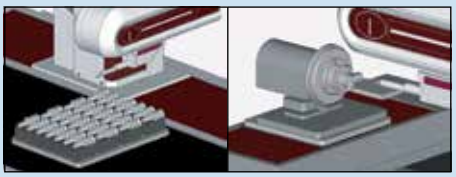
# Optional Accessories for Surftest / Formtracer

## Compatible with Desktop Models of Surftest and Formtracer

| Drive unit tilting function (Patent pending: Japan) | Large θ Table | Rotary-type detector holder |
|---|---|---|
|  |  |  |
| ● | — | — |
| ▲ | — | — |
| — | — | — |
| — | — | — |
| — | — | — |
| ▲ | — | — |
| — | — | — |
| — | — | — |
| — | — | — |
| ● | — | — |
| ● | — | — |
| — | — | — |
| — | — | — |
| — | ● | — |
| — | — | ● |

●: Essential ▲: Recommended
—: Not necessary

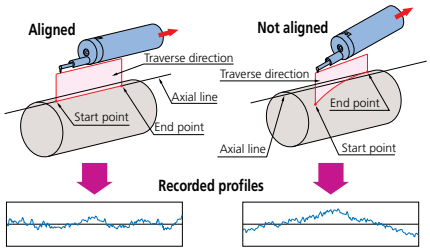


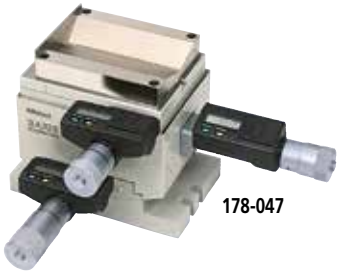




### 3-axis adjustment table

This table helps make the required alignment adjustments when measuring cylindrical surfaces. The corrections for the pitch angle and the swivel angle are determined from a preliminary measurement and the Digimatic micrometers are adjusted accordingly. A flat-surfaced workpiece also can be leveled with this table.





178-047





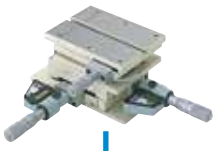
### Leveling table

**178-043-1** (mm), **178-053-1** (inch)
- Table top: 130 x 100mm
- Leveling range: ±1.5°
- XY travel: ±12.5mm



### Digital leveling table

**178-042-1** (mm)
**178-052-1** (inch)
- Table top: 130 x 100mm
- Leveling range: ±1.5°
- XY travel: ±12.5mm



### Leveling table

**178-016**
- Table top: 130 x 100mm
- Leveling range: ±1.5°
- Height: 40mm



### Calibration stand *1

**12AAM100**



### Calibration stand *2

**12AAG175**



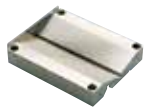
### Calibration stand *3

**12AAM309**



### V-block

**998291**
- Workpiece diameter: 1mm to 160mm
- Can be mounted on a leveling table



### Precision vise

**178-019**
- Max. workpiece size: 36mm
- Can be mounted on a leveling table.



### Cross-travel table

**218-001** (mm),
**218-011** (inch)
- Table top: 280 x 180mm
- XY travel: 100 x 50mm



### Cross-travel table

**218-041** (mm),
**218-051** (inch)
- Table top: 280 x 152mm
- XY travel: 50 x 25mm





### Rotary vise

**218-003**
- Two-slide jaw type.
- Max. workpiece size: ø60mm
- Minimum reading: 1°



### Center support

**172-142**
- Max. workpiece dia.: 120mm
- 60mm riser is optional



### Center support riser

**172-143**
- Used with a center support.
- Max. workpiece dia.: 240mm



### Swivel center support

**172-197**
- Max. workpiece dia.: 80mm*
  *65mm when swiveled 10°
- Max. workpiece length: 140mm



### Holder with clamp

**176-107**
- Used with a cross-travel table or rugged table.
- Max. workpiece height: 35mm


172-234 172-378

### V-block with clamp

**172-234, 172-378**
- Used with a cross-travel table or rugged table.
- Max. workpiece dia.: 50mm (**172-234**), 25mm (**172-378**)

*1: Required for calibrating upward measurement of **CV-3200** series.
*2: Required for calibrating in bulk by mounting straight arm/small-hole stylus arm without using cross-travel table and Y-axis table.
*3: Required for calibrating in bulk by mounting straight arm/eccentric arm/small-hole stylus arm without using cross-travel table and Y-axis table.



Mitutoyo

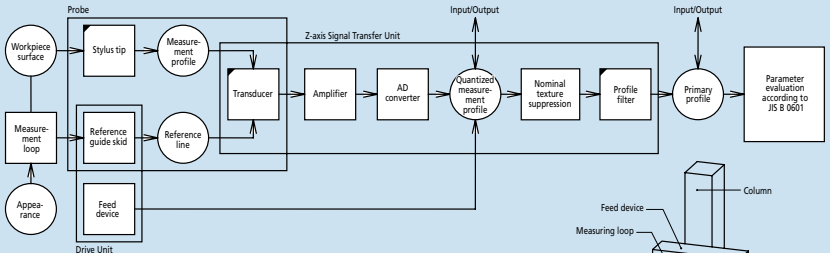
# Quick Guide to Precision Measuring Instruments

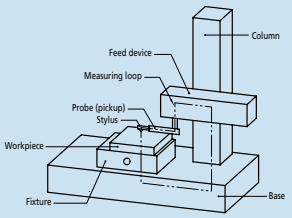
## Surftest (Surface Roughness Testers)

- JIS B 0601:2001 Geometric Product Specifications (GPS) –Surface Texture: Profile method– Terms, definitions, and surface texture parameters
- JIS B 0632:2001 Geometric Product Specifications (GPS) –Surface Texture: Profile method– Metrological characterization of phase-correct filters
- JIS B 0633:2001 Geometric Product Specifications (GPS) –Surface Texture: Profile method– Rules and procedures for the assessment of surface texture
- JIS B 0651:2001 Geometric Product Specifications (GPS) –Surface Texture: Profile method– Nominal characteristics of contact (stylus) instruments

## Nominal Characteristics of Contact (Stylus) Instruments

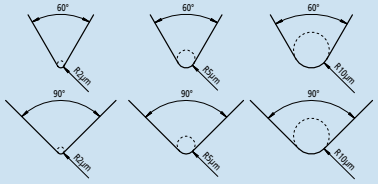
JIS B 0651: 2001 (ISO 3274: 1996)




### Stylus Shape

A typical shape for a stylus end is conical with a spherical tip.
Tip radius: $r_{tip}$ = 2 µm, 5 µm or 10 µm
Taper angle of cone: 60°, 90°
In typical surface roughness testers, the taper angle of the stylus end is 60° unless otherwise specified.




### Static Measuring Force

| Nominal radius of curvature of stylus tip: µm | Static measuring force at the mean position of stylus: mN | Tolerance on static measuring force variations: mN/µm |
|---|---|---|
| 2 | 0.75 | 0.035 |
| 5 | 0.75 (4.0) Note 1 | 0.2 |
| 10 | | |

Note 1: The maximum value of static measuring force at the average position of a stylus is to be 4.0mN for a special structured probe including a replaceable stylus.

### Relationship between Cutoff Value and Stylus Tip Radius

The following table lists the relationship between the roughness profile cutoff value λc, stylus tip radius $r_{tip}$, and cutoff ratio λc/λs.

| λc mm | λs µm | λc/λs | Maximum $r_{tip}$ µm | Maximum sampling length µm |
|---|---|---|---|---|
| 0.08 | 2.5 | 30 | 2 | 0.5 |
| 0.25 | 2.5 | 100 | 2 | 0.5 |
| 0.8 | 2.5 | 300 | 2 Note 1 | 0.5 |
| 2.5 | 8 | 300 | 5 Note 2 | 1.5 |
| 8 | 25 | 300 | 10 Note 2 | 5 |

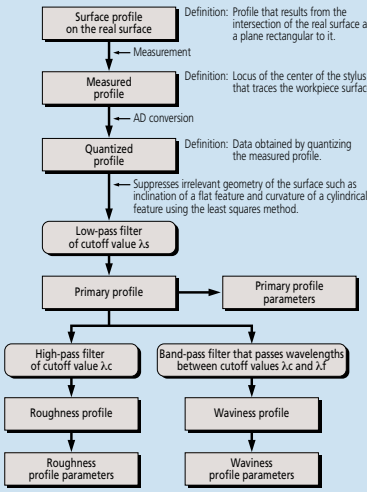
Note 1: For a surface with Ra>0.5µm or Rz>3µm, a significant error will not usually occur in a measurement even if $r_{tip}$= 5µm.
Note 2: If a cutoff value λs is 2.5µm or 8µm, attenuation of the signal due to the mechanical filtering effect of a stylus with the recommended tip radius appears outside the roughness profile pass band. Therefore, a small error in stylus tip radius or shape does not affect parameter values calculated from measurements. If a specific cutoff ratio is required, the ratio must be defined.

## Metrological Characterization of Phase Correct Filters

JIS B 0632: 2001 (ISO 11562: 1996)

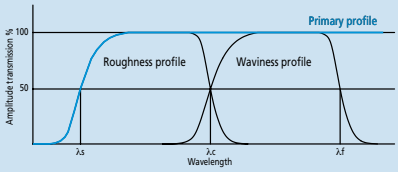
A profile filter is a phase-correct filter without phase delay (cause of profile distortion dependent on wavelength).
The weight function of a phase-correct filter shows a normal (Gaussian) distribution in which the amplitude transmission is 50% at the cutoff wavelength.

## Data Processing Flow



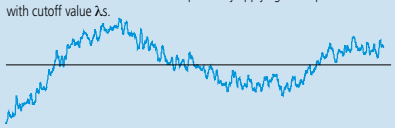

## Surface Profiles

JIS B 0601: 2001 (ISO 4287: 1997)




### Primary Profile

Profile obtained from the measured profile by applying a low-pass filter with cutoff value λs.



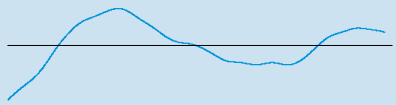
### Roughness Profile

Profile obtained from the primary profile by suppressing the longer wavelength components using a high-pass filter of cutoff value λc.



### Waviness Profile

Profile obtained by applying a band-pass filter to the primary profile to remove the longer wavelengths above λf and the shorter wavelengths below λc.



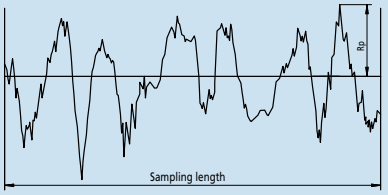
## Definition of Parameters

JIS B 0601 : 2001 (ISO 4287 : 1997)

### Amplitude Parameters (peak and valley)

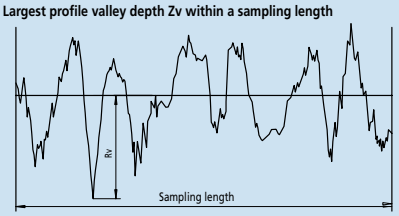
Maximum peak height of the primary profile Pp
Maximum peak height of the roughness profile Rp
Maximum peak height of the waviness profile Wp

**Largest profile peak height Zp within a sampling length**



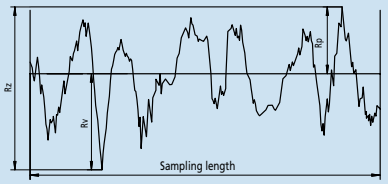

Maximum valley depth of the primary profile Pv
Maximum valley depth of the roughness profile Rv
Maximum valley depth of the waviness profile Wv

**Largest profile valley depth Zv within a sampling length**




Maximum height of the primary profile Pz
Maximum height of the roughness profile Rz
Maximum height of the waviness profile Wz

**Sum of height of the largest profile peak height Zp and the largest profile valley depth Zv within a sampling length**

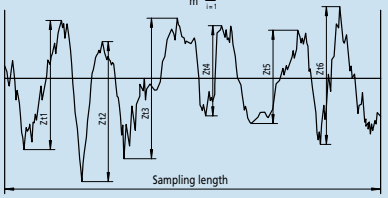



In Old JIS and ISO 4287-1: 1984, Rz was used to indicate the "ten point height of irregularities." Care must be taken because differences between results obtained according to the existing and old standards are not always negligibly small. (Be sure to check whether the drawing instructions conform to existing or old standards.)

Mean height of the primary profile elements Pc
Mean height of the roughness profile elements Rc
Mean height of the waviness profile elements Wc

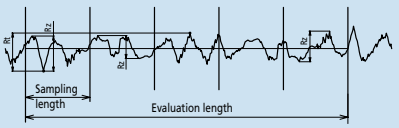
**Mean value of the profile element heights Zt within a sampling length**

$$Pc, Rc, Wc = \frac{1}{m}\sum_{i=1}^{m} Zt_i$$




Total height of the primary profile Pt
Total height of the roughness profile Rt
Total height of the waviness profile Wt

**Sum of the height of the largest profile peak height Zp and the largest profile valley depth Zv within the evaluation length**



## Amplitude Parameters (average of ordinates)

Arithmetical mean deviation of the primary profile Pa
Arithmetical mean deviation of the roughness profile Ra
Arithmetical mean deviation of the waviness profile Wa

**Arithmetic mean of the absolute ordinate values Z(x) within a sampling length**

$$Pa, Ra, Wa = \frac{1}{l}\int_0^l |Z(x)|dx$$

with l as lp, lr, or lw according to the case.

Root mean square deviation of the primary profile Pq
Root mean square deviation of the roughness profile Rq
Root mean square deviation of the waviness profile Wq

**Root mean square value of the ordinate values Z(x) within a sampling length**

$$Pq, Rq, Wq = \sqrt{\frac{1}{l}\int_0^l Z^2(x)dx}$$

with l as lp, lr, or lw according to the case.

Skewness of the primary profile Psk
Skewness of the roughness profile Rsk
Skewness of the waviness profile Wsk

**Quotient of the mean cube value of the ordinate values Z(x) and the cube of Pq, Rq, or Wq, respectively, within a sampling length**

$$Rsk = \frac{1}{Rq^3}\left[\frac{1}{lr}\int_0^{lr} Z^3(x)dx\right]$$

The above equation defines Rsk. Psk and Wsk are defined in a similar manner. Psk, Rsk, and Wsk are measures of the asymmetry of the probability density function of the ordinate values.

Kurtosis of the primary profile Pku
Kurtosis of the roughness profile Rku
Kurtosis of the waviness profile Wku

**Quotient of the mean quartic value of the ordinate values Z(x) and the fourth power of Pq, Rq, or Wq, respectively, within a sampling length**

$$Rku = \frac{1}{Rq^4}\left[\frac{1}{lr}\int_0^{lr} Z^4(x)dx\right]$$

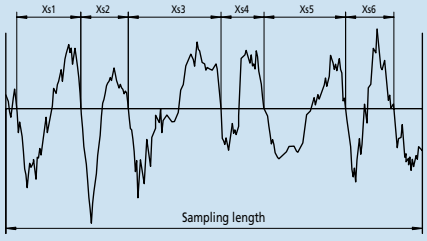
The above equation defines Rku. Pku and Wku are defined in a similar manner. Pku, Rku, and Wku are measures of the sharpness of the probability density function of the ordinate values.

## Spacing Parameters

Mean width of the primary profile elements PSm
Mean width of the roughness profile elements RSm
Mean width of the waviness profile elements WSm

**Mean value of the profile element widths Xs within a sampling length**

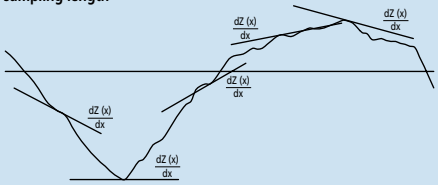
$$PSm, RSm, WSm = \frac{1}{m}\sum_{i=1}^{m} X_{si}$$




## Hybrid Parameters

Root mean square slope of the primary profile PΔq
Root mean square slope of the roughness profile RΔq
Root mean square slope of the waviness profile WΔq

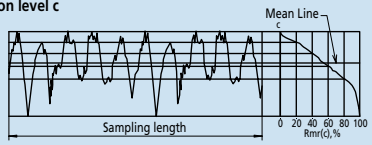
**Root mean square value of the ordinate slopes dZ/dX within a sampling length**




## Curves, Probability Density Function, and Related Parameters

Material ratio curve of the profile (Abbott-Firestone curve)

**Curve representing the material ratio of the profile as a function of section level c**




Material ratio of the primary profile Pmr(c)
Material ratio of the roughness profile Rmr(c)
Material ratio of the waviness profile Wmr(c)

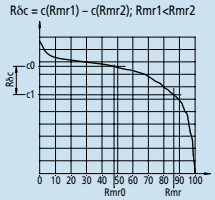
**Ratio of the material length of the profile elements Ml(c) at a given level c to the evaluation length**

$$Pmr(c), Rmr(c), Wmr(c) = \frac{Ml(c)}{ln}$$

Section height difference of the primary profile Pdc
Section height difference of the roughness profile Rdc
Section height difference of the waviness profile Wdc

**Vertical distance between two section levels of a given material ratio**

$$R\delta c = c(Rmr1) - c(Rmr2);\ Rmr1<Rmr2$$




Relative material ratio of the primary profile Pmr
Relative material ratio of the roughness profile Rmr
Relative material ratio of the waviness profile Wmr

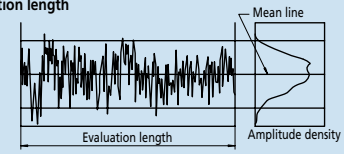
**Material ratio determined at a profile section level Rδc (or Pδc or Wδc), related to the reference section level c0**

$$Pmr, Rmr, Wmr = Pmr(c1), Rmr(c1), Wmr(c1)$$

where $c1 = c0 - R\delta c(R\delta c, W\delta c)$
$c0 = c(Pm0, Rmr0, Wmr0)$

Probability density function
(profile height amplitude distribution curve)

**Sample probability density function of the ordinate Z(x) within the evaluation length**

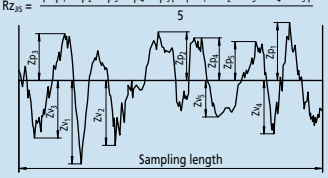



## JIS Specific Parameters

Ten-point height of irregularities, $Rz_{JIS}$

**Sum of the absolute mean height of the five highest profile peaks and the absolute mean depth of the five deepest profile valleys, measured from the mean line within the sampling length of a roughness profile. This profile is obtained from the primary profile using a phase-correct band-pass filter with cutoff values of lc and ls.**

$$Rz_{JIS} = \frac{|Zp_1+Zp_2+Zp_3+Zp_4+Zp_5| + |Zv_1+Zv_2+Zv_3+Zv_4+Zv_5|}{5}$$




| Symbol | Used profile |
|---|---|
| RzJIS82 | Surface profile as measured |
| RzJIS94 | Roughness profile derived from the primary profile using a phase-correct high-pass filter |

Arithmetic mean deviation of the profile $Ra_{75}$

**Arithmetic mean of the absolute values of the profile deviations from the mean line within the sampling length of the roughness profile (75%). This profile is obtained from a measurement profile using an analog high-pass filter with an attenuation factor of 12db/octave and a cutoff value of λc.**

$$Ra_{75} = \frac{1}{ln}\int_0^{ln} |Z(x)|dx$$

## Sampling Length for Surface Roughness Parameters

JIS B 0633: 2001 (ISO 4288: 1996)

**Table 1: Sampling lengths for aperiodic profile roughness parameters (Ra, Rq, Rsk, Rku, RΔq), material ratio curve, probability density function, and related parameters**

| Ra μm | Sampling length lr mm | Evaluation length ln mm |
|---|---|---|
| (0.006)<Ra≤0.02 | 0.08 | 0.4 |
| 0.02 <Ra≤0.1 | 0.25 | 1.25 |
| 0.1 <Ra≤2 | 0.8 | 4 |
| 2 <Ra≤10 | 2.5 | 12.5 |
| 10 <Ra≤80 | 8 | 40 |

**Table 2: Sampling lengths for aperiodic profile roughness parameters (Rz, Rv, Rp, Rc, Rt)**

| Rz Rz1max μm | Sampling length lr mm | Evaluation length ln mm |
|---|---|---|
| (0.025)<Rz, Rz1max≤0.1 | 0.08 | 0.4 |
| 0.1 <Rz, Rz1max≤0.5 | 0.25 | 1.25 |
| 0.5 <Rz, Rz1max≤10 | 0.8 | 4 |
| 10 <Rz, Rz1max≤50 | 2.5 | 12.5 |
| 50 <Rz, Rz1max≤200 | 8 | 40 |

1) Rz is used for measurement of Rz, Rv, Rp, Rc, and Rt.
2) Rzlmax only used for measurement of Rzlmax, Rvlmax, Rplmax, and Rclmax.

**Table 3: Sampling lengths for measurement of periodic roughness profile roughness parameters and periodic or aperiodic profile parameter Rsm**

| Rsm mm | Sampling length lr mm | Evaluation length ln mm |
|---|---|---|
| 0.013 <Rsm≤0.04 | 0.08 | 0.4 |
| 0.04 <Rsm≤0.13 | 0.25 | 1.25 |
| 0.13 <Rsm≤0.4 | 0.8 | 4 |
| 0.4 <Rsm≤1.3 | 2.5 | 12.5 |
| 1.3 <Rsm≤4 | 8 | 40 |

## Procedure for determining a sampling length if it is not specified

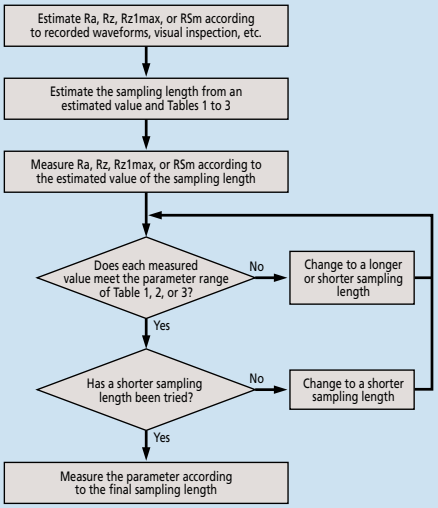



Table.1 Procedure for determining the sampling length of an aperiodic profile if it is not specified.

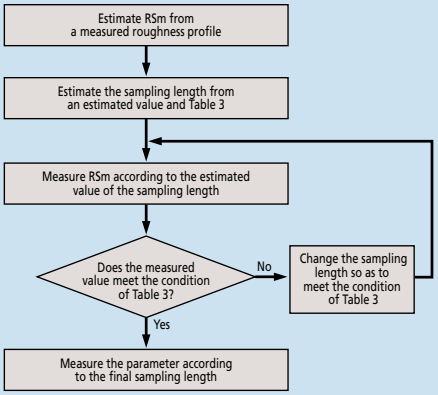



Table 2. Procedure for determining the sampling length of a periodic profile if it is not specified.



Mitutoyo

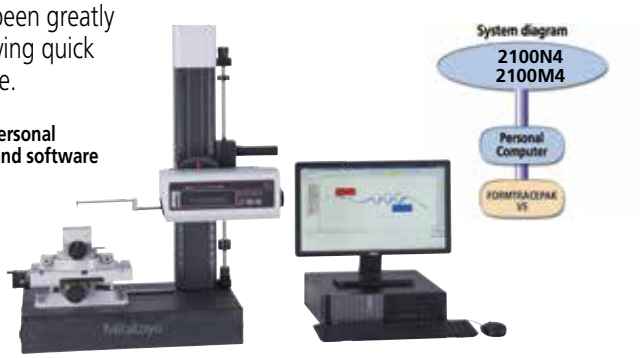
# Contracer CV-2100

## SERIES 218 — Contour Measuring Instruments

### FEATURES

- Newly designed high-precision digital ARC scale improves the Z-axis accuracy and resolution.
- Quick-release grip handle allows for rapid traverse in column Z-axis for CV-2100M4.
- Key operation buttons are now mounted onto the X-axis drive unit, eliminating wired remote box.
- X-axis traverse speed has been greatly improved to 20mm/s allowing quick positioning and set-up time.
- New added function for automatic stylus up/down means high-volume repetitive measurements are now capable with part programming.
- Z-axis detector measuring range has been improved to 50mm for both models.
- CV-2100N4 model can be mounted to optional manual column stand or custom fixture supplied by end user.

**CV-2100M4 with personal computer system and software**

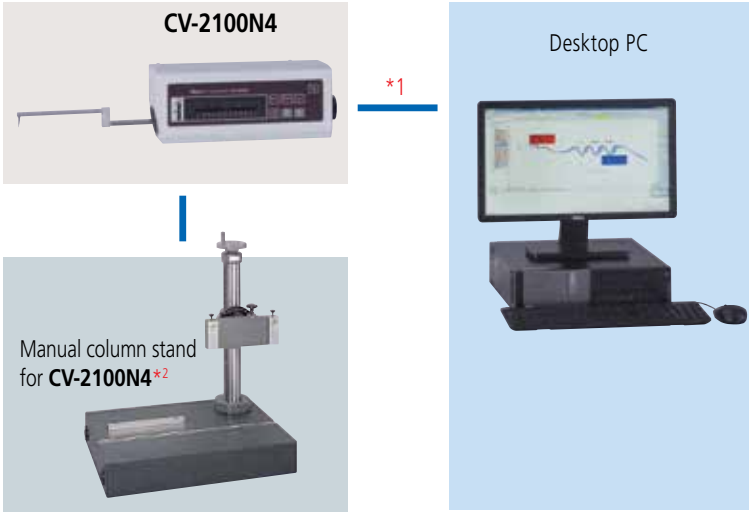



Connected to a personal computer, the FORMTRACEPAK V5 contour analysis program provides various modes of measurement and analysis.
*Printer not included


Centralized front control panel


Quick-vertical motion handle


X-axis jog shuttle




*1: If the **CV-2100N4** is operated without the dedicated manual stand, the measuring range of the Z-axis might be reduced, depending on the installation conditions. If you are considering using the **CV-2100N4** without the stand, contact your local Mitutoyo sales office for advice.

*2: Optional accessory **218-042** manual column stand

### Technical Data

X1-axis
- Measuring range: 4" (100mm) (CV-2100)
- Resolution: 3.93µin (0.1µm)
- Measurement method: STVC-10Z
- Drive speed: 0-.79"/s (0-20mm/s)
- Measuring speed: .000787"/s, .2"/s (.02, 5mm/s)
- Measuring direction: Forward / Backward
- Traverse linearity: 98.4µin/4" (2.5µm/100mm) (CV-2100)
- Linear displacement: ±(100+20L)µin ±(2.5+2L/100)µm
  * L = Drive length (mm)
- Inclining range: ±45°

Z2-axis (column)
- Column type: Manual (M4 type)
- Vertical travel: 13.8" (350mm) (M4 type)

Z1-axis (detector unit)
- Measuring range: 2" (50mm)
- Resolution: 3.93µin (0.1µm)
- Measurement method: Digital arc scale
- Linear displacement: ±(100+100h)µin ±(2.5+I0.1HI)µm
- Accuracy (at 20°C) *H: Measurement height from the horizontal position within ±1" (±25mm)
- Stylus up/down operation: Arc movement
- Face of stylus: Downward
- Measuring force: 30±10mN (3gf)
- Traceable angle: Ascent: 77°, descent: 87° (using the standard stylus provided and depending on the surface roughness)

Stylus tip: Radius: 25µm, carbide tip
Base size (W x H): 23.6 x 17.7" (600 x 450mm)
Base material: Granite
Mass: 321 lbs (145.8kg) (CV-2100M4),
Power supply: 100 – 240VAC ±10%, 50/60Hz
Power consumption: 30W (main unit only)

### Highly accurate arc scale



This scale directly tracks the arc trajectory of the stylus tip so that the most accurate compensation can be applied to the scale output, which leads to higher accuracy and resolution.

# Contracer CV-2100

## SERIES 218 — Contour Measuring Instruments

### Optional Accessories

**218-042**: Column stand for CV-2100N4 (vertical travel: 250mm, inclination: ±45°)
**218-001**: Cross-travel table (XY range: 100 x 50mm)
**218-011**: Cross-travel table (XY range: 4″ x 2")
**218-041**: Cross-travel table (XY range: 50 x 25mm)
**218-051**: Cross-travel table (XY range: 2″ x 1")
**218-002**: Rugged table
**176-107**: Holder with clamp
**218-003**: Rotary vise (heavy-duty type)
**172-144**: Rotary vise
**172-234**: V-block with clamp (Max. workpiece dia.: 50mm)
**172-378**: V-block with clamp (Max. workpiece dia.: 25mm)
**172-197**: Swivel center support
**172-142**: Center support
**172-143**: Center support riser
**998862**: Pin gage unit for calibration (mm)
**998861**: Pin gage unit for calibration (inch)
**———**: Arms and styli (See page J-32/33.)
**12AAG175**: Calibration table
**178-047**: 3-axis adjustment table

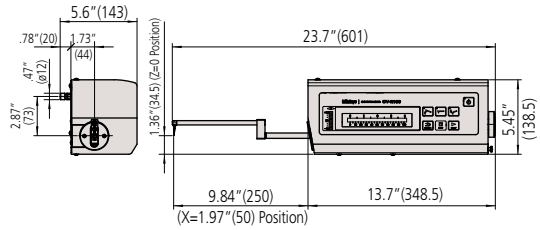
## SPECIFICATIONS

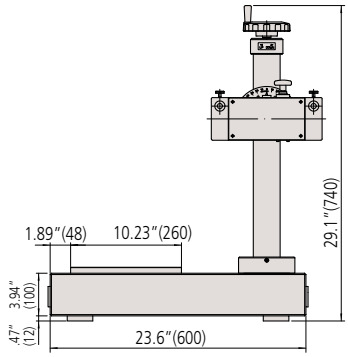
| Model | | CV-2100M4 | CV-2100N4 |
|---|---|---|---|
| **Order No.** | | **218-643A** | **218-623A** |
| Measurement range | X-axis | 4"(100mm) | |
| | Z1-axis (detector unit) | 2"(50mm) | |
| Z2-axis (column) travel range | | 13.8"(350mm) | — |
| X-axis inclination angle | | ±45° | — |
| Resolution | X-axis | 3.93µin (0.1µm) | |
| | Z1-axis | 3.93µin (0.1µm) | |
| Drive method | X-axis | Motorized drive 0 - 0.79in/s (0 - 20mm/s) | |
| | Z2-axis (column) | Manual (quick up-and-down motion, fine feed) | — |
| Measuring speed | | .00078 - .2"/sec (0.02 - 5mm/s) | |
| Linearity accuracy (X-axis horizontal orientation) | | 98.4µin/4in (2.5µm/100mm) | |
| Accuracy (20°C) | X-axis | ±(100+20L) µin [±(2.5+0.02L) µm)] L = Measurement Length (mm) | |
| | Z1-axis | ±(100+\|100H\|µin) [±(2.5+\|0.1H\|) µm] H = Measurementt height from horizontal position within 1"(±25mm) | |
| Measurement direction | | Forward / Backward | |
| Measurement surface direction | | Downward | |
| Measuring force | | (3gf) (30±10mN) | |
| Stylus traceable angle (Standard accessory stylus) | | Ascent 77°, Descent 87° (Depends on the surface condition) | |
| External dimensions (W×D×H) | | 29.3 x 17.7 x 34.8" (745×450×885mm) | 25.6 x 5.63 x 5.45" (651×143×138.5mm) |
| Mass | | 321.43 lbs (145.8 kg) | 12.78 lbs (5.8 kg) |

## DIMENSIONS

Unit: inch(mm)

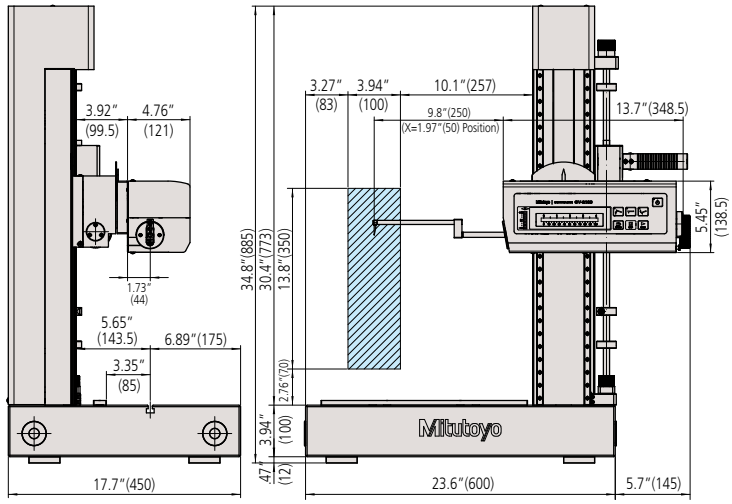
**CV-2100N4**



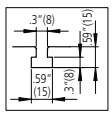




Optional Manual Column Stand for CV-2100N4

**CV-2100M4**




Measuring area




T-groove dimensions (**CV-2100M4**)



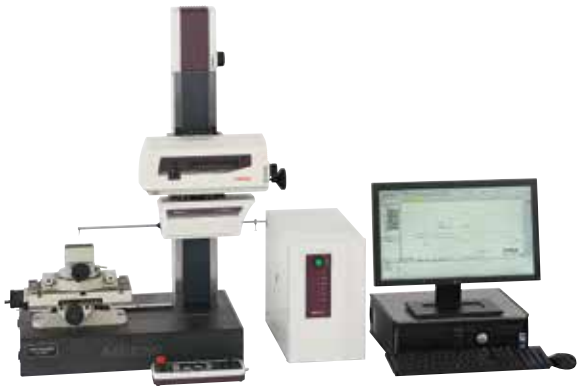
Mitutoyo

# Contracer CV-3200 / CV-4500

## SERIES 218 — Contour Measuring Instruments



CV-3200L4 (with options)



**CV-3200S4** with personal computer system and software

## CV-3200 FEATURES

- Dramatically increased drive speed (X axis: 80 mm/s, Z2 axis: 20 mm/s) further reduces total measurement time.
- In order to maintain the traverse linearity specification for an extended period of time, Mitutoyo has adopted highly rigid ceramic guides that combine the characteristics of smallest secular change and remarkable resistance to abrasion.
- With the support for a wide range of optional peripherals designed for use with the CNC models enables simplified CNC measurement.
- The drive unit (X-axis) and column (Z2-axis) are equipped with a high-accuracy linear encoders (ABS type on Z2-axis). This improves reproducibility of continuous automatic measurement of small holes in the vertical direction and repeated measurement of parts which are difficult to position.
- A newly designed straight arm reduces interference on the workpiece and expands the measurement range in the Z1 axis (height) direction.
- One-touch mounting and removal of the arm.
- X1-axis accuracy: ±(0.8+0.01L)µm*
  Z1-axis accuracy: ±(1.6+l2Hl/100)µm
  Designed to handle workpieces calling for high accuracy.

* CV-3200S4, H4, W4 types, L = Drive length, H = Measurement height (mm)

With the addition of a new function for continuously measuring top and bottom faces, the variable measuring force function has become more useful, enabling a wide variety of efficient, high-precision measurements.

## CV-4500 FEATURES

- When combined with the double cone-end stylus (a new product with diametrically opposed contact points), the instrument can continuously measure in the upward and downward directions without the need to change the arm orientation or reset the workpiece fixturing.
- The measuring force can be switched among five levels (upward and downward) from the data-processing program (Formtracepak).
- High-precision and high-speed drive has been achieved, significantly improving measurement efficiency.
- A newly designed straight arm has reduced interference on the workpiece and expanded the measurement range in the Z1 axis (height) direction.
- One-touch mounting and removal of the arm.



## Technical Data

X-axis

| | |
|---|---|
| Measuring range: | 4" (100mm) or 8" (200mm) |
| Resolution: | 1.97µin (0.05µm) |
| Measurement method: | Reflective-type linear encoder |
| Drive speed: | 3.15"/s (80mm/s) and manual |
| Measuring speed: | .0008 - .79"/s (0.02 - 20mm/s)* |

*Recommended speed: under 5mm/s
If using higher speed, stylus tip may be chipped and/or accuracy may be worse, depending on surface condition.

| | |
|---|---|
| Measuring direction: | Forward / Backward |
| Traverse linearity: | 32µin/4", 80µin/8" (0.8µm/100mm, 2µm/200mm) *with the X axis in horizontal orientation |
| Linear displacement accuracy (at 20°C): | (31.5+10L)µin {±(.8+0.01L)µm} (CV-3200S4, H4, W4, L4)<br>(32+10L)µin {±(0.8+0.01L)µm} (CV-4500S4, H4, W4, L4)<br>(31.5+20L)µin {±(0.8+0.02L)µm} (CV-3200S8, H8, W8, L8)<br>(32+20L)µin {±(0.8+0.02L)µm} (CV-4500S8, H8, W8, L8)<br>* L = Drive length (mm) |
| Inclining range: | ±45° |

Z2-axis (column)

| | |
|---|---|
| Vertical travel: | 10" (300mm) or 20" (500mm) |
| Resolution: | 39.4µin (1µm) |
| Measurement method: | ABSOLUTE linear encoder |
| Drive speed: | 0 - 1.2"/s (0 - 30mm/s) and manual |

Z1-axis (detector unit)

| | |
|---|---|
| Measuring range: | ±1.2" (±30mm) |
| Resolution: | 1.57µin (.04µm) (CV-3200 series), .78µin (0.02µm) (CV-4500 series) |
| Measurement method: | Rotory arc encoder (CV-3200 series), (CV-4500 series) |
| Linear displacement Accuracy (at 20°C): | ±(63+l20Hl)µin {±(1.4+l2Hl/100)µm} (CV-3200 series)<br>±(32+l20Hl)µin {±(0.8+l2Hl/100)µm} (CV-4500 series)<br>*H: Measurement height from the horizontal position (mm) |
| Stylus up/down operation: | Arc movement |
| Face of stylus: | Upward/downward |
| Measuring force: | 30mN (CV-3200) |
| Measuring force: | 10, 20, 30, 40, 50mN (CV-4500) (Specified from the data-processing program Formtracepak) |
| Traceable angle: | Ascent: 77°, descent: 83° (using the standard stylus provided and depending on the surface roughness) |
| Stylus tip | Radius: 25µm, carbide tip |
| Base size (W x H): | 17.7 x 23.6" (450 x 600mm) or 39.4 x 17.7" (1000 x 450mm) |
| Base material: | Granite |
| Power supply: | 100 – 240VAC ±10%, 50/60Hz |
| Power consumption: | 400W (main unit only) |




Refer to Bulletin No. (2177) for more details.

# Contracer CV-3200 / CV-4500

## SERIES 218 — Contour Measuring Instruments

## SPECIFICATIONS

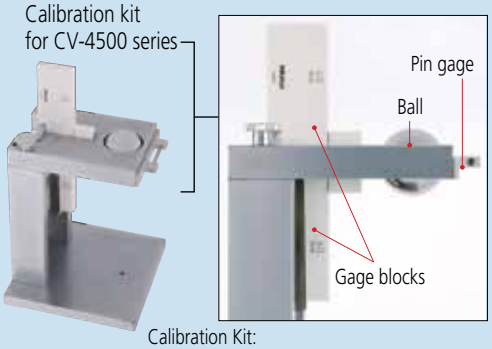
| Model No. | CV-3200S4 | CV-3200H4 | CV-3200W4 | CV-3200L4 |
|---|---|---|---|---|
| **Order No.** (inch) | **218-491-10A** | **218-492-10A** | **218-493-10A** | **218-494-10A** |
| Model No. | CV-4500S4 | CV-4500H4 | CV-4500W4 | CV-4500L4 |
| **Order No.** (inch) | **218-451-10A** | **218-452-10A** | **218-453-10A** | **218-454-10A** |
| X1-axis measuring range | 4" (100mm) | 4" (100mm) | 4" (100mm) | 4" (100mm) |
| Vertical travel | 12" (300mm) power column | 20" (500mm) power column | 20" (500mm) power column | 27.6" (700mm) power column |
| Granite base size (WxD) | 23.6 x 17.7" (600 x 450mm) | 23.6 x 17.7" (600 x 450mm) | 39.4 x 17.7" (1000 x 450mm) | 39.4 x 17.7" (1000 x 450mm) |
| Dimensions (main unit, WxDxH) | 29.2 x 17.7 x 35.6" (741 x 450 x 905mm) | 29.2 x 17.7 x 43.5" (741 x 450 x 1105mm) | 45.5 x 19 x 46.3" (1156 x 482 x 1176mm) | 45.5 x 19.4 x 56.5" (1156 x 492 x 1436mm) |
| Mass (main unit) | 309 lbs (140kg) | 331 lbs (150kg) | 485 lbs (220kg) | 595 lbs (270kg) |

| Model No. | CV-3200S8 | CV-3200H8 | CV-3200W8 | CV-3200L8 |
|---|---|---|---|---|
| **Order No.** (inch) | **218-496-10A** | **218-497-10A** | **218-498-10A** | **218-499-10A** |
| Model No. | CV-4500S8 | CV-4500H8 | CV-4500W8 | CV-4500L8 |
| **Order No.** (inch) | **218-456-10A** | **218-457-10A** | **218-458-10A** | **218-459-10A** |
| X1-axis measuring range | 8" (200mm) | 8" (200mm) | 8" (200mm) | 8" (200mm) |
| Vertical travel | 12" (300mm) power column | 20" (500mm) power column | 20" (500mm) power column | 27.6" (700mm) power column |
| Granite base size (WxD) | 23.6 x 17.7" (600 x 450mm) | 23.6 x 17.7" (600 x 450mm) | 39.4 x 17.7 (1000 x 450mm) | 39.4 x 17.7" (1000 x 450mm) |
| Dimensions (main unit, WxDxH) | 30.2 x 19 x 38" (767 x 482 x 966mm) | 30.2 x 19 x46" (767 x 482 x 1166mm) | 45.9 x 19 x 46.3" (1166 x 482 x 1176mm) | 45.9 x 19.4 x 56.5" (1166 x 492 x 1436mm) |
| Mass (main unit) | 309 lbs (140kg) | 331 lbs (150kg) | 485 lbs (220kg) | 595 lbs (270kg) |

### Collective Calibration Function

- A dedicated calibration gage enables the user to calibrate the instrument for Z-axis gain, symmetry, stylus-tip radius, etc., in a single procedure.

Calibration kit for CV-4500 series




Calibration Kit:
CV-4500: **12AAQ491**
CV-3200: **12AAQ489** (not shown)

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
FORM

### Software

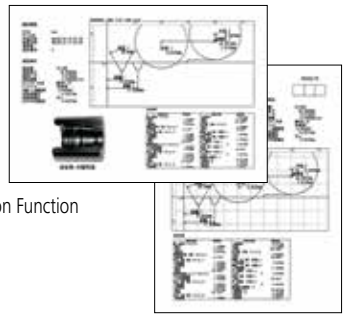
**FORMTRACEPAK V5**



Measurement Control Screen

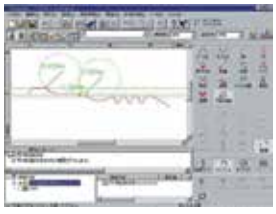


Profile Analysis Screen

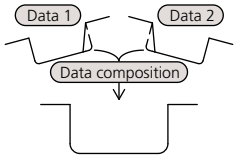


Report Creation Function

Automatic Circle/Line Application Function



Data Composition Function



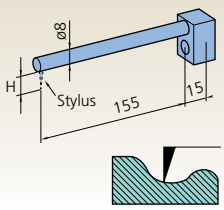



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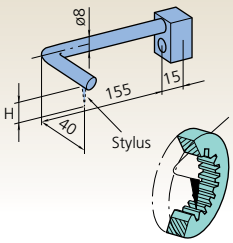
# Optional Arms and Styli for Contour Measurement

## For CV-2100

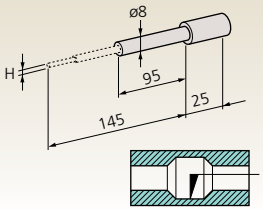
### Straight type



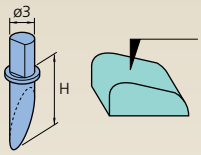

### Eccentric type




### For small-hole stylus

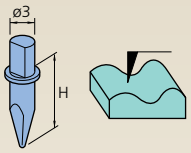



### Single bevel



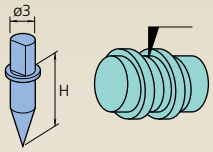

Tip angle: 12°
Tip radius: 25µm
Tip material: Carbide

### Cross ground



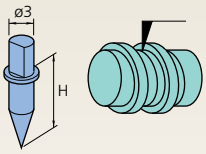

Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

### Cone



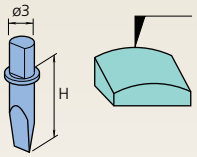

Tip angle: 30°/50°*
Tip radius: 25µm
Tip material: Carbide, Sapphire, Diamond*

### Cone



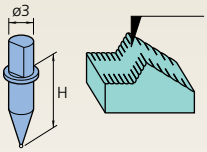

Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

### Knife edge



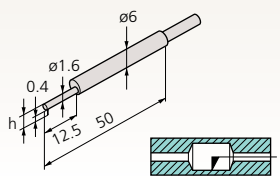

Tip angle: 20°
Edge width: 3mm
Tip radius: 25µm
Tip material: Carbide

### Ball



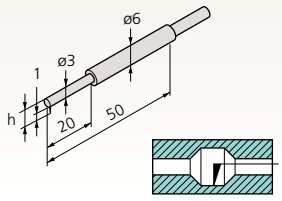

Ball dia: 1mm
Tip material: Carbide

### Small hole: 932693 / 12AAE873



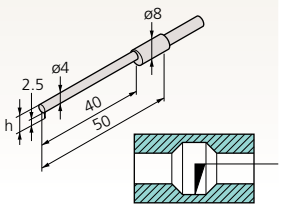

| | 932693 | 12AAE873 |
|---|---|---|
| Tip shape: | Single bevel | Cone |
| Tip angle: | 20° | 30° |
| Tip radius: | 25µm | 25µm |
| Tip material: | Carbide | Carbide |

### Small hole: 932694 / 12AAE874




| | 932694 | 12AAE874 |
|---|---|---|
| Tip shape: | Single bevel | Cone |
| Tip angle: | 20° | 30° |
| Tip radius: | 25µm | 25µm |
| Tip material: | Carbide | Carbide |

### Small hole: 932695 / 12AAE875




| | 932695 | 12AAE875 |
|---|---|---|
| Tip shape: | Single bevel | Cone |
| Tip angle: | 20° | 30° |
| Tip radius: | 25µm | 25µm |
| Tip material: | Carbide | Carbide |

## List of Applicable Arms

| Arm name | Order No. | Compatible stylus height |
|---|---|---|
| Straight type | 935111 | H = 6mm |
| | 935112 | H = 12mm |
| | 935113 | H = 20mm |
| | 935114 | H = 30mm |
| | 935115 | H = 42mm |
| Eccentric type | 935116 | H = 6mm |
| | 935117 | H = 12mm |
| | 935118 | H = 20mm |
| | 935119 | H = 30mm |
| | 935120 | H = 42mm |
| Small hole | 935110 | H = 0.4, 1, 2.5mm |

## List of Applicable Styli

| Stylus name | Order No. | Stylus height |
|---|---|---|
| Single-bevel stylus carbide-tipped | 354882 | H = 6mm |
| | 354883 | H = 12mm |
| | 354884 | H = 20mm |
| | 354885 | H = 30mm |
| | 354886 | H = 42mm |
| Cross-ground stylus carbide-tipped | 354887 | H = 6mm |
| | 354888 | H = 12mm |
| | 354889 | H = 20mm |
| | 354890 | H = 30mm |
| | 354891 | H = 42mm |
| Cone stylus carbide-tipped tip angle 20° | 12AAE865 | H = 6mm |
| | 12AAE866 | H = 12mm |
| | 12AAE867 | H = 20mm |
| | 12AAE868 | H = 30mm |
| | 12AAE869 | H = 42mm |
| Cone stylus sapphire tipped tip angle 30° *Diamond tipped *tip angle 50° | 354892 | H = 6mm |
| | 354893 | H = 12mm |
| | 354894 | H = 20mm |
| | 355129* | H = 20mm |
| | 354895 | H = 30mm |
| | 354896 | H = 42mm |
| Cone stylus carbide-tipped tip angle 30° | 12AAA566 | H = 6mm |
| | 12AAA567 | H = 12mm |
| | 12AAA568 | H = 20mm |
| | 12AAA569 | H = 30mm |
| | 12AAA570 | H = 42mm |
| Knife-edge stylus carbide-tipped | 354897 | H = 6mm |
| | 354898 | H = 12mm |
| | 354899 | H = 20mm |
| | 354900 | H = 30mm |
| | 354901 | H = 42mm |
| Ball stylus carbide-tipped | 354902 | H = 6mm |
| | 354904 | H = 20mm |
| | 354905 | H = 30mm |
| | 354906 | H = 42mm |
| Small-hole stylus carbide-tipped single bevel | 932693 | H = 2mm |
| | 932694 | H = 4mm |
| | 932695 | H = 6.5mm |
| Small-hole stylus carbide-tipped cone | 12AAE873 | H = 2mm |
| | 12AAE874 | H = 4mm |
| | 12AAE875 | H = 6.5mm |

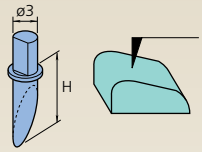
# Optional Styli for Contour Measurement

## CV-2100, CV-3200, CV-4500, SV-C3200, SV-C4500 and SV-C4500CNC

### List of Applicable Styli

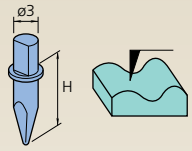
| Stylus name | Order No. | Stylus height |
|---|---|---|
| Single-bevel cut stylus carbide-tipped | **354882** | H = 6mm |
| | **354883** | H = 12mm |
| | **354884** | H = 20mm |
| | **354885** | H = 30mm |
| | **354886** | H = 42mm |
| Cross-ground stylus carbide-tipped | **354887** | H = 6mm |
| | **354888** | H = 12mm |
| | **354889** | H = 20mm |
| | **354890** | H = 30mm |
| | **354891** | H = 42mm |
| Cone stylus carbide-tipped tip angle 20° | **12AAE865** | H = 6mm |
| | **12AAE866** | H = 12mm |
| | **12AAE867** | H = 20mm |
| | **12AAE868** | H = 30mm |
| | **12AAE869** | H = 42mm |
| Cone stylus sapphire tipped tip angle 30° *Diamond tipped *tip angle 50° | **354892** | H = 6mm |
| | **354893** | H = 12mm |
| | **354894** | H = 20mm |
| | **355129*** | H = 20mm |
| | **354895** | H = 30mm |
| | **354896** | H = 42mm |
| Cone stylus carbide-tipped tip angle 30° | **12AAA566** | H = 6mm |
| | **12AAA567** | H = 12mm |
| | **12AAA568** | H = 20mm |
| | **12AAA569** | H = 30mm |
| | **12AAA570** | H = 42mm |
| Knife-edge stylus carbide-tipped | **354897** | H = 6mm |
| | **354898** | H = 12mm |
| | **354899** | H = 20mm |
| | **354900** | H = 30mm |
| | **354901** | H = 42mm |
| Ball stylus carbide-tipped | **354902** | H = 6mm |
| | **354904** | H = 20mm |
| | **354905** | H = 30mm |
| | **354906** | H = 42mm |

**Single-bevel**



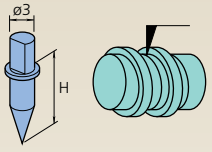

Tip angle: 12°
Tip radius: 25µm
Tip material: Carbide

**Cross-ground**



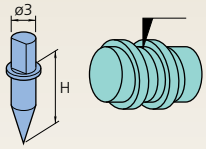

Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

**Cone**



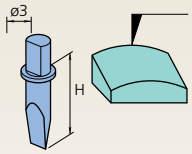

Tip angle: 30°/50°*
Tip radius: 25µm
Tip material: Carbide, Sapphire, Diamond*

**Cone**



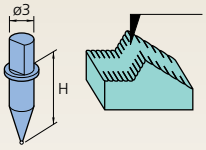

Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

**Knife edge**




Tip angle: 20°
Edge width: 3mm
Tip radius: 25µm
Tip material: Carbide

**Ball**




Ball dia: 1mm
Tip material: Carbide

• Any specified arm and stylus other than above listed can be custom-made for special order.

### Arm and Stylus set: 12AAR588

| Set for CV-4500 / SV-C4500 / SV-C4500CNC | | |
|---|---|---|
| Part | **Part No.** | Part Description |
| Arm | **12AAQ762** | Eccentric arm |
| | **12AAM103** | Small-hole arm |
| Stylus | **354889** | Cross-ground stylus |
| | **354882** | Single-bevel cut stylus |
| | **12AAA568** | Cone stylus |
| | **12AAM104** | Small hole stylus |
| | **12AAM106** | Small hole stylus |
| | **12AAM096** | Double-sided cone stylus |
| | **12AAM097** | Double-sided cone stylus |
| Integrated arm and stylus | **12AAM109** | Double-sided small hole arm stylus |

### Arm and Stylus set: 12AAR587

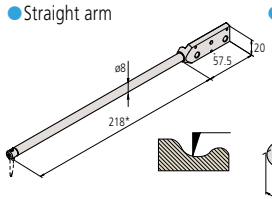
| Set for CV-3200 /CV-4500 / SV-C3200 / SV-C4500 / SV-C4500CNC | | |
|---|---|---|
| Part | **Part No.** | Part Description |
| Arm | **12AAQ762** | Eccentric arm |
| | **12AAM103** | Small-hole arm |
| Stylus | **354889** | Cross-ground stylus |
| | **354882** | Single-bevel cut stylus |
| | **12AAA568** | Cone stylus |
| | **12AAM104** | Small hole stylus |
| | **12AAM106** | Small hole stylus |



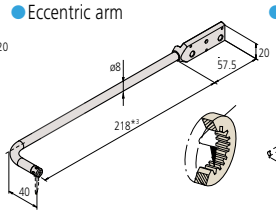
Mitutoyo

# Optional Arms and Styli for Contour Measurement
# For CV-3200, CV-4500, SV-C3200, SV-C4500 and SV-C4500CNC

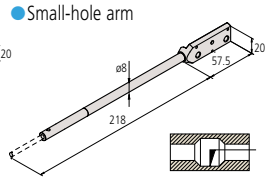
● Straight arm



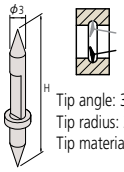

● Eccentric arm




● Small-hole arm

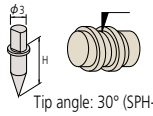



● Double cones



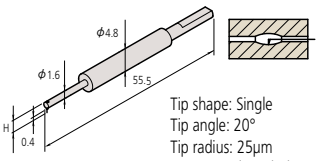

Tip angle: 30°
Tip radius: 25µm
Tip material: Carbide

● Cone



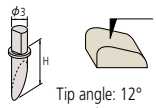

Tip angle: 30° (SPH-79: 50°)
Tip radius: 25µm
Tip material: Carbide,Sapphire
(SPH-79: Diamond)

● Small hole: **12AAM104**



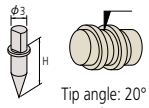

Tip shape: Single
Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

● Single bevel



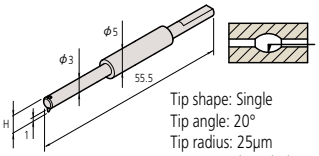

Tip angle: 12°
Tip radius: 25µm
Tip material: Carbide

● Cone



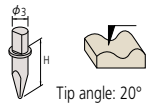

Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

● Small hole: **12AAM105**



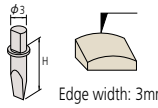

Tip shape: Single
Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

● Cross ground



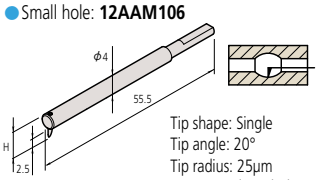

Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

● Knife-edge



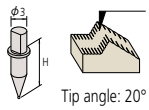

Edge width: 3mm
Tip radius: 25µm
Tip material: Carbide

● Small hole: **12AAM106**




Tip shape: Single
Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

● Cone Knife-edge Ball




Tip angle: 20°
Tip radius: 25µm
Tip material: Carbide

## List of Applicable Arms

| Arm Name | Order No. |
|---|---|
| Straight type | **12AAM101** |
| Eccentric type | **12AAQ762** |
| Small hole | **12AAM103** |

*1: Standard accessory
*2: Stylus for **CV-4500** series
*3: One-sided cut stylus **SPH-71**(standard accessory) mounting

## List of Applicable Styli

| Stylus Name | Order No. | H (mm) |
|---|---|---|
| Double cones stylus *4 | **12AAM095** *5 | 20 |
| | **12AAM096** | 32 |
| | **12AAM097** | 48 |
| Single-bevel stylus carbide-tipped | **354882** | 6 |
| | **354883** | 12 |
| | **354884** *6 | 20 |
| | **354885** | 30 |
| | **354886** | 42 |
| Cross-ground stylus carbide-tipped | **354887** | 6 |
| | **354888** | 12 |
| | **354889** | 20 |
| | **354890** | 30 |
| | **354891** | 42 |
| Cone stylus sapphire-tipped tip angle 30° | **354892** | 6 |
| | **354893** | 12 |
| | **354894** | 20 |
| | **354895** | 30 |
| | **354896** | 42 |
| Cone stylus carbide-tipped tip angle 30° | **12AAA566** | 6 |
| | **12AAA567** | 12 |
| | **12AAA568** | 20 |
| | **12AAA569** | 30 |
| | **12AAA570** | 42 |
| Cone stylus carbide-tipped tip angle 20° | **12AAE865** | 6 |
| | **12AAE866** | 12 |
| | **12AAE867** | 20 |
| | **12AAE868** | 30 |
| | **12AAE869** | 42 |
| Cone stylus diamond-tipped tip angle 50° | **355129** | 20 |
| Knife-edge stylus carbide-tipped | **354897** | 6 |
| | **354898** | 12 |
| | **354899** | 20 |
| | **354900** | 30 |
| | **354901** | 42 |
| Ball stylus carbide-tipped | **354902** | 6 |
| | **354904** | 20 |
| | **354905** | 30 |
| | **354906** | 42 |
| Small-hole stylus *7 | **12AAM104** | 2 |
| | **12AAM105** | 4 |
| | **12AAM106** | 6.5 |

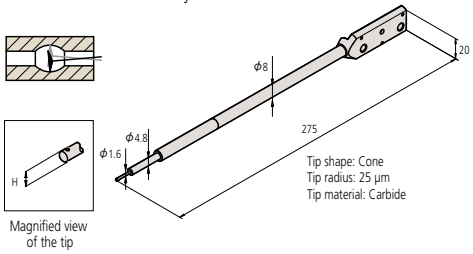
*4: Stylus for **CV-4500** series
*5: Standard accessory of **CV-4500** series
*6: Standard accessory of **CV-3200** series
*7: Styli **SPH-21, 22,** and **23** for **CV-3100/4100** series are not available.

## Arm stylus (integrated arm and stylus) only for CV-4500

| Arm stylus name | Order No. | H (mm) | Tip angle |
|---|---|---|---|
| Double small-hole arm stylus *8 | **12AAT469** | 2.4 | 20° |
| | **12AAT470** | 5 | 20° |
| | **12AAM108** | 2.4 | 30° |
| | **12AAM109** | 5 | 30° |
| | **12AAM110** | 9 | 30° |

*8: Arm Stylus for **CV-4500, SV-C4500 and SV-C4500CNC series.** series

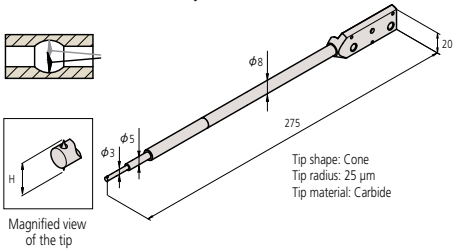
● Double small-hole arm stylus: **12AAM108/12AAT469**




Tip shape: Cone
Tip radius: 25 µm
Tip material: Carbide

Magnified view of the tip

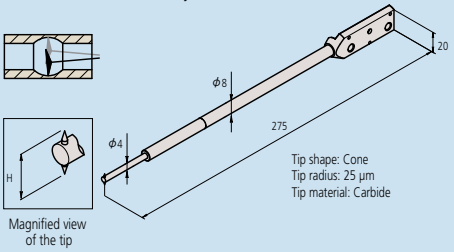
● Double small-hole arm stylus: **12AAM109/12AAT470**




Tip shape: Cone
Tip radius: 25 µm
Tip material: Carbide

Magnified view of the tip

● Double small-hole arm stylus: **12AAM110**




Tip shape: Cone
Tip radius: 25 µm
Tip material: Carbide

Magnified view of the tip

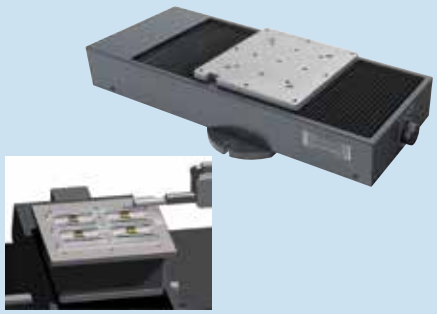
# Optional Accessories for Automatic Measurement

## Compatible with CV-3200, CV-4500 and CNC Models

### Y-axis table*: 178-097

A Y-axis table for both positioning and capable of 3D surface roughness measurement when used withoptional software FTPK-PRO or MCubeMap.**

*Not supporting Y-axis measurements. ** Only for **178-096**

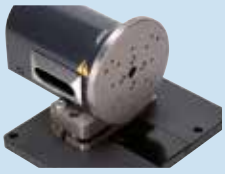


| | 178-097 | 178-096 |
|---|---|---|
| Travel range | 8" (200mm) | 4" (100mm) |
| Resolution | 1.97µin (0.05µm) | 1.97µin (0.05µm) |
| Positioning accuracy | ±3µm | ±1µm |
| Drive speed | Max. 3.15"/s (80mm/s) | Max. .78"/s (20mm/s) |
| Maximum load | 110 lbs (50kg) | 33 lbs (50kg) |
| Mass | 62 lbs (28kg) | 68 lbs (31kg) |

### θ2-axis table: 178-078*

You can measure multiple points on a cylindrical workiece and automate front/rear-side measurement.

*θ2-axis mounting plate (**12AAE718**) is required when directly installing on the base of the SV-3100.





| | |
|---|---|
| Displacement | 360° |
| Resolution | 0.0072° |
| Maximum load (loading moment) | 4kg (343N•cm or less) |
| Rotational speed | Max. 18°/s |
| Mass | 11 lbs (5kg) |

### Quick chuck: 211-032

This chuck is useful when measuring small workpieces. You can easily clamp them with its knurled ring.

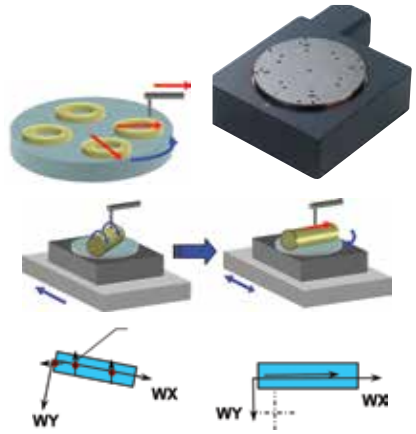


| | | |
|---|---|---|
| Retention range | Inner latch | OD: ø .04 - 1.42" (1 - 36mm) |
| | Inner latch | ID: ø .55 - 2.76" (14 - 70mm) |
| | Outer latch | OD: ø .04 - 2.95" (1 - 75mm) |
| Dimensions | | ø 4.65 x 1.61" (118 x 41mm) |
| Mass | | 2.65 lbs (1.2kg) |

### θ1-axis table: 12AAD975*

For efficient measurement in the axial/transverse directions. When measuring a cylindrical workpiece, automatic alignment can be performed in combination with the Y-axis table.

*θ1-axis mounting plate (**12AAE630**) is required when directly installing on the base of the SV-3100.




| | |
|---|---|
| Displacement | 360° |
| Resolution | 0.004° |
| Maximum load | 26.5 lbs (12kg) |
| Rotational speed | Max. 10°/s |
| Mass | 15 lbs (7kg) |

### Automatic-leveling table:178-087 (SV, CV, CS3200)
### Automatic-leveling table:178-037 (CNC Models)

This is a stage that performs fully automatic leveling as measurement starts, freeing the user from this troublesome operation. Fully automatic leveling can be done quickly by anyone. In addition, the operation is easy and reliable.



| | |
|---|---|
| Inclination adjustment angle | ±2° |
| Maximum load | 7kg |
| Table dimensions | 130 x 100mm |
| Mass | 7.7lbs (3.5kg) |

### Micro-chuck: 211-031

This chuck is suitable for clamping extra-small diameter workpieces (ø1 mm or less), which cannot be retained with the centering chuck.



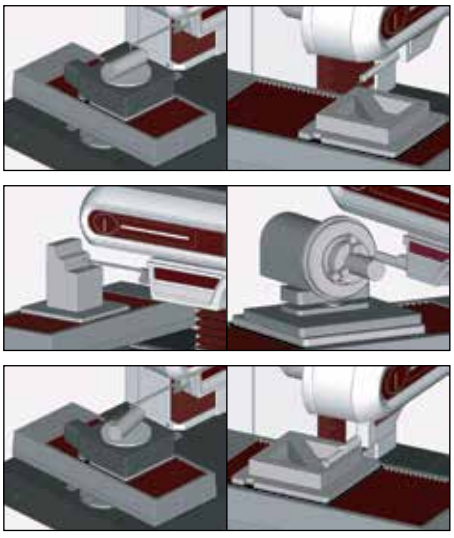
| | |
|---|---|
| Retention range | OD: ø 0 -.06"(0 - 1.5mm) |
| Dimensions | ø 4.65" x 1.9" (118 x 48.5mm) |
| Mass | 1.32 lbs (0.6kg) |

### Examples of optimal combinations of accessories for CNC models

| Optional accessory / Function | Y-axis Table | θ1 Table | θ2 Table |
|---|---|---|---|
| Automatic alignment (Patented: Japan) | ● | ● | — |
| Multiple workpiece batch measurement | ▲ | — | — |
| Multiple-piece measurement in the Y-axis direction (Positioning in the Y-axis direction) | ● | — | — |
| Multiple-piece measurement in the radius direction (Positioning in the rotating direction of XY plane) | ▲ | ● | — |
| Tracking measurement in the Z-axis direction * | — | — | — |
| Inclined surface measurement in the X-axis direction | ▲ | — | — |
| Inclined hole inside measurement in the X-axis direction | ▲ | — | — |
| Multiple cylinder generatrix line measurement | ▲ | — | ● |
| Measurement of both top and bottom surfaces | ▲ | — | ● |
| Rotary positioning of large workpiece ** | — | — | — |
| Upward/downward and frontward/backward measurement of large workpiece ** | — | — | — |

* : Applicable only to form/contour measurement
** : Applicable only for SV-M3000CNC

▲ Recommended ● Essential — Not necessary





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# Optional Accessories for Contracer / Formtracer

## Compatible with Desktop Models of Contracer and Formtracer

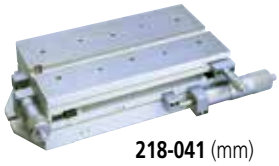
### Cross-travel table

- Table top: 11″ x 7″(280 x 180mm)
- XY travel: 3.94″ x 1.97″(100 x 50mm)
- Max. load 110 lbs (50kg)



**218-001** (mm)
**218-011** (inch)

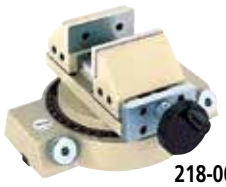
- Table top: 11″ x 5.98″(280 x 152mm)
- XY travel: 1.97″ x .98″(50 x 25mm)
- Max. load 44 lbs (20kg)



**218-041** (mm)
**218-051** (inch)

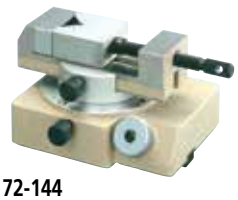
### Rotary vise

- Two-slide jaw type.
- Max. workpiece size: ø 2.36″ (60mm)
- Minimum reading: 1°



**218-003**

- One-slide jaw type.
- Max. workpiece size: ø 2.36″ (60mm)
- Minimum reading: 5°



**172-144**

### Leveling table

- Table top: 5.12″ x 3.94″(130 x 100mm)
- Leveling range: ±1.5°
- Height: 1.57″ (40mm)



**178-016**

### V-block with clamp

- Used with a cross-travel table or rugged table.
- Max. workpiece diameter:1.97″(50mm)
- Max. workpiece diameter: .98″ (25mm)



**172-378**
**172-234**

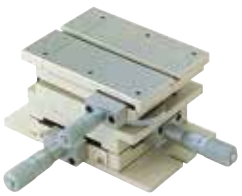
- Workpiece diameter: 0.039″ to 6.3″ (1mm to 160mm)
- Can be mounted on a leveling table



**998291**

### Leveling table

- Table top: 5.12″ x 3.94″(130 x 100mm)
- Leveling range: ±1.5°
- XY travel: .49″ ±(12.5mm)



**178-043-1** (mm)
**178-053-1** (inch)

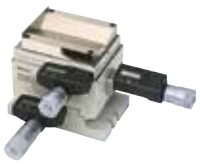
### Digital leveling table

- Table top: 5.12″ x 3.94″(130 x 100mm)
- Leveling range: ±1.5°
- XY travel: .49″ ±(12.5mm)



**178-042-1** (mm)

### Three-axis adjustment table



**178-047**
(V-block not included)

### Precision vise

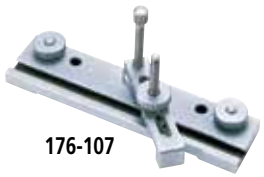
- Max. workpiece size: 1.42″ (36mm)
- Can be mounted on a leveling table.



**178-019**

### Holder with clamp

- Used with a cross-travel table or rugged table.
- Max. workpiece height: 1.38″ (35mm)



**176-107**

### Swivel center support

- Max. workpiece diameter: 3.15″ (80mm)*
  *2.56″ (65mm) when swiveled 10°
- Max. workpiece length: 5.51″(140mm)



**172-197**

### Center support

- Max. workpiece diameter: 4.72″(120mm)
- 2.36″ (60mm) riser is optional (**172-143**)



**172-142**

### Center support riser

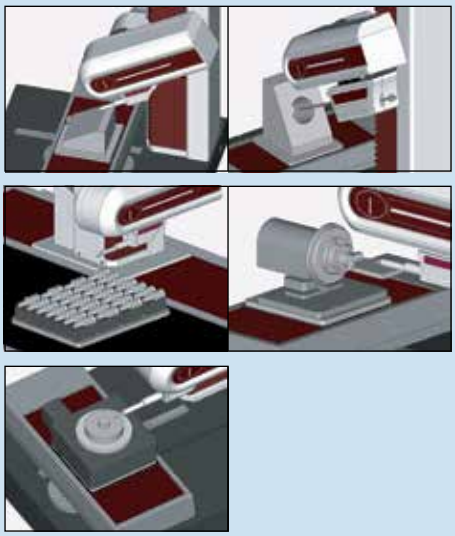
- Used with a center support.
- Max. workpiece diameter: 9.45″ (240mm)



**172-143**

| Drive unit tilting function (Patent pending: Japan) | Large θ Table | Rotary-type detector holder |
|---|---|---|
|  |  |  |
| ▲ | — | — |
| — | — | — |
| — | — | — |
| — | — | — |
| — | — | — |
| ● | — | — |
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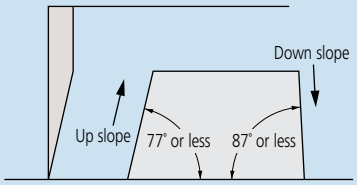
●: Essential ▲: Recommended
—: Not necessary



### Three-axis adjustment table

| Order No. | 178-047 |
|---|---|
| Table top | 5.11 x 3.94" (130 x 100mm) |
| Workpiece weight | 33lbs. (15kg) at max. |
| Workpiece diameter | .04 - 6.3" (1 - 160mm) |
| Leveling range | ±1.5° |
| Swivel range | ±2° |
| Y-axis adjustment | ±0.5" (±12.5mm) |
| Height | 6" (152.5mm) |
| Mass | 19.8lbs. (9kg) |
| Remarks | V-block (**998291**) not included |

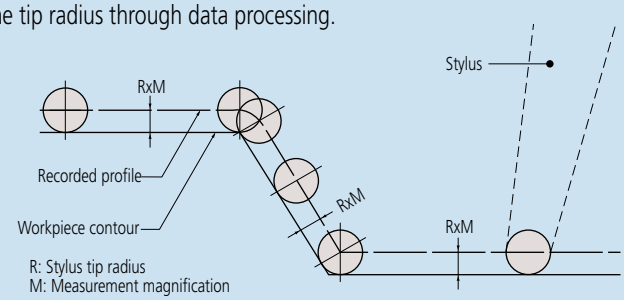
## Traceable Angle




The maximum angle at which a stylus can trace upward or downward along the contour of a workpiece, in the stylus travel direction, is referred to as the traceable angle. A one-sided sharp stylus with a tip angle of 12° (as in the above figure) can trace a maximum 77° of up slope and a maximum 87° of down slope. For a conical stylus (30° cone), the traceable angle is smaller. An up slope with an angle of 77° or less overall may actually include an angle of more than 77° due to the effect of surface roughness. Surface roughness also affects the measuring force.
For model CV-3200/4500, the same type of stylus (SPH-71: one-sided sharp stylus with a tip angle of 12°) can trace a maximum 77° of up slope and a maximum 83° of down slope.

## Compensating for Stylus Tip Radius

A recorded profile represents the locus of the center of the ball tip rolling on a workpiece surface. (A typical radius is 0.025mm.) Obviously this is not the same as the true surface profile so, in order to obtain an accurate profile record, it is necessary to compensate for the effect of the tip radius through data processing.




If a profile is read from the recorder through a template or scale, it is necessary to compensate for the stylus tip radius beforehand, according to the applied measurement magnification.

## Compensating for Arm Rotation

The stylus is carried on a pivoted arm so it rotates as the surface is traced and the contact tip does not track purely in the Z direction. Therefore, it is necessary to apply compensation in the X direction to ensure accuracy. There are three methods of compensating for arm rotation.

1: Mechanical compensation
2: Electrical compensation
3: Software processing. To measure a workpiece contour that involves a large displacement in the vertical direction with high accuracy, one of these compensation methods needs to be implemented.

## Accuracy

As the detector units of the X and Z axes incorporate scales, the magnification accuracy is displayed not as a percentage but as the linear displacement accuracy for each axis.

## Overload Safety Cutout

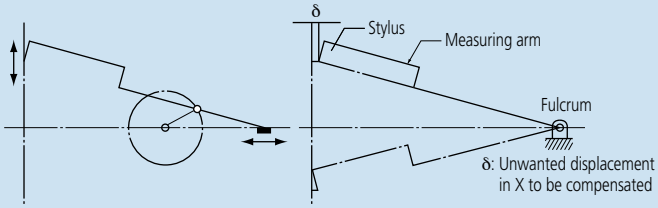
If an excessive force (overload) is exerted on the stylus tip due, perhaps, to the tip encountering a too-steep slope on a workpiece feature, or a burr, etc., a safety device automatically stops operation and sounds an alarm buzzer. This type of instrument is commonly equipped with separate safety devices for the tracing direction (X axis) load and vertical direction (Y axis) load.
For model CV-3200/4500 a safety device functions if the arm comes off the detector mount.

## Simple or Complex Arm Guidance

In the case of a simple pivoted arm, the locus that the stylus tip traces during vertical movement (Z direction) is a circular arc that results in an unwanted offset in X, for which compensation has to be made. The larger the arc movement, the larger the unwanted X displacement (δ) that has to be compensated. (See figure below.) The alternative is to use a complex mechanical linkage arrangement to obtain a linear translation locus in Z, and, therefore, avoid the need to compensate in X.

## Z-axis Measurement Methods

Though the X axis measurement method commonly adopted is by means of a digital scale, the Z axis measurement divides into analog methods (using a differential transformer, etc.) and digital scale methods.
Analog methods vary in Z-axis resolution depending on the measurement magnification and measuring range. Digital scale methods have fixed resolution.
Generally, a digital scale method provides higher accuracy than an analog method.



## Contour Analysis Methods

You can analyze the contour with one of the following two methods after completing the measurement operation.

### 1. Data processing section

The measured contour is input into the data processing section in real time and a dedicated program performs the analysis using the mouse and/or keyboard. The angle, radius, step, pitch and other data are directly displayed as numerical values.

### 2. Analysis program

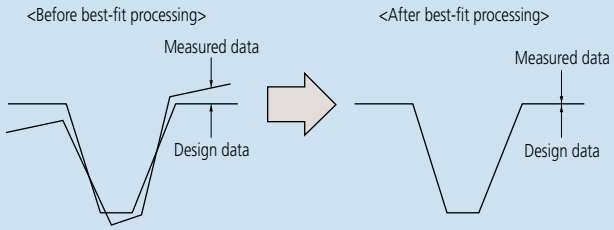
Analysis combining coordinate systems can be easily performed. The graph that goes through stylus radius correction is output to the printer as the recorded profile.

## Tolerancing with Design Data

Measured workpiece contour data can be compared with design data in terms of actual and designed shapes rather than just analysis of individual dimensions. In this technique each deviation of the measured contour from the intended contour is displayed and recorded. Also, data from one workpiece example can be processed so as to become the master design data to which other workpieces are compared. This function is particularly useful when the shape of a section greatly affects product performance, or when its shape has an influence on the relationship between mating or assembled parts.

## Best-fitting

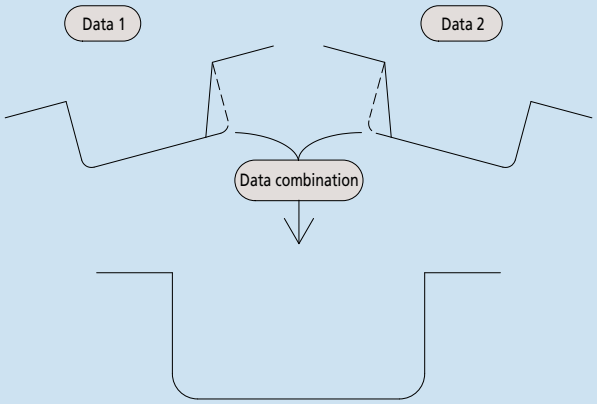
If there is a standard for surface profile data, tolerancing with design data is performed according to the standard. If there is no standard, or if tolerancing only with shape is desired, best-fitting between design data and measurement data can be performed.



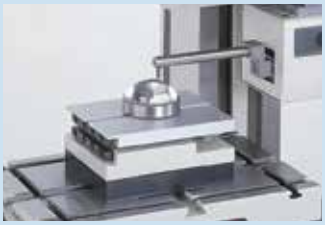

The best-fit processing algorithm searches for deviations between both sets of data and derives a coordinate system in which the sum of squares of the deviations is a minimum when the measured data is overlaid on the design data.

## Data Combination

Conventionally, if tracing a complete contour is prevented by stylus traceable-angle restrictions then it has to be divided into several sections that are then measured and evaluated separately. This function avoids this undesirable situation by combining the separate sections into one contour by overlaying common elements (lines, points) onto each other. With this function the complete contour can be displayed and various analyses performed in the usual way.




## Measurement Examples

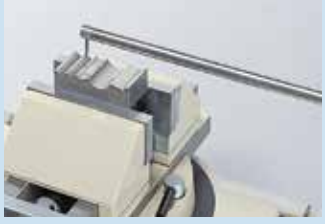

Aspheric lens contour


Inner/outer ring contour of a bearing


Internal gear teeth


Female thread form


Male thread form

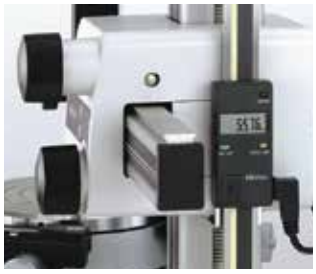

Gage contour

# Roundtest RA-120 / 120P

## SERIES 211 — Roundness Measuring Instruments

The Roundtest RA-120 / 120P are a compact, affordable, and simple-to-use device for measuring part geometry on the shop floor. It also provides such superb data analysis capabilities as required with laboratory roundness measuring instruments and has a ±1000µm wide range detector and precision turntable with excellent rotation accuracy.

The RA-120 is a dedicated processor-based model which controls all operations via the control panel incorporated in the main unit.



**Z-axis scale unit**



**Optional X-axis stop**



**RA-120**

**Order No.: 211-544A (with mechanical mic-heads)**
**Order No.: 211-543A (with DAT function, inch/mm)**

### Technical Data

Turntable
- Rotational accuracy: Radial: (0.04+6H/10000)µm (H: Probing height (mm))
  Axial: (0.04+6X/10000)µm (X: Distance from rotation center)
- Rotating speed: 6rpm
- Table top diameter: ø 1.96" (150mm)
- Centering range: ±.12" (3mm)
- Leveling range: ±1°
- Maximum probing diameter: ø 11" (280mm)
- Maximum workpiece diameter: ø 17.3" (440mm)
- Maximum workpiece weight: 55 lbs (25kg)

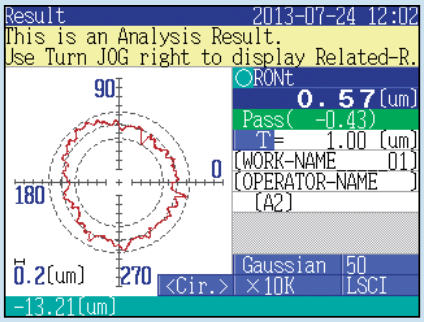
Vertical column (Z-axis)
- Vertical travel: 11" (280mm)
- Feeding: 1.18" (30mm)/rev. (coarse), 0.039" (1mm)/rev. (fine)
- Maximum probing height: 11" (280mm) from the turntable top
- Maximum probing depth: 3.94" (100mm) (min. ID: 1.18"(30mm)

Horizontal arm (X-axis)
- Horizontal travel: 65" (165mm) (Including a protrusion of 1" (25mm) the turntable rotation center)

Probe and stylus
- Measuring range: ±1000µm
- Measuring force: 100mN±30mN
- Standard stylus: 12AAL021, carbide ball, ø1.6mm
- Measuring direction: Two directional
- Stylus angle adjustment: ±45° (with graduations)

Data analysis unit:
- Processing unit: Built-in (PC with Roundpak)*
- Data sampling points: 3,600 points/rotation
- Data analysis items:
  Roundness, Coaxiality, Concentricity, Flatness, Circular runout (radial), Circular runout (axial), Squareness (against axis), Squareness (against plane), Thickness deviation, Parallelism
- Reference circles for roundness evaluation:
  LSC, MZC, MIC, MCC
- Recording device:
  Built-in thermal line printer (optional external printer)*
- Recording magnification:
  X5 to X200,000, Auto (X1 to X500,000)*
- Roughness component reduction:
  Low pass filter, band pass filter
- Filter type:
  2CR-75%, 2CR-50%, 2CRPC-75% (phase corrected), 2CRPC-50% (phase corrected), Gaussian, filter OFF
- Cutoff value;
  15upr, 50upr, 150upr, 500upr, 15-150upr, 15-500upr, 50-500upr, Manual setting*
- Number of measuring sections
  Max. 5-section (100-section)*

*RA-120P




Large color LCD display for RA-120 models

### SPECIFICATIONS

| Model No. | RA-120* | RA-120D | RA-120P | RA-120PD |
|---|---|---|---|---|
| **Order No.** | **211-544A** | **211-543A** | **211-547A** | **211-546A** |

* Does not include Z-axis scale unit.

The RA-120P is a PC-based model which controls all operations via ROUNDPAK software (optional).



**RA-120P**

**Order No.: 211-547A (with mechanical mic-heads)**
**Order No.: 211-546A (with DAT function, inch/mm)**

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
FORM



Mitutoyo

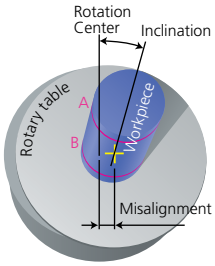
# Roundtest RA-120 / 120P

## SERIES 211 — Roundness Measuring Instruments

### DAT (Digital Adjustment Table) function

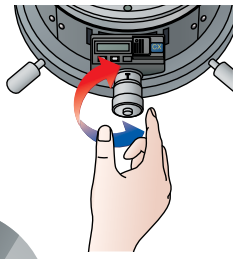
The turntable digitally displays the centering and leveling adjustments, turning what used to be a difficult task into one that is simple enough for even new operators to perform.

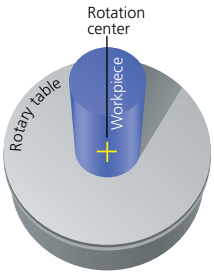
1. Preliminary measurement of two cross sections: A and B.




2. Following preliminary measurement, the centering and leveling adjustment values are displayed on the monitor.

3. Manipulate the digital micrometer heads of the rotary table so that the adjustment values displayed on the monitor are realized.





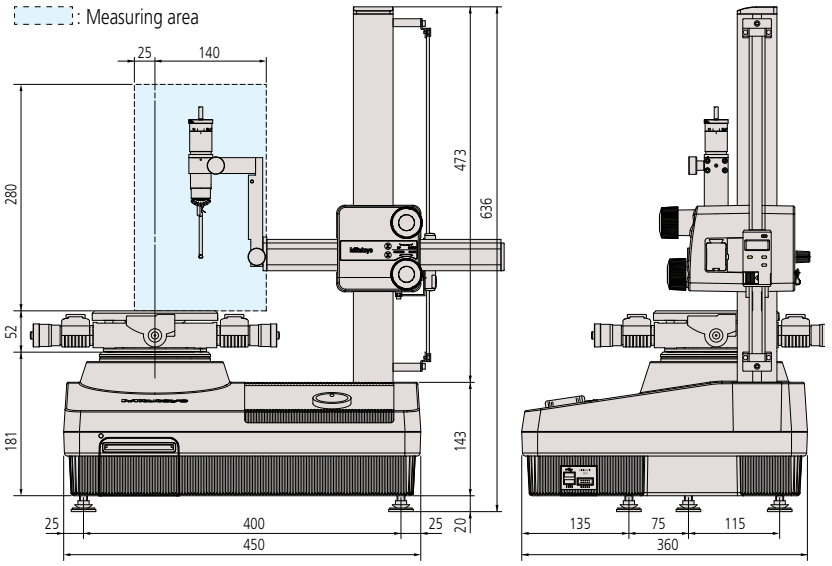

4. Centering and leveling are complete.
   Centering range: ±3mm
   Leveling (inclination) range: ±1°

## DIMENSIONS

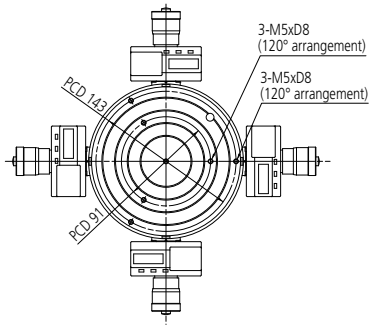
### External dimensions

Unit: mm

: Measuring area

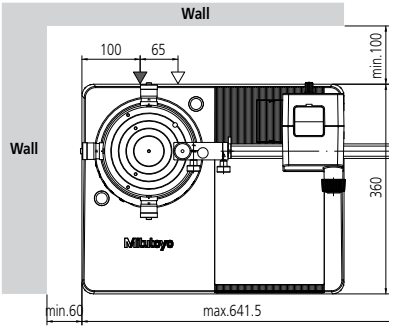



### Turntable top view




### Installation floor plan

▼Power inlet
▽Air inlet




Functions
- Notched workpiece measurement
- Recalculation of datum/measured data
- Limaçon function compensates for eccentricity
- Rotation of 3D display**
- Real-time display**
- Simplified layout (divided layout)**
- Hair line, auxiliary line, hidden line, fill line**
- Color setting of measured data**
- Offsetting of recorded profile generation**
- Zooming of recorded profile**
- Data deletion**
- Graph analysis (displacement/angle between measured points)**
- Power spectrum analysis**
- Gear tooth analysis**
- Harmonic analysis**
- Text data output (via CSV format)**

**Function of ROUNDPAK software

Air supply
Air pressure: 390kPa
Air consumption: 30L/min.
Power supply: 100V AC – 240V AC, 50/60Hz
Dimensions (W x D x H): 17.7" x 14.2" x 25" (450 x 360 x 636mm)
Mass: 70.5 lbs (32kg) (main unit), 4.4 lbs (2kg) (air regulator)

## Optional Accessories

| | |
|---|---|
| **211-032:** | Quick chuck (OD: 1 - 79mm, ID: 16 - 69mm) |
| **211-014:** | Three-Jaw chuck (OD: 2 - 78mm, ID: 25 - 68mm) |
| **211-031:** | Micro-chuck (OD: 1.5mm max.) |
| **356038:** | Auxiliary stage for a low-height workpiece |
| **211-016:** | Reference hemisphere |
| **211-045:** | Magnification checking gage |
| **997090:** | Gage block set for calibration |
| **12AAH320:** | X-axis stop |
| **211-013:** | Vibration damping stand |
| **12AAH433:** | Z-axis scale unit for RA-120 |
| ———: | Interchangeable styli (See page J-49.) |



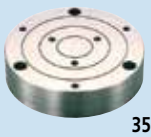
**211-032**



**211-014**



**211-031**



**356038**



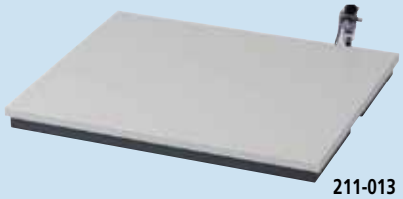
**211-016**



**997090**



**211-045**



**211-013**

## CONSUMABLE PARTS

| | | |
|---|---|---|
| **12AAH181:** | Printer paper | 10 rolls/set |
| **358592:** | Element for air filter | 1 pc./set |
| **358593:** | Element for air regulator | 10 pcs./set |

# Roundtest RA-1600 / RA-1600M

## SERIES 211 — Roundness/Cylindricity Measuring System

### Technical Data

Turntable
- Rotational accuracy (radial): (0.02+6H/10000)µm (RA-1600)
- Rotational accuracy (axial): (0.02+6X/10000)µm (RA-1600)
- Rotational accuracy (radial): (0.03+6H/10000)µm (RA-1600M)
- Rotational accuracy (axial): (0.03+6X/10000)µm (RA-1600M)

  H: Probing height (mm), X: Probing radius (mm)
- Rotational speed: 4, 6, 10rpm
- Table top diameter: ø5.9"(150mm)
- Centering range: ±3mm (with DAT function)
- Leveling range: ±1° (with DAT function)
- Maximum probing diameter: ø11"(ø280mm)
- Maximum workpiece diameter: ø22"(ø560mm)
- Maximum table loading: 55lbs (25kg)

Vertical column (Z-axis)
- Vertical travel: 11.8"(300mm)
- Straightness (in narrow range: 0.20µm / 100mm (RA-1600)
- Straightness (in entire range): 0.30µm / 300mm (RA-1600)
- Straightness (in narrow range: 0.40µm / 100mm (RA-1600M)
- Straightness (in entire range): 0.80µm / 100mm (RA-1600M)
- Parallelism with turntable axis: 1.5µm / 300mm
- Positioning speed: Max. 15mm/s
- Measuring speed: 0.5, 1, 2, 5mm/s
- Maximum probing height (ID/OD): 11.8"(300mm)*1
- Maximum probing depth: 91mm (over ø32)
  3.6"(over ø1.26")((91mm (over ø32))
  1.97"(over ø0.27")((50mm (over ø7))

Horizontal arm (X-axis)
- Horizontal travel: 6.5"(165mm) (From table axis -1~±5.5" ((-25mm – ±140mm))
- Positioning speed: Max. 15mm/s
- Measuring speed: 0.5, 1, 2, 5mm/s
- X-axis straightness: 2.7µm/140mm (RA-1600)
- X-axis parallelism to turntable axis: 1.6µm/140mm (RA-1600)

Probe and stylus
- Measuring range: ±400µm / ±40µm / ±4µm
- Measuring force: 10–50mN (5 level switching)
- Standard stylus: **12AAL021**, carbide ball, ø1.6mm
- Measuring direction: Bi-directional
- Stylus angle adjustment: ±45° (with graduations)

Air supply
- Air pressure: 0.39MPa (4kgf/cm²)
- Air consumption: 22L/min.

Power supply: 100V AC – 240V AC, 50/60Hz

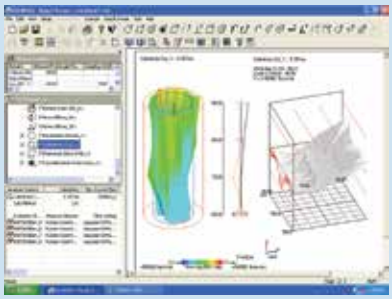
Dimensions (W x D x H): 35 x 19.3 x 33"(890 x 490 x 840mm)

Mass: 375lbs (170kg)

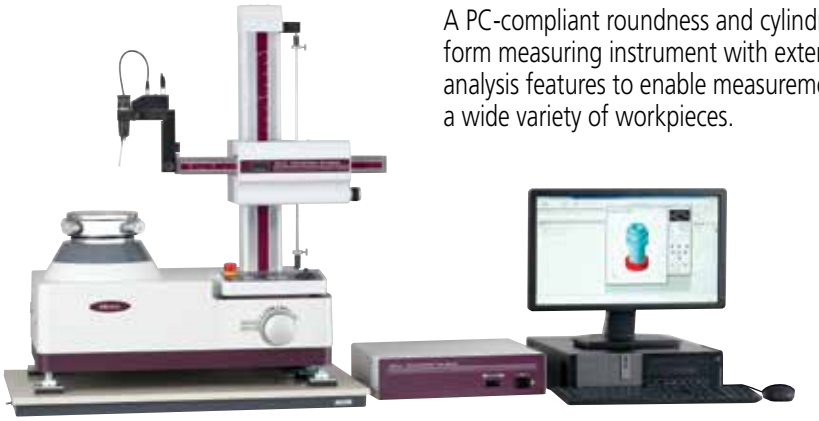
*1 Use an optional auxiliary stage for measuring a workpiece whose height is 20mm or less.

### ROUNDPAK

The latest roundness/cylindrical form analysis program



MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
FORM

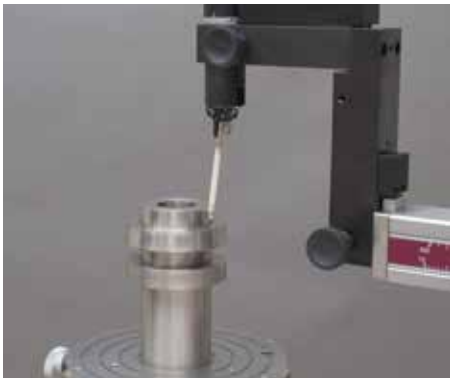


**RA-1600 / RA-1600M**
with personal computer system and software

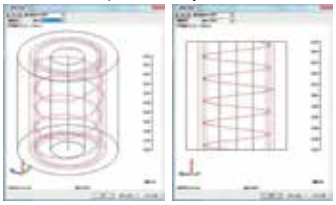
A PC-compliant roundness and cylindrical-form measuring instrument with extensive analysis features to enable measurement of a wide variety of workpieces.

### Spiral Measurement/Analysis

The spiral-mode measurement function combines table rotation and rectilinear action allowing cylindricity, coaxiality, and other measurement data to be loaded as a continuous data set.



Spiral-mode cylinder measurement



### Safety mechanism provided as a standard feature

A collision-sensing function has been added to the detector unit (when it is in the vertical orientation) to prevent collision in the Z-axis direction. Additionally, an accidental collision prevention function, which stops the system when the detector displacement exceeds its range, has been added. When an accidental touch is detected, the dedicated analysis software (ROUNDPAK) senses the error and automatically stops the system.



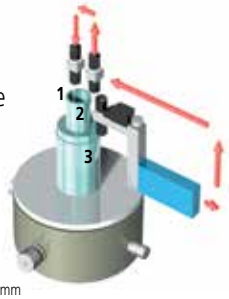
### Measurement Through X-axis Tracking

Measurement while tracing is possible through a built-in linear scale in the X-axis. This type of measurement is useful when displacement due to form variation exceeds the measuring range of the detector, and X-axis motion is necessary to maintain contact with the workpiece surface.



### Continuous Internal/External Diameter Measurement

Continuous internal/external diameter measurement is possible without changing the detector position.




1), 2) : External diameter measurement
3) : Internal diameter measurement
➡ : Displacement
3) = inner diameter: Up to ø50 mm



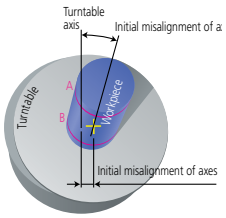
Mitutoyo

# Roundtest RA-1600 / RA-1600M

## SERIES 211 — Roundness/Cylindricity Measuring System

### Centering and Leveling Function

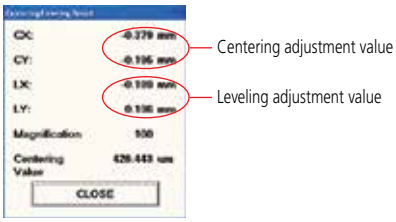
The turntable displays centering and leveling adjustments digitally, making this challenging task simple enough for even a new operator to perform.




1. Preliminary measurement of two cross sections: A and B.

2. Following preliminary measurement, the centering and leveling adjustment values are displayed on the monitor.

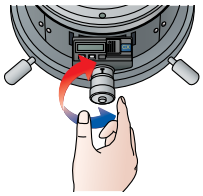
**For RA-1600**



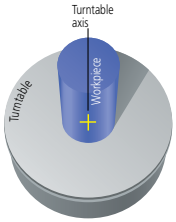

**For RA-1600M**




3. By adjusting the micrometer heads for the rotary table, the adjustment values or level meter displayed on the monitor can be achieved.



4. Centering and leveling are complete.
   Centering range: ±3mm
   Leveling (inclination) range: ±1°

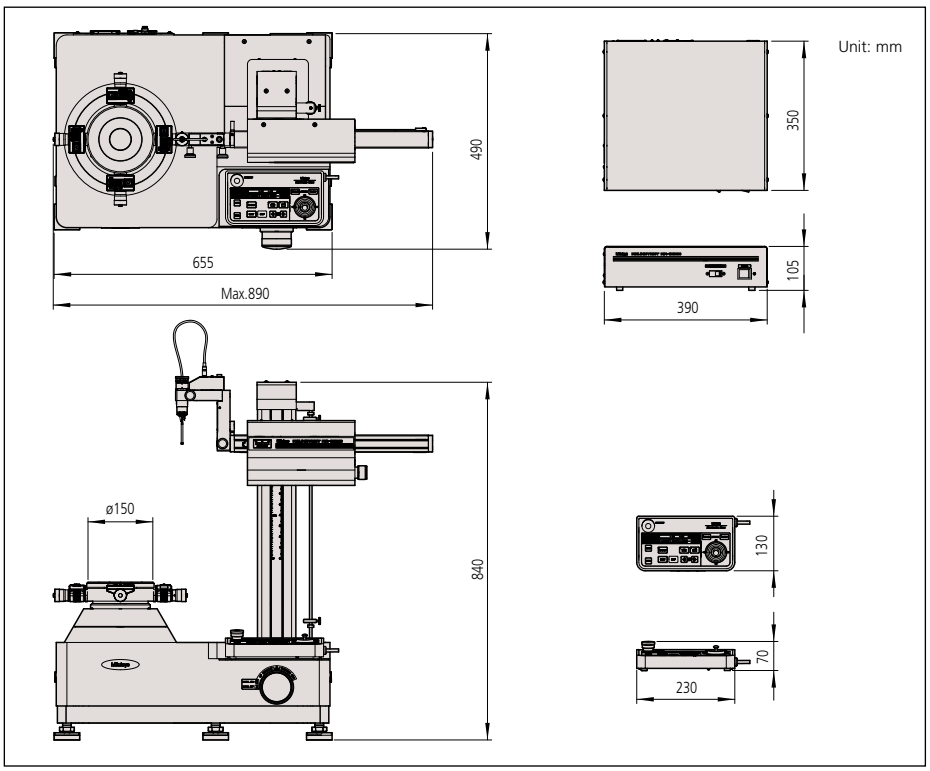



## SPECIFICATIONS

| Model No. | RA-1600 | RA-1600M |
|---|---|---|
| **Order No.** (inch/mm) | **211-733A** | **211-724A** |
| Mic Heads | Digimatic | Mechanical |

## DIMENSIONS

Unit: mm




## Optional Accessories

**350850**: Cylindrical square
**356038**: Auxiliary stage for a low-height workpiece
**12AAF203**: 2x extension detector holder
**12AAF204**: Auxiliary detector holder for a large-diameter workpiece
**12AAL090**: Sliding detector holder
**211-045**: Magnification checking gage
**211-014**: Chuck (OD: ø2 - 78mm, ID: ø25 - 68mm)
**211-032**: Quick chuck (OD: ø1 - 79mm, ID: 16 - 69mm)
**211-031**: Micro-chuck (OD: ø0.1 - 1.5mm max.)
**178-025**: Vibration isolator (Desktop type)
**64AAB213**: Vibration isolation workstation
**12AAL019**: Side table for PC
———: Interchangeable styli (See page J-49.)




**Sliding detector-unit holder (Option) 12AAL090**

The detector-unit holder is equipped with a sliding mechanism, enabling one-touch measurement of a workpiece with a deep hole having a thick wall, which has been difficult with the conventional standard arm.



Sliding distance: 4.4" (112mm)

The detector-unit holder can be stopped at a position sufficiently higher than the workpiece along the Z-axis, and then lowered and positioned to make measurements.
Furthermore, internal/external diameters can be easily measured with the continuous internal/external diameter measurement function*.

*: See page 41 for details about the continuous ID and OD measuring function.

# Roundtest RA-2200AS / DS / AH / DH

## SERIES 211 — Roundness / Cylindricity Measuring System

### Technical Data

Turntable
Rotational accuracy (radial): {(0.02+3.5H/10000)µm}
Rotational accuracy (axial): {(0.02+3.5R/10000)µm}
H: Probing height (mm), R: Probing radius (mm)
- Rotating speed: 2, 4, 6, 10rpm
- Tabletop diameter: ø9.2" (235mm) AS / AH models; ø 7.9" (200mm) DS / DH models
- Centering range: ±3mm (±5mm: DS / DH models)
- Leveling range: ±1°
- Maximum probing diameter: ø 11.8" (300mm)
- Maximum workpiece diameter: ø22.8" (580mm)
- Maximum workpiece weight: 66 lbs (30kg)

Vertical column (Z-axis)
- Vertical travel: 11.8" (300mm) (22.8" (500mm): AH/DH models)
- Straightness (λc2.5): 0.10µm / 100mm, 0.15µm / 300mm (0.25µm / 500mm: AH / DH models)
- Parallelism with rotating axis: 0.7µm / 300mm (1.2µm / 500mm: AH / DH models)
- Positioning speed: Max. 50mm/s
- Measuring speed: 0.5, 1, 2, 5mm/s
- Maximum probing height: 11.8" (300mm) (OD / ID) [22.8" (500mm): AH / DH models)
- Maximum probing depth: over ø32: 85mm (w/standard stylus) over ø7: 50mm (w/standard stylus)

Horizontal arm (X-axis)
- Horizontal travel: 6.9" (175mm) (Including a protrusion of 1" (25mm) the turntable rotation center)
- Straightness (λc2.5): 0.7µm / 150mm
- Squareness with rotating axis: 1.0µm / 150mm
- Positioning speed: Max. 30mm/s with joystick operation
- Measuring speed: 0.5, 1, 2, 5mm/s

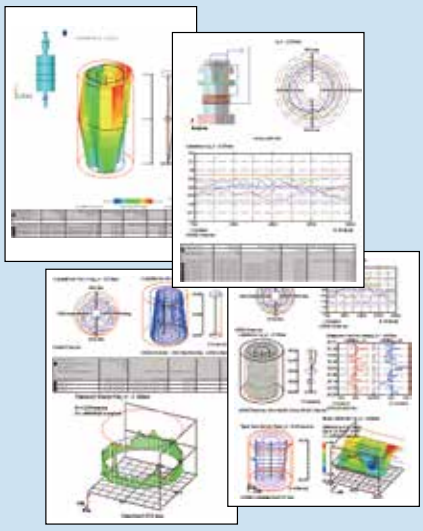
Probe and stylus
- Measuring range: ±400µm/±40µm/±4µm (±5mm: tracking range)
- Measuring force: 10mN~50mN (in 5 steps)
- Standard stylus: **12AAL021**, carbide ball, ø1.6mm
- Measuring direction: Two directional
- Stylus angle adjustment: ±45° (with graduations)

Data analysis system
- Analysis software: Roundpak
- Filter type: 2CRPC-75%, 2CRPC-50%, 2CR-75% (non-phase corrected), 2CR-50% (non-phase corrected), Gaussian, filter OFF
- Cutoff value; 15upr, 50upr, 150upr, 500upr, 1500upr, 15-150upr, 15-500upr, 15-1500upr, 50-500upr, 50-1500upr, 150-1500upr, Manual setting
- Reference circles for roundness evaluation: LSC, MZC, MIC, MCC

Air supply
- Air pressure: 390kPa (4kgf/cm²)
- Air consumption: 30L/min.

Power supply: 100V AC – 240V AC, 50/60Hz
Dimensions (W x D x H): 26.3 x 20 x 35.4" (667 x 510 x 900mm) 26.3 x 20 x 43.3" (667 x 510 x 1100mm: AH / DH models)
Mass: 396 lbs (180kg) 440 lbs (200kg) AH / DH models

### Printout



The RA-2200 provides high accuracy, high speed and high performance in roundness measurement. The fully-automatic, or DAT (Digital Adjustment Table), function-aided manual workpiece centering and leveling turns what used to be a difficult task into one that is simple enough for even new users to perform. This facilitates substantial reductions in overall measurement time. The RA-2200 system comes complete with powerful data analysis software ROUNDPAK, which requires only simple manipulation using a mouse and icons, achieving enhanced functionality and ease of operation.

**RA-2200AS with personal computer system and software**

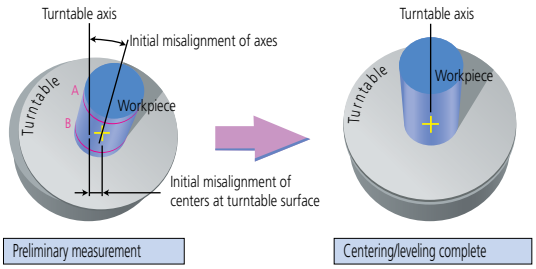
* Shown with optional vibration isolator and side table for PC



### Highly accurate and easy-to-use turntable

With extremely high rotational accuracy, both in the radial and axial directions, the turntable allows high accuracy flatness testing to be performed in addition to roundness and cylindricity measurements.

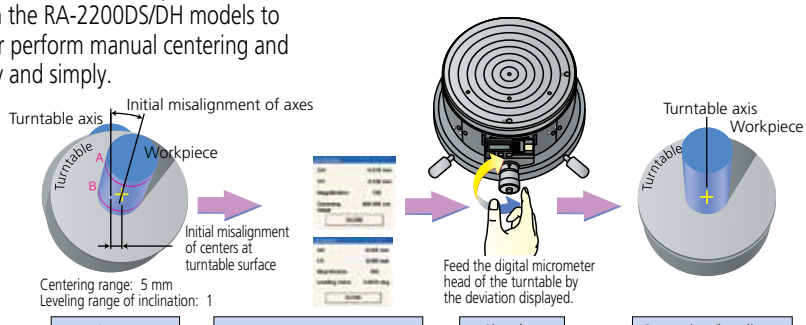
Incorporating an automatic centering/leveling turntable (A.A.T.), the top-of-the-line RA-2200AS/AH models relieve the operator of the bothersome task of workpiece centering and leveling.




Preliminary measurement of two cross-sections A and B.

Preliminary measurement is followed by automatic centering and leveling.

A guidance system (D.A.T.) is incorporated into the turntables on the RA-2200DS/DH models to help the operator perform manual centering and leveling smoothly and simply.




Preliminary measurement of two cross-sections A and B.



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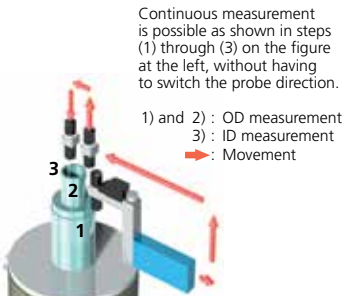
# Roundtest RA-2200AS / DS / AH / DH

## SERIES 211 — Roundness / Cylindricity Measuring System

### Greater productivity by continuous measurement

Both the OD and ID of a workpiece* can be measured in succession without the need for changing the traverse direction of the stylus.

*Inside diameter up to 50 mm.




Continuous measurement is possible as shown in steps (1) through (3) on the figure at the left, without having to switch the probe direction.

1) and 2) : OD measurement
3) : ID measurement
➡: Movement

Highly repeatable measurements with high-accuracy scales Mitutoyo linear scales are used in the X/Z drive unit to guarantee the high precision positioning so vital for repetitive measurement.

### Surface roughness measurement function (Surface roughness unit: option)

A surface roughness detector, compliant with the relevant International Standards, can be mounted in place of the roundness measuring detector. This creates a multiple sensor system that can not only test the geometrical roundness/ cylindricity of a surface but also the roughness of that surface as well.

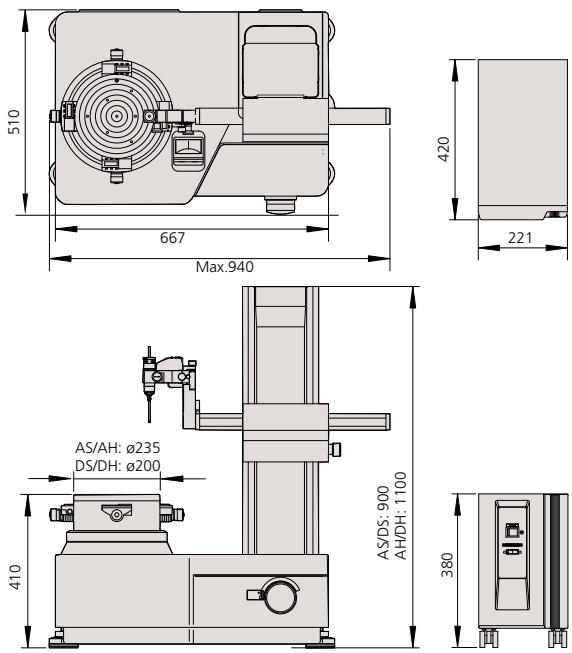


## SPECIFICATIONS

| Model No. | RA-2200AS | RA-2200DS | RA-2200AH | RA-2200DH |
|---|---|---|---|---|
| **Order No.** | **211-511A** (mm/inch) | **211-514A** (inch) | **211-512A** (mm/inch) | **211-516A** (inch) |
| Effective table diameter | 9.25" (235mm) | 8" (200mm) | 9.25" (235mm) | 8" (200mm) |
| Centering/leveling adjustment | A.A.T. | D.A.T. | A.A.T. | D.A.T. |
| Centering range | ±0.118" (±3mm) | ±0.197" (±5mm) | ±0.118" (±3mm) | ±0.197" (±5mm) |
| Column travel | 12" (300mm) (standard column) | | 20" (500mm) (high column) | |
| Basic unit mass | 396 lbs. (180kg) | | 440 lbs. (200kg) | |

## DIMENSIONS

Unit: mm



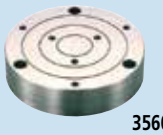

## Optional Accessories

| | |
|---|---|
| **350850**: | Cylindrical square |
| **356038**: | Auxiliary stage for a low-height workpiece |
| **12AAF203**: | Extension probe holder (2X higher) |
| **12AAF204**: | Auxiliary probe holder for a large diameter workpiece |
| **211-045**: | Magnification checking gage |
| **211-014**: | Chuck (OD: 1 - 85mm, ID: 33 - 85mm) |
| **211-032**: | Quick chuck (OD: 1 - 75mm, ID: 14 - 70mm) |
| **211-031**: | Micro-chuck (OD: 1.5mm max.) |
| **178-025**: | Vibration isolator |
| **178-024**: | Stand for vibration isolator |
| ———: | Interchangeable styli (See page J-49.) |
| **12AAK110**: | Vibration isolator |
| **12AAK120**: | Monitor arm |
| **12AAL019**: | Side table for PC |
| **12AAF353**: | Surface roughness detector holder |


**211-032**


**211-014**


**211-031**


**356038**


**211-045**


**350850**

### Sliding detector-unit holder (Standard) 12AAL090

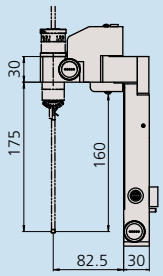
The detector-unit holder is equipped with a sliding mechanism, enabling one-touch measurement of a workpiece with a deep hole having a thick wall, which has been difficult with the conventional standard arm.



Sliding distance: 4.4"(112mm)

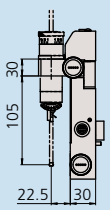
The detector-unit holder can be stopped at a position sufficiently higher than the workpiece along the Z-axis, and then lowered and positioned to make measurements. Furthermore, internal/external diameters can be easily measured with the continuous internal/external diameter measurement function*.

*: See page 41 for details about the continuous ID and OD measuring function.



**12AAF203**

Unit: mm



**12AAF204**

# Roundtest RA-H5200AS / AH

## SERIES 211 — Roundness / Cylindricity Measuring System

### Technical Data

Turntable
Rotational accuracy (radial): {(0.02+3.5H/10000)µm}
Rotational accuracy (axial): {(0.02+3.5X/10000)µm}
H: Probing height (mm), X: Distance from the turntable axis (mm)
- Rotating speed: 2, 4, 6, 10rpm (20rpm: auto-centering)
- Table top diameter: ø 11.8" (300mm)
- Centering range: ±5mm
- Leveling range: ±1°
- Maximum probing diameter: ø 15.7" (400mm)
- Maximum workpiece diameter: ø 26.8" (680mm)
- Maximum workpiece weight: 176 lbs (80kg)
  143 lbs (65kg): auto-centering

Vertical column (Z-axis)
- Vertical travel: 13.8" (350mm), (21.7" (550mm): AH model)
- Straightness (λc2.5): 0.05µm / 100mm, 0.14µm / 350mm
  (0.2µm / 550mm: AH model)
- Parallelism with rotating axis: 0.2µm / 350mm
  (0.32µm / 550mm: AH model)
- Positioning speed: Max. 60mm/s
- Measuring speed: 0.5, 1, 2, 5mm/s
- Maximum probing height: 13.8" (350mm) (OD / ID)
  [21.7" (550mm) (OD / ID): AH model)
- Maximum probing depth: over ø32: 85mm (w/standard stylus)
  over ø7: 50mm (w/standard stylus)

Horizontal arm (X-axis)
- Horizontal travel: 8.9" (225mm)
- Straightness (λc2.5): 0.4µm / 200mm
- Squareness with rotating axis: 0.5µm / 200mm
- Positioning speed: Max. 50mm/s
- Measuring speed: 0.5, 1, 2, 5mm/s

Probe and stylus
- Measuring range: ±400µm (±5mm: tracking range)
- Measuring force: 10mN~50mN (in 5 steps)
- Standard stylus: **12AAL021**, carbide ball, ø1.6mm
- Measuring direction: Two directional
- Stylus angle adjustment: ±45° (with graduations)

Data analysis system
- Analysis software: Roundpak
- Filter type:
  2CRPC-75%, 2CRPC-50%, 2CR-75% (non-phase corrected), 2CR-50% (non-phase corrected), Gaussian, filter OFF
- Cutoff value;
  15upr, 50upr, 150upr, 500upr, 1500upr, 15-150upr, 15-500upr, 15-1500upr, 50-500upr, 50-1500upr, 150-1500upr, Manual setting
- Reference circles for roundness evaluation:
  LSC, MZC, MIC, MCC

Air supply
- Air pressure: 390kPa (4kgf/cm²)
- Air consumption: 45L/min.

Power supply: 100V AC – 240V AC, 50/60Hz
Dimensions (W x D x H): 49.6 x 28.0 x 66.9"
(1260 x 710 x 1700mm)
49.6 x 28.0 x 74.8"
(1260 x 710 x 1900mm: AH model)
Mass: Main unit: 1433lbs. (650kg)
1477lbs. (670kg): AH model
Vibration isolator: 375 lbs (170kg)

RA-H5200AS / AH, a roundness/cylindricity measuring system developed to combine world-class accuracy with maneuverability/ high-analysis capability.

Enhanced detector safety functions, such as accidental touch and collision detection, is installed to minimize damage to both machine and workpieces.

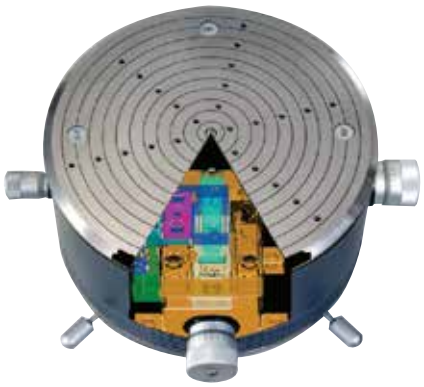


**RA-H5200AS with personal computer system and software**

* Shown with optional side table for PC.

### High-accuracy automatic centering/leveling turntable

A highly accurate, highly rigid turntable has been achieved through exceptional manufacturing accuracy of the critical components, such as the rotor and stator, in addition to an air-bearing incorporating a complex aperture that provides superior rigidity and uniform pressure distribution. As a result, the rotational accuracy (radial), which is the heart of the roundness/ cylindricity measuring system, is a world-class (0.02 +3.5H/10000)µm.



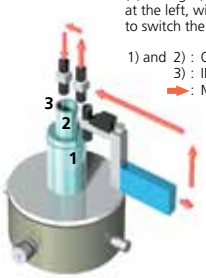
### Automatic continuous OD/ID measurement

Automatic measurement can be performed continuously from external diameter to internal diameter without having to change the probe position. This not only reduces measurement time, but eliminates the error factors otherwise involved in changing the probe position, greatly facilitating high-accuracy measurement.

The automatic centering/leveling mechanism incorporates a high-precision glass scale on each axis of the turntable. This allows feedback to be generated that prevents positioning errors from affecting centering/leveling adjustments. The high-speed, automatic, centering/leveling capability achieved greatly contributes to reducing the total measurement time from workpiece setting to workpiece measurement.

Continuous measurement is possible as shown in steps (1) through (3) on the figure at the left, without having to switch the probe direction.

1) and 2) : OD measurement
3) : ID measurement
→ : Movement






Mitutoyo

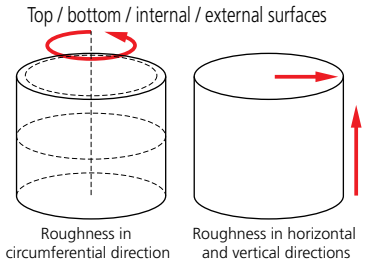
# Roundtest RA-H5200AS / AH

## SERIES 211 — Roundness / Cylindricity Measuring System

**X-axis tracking measurement**
Because of the linear scale incorporated into the X-axis, measurement can be performed by tracking the workpiece surface (tracking range: ±5mm). This function is effective for measuring a workpiece with a displacement that exceeds the detection range of the probe in measuring roundness/cylindricity or a taper that is determined with slider/column movement.

**Surface roughness measurement function (Surface roughness unit: option)**
A surface roughness detector, compliant with the relevant international standards, can be mounted in place of the roundness measuring detector. This creates a multiple sensor system that can not only test the geometrical roundness/cylindricity of a surface, but also the roughness of that surface.





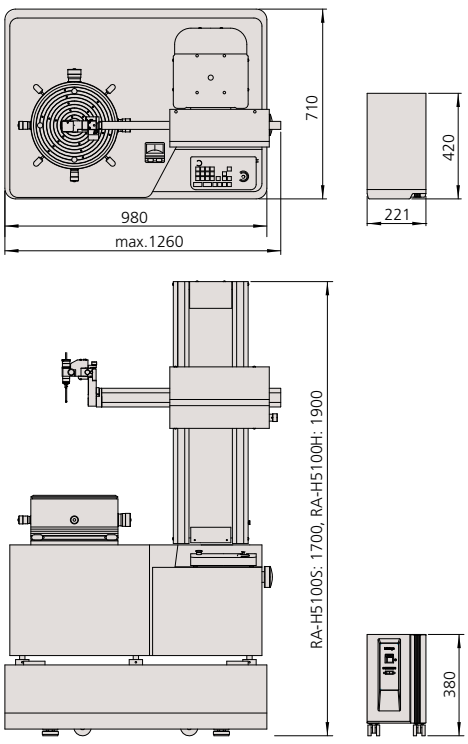



## SPECIFICATIONS

| Model No. | RA-H5200AS | RA-H5200AH |
|---|---|---|
| **Order No. *** with vibration isolating stand | **211-531A** | **211-532A** |
| Column travel | 13.77" (350mm) (standard column) | 21.65" (550mm) (high column) |

## DIMENSIONS

Unit: mm




## Optional Accessories

**350850**: Cylindrical square
**12AAF203**: Extension probe holder (2X higher)
**12AAF205**: Extension probe holder (3X higher)
**12AAF204**: Auxiliary probe holder for a large diameter workpiece
**211-045**: Magnification calibration gage
**211-014**: Chuck (OD: 2 - 78mm, ID: 25 - 68mm)
**211-032**: Quick chuck (OD: 1 - 79mm, ID: 16 - 69mm)
**211-031**: Micro-chuck (OD: 0.1~1.5mm max.)
**12AAB598**: Protective shield
———: Interchangeable styli (See page J-49.)
**12AAL019**: Side table for PC




**Sliding detector-unit holder (Standard) 12AAL090**
The detector-unit holder is equipped with a sliding mechanism, enabling one-touch measurement of a workpiece with a deep hole having a thick wall, which has been difficult with the conventional standard arm.

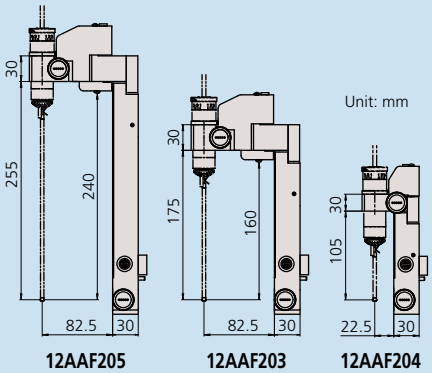


Sliding distance: 4.4" (112mm)

The detector-unit holder can be stopped at a position sufficiently higher than the workpiece along the Z-axis, and then lowered and positioned to make measurements. Furthermore, internal/external diameters can be easily measured with the continuous internal/external diameter measurement function*.

*: See page 41 for details about the continuous ID and OD measuring function.

Unit: mm



# Roundtest Extreme RA-2200CNC / RA-H5200CNC

## SERIES 211 — CNC Roundness, Cylindricity and Surface Roughness Measuring System

Mitutoyo offers innovative roundness/ cylindricity measuring systems capable of automated measurement with independent/ simultaneous multi-axis CNC control. In addition to high measuring accuracy and reliability, these CNC models provide excellent inspection productivity. Roundness and surface roughness measurements are both available from a single measuring system so workpiece resetting for roughness measurement is not required. Roughness measurement is possible in the axial and circumferential directions.



Holder-arm orientation switching (vertical position - horizontal position)



Detector rotation mechanism (0 to 290°, in increments of 1°)



**RA-2200H CNC**
with personal computer system and software

* Shown with optional vibration isolator and side table for PC.



**RA-H5200H CNC**
with personal computer system and software

* Shown with optional side table for PC.

### Technical Data: RA-2200CNC

Turntable
- Rotational accuracy (radial): {(0.02+3.5H/10000)µm}
- Rotational accuracy (axial): {(0.02+3.5X/10000)µm}
  H: Probing height (mm), X: Distance from the turntable axis (mm)
- Rotating speed: 2, 4, 6, 10rpm
- Tabletop diameter: ø 9.25" (235mm)
- Centering range: ±3mm
- Leveling range: ±1°
- Maximum probing diameter: ø 10.1" (256mm)
- Maximum workpiece diameter: ø 22.8" (580mm)
- Maximum workpiece weight: 66 lbs (30kg)

Vertical column (Z-axis)
- Vertical travel: 11.8" (300mm) 19.7" (500mm: 2200H model)
- Straightness (c2.5): 0.10µm / 100mm, 0.15µm / 300mm (0.25µm / 500mm: 2200H model)
- Parallelism with rotating axis: 0.7µm / 300mm (1.2µm / 500mm: 2200H model)
- Positioning speed: Max. 50mm/s
- Measuring speed: 0.5, 1, 2, 5mm/s
- Maximum probing height: 11.8" (300mm) (OD / ID) [19.7" (500mm) (OD / ID): 2200H model]
- Maximum probing depth: over ø32: 104mm (w/standard stylus) over ø12.7: 26mm (w/standard stylus)

Horizontal arm (X-axis)
- Horizontal travel: 6.9" (175mm) (Including a protrusion of 1" (25mm) the turntable rotation center)
- Straightness (c2.5): 0.7µm / 150mm
- Squareness with rotating axis: 1.0µm / 150mm
- Positioning speed: Max. 30mm/s
- Measuring speed: 0.5, 1, 2, 5mm/s

Probe and stylus
- Measuring range: ±400µm/±40µm/±4µm (±5mm: tracking range)
- Measuring force: 40mN (not adjustable)
- Standard stylus: **12AAE301**, carbide ball, ø1.6mm
- Measuring direction: one direction
- Stylus angle adjustment: ±45° (with graduations)

Air supply
- Air pressure: 390kPa (4kgf/cm$^2$)
- Air consumption: 30L/min.

Power supply: 100V AC – 240V AC, 50/60Hz

Dimensions (W x D x H): 26.3 x 20 x 35.4" (667 x 510 x 900mm) (26.3 x 20 x 43.3" (667 x 510 x 1100mm): 2200H model)

Mass: 397 lbs (180kg) (441 lbs (200kg): 2200H model)

### Technical Data: RA-H5200CNC

Turntable
- Rotational accuracy (radial): (.8+.35H)µin {(0.02+3.5H/10000)µm}
- Rotational accuracy (axial): (.8+.35X)µin {(0.02+3.5X/10000)µm}
  H: Probing height (mm), X: Distance from the turntable axis (mm)
- Rotating speed: 2, 4, 6, 10rpm (20rpm: auto-centering)
- Table top diameter: ø300mm
- Centering range: ±5mm
- Leveling range: ±1°
- Maximum probing diameter: ø14" (356mm)
- Maximum workpiece diameter: ø 26.8" (680mm)
- Maximum workpiece weight: 176 lbs (80kg) 143 lbs (65kg): auto-centering

Vertical column (Z-axis)
- Vertical travel: 13.7" (350mm) 21.7" (550mm): H5200H model
- Straightness (λc2.5): 0.05µm / 100mm, 0.14µm / 350mm (0.2µm / 550mm: H5200H model)
- Parallelism with rotating axis: 0.2µm / 350mm (0.32µm / 550mm: H5200H model)
- Positioning speed: Max. 60mm/s
- Measuring speed: 0.5, 1, 2, 5mm/s
- Maximum probing height: 13.7" (350mm) (OD / ID) [21.7" (550mm) (OD / ID): H5200H model)
- Maximum probing depth: over ø32: 104mm (w/standard stylus) over ø12.7: 26mm (w/standard stylus)

Horizontal arm (X-axis)
- Horizontal travel: 8.8" (225mm)
- Straightness (λc2.5): 0.4µm / 200mm
- Squareness with rotating axis: 0.5µm / 200mm
- Positioning speed: Max. 50mm/s
- Measuring speed: 0.5, 1, 2, 5mm/s

Probe and stylus
- Measuring range: ±400µm (±5mm: tracking range)
- Measuring force: 40mN (not adjustable)
- Standard stylus: **12AAE301**, carbide ball, ø1.6mm
- Measuring direction: one direction
- Stylus angle adjustment: ±45° (with graduations)

Air supply
- Air pressure: 390kPa (4kgf/cm$^2$)
- Air consumption: 45L/min.

Power supply: 100V AC – 240V AC, 50/60Hz

Dimensions (W x D x H): 49.6 x 28.0 x 66.9" (1260 x 710 x 1700mm) 49.6 x 28.0 x 74.8" (1260 x 710 x 1900mm: H5200H model)

Mass: Main unit: 1433 lbs (650kg) 1477 lbs (670kg): H5200H (model)

Vibration isolator: 375 lbs (170kg)



Mitutoyo

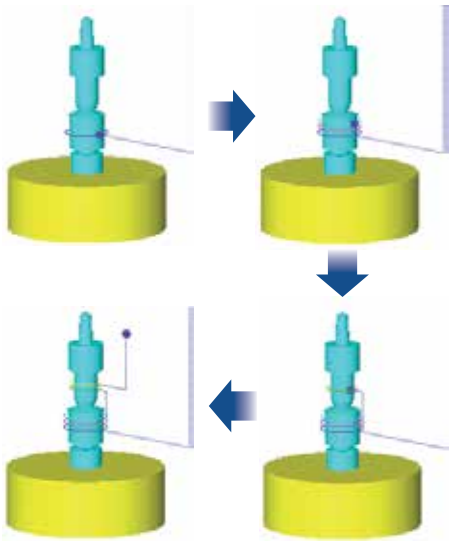
# Roundtest Extreme
# RA-2200CNC / RA-H5200CNC

## SERIES 211 — CNC Roundness, Cylindricity and Surface Roughness Measuring System

### ROUNDPAK

**Off-line measurement procedure programming function**

On-screen virtual 3D simulation measurements can be performed with the incorporated off-line teaching function that allows a part program (measurement procedure) to be created without an objective workpiece. The probe and the holder unit of the Roundtest Extreme can be precisely represented and an alarm can be raised to indicate that there is a collision risk predicted by the simulation.





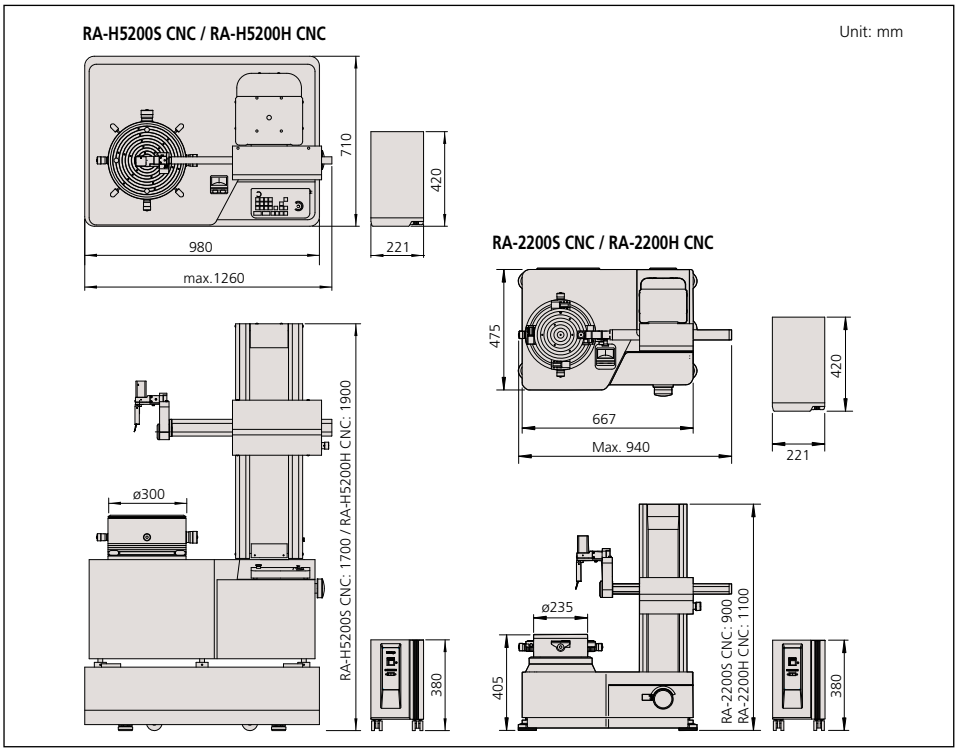
3D simulation screens (work-view windows) can be generated after entering CAD data (in IGES, DXF form) and text data.

## SPECIFICATIONS

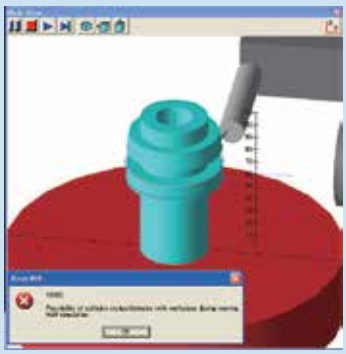
| Model No. | EXTREME RA-2200S CNC | EXTREME RA-2200H CNC |
|---|---|---|
| **Order No.** | **211-517A** | **211-518A** |
| Column travel | 11.8″ (300mm) (standard column) | 19.7″ (500mm) (high column) |

| Model No. | EXTREME RA-H5200S CNC | EXTREME RA-H5200H CNC |
|---|---|---|
| **Order No.** with vibration isolating stand | **211-533A** | **211-534A** |
| Column travel | 13.77″ (350mm) (standard column) | 21.65″ (550mm) (high column) |

## DIMENSIONS




MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
FORM



## Optional Accessories

**350850**: Cylindrical square
**211-045**: Magnification calibration gage
**211-014**: Chuck (OD: 1 - 78mm, ID: 25 - 68mm)
**211-032**: Quick chuck (OD: 1 - 79mm, ID: 16 - 69mm)
**211-031**: Micro-chuck (OD: 0.1~1.5mm max.)
**12AAB598**: Protective shield (RA-H5200 only)
———: Interchangeable styli (See page J-49.)
**12AAK110**: Vibration isolator (RA-2200 only)
**12AAK120**: Monitor arm (RA-2200 only)
**12AAL019**: Side table for PC
**12AAG419**: Surface roughness detector for RA-CNC



**64AAB573 Workstation**

### Dimensions

Overall: 36 x 30 x 24-32″ (W x D x H)
Cord Bin: 4″h x 5-3/8″d (width is 10″ less than table width)
Distance From Front Edge to Cord Bin: 30″d table – 15-1/2″d
Distance Between Legs: 10″ less than the overall table width

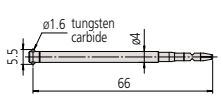
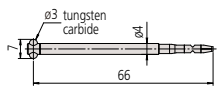
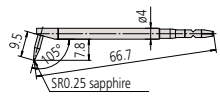
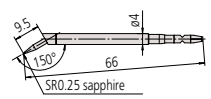
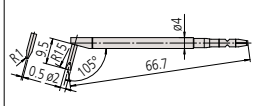
Work surface feature a 1″, 45 lb density, furniture board substrate with attractive Gray laminate tabletop brimmed with bullnose edge band in Quartz gray color. Work surface is height adjustable in one inch increments from 24″ to 32″.

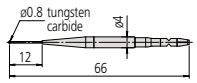
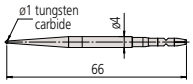
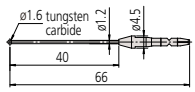
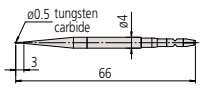
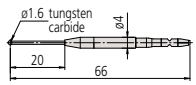
Tabletop incorporates metal threaded inserts on the underside to affix the leg assemblies for added strength and durability. Table comes with 4″ casters with two as locking type for stationary placement.

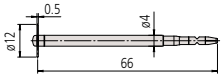
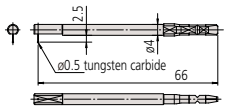
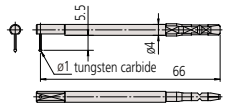
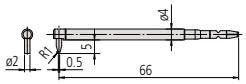
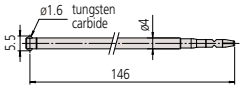
*Laptop PC not included with table.

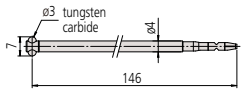
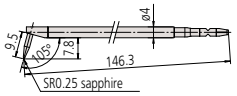
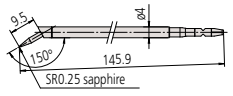
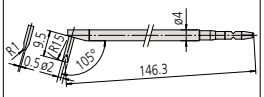
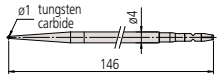
# Optional Styli for Roundtest

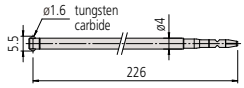
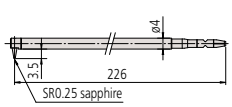
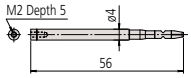
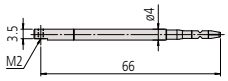
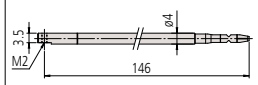
## Interchangeable Styli for RA-120, RA-120P, RA-1600/M, RA-2200, RA-H5200

| Application/Type | Standard (Standard accessory) | Notch | Deep groove | Corner | Cutter mark |
|---|---|---|---|---|---|
| **Order No.** | **12AAL021*** | **12AAL022** | **12AAL023** | **12AAL024** | **12AAL025** |
| Stylus tip | ø1.6 mm tungsten carbide | ø3 mm tungsten carbide | SR0.25mm sapphire | SR0.25mm sapphire | tungsten carbide |
| Dimensions (mm) |  |  Included in 5-pcs. styli set No. 12AAL020 |  Included in 5-pcs. styli set No. 12AAL020 |  |  |

| Application/Type | Small hole (ø0.8) | Small hole (ø1.0) | Small hole (ø1.6) | Extra small hole (Depth 3mm) | ø1.6 mm ball |
|---|---|---|---|---|---|
| **Order No.** | **12AAL026** | **12AAL027** | **12AAL028** | **12AAL029** | **12AAL030** |
| Stylus tip | ø0.8 mm tungsten carbide | ø1 mm tungsten carbide | ø1.6 mm tungsten carbide | ø0.5 mm tungsten carbide | ø1.6 mm tungsten carbide |
| Dimensions (mm) |  |  Included in 5-pcs. styli set No. 12AAL020 |  |  |  Included in 5-pcs. styli set No. 12AAL020 |

| Application/Type | Disk | Crank (ø0.5) | Crank (ø1.0) | Flat surface | 2X-long type** |
|---|---|---|---|---|---|
| **Order No.** | **12AAL031** | **12AAL032** | **12AAL033** | **12AAL034** | **12AAL035** |
| Stylus tip | ø12 mm tungsten carbide | ø0.5 mm tungsten carbide (Depth 2.5 mm) | ø1 mm tungsten carbide (Depth 5.5 mm) | tungsten carbide | ø1.6 mm tungsten carbide |
| Dimensions (mm) |  |  |  |  |  Included in 5-pcs. styli set No. 12AAL020 |

| Application/Type | 2X-long type notch** | 2X-long type deep groove** | 2X-long type corner** | 2X-long type cutter mark** | 2X-long type Small hole** |
|---|---|---|---|---|---|
| **Order No.** | **12AAL036** | **12AAL037** | **12AAL038** | **12AAL039** | **12AAL040** |
| Stylus tip | ø3 mm tungsten carbide | SR0.25 mm sapphire | SR0.25 mm sapphire | tungsten carbide | ø1 mm tungsten carbide |
| Dimensions (mm) |  |  |  |  |  |

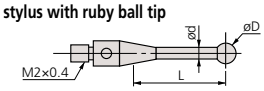
| Application/Type | 3X-long type** | 3X-long type deep groove** | Stylus shank | Stylus shank (standard groove) | Stylus shank (2X-long groove)** |
|---|---|---|---|---|---|
| **Order No.** | **12AAL041** | **12AAL042** | **12AAL043** | **12AAL044** | **12AAL045** |
| Stylus tip | ø1.6 mm tungsten carbide | SR0.25 mm sapphire | For mounting CMM stylus (mounting thread M2) | For mounting CMM stylus (mounting thread M2) | For mounting CMM stylus (mounting thread M2) |
| Dimensions (mm) |  |  |  |  |  |

* **12AAL021** is a standard accessory for all Roundtest models.
** Not available for RA-10, RA-120/P and RA-220
Measuring is only in the vertical direction. Measuring magnification of 20000X is available using the 2X-long stylus.
Customized special interchangeable styli are available on request. Please contact any Mitutoyo office for more information.
† New design for holding styli is not shown in above illustrations.
**New styli for RA-2200 / H5200 are compatible with old RA-2100 / H5100 detectors.**
**Old styli for RA-2100 / H5100 are NOT compatible with new RA-2200 / H5200 detectors.**

### 5 pc. Stylus set: 12AAL020

| Part No. | Part Description |
|---|---|
| **12AAL022** | Stylus for notched workpiece |
| **12AAL023** | Stylus for deep groove |
| **12AAL027** | Stylus for small hole (1.0mm) |
| **12AAL030** | 1.6mm ball stylus |
| **12AAL035** | 2X-long type stylus |

**M2 CMM stylus with ruby ball tip**




Unit: mm



**K651276**
D = ø0.5, d = ø0.34, L = 3.0, Mass = 0.3g



**K651236**
D = ø0.7, d = ø0.5, L = 4.0 , Mass = 0.3g



**K651012**
D = ø1.0, d = ø0.7, L = 4.5, Mass = 0.3g



**K651013**
D = ø1.5, d = ø0.7, L = 4.5, Mass = 0.3g



**K651014**
D = ø2.0, d = ø1.0, L = 6.0, Mass = 0.3g



**K651016**
D = ø3.0, d = ø1.5, L = 7.5, Mass = 0.4g



**K651017**
D = ø4.0, d = ø1.5, L = 10.0, Mass = 0.4g



**K651018**
D = ø5.0, d = ø2.5, R = 10.0, Mass = 0.7g



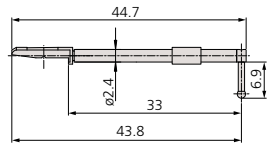
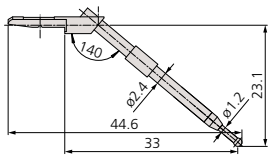
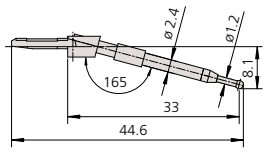
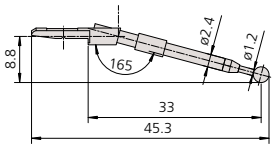
**K651024**
D = ø6.0, d = ø2.5, R = 10.0, Mass = 0.9g

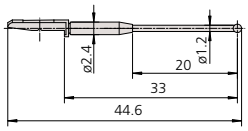
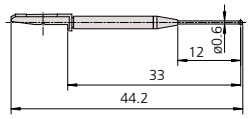
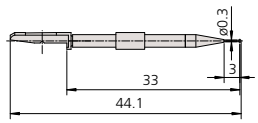
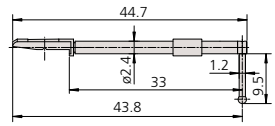


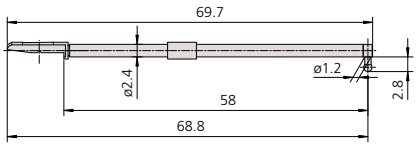
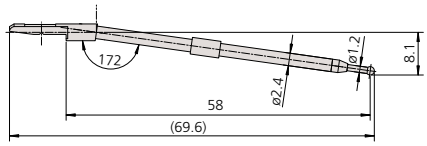
**K651025**
D = ø8.0, d = ø2.5, R = 11.0, Mass = 1.5g

# Optional Styli for Roundtest

## Interchangeable Styli for RA-2200 CNC, RA-H5200 CNC

| Application/Type | Groove | Flat surface | General purpose | Notch |
|---|---|---|---|---|
| **Order No.** | **12AAE310** | **12AAE302** | **12AAE301** | **12AAE309** |
| Stylus tip | ø1.6 mm tungsten carbide | ø1.6 mm tungsten carbide | ø1.6 mm tungsten carbide | ø3 mm tungsten carbide |
| Dimensions (mm) |  |  |  |  |

| Application/Type | ø1.6 mm ball | ø0.8 mm ball | ø0.5 mm ball | Deep groove |
|---|---|---|---|---|
| **Order No.** | **12AAE303** | **12AAE304** | **12AAE305** | **12AAE308** |
| Stylus tip | ø1.6 mm tungsten carbide | ø0.8 mm tungsten carbide | ø0.5 mm tungsten carbide | ø1.6 mm tungsten carbide |
| Dimensions (mm) |  |  |  |  |

| Application/Type | Deep hole A | Deep hole B |
|---|---|---|
| **Order No.** | **12AAE306** | **12AAE307** |
| Stylus tip | ø1.6 mm tungsten carbide | ø1.6 mm tungsten carbide |
| Dimensions (mm) |  |  |

| Analysis options | | RA-H5200CNC/ RA-H5200 | RA-2200CNC/ RA-2200 | RA-1600 | RA-1600M | RA-120P | RA-120 |
|---|---|---|---|---|---|---|---|
| Roundness | ○ | ● | ● | ● | ● | ● | ● |
| Cylindricity | ⌭ | ● | ● | ● | ● | — | — |
| Concentricity | ◎ | ● | ● | ● | ● | ● | ● |
| Coaxiality | axis-element | ◉ | ● | ● | ● | ● | ● | ● |
| | Axis-axis | | ● | ● | ● | ● | ● | — |
| Flatness | ▱ | ● | ● | ● | ▲ | ● | ● |
| Parallelism | // | ● | ● | ● | ▲ | ● | ● |
| Perpendicularity | ⊥ | ● | ● | ● | ● | ● | ● |
| Runout | ↗ | ● | ● | ● | ● | ● | ● |
| Total runout | ⌰ | ● | ● | ● | ▲ | — | — |
| Straightness | — | ● | ● | ● | ▲ | — | — |
| Inclination | ∠ | ● | ● | ● | ▲ | — | — |
| Taper | /\ | ● | ● | ● | ▲ | — | — |

● Full measurment capability
▲ Limited measurement capability; R-Axis must be stationary.

### Usage examples of styli


Cutter mark

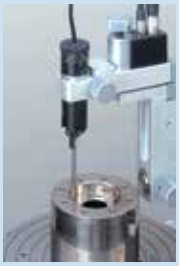

Corner


Small hole


Small hole


Flatness measurement


Notched workpiece measurement


ID measurement

# Optional Accessories for Roundtest



**Centering chuck** (ring operated)
**211-032**
Suitable for holding small parts with easy-to-operate knurled-ring clamping.
- Holding capacity:
  Internal jaws: OD = 1-36 mm, ID = 14-70 mm.
External jaws: OD = 1-75 mm.
- External dimensions: ø118x41 mm
- Mass: 1.2kg



**Centering chuck** (key operated)
**211-014**
Suitable for holding longer parts and those requiring a relatively powerful clamp.
- Holding capacity:
  Internal jaws: OD = 1 - 35mm, ID = 33 - 85mm
  External jaws: OD = 30-80mm.
- External dimensions: ø157 x 76mm
- Mass: 3.8kg

**Vibration Isolated frame with work surface**



| Code No. | Dimensions | Load Capacity |
|---|---|---|
| 64AAB357 | 30 x 48 x 30" | 1300 lbs |



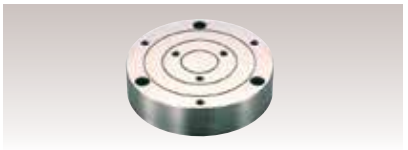
**Cylindrical square**
**350850**
- Used for checking and aligning table rotation axis parallel to the Z-axis column.
- Squareness: 3µm
- Straightness: 1µm
- Cylindricity: 2µm
- Roundness: 0.5µm
- Mass: 7.5kg



**Micro-chuck**
**211-031**
Used for clamping a workpiece (less than ø1 mm dia.) that the centering chuck cannot handle.
- Holding capacity: up to ø1.5 mm
- External dimensions: ø118x48.5 mm
- Mass: 0.8kg



**Magnification calibration gage**
**211-045**
Used for normalizing detector magnification by calibrating detector travel against displacement of a micrometer spindle.
- Maximum calibration range: 400µm
- Graduation: 0.2µm
- Mass: 4kg



**Auxiliary workpiece stand**
**356038**
- Used for measuring a workpiece whose diameter is 20mm or shorter and whose height is 20mm or lower.



**Magnification checking kit***
**997090**
- A combination of gage blocks and an optical flat.

* Standard accessory for RA-2200, RA-2200CNC, RA-H5200 and RA-H5200CNC



**Origin-point gage***
**998382**
- A gage for zero setting of the R-axis and Z-axis.

* Standard accessory for RA-2200 and RA-H5200



**211-016**
**Reference Hemisphere**



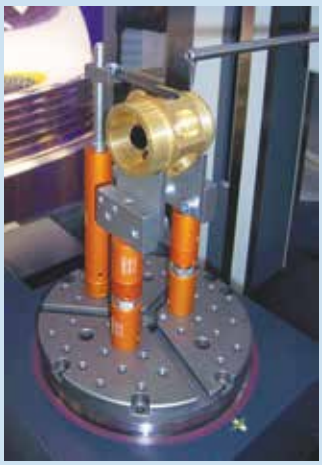
Mitutoyo

# Eco-Fix Kit Form-S

## Mitutoyo ECO-FIX Kit Fixture Systems



| Part No. | Qty. | Part name | Part No. | Qty. | Part name |
|---|---|---|---|---|---|
| **K551038** | 1 | Adaptor plate ø 150mm | **K551069** | 1 | Flat top ø 12mm |
| **K551024** | 1 | Location pin ø 12 X 13mm | **K550262** | 1 | V-block mini |
| **K551025** | 1 | Location pin ø 12 X 25mm | **K550261** | 2 | Cone receiver mini |
| **K551026** | 1 | Location pin ø 12 X 50mm | **K550250** | 1 | Stopper element mini |
| **K551027** | 1 | Location pin ø 12 X 100mm | **K550247** | 1 | Back square mini |
| **K551028** | 1 | Location pin ø 20 X 13mm | **K550888** | 2 | Straight pin Ø 6mm x 20mm |
| **K551029** | 1 | Location pin ø 20 X 25mm | **K550889** | 2 | Straight pin Ø 6mm x 30mm |
| **K551030** | 1 | Location pin ø 20 X 50mm | **K550890** | 2 | Straight pin Ø 6mm x 40mm |
| **K551031** | 1 | Location pin ø 20 X 100mm | **K551046** | 1 | Slotted nut for receiver bracket h=12mm |
| **K551035** | 1 | Receiver bracket small | **K551050** | 1 | Allen key 2mm |
| **K551036** | 1 | Receiver bracket large | **K551051** | 1 | Allen key 3mm |
| **K551040** | 1 | Adjustable location pin ø 20mm | **K551052** | 1 | Allen key 4mm |
| **K551041** | 1 | Adjustable location pin ø 12mm | **K551053** | 1 | Allen key 5mm |
| **K551042** | 3 | Location pin ø 12mm with bore ø 6mm | **K551054** | 1 | Double open ended spanner 10-17 |
| **K551044** | 1 | Receiver bracket L=90; ø 12mm | **K550591** | 1 | Washer ø 6,4mm / ø 17mm |
| **K550716** | 1 | Straight pin with thread | **K550110** | 8 | Cylinder head screw M6 x 20mm |
| **K550279** | 1 | Spring clip, d= 8mm, L= 60mm | **K550563** | 6 | Cylinder head screw M6 x 25mm |
| **Kit Part No.** | | | **K551133** | | |



# Eco-Fix Kit Form-L



| Part No. | Qty. | Part name | Part No. | Qty. | Part name |
|---|---|---|---|---|---|
| **K551039** | 1 | Adaptor plate ø 200mm | **K550247** | 1 | Back square mini |
| **K551024** | 1 | Location pin ø 12 X 13mm | **K550058** | 1 | V-block |
| **K551025** | 1 | Location pin ø 12 X 25mm | **K550365** | 2 | Cone receiver |
| **K551026** | 1 | Location pin ø 12 X 50mm | **K550982** | 1 | Stopper element |
| **K551027** | 2 | Location pin ø 12 X 100mm | **K550248** | 1 | Back square |
| **K551028** | 2 | Location pin ø 20 X 13mm | **K550888** | 2 | Straight pin Ø 6mm x 20mm |
| **K551029** | 2 | Location pin ø 20 X 25mm | **K550889** | 2 | Straight pin Ø 6mm x 30mm |
| **K551030** | 2 | Location pin ø 20 X 50mm | **K550890** | 2 | Straight pin Ø 6mm x 40mm |
| **K551031** | 1 | Location pin ø 20 X 100mm | **K550000** | 2 | Straight pin Ø 8mm x 30mm |
| **K551035** | 1 | Receiver bracket small | **K550001** | 2 | Straight pin Ø 8mm x 50mm |
| **K551036** | 1 | Receiver bracket large | **K550002** | 2 | Straight pin Ø 8mm x 95mm |
| **K551040** | 2 | Adjustable location pin ø 20mm | **K551046** | 1 | Slotted Nut for receiver bracket h= 12mm |
| **K551041** | 1 | Adjustable location pin ø 12mm | **K551047** | 1 | Slotted Nut for receiver bracket h= 15mm |
| **K551042** | 2 | Location pin ø 12mm with bore ø 6mm | **K551050** | 1 | Allen key 2mm |
| **K551043** | 3 | Location pin ø 20mm with bore ø 8mm | **K551051** | 1 | Allen key 3mm |
| **K551044** | 1 | Receiver bracket L=90; ø 12mm | **K551052** | 1 | Allen key 4mm |
| **K551045** | 1 | Receiver bracket L=120; ø 20mm | **K551053** | 1 | Allen key 5mm |
| **K550279** | 2 | Spring clip, d= 8mm, L= 60mm | **K550591** | 1 | Washer ø 6,4mm / ø 17mm |
| **K550262** | 1 | V-block mini | **K550110** | 12 | Cylinder head screw M6 x 20mm |
| **K550261** | 2 | Cone receiver mini | **K550563** | 6 | Cylinder head screw M6 x 25mm |
| **K550250** | 1 | Stopper element mini | | | |
| **Kit Part No.** | | | **K551134** | | |



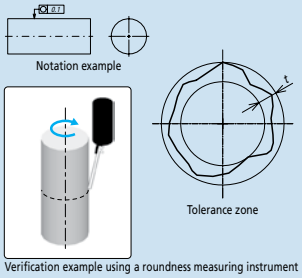
# Quick Guide to Precision Measuring Instruments

## Roundtest (Roundform Measuring Instruments)

- **JIS B 7451-1997: Roundness measuring instruments**
- **JIS B 0621-1984: Definition and notation of geometric deviations**
- **JIS B 0021-1998: Geometric property specifications touching of products – Geometric tolerance Roundness Testing**

### Roundness

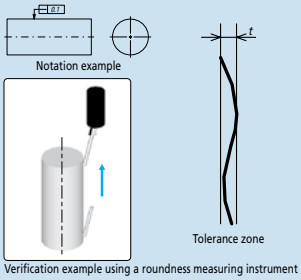
Any circumferential line must be contained within the tolerance zone formed between two coplanar circles with a difference in radii of t




Verification example using a roundness measuring instrument

### Straightness

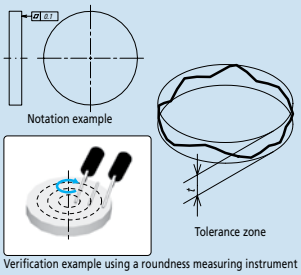
Any line on the surface must lie within the tolerance zone formed between two parallel straight lines a distance t apart and in the direction specified




Verification example using a roundness measuring instrument

### Flatness

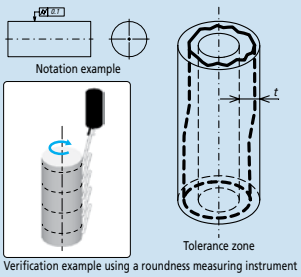
The surface must be contained within the tolerance zone formed between two parallel planes a distance t apart




Verification example using a roundness measuring instrument

### Cylindricity

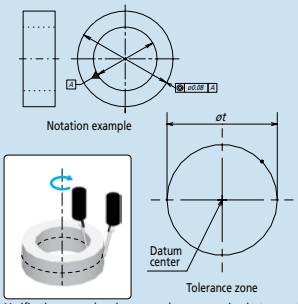
The surface must be contained within the tolerance zone formed between two coaxial cylinders with a difference in radii of t




Verification example using a roundness measuring instrument

### Concentricity

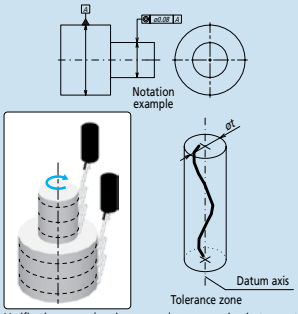
The center point must be contained within the tolerance zone formed by a circle of diameter t concentric with the datum




Verification example using a roundness measuring instrument

### Coaxiality

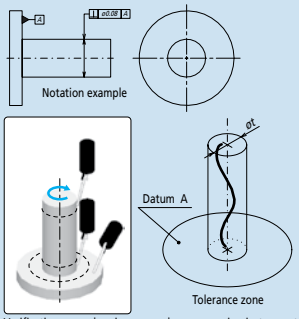
The axis must be contained within the tolerance zone formed by a cylinder of diameter t concentric with the datum



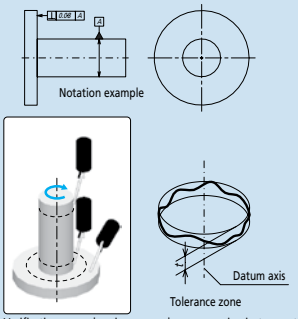

Verification example using a roundness measuring instrument

### Perpendicularity

The line or surface must be contained within the tolerance zone formed between two planes a distance t apart and perpendicular to the datum



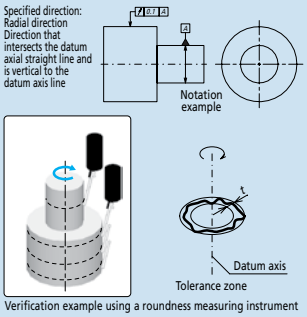

Verification example using a roundness measuring instrument



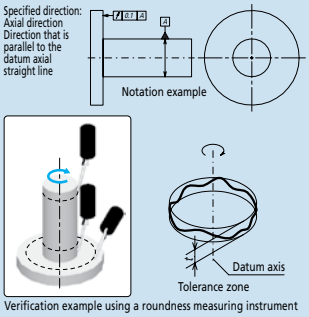

Verification example using a roundness measuring instrument

### Circular Runout

The line must be contained within the tolerance zone formed between two coplanar and/or concentric circles a distance t apart concentric with or perpendicular to the datum



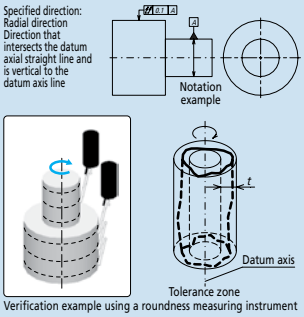

Verification example using a roundness measuring instrument



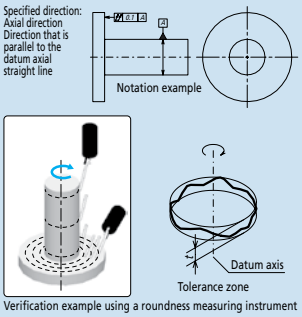

Verification example using a roundness measuring instrument

### Total Runout

The surface must be contained within the tolerance zone formed between two coaxial cylinders with a difference in radii of t, or planes a distance t apart, concentric with or perpendicular to the datum




Verification example using a roundness measuring instrument

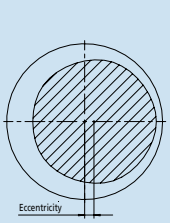


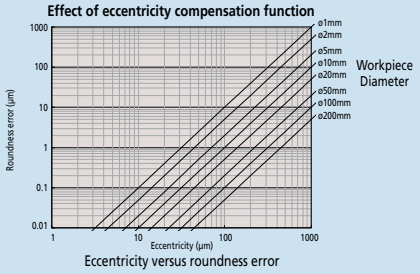

Verification example using a roundness measuring instrument

## Adjustment prior to Measurement

### Centering

A displacement offset (eccentricity) between the Roundtest's rotary table axis and that of the workpiece results in distortion of the measured form (limaçon error) and consequentially produces an error in the calculated roundness value. The larger the eccentricity, the larger is the error in calculated roundness. Therefore the workpiece should be centered (axes made coincident) before measurement.
Some roundness testers support accurate measurement with a limaçon error correction function.
The effectiveness of this function can be seen in the graph below.

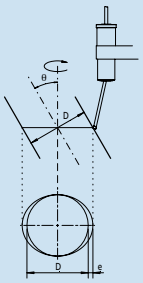


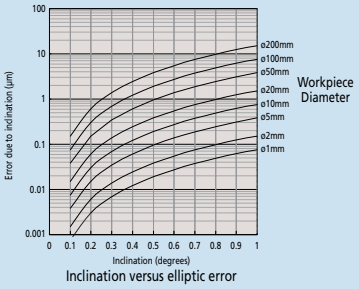




Eccentricity versus roundness error

### Leveling

Any inclination of the axis of a workpiece with respect to the rotational axis of the measuring instrument will cause an elliptic error. Leveling must be performed so that these axes are sufficiently parallel.




Inclination versus elliptic error

## Effect of Filter Settings on the Measured Profile

**Roundness values as measured are greatly affected by variation of filter cutoff value. It is necessary to set the filter appropriately for the evaluation required.**

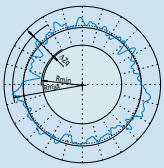



## Evaluating the Measured Profile Roundness

**Roundness testers use the measurement data to generate reference circles whose dimensions define the roundness value. There are four methods of generating these circles, as shown below, and each method has individual characteristics so the method that best matches the function of the workpiece should be chosen.**

### Least Square Circle (LSC) Method

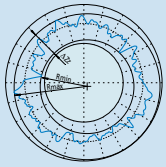
A circle is fitted to the measured profile such that the sum of the squares of the departure of the profile data from this circle is a minimum. The roundness figure is then defined as the difference between the maximum departures of the profile from this circle (highest peak to the lowest valley).



ΔZq = Rmax-Rmin

### Minimum Zone Circles (MZC) Method

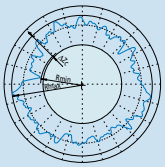
Two concentric circles are positioned to enclose the measured profile such that their radial difference is a minimum. The roundness figure is then defined as the radial separation of these two circles.



ΔZz = Rmax-Rmin

### Minimum Circumscribed Circle (MCC) Method

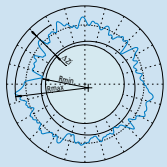
The smallest circle that can enclose the measured profile is created. The roundness figure is then defined as the maximum departure of the profile from this circle. This circle is sometimes referred to as the 'ring gage' circle.



ΔZc = Rmax-Rmin

### Maximum inscribed Circle (MIC) Method

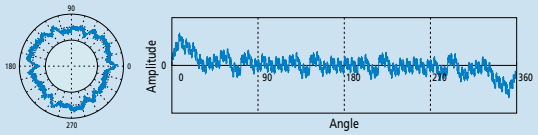
The largest circle that can be enclosed by the profile data is created. The roundness figure is then defined as the maximum departure of the profile from this circle. This circle is sometimes referred to as the `plug gage' circle.



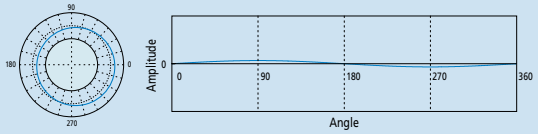
ΔZi = Rmax-Rmin

## Undulations Per Revolution (UPR) data in the roundness graphs

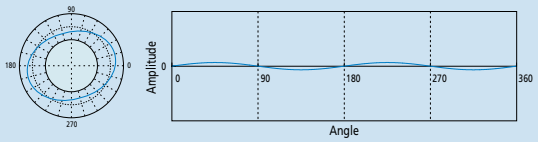
**Measurement result graphs**



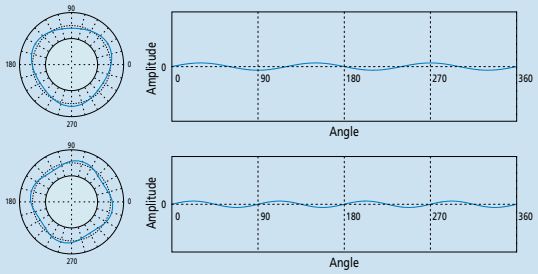

A 1 UPR condition indicates eccentricity of the workpiece relative to the rotational axis of the measuring instrument. The amplitude of undulation components depends on the leveling adjustment.



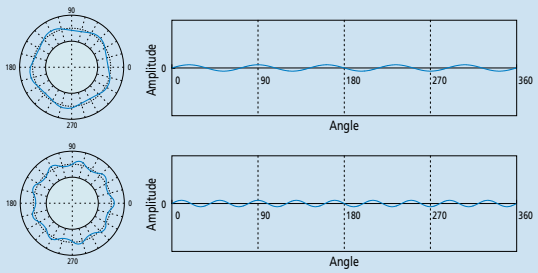

A 2 UPR condition may indicate: (1) insufficient leveling adjustment on the measuring instrument; (2) circular runout due to incorrect mounting of the workpiece on the machine tool that created its shape; (3) the form of the workpiece is elliptical by design as in, for example, an IC-engine piston.



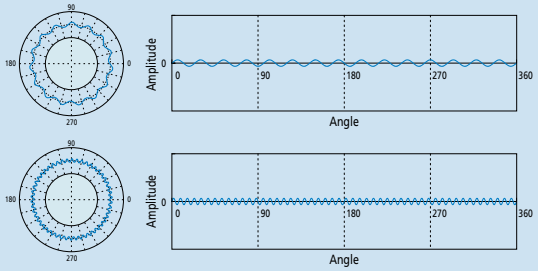

A 3 to 5 UPR condition may indicate: (1) Deformation due to over-tightening of the holding chuck on the measuring instrument; (2) Relaxation deformation due to stress release after unloading from the holding chuck on the machine tool that created its shape.




A 5 to 15 UPR condition often indicates unbalance factors in the machining method or processes used to produce the workpiece.




A 15 (or more) UPR condition is usually caused by tool chatter, machine vibration, coolant delivery effects, material non-homogeneity, etc., and is generally more important to the function than to the fit of a workpiece.








## Micro Hardness Testing Machines



## Rockwell Hardness Testing Machines



## Micro Zone Test System



## Portable Hardness Testing Instruments




Hardmatic HH-411



HM-210D/220D

## INDEX


| | |
|---|---|
| **Test Equipment** | |
| **Micro Hardness Testing Machines** | |
| Lineup of Hardness Testing Machines | K-2 |
| HM-210 / 220 Type A | K-3 |
| HM-200 Series with AVPAK Software | K-4 |
| MZT-500 | K-5 |
| HV-110 / 120 | K-6, 7 |
| Optional Accessories Micro-Vickers/Vickers Hardness Testing Machine | K-8 |
| **Rockwell Hardness Testing Machines** | |
| HR-530/530L | K-9 |
| HR-523/523L | K-10 |
| Optional Accessories For Rockwell/Rockwell Superficial Hardness Testing Machine | K-11,12 |
| **Portable Hardness Testing Machines** | |
| Hardmatic HH-411 | K-13 |
| Hardmatic HH-300 | K-14 |
| Hardmatic HH-300 Test Block Set | K-15 |
| Quick Guide to Precision Measuring Instruments - Hardness Testing Machines | K-16,17 |




HV110 Type B



HH-300 Durometers

# Lineup of Hardness Testing Machines

Hardness testing machines provide the simplest and most economical testing methods among many material testing machines, playing an important role in research activities, production activities, and commercial transactions. Mitutoyo offers a choice of standard hardness testing machines that are optimal for hard materials such as metals to soft materials such as plastic and rubber, as well as custom-designed testers such as in line-type automatic machines and labor-saving machines required on the shop floor.

Microhardness
(Micro-Vickers)



Automatic Vickers
Hardness Testing



Vickers



Rockwell



Rockwell Superficial

Rebound type
portable



For rubber
and plastic



## Technical Data

Test force range:
HM-210A: 9 steps + arbitrary test force
HM-220A: 19 steps + arbitrary test force
Load dwell time: 0 - 999s
Manual XY stage unit
Stage size: 100x100mm
Travel range: 25x25mm
with Digimatic in/mm micrometer heads
Resolution: 0.001mm
Max. specimen height: 133mm (Stage size: 25 x 25mm)
Max. specimen height: 121mm (Stage size: 50 x 50mm)
Max. specimen depth: 160mm (from the center of indenter)
Optical path: 4-port objectives switching system of Infinity-correction optical system
Resolution: 0.01µm (When using objectives of X40 or more)
Data output: Serial interface (RS-232), Digimatic interface, USB 2.0
Power supply: 39VA 100-125/220-240V AC, 50/60Hz
Dimensions: (W x D x H): 315x671x595mm
Mass: 43kg

## Optional Accessories (Factory-installed option)

**11AAC104**: Objective lens unit 2X
**11AAC105**: Objective lens unit 5X
**11AAC106**: Objective lens unit 10X
**11AAC107**: Objective lens unit 20X
**11AAC108**: Objective lens unit 100X
**11AAC129**: Measuring microscope (Digital ocular)
**11AAC109**: Knoop Indenter Assembly (HM-210 Series)
**11AAC110**: Knoop Indenter Assembly (HM-220 Series)

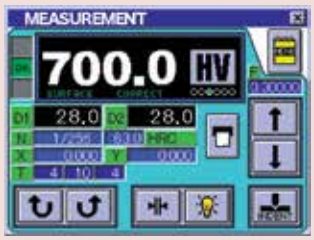
## Optional Accessories

**810-454A**: TV camera unit (8.4 inch LCD)
**19BAA058**: Diamond indenter for Vickers (HM210 Series standard test force)
**19BAA059**: Diamond indenter for Vickers (HM220 Series low test force)
**19BAA061**: Diamond indenter for Knoop (HM210 Series)
**19BAA062**: Diamond indenter for Knoop (HM220 Series)
**810-013**: Specimen (thin plate) holder
**810-014-1**: Specimen (wire) holder
**810-015-1**: Specimen (wire or ball) holder
**810-016**: 50 mm Vise
**810-017**: 100 mm Vise
**810-019**: Specimen tilting holder
**810-020**: Universal specimen holder
**810-018**: Rotary table
**810-084**: Rotatable universal specimen holder
**810-085**: Adjustable specimen (thin plate) holder
**810-095**: Rotatable specimen stage
**375-056**: Stage Micrometer (glass) Micro-scale
**810-650-1**: Resin mold specimen stage ø25.4
**810-650-2**: Resin mold specimen stage ø30
**810-650-3**: Resin mold specimen stage ø31.75
**810-650-4**: Resin mold specimen stage ø38.1
**810-650-5**: Resin mold specimen stage ø40
**810-641**: Vibration Isolator
**810-870A**: Sample Heating Device HST-250
**810-420**: 25x25mm stage (metric only)
**810-423**: 50x50mm stage (metric only)
**810-424**: 1"x1" in/mm stage (standard)
**810-427**: 2"x2" in/mm stage



Power turret with up to 2 indenter mounts and 4 objective mounts (manual operation possible)

Touch-screen type control panel




# HM-210 / 220 Type A

## SERIES 810 — Micro Vickers Hardness Testing Machines

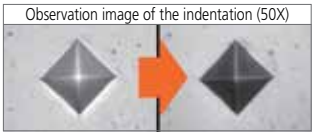
## FEATURES

- The electromagnetic force motor used in the loading mechanism enables the test force to be freely selected (see test force specifications) over the wide range of 0.4903mN to 19610mN (0.05gf to 2 kgf). It is also possible to freely set load dwell times. Now your desire for absolute control over the indentation size in Vickers hardness testing can be satisfied. The HM-200 series always offers the test force most appropriate for the specimen material and shape.
- The long working distance objectives used enable a comfortable working distance between the objective and the specimen surface. This greatly reduces the possibility of collision between the specimen and the objective during focusing operations. (e.g. for 50X objectives: 1.1mm for conventional models, 2.5mm for HM-200 series)
- Newly-designed 'MH Plan' objectives are optimized for measuring indentation images. The lineup includes 6 types of long working distance objectives: 10X, 20X, 50X and 100X for measuring indentation images, and 2X and 5X for enabling wide-range measurement around indentations.
- LEDs, which have a longer life, produce less heat, consume less power and are more energy efficient than incandescent bulbs, are employed for the illumination system.
- The motorized turret allows for up to 4 objective lenses and 2 indenter assemblies to be mounted at the same time.





Observation image of the indentation (50X)



Stray light reduction around the indentation





**HM-210A**

## SPECIFICATIONS **TYPE A** Digital Hardness Tester

| Model No. | HM-210 Type A | HM-210 Type A V/K | HM-220 Type A | HM-220 Type A V/K |
|---|---|---|---|---|
| **Part No.** | **64AAB305P** | **64AAB306P** | **64AAB307P** | **64AAB308P** |
| Fixed test force (mN) | 98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807 (10gf-1000gf) | | 0.4903, 0.9807, 1.961, 2.942, 4.903, 9.807, 19.61, 29.42, 49.03, 98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807, 19610 (0.05 gf-2kgf) | |
| Arbitrary test force | ≤100 gf in 1 gram increments, > 100gf in 10 gram increments | | < 1 gf in .1 gf increments, ≤100 gf in 1 gram increments, > 100gf in 10 gram increments | |
| Test force control | Force generation by electromagnetic and automatic control (load, dwell, unload) | | | |
| Control unit | Color LCD Touch Screen | | | |
| Loading rate | 60 µ/ sec | | 60µm/s, Variable between 2 and 60µm/s. ≤ 30 gf. | |
| Load dwell time | 0-999 sec | | | |
| Indenter | Vickers | Vickers and Knoop | Vickers | Vickers and Knoop |
| Objective lenses | 10x, 50x | 10x, 20x, 50x | 10x, 50x, 100x | 10x, 50x, 100x |
| Objective turret | Motor driven and manual operation | | | |
| Filar eye piece | Dual Line, 10X, .01µ min | | | |

**With TV camera unit 810-454A (selectable with HM-210A/220A)**

Measurement of indentation dimensions on a TV monitor reduces eye fatigue, which leads to improvement in operation efficiency in multi-point testing.





Mitutoyo

# HM-200 Series with AVPAK software

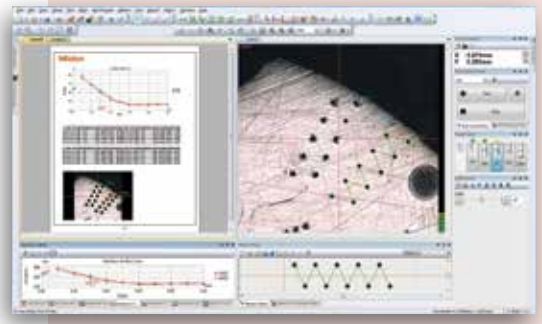
## For semi and fully automatic Type B and D Systems



### System B (HM-210B/220B)

System B is equipped with **AVPAK-10**, a the software package that automatically measures the diagonal length of an indentation and calculates the corresponding hardness value. This means that measurement error caused by variation in operator interpretation is eliminated, thereby reducing costs.

Automatic measurement of indentation/ manual stage



AVPAK Software



Indentation-reading example



### System D (HM-210D/220D)

In addition to the functions of System B, System D is equipped with the autofocus function and motorized x-y stage. This function allows for automatic hardness testing, thereby increasing efficiency and reducing labor costs.

Automatic measurement of indentation / motorized XY stage / Autofocusing

### System D Technical Data

| | | |
|---|---|---|
| Motorized X-Y Stage | Travel Max | 50 x 50 mm* |
| | Travel Min | 1µ |
| | Table Size | 130 x 130mm |
| | Speed Max | 25mm/ sec |
| Motorized Focusing Stage | Max Range | 1.4mm |
| | Min Unit | .1µ |
| | Max Speed | 1mm/ sec |
| Joystick Controller Functions | Functions | X and Y Lock out |
| | Axis | X, Y and Z (Focus) |
| | Speed Control | Adjustable H,M,L |
| | Tester Control | Indent, Turret Position |
| | Other | Emergency Stop |

*Optional 100 x 100 mm

## SPECIFICATIONS

**TYPE B** PC-Driven Test System **TYPE D** PC-Driven Test System with motorized stage and auto focus

| Model No. | HM-210 Type B | HM-210 Type B V/K | HM-220 Type B | HM-220 Type B V/K |
|---|---|---|---|---|
| **Part No.** | **64AAB323P** | **64AAB324P** | **64AAB325P** | **64AAB326P** |
| Model No. | HM-210 Type D | HM-210 Type D V/K | HM-220 Type D | HM-220 Type D V/K |
| **Part No.** | **64AAB380P** | **64AAB381P** | **64AAB382P** | **64AAB383P** |
| Fixed test force (mN) | 98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807 (10gf-1000gf) | | 0.4903, 0.9807, 1.961, 2.942, 4.903, 9.807, 19.61, 29.42, 49.03, 98.07, 196.1, 294.2, 490.3, 980.7, 1961, 2942, 4903, 9807, 19610 (0.05 gf-2kgf) | |
| Arbitrary test force | ≤100 gf in 1 gram increments, > 100gf in 10 gram increments | | < 1 gf in .1 gf increments, ≤100 gf in 1 gram increments, > 100gf in 10 gram increments | |
| Test force control | Force generation by electromagnetic and automatic control (load, dwell, unload) | | | |
| Control unit | None, By PC* | | | |
| Loading rate | 60 µ/ sec | | 60µm/s, Variable between 2 and 60µm/s. ≤ 30 gf. | |
| Load dwell time | 0-999 sec | | | |
| Indenter | Vickers | Vickers and Knoop | Vickers | Vickers and Knoop |
| Objective lenses | 10x, 50x | 10x, 20x, 50x | 10x, 50x, 100x | 10x, 50x, 100x |
| Objective turret | Motor-driven and manual operation | | | |
| Filar eye piece | None | | | |
| CCTV camera | 3 megapixel, 1/2" | | 3 megapixel, 1/2" | |
| Software | AV Pak | | AV Pak | |

*Must use specified PC

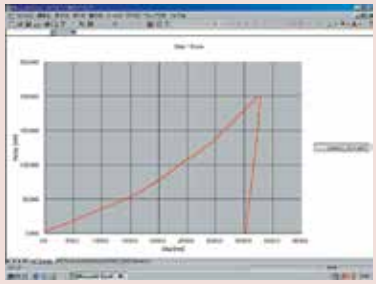
# MZT-500

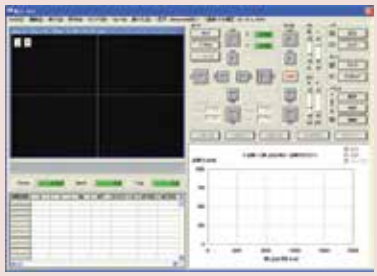
## SERIES 810 — Micro Zone Test System

## FEATURES

When it comes to evaluating mechanical properties of ultra-small regions of ultra-fine specimens, the MZT-500 Series models are exceptionally powerful tools in the fields of research and development and quality control. The MZT-500 can evaluate mechanical properties, which conventional hardness testing machines for fine specimens cannot measure, such as various CVD and PVD-deposited or generated films, including ion-plated films; hardness of ultra-fine cross-sections; bonding mechanical properties; and mechanical wear properties of carbon fibers, glass fibers, whiskers, etc.

- Test data
  The indentation factor can be obtained, which is related to the hardness value (partially) shown in Martens hardness test (ISO14577) and Young's modulus. Deformation characteristics in the load, dwell, and unload phases are also obtainable for use in determining properties of the specimen material.
- Hardness tests such as Vickers and Knoop hardness tests are supported.
- The balance lever vibration isolation mechanism reduces the effect of external vibrations on measurements.
- Indenter indentation depth can be measured up to a maximum of 20μm with a resolution of 0.1nm.
- Test forces between 0.1mN and 1000mN can be applied electromagnetically for evaluation of material properties in submicroscopic areas.
- Field-compatible form with cover for protection against dust and wind.







## SPECIFICATIONS

| Model No. | MZT-500L | MZT-500P |
|---|---|---|
| **Order No.** | **810-813A** | **810-814A** |
| Basic system | ✔ | ✔ |
| Data analysis / control device | ✔ | ✔ |
| Manual type XY stage (Travel range 25x25mm) | ✔ | — |
| Automatic XY stage (Travel range: 50x50mm) | — | ✔ |

| | |
|---|---|
| Test force loading device | Test force range: 0.1 to 1000mN |
| | Control resolution: 0.916μN |
| | Loading speed: 0.01 to 100mN/s |
| Indentation depth measurement | Range: 0 to 20μm |
| | Resolution: 0.1nm |
| Indenter | Type: Bercovich triangular pyramid indenter |
| Sample surface observation method | Camera: 1/3 inch black and white (410,000 pixels) |
| | Objective (monitor magnification): 100X (2500X), Optional: 10X (250X), 40X (1000X) |
| Specimen dimensions | Maximum height: 90mm |
| | Maximum depth: 90mm (From the center of the indenter axis) |
| Test type | Indentation test (with preliminary test force) |
| | Indentation test (without preliminary test force) |
| | Indentation depth setting test, continuous indentation test, repeated indentation test |



Mitutoyo

# HV110 / HV120

## Series 810—Vickers Hardness Testing Machines – Type A

### FEATURES

- Heavy load Vickers testing machines feature motorized force selection from 1-50kgf or .3 to 30kgf. Fully adjustable long-life LED illumination runs cool.
- A dual-line filar eyepiece combines with a color touch-screen LCD to create accurate measurements with the touch of a button.
- The motorized turret can accommodate up to 3 long working distance objective lenses for an even wider range of materials and a wide variety of anvils and x-y stages are also available.



HV120 show with optional **810-454A** CCTV Camera

### SPECIFICATIONS

| Model | HV110 | HV120 |
|---|---|---|
| **Order No.** | **810-441A** | **810-446A** |
| Test force | 9.807N (1kgf),19.61N (2kgf),29.42N (3kgf), 49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf)294.2N (30kgf), 490.3N (50kgf) | 2.942N (0.3kgf),4.903N (0.5kgf), 9.807N (1kgf),24.51N (2.5kgf),49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf)294.2N (30kgf) |
| Supported test method | HV, HK, HB (Light Force*), Kc | |
| Test force selection | Motorized | |
| Loading accuracy | ±1% | |
| Load control | 60µ/s, 150µ/s Automatic (loading, duration, unloading) | |
| Load rate | 5~999 sec. | |
| Objective lens | 2X, 5X, 10X (standard), 20X, 50X, 100X | |
| Measuring microscope | 10X Dual-line filar | |
| Total magnification | 20-1000X (100X Standard) | |
| Field of view | 1,400µ (10X Lens) Type A | |
| Minimum reading | < 50x = 0.1µm, ≥50x = 0.01µm | |
| Display | Color LCD touch-screen | |
| Scaled conversion: | 8 Types (ASTM, ISO, JIS, SAE and BS) | |
| Statistics: | N, Max., Min., Average, Range, High, Low, Good, Over, Under, SD(n-1), SD(n-1), SD(n) go/no-go judgment, | |
| Curvature correction; | 0.01 to 200.00mm | |
| Maximum sample height | 210mm Type A | |
| Maximum sample depth | 160mm | |
| Maximum sample weight | 20 Kg Anvil, 10 Kg with x-y Stage | |
| Optical path | 100% Eyetube or Camera | |
| Output | Rs232, SPC, USB2.0 | |
| Power supply | 120 Volt AC/ 60 Hz | |
| Dimensions main unit (WxDxH) | 9.9"x 24.7"x30.7 " (252x627x781mm) | |
| Mass | 110lbs. (50kg) | |

* Optional test forces may be required.

### Optional Accessories

**Lens:**
**11AAC712** OBJECTIVE LENS 2X
**11AAC713** OBJECTIVE LENS 5X
**11AAC714** OBJECTIVE LENS 20X
**11AAC715** OBJECTIVE LENS 50X
**11AAC716** OBJECTIVE LENS 100X

**Stage**
**810-423** MANUAL STAGE 50X50
**810-427** MANUAL STAGE 2"X 2"(In/mm)

**959149** SPC cable (1m / 40")

**Optical**
**11AAC711** "C" mount CAMERA ADAPTER
**810-454A** CCTV System

**Indenters**
**19BAA060** DIAMOND INDENTER (VICKERS TYPE)
**19BAA063** KNOOP DIAMOND INDENTER
**19BAA281** CARBIDE-ALLOY BALL 1MM DIA.
**11AAD469** CARBIDE-ALLOY INDENTER, 1MM DIA.
**19BAA283** CARBIDE-ALLOY BALL, 2.5MM DIA.
**11AAD470** CARBIDE-ALLOY INDENTER, 2.5MM DIA.

**Additional Test Force**
**11AAC697** 0.5 kg Brinell Weight
**11AAC698** 1.25 kg Brinell Weight
**11AAC699** 5.625 kg Brinell Weight
**11AAC700** 12.5 kg Brinell Weight

# HV110 / HV120

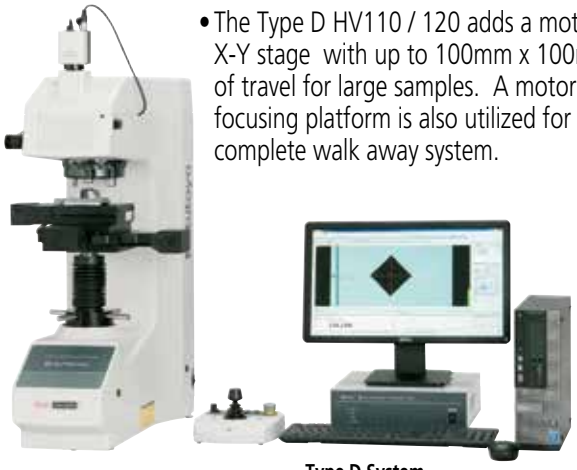
## Series 810—Vickers Hardness Testing Machines – Type B / D

### FEATURES

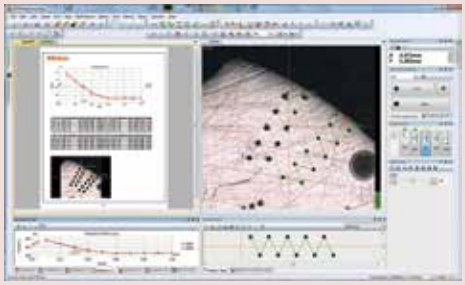
- The Type B HV110/ HV120 Vickers hardness testers add computer control to make measurements even more repeatable.
- A high-resolution 3 mega-pixel camera produces crisp images that are automatically measured in less than .3 seconds.
- Various software functions such as automatic light intensity, simple to use report generator and programming wizards make tedious and repetitive testing requirements more accurate than manual testing and eliminates common operator errors.
- The Type D HV110 / 120 adds a motorized X-Y stage with up to 100mm x 100mm of travel for large samples. A motorized focusing platform is also utilized for a complete walk away system.



**Type B System**
show with optional PC



**Type D System**
show with optional PC



### SPECIFICATIONS

| Model | HV110 Main Unit Only | HV120 Main Unit Only |
|---|---|---|
| **Order No.** | **810-443A** | **810-448A** |
| Test force | 9.807N (1kgf),19.61N (2kgf),29.42N (3kgf), 49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf)294.2N (30kgf), 490.3N (50kgf) | 2.942N (0.3kgf),4.903N (0.5kgf), 9.807N (1kgf),24.51N (2.5kgf),49.03N (5kgf), 98.07N (10kgf), 196.1N (20kgf)294.2N (30kgf) |
| Supported test method | HV, HK, HB (Light Force**), Kc | |
| Measuring microscope | Optional | |
| Field of View w/ 10X Lens | 590 x 443 µm | |
| Display | Via PC | |
| Curvature correction; | 0.01 to 200.00mm | |
| Maximum sample height | 172mm Type B, 132mm Type D | |
| Maximum sample depth | 160mm | |
| Maximum sample weight | 10 Kg Type B, 3 kg Type D | |
| Optical path | 100% Eyetube or Camera | |
| Output | USB2.0 | |
| Mass | 110lbs. (50kg) | |

*Other specifications as Type A testers
** Optional test forces may be required

| Basic Configuration | Type B | Type D |
|---|---|---|
| Main Unit | 810-443A or 810-448A | 810-443A or 810-448A |
| AVPak-10 Software | 11AAC664 | 11AAC664 |
| PC*** | *** | *** |
| Automatic Focus Stage | | 810-465 |
| Motorized X-Y Stage 50x50 | | 810-461A |
| Motorized X-Y Stage 100x100 | | 810-462A |

*** PC not included



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# Optional Accessories

## Micro-Vickers/Vickers Hardness Testing Machine

### Test Blocks

| Order No. | Description | Load |
|---|---|---|
| **64BAA173** | Vickers 100HV Test Block | 100gf |
| **64BAA174** | Vickers 200HV Test Block | 100gf |
| **64BAA175** | Vickers 300HV Test Block | 100gf |
| **64BAA176** | Vickers 400HV Test Block | 100gf |
| **64BAA177** | Vickers 500HV Test Block | 100gf |
| **64BAA178** | Vickers 600HV Test Block | 100gf |
| **64BAA179** | Vickers 700HV Test Block | 100gf |
| **64BAA180** | Vickers 800HV Test Block | 100gf |
| **64BAA181** | Vickers 900HV Test Block | 100gf |
| **64BAA182** | Vickers 100HV Test Block | 500gf |
| **64BAA183** | Vickers 200HV Test Block | 500gf |
| **64BAA184** | Vickers 300HV Test Block | 500gf |
| **64BAA185** | Vickers 400HV Test Block | 500gf |
| **64BAA186** | Vickers 500HV Test Block | 500gf |
| **64BAA187** | Vickers 600HV Test Block | 500gf |
| **64BAA188** | Vickers 700HV Test Block | 500gf |
| **64BAA189** | Vickers 800HV Test Block | 500gf |
| **64BAA190** | Vickers 900HV Test Block | 500gf |
| **64BAA191** | Vickers 100HV Test Block | 1000gf |
| **64BAA192** | Vickers 200HV Test Block | 1000gf |
| **64BAA193** | Vickers 300HV Test Block | 1000gf |
| **64BAA194** | Vickers 400HV Test Block | 1000gf |
| **64BAA195** | Vickers 500HV Test Block | 1000gf |
| **64BAA196** | Vickers 600HV Test Block | 1000gf |
| **64BAA197** | Vickers 700HV Test Block | 1000gf |
| **64BAA198** | Vickers 800HV Test Block | 1000gf |
| **64BAA199** | Vickers 900HV Test Block | 1000gf |
| **64BAA200** | Knoop 200HK Test Block | 100gf |
| **64BAA201** | Knoop 300HK Test Block | 100gf |
| **64BAA202** | Knoop 400HK Test Block | 100gf |
| **64BAA203** | Knoop 500HK Test Block | 100gf |
| **64BAA204** | Knoop 600HK Test Block | 100gf |
| **64BAA205** | Knoop 700HK Test Block | 100gf |
| **64BAA206** | Knoop 800HK Test Block | 100gf |
| **64BAA207** | Knoop 250HK Test Block | 500gf |
| **64BAA208** | Knoop 300HK Test Block | 500gf |
| **64BAA209** | Knoop 400HK Test Block | 500gf |
| **64BAA210** | Knoop 500HK Test Block | 500gf |
| **64BAA211** | Knoop 600HK Test Block | 500gf |
| **64BAA212** | Knoop 700HK Test Block | 500gf |
| **64BAA213** | Knoop 800HK Test Block | 500gf |
| **64BAA214** | Knoop 250HK Test Block | 1000gf |
| **64BAA215** | Knoop 300HK Test Block | 1000gf |
| **64BAA216** | Knoop 400HK Test Block | 1000gf |
| **64BAA217** | Knoop 500HK Test Block | 1000gf |
| **64BAA218** | Knoop 600HK Test Block | 1000gf |
| **64BAA219** | Knoop 700HK Test Block | 1000gf |
| **64BAA220** | Knoop 800HK Test Block | 1000gf |

*Other hardness ranges and test forces available

### Indenters

| Order No. | Type | Model |
|---|---|---|
| **19BAA058** | Vickers Indenter | H, HM Standard Series |
| **19BAA059** | Vickers Indenter | MVK-H2, H3, HM114, HM220 |
| **19BAA061** | Knoop Indenter | H, HM Standard Series |
| **19BAA062** | Knoop Indenter | MVK-H2, H3, HM114, HM220 |
| **19BAA060** | Vickers Indenter | HV, AVK-C Series |
| **19BAA063** | Knoop Indenter | HV, AVK-C Series |

### Universal Specimen Holder



Used to secure a specimen that has a measuring surface that is hard to stabilize, perpendicular to the indenter axis.

**810-020**

### Mounted Specimen Vise



| 1.5" (39mm) Max Height | Diameter | |
|---|---|---|
| **810-650-1** | 1" | 25.4mm |
| **810-650-2** | | 30mm |
| **810-650-3** | 1.25" | 31.75mm |
| **810-650-4** | 1.5" | 38.1mm |
| **810-650-5** | | 40mm |

### 50x50mm travel stage



Manual XY Stage Unit 50 x 50
Manual XY Stage Unit 2"x 2"
**810-423** Metric
**810-427** Inch/Metric

### Bulbs

| Order No. | Description |
|---|---|
| **513667** | Bulb, 12v/50w, halogen double pin type, HM series with box style illuminators |
| **19BAA219** | Bulb, 6v/20w, halogen double pin type, Later H series |
| **19BAA095** | Bulb, 6v/15w, halogen bayonet type, all E, G and early H series testers |

### Clamping devices (Vises)



**Vise**
Max. opening: 3.94"(100mm)
**810-017**



**Vise**
Max. opening: 2"(51mm)
**810-016**

### Rotary Table



**Rotary Table**
**810-018**

### Round Tables



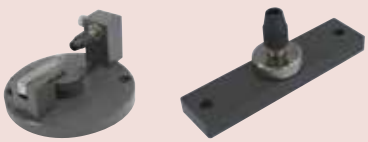
Dimensions: 7.08"(180mm)
**810-037**

### Specimen (thin plate) Holder



Secures a plate with a thickness of .197"(5mm) or less, or foil-like specimens.
**810-013**

### Specimen (wire) Holder



Used to horizontally or vertically secure a wire or needle specimen that has a diameter of .126"(3.2mm) or less.
**810-014-1** horizontal
**810-015-1** vertical

# HR-530/530L

## SERIES 810 — Rockwell Type Hardness Testing Machines

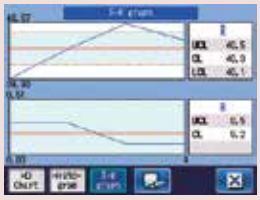


HR-530
(810-237)




Standard operating display

Graphic display of statistical calculation results and X̄-R control charts



**Fine-adjustment table for Jominy testing**
**810-700**



**Optional Accessories:** See page K-11, 12

**Function: Touch-screen type**
- Touch-screen operation with a back-lit LCD graphic display.
- Remote selection of the test force linked to the hardness scale selection.
- Choice of message language in English, German, French, Spanish, Italian and Japanese.
- Cylindrical and spherical surface compensation.
- Data offset.
- Conversion to other hardness scales.
- Powerful statistical processing with flexible data point editing and 1024 data memory.
- Measured data editing
- Go/no-go tolerance judgment.
- Statistical processing, histogram and x̄-R chart

## FEATURES

- Closed Loop Test Force Control allows for a wide variety of hardness testing including Rockwell, Superficial and Light Force Brinell (6.25 to 187.5 kgf).
- Hardness testing of plastics according to ASTM D785 (Proceedure A and B) and ISO2039-2 are also possible.
- Projected nose type tester allows testing of interior parts down to 40mm or 22mm with optional 19BAA292 indenter
- 5 display formats are possible to show you the information you need. Statistics and graphs can also be displayed on the color touch screen control panel.
- Simple to use automatic brake-start system begins the test automatically when initial force is reached
- The HR-530 is available in 9.8" (250mm) or 15.5" (395mm) height capacity models.
- Complete with a combination diamond indenter, a 1/16" carbide ball indenter, one flat and one V anvil, 2 HRC, 1 HRBW, 1 HR30TW and 1 HR30N test block.



5.7-inch color LCD

## SPECIFICATIONS

| Order No. | | 810-237 | 810-337 |
|---|---|---|---|
| Model | | HR-530 | HR-530L |
| Hardness testing methods | | Rockwell/Rockwell Superficial/Brinell/Plastics hardness | |
| Initial test force (N) | | 29.42N (3kgf), 98.07N (10kgf) | |
| Test force (N) | Rockwell Superficial | 147.1N (15kgf), 294.2N (30kgf), 441.3N (45kgf) | |
| | Rockwell | 588.4N (60kgf), 980.7N (100kgf), 1471N (150kgf) | |
| | Light Force Brinell | 61.29 (6.25kgf), 98.07 (10kgf), 153.2 (15.625kgf), 245.2 (25kgf), 294.2 (30kgf), 306.5 (31.25kgf), 612.9 (62.5kgf), 980.7 (100kgf), 1226 (125kgf), 1839 (187.5kgf) | |
| Test force control | | Automatic (load/hold/unload) | |
| Table up/down mechanism | | Manual (automatic braking and load sequencing) | |
| Control unit | | Color touch-panel | |
| Test force switching | | Operated with the display unit | |
| Test force hold time | | 1 to 120s (Selectable in units of 1s) | |
| Maximum specimen size | | Height: 9.8" (250 mm)<br>Depth: 5.9" (150 mm) | Height: 15.5" (395 mm)<br>Depth: 5.9" (150 mm) |
| Permissible inside diameter of a tube specimen | | Minimum hole diameter: 1.38" (35 mm) (when using the special indenter: .87" (22 mm)) | |
| Maximum table loading | | 45 lb (20 kg) | |
| Ball indenter | | Tungsten carbide ball indenter | |
| Unit (display unit) | | inch | |
| Display | | Hardness value, test condition, go/no-go judgment result, statistical calculation result, X-R control chart, hardness conversion value | |
| | | Conversion function [HV, HK, HR (Rockwell hardness A, B, C, D, F, G / Rockwell Superficial 15T, 30T, 45T, 15N, 30N, 45N), HS, HB, tensile strength] | |
| | | Go/no-go judgment function | |
| | | Continuous test function (for specimens with the same thickness) | |
| | | Cylindrical correction, spherical correction, offset correction, multi-point correction functions | |
| | | Statistical calculation function (maximum value, minimum value, mean value, standard deviation, upper limit value, lower limit value, go count, range, no-go count) | |
| | | Graph generation function (X-R control chart) | |
| Language support | | Japanese, English, German, French, Italian, Spanish, Korean, Chinese (simplified characters/traditional characters), Turkish, Portuguese, Hungarian, Polish, Dutch and Czech | |
| External data output | | RS-232C, SPC, USB2.0 | |
| Power supply | | AC120V | |
| External dimensions | Main unit | 9.84" x 26.38" x 23.82"<br>(250(W)×667(D)×621(H) mm) | 11.8" x 26.2" x 30.1" (300(W)×667(D)×766(H) mm) |
| | Touch-panel display | 191(W)×147(D)×71(H) mm | |
| Mass | | Approx. 60 kg | Approx. 69 kg |

Note: Plastic testing may not be enabled, depending on the material.



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# HR-523/523(L)

## SERIES 810 — Rockwell Type Hardness Testing Machines

### FEATURES

- Multiple test force generation for Rockwell, Rockwell Superficial and Light Force Brinell hardness.
- Dolphin-nose indenter arm for easy reach of interior (min. ø40mm/ø22mm*) and exterior surfaces.
  *When using an optional diamond indenter (**19BAA292**).
- Real-time electronic test force control for accurate loading. This eliminates load force overshooting.
- Indenter escape function for continuous testing at fixed table position. This eliminates instability caused by the table retraction.
- Auto-stop elevation table and automatic preliminary test force loading to provide stable test force generation.
- Complete with one flat and V anvil, diamond and 1/16" carbide ball indenters, 2 HRC and 1 HRBW Rockwell test blocks and an HR30N and HR30TW test block.



**HR-523**
**810-204-03A**



### SPECIFICATIONS

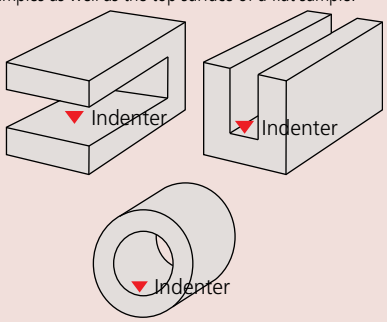
| Model | | HR-523 | HR-523L |
|---|---|---|---|
| **Order No.** | | **810-204-03A** | **810-207-03A** |
| Preliminary Test Force | | 29.42N (3kgf), 98.07N (10kgf) | |
| Test Force | Rockwell | 588.4N (60kgf), 980.7N (100kgf), 1471N (150kgf) | |
| | Rockwell Superficial | 147.1N (15kgf), 294.2N (30kgf), 441.3N (45kgf) | |
| | Light Force Brinell | 61.29 (6.25kgf), 98.07 (10kgf), 153.2 (15.625kgf), 245.2 (25kgf), 294.2 (30kgf), 306.5 (31.25kgf), 612.9 (62.5kgf), 980.7 (100kgf), 1226 (125kgf), 1839 (187.5kgf) | |
| Force Control | | Automatic control (unloading/duration/unloading) with closed-loop feed back | |
| Console/Display Unit | | Touch-screen operation with back-lit LCD graphic display | |
| Test Force Selection | | By touch screen | |
| Table up/down drive | | Power-Drive (for full-automatic measurement) | |
| Load Duration | | 0 to 120 sec. (1 sec. step) | |
| Maximum Specimen Height | | 8.1" (205mm) | 15.5" (395mm) |
| Maximum Specimen Depth | | 5.9" (150mm) | |
| Display Indication Functions | | Hardness value, Converted hardness value, Test conditions, go/no-go tolerance judgment, statistical processing result<br>Rockwell/Rockwell superficial hardness testing. Continuous testing.<br>Cylindrical/spherical surface compensation, data offset.<br>Hardness conversion (HV, HK, HRA/B/C/D/F/G/15T/30T/45T/15N/30N/45N, HS, HB, HBW, tensile strength)<br>Go/no-go tolerance judgment, measured data editing, data memory (max 1024 data)<br>SPC calculation (No. of data, max/min/mean values, range, upper/lower limit values, standard deviation, No. of passing/defective) Histogram, x̄-R chart | |
| Data Output | | RS-232C, SPC, Centronics | |
| Dimensions (W x D x H) | | 9.84" x 26.38" x 23.82" (250 x 670 x 605mm) | |
| Mass | | 60kg (133lb) | 63kg (139lb) |

### Technical Data

| | |
|---|---|
| Preliminary test force: | 29.42N, 98.07N |
| Test force | |
| Rockwell superficial: | 147.1, 294.2, 441.3N |
| Rockwell: | 588.4, 980.7, 1471N |
| Brinell*: | |
| Test force setting: | By control unit |
| Load control: | Automatic (loading, duration, unloading) |
| Load duration: | 0s - 120s (1s increments) |
| Max. specimen height: | 205mm (for standard flat anvil) |
| Max. specimen depth: | 150mm (from the center of indenter shaft) |
| Stage elevation: | Manual or power drive |
| Control unit: type | Sheetswitch type or touch-screen |
| Data output: | RS-232C, Digimatic code (SPC) and Centronics |
| Power supply: | 120V AC, 50/60Hz |
| Dimensions (W x D x H) | |
| Main unit: | 250 x 670 x 605mm |
| Control unit: | 165 x 260 x 105mm |

### Optional Accessories: See page K-11, 12

**Various shapes of specimen can be measured. (Nose-type indenter axis mechanism has been adopted.)**
The nose-type indenter mechanism allows measurement of pipe samples as well as the top surface of a flat sample.






**Function: Touch-screen type**

- Touch-screen operation with a back-lit LCD graphic display.
- Remote selection of the test force linked to the hardness scale selection.
- Choice of message language in English, German, French, Spanish, Italian and Japanese.
- Cylindrical and spherical surface compensation.
- Data offset.
- Conversion to other hardness scales.
- Powerful statistical processing with flexible data point editing and 1024 data memory.
- Measured data editing
- Go/no-go tolerance judgment.
- Statistical processing, histogram and x̄-R chart

# Optional Accessories

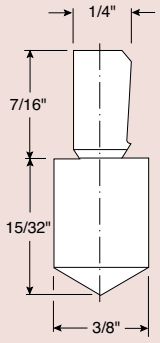
## For Rockwell/Rockwell Superficial Type Hardness Testing machine



### Calibration Set

| Order No. 64BAA241 C Scale Set | Order No. 64BAA242 B Scale Set |
|---|---|
| Test Blocks | Test Blocks |
| 64BAA125 | 64BAA126 |
| 64BAA124 | 64BAA132 |
| 64BAA158 | 64BAA135 |
| Indenter | Indenter |
| 64BAA072 | 64BAA078 |
| **Order No. 64BAA243 30N Scale Set** | **Order No. 64BAA244 30T Scale Set** |
| Test Blocks | Test Blocks |
| 64BAA128 | 64BAA129 |
| 64BAA165 | 64BAA140 |
| 64BAA167 | 64BAA130 |
| Indenter | Indenter |
| 64BAA073 | 64BAA078 |

### Rockwell Type Diamond Indenters




| Order No. | Scale |
|---|---|
| 64BAA072 | C |
| 64BAA073 | N |
| 64BAA086 | A |
| 64BAA071 | C & N |

| Order No. | Hardness |
|---|---|
| 64BAA159 | HRA81/86 Rockwell Test Block |
| 64BAA160 | HRA75/79 Rockwell Test Block |
| 64BAA161 | HRA70/73 Rockwell Test Block |
| 64BAA162 | HRA65/68 Rockwell Test Block |
| 64BAA163 | HRA60/62 Rockwell Test Block |
| | |
| 64BAA249 | HRBW95/100 Rockwell Test Block |
| 64BAA126 | HRBW90/95 Rockwell Test Block |
| 64BAA131 | HRBW80/85 Rockwell Test Block |
| 64BAA132 | HRBW70/75 Rockwell Test Block |
| 64BAA133 | HRBW60/65 Rockwell Test Block |
| 64BAA134 | HRBW50/55 Rockwell Test Block |
| 64BAA135 | HRBW40/45 Rockwell Test Block |
| 64BAA127 | HRBW30/35 Rockwell Test Block |
| 64BAA136 | HRBW20/25 Rockwell Test Block |
| 64BAA137 | HRBW10/15 Rockwell Test Block |
| 64BAA138 | HRBW0/5 Rockwell Test Block |
| | |
| 64BAA125 | HRC60/65 Rockwell Test Block |
| 64BAA157 | HRC50/55 Rockwell Test Block |
| 64BAA124 | HRC40/45 Rockwell Test Block |
| 64BAA123 | HRC30/35 Rockwell Test Block |
| 64BAA158 | HRC20/25 Rockwell Test Block |

| Order No. | Hardness |
|---|---|
| 64BAA129 | HR30T74/79 Rockwell Test Block |
| 64BAA139 | HR30T70/73 Rockwell Test Block |
| 64BAA140 | HR30T63/67 Rockwell Test Block |
| 64BAA141 | HR30T56/60 Rockwell Test Block |
| 64BAA142 | HR30T49/53 Rockwell Test Block |
| 64BAA130 | HR30T43/47 Rockwell Test Block |
| 64BAA143 | HR30T36/39 Rockwell Test Block |
| 64BAA144 | HR30T29/33 Rockwell Test Block |
| 64BAA145 | HR30T22/26 Rockwell Test Block |
| 64BAA146 | HR30T15/18 Rockwell Test Block |
| | |
| 64BAA147 | HR15T90/92 Rockwell Test Block |
| 64BAA148 | HR15T86/69 Rockwell Test Block |
| 64BAA149 | HR15T83/85 Rockwell Test Block |
| 64BAA150 | HR15T80/82 Rockwell Test Block |
| 64BAA151 | HR15T77/79 Rockwell Test Block |
| 64BAA152 | HR15T72/74 Rockwell Test Block |
| 64BAA153 | HR15T70/72 Rockwell Test Block |
| 64BAA154 | HR15T68/69 Rockwell Test Block |
| 64BAA155 | HR15T64/66 Rockwell Test Block |
| 64BAA156 | HR15T61/63 Rockwell Test Block |

| Order No. | Hardness |
|---|---|
| 64BAA222 | HR45N65/70 Rockwell Test Block |
| 64BAA223 | HR45N55/60 Rockwell Test Block |
| 64BAA224 | HR45N45/50 Rockwell Test Block |
| 64BAA225 | HR45N35/40 Rockwell Test Block |
| 64BAA226 | HR45N25/30 Rockwell Test Block |
| | |
| 64BAA128 | HR30N64/69 Rockwell Test Block |
| 64BAA164 | HR30N68/73 Rockwell Test Block |
| 64BAA165 | HR30N59/64 Rockwell Test Block |
| 64BAA166 | HR30N50/55 Rockwell Test Block |
| 64BAA167 | HR30N40/45 Rockwell Test Block |
| | |
| 64BAA168 | HR15N90/93 Rockwell Test Block |
| 64BAA169 | HR15N85/88 Rockwell Test Block |
| 64BAA170 | HR15N80/83 Rockwell Test Block |
| 64BAA171 | HR15N75/77 Rockwell Test Block |
| 64BAA172 | HR15N69/72 Rockwell Test Block |

### Carbide Ball Indenters

| Order No. | Description |
|---|---|
| 11AAD465 | 1/16″ Carbide ball indenter |
| 11AAD466 | 1/8″ Carbide ball indenter |
| 11AAD467 | 1/4″ Carbide ball indenter |
| 11AAD468 | 1/2″ Carbide ball indenter |
| 19BAA507 | 1/16″ Carbide ball (1pc.) |
| 19BAA508 | 1/8″ Carbide ball (1pc.) |
| 19BAA509 | 1/4″ Carbide ball (1pc.) |
| 19BAA510 | 1/2″ Carbide ball (1pc.) |

### Steel Ball Indenters

| Order No. | Description |
|---|---|
| 11AAD461 | 1/16″ diameter steel ball indenter |
| 19BAA078 | 1/16″ diameter steel ball indenter (auto-discrimination type) |
| 11AAD462 | 1/8″ diameter steel ball indenter |
| 64BAA079 | 1/8″ diameter steel ball indenter (auto-discrimination type) |
| 11AAD463 | 1/4″ diameter steel ball indenter |
| 64BAA080 | 1/4″ diameter steel ball indenter (auto-discrimination type) |
| 11AAD464 | 1/2″ diameter steel ball indenter |
| 64BAA081 | 1/2″ diameter steel ball indenter (auto-discrimination type) |
| 64BAA082 | 1/16″ diameter spare steel ball (10 pcs) |
| 64BAA083 | 1/8″ diameter spare steel ball (10 pcs) |
| 64BAA084 | 1/4″ diameter spare steel ball (10 pcs) |
| 64BAA085 | 1/2″ diameter spare steel ball (10 pcs) |



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# Optional Accessories

## For Rockwell/Rockwell Superficial Type Hardness Testing machine

**Round table**
**810-038** Outside ø250 mm



For large specimens such as molded items

**Round table**
**810-037** Outside ø180 mm



For large specimens such as molded items

**V-anvil (large)**
**810-040**
(Outside ø40 mm,
Groove width 30 mm)



For round specimens (max. ø60 mm)

**V-anvil (small)**
**810-041**
(Outside ø40 mm,
Groove width 6 mm)



For shaft materials (max. ø8.4 mm)

**Spot anvil**
**810-043**
(Outside ø12 mm)

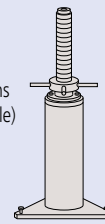


**Spot anvil**
**810-044**
(Outside ø5.5 mm)



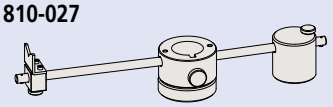
For sheet specimens

**Jack rest**
**810-028**
For supporting long specimens
(Used with anvil or round table)



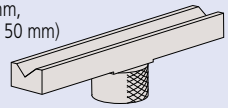
**EXPAK Data processing software**
**11AAC236** HR530 and HM200 Series
**11AAC237** HR523 Series

**VARI-REST**
**810-027**



For testing long specimens (commonly used for the anvil)

**Special V-anvil**
**810-029**
(Length 400 mm,
Groove width 50 mm)



For round specimens ø14-98 mm

**Diamond-spot anvil**
**810-030**
(Outside ø10 mm)
For sheet specimens



*Dedicated to the Rockwell Superficial hardness test

**Small V-anvil**
**810-042**
(Outside ø10 mm)



For round specimens (max. ø16 mm)

**Testing machine table**
**11AAD186**
Supplied with
stability bracket

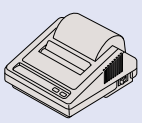
Testing machine table



**Vibration isolator**
**810-643**
Only for mounting hardness testing machines

**Foot switch**
**11AAD537**

**Printer**
**DPU-414**
**02AGD600B**
with connection cable





**Digimatic mini-processor**
**DP-1VA**
**264-505A**

Connection cable not supplied. (To be ordered separately.)



**937386**



**936937**

### Optional Accessories

**HR523 and most older models:**

**06AFM380E**: USB input tool – Tester to PC
**937386**: Tester to DP1-VA Printer

**HM200 and HR-530 Series:**

**06AFM380D**: USB input tool – Tester to PC
**936937**: Tester to DP1-VA Printer




Refer to Bulletin No. (2255) for more details.

# Hardmatic HH-411

## SERIES 810 — Impact Type Hardness Testing Unit

HH-411 is a rebound-type portable hardness tester for metal with a compact body and high operability. It allows anyone to perform hardness testing easily at the touch of a key, so it can be used widely on various components in the field.




**810-298-10**: ASTM standard
Including the display unit, D type impactor (**810-287-10**) and carbide ball (**19BAA457**).

### Technical Data

| | |
|---|---|
| Impactor: | Impact hammer with integrated detector and carbide-ball tip (D type: conforming to ASTM A 956) |
| Display unit: | 7-segment LCD |
| Functions: | Auto angle compensation, Offset, go/no-go judgment, Hardness scale conversion<br>Data storage (1800 data entries)<br>Statistical analysis (Average, Maximum, Minimum, Dispersion)<br>Auto sleep function<br>Impact counter display function |
| Testable workpiece | |
| Thickness: | Minimum 5mm or more |
| Mass: | 5kg or more in mass |
| Test points: | 5mm or more from the edge of the sample, 3mm or more to each of the tested points. |
| Surface roughness: | Ra 10μm or less |
| Power supply: | Lithium AA battery 2pcs or optional AC adapter (battery life: 70 hours) |

### Standard Accessories

**19BAA265** Test Block HLD800
**810-291-10** Display Unit
**810-287-10** Detector
**19BAA460** Cable
Battery AA (Lithium) 2pcs.

### Optional Accessories

**264-505A**: Digimatic Mini-Processor DP-1VR
**937387**: Connecting cable for
**09EAA082**: Printer paper (10 rolls/set)
**810-622A**: Thermal printer DUP-414
**19BAA285**: Thermal printer connecting cable
**19BAA157**: Thermal printer paper
**19BAA238**: RS-232C connecting cable for PC
**06AEG302JA**: AC adapter of display unit
**19BAA243**: Hardness test block (880HLD)
**19BAA244**: Hardness test block (830HLD)
**19BAA245**: Hardness test block (730HLD)
**19BAA246**: Hardness test block (620HLD)
**19BAA247**: Hardness test block (520HLD)
**19BAA248**: Support ring for convex surface of cylinder (R10 - R20)
**19BAA249**: Support ring for convex surface of cylinder (R14 - R20)
**19BAA250**: Support ring for convex surface of sphere (R10 - R27.5)
**19BAA251**: Support ring for concave surface of sphere (R13.5 - R20)
**19BAA457**: Carbide ball for D, DC, D+15 type impactors
**19BAA458**: Ball shaft for DL type impactor
**810-287-10**: D type impactor UD-411
**810-288-10**: DC type impactor UD-412
**810-289-10**: D+15 type impactor UD-413
**810-290-10**: DL type impactor UD-414

## SPECIFICATIONS

| Model | HH-411 | | |
|---|---|---|---|
| **Order No.** | **810-298-10** | | |
| Hardness Range | L-Value (ASTM A956) | | |
| Detector | Input device D (carbide ball) | | |
| Display | **Hardness** | **Range** | **Resolution** |
| | HL | 1-999 HL | 1 HL |
| | HV | 43-950 HV | 1 HV |
| | HB | 20-894 HB | 1 HB |
| | HRC | 19.3-68.2 HRC | 0.1 HRC |
| | HRB | 13.5 - 101.7 HRB | 0.1 HRB |
| | HS | 13.2 - 99.3 HS | 0.1 HS |
| | HTN | 499 - 1996 Mpa | 1 Mpa |
| Functions | Conversions: HL,HV, HB, HRC, HRB, HS, HTN<br>Judgment: go/no go<br>Offsetting<br>Memory: 1,800 data | | |
| Indentation Direction | Any direction | | |
| Output | RS-232C, SPC | | |
| Power supply | Lithium AA Battery 2pcs. | | |
| Dimensions | Detector: (Dia. X H) 1.10" x 6.89"<br>(28 x 175mm)<br>Display: (W x D x H) 2.76" x 4.33" x 1.38"<br>(70 x 110 x 35mm) | | |
| Mass | Detector: .26lbs (120g)<br>Display: .44lbs (200g) | | |

### Impactors (Optional accessories)

Various impactors can be connected to the display unit.



**810-288-10**
Use for inner walls of cylinders. The grip is short to allow easy positioning within a cylinder.



**810-289-10**
Use for concave workpieces such as gear teeth, ball bearing races, etc.



**810-290-10**
Use for gear teeth, welded corners, etc.



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# Hardmatic HH-300

## SERIES 811 — Durometers for Rubber and Plastics Hardness Testing

### FEATURES

Digital / Dial Durometers are suitable for testing the nature of the following materials — natural rubber, neoprene, polyesters, P.V.C., leather, nitrite rubber, wax, vinyl, cellulose acetates, glass polystyrene, etc.



**Compact Digital** **811-336-10**
**Compact Dial** **811-335-10**



**Long Leg Digital** **811-332-10**
**Long Leg Dial** **811-331-10**

### Technical Data

- Designed in accordance with the ASTM D 2240, ISO868, ISO 7619, DIN 53 505, JIS K 6253, and JIS K 7215 specifications.
- Units are available in both Shore A and Shore D scales, and will test a wide variety of applications.
- The Digital Durometer is provided with data hold function, permitting the operator to make an error-free reading on the LCD screen.
- The Dial Durometer is provided with a peak retaining hand for error-free reading.





### SPECIFICATIONS

| **Order No.** | Digital | **811-330-10** | **811-336-10** | **811-336-11** | **811-332-10** | **811-338-10** | **811-338-11** | **811-334-10** |
|---|---|---|---|---|---|---|---|---|
| | Dial | **811-329-10** | **811-335-10** | **811-335-11** | **811-331-10** | **811-337-10** | **811-337-11** | **811-333-10** |
| Model No. | Digital | HH-330 | HH-336 | HH-336 | HH-332 | HH-338 | HH-338 | HH-334 |
| | Dial | HH-329 | HH-335 | HH-335 | HH-331 | HH-337 | HH-337 | HH-333 |
| Scale | | Shore E | Shore A | | | Shore D | | |
| Applications | | Soft Rubber, Sponge, Felt, Hard Foam | Natural rubber, soft elastomers, etc. | | | Hard elastomers, plastics, hard rubber, ebonite, etc. | | |
| Resolution | | 0.1 (digital) or 1 (dial) | | | | 0.1 (digital) or 1 (dial) | | |
| Range | | HA: 10 - 90 | | | | HD: 20 - 90 | | |
| Standards | ASTM D 2240 | — | ✓ | ✓ | | ✓ | ✓ | |
| | ISO 868 | — | ✓ | ✓ | | ✓ | ✓ | |
| | ISO 7619 | — | ✓ | ✓ | | ✓ | ✓ | |
| | DIN 53 505 | — | — | ✓ | | — | ✓ | |
| | JIS K 6253 | ✓ | ✓ | ✓ | | ✓ | ✓ | |
| | JIS K 7215 | — | ✓ | ✓ | | ✓ | ✓ | |
| Pressure foot | | 44 x 18mm | 44 x 18mm | ø18mm | | 44 x 18mm | ø18mm | |
| Spring force (mN) | | WE=550+HE | WA=550+75HD (HA:Reading 10-90) | | | WD=444.5HD (HD:Reading 20-90) | | |
| Indenter | | Sphere (Tip diameter: 0.79mm) | Blunt taper (Tip diameter: 0.79mm) | | | Sharp point (Tip curvature: 0.1±0.01mm) | | |
| Tip angle | | — | 35°±0.25° | | | 30°±0.5° | | |
| Indenter diameter | | 5mm | 1.25mm | | | | | |
| Indenter protrusion | | 2.5mm | | | | | | |
| Functions | | Digital: Data hold, Zero -setting, SPC output, Power ON/OFF (Power supply: SR44 x 1pc.) Analog Durometer: Peak retaining hand | | | | | | |
| Type | | Compact | Compact | | Long-leg | Compact | | Long-leg |
| Dimensions (WxDxH) | Digital | 60 x 28.5 x 151 | 60 x 28.5 x 151mm | | 60 x 28.5 x 193mm | 60 x 28.5 x 151mm | | 60 x 28.5 x 193mm |
| | Dial | 56 x 33.5 x 144mm | 56 x 33.5 x 144mm | | 56 x 33.5 x 186mm | 56 x 33.5 x 144mm | | 56 x 33.5 x 186mm |
| Mass | Digital | 290g | 290g | | 310g | 290g | | 310g |
| | Dial | 300g | 300g | | 320g | 300g | | 320g |

# Hardmatic HH-300

## Test Block Set




64AAA964



64AAA963



905693

811-332-10

264-505A

**Testing stand applications**

These stands are used to mount Durometers. They allow constant-pressure hardness measurement by pressing the Durometer vertically on a workpiece.

- Anyone can perform repeatable hardness measurement due to fewer possibilities of human error and measurement variations.
- The supplied weights can be attached directly to a Durometer and allow constant-pressure hardness measurement of large samples for which a stand cannot be used.
- The supplied weights are used for calibrating the spring tension of Durometers.

| Item No. | Description |
|---|---|
| **64AAA964** | Calibration Set (Shore A Scale)<br>Test Block 30* DURO (Blue)<br>Test Block 60* DURO (Yellow)<br>Test Block 90* DURO (Gray)<br>Mahogany Box |
| **64AAA590** | Calibration Set (Shore D Scale)<br>Test Block 20* DURO (Blue)<br>Test Block 40* DURO (Gray)<br>Test Block 80* DURO (Black) |
| **64AAA962** | "A" Scale Durometer Stand |
| **64AAA794** | "A" Scale Durometer Stand with Air Damper |
| **64AAA796** | Combination "D" & "A" Scale Durometer Stand |
| **64AAA963** | O-Ring Fixture Set 1/16", 3/32", 1/8", 3/16" and 1/4"<br>O-Ring cross sections |
| **264-505A** | Digimatic Miniprocessor with printer |
| **905693** | Connecting Cable 40" (1m) for<br>Durometer and Digimatic Miniprocessor |

* Values shown are nominal only. Test Block Size 2" x 2" x 1/4"



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# Quick Guide to Precision Measuring Instruments

## Hardness Testing Machines

### Hardness Test Methods and Guidelines for Selection of a Hardness Testing Machine

| Material / Test Method | Micro Vickers | Micro surface material characteristics | Vickers | Rockwell | Rockwell Superficial | Durometer | Rebound type portable | Brinell | Shore |
|---|---|---|---|---|---|---|---|---|---|
| IC wafer | ● | ● | | | | | | | |
| Carbide, ceramics (cutting tool) | | ▲ | ● | ● | | | | | |
| Steel (heat-treated material, raw material) | ● | ▲ | ● | ● | ● | | ● | | ● |
| Non-ferrous metal | ● | ▲ | ● | ● | ● | | ● | | |
| Plastic | | ▲ | | ● | | ● | | | |
| Grinding wheel | | | | ● | | | | | |
| Casting | | | | | | | | ● | |
| Sponge, rubber | | | | | | ● | | | |
| **Shape** | | | | | | | | | |
| Thin metal sheet (safety razor, metal foil) | ● | ● | ● | | ● | | | | |
| Thin film, plating, painting, surface layer (nitrided layer) | ● | ● | | | | | | | |
| Small parts, acicular parts (clock hand, sewing-machine needle) | ● | ▲ | | | | | | | |
| Large specimen (structure) | | | | | | | ● | ● | ● |
| Metallic material configuration (hardness for each phase of multilayer alloy) | ● | ● | | | | | | | |
| Plastic plate | ▲ | ▲ | | ● | | ● | | | |
| Sponge, rubber plate | | | | | | ● | | | |
| **Inspection, judgment** | | | | | | | | | |
| Strength or physical property of materials | ● | ● | ● | ● | ● | ● | ▲ | ● | ● |
| Heat treatment process | ● | | ● | ● | ● | | ▲ | | ▲ |
| Carburized case depth | ● | | ● | | | | | | |
| Decarburized layer depth | ● | | ● | | ● | | | | |
| Flame or high-frequency hardening layer depth | ● | | ● | ● | | | | | |
| Hardenability test | | | ● | ● | | | | | |
| Maximum hardness of a welded spot | | | ● | | | | | | |
| Weld hardness | | | ● | ● | | | | | |
| High-temperature hardness (high-temperature characteristics, hot-workability) | | | ● | | | | | | |
| Fracture toughness (ceramics) | ● | | ● | | | | | | |

Key: ● Well-suited ▲ Reasonably suited

### Methods of Hardness Measurement

#### (1) Vickers

Vickers hardness is a test method that has the widest application range, allowing hardness inspection with an arbitrary test force. This test has an extremely large number of application fields particularly for hardness tests conducted with a test force less than 9.807N (1kgf). As shown in the following formula, Vickers hardness is a value determined by dividing test force F (N) by contact area S ($mm^2$) between a specimen and an indenter, which is calculated from diagonal length d (mm, mean of two directional lengths) of an indentation formed by the indenter (a square pyramidal diamond , opposing face angle $\theta$=136°) in the specimen using a test force F (N). k is a constant (1/$g$=1/9.80665).

$$HV=k\frac{F}{S}=0.102\frac{F}{S}=0.102\frac{2F\sin\frac{\theta}{2}}{d^2}=0.1891\frac{F}{d^2}$$

F:N
d:mm

The error in the calculated Vickers hardness is given by the following formula. Here, $\Delta d_1$, $\Delta d_2$, and 'a' represent the measurement error that is due to the microscope, an error in reading an indentation, and the length of an edge line generated by opposing faces of an indenter tip, respectively. The unit of $\Delta\theta$ is degrees.

$$\frac{\Delta HV}{HV}\fallingdotseq\frac{\Delta F}{F}-2\frac{\Delta d_1}{d}-2\frac{\Delta d_2}{d}-\frac{a^2}{d^2}\ 3.5\times10^{-3}\Delta\theta$$

#### (2) Knoop

As shown in the following formula, Knoop hardness is a value obtained by dividing test force by the projected area A ($mm^2$) of an indentation, which is calculated from the longer diagonal length d (mm) of the indentation formed by pressing a rhomboidal diamond indenter (opposing edge angles of 172°30' and 130°) into a specimen with test force F applied. Knoop hardness can also be measured by replacing the Vickers indenter of a microhardness testing machine with a Knoop indenter.

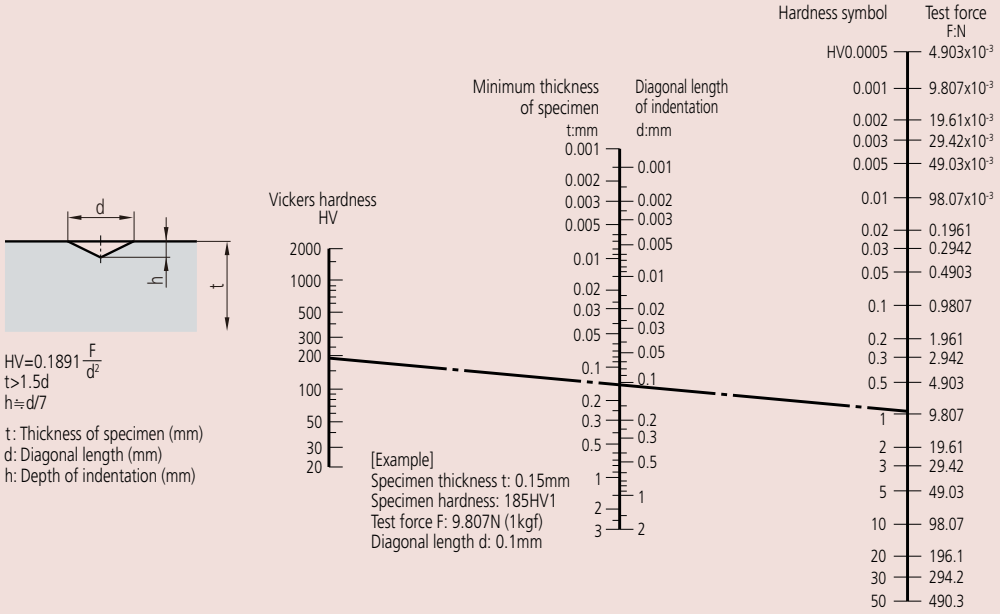
$$HK=k\frac{F}{A}=0.102\frac{F}{A}=0.102\frac{F}{cd^2}=1.451\ \frac{F}{d^2}$$

F:N
d:mm
c:Constant

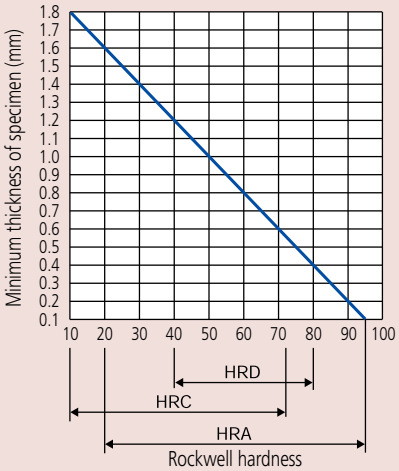
#### (3) Rockwell and Rockwell Superficial

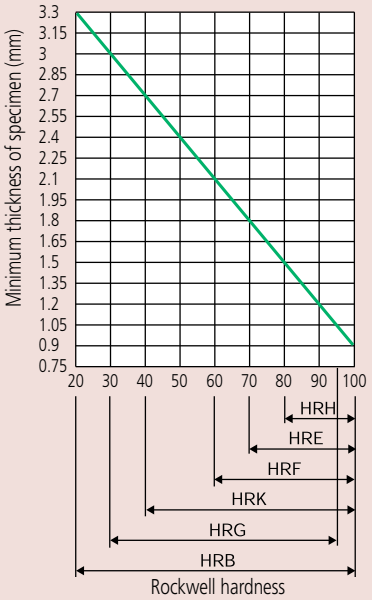
To measure Rockwell or Rockwell Superficial hardness, first apply a preload force and then the test force to a specimen and return to the preload force using a diamond indenter (tip cone angle: 120°, tip radius: 0.2mm) or a sphere indenter (steel ball or carbide ball). This hardness value is obtained from the hardness formula expressed by the difference in indentation depth h (μm) between the preload and test forces. Rockwell uses a preload force of 98.07N, and Rockwell Superficial 29.42N. A specific symbol provided in combination with a type of indenter, test force, and hardness formula is known as a scale. Japanese Industrial Standards (JIS) define various scales of related hardness.

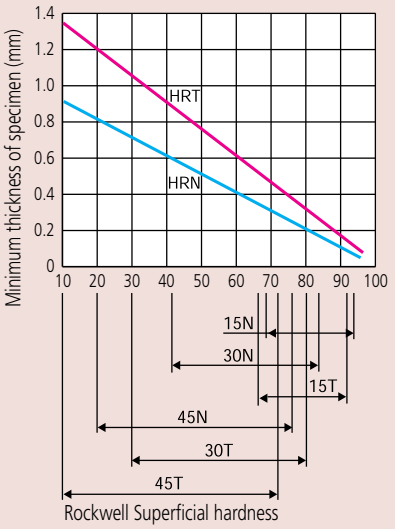
## Relationship Between Vickers Hardness and the Minimum Allowable Thickness of a Specimen




## Relationship Between Rockwell/Rockwell Superficial Hardness and the Minimum Thickness of a Specimen




## Rockwell Hardness Scales

| Scale | Indenter | Test force | Application |
|---|---|---|---|
| A | Diamond | 588.4N | Carbide, sheet steel |
| D | | 980.7N | Case-hardened steel |
| C | | 1471N | Steel (100HRB or more to 70HRC or less) |
| F | Sphere of 1.5875mm diameter | 588.4N | Bearing metal, annealed copper |
| B | | 980.7N | Brass<br>Hard aluminum alloy, beryllium copper, phosphor bronze |
| G | | 1471N | |
| H | Sphere of 3.175mm diameter | 588.4N | Bearing metal, grinding wheel |
| E | | 980.7N | Bearing metal |
| K | | 1471N | Bearing metal |
| L | Sphere of 6.35mm diameter | 588.4N | Plastic, lead |
| M | | 980.7N | |
| P | | 1471N | |
| R | Sphere of 12.7mm diameter | 588.4N | Plastic, lead |
| S | | 980.7N | |
| V | | 1471N | |

## Rockwell Superficial Hardness Scales

| Scale | Indenter | Test force | Application |
|---|---|---|---|
| 15-N | Diamond | 147.1N | Thin surface-hardened layer on steel such as carburized or nitrided |
| 30-N | | 294.2N | |
| 45-N | | 441.3N | |
| 15-T | Sphere of 1.5875mm diameter | 147.1N | Sheet of mild steel, brass, bronze, etc. |
| 30-T | | 294.2N | |
| 45-T | | 441.3N | |
| 15-W | Sphere of 3.175mm diameter | 147.1N | Plastic, zinc, bearing alloy |
| 30-W | | 294.2N | |
| 45-W | | 441.3N | |
| 15-X | Sphere of 6.35mm diameter | 147.1N | Plastic, zinc, bearing alloy |
| 30-X | | 294.2N | |
| 45-X | | 441.3N | |
| 15-Y | Sphere of 12.7mm diameter | 147.1N | Plastic, zinc, bearing alloy |
| 30-Y | | 294.2N | |
| 45-Y | | 441.3N | |

# MITUTOYO INSTITUTE OF METROLOGY








The Mitutoyo Institute of Metrology, the educational department of Mitutoyo America, provides unrivaled educational seminars, courses and on-demand resources for a wide variety of metrology and measurement-related topics such as basic inspection techniques, principles of dimensional metrology, calibration methods and GD&T. This comprehensive curriculum meets the educational needs of manufacturing, quality and measurement professionals. These popular courses are scheduled regularly throughout the year.

The calibration expertise of Mitutoyo America is now available on-demand for anybody through our On-Demand Portal. Here, you can access metrology educational materials that leverages the available American National Standards in dimensional metrology.

Mitutoyo now offers online courses introducing important concepts in general calibration of micrometers and calipers. Mitutoyo also offers the first certified credentials in dimensional calibration in the United States, addressing both theory (Level 1 credential) and hands-on performance skills (Level 2 credential). These credentials satisfy auditors' requirements.

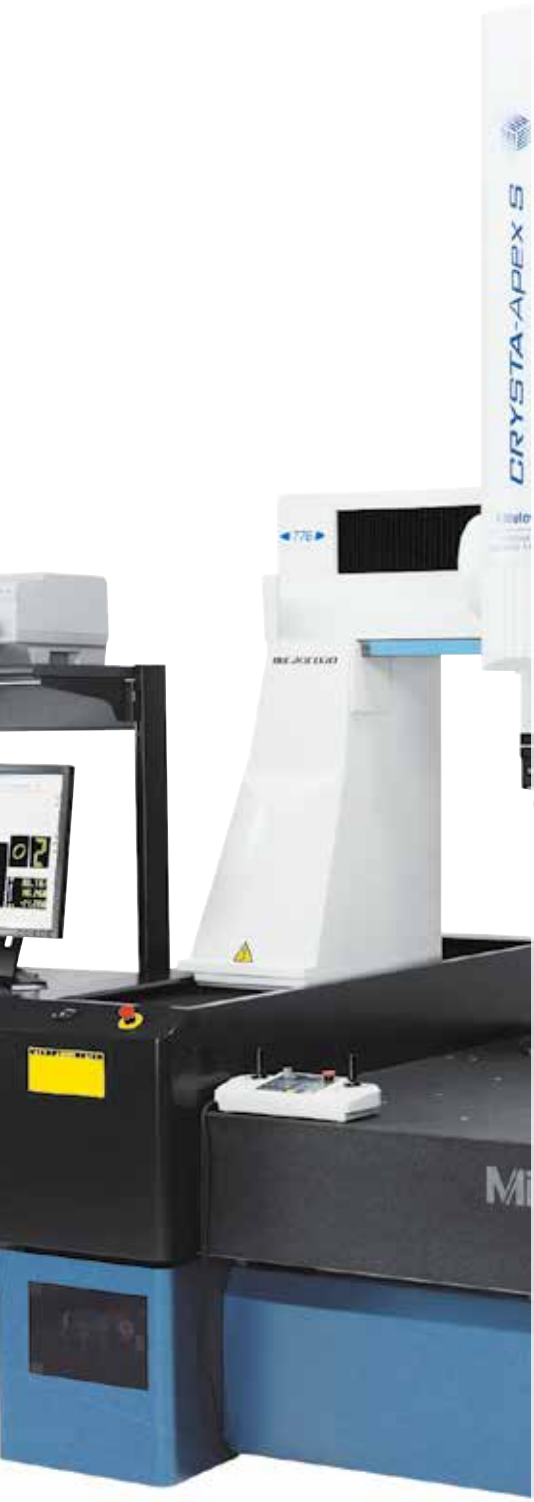
If you have any questions or would like more information regarding Mitutoyo Institute of Metrology, contact: **MIM@Mitutoyo.com**

Mitutoyo
Institute of Metrology

L



# Coordinate Measuring Machines



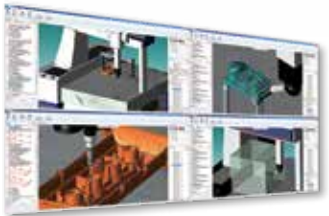

NEW-STYLE
Vision Measuring Systems



**SurfaceMeasure Probes**
*(Laser scanning probes—non-contact)*



**CRYSTA-Apex EX 500T w/PH-20 Probe**



**MiCAT Planner**



**LEGEX 574**

## INDEX


| | |
|---|---|
| **Coordinate Measuring Machines** | |
| Mitutoyo CMM Accuracy Statements | L-2 |
| CrystaPlus M Series 196 — Manual Floating CMM | L-3 |
| CRYSTA-Apex S 500/700/900/1200 Series 191 — Standard CNC | L-4, 5 |
| CRYSTA-Apex EX 500T/700T/900T Series PH20-Equipped 5-Axis CNC CMM | L-6 |
| CRYSTA-Apex EX 1200R Series — REVO-Equipped 5-Axis CNC CMM | L-7 |
| CRYSTA-Apex S 1600/2000 Series 191 — Standard CNC CMM | L-8 |
| STRATO-Apex 500/700/900 Series 355 — High-Accuracy CNC CMM | L-9 |
| STRATO-Apex 1600 Series 355 — High-Accuracy CNC CMM | L-10 |
| FALCIO-Apex 2000/3000 Series 355 — High-Accuracy Large CNC CMM | L-11 |
| LEGEX 500/700/900 Series 356 — Ultra-High Accuracy CNC CMM | L-12 |
| MACH-V 9106 Series 360 – Inline CNC CMM | L-13 |
| MACH-3A 653 Series 360 – Inline CNC CMM | L-13 |
| MACH KO-GA-ME Series 360 – Inline CNC CMM | L-14 |
| CARBapex / CARBstrato Series – Car Body Measuring System CNC CMM | L-15 |
| **Software and Probes** | |
| MCOSMOS Software for Manual / CNC Coordinate Measuring Machines | L-16, 17 |
| MiCAT Planner — Automatic Measurement Program Generation Software | L-18, 19 |
| CMM Probe & Change Rack Options – Touch-Trigger Probe System | L-20 |
| CMM Probe & Change Rack Options – Motorized Probe Heads | L-21 |
| Non-Contact CMM Probe Options – SurfaceMeasure 606/610/1010/606T/201FS | L-22, 23 |
| MSURF Software for Manual / CNC Coordinate Measuring Machines | L-24, 25 |
| Non-Contact CMM Probe Options – QVP Quick Vision Probe | L-26 |
| CMM Surface Roughness Measuring – CMM Surftest Probe | L-27 |
| **Accessories** | |
| Mitutoyo Styli Kits | L-28 |
| Mitutoyo ECO-FIX Kit Fixture Systems | L-29 |
| Mitutoyo ECO-FIX Kit Fixture Systems | L-29 |


**Surftest Probe**
*(surface finish)*



**MACH Kogame**





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# Mitutoyo CMM Accuracy Statements

The accuracy statements specified on the following pages for Mitutoyo CMM's are based on ISO standards. The following is a brief description of these standards.

## Performance Assessment Method of Coordinate Measuring Machines

CMM accuracy is specified in accordance to international standards, the ISO 10360 series of standards, and entitled "Acceptance and Reverification Test for CMMs." ISO 10360 consists of multiple parts, with each part describing tests that apply to various configuration and components of CMMs.

Table 1 JIS B 7440 (2003) Series

| | Item | JIS Standard No. | Year of issue |
|---|---|---|---|
| 1 | Terms | ISO 10360-1 | 2000 |
| 2 | Dimensional measurement | ISO 10360-2 | 2009 |
| 3 | Rotary table-equipped CMM | ISO 10360-3 | 2000 |
| 4 | Scanning measurement | ISO 10360-4 | 2000 |
| 5 | Probing systems | ISO 10360-5 | 2010 |

## Maximum Permissible Measuring Error $E_{0,MPE}$ ISO 10360-2:2009

This volumetric test procedure requires that a coordinate measuring machine (CMM) is made to perform a series of five different length measurements in each of seven directions, as shown in Figure 1, to produce a set of 35 measurements. This sequence is then repeated twice more to produce 105 measurements in all. If these test values are equal to or less than the limits specified by the manufacturer, then the performance of the CMM has been determined to meet its specification. This test procedure is a part of Mitutoyo America Corporation's A2LA-accredited calibration of Mitutoyo CMMs.

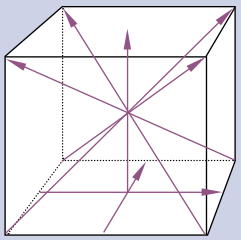


Figure 1 Typical test measurement directions within the CMM measuring volume

## Maximum Permissible Measuring Error $E_{150,MPE}$ ISO 10360-2:2009

This test is an extension of the E0 test but uses a probe tip that is offset a default length of 150 mm perpendicular to the ram axis of the CMM (typically the Z-axis). Five different lengths are measured along two different planar diagonals to produce 10 measurements. This sequence is then repeated twice more to produce 30 measurements in all. If these test values are equal to or less than the specified limits, then the performance of the CMM has been determined to meet its specification.
*This test is not part of Mitutoyo America's standard A2LA-accredited CMM calibration procedure and is quoted upon request.*

## Maximum Permissible Limit Repeatability of the Range $R_{0,MPL}$ ISO 10360-2:2009

This test of repeatability is not a separate test but is determined directly from the E0 test values. For each of the 35 sets of three repeated length measurements, the difference between the maximum and minimum of the three test values is calculated. If these 35 calculated test values are equal to or less than the specified limits, then the CMM has been determined to meet its specification.
*This test is not part of Mitutoyo America's standard A2LA-accredited CMM calibration procedure and is quoted upon request.*

## Maximum Permissible Scanning Probing Error $MPE_{THP}$ ISO 10360-4:2000

This is the accuracy standard for a CMM if equipped with a scanning probe. The test procedure under this standard is to perform a scanning measurement of 4 planes on the standard sphere and then, for the least squares sphere center calculated using all the measurement points, calculate the range (dimension 'A' in Figure 2) in which all measurement points exist. Based on the least squares sphere center calculated above, calculate the distance between the calibrated standard sphere radius and the maximum measurement point or minimum measurement point, and take the larger distance (dimension 'B' in Figure 2). If both calculated values are less than the specified limits, this scanning probe test is passed.

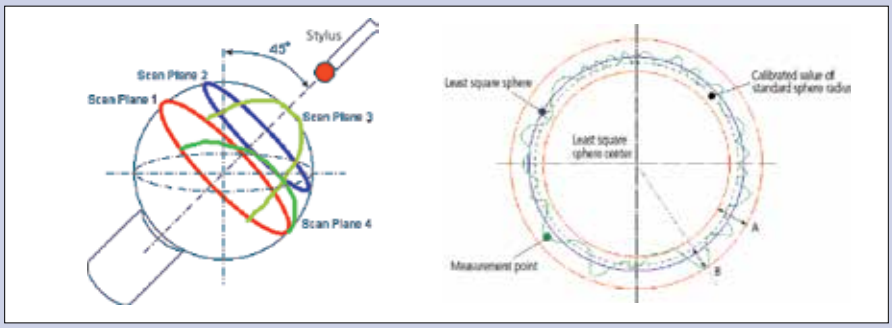



Figure 2 Target measurement planes for the maximum permissible scanning probing error and its evaluation concept

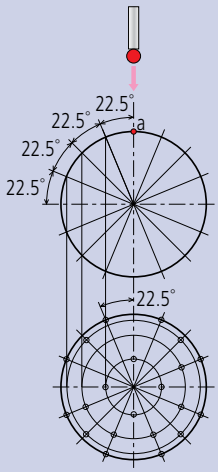



Figure 3 Target points on standard sphere for determining the Maximum Permissible Probing Error

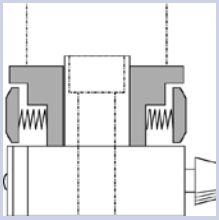
## Maximum Permissible Probing Error $P_{FTU,MPE}$ ISO 10360-5:2010

The test procedure under this standard is that a probe is used to measure defined target points on a standard sphere (25 points, as in Figure 3) and the result used to calculate the position of the sphere center by a least squares method. Then the distance R from the sphere center for each of the 25 measurement points is calculated, and the radius difference Rmax - Rmin is computed. If this final calculated value is equal to or less than the specified value, the probe has passed the test.

# CRYSTA-Plus M

## SERIES 196 — Manual Floating CMM





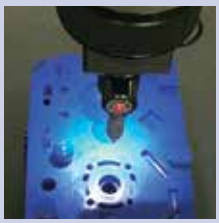
Ergonomically designed guide grip on Z-axis for reliable measurement
(only for Crysta-Plus M776 and M7106)



One-touch air clamp and fine feed for rapid and easy positioning



**Crysta-Plus M443**





Probe illumination (optional) to illuminate the probe and styli directly and brighten the working field

Manual floating CMMs were developed in quest for high-accuracy, low-cost and easy operation. The Crysta-Plus M is suitable to measure a wide range of applications from a simple dimension to a complex form. The scale systems on Mitutoyo high-precision models use a high-performance linear encoder (manufactured by Mitutoyo) for detecting axis position. In addition, various technologies have been used in the structure, part processing and assembly to provide high-accuracy measurement.

The Crysta-Plus M700 series has a large main unit and is equipped with a mobile clamp so that one-touch clamping on each axis can be performed by hand. Continuous fine feed over the entire measuring range can be performed.

## FEATURES

- Smooth operation utilizing high-precision air bearings and lightweight moving members.
- Continuous fine feed over the entire measuring range.
- One-touch air clamp for each axis.

**Crysta-Plus M574**





**MH20i**
*see page L-20*



**Crysta-Plus M7106**

## SPECIFICATIONS

| Type: Bridge | Model No. | Crysta-Plus M443 | Crysta-Plus M574 | Crysta-Plus M7106 |
|---|---|---|---|---|
| Range | X axis | 15.74″ (400mm) | 19.68″ (500mm) | 27.55″ (700mm) |
| | Y axis | 15.74″ (400mm) | 27.55″ (700mm) | 39.36″ (1000mm) |
| | Z axis | 11.81″ (300mm) | 15.74″ (400mm) | 23.62″ (600mm) |
| Resolution | | 0.000019″ (0.0005mm) | | |
| Work table | Material | Granite | | |
| | Size | 24.56″ x 31.69″ (624mm x 805mm) | 30.07″ x 46.25″ (764mm x 1175mm) | 35.43″ x 68.50″ (900mm x 1740mm) |
| | Tapped insert | M8 x 1.25mm | | |
| Workpiece | Max. height | 18.89″ (480mm) | 23.22″ (590mm) | 31.49″ (800mm) |
| | Max. load | 396 lbs. (180kg) | | 1,763 lbs. (800kg) |
| Mass (incl. stand) | | 793 lbs. (360kg) | 1,424 lbs. (646kg) | 3,968 lbs. (1800kg) |
| Dimensions W x D x H | | 38.62 x 41.22 x77.44″ (981 x 1047 x 1967mm) | 56.45 x 44.17 x 89.25″ (1434 x 1122 x 2267mm) | 57.48 x 79.40 x 111.81″ (1460 x 2017 x 2840mm) |
| Air Supply | Pressure | 50.7 PSI (0.35MPa) | | 58.0 PSI (0.4MPa) |
| | Consumption | 1.76CFM (50L/min) | | |
| | Source | 3.53CFM (100L/min) | | |
| ISO-10360-2: 2001 | | | | |
| 19-21°C (66.2-69.8°F) | TP20: E | (3.0+4.0L/1000)µm | (3.5+4.0L/1000)µm | (4.5+4.5L/1000)µm |
| | TP20: R | 4µm | | 5µm |

| Stylus Configurations for ISO Tests | |
|---|---|
| TP20: | Ø4mm x L10mm |

| Environment | 19-21°C (66.2-69.8°F) |
|---|---|
| Rate of change | 2.0C° or less per hour<br>5.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal |

*See page L-2 for explanation of ISO accuracy statements*



Mitutoyo

# CRYSTA-Apex S 500/700/900/1200

High-performance, low-price CNC Coordinate Measuring Machine that meets global standards

## SERIES 191 — Standard CNC CMM

### High accuracy in the 1.7µm class

The CRYSTA-Apex S is a high-accuracy CNC coordinate measuring machine that guarantees a maximum permissible error of $*E_{0,MPE}$ = (1.7+3L/1000)µm [500/700/900 Series]. Comparing the CRYSTA-Apex S with CMMs offering $*E_{0,MPE}$ of approximately (2.5+4L/1000)µm where a required tolerance on a dimension is ±0.02 mm, then the measuring machine uncertainty should be no more than one-fifth (ideally one-tenth) of that, i.e. 4µm. This means that with a general purpose CMM, when the measured length exceeds 14.8"(375mm), machine uncertainty exceeds one-fifth of the dimension tolerance in this case. In contrast, as shown in the figure on the right, with the CRYSTA-Apex S the measurement uncertainty remains within one-fifth of the dimension tolerance up to 30.2" (766mm). The higher accuracy specification of the CRYSTA-Apex S, therefore, gives it more than double the effective measuring range in terms of accuracy-guarantee capability in this case.

**ISO 10360-2:2009*






**Surftest**
*(surface finish)*
*See page L-27*



**CRYSTA-Apex S 544**



**CRYSTA-Apex S 776**



**CRYSTA-Apex S 9106**

## SPECIFICATIONS

| Type: BRIDGE | Model No. | CRYSTA-Apex S 544 | CRYSTA-Apex S 574 | CRYSTA-Apex S 776 | CRYSTA-Apex S 7106 | CRYSTA-Apex S 9106 | CRYSTA-Apex S 9166 | CRYSTA-Apex S 9206 |
|---|---|---|---|---|---|---|---|---|
| Range | X axis | 19.68" (500mm) | | 27.55" (700mm) | | 35.43" (900mm) | | |
| | Y axis | 15.74" (400mm) | 27.55" (700mm) | | 39.36" (1000mm) | | 62.99" (1600mm) | 78.73" (2000mm) |
| | Z axis | 15.74" (400mm) | | 23.62" (600mm) | | | | |
| Resolution | | 0.000004" (0.0001mm) | | | | | | |
| Guide Method | | Air bearing on each axis | | | | | | |
| Maximum Drive Speed 3D | | 20.43"/s (519mm/s) | | | | | | |
| Maximum Acceleration 3D | | 0.23G (2,309mm/s²) | | | | | | |
| Work table | Material | Granite | | | | | | |
| | Size | 25.11 x 33.86" (638 x 860mm) | 25.11 x 45.67" (638 x 1160mm) | 34.64 x 55.90" (880 x 1420mm) | 34.64 x 67.71" (880 x 1720mm) | 42.51 x 67.71" (1080 x 1720mm) | 42.51 x 91.33" (1080 x 2320mm) | 42.51 x 107.08" (1080 x 2720mm) |
| | Tapped insert | M8 x 1.25mm | | | | | | |
| Workpiece | Max. height | 21.45" (545mm) | | 31.49" (800mm) | | | | |
| | Max. load | 396 lbs. (180kg) | | 1,763 lbs. (800kg) | 2,204 lbs. (1000kg) | 2,645 lbs. (1200kg) | 3,306 lbs. (1500kg) | 3,968 lbs. (1800kg) |
| Mass (incl. stand & controller) | | 1,135 lbs. (515kg) | 1,377 lbs. (625kg) | 3,692 lbs. (1675kg) | 4,301 lbs. (1951kg) | 4,918 lbs. (2231kg) | 6,322 lbs. (2868kg) | 8,624 lbs. (3912kg) |
| Dimensions W x D x H | | 42.60x46.88x86.02" (1082x1191x2185mm) | 42.60x60.94x86.02" (1082x1548x2185mm) | 57.87x66.92x107.48" (1470x1700x2730mm) | 57.87x78.73x107.48" (1470x2000x2730mm) | 65.74x78.73x107.48" (1670x2000x2730mm) | 65.74x107.87x107.48" (1670x2740x2730mm) | 65.74x126.77x107.48" (1670x3220x2730mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | | | | | | | |
| 18-22°C (64.4-71.6°F) | TP200: | (1.9+3L/1000)µm | | | | | | |
| | MPP310/SP25: | (1.7+3L/1000)µm | | | | | | |
| 16-26°C (60.8-78.8°F) | TP200: | (1.9+4L/1000)µm | | | | | | |
| | MPP310/SP25: | (1.7+4L/1000)µm | | | | | | |
| ISO-10360-2:2009 $E_{150,MPE}$ † | | | | | | | | |
| 18-22°C (64.4-71.6°F) | TP200: | (2.4+3L/1000)µm | | | | | | |
| | MPP310/SP25: | (1.7+3L/1000)µm | | | | | | |
| 16-26°C (60.8-78.8°F) | TP200: | (2.4+4L/1000)µm | | | | | | |
| | MPP310/SP25: | (1.7+4L/1000)µm | | | | | | |
| ISO-10360-2:2009 $R_{0,MPL}$ † | | | | | | | | |
| | TP200: | 1.5µm | | 1.9µm | | | | |
| | MPP310/SP25: | 1.3µm | | | | | | |
| ISO-10360-4 $MPE_{THP}/MPT_{THP}$ † | | | | | | | | |
| | SP25: | 2.3µm/50sec | | | | | | |
| | SP80: | N/A | | 2.0µm/50sec | | | | |
| | MPP310: | 1.8mm/90sec | | | 1.8mm/80sec | | | |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | | | | | | | | |
| | TP200: | 1.9µm | | | | | | |
| | SP25: | 1.7µm | | | | | | |
| | MPP310: | 1.5µm | | 1.7µm | | | | |

| Stylus Configurations for ISO Tests | |
|---|---|
| TP200: | Ø4mm x L10mm |
| SP25/SP80: | Ø4mm x L50mm |
| MPP310Q: | Ø4mm x L18mm |

| Air Supply | 500 | 700/900 |
|---|---|---|
| Pressure | 58.0 PSI (0.4MPa) | |
| Consumption | 1.76CFM (50L/min) | 2.11CFM (60L/min) |
| Source | 3.53CFM (100L/min) | |

| Environment | 18-22°C (64.4-71.6°F ) | 16-26°C (60.8-78.8°F) |
|---|---|---|
| Rate of change | 2.0C° or less per hour<br>2.0C° or less per day | 2.0C° or less per hour<br>5.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal | |

† This test is not part of Mitutoyo America's standard A2LA-accredited CMM calibration procedure and is quoted upon request.

*See page L-2 for explanation of ISO accuracy statements*

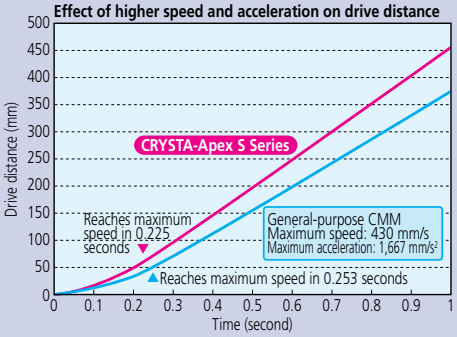
# CRYSTA-Apex S 500/700/900/1200

## SERIES 191 — Standard CNC CMM





Integrated Y-Axis in Granite Table




### Designed for high rigidity

As is the case with Mitutoyo's conventional CMMs, various structures are employed in the CRYSTA-Apex S in order to give the body higher rigidity. The Y-axis guide rail, which is attached to one side of the granite surface plate, shows very little deterioration with use, and thus promises to maintain high accuracy for a long time. The air bearings located on the bottom face, in addition to those at the front, rear, and upper surfaces of the slider unit of the X-axis, minimize vibration even during high-speed, high-acceleration movement, thus ensuring stable linear motion.

| Supported Probe Systems | | | |
|---|---|---|---|
| **Type** | **Probe** | **AS500** | **AS700/900/1200** |
| **TOUCH TRIGGER PROBES** | MH20i | ● | ● |
| | TP20 | ● | ● |
| | TP200 | ● | ● |
| | TP7 | ● | ● |
| **SCANNING PROBES** | SP25 | ● | ● |
| | MPP | ● | ● |
| | SP80 | — | ● |
| **LASER PROBES** | SM606 | ▲ | ● |
| | SM606T | ▲ | ● |
| | SM610 | ▲ | ● |
| | SM1010 | ▲ | ● |
| **SURFACE FINISH** | SurfTest | ● | ● |
| **OPTICAL** | QVP | ▲ | ● |
| | CF20 | ● | ● |

● Supported ▲ Not Recommended — Not supported

*See page L-20 through L-27 for probe system information*



**CRYSTA-Apex S 122010**



**SP25 Probe**
*(Scanning)*
*See page L-21*



**Quick Vision Probe**
*(Optical probe–non-contact)*
*See page L-26*

## SPECIFICATIONS

| Type: BRIDGE | Model No. | CRYSTA-Apex S 9108 | CRYSTA-Apex S 9168 | CRYSTA-Apex S 9208 | CRYSTA-Apex S 121210 | CRYSTA-Apex S 122010 | CRYSTA-Apex S 123010 |
|---|---|---|---|---|---|---|---|
| Range | X axis | 35.43" (900mm) | | | 47.24" (1200mm) | | |
| | Y axis | 39.36" (1000mm) | 62.99" (1600mm) | 78.73" (2000mm) | 47.24" (1200mm | 78.73" (2000mm) | 118.1" (3000mm) |
| | Z axis | 31.49" (800mm) | | | 39.36" (1000mm) | | |
| Resolution | | 0.000004" (0.0001mm) | | | | | |
| Guide Method | | Air bearing on each axis | | | | | |
| Maximum Drive Speed 3D | | 20.43"/s (519mm/s) | | | 27.28"/s (693mm/s) | | |
| Maximum Acceleration 3D | | 0.17G (1732mm/s²) | | | | | |
| Work table | Material | Granite | | | | | |
| | Size | 42.51 x 67.71" (1080 x 1720mm) | 42.51 x 91.33" (1080 x 2320mm) | 42.51 x 107.08" (1080 x 2720mm) | 55.90 x 67.71" (1420 x 2165mm) | 55.90 x 116.73" (1420 x 2965mm) | 55.90 x 156.10" (1420 x 3965mm) |
| | Tapped insert | M8 x 1.25mm | | | | | |
| Workpiece | Max. height | 39.36" (1000mm) | | | 47.24" (1200mm) | | |
| | Max. load | 2,645 lbs. (1200kg) | 3,306 lbs. (1500kg) | 3,968 lbs. (1800kg) | 4,409 lbs. (2000kg) | 5,511 lbs. (2500kg) | 6,613 lbs. (3000kg) |
| Mass (incl. stand & controller) | | 4,985 lbs. (2261kg) | 6,389 lbs. (2898kg) | 8,691 lbs. (3942kg) | 8,928 lbs. (4050kg) | 13,558 lbs. (6150kg) | 20,084 lbs. (9110kg) |
| Dimensions W x D x H | | 65.74x78.73x123.22" (1670x2000x3130mm) | 65.74x107.87x123.22" (1670x2740x3130mm) | 65.74x126.77x123.22" (1670x3220x3130mm) | 86.61x102.16x143.50" (2200x2595x3645mm) | 86.61x133.66x143.50" (2200x3395x3645mm) | 86.61x173.03x143.50" (2200x4395x3645mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | | | | | | |
| 18-22°C (64.4-71.6°F) | TP200: | (1.9+3L/1000)µm | | | (2.5+3L/1000)µm | | |
| | MPP310/SP25/SP80: | (1.7+3L/1000)µm | | | (2.3+3L/1000)µm | | |
| 16-26°C (60.8-78.8°F) | TP200: | (1.9+4L/1000)µm | | | (2.5+4L/1000)µm | | |
| | MPP310/SP25/SP80: | (1.7+4L/1000)µm | | | (2.3+4L/1000)µm | | |
| ISO-10360-2:2009 $E_{150,MPE}$ † | | | | | | | |
| 18-22°C (64.4-71.6°F) | TP200: | (2.4+3L/1000)µm | | | (3.0+3L/1000)µm | | |
| | MPP310/SP25/SP80: | (1.7+3L/1000)µm | | | (2.3+3L/1000)µm | | |
| 16-26°C \| (60.8-78.8°F) | TP200: | (2.4+4L/1000)µm | | | (3.0+4L/1000)µm | | |
| | MPP310/SP25/SP80: | (1.7+4L/1000)µm | | | (2.3+4L/1000)µm | | |
| ISO-10360-2:2009 $R_{0,MPL}$ † | | | | | | | |
| | TP200: | 1.9µm | | | 2.0µm | | |
| | MPP310/SP25/SP80: | 1.3µm | | | 1.9µm | | |
| ISO-10360-4 $MPE_{THP}/MPT_{THP}$ † | | | | | | | |
| | SP25: | 2.3µm/60sec | | | 2.8µm/50sec | | |
| | SP80: | 2.3µm/60sec | | | 2.5µm/50sec | | |
| | MPP310: | 1.8µm/80sec | | | 2.3µm/80sec | | |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | | | | | | | |
| | TP200: | 1.9µm | | | 2.2µm | | |
| | MPP310/SP25/SP80: | 1.7µm | | | 2.0µm | | |

| Stylus Configurations for ISO Tests | |
|---|---|
| TP200: | Ø4mm x L10mm |
| SP25/SP80: | Ø4mm x L50mm |
| MPP310Q: | Ø4mm x L18mm |

| Air Supply | 900 | 1200 |
|---|---|---|
| Pressure | 58.0 PSI (0.4MPa) | |
| Consumption | 2.11CFM (60L/min) | 3.53CFM (100L/min) |
| Source | 4.23CFM (120L/min) | 5.29CFM (150L/min) |

| Environment | 18-22°C (64.4-71.6°F ) | 16-26°C (60.8-78.8°F) |
|---|---|---|
| Rate of change | 2.0C° or less per hour<br>2.0C° or less per day | 2.0C° or less per hour<br>5.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal | |

† This test is not part of Mitutoyo America's standard A2LA accredited CMM calibration procedure and is quoted upon request.

*See page L-2 for explanation of ISO accuracy statements*



Mitutoyo

# CRYSTA-Apex EX 500T/700T/900T

## SERIES 191 — PH20 Equipped 5-Axis CNC CMM

The CRYSTA-Apex EX 500T/700T/900T series are CNC CMMs equipped with the PH20 5-axis control touch-trigger probe. The 5-axis operation reduces the time required for probe rotational movements and allows more flexible positioning. This also ensures easy access to complex workpieces and saves time both during programming and measurement.
In addition to 3-axis point measurement similar to conventional coordinate measuring machines, the PH20 probe head also supports head-touch operation for quick point measurement using the two rotational axes of the probe only, with no movement required along the CMM axes.
The PH20 incorporates a TP20 probe and allows use of modules designed for the TP20. Automatic probe changes with a module changer is also supported with the use of the TCR20 change rack (option).



## FEATURES

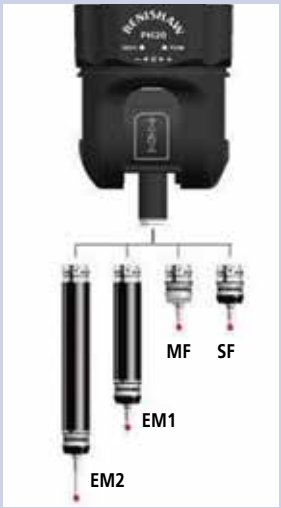
- Incorporates PH20 5-axis touch-trigger probe
- Ultra-high speed 5-axis control touch-trigger probe
- Smooth 5-axis control drastically reduces measurement time (typically 40-65%) for probe rotation
- 5-axis design provides highly efficient measurement method of head touch for point measurement by moving the probe head only in two axes







CRYSTA-Apex EX 544T




### Specifications PH20

| | | |
|---|---|---|
| Rotation angle (Pitch angle) | Vertical (A-axis) | -115° to +115° (0.08sec) |
| | Horizontal (B-axis) | ∞ (0.08sec) |
| Stylus | Maximum length | 50mm |

## SPECIFICATIONS

| Type: BRIDGE | Model No. | CRYSTA-Apex EX 544T | CRYSTA-Apex EX 574T | CRYSTA-Apex EX 776T | CRYSTA-Apex EX 7106T | CRYSTA-Apex EX 9106T | CRYSTA-Apex EX 9166T | CRYSTA-Apex EX 9206T |
|---|---|---|---|---|---|---|---|---|
| Range | X axis | 19.68″ (500mm) | | 27.55″ (700mm) | | 35.43″ (900mm) | | |
| | Y axis | 15.74″ (400mm) | 27.55″ (700mm) | | 39.36″ (1000mm) | | 62.99″ (1600mm) | 78.73″ (2000mm) |
| | Z axis | 15.74″ (400mm) | | 23.62″ (600mm) | | | | |
| Resolution | | 0.000004″ (0.0001mm) | | | | | | |
| Guide Method | | Air bearing on each axis | | | | | | |
| Work table | Material | Granite | | | | | | |
| | Size | 25.11 x 33.86″ (638 x 860mm) | 25.11 x 45.67″ (638 x 1160mm) | 34.64 x 55.90″ (880 x 1420mm) | 34.64 x 67.71″ (880 x 1720mm) | 42.51 x 67.71″ (1080 x 1720mm) | 42.51 x 91.33″ (1080 x 2320mm) | 42.51 x 107.0″ (1080 x 2720mm) |
| | Tapped insert | M8 x 1.25mm | | | | | | |
| Workpiece | Max. height | 21.45″ (545mm) | | 31.49″ (800mm) | | | | |
| | Max. load | 396 lbs. (180kg) | | 1,763 lbs. (800kg) | 2,204 lbs (1000kg) | 2,645 lbs. (1200kg) | 3,306 lbs. (1500kg) | 3,968 lbs. (1800kg) |
| Mass (incl. stand & controller) | | 1,181 lbs. (536kg) | 1,424 lbs. (646kg) | 3,739 lbs. (1696kg) | 4,347 lbs. (1972kg) | 4,964 lbs. (2252kg) | 6,369 lbs. (2889kg) | 8,670 lbs. (3933kg) |
| Dimensions W x D x H | | 42.60x46.88x86.02″ (1082x1191x2185mm) | 42.60x60.94x86.02″ (1082x1548x2185mm) | 57.87x66.92x107.48″ (1470x1700x2730mm) | 57.87x78.73x107.48″ (1470x2000x2730mm) | 65.74x78.73x107.48″ (1670x2000x2730mm) | 65.74x107.87x107.48″ (1670x2740x2730mm) | 65.74x126.77x107.48″ (1670x3220x2730mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | | | | | | | |
| 18-22°C (64.4-71.6°F) | | (2.2+3L/1000)µm | | | | | | |
| 16-26°C (60.8-78.8°F) | | (2.2+4L/1000)µm | | | | | | |
| ISO-10360-2:2009† $R_{0,MPL}$ | | 1.8µm | | 2.2µm | | | | |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | | 2.2µm | | | | | | |

| Stylus Configurations for ISO Tests | |
|---|---|
| TP20: | Ø4mm x L12mm |

| Air Supply | 500 | 700/900 |
|---|---|---|
| Pressure | 58.0 PSI (0.4MPa) | |
| Consumption | 1.76CFM (50L/min) | 2.11CFM (60L/min) |
| Source | 3.53CFM (100L/min) | 4.23CFM (120L/min) |

| Environment | 18-22°C (64.4-71.6°F ) | 16-26°C (60.8-78.8°F) |
|---|---|---|
| Rate of change | 2.0C° or less per hour<br>2.0C° or less per day | 2.0C° or less per hour<br>5.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal | |

† This test is not part of Mitutoyo America's standard A2LA-accredited CMM calibration procedure and is quoted upon request.

*See page L-2 for explanation of ISO accuracy statements.*

# CRYSTA-Apex EX 1200R

## SERIES 191 — REVO-Equipped 5-Axis CNC CMM

The CRYSTA-Apex EX 1200R series is advanced CNC CMMs equipped with the REVO 5-axis scanning probe head. The 5-axis operation reduces the time required for probe repositioning movements and allows for more flexible positioning. This also facilitates access to complex workpieces and saves time both during programming and measurement.
The ultra-high speed 5-axis scanning (max. 500mm/s) surpasses conventional 3-axis control, supporting high-speed sampling of up to 4,000 points per second and allowing data acquisition of densely spaced measurement points, even during high-speed scanning.
The internal implementation of laser sensing technology ensures high-accuracy measurement, even with long styli (up to 500 mm as measured from probe rotation center to stylus tip). Two types of scanning probes are supported:

- RSP2 for 5-axis scanning
- RSP3 probe (SP25M type), allowing the use of a cranked stylus

Automatic changeover of these probes with an auto probe changer is possible, enabling fully automated measurement of parts with diverse shapes. Probe calibration of RSP2 requires only about 20 minutes to enable use of the full angular range. Compared to conventional scanning probes, this reduces preparation time.

## FEATURES

- Equipped with REVO 5-axis scanning probe head
- Ultra-high speed 5-axis scanning






## SPECIFICATIONS

| Type: BRIDGE | Model No. | Crysta-Apex EX 121210R | Crysta-Apex EX 122010R | Crysta-Apex EX 123010R |
|---|---|---|---|---|
| Range | X axis | | 47.24″ (1200mm) | |
| | Y axis | 47.24″ (1200mm) | 78.73″ (2000mm) | 118.10″ (3000mm) |
| | Z axis | | 39.36″ (1000mm) | |
| Resolution | | | 0.000004″ (0.0001mm) | |
| Guide Method | | | Air bearing on each axis | |
| Work table | Material | | Granite | |
| | Size | 55.11″ x 85.23″ (1400mm x 2165mm) | 55.11″ x 116.73″ (1400mm x 2965mm) | 55.11″ x 156.10″ (1400mm x 3965mm) |
| | Tapped insert | | M8 x 1.25mm | |
| Workpiece | Max. height | | 45.66″ (1160mm) | |
| | Max. load | 4,409 lbs. (2000kg) | 5,511 lbs. (2500kg) | 6,613 lbs. (3000kg) |
| Mass (incl. stand & controller) | | 8,928 lbs. (4050kg) | 13,558 lbs. (6150kg) | 20,084 lbs. (9110kg) |
| Dimensions W x D x H | | 86.61 x 102.16 x 143.50″ (2200 x 2595 x 3645mm) | 86.61 x 133.66 x 143.50″ (2200 x 3395 x 3645mm) | 86.61 x 173.03 x 143.50″ (2200 x 4395 x 3645mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | | | |
| 18-22°C (64.4-71.6°F) | | | (2.9+4L/1000)µm | |
| 16-26°C (60.8-78.8°F) | | | (2.9+5L/1000)µm | |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | | | 3.2µm | |

| Configuration for ISO Tests | |
|---|---|
| RSP2+RSH250 | Ø6mm x L10mm |

| Air Supply | |
|---|---|
| Pressure | 72.5 PSI (0.5MPa) |
| Consumption | 5.29CFM (150L/min) |
| Source | 8.12CFM (230L/min) |

| Environment | 18-22°C (64.4-71.6°F) | 16-26°C (60.8-78.8°F) |
|---|---|---|
| Rate of change | 1.0C° or less per hour<br>2.0C° or less per day | 1.0C° or less per hour<br>5.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal | |

### Specification of REVO Scanning Probe

| | | |
|---|---|---|
| Rotation angle (Pitch angle) | Vertical (A-axis) | -5° to +120° (0.08 sec) |
| | Horizontal (B-axis) | ∞ (0.08sec) |
| Stylus | Maximum length | 50mm (Distance from probe rotation center to stylus tip) |

*See page L-2 for explanation of ISO accuracy statements.*



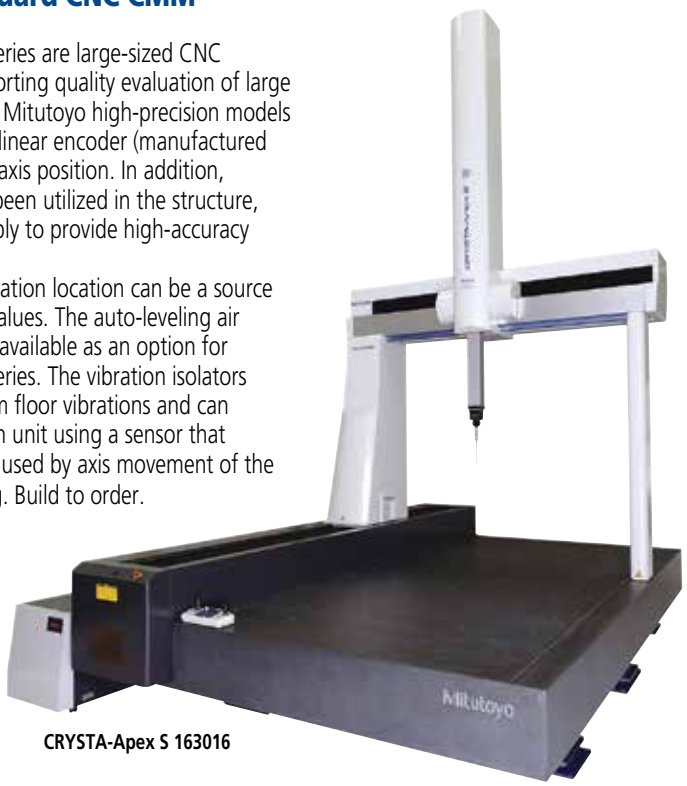
Mitutoyo

# CRYSTA-Apex S 1600/2000

## SERIES 191 — Standard CNC CMM

Crysta-Apex S1600/2000 series are large-sized CNC CMMs developed for supporting quality evaluation of large parts. The scale systems on Mitutoyo high-precision models utilize a high-performance linear encoder (manufactured by Mitutoyo) for detecting axis position. In addition, various technologies have been utilized in the structure, part processing and assembly to provide high-accuracy measurement.

Floor vibration at the installation location can be a source of variations in measured values. The auto-leveling air spring vibration isolators is available as an option for Crysta-Apex S1600/2000 series. The vibration isolators insulates the main unit from floor vibrations and can quickly level the CMM main unit using a sensor that detects load fluctuations caused by axis movement of the CMM or workpiece loading. Build to order.




**CRYSTA-Apex S 163016**



**SP80 Probe**
*(Extended reach scanning)*
*See page L-21*

| Supported Probe Systems | | | |
|---|---|---|---|
| **Type** | **Probe** | **AS1600** | **AS2000** |
| **TOUCH-TRIGGER PROBES** | MH20i | ● | ● |
| | TP20 | ● | ● |
| | TP200 | ● | ● |
| | TP7 | ● | ● |
| **SCANNING PROBES** | SP25 | ● | ● |
| | MPP | ● | ● |
| | SP80 | ● | ● |
| **LASER PROBES** | SM606 | ● | ● |
| | SM606T | ● | ● |
| | SM610 | ● | ● |
| | SM1010 | ● | ● |
| **SURFACE FINISH** | SurfTest | ● | ▲ |
| **OPTICAL** | QVP | ● | ● |
| | CF20 | ● | ● |

● Supported ▲ Not Recommended

*See page L-20 thru L-27 for probe system information.*

## SPECIFICATIONS

| Type: BRIDGE | Model No. | CRYSTA-Apex S 162012 [CRYSTA-Apex S 162016] | CRYSTA-Apex S 163012 [CRYSTA-Apex S 163016] | CRYSTA-Apex S 164012 [CRYSTA-Apex S 164016] | CRYSTA-Apex S 203016 | CRYSTA-Apex S 204016 |
|---|---|---|---|---|---|---|
| Range | X axis | 62.99" (1600mm) | | | 78.73" (2000mm) | |
| | Y axis | 78.73" (2000mm) | 118.10" (3000mm) | 157.47" (4000mm) | 118.10" (3000mm) | 157.47" (4000mm) |
| | Z axis | 47.24" (1200mm) [62.99" (1600mm)] | | | 62.99" (1600mm) | |
| Resolution | | 0.000004" (0.0001mm) | | | | |
| Guide Method | | Air bearing on each axis | | | | |
| Maximum Drive Speed 3D | | 27.28"/s (693mm/s) | | | | |
| Maximum Acceleration 3D | | 0.14G (1,390mm/s²) | | | | |
| Work table | Material | Granite | | | | |
| | Size | 70.86" x 126.18" (1800mm x 3205mm) | 70.86" x 165.55" (1800mm x 4205mm) | 70.86" x 204.92" (1800mm x 5205mm) | 86.61" x 165.55" (2200mm x 4205mm) | 86.61" x 204.92" (2200mm x 5205mm) |
| | Tapped insert | M8 x 1.25mm | | | | |
| Workpiece | Max. height | 55.11" (1400mm) [70.86" (1800mm)] | | | 70.86" (1800mm) | |
| | Max. load | 6,613 lbs. (3000kg) | 7,716 lbs. (3500kg) | 9,920 lbs. (4500kg) | 8,818 lbs. (4000kg) | 11,023 lbs. (5000kg) |
| Mass (incl. stand & controller) | | 20,502 lbs. (9300kg) [20,613 lbs. (9350kg)] | 23,368 lbs. (10600kg) [23,479 lbs. (10650kg)] | 32,628 lbs. (14800kg) [37,738 lbs. (14850kg)] | 31,085 lbs. (14100kg) | 42,769 lbs. (19400kg) |
| Dimensions W x D x H | | 106.29 x 141.73 x 162.99" (2700 x 3600 x 4140mm) [106.29 x 141.73 x 194.48"] [(2700 x 3600 x 4940mm)] | 106.29 x 181.10 x 162.99" (2700 x 4600 x 4140mm) [106.29 x 181.10 x 194.48"] [(2700 x 4600 x 4940mm)] | 106.29 x 220.47 x 164.96" (2700 x 5600 x 4190mm) [106.29 x 220.47 x 196.45"] [(2700 x 5600 x 4990mm)] | 122.04 x 183.07 x 196.45" (3100 x 4650 x 4990mm) | 122.04 x 222.44 x 198.42" (3100 x 5650 x 5040mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | | | | | |
| 18-22°C (64.4-71.6°F) | TP200: | (6+4.5L/1000)µm [(7+5.5L/1000)µm] | | | (9+8L/1000)µm | |
| | MPP310/SP25: | (3.3+4.5L/1000)µm [(4.5+5.5L/1000)µm] | | | (4.5+8L/1000)µm | |
| 16-24°C (60.8-75.2°F) | TP200: | (6+5.5L/1000)µm [(7+6.5L/1000)µm] | | | (9+9L/1000)µm | |
| | MPP310/SP25: | (3.3+5.5L/1000)µm [(4.5+6.5L/1000)µm] | | | (4.5+8L/1000)µm | |
| ISO-10360-4 $MPE_{THP}/MPT_{THP}$ † | | | | | | |
| | MPP310/SP25: | 5µm/60sec | | | 6µm/60sec | |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | | | | | | |
| | TP200: | 6.5µm [7.5 µm] | | | 9.5µm | |
| | MPP310/SP25: | 5µm [6µm] | | | 6µm | |

| Stylus Configurations for ISO Tests | |
|---|---|
| TP200: | Ø4mm x L10mm |
| SP25/SP80: | Ø4mm x L50mm |
| MPP310Q: | Ø4mm x L18mm |

| Air Supply | |
|---|---|
| Pressure | 58.0 PSI (0.4MPa) |
| Consumption | 5.29CFM (150L/min) |
| Source | 7.06CFM (200L/min) |

| Environment | 18-22°C (64.4-71.6°F ) | 16-24°C (60.8-75.2°F) |
|---|---|---|
| Rate of change | 1.0C° or less per hour<br>2.0C° or less per day | 1.0C° or less per hour<br>5.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal | |

† This test is not part of Mitutoyo America's standard A2LA-accredited CMM calibration procedure and is quoted upon request.

*See page L-2 for explanation of ISO accuracy statements.*

| Supported Probe Systems | | | |
|---|---|---|---|
| Type | Probe | STRATO Apex 500 | STRATO Apex 700/900 |
| TOUCH-TRIGGER PROBES | MH20i | ● | ● |
| | TP20 | ● | ● |
| | TP200 | ● | ● |
| | TP7 | ● | ● |
| SCANNING PROBES | SP25 | ● | ● |
| | MPP | ● | ● |
| | SP80 | ▲ | ● |
| LASER PROBES | SM606 | ▲ | ● |
| | SM606T | ▲ | ● |
| | SM610 | ▲ | ● |
| | SM1010 | ▲ | ● |
| SURFACE FINISH | SurfTest | — | ● |
| OPTICAL | QVP | ▲ | ● |
| | CF20 | ● | ● |

● Supported ▲ Not Recommended — Not supported

*See page L-20 thru L-27 for probe system information.*



**Ultra-high precision glass scales**



**Internal heat generation minimized**

# STRATO-Apex 500/700/900

## SERIES 355 — High-Accuracy CNC CMM

The STRATO-Apex series is high-accuracy CNC CMMs achieving 0.9µm for the first term. The series guarantees high accuracy and also high-moving speed and acceleration achieved with improved rigid air bearings on all axial guideways. The scale systems on Mitutoyo high-precision models utilize a high-performance linear encoder (manufactured by Mitutoyo), for detecting axis position. In addition, various technologies have been utilized in the structure, part processing and assembly to provide high-accuracy measurement.



**TP7 Probe**
*(High-precision touch trigger)*
*See page L-20*



**STRATO-Apex 574** **STRATO-Apex 776** **STRATO-Apex 9106**

## SPECIFICATIONS

| Type: BRIDGE | Model No. | STRATO-Apex 574 | STRATO-Apex 776 | STRATO-Apex 7106 | STRATO-Apex 9106 | STRATO-Apex 9166 |
|---|---|---|---|---|---|---|
| Range | X axis | 19.68" (500mm) | 27.55" (700mm) | | 35.43" (900mm) | |
| | Y axis | 27.55" (700mm) | | 39.36" (1000mm) | | 62.99" (1600mm) |
| | Z axis | 15.74" (400mm) | 23.62" (600mm) | | | |
| Resolution | | 0.0000019" (0.00005mm) | 0.00000078" (0.00002mm) | | | |
| Guide Method | | Air bearing on each axis | | | | |
| Maximum Drive Speed 3D | | 20.43"/s (519mm/s) | | | | |
| Maximum Acceleration 3D | | 0.17G (2,309mm/s$^2$) | 0.26G (2,598mm/s$^2$) | | | |
| Work table | Material | Granite | | | | |
| | Size | 26.61 x 55.90" (676 x 1420mm) | 33.93 x 55.90" (862 x 1420mm) | 33.93 x 67.71" (862 x 1720mm) | 41.81 x 67.71" (1062 x 1720mm) | 41.81 x 91.33" (1062 x 2320mm) |
| | Tapped insert | M8 x 1.25mm | | | | |
| Workpiece | Max. height | 22.04" (560mm) | 30.31" (770mm) | | | |
| | Max. load | 396 lbs. (180kg) | 1,102 lbs. (500kg) | 1,763 lbs. (800kg) | 1,763 lbs. (800kg) | 2,645 lbs. (1200kg) |
| Mass (incl. stand & controller) | | 3,373 lbs. (1530kg) | 4,177 lbs. (1895kg) | 4,806 lbs. (2180kg) | 5,313 lbs. (2410kg) | 6,801 lbs. (3085kg) |
| Dimensions W x D x H | | 49.99x66.92x94.88" (1270x1700x2410mm) | 57.48x75.19x111.41" (1460x1910x2830mm) | 57.48x87.00x111.41" (1460x2210x2830mm) | 65.35x87.00x111.41" (1660x2210x2830mm) | 65.35x110.62x111.41" (1660x2810x2830mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | | | | | |
| | TP200: | (1.4+2.5L/1000)µm* | (1.4+2.5L/1000)µm** | | (1.5+2.5L/1000)µm** | |
| | SP25: | (0.7+2.5L/1000)µm* | (0.9+2.5L/1000)µm** | | | |
| ISO-10360-2:2009 $E_{150,MPE}$ | | | | | | |
| | TP200: | (1.9+2.5L/1000)µm* | (1.9+2.5L/1000)µm** | | (2.0+2.5L/1000)µm** | |
| | SP25: | (0.7+2.5L/1000)µm* | (0.9+2.5L/1000)µm** | | | |
| ISO-10360-2:2009 $R_{0,MPL}$ | TP200: | 1.2µm* | 1.2µm** | | | |
| | SP25: | 0.7µm* | 0.8 µm** | | | |
| ISO-10360-4 $MPE_{THP}/MPT_{THP}$ | SP25: | 1.3µm/40sec* | 1.8µm/45sec** | | | |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | TP200: | 1.8µm* | 1.8µm** | | | |
| | SP25: | 0.7µm* | 0.9 µm** | | | |

* 18-22°C (64.4-71.6°F - Strato Apex 574
** 19-21°C (66.2-69.8°F) - Strato Apex 776/7106/9106/9166

| Stylus Configurations for ISO Tests | |
|---|---|
| TP200: | Ø4mm x L10mm |
| SP25/SP80: | Ø4mm x L50mm |

| Air Supply | |
|---|---|
| Pressure | 58.0 PSI (0.4MPa) |
| Consumption | 2.11CFM (60L/min) |
| Source | 4.23CFM (120L/min) |

| Environment | 18-22°C (64.4-71.6°F ) | 19-21°C (66.2-69.8°F) |
|---|---|---|
| Rate of change | 1.0C° or less per hour<br>2.0C° or less per day | |
| Gradient | 1.0C° or less per meter vertical & horizontal | |

*See page L-2 for explanation of ISO accuracy statements.*



Mitutoyo

# STRATO-Apex 1600

## SERIES 355 — High-Accuracy CNC CMM

The STRATO-Apex 1600 series is a large-sized CNC CMM developed for supporting quality evaluation and assembly of large parts.The scale systems on Mitutoyo high-precision models utilize a high-performance linear encoder (manufactured by Mitutoyo) for detecting axis position. In addition, various technologies have been utilized in the structure, part processing and assembly to provide high-accuracy measurement. Floor vibration at the installation location can be a source of variation in measured values. The auto-leveling air spring vibration isolator is available as an option for STRATO-Apex 1600 series. The vibration isolator insulates the main unit from floor vibrations and can quickly level the CMM main unit using a sensor that detects load fluctuations caused by axis movement of the CMM or workpiece loading. All STRATO-Apex high-precision series CMMs are equipped with temperature compensation and therefore do not require a temperature-controlled room. Accuracy is guaranteed within the range of 16 to 26°C.




**STRATO-Apex 1600**

| Supported Probe Systems | | |
|---|---|---|
| **Type** | **Probe** | **STRATO Apex 1600** |
| **TOUCH TRIGGER PROBES** | MH20i | ● |
| | TP20 | ● |
| | TP200 | ● |
| | TP7 | ● |
| **SCANNING PROBES** | SP25 | ● |
| | MPP | ● |
| | SP80 | ● |
| **LASER PROBES** | SM606 | ● |
| | SM606T | ● |
| | SM610 | ● |
| | SM1010 | ● |
| **SURFACE FINISH** | SurfTest | ● |

● Supported ▲ Not Recommended

*See page L-20 thru L-27 for probe system information*



**SP80 Probe**
*(Extended reach scanning)*
*See page L-21*

## SPECIFICATIONS

| Type: BRIDGE | Model | STRATO-Apex 162012 | STRATO-Apex 162016 | STRATO-Apex 163012 | STRATO-Apex 163016 |
|---|---|---|---|---|---|
| Range | X axis | 62.99″ (1600mm) | | | |
| | Y axis | 78.73″ (2000mm) | | 118.10″ (3000mm) | |
| | Z axis | 47.24″ (1200mm) | 62.99″ (1600mm) | 47.24″ (1200mm) | 62.99″ (1600mm) |
| Resolution | | 0.0000019″ (0.00005mm) | | | |
| Guide Method | | Air bearing on each axis | | | |
| Maximum Drive Speed 3D | | 23.85″/s (606mm/s) | | | |
| Maximum Acceleration 3D | | 0.13G (1,350mm/s$^2$) | | | |
| Work table | Material | Granite | | | |
| | Size | 72.83 x 129.13″ (1850mm x 3280mm) | | 72.83 x 168.50″ (1850mm x 4280mm) | |
| | Tapped insert | M8 x 1.25mm | | | |
| Workpiece | Max. height | 53.14″ (1350mm) | 368.89″ (1750mm) | 53.14″(1350mm) | 68.89″ (1750mm) |
| | Max. load | 7,716 lbs. (3500kg) | | 8,818 lbs. (4000kg) | |
| Mass (incl. stand & controller) | | 24,582 lbs. (11150kg) | 24,692 lbs. (11200kg) | 33,730 lbs. (15300kg) | 33,841 lbs. (15350kg) |
| Dimensions W x D x H | | 110.43x147.24x170.86″ (2805x3740x4340mm) | 110.43x147.24x202.36″ (2805x3740x5140mm) | 110.43x186.61x172.83″ (2805x4740x4390mm) | 110.43x186.61x204.33″ (2805x4740x5190mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ 18-22°C (64.4-71.6°F) | | | | | |
| | TP200: | (3.5+4L/1000)µm | (4.0+4L/1000)µm | (3.5+4L/1000)µm | (4.0+4L/1000)µm |
| | SP25/SP80: | (2.5+4L/1000)µm | (3.0+4L/1000)µm | (2.5+4L/1000)µm | (3.0+4L/1000)µm |
| ISO-10360-2:2009 $E_{150,MPE}$ † 18-22°C (64.4-71.6°F) | | | | | |
| | TP200: | (3.5+4L/1000)µm | (4.0+4L/1000)µm | (3.5+4L/1000)µm | (4.0+4L/1000)µm |
| | SP25/SP80: | (2.5+4L/1000)µm | (3.0+4L/1000)µm | (2.5+4L/1000)µm | (3.0+4L/1000)µm |
| ISO-10360-2:2009 $R_{0,MPL}$ † | | | | | |
| | TP200: | 3.5µm | 4.0µm | 3.5µm | 4.0µm |
| | SP25: | 2.5µm | | | |
| ISO-10360-4 $MPE_{THP}/MPT_{THP}$ † | | | | | |
| | SP25/SP80: | 2.5µm/60sec | 3.0µm/60sec | 2.5µm/60sec | 3.0µm/60sec |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | TP200: | 3.5µm | 4.0µm | 3.5µm | 4.0µm |
| | SP25/SP80: | 2.3µm | 2.8µm | 2.3µm | 2.8µm |

| Stylus Configurations for ISO Tests | |
|---|---|
| TP200: | Ø4mm x L10mm |
| SP25/SP80: | Ø4mm x L50mm |

| Air Supply | |
|---|---|
| Pressure | 58.0 PSI (0.4MPa) |
| Consumption | 3.53CFM (100L/min) |
| Source | 8.82CFM (250L/min) |

| Environment | 18-22°C (64.4-71.6°F ) |
|---|---|
| Rate of change | 1.0C° or less per hour<br>2.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal |

† This test is not part of Mitutoyo America's standard A2LA-accredited CMM calibration procedure and is quoted upon request.

*See page L-2 for explanation of ISO accuracy statements.*

NEW-STYLE
Vision Measuring Systems

# FALCIO-Apex 2000/3000

## SERIES 355 — High-Accuracy Large CNC CMM

The FALCIO-Apex 2000/3000 series CNC CMMs use Mitutoyo's standard structure for large machines, which are designed for measuring large and heavy workpieces with high accuracy. The measuring accuracy and drive speed are the highest level in the X-axis measuring range of 2000mm and 3000mm for CNC CMMs worldwide. Units are equipped with a system (MOVAC) to automatically restore accuracy deterioration caused by foundation deformation as a standard feature. Safety devices such as Z-axis beam sensor, tape switch and area sensor are available as options. Built to order.



**SurfaceMeasure Probes**
(Laser scanning probes—non-contact)
*See page L-22*



**FALCIO Apex 305015G**

## SPECIFICATIONS

| Type: SEPARATE GUIDE | Model No. | FALCIO-Apex 203015 | FALCIO-Apex 204015 | FALCIO-Apex 205015 | FALCIO-Apex 305015 |
|---|---|---|---|---|---|
| Range | X axis | 78.73" (2000mm) | | | 118.10" (3000mm) |
| | Y axis | 118.10" (3000mm) | 157.47" (4000mm) | 196.84" (5000mm) | |
| | Z axis | 59.05" (1500mm) | | | |
| Resolution | | 0.0000039" (0.0001mm) | | | |
| Mass (incl. stand & controller) | | 23,368 lbs. (10600kg) | 27,557 lbs. (12500kg) | 34,392 lbs. (15600kg) | 35,273 lbs. (16000kg) |
| Dimensions W x D x H | | 174.40x234.25x184.64" (4430x5950x4690mm) | 174.40x273.62x184.64" (4430x6950x4690mm) | 174.40x312.99x184.64" (4430x7950x4690mm) | 213.77x312.99x184.64" (5430x7950x4690mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | | | | |
| 18-22°C (64.4-71.6°F) | TP200: | 3.5+4L/1000µm | | | |

| Supported Probe Systems | | |
|---|---|---|
| Type | Probe | FALCIO Apex |
| TOUCH-TRIGGER PROBES | MH20i | ● |
| | TP20 | ● |
| | TP200 | ● |
| | TP7 | ● |
| SCANNING PROBES | SP25 | ● |
| | MPP | ▲ |
| | SP80 | ● |
| LASER PROBES | SM606 | ● |
| | SM606T | ● |
| | SM610 | ● |
| | SM1010 | ● |
| SURFACE FINISH | SurfTest | ● |

● Supported ▲ Not Recommended

*See page L-20 thru L-27 for probe system information.*

| Stylus Configurations for ISO Tests | |
|---|---|
| TP200: | Ø4mm x L10mm |

*See page L-2 for explanation of ISO accuracy statements.*

**Main Unit Startup System**

This machine incorporates a startup system (relocation detection system), which disables operation when an unexpected vibration is applied or the machine is relocated. Be sure to contact your nearest Mitutoyo prior to relocating this machine after initial installation. Refer to page VIII for details.



**TP200 Probe**
*(Touch trigger)*
*See page L-20*



Mitutoyo

# LEGEX 500/700/900

## SERIES 356 — Ultra-high Accuracy CNC CMM

Achieving premium performance, the LEGEX series with its fixed bridge structure and precision air bearings resting on rigid guideways ensures superior stability of motion and ultra-high measuring accuracy. Thorough testing, using FEM structure analysis simulation, guarantees geometric motion accuracy has minimal errors from fluctuations in the load and other variables. LEGEX series CNC CMMs are suitable for complex small- to medium-size workpieces, such as gears, bearings, lens, precision dies or other high-precision workpieces requiring dimensional accuracies with small tolerances.

The LEGEX series incorporates an ultra-high accuracy scale unit with crystallized glass scales (thermal expansion coefficient of $0.01x10^{-6}$/K), and a high-resolution, high-performance reflection linear encoder providing premium positioning performance. All LEGEX Ultra-accuracy series CMM's are equipped with temperature compensation and therefore do not require a temperature controlled room. Accuracy is guaranteed within the range of 18 to 22°C.



### MPP-310Q

Mitutoyo's MPP-310Q probe can be used for point-to-point measuring and continuous scanning applications. If the workpiece requires the maximum accuracy, the MPP-310Q offers zero-point data acquisition for statistical measurement. In this mode the MPP-310Q obtains the measurement data after all the CMM slides have come to a complete standstill. This statistical measurement is intended to eliminate dynamic effects on measurement. *See page L-21 for MPP-310Q system information.*

**MPP-310Q Specs**

- Resolution: 0.01µm
- Measuring Force: 0.20N/mm
- Maximum Stylus Length: 200mm
- Maximum Stylus Weight: 75g



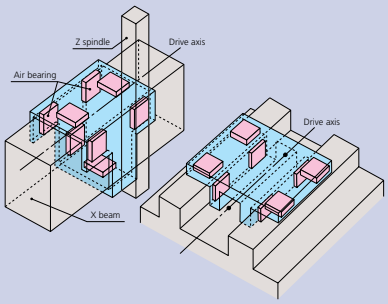
LEGEX 574



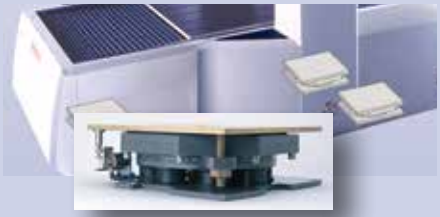
LEGEX 776



LEGEX 9106




**XY axis independence and center-of-gravity drive system.** The fixed-bridge design of the LEGEX allows the axes to operate independently. Movement of the X-axis slide does not change the loading on the Y-axis slide and therefore does not cause deformation. In addition, the center-of-gravity drive system places the drive units near the center of gravity of each slide, allowing high speed and highly accurate measurements by reducing inertia-induced deflections during acceleration and deceleration.



**Vibration Control**
The LEGEX is hardened against floor-induced vibration by use of air-damped spring isolators with an auto-leveling function, virtually eliminating factory-floor vibrations from the entire machine structure.

**Ceramic-coated worktable**
Standard feature for corrosion resistance and long life.



## SPECIFICATIONS

| Type: FIXED BRIDGE | Model No. | LEGEX 574 | LEGEX 774 | LEGEX 776 | LEGEX 9106 |
|---|---|---|---|---|---|
| Range | X axis | 19.68" (500mm) | 27.55" (700mm) | | 35.43" (900mm) |
| | Y axis | 27.55" (700mm) | | | 39.36" (1000mm) |
| | Z axis | 15.74" (400mm) | | 23.62" (600mm) | |
| Resolution | | 0.00000039" (0.01µm) | | | |
| Guide Method | | Air bearing on each axis | | | |
| Maximum Drive Speed 3D | | 7.8"/s (200mm/s) | | | |
| Maximum Acceleration 3D | | 0.1G (980mm/s²) | | | |
| Work table | Material | Cast Iron with Ceramic Coating | | | |
| | Size | 21.65" x 29.52" (550mm x 750mm) | 29.52" x 29.52" (750mm x 750mm) | | 37.40" x 41.33" (950mm x 1050mm) |
| | Tapped insert | M8 x 1.25mm | | | |
| Workpiece | Max. height | 27.55" (700mm) | | 33.46" (850mm) | |
| | Max. load | 551 lbs. (250kg) | 1,102 lbs. (500kg) | | 1,763 lbs. (800kg) |
| Mass (incl. stand & controller) | | 7,716 lbs. (3500kg) | 11,023 lbs. (5000kg) | 11,243 lbs. (5100kg) | 14,330 lbs. (6500kg) |
| Dimensions W x D x H | | 62.44 x 95.66 x 103.54" (1470 x 2430 x 2630mm) | 65.74 x 95.66 x 103.54" (1670 x 2430 x 2630mm) | 65.74 x 94.48 x 115.35" (1670 x 2430 x 2930mm) | 73.62 x 119.29 x 120.07" (1870 x 3030 x 3050mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | 19-21°C (66.2-69.8°F) | | *18-22°C (64.4-71.6°F)* | |
| 19-21°C (66.2-69.8°F) | MPP310Q: | (0.28+L/1000)µm | | *(0.30+L/1000)µm* | |
| | SP25M: | (0.38+L/1000)µm | | *(0.40+L/1000)µm* | |
| ISO-10360-4 $MPE_{THP}$/$MPT_{THP}$ † | MPP310Q/SP25M: | 1.1µm/60sec | | | |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | MPP310Q: | 0.40µm | | | |
| | SP25M: | 0.45µm | | | |

| Stylus Configurations for ISO Tests | |
|---|---|
| MPP310Q: | Ø4mm x L18mm |
| SP25M: | Ø4mm x L50mm |

| Air Supply | 500/700/1200 | 900 |
|---|---|---|
| Pressure | 58.0 PSI (0.5MPa) | 72.5 PSI (0.4MPa) |
| Consumption | 4.23CFM (120L/min) | |
| Source | 5.65CFM (160L/min) | |

| Environment | 19-21°C (66.2-69.8°F) / 18-22°C (64.4-71.6°F) |
|---|---|
| Rate of change | 0.5C° or less per hour<br>1.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal |

† This test is not part of Mitutoyo America's standard A2LA-accredited CMM calibration procedure and is quoted upon request.

*See page L-2 for explanation of ISO accuracy statements.*

# MACH-V 9106

## SERIES 360 — Inline CNC CMM

The MACH-3A and MACH-V maximize machining operations by performing in-line or near-line high-speed coordinate measuring in conjunction with your CNC machine tools. These high-throughput machines can be incorporated right into the manufacturing line and can provide pre/post machining feedback to your machine tool for machining adjustments.



MACH-V 9106



## SPECIFICATIONS

| Type: INLINE | Model No. | MACH-V 9106 |
|---|---|---|
| Range | X axis | 35.43" (900mm) |
| | Y axis | 39.36" (1000mm) |
| | Z axis | 23.62" (600mm) |
| Resolution | | 0.0000039" (0.0001mm) |
| Guide Method | | Mechanical bearing on each axis |
| Maximum Drive Speed 3D | | 34.09"/s (866mm/s) |
| Maximum Acceleration 3D | | 0.88g (8660mm/s²) |
| Work table | Material | Steel |
| | Size | 35.62" x 41.96" (905mm x 1066mm) |
| | Tapped insert | M8 x 1.25mm |
| Workpiece | Max. height | 31.49" (800mm) |
| | Max. load | 330 lbs. (150kg) |
| Mass (including controller) | | 9,105 lbs. (4130kg) |
| Dimensions W x D x H | | 58.14 x 115.82 x 114.17" (1477 x 2942 x 2900mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | |
| TP7/SP25: | 19-21°C (66.2-69.8°F) | (2.5+3.5L/1000)µm |
| | 18-22°C (64.4-71.6°F) | (2.7+3.8L/1000)µm |
| | 15-25°C (59.0-77.0°F) | (2.9+4.3L/1000)µm |
| | 5-35°C (41.0-95.0°F) | (3.6+5.8L/1000)µm |
| ISO-10360-4 $MPE_{THP}/MPT_{THP}$ † | SP25: | 4.0µm/40sec |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | TP7: | 2.2µm |
| | SP25: | 2.2µm |

† This test is not part of Mitutoyo America's standard A2LA-accredited CMM calibration procedure and is quoted upon request.



*See page L-21.*

| Stylus Configurations for ISO Tests | |
|---|---|
| TP7: | Ø4mm x L20mm |
| SP25: | Ø4mm x L50mm |

| Environment | 5-35°C (71.6-64.4°F) |
|---|---|
| Rate of change | 2.0C° or less per hour 10.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal |

# MACH-3A 653

## SERIES 360 — Inline CNC CMM

Inline CNC CMM (horizontal type) incorporating the CMM controller and host computer in the main unit results in a compact spacing-saving footprint for the shop floor. This series is designed for 24-hour operation, resulting in stable operation.



MACH-3A 653



## SPECIFICATIONS

| Type: INLINE | Model No. | MACH-3A 653 |
|---|---|---|
| Range | X axis | 23.62" (600mm) |
| | Y axis | 19.68" (500mm) |
| | Z axis | 11.02" (280mm) |
| Resolution | | 0.0000039" (0.0001mm) |
| Guide Method | | Mechanical bearing on each axis |
| Maximum Drive Speed 3D | | 47.71"/s (1,212mm/s) |
| Maximum Acceleration 3D | | 1.21G (11,882mm/s²) |
| Mass | | 8,818 lbs. (4000kg) |
| Dimensions W x D x H | | 73.62 x 50.39 x 75.59" (1870 x 1280 x 1920mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ | | |
| SP25: | 19-21°C (66.2-69.8°F) | (2.2+3.5L/1000)µm |
| | 15-25°C (66.2-69.8°F) | (2.5+4.2L/1000)µm |
| | 10-30°C (50.0-86.0°F) | (2.9+5.0L/1000)µm |
| | 5-35°C (66.2-95.0°F) | (3.2+5.7L/1000)µm |
| TP7: | 19-21°C (66.2-69.8°F) | (2.5+3.5L/1000)µm |
| | 15-25°C (66.2-69.8°F) | (2.8+4.2L/1000)µm |
| | 10-30°C (50.0-86.0°F) | (3.2+5.0L/1000)µm |
| | 5-35°C (66.2-95.0°F) | (3.5+5.7L/1000)µm |
| ISO-10360-4 $MPE_{THP}/MPT_{THP}$ † | SP25: | 4.0µm/40sec |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | SP25: | 2.2µm |
| | TP7: | 2.5µm |

† This test is not part of Mitutoyo America's standard A2LA-accredited CMM calibration procedure and is quoted upon request.

*See page L-2 for explanation of ISO accuracy statements.*



**TP7 Probe**
*(High-precision tough-trigger)*
*See page L-20.*

| Stylus Configurations for ISO Tests | |
|---|---|
| TP7: | Ø4mm x L20mm |
| SP25: | Ø4mm x L50mm |

| Environment | 5-35°C (71.6-64.4°F) |
|---|---|
| Rate of change | 2.0C° per hour 10.0C° per day |
| Gradient | 1.0C° or less per meter vertical & horizontal |



Mitutoyo

# MACH KO-GA-ME

## SERIES 360 — Inline CNC CMM

Mitutoyo MACH Ko-ga-me is a compact, 3D CNC measuring system that can be configured to almost any process. Use for stand-alone applications or integrate into cells. If required, the system can measure workpiece features that exceed the Ko-ga-me's X stroke by mounting the workpiece, or the Ko-ga-me, on an auxiliary X axis. Ideal for inspection of large or small workpieces and offers a wide choice of measuring probes including touch-trigger, optical and scanning types. (Note: Probe choice may be restricted, depending on the application.)





**SP25 Scanning Probe**
*See page L-21.*



**TP200 Touch-Trigger Probe**
*See page L-20.*

## SPECIFICATIONS

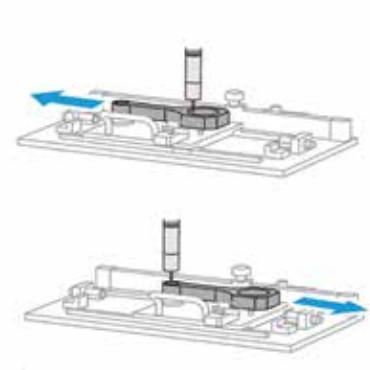
| Type: INLINE | Model No. | KGM888-B | KGM12128-B |
|---|---|---|---|
| Range | X axis | 3.14" (80mm) | 4.72" (120mm) |
| | Y axis | 3.14" (80mm) | 4.72" (120mm) |
| | Z axis | 3.14" (80mm) | |
| Resolution | | 0.00000078" (0.02µm) | |
| Guide Method | | Straight-motion hard bearing | |
| Maximum Drive Speed 3D | | 13.38"/s (340mm/s) | |
| Maximum Acceleration 3D | | 0.68G (6,750mm/s²) | |
| Mass: main unit | | 61.7 lbs. (28kg) | |
| Dimensions* W x D x H: (height includes Z measuring range) | | 15.03 x 14.68 x 30.90" (382 x 373 x 785mm) | |
| Measuring Accuracy (ISO 10360-2:2009) | | | |
| TP200/SP25: | 19-21°C (66.2-69.8°F) | (2.4+5.7L/1000)µm | |
| | 15-25°C (66.2-69.8°F) | (2.7+6.4L/1000)µm | |
| | 10-30°C (50.0-86.0°F) | (3.1+7.2L/1000)µm | |
| | 10-35°C (50.0-95.0°F) | (3.4+7.9L/1000)µm | |
| Probing Error (ISO 10360-2:2009) | | | |
| | TP200/SP25: | 2.0µm | |
| Scanning probing error (ISO 10360-4:2000) | | | |
| | SP25: | 2.7µm/(30s) | |

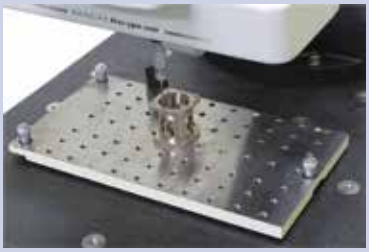
| Stylus Configurations for Accuracy Tests | |
|---|---|
| TP200: | Ø3mm x L10mm |
| SP25: | Ø4mm x L50mm |

| | |
|---|---|
| Environment | 10-35°C (50.0-95.0°F) |
| Rate of Change | 2.0C° or less per hour<br>10.0C° or less per day |
| Gradient | 1.0C° or less per meter vertical & horizontal |









*See page L-2 for explanation of ISO accuracy statements.*

# CARBapex / CARBstrato

## SERIES 355 — Car Body Measuring System CNC CMM

NEW-STYLE
Vision Measuring Systems

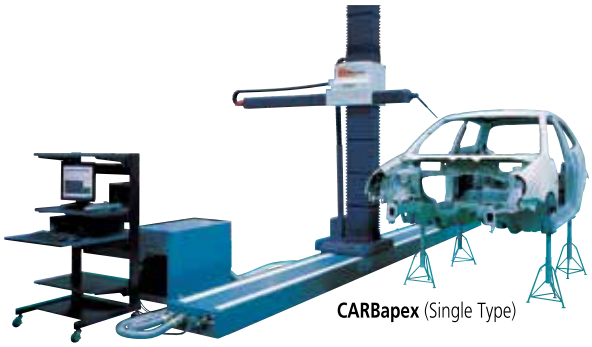


**SurfaceMeasure Probes**
(Laser scanning probes—non-contact)

*See page L-22 for probe system information.*

**The world's largest class**
The CARBapex and CABstrato series is a lineup of cost-effective horizontal, large CNC CMMs and offers the world's largest class measurement range, making it possible to measure car bodies.

**Single & Dual**
Single- and dual-types are available to fit the intended use.
Single type: Measure a workpiece with a single CMM from the CARBstrato series.
Dual type: Measure a workpiece placed between two simultaneously controlled CMMs from the CARBstrato series.

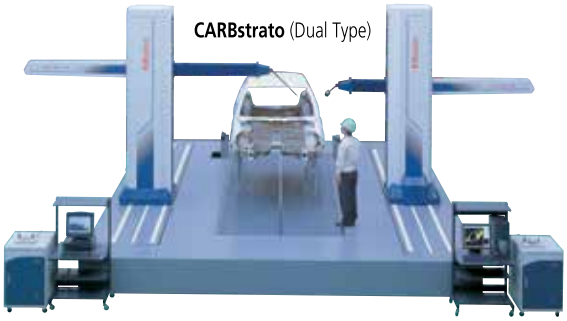


**CARBapex** (Single Type)

Because the height of the X-axis base of both the single- and the dual-type is set lower, the required depth for the foundation before the installation is relatively shallow.

**Remarkable usability**
The CARBapex series not only has remarkable usability, but also has the ability to enhance the safety operation by performing the procedures on the shop floor. The Y-axis spindle in the vertical direction is set lower in order to perform measurements at a lower workpiece setting height. In addition, the small cross-section of the Y-axis spindle reduces interference during measurement and expands the measurement area inside a car body.

**Safety after installation**
Since the height of the X-axis base is set lower, the required depth for the foundation before installation is comparatively shallow. The structure is designed to avoid both long- and short-term problems, such as a aging of the foundation (concrete) or accuracy deterioration resulting in the bimetal phenomenon caused by deformation of the foundation or the X-axis base due to common environmental changes.



**CARBstrato** (Dual Type)

**Options**
- Line laser probe for non-contact measurement (SurfaceMeasure).
- Measurement point search function, a necessity for car body measuring, is included in the metrology software.
- A variety of optional safety devices enhance operator safety. Built to order.



**Main Unit Startup System**

This machine incorporates a startup system (relocation detection system), which disables operation when an unexpected vibration is applied or the machine is relocated. Be sure to contact your nearest Mitutoyo prior to relocating this machine after initial installation.

## SPECIFICATIONS

| Type: HORIZONTAL ARM | Model No. | | CARBapex 601624 | CARBstrato 601624 |
|---|---|---|---|---|
| Range | X axis | | 236.21" (6000mm) | |
| | Y axis (Single) | | 62.99" (1600mm) | |
| | Y axis (Dual) | | 153.54" (3900mm) | |
| | Z axis | | 94.48" (2400mm) | |
| Resolution | | | 0.0000039" (0.0001mm) | |
| Mass | Single Arm | | 4,982 lbs. (2260kg) | 13,845 lbs. (6280kg) |
| | Dual Arm | | 9,964 lbs. (4520kg) | 27,690 lbs. (12560kg) |
| Dimensions W x D x H | Single Arm | | 163.18 x 275.58 x 144.33" (4145 x 7000 x 3666mm) | 176.10 x 238.34 x 155.62" (4473x 7324 x 3953mm) |
| | Dual Arm | | 322.79 x 275.58 x 144.33" (8190 x 7000 x 3666mm) | 348.26 x 238.34 x 155.62" (8846x 7324 x 3953mm) |
| ISO-10360-2:2009 $E_{0,MPE}$ 16-26°C (60.8-78.8°F) | Single Arm | TP20: | (25+28L/1000≤95)µm | (18+20L/1000≤70)µm |
| | | SP25: | (20+28L/1000≤95)µm | (15+20L/1000≤70)µm |
| | Dual Arm | TP20: | (50+35L/1000≤120)µm | (38+30L/1000≤90)µm |
| | | SP25: | (45+35L/1000≤120)µm | (35+30L/1000≤90)µm |
| ISO-10360-5: 2010 $P_{FTU,MPE}$ | Single Arm | TP20: | 20µm | 15µm |
| | | SP25: | 15µm | 13µm |
| | Dual Arm | TP20: | 20µm | 15µm |
| | | SP25: | 15µm | 13µm |

| Stylus Configurations for ISO Tests | |
|---|---|
| TP20: | Ø3mm x L10mm |
| SP25: | Ø4mm x L50mm |

*See page L-2 for explanation of ISO accuracy statements.*



Mitutoyo

# MCOSMOS

## Software for Manual / CNC Coordinate Measuring Machines

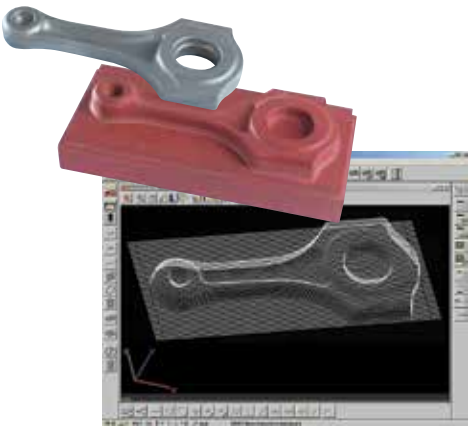
### Three levels of module configuration

MCOSMOS has three choices of module configuration. From the basic MCOSMOS-1 to the advanced MCOSMOS-3, choose a configuration for your measurement applications.

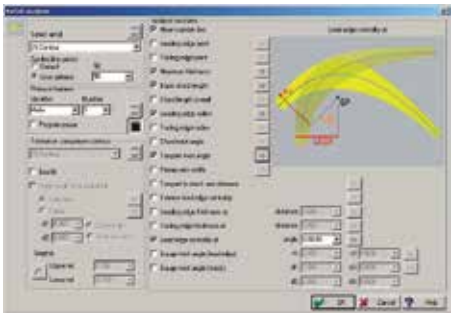
| MCOSMOS Coordinate Measuring Machine Software | | | | |
|---|---|---|---|---|
| | CNC | | | Manual |
| | MCOSMOS-1 | MCOSMOS-2 | MCOSMOS-3 | MCOSMOS-M |
| GEOPAK | ● | ● | ● | ● |
| CAT1000P | ▲ | ● | ● | — |
| CAT1000S | ▲ | ● | ● | ▲ |
| Scanpak | ▲ | ▲ | ● | ▲ |
| Gearpak | ▲ | ▲ | ● | — |
| MAFIS* | ▲ | ▲ | ▲ | — |

● Standard ▲ Option — Not supported * *Requires Scanpak*

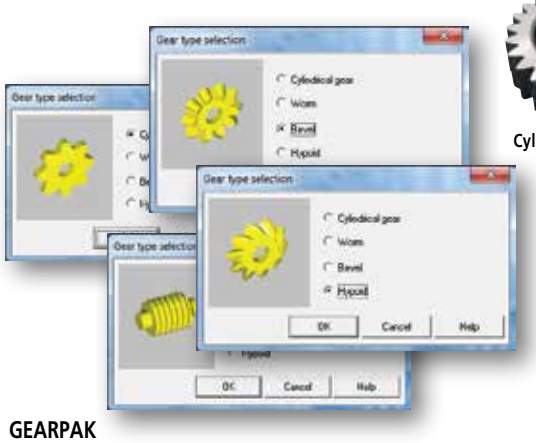
**GEOPAK (Basic Geometry Module)**
Geopak provides an easy graphical console through the use of tool bars and windows which can be personalized to the operator's preference. Geographically enhanced displays provide step-by-step on-screen wizards that prompt the operator, allowing even inexperienced users to create routines to measure parts. The entry-level MCOSMOS-1 software includes flexible advanced tools demanded by the most experienced operators; e.g. looping, formula calculations or expressions that use variables, libraries of day-to-day subroutines and conditional statements, which can add logic for a variety of applications.



**SCANPAK (2D Profile Evaluation Module)**
For the scanning and evaluation of workpiece contours (2D), and data transfer to CAD system.



**MAFIS (Mitutoyo Airfoil Inspection System)**
Evaluation and analysis of airfoil shapes such as turbine blades that require special calculations according to the particular design specifications. The MAFIS system uses cross sectional data of the shape obtained by Scanpak to perform these calculations and outputs the result via the standard geometry program.



**GEARPAK**
**(Gear Measurement and Analysis Module)**
Advances in CMM controller techniques make the measurement of gears feasible, and the Gearpak module takes advantage of this to bring sophisticated measurement capabilities within reach.



Cylindrical Gear Spur



Cylindrical Gear Helical



Worm Cylindrical Gear



Hypoid

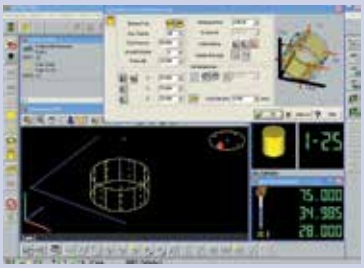


Straight-Bevel



Spiral-Bevel

MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
CMM



## Mitutoyo Controlled Open Systems for Modular Operation Support

MCOSMOS by Mitutoyo is a proprietary metrology suite of inter-related modules and dedicated expansion modules for the Microsoft Windows 7 operating system. The world's standard in metrology software, MCOSMOS is supported in 37 locations worldwide and in 12 languages. *(A proud Microsoft Gold Partner.)*

Developed with MiCAT (Mitutoyo Intelligent Computer Aided Technology), your Mitutoyo CMM is streamlined with intuitive user interfaces that provide a familiar look and feel to operate multiple modules. They work together seamlessly for applications throughout the entire production process to put reliable metrology at you fingertips.

MCOSMOS allows integration among a whole series of applications, improving the efficiency of your CMM and the productivity of your quality control functions. Specific expansion modules are available including GEOPAK or for specific applications such as gear measurement, airfoil analysis, reverse engineering and integrating CAD with metrology.



**CAT-1000P (Prismatic)**
Not available for manual CMMs

CAT1000P significantly facilitates the programming of measurement tasks during the GEOPAK learn mode. All data for measuring parts and tolerance evaluations are taken from the CAD model via pointing device (mouse, trackball, etc.). The same principles apply for programming probe paths (clearance and measurement), while at the same time using the nominal directly from the CAD model for tolerance comparison.

Spatial's 3D InterOp delivers the highest quality data exchange between CAD formats, enabling superior CAD file translation.

Standard with CAT-1000 is ACIS (*.sat) and STEP AP203, which are both licensed copies from Spatial InterOp.CATIA V5, SolidWorks, NX Siemens (Unigraphics), Parasolids, AutoDesk Inventor, Pro-Engineer and IGES or VDAFS exchange formats are available as an option.

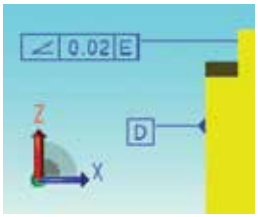
The comprehensive suite of translators provides import/export for all applications, including ACIS, CGM and Parasolid-based applications.

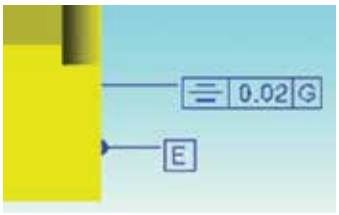
3D InterOp is embedded in many of today's leading design, engineering and manufacturing applications.

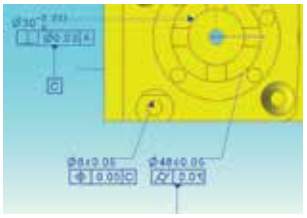
CAT-1000 uses 3D ACIS® Modeler, Spatial's prominent modeling component used in more than 350 customer applications with more than 2 million seats worldwide.

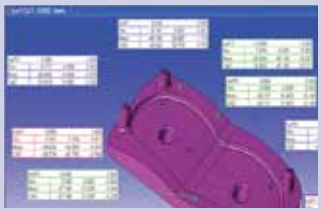
CAT-1000 fully supports and reads PMI (Product Manufacturing Information), which is embedded in the model for datum alignment and GD&T (Geometric Dimensioning and Tolerancing).





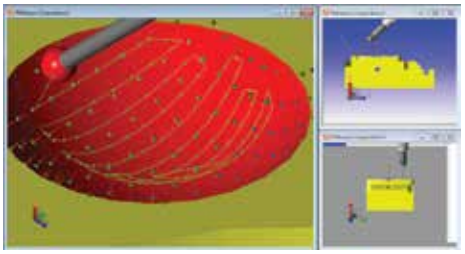





**CAT-1000S (Free-form Sculpted)**

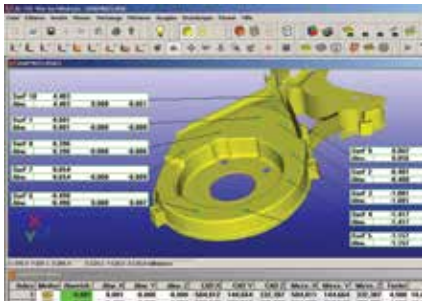
CAT-1000S is a highly versatile tool that can be used on a manual CMM or a CNC CMM. A coordinate system in GEOPAK is compared to the CAD model. Real-time surface disposition is displayed by showing a color class to determine if there is material to remove or replace.
Surface deviation can be displayed as spherical points or as a gradient surface. Cones also can be used to show the direction of the deviation.
GEOPAK CNC can create grid pattern to verify the surface points. A one-click tool calculates a collision-free probe path to measure a grid of surface points offset from the edge.



If the CAD model has specific points, GEOPAK-CNC can drive the machine to the defined points or vertices.



In addition to the online/offline part program creation, CAD model-based generation of surface measurement points, and comparison of actual/nominal data, with graphical output is available.





Mitutoyo

# MiCAT Planner

## Automatic Measurement Program Generation Software

MiCAT Planner is Mitutoyo's latest software development for fast and efficient CMM part programming. Operation of MiCAT Planner is easy and intuitive. Programs are made with a few mouse clicks in jminutes instead of hours or days.

**WORKFLOW:**

1) Load design model
2) Select target CMM
3) Part placement via virtual alignment
4) Measurement program creation
5) Translate to Geopak MCOSMOS




**MiCAT Planner toolbar is workflow based.**

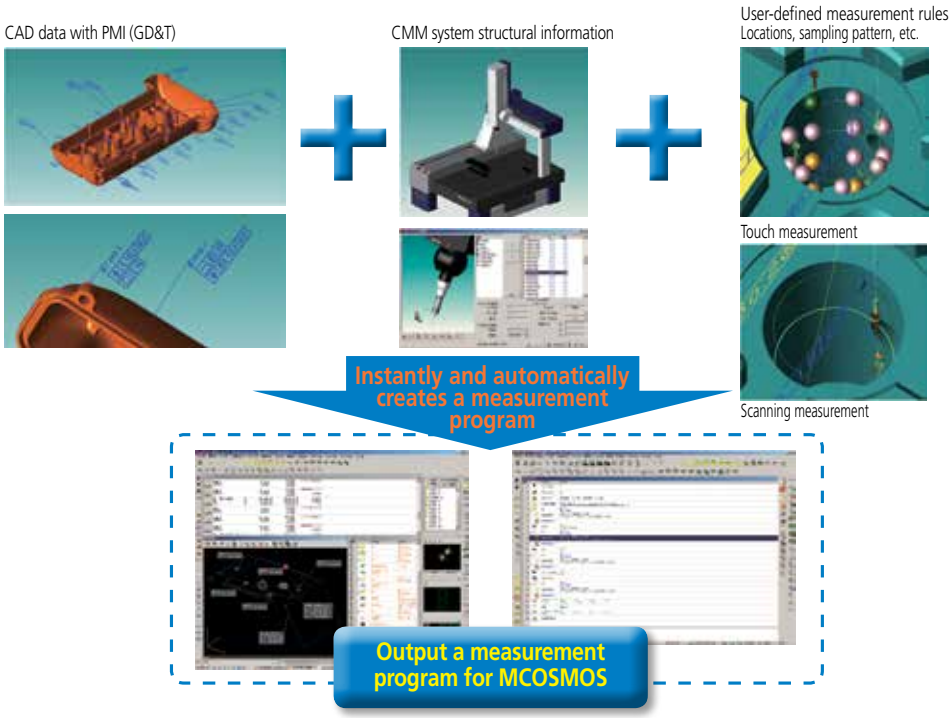
In order to generate a measurement plan, GD&T information attached to the 3D Design Model is needed. Design Model formats marked "w/PMI" will read GD&T information created in the CAD system and stored in the Design Model file. Design Model formats without PMI can be annotated with GD&T in MiCAT Planner.

**Design Model Support:**

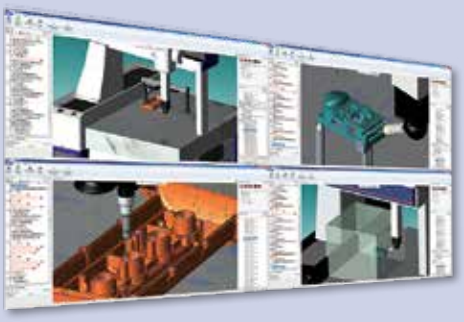
- Siemens NX w/PMI
- CATIA v5 w/PMI
- PRO/E w/PMI
- SOLIDWORKS w/PMI
- ACIS (SAT)

If the Design Model does not contain GD&T information, or the information is incomplete, GD&T information can be added or edited with MiCAT Planner with the following:

- Add new GD&T to an existing feature
- Add GD&T to a new feature
- Edit exiting GD&T information
- Modify display of GD&T in 3D view




MiCAT



## Feature/Benefits of MiCAT Planner:

**Automatic part program generation**
- Up to 90% time savings in CMM part program creation

**Collision control**
- Minimize potential costly and damaging probe collisions

**Program simulation**
- Virtual pre-run of measurement program ensures maxim efficiency

**Rule editor**
- Automatically apply individual or global measurement strategies for all part programs or specific programs

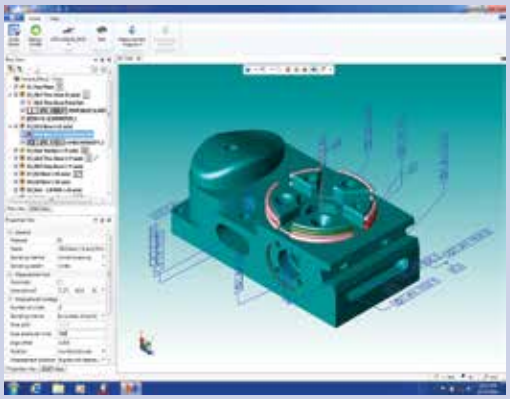
**Plan view**
- Easy selection of characteristics, features and measurement point sets to include or exclude from the measurement plan

**Property pane**
- Feature parameter settings for the current selected item can be an exception to a user-defined rule

**Direct Help**
- Clear, concise explanation for features that can't be measured (missing GD&T, probe angle not defined, etc.)

**GD&T Wizard**
- The GD&T Wizard enables the use of Design Models that do not include any PMI by allowing the user to add, edit or delete PMI information without modifying the original CAD file. All additions, changes or deletions reside solely within the MiCAT Planner project database. *(See Design Model Support above left for the current list)*

www.mitutoyo.com/MiCAT



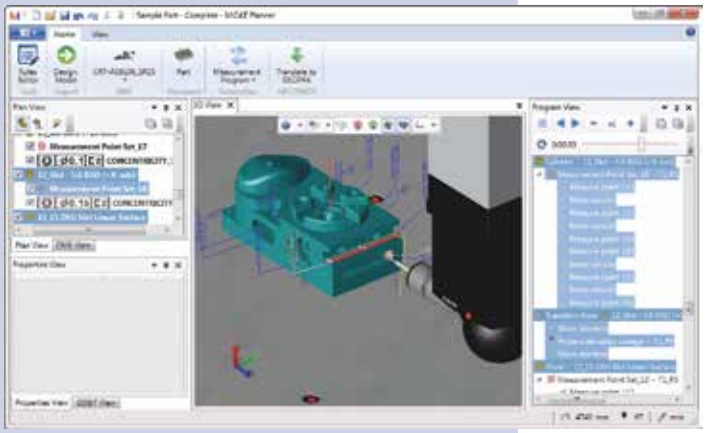
## Measurement Plan

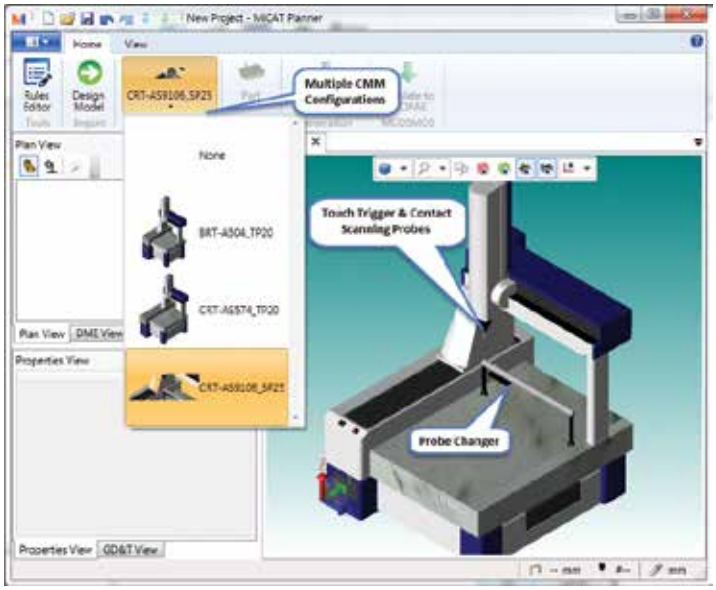
The measurement plan is synchronized with the 3D view and Program View. For example, a feature can be selected in any of the views (Plan View, 3D View, Program View) and is highlighted in the other views. Manual reordering of the feature measurement order is possible by drag and drop of the features in the Plan View. Users can select a feature, characteristic or point set in the Plan View to modify the corresponding properties in the Property View.

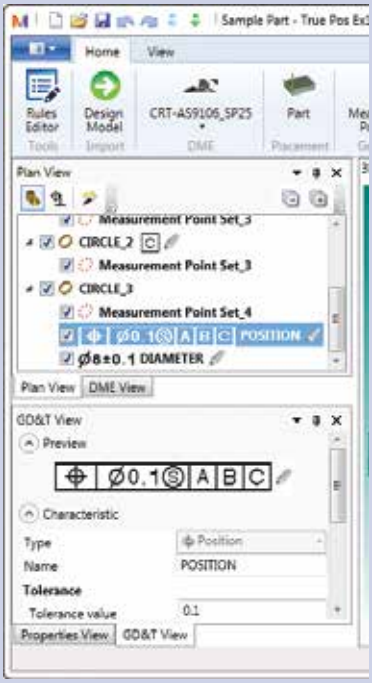
## Load and Use MCOSMOS DME Configurations:

(DME: Dimensional Measuring Equipment)

- Load predefined DME configurations from CMM SystemManager
- Default DME is read directly from the MCOSMOS settings
- MiCAT Planner generates a program specifically for the selected DME
- Align DME and Design Model by mating, dragging, center of table or volume, or by direct numerical input
- Import PCS (part coordinate system) information from MCOSMOS

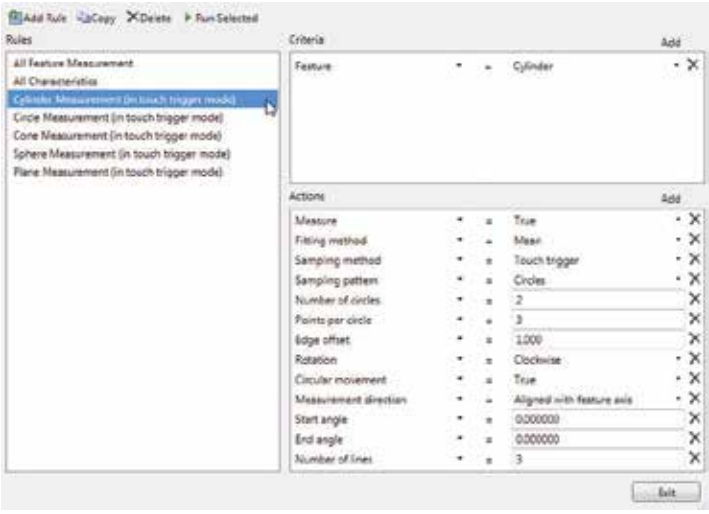





## Rules Editor

The Rules Editor allows users to create rules to define measurement approaches, such as number of points per feature, sensor type, fitting method and automatic sensor selection.







Rules are applied during CAD import and can be re-applied after design model import. The Run Selected command automatically updates the measurement plan with the current defined rules and updates changes in the Plan and Program views.



Mitutoyo

# CMM Probe & Change Rack Options

## Touch-trigger Probe System



**MH20i -** Manual head **CMM:MANUAL | CNC**

MH20i is a manually adjustable probe head with an integral TP20 kinematic stylus module mount with two-axis indexing. The A-axis rotates through ±180° in the X-Y plane. The B-axis rotates through 90° in the Z plane. A lever locks the head in one of up to 168 repeatable positions, set at 15° increments. Capable of carrying the full range of TP20 modules, which can be changed without re-qualification, providing qualification has taken place in each position with each stylus/module combination.



**PH1 -** Manual probe head **CMM:MANUAL | CNC**

The PH1 is a general purpose, swivel-type probe head. Its compact design makes it ideally suited to a CMM where manual orientation of an M8 thread-mounted touch-trigger probe is required (TP20, TP200). The PH1 provides two axes of movement. The A-axis allows probe orientation in the vertical plane; the B-axis allows rotational probe orientation. Axis rotation is in relation to the shank mount. Probe re-qualification is required after each re-orientation of the PH1. TP200 not supported on manual CMM..



**MIH -** Manual indexable probe head **CMM:MANUAL | CNC**

The manually indexable head (MIH) has 720 repeatable positions and features an autojoint probe mount for fast, repeatable probe changing. This probe head is compatible with the TP6A touch probe directly and supports the TP20, andTP200 probe with the use of the autojoint extension bars (e.g. PAA1). An integral LCD enables easy programming with the facility to memorize up to 20 probe positions. Not for use with multi-wire probes.



**Probe Mount:** M8
**Stylus Mount:** M2

**TP20 -** Touch-trigger probe **CMM:MANUAL | CNC**

The TP20 is a compact kinematic touch-trigger probe system featuring a two-piece design, comprising probe body and detachable stylus module(s), connected using a highly repeatable magnetic kinematic coupling. This provides the facility to change stylus configurations either manually or automatically without the need for requalification of the stylus tips. Modules offering a range of trigger forces allow the probe performance to be best matched to the measurement task.



**Probe Mount:** M8
**Stylus Mount:** M2

**TP200 -** Touch-trigger probe **CMM:CNC**

The TP200 features quick-change stylus configurations without the need for requalification, utilizing electronic strain sensing techniques to improve on the form measuring accuracy and operating life that can be achieved when compared with kinematic touch-trigger probes. The TP200 probe is a two-piece design comprising the probe body and a detachable stylus module that holds the stylus assembly.



**Probe Mount:** Autojoint
**Stylus Mount:** M4

**TP7 -** High-accuracy, touch-trigger probe **CMM:CNC**

The TP7M is a high-accuracy touch-trigger probe with a maximum repeatability of $2\sigma \leq 0.25\mu m$. The TP7M can mount a long stylus up to 150mm. In combination with the longest autojoint probe extension of 200mm for direct mounting to the PH10M or PH10MQ, gives the TP7M a maximum access distance of 350mm.



**UMAP-CMM -** Micro-touch probe **CMM:CNC**

A stylus with an ultra-small diameter of ø0.1mm or ø0.3mm can be used. Measurement of miniscule form and dimensions from practically any direction is possible by mounting on the PH10MQ.

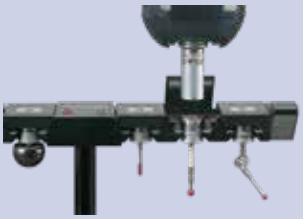
*See page L-28 for stylus information.*

**MCR20 -** Module Change Rack (TP20)



The MCR20 is designed to securely hold the stored TP20 probe modules for automatic changing (CNC CMM only) and to protect from airborne contaminants.

**SCR200 -** Module Change Rack (TP200)



The SCR200 provides automatic, high-speed changing between up to six TP200 stylus modules (CNC CMM only). The SCR200 is powered by the separate probe interface, PI 200, and provides features to facilitate safe stylus changing.

**MSR -** Manual Storage Rack (TP20/TP200)



The MSR1 manual storage rack holds up to 6 pre-qualified stylus assemblies fitted to TP20 or TP200 probe modules to simplify manual module changing. The MSR1 can be mounted on the CMM table or on a vertical surface.

**MAP -** Manual Autojoint Probe (TP6A/TP7)



The MAP (manual autojoint probe) stand is a low-cost storage rack capable of holding up to six autojoint mounted probes and extension bars. The MAP stand can be mounted directly on the table of a CMM, cabinet, wall or any vertical surface.

**SC6** - Stylus Changer (MPP-310Q)



**ACR3 -** Autojoint Change Rack (SP25M)



**FCR25 -** Flexible Change Rack (SP25M)



**FCR25-L3 -** Flexible Change Rack (SP25M)



**FCR25-L6 -** Flexible Change Rack (SP25M)



**SCP80 -** Stylus Change Port (SP80)



# CMM Probe & Change Rack Options

## Motorized Probe Heads

The range of PH10 PLUS motorized probe heads increases throughput by giving CNC CMMs the added capability of program controlled probe re-orientation. This enables the inspection of features at different angles without the need for frequent, time-consuming stylus cluster changes.




### PH10T

Shank-mounted head with two-wired probe capability and an M8 thread supporting TP20, TP200 and TP6 touch-trigger probes.




**PH10M**

### PH10M/10MQ

The PH10M PLUS can carry long extension bars and multi-wire probes such as QVP, SP25M, SurfaceMeasure, Surftest, UMAP-CMM or TP7M. The highly repeatable autojoint allows rapid probe or extension bar changing without the need for re-qualification. The PH10MQ PLUS is a variant of the PH10M PLUS that allows the motorized head to be attached directly to the quill with the B-axis of the head inside the quill itself. This option provides a neater and shorter probe mount, with only the A-axis protruding from the quill.



**PH10MQ**

## Scanning Probe Systems



### MPP-310Q Ultra-High Accuracy Scanning

The MPP310Q is a multifunctional measuring head for CNC CMMs. It not only performs continuous contact scanning measurements at V2≤0.3µm, it also allows highly precise point measurements and self-centering measurements. The MPP-310Q incorporates 0.01µm resolution high-precision scales for each axis (XYZ). Air bearings on all axes ensures smooth measuring with minimal measuring force. Software-controlled clamps in each axis eliminate probe deflection while scanning slanted or arched surfaces to reduce measurement errors. The MPP-310Q allows for contact force as low as 0.03 Newtons for sensitive workpieces or when using very small stylus tips. Scanning speed up to 120mm/second can be achieved on known path geometry. Stylus holder changing is supported with the SCR6.

### SP25M Compact High-Accuracy Scanning Probe

The SP25 is a compact high-accuracy scanning probe with an outside diameter of ø25 mm. This multi-functional probe is suitable for CNC coordinate measuring machines that perform not only scanning measurement, but also high-accuracy point measurement, as well as data collection from a centering-point measurement. The SP25M measuring head is extremely flexible, in addition to its measuring accuracy at very low contact forces, the SP25M can be used with probe systems ranging in lengths from 20mm (SP25-1) up to 400mm (SP25-4). The SP25M can be used on a fixed probe head (PH6M), or a motorized probe head (PH10M/10MQ). Probe systems, probe module and stylus holder changing is supported with the ACR3 and FCR25 rack changing systems.





### SP80 Extended-Length High-Accuracy Scanning

The SP80 scanning measuring head is specially designed for extended length stylus with high-accuracy measurement for lengths up to 500mm (measured in the vertical and horizontal directions). The multifunctional head for CNC CMM' allows not only scanning measurements but also high-precision point measurements and self-centering measurements. Stylus holder changing is supported with the SCP80.




*See page L-28 for stylus information.*



Mitutoyo

# Non-Contact CMM Probe Options

## SurfaceMeasure 606/610/1010/606T/201FS



## FEATURES

Mitutoyo's line of laser scanning probes automatically adjusts to workpiece surface characteristics to deliver highly efficient measurements. With a conventional laser probe, laser intensity and camera sensitivity must be adjusted according to the environment and workpiece material. In contrast, the SurfaceMeasure line laser probes, which automatically adjust for these factors, enable hassle-free and more reliable laser scanning results.

The SurfaceMeasure makes it possible to use coordinate measuring machines as production systems that can be used throughout the entire process, from development and prototyping to production.

### Development phase

Optimized design utilizing measurement point cloud data significantly improves the efficiency of the development process, even when no master model or CAD data is available.



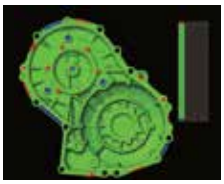




### Prototyping phase

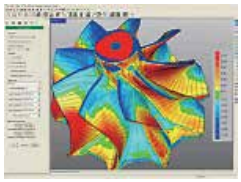
Shortens the entire process from prototyping to mass production because simulations can be used to compare prototypes with CAD data, check for part interference and set clearances, and optimize machine settings.

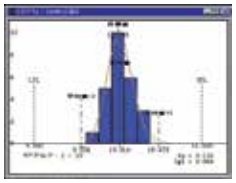




### Production phase

Allows the obtained data to be used for correcting dies, for example, by controlling the variability in mass-produced products, and feeding analysis data back to the preceding process step.



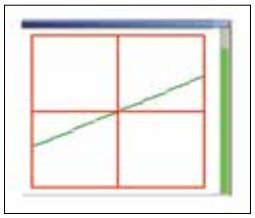




With a conventional laser probe, laser intensity and camera sensitivity must be adjusted according to the environment and the workpiece material. In contrast, the **SurfaceMeasure Series**, which automatically adjusts for these factors, enables simpler and more comfortable laser scanning.

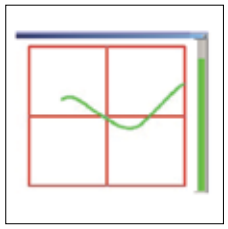


Measuring a color sample plate

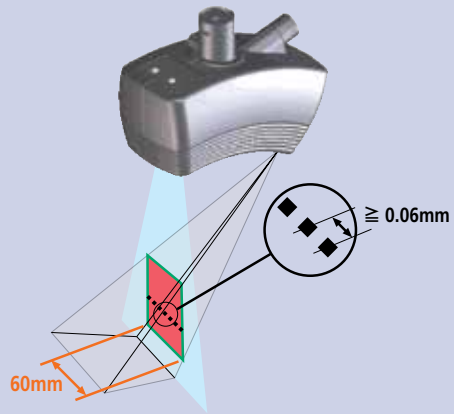


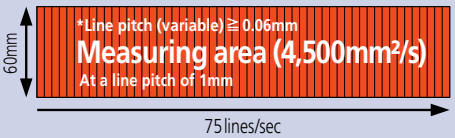


Measuring a glossy object

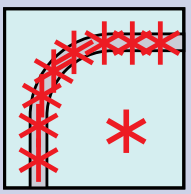


Because the laser intensity and camera sensitivity are automatically adjusted, stable shape data can be obtained even when the workpiece has multiple colors and varying degrees of reflectance.

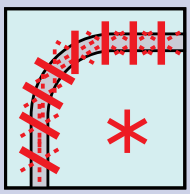



Improvement in measurement efficiency by reducing the frequency of probe attitude change.

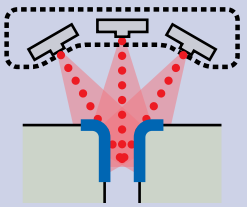


No change of probe attitude



Individual beam selectable

Simultaneous measurement of top and side by concurrently scanning 3-directional laser beams



The laser beams converge from 3 directions toward a central point.

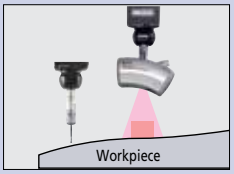
The line-laser crossing enables simultaneous scanning by 3 laser beams, thus allowing efficient measurement of complicated shapes.
(Applies to **SurfaceMeasure 606T**)

# Non-Contact CMM Probe Options

## SurfaceMeasure 606/610/1010/606T/201FS

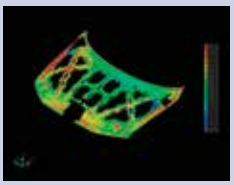



### Features of Non-contact CMM



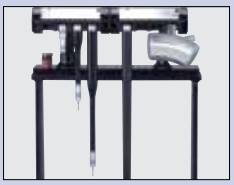

**Reliability**

- Based on a CMM that supports quality assurance operations.
- Allows the verification of non-contact measurement data with a contact probe.



**Hybrid measurement**

- Visualizes a shape that was previously invisible by establishing a cutting plane from measured points.
- Allows interchange between contact and non-contact probes according to the required measuring accuracy or workpiece shape.



**Fully automatic measurement**

- Automatic probe change with a probe changing rack.
- Allows programming a series of jobs from measurement to report creation.

### Ultra-high speed data collection

- SurfaceMeasure is a laser probe that collects coordinate values of the surface of the workpiece by moving and irradiating laser light over the workpiece.

* When using SurfaceMeasure 606/610/1010

### Advantages of non-contact type

- Non-contact measurement enables measurement of materials that can be easily-deformed by contact measurement, including resin or thin, elastic parts.

### Powder-less measurement

- Automatic configuration of the camera sensitivity and the laser intensity settings according to the environment and materials enable establishing a simple and comfortable laser-scanning environment since measurement is now powder and spray free.

### Evaluation cases

- The collected point cloud data can be used by various optional software in a wide range of applications, such as editing, plane creation, comparison using CAD data and more.

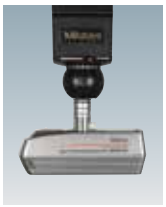




606/610/1010



606T



201FS

## SPECIFICATIONS

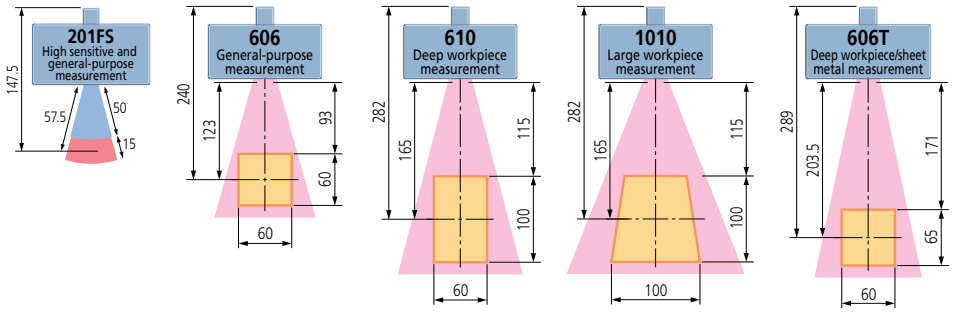
| Item/Model | | SurfaceMeasure 606 | SurfaceMeasure 610 | SurfaceMeasure 1010 | SurfaceMeasure 606T | SurfaceMeasure 201FS |
|---|---|---|---|---|---|---|
| Laser irradiation method | | Line Laser (single) | | | Line Laser (cross) | Flying spot |
| Max. scan width | | 2.36" (60mm) | 2.36" (60mm) | 3.94" (100mm) | .2"×2.56"(3×65mm) | Max. 23mm |
| Max. scan depth | | 2.36" (60mm) | 3.94" (100mm) | 3.94" (100mm) | 2.56" (65mm) | 15mm |
| Working distance | | 3.54" (93mm) | 4.53" (115mm) | 4.53" (115mm) | 6.85" (174mm) | 57.5mm |
| Scanning error * | | 12μm | 15μm | 18μm | 17μm | 1.8μm |
| Max. Acquisition rate | | 75,000 points/sec | | | 3×25,000 points/sec | 25,000 points/sec. |
| Mass | | 0.95 lbs (430g) | 0.88 lbs (400g) | 0.88 lbs (400g) | 1.06 lbs (480g) | 500g |
| Laser Class | EN/IEC | Class2 [ EN/IEC 60825-1(2007) ] | | | | |
| | JIS | Class2 [ JIS C 6802 : 2011 ] | | | | |
| | Laser type | Red semiconductor | | | | Semiconductor |
| Line Laser | Wavelength | 660nm | | | | 670nm |
| | Output | 4mW | | | | 1 mW |
| Point Laser | Wavelength | 635nm | | | — | — |
| | Output | 1mW | | | — | — |

*1: Made-to-order models

*2: According to Mitutoyo's acceptance procedure. (1σ/sphere measurement, probe alone)

| | | |
|---|---|---|
| * | Accuracy inspection environment | Temperature: 20℃±1℃ / Humidity: 50%±10% |
| | Target workpiece | Specified master ball for inspection (Diameter 30mm) |
| | Inspection method | According to Mitutoyo's acceptance procedure. (1σ/sphere measurement, probe alone) |

## MEASURING RANGE






Mitutoyo

# MSURF

## Software for SurfaceMeasure Probe for CNC CMMs

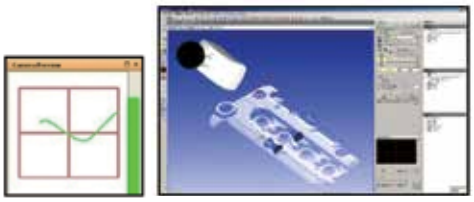
MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
CMM

### Laser Scanning: MSURF-S

#### A scanning path can be created by defining a scanning start point, a scanning length and a scanning width.

- Specify the 3 points using the joystick while watching the camera view.
- When a point group or master data exists on the screen, 3 points can be defined by selecting the data using the mouse. Automation of measuring paths from start to finish reduces measuring time.
- Operating of a joystick and buttons enables configuration and execution of a scanning path, and registration to or deletion from a macro. The ability to measure without using a PC has significantly improved operational efficiency, particularly for large-sized CMMs.





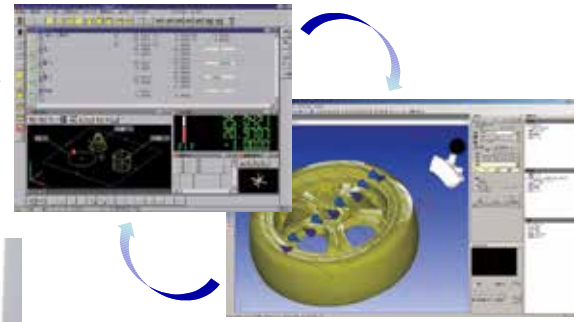
#### Scanning paths can be registered as a measurement macro.

- The measurement conditions of a measurement macro can be partly or wholly changed by the override function.
- The sub-macro function is effective for measuring multiple identical workpieces.
- A trial calculation of measurement macro execution time is based on the measurement conditions and the specifications of the CMM.



#### MSURF-S can be started from MCOSMOS.

- A work coordinate system created with MCOSMOS can be used with MSURF-S. Therefore, fully automatic measurement combined with contact measurement/ non-contact measurement can be performed.





Note: If not using ACR3, probe replacement is performed manually.

MSURF software enables users to perform operations from measurement to evaluation on the same platform when the non-contact line laser probe, SurfaceMeasure, is used. Three types of software are provided according to the task:

**MSURF-S:** Calculates point cloud data measured by CNC CMM with SurfaceMeasure. Generates scanning paths by defining the scanning start position, length and width.

**MSURF-I:** Conducts analysis or comparison verification of measured point cloud data in reference to nominal data (supporting CAD data import).

**MSURF-G:** Primarily creates part programs (measurement procedure programs) using CAD data.

MiCAT
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the standard in world metrology software
cmm

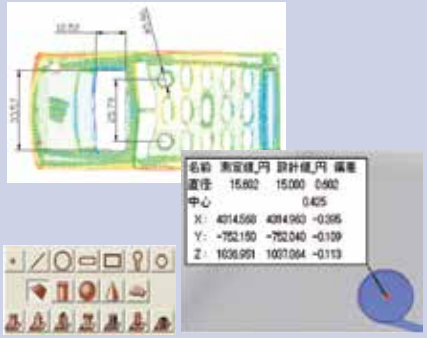
## Inspection: MSURF-I

### CAD data import

- SAT and STEP format are supported as standard.
- As an option, CATIA V4, CATIA V5, Creo, Unigraphics/NX, IGES, VDAFS, Parasolid, and Solidworks are available.

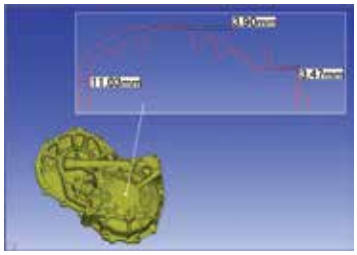
### Comparison by features

- MSURF-I can detect various features from point cloud or mesh data and compare with nominal data. It also can calculate distances between features that have point data such as circle elements.
- Detectable features include basic plane, point, straight line, circle, slot, cylinder, cone, sphere, etc., and also weld bolt, weld nut, cylindrical pin, T-shaped stud and more.

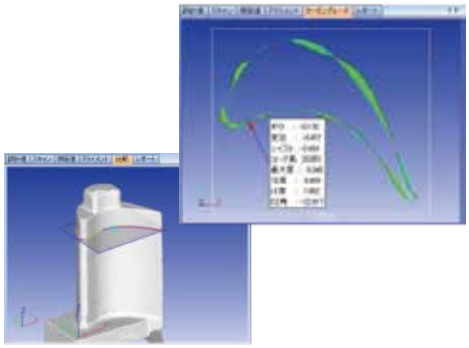


### Comparison of cross-sectional shape

- Cut of a point cloud, mesh data or master data allows for comparison of cross-sectional shapes and calculation of angle, distance, radius of curvature and more.
- The turbine blade analysis function enables calculation of LE thickness, TE thickness, maximum thickness, cord length, etc.



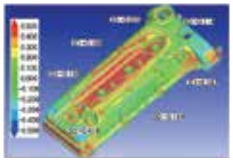
Section evaluation (dimensional calculation)



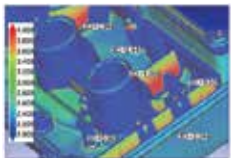
Turbine blade analysis (optional function)

### Comparison of plane shape

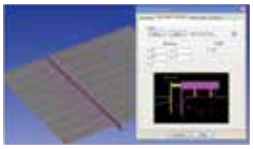
- The plane shape error will be displayed on a color map by comparing a point cloud or mesh data with CAD data.
- Thickness can be displayed on a color map, therefore, it is not necessary to cut a real workpiece.
- Capability of defining the shape of digital calipers enables evaluation of various types of uneven gaps.
- The evaluation of surface curvature can be used for evaluating an angle R within a specified dimensional tolerance.



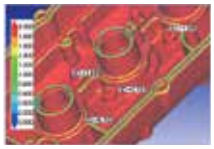
Error color map



Thickness color map



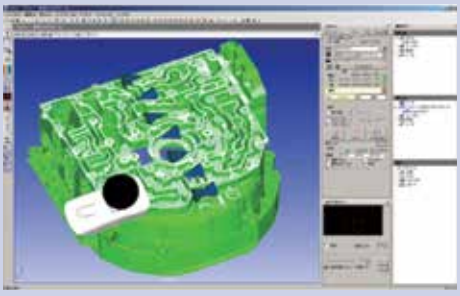
Evaluation of step/clearance

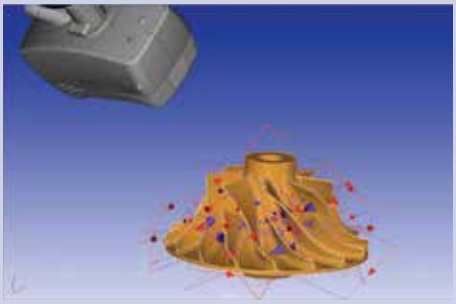


Surface curvature evaluation

### Creation of operating procedure macro by automation function

- The automation function allows users to record the operating procedure including execution of a measurement macro.
- A series of operations from measurement to evaluation and report can be automated.





### Off-line teaching: MSURF-G

MSURF-G allows users to create measurement macros using model data. Therefore, users can start measurement immediately when a real workpiece is available.
MSURF-G can improve the operating rate of your measuring instrument. Combining it with MSURF-I can reduce the man-hours from measurement to product evaluation.

- CMM time for creating measurement macros can be reduced.
- Measurement macros are created regardless of operator's skill level.
- The workflow from measurement to evaluation can be optimized.

### MSURF-PLANNER

MSURF-PLANNER software automatically creates measurement macros (surface form, feature form) for the line laser probe from 3D CAD data.
Optimized data (travel path, number of probe head revolutions, etc.) of a measurement path contributes to improvements in productivity.

*MSURF-PLANNER is optional software for MSURF-S and MSURF-G.

# Non-Contact CMM Probe Options

## QVP Quick Vision Probe

### Provides image measuring capability for coordinate measuring machines.

The QVP probe performs form measurement by image processing micro geometry that cannot be measured by a contact-type probe or flexible bodies that are easily deformed by slight measuring forces. Although the method of microscopic measurement with the centering microscope mounted on the coordinate measuring machine has been used since CMMs came into use in the industry, they have an inherent disadvantage in that the operation of identifying positions is dependent on the operator, possibly resulting in measurement errors. Even with a CNC CMM, manual measurement may still need to be performed, such as with an installed centering microscope. The QVP probe is a vision probe for CMMs and was developed based on Mitutoyo's state-of-the-art technology in order to enable full automation of image measurement with a CNC CMM. This technology was originally developed for Mitutoyo vision measuring machines.



### Automatic detection of workpiece edge

The QVP-captured image will have various automatic edge detections performed by the dedicated software, Visionpak, and then various calculation processes (calculation of dimensions and geometrical deviations) will be performed with the general purpose measurement program, Geopak.



### Standard provision of white LED illumination

Since the QVP is equipped with the standard co-axial light running through the lens system, as well as white-light LED ring illumination, which is bright and has a long service life, no auxiliary illumination is required. The light volume can be set to between 0 and 100% in 1% increments.

### Mounting on the automatic probe changer

The QVP also can be mounted on an automatic probe changer (ACR3), allowing full-automatic measurement including both the contact and non-contact types in combination with the contact-type probes. QVP requires PH10M, PH10MQ or PH6M probe head.

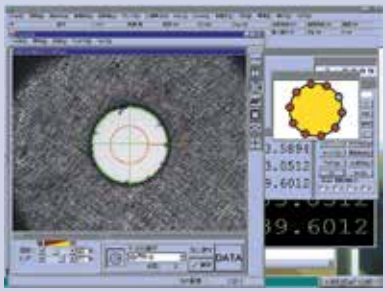


## QVP Specifications

| | | | | | | |
|---|---|---|---|---|---|---|
| **QVP Main Unit** | CCD Size | | 1/3 inch (B/W) | | | |
| | Optical tube magnification | | 0.375× | | | |
| | Illuminating function | Co-axial | White light LED source (built-in): Power dissipation 5W or less | | | |
| | | Ring | White light LED source: Power dissipation 10W or less | | | |
| | Mass | | Automatic-joint type: 315g, shank type: 390g | | | |
| | Optical magnification | | 0.375× | 1.125× | 1.875× | 3.75× |
| | Observation range (mm) | | 9.6×12.8 | 3.2×4.3 | 1.9×2.6 | 1×1.3 |
| | Working distance (mm) | | 61 | 72.3 | 61 | 51 |
| **Objective** | Magnification | | ML1× | ML3× | ML5× | ML10× |
| | | | Optional | Standard | Optional | Optional |
| | Numerical Aperture N.A. | | 0.03 | 0.09 | 0.13 | 0.21 |
| | Depth of focus (μm) | | 306 | 34 | 16.3 | 6.2 |
| | Mass | | 80g | 55g | 60g | 95g |
| **QVP I/F BOX** | Supply voltage | | AC100 to 240V | | | |
| | Frequency | | 50/60Hz | | | |
| | Power capacity | | 45W | | | |
| | Mass | | 3800g | | | |

Objective ML1X **375-036**
Objective ML5X **375-034**
Objective ML10X **375-035**





### VISIONPAK
### Dedicated data processing software

VISIONPAK operates using the Microsoft Windows operating system and is a general purpose measurement program for coordinate measuring machines. It displays the image window when it detects a workpiece edge. After detecting an edge, it undertakes various calculations with regular general purpose measurement programs.

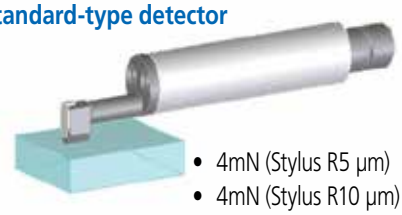
### Variety of image processing functions

With the powerful image processing functions (tools), it can detect various forms of edges at high speed. It can measure in the height direction by means of its auto-focus function, and save the captured image as the image data (bitmap format).

### Outlier removal function

In ordinary micro-form measurement it is often difficult to remove burrs and dusts from the objective workpiece, resulting in an inevitable measurement error. In contrast, VISIONPAK can recognize, for example, the obstruction as an outlier and bypass it during measurement.

### Standard-type detector



- 4mN (Stylus R5 µm)
- 4mN (Stylus R10 µm)

### Small hole detector



- 4mN (Stylus R5 µm)

### Extra-small hole detector



- 4mN (Stylus R5 µm)

### Deep groove detector



- 4mN (Stylus R5 µm)

### Gear-tooth surface detector



- 4mN (Stylus R5 µm)





Note: For new purchase of Crysta-AS700 and larger, retrofit of existing Crysta-AS CMM by request.

# CMM Surface Roughness Measuring

## CMM Surftest Probe

### CNC CMMs can be used to measure surface roughness, eliminating workpiece changeover to a second measurement device.




Mitutoyo has developed a range of surface roughness analysis products from handheld portable units to CNC-type Surftest with broader functions and higher accuracy. By utilizing the technologies developed over the years on surface roughness measuring machines, our coordinate measuring machines can execute surface roughness analysis by implementing a Surftest Probe and the dedicated software. The Surftest probe requires PH10M or PH10MQ probe head.

## FEATURES

- Can be attached to our CNC CMM. (Retro-fitting is possible depending on the model.)
- The auto joint-probe system allows probe changing automatically between scanning (SP25M) and the CMM Surftest surface analysis probe. The measurement and evaluation of size, shape and roughness, is completely automated with auto joint-probe changing.*
- PH10M(Q) allows surface roughness measurement for features requiring rotation.
- The CMM Surftest Probe is derived from the successful Mitutoyo SJ-210/310 Series of portable surface finish units.

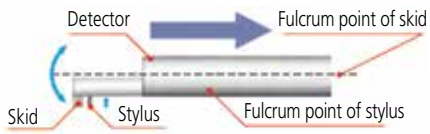
* Requires ACR3 change rack (OPTION)

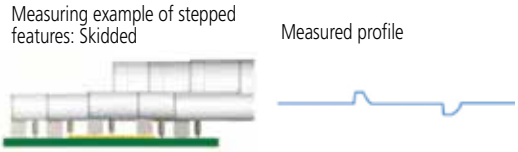
## Skid Measurement Specifications

| Item | | Specifications |
|---|---|---|
| **Probe (Detector specifications)** | Measurement range | AUTO,25,100,360 µm |
| | Driving range | 17.5 mm |
| | Measurement speed | 0.25, 0.5, 0.75 mm/s |
| | Stylus tip radius | 2,5,10*µm *Standard-type detector only |
| | Measuring force | 4mN (Std) , 0.75mN (Opt.) |
| **Evaluation software** | Analysis software | SURFPAK-SP |
| | Control software | MCOSMOS |
| | Miscellaneous | Multi-wire autojoint probe head required (PH6M, PH10M, PH10MQ) |

## Skidded Measurement

In skidded measurements, surface features are measured with reference to a skid following close behind the stylus. This cannot measure waviness and stepped features exactly, but the range of movement within which measurement can be made is greater because the skid tracks the workpiece surface contour.






Mitutoyo

# CMM Probing Accessories

## Mitutoyo Styli Kits

### M2



STARTER - K651376



BASIC 1 - K651377



BASIC 2 - K651354



EXPANSION - K651378



PROFESSIONAL - K651379

### M3



STARTER - K651380



BASIC 1 - K651381



Carbon Fiber 1 - K651318



Carbon Fiber 2 - K651319



Carbon Fiber 3 - K651320

## Materials used for spherical probes



**Ruby**

As the hardest of all probe element materials, ruby is the perfect all-round material. Spherical probes made of ruby have been used for most standard applications. The low specific density of ruby enables the mass of the stylus tip to be kept as small as possible. This effectively allows the elimination of false triggers caused by mass inertia when the CMM moves.



**Zirconium oxide**

Because of the specific surface properties of balls made of zirconium oxide - a ceramic compound – it is ideally suited for aggressive scanning of abrasive surfaces, such as workpieces made of cast iron. Zirconium oxide has virtually the same hardness and wear-resistant properties as ruby.



**Silicon nitride**

Silicon nitride is extremely hard and wear-resistant with the lowest surface roughness of all ball materials. Specific advantage: Silicon nitride is resistant to absorbing aluminum from workpiece surfaces.

Locating Pins 1 - K551123



Locating Pins 2 - K551124



Clamping Elements 1 - K551125



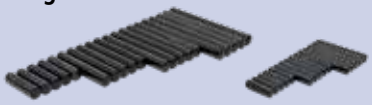
Supporting Elements 1 - K551126



Supporting Elements 2 - K551127



Straight Pins - K551128



Receiver Brackets 1 - K551129



Receiver Brackets 2 - K551130



Magnet 1 - K551131



Joints 1 - K551132



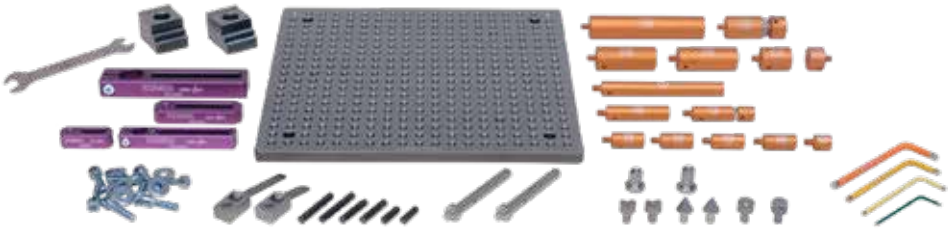
# CMM Accessories

## Mitutoyo ECO-FIX Kit Fixture Systems

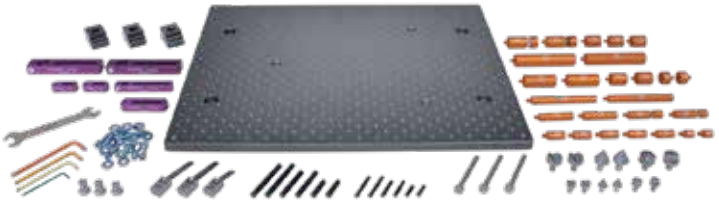
The Mitutoyo Eco-Fix Clamping System for modular CMM and vision product workholding setups work well for different part sizes/types and environments. The design combines operational modularity advances with lower-cost solutions. This can be found both in the reduction or elimination of hard fixturing costs and setup time. This system is comprised of well-marked, color-coded components designed to simplify part measurement requirements. Magnetic or threaded fastening points deliver fast, plug-and-play connectivity. First-time fixturing jobs can be established and reconfigured in a matter of minutes for quick turnaround for future part measurement. Or, as needed, fixtures can be built and stored to meet all common part measurement requirements. Base plates are hard-coated and other components are machined for durability.

The entry-level Mitutoyo Eco-Fix Kit S version is comprised of a 250mm x 250mm base plate footprint and 59 total components in the system. The Eco-Fix Kit L is a larger version and built for more complex part fixturing applications (measuring 500mm x 400mm in base plate footprint and a total of 98 total components in the system).

**Eco-Fix Kit - S K551048**



**Eco-Fix Kit L - K551049**



**Eco-Fix MAG S - K551089**



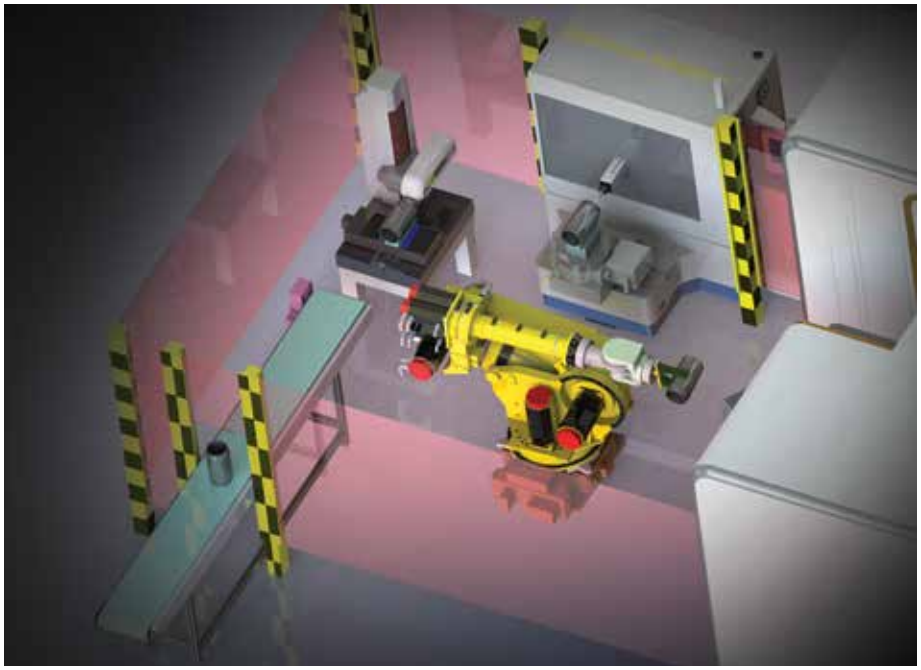
**Eco-Fix MAG L - K551090**





Mitutoyo

# MITUTOYO CUSTOM SOLUTIONS







Mitutoyo Custom Solutions helps businesses in a wide range of industries achieve higher quality products, parts and machines with custom precision measurement tools and equipment.

Mitutoyo's highly skilled engineers specialize in designing and building custom measurement systems, applications and software to bring value-added solutions to resolve nearly every measurement need for customers with unique applications.

## Custom Solutions & Services Include:

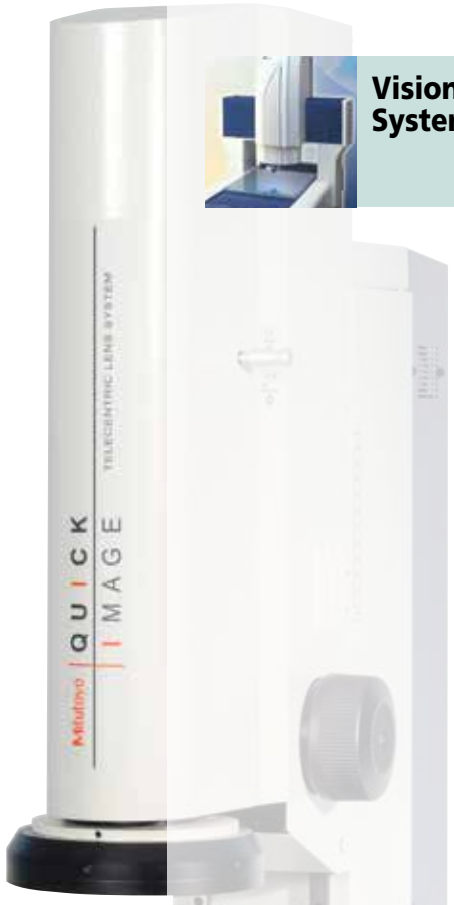
- Inline/near line part inspection and gaging
- Factory automation
- Data management
- Fixture design/build
- 3D CAD concepts/renderings
- Turnkey capital projects
- Product implementation
- Custom styli/accessories
- "Green button" technology

If you have any questions or would like more information regarding Mitutoyo Custom Solutions, contact: **solutions@mitutoyo.com**.

# Vision Measuring Systems

## INDEX


| Vision Measuring Systems | |
|---|---|
| Quick Scope Series 359 — Manual Vision Measuring System | M-2 |
| Quick Image Series 361 — Non-contact 2D Vision Measuring System | M-3 |
| QV Active Compact CNC Vision Measuring Systems | M-4 |
| QV Apex Series 363 — CNC Vision Measuring System | M-5 |
| QV Stream Plus Series 363 — CNC Vision Measuring System | M-6 |
| QV Hyper Series 363 — High-Accuracy CNC Vision Measuring System | M-7 |
| QV Hybrid Type 1, Type 4 Series 365 — CNC Vision Measuring System with a Non-contact Displacement Sensor | M-8 |
| QV- WLI Series 363 — CNC Video Measuring System with White Light Interferometry | M-9 |
| ULTRA QV Series 363 — Ultra-High Accuracy CNC Vision Measuring System | M-10 |
| UMAP Vision System TYPE2 Series 364 — Micro-Form Measuring System | M-11 |
| QV ACCEL Series 363 — Large-Format CNC Vision Measuring System | M-12 |
| Quick Vision with Touch-Trigger Probe | M-13 |
| Accessories for Quick Vision | M-14 |
| OPTI-FIX Kits — Modular Clamping System for Vision Measuring Systems | M-15-17 |
| Quick Guide to Precision Measuring Instruments | M-18,19 |





QV H4 606




QV WLI



QV Active 202



Mitutoyo

# Quick Scope

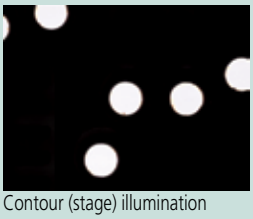
## SERIES 359 — Manual Vision Measuring System

### FEATURES

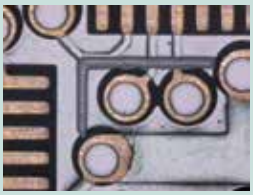
- Surface, contour and fiber-optic ring light illumination options enable users to configure the QS lighting to meet a variety of measurement needs.
- Powerful, Windows®-based QSPAK software offers a spectrum of measuring and analysis capabilities.
- Functions include auto-focus, measurement playback, one-click edge detection, graphic display, 48 different macros and a pattern matching function for several common part features.
- Excellent surface observation model for a variety of workpieces.
- 0.1µm resolution and 150mm Z-axis range.
- Power zoom enables quick magnification changes.
- Fine illumination capability enables lighting changes to match workpiece requirements.
- The quick release system on the stage enables instant switching between coarse and fine movements.
- Quick Navigation function enables the user to repeat measurements quickly.



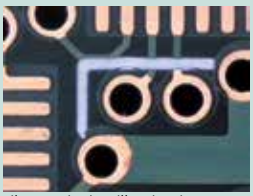
### Illumination



Contour (stage) illumination



Surface (coaxial) illumination



Fiber-optic ring illumination

During automatic measurement the part program provides automatic control over the illumination system, thus providing the necessary balance between user-friendliness and high efficiency.

### SPECIFICATIONS

| Model No. | QS-L2010ZB | QS-L3017ZB | QS-L4020ZB |
|---|---|---|---|
| Range (X-axis / Y-axis / Z-axis) | 8" x 4" x 6" / 200 x 100 x 150mm | 12" x 6.7" x 6" / 300 x 170 x 150mm | 15.7" x 8" X 6" / 400 x 200 x 150mm |
| Resolution | 0.1µm | | |
| Scale type | Linear encoder | | |
| Measuring accuracy (at 20°C and 3.0x magnification) | XY: (2.5+20L/1000)µm<br>Z: (5+40L/1000)µm | | |
| Image detecting unit | 1/2" 3 MP Color CMOS camera | | |
| Illumination (Halogen) | Co-axial light, fiber-optic ring light, stage light | | |
| Stage glass size | 9.84 x 5.91"(250 x 150 mm) | 14.57 x 9.45"(370 x 240 mm) | 17.32 x 9.45"(440 x 240 mm) |
| Max. workpiece height | 6" / 150mm | | |
| Max. stage loading | 22 lbs / 10 kg | 44 lbs / 20 kg | 33 lbs / 15 kg |
| Dimensions (W x D x H) | 25" x 30" x 28" / 624 x 769 x 722 mm | 27" x 33" x 36" / 682 x 837 x 916 mm | 30" x 33" x 37" / 757 x 837 x 930 mm |
| Mass (main unit) | 158.7 lbs / 72 kg | 308.6 lbs /140 kg | 321.9 lbs / 146 kg |

### System diagram

**Software options**

- Measurement support software: **QS-CAD I/F**
- Shape evaluation and analysis software: **FORMPAK-QV**
- Statistical process control software: **MeasurLink**

**QS-LZB**

**PC Set**
Standard software
**QSPAK**

**Peripheral options**

- Foot switch - standard type (**937179T**)
- Calibration chart (**02AKN020**)

**Stage accessory options**

- Rotary table
  - ·Rotary table with fine-feed knob (A) (**176-305**) For 2010 size stages
  - ·Rotary table with fine-feed knob (B) (**176-306**) For 3017 or 4020 size stages
- Swivel center support (**172-197**)
- Holder with clamp (**176-107**)
- V-block with clamp (**172-378**)

*1 Adapter B (**176-310**) is required for 2010 models.
Adapter (**176-304**) is required for 3017 and 4020 models.
*2 Can be installed on rotary table with fine-feed knob (A).
Cannot be installed on rotary table with fine-feed knob (B).

### Control Box



For **QS-LZB**

### Optical system magnification ratios available for QS-LZB

| Total magnification<br>Field of View (mm) | 29X<br>8.8x6.6 | 38X<br>6.8x5.1 | 49X<br>5.2x3.9 | 58X<br>4.4x3.3 | 87X<br>2.9x2.2 | 116X<br>2.2x1.6 | 145X<br>1.7x1.3 | 202X<br>1.2x0.9 |
|---|---|---|---|---|---|---|---|---|
| **QS-LZB**<br>Working distance (mm) | 0.75X | 0.98X | 1.28X | 1.5X<br>55 | 2.25X | 3X | 3.75X | 5.25X |

* Total magnification shown in the above table is a reference value displayed in the default window state when using 22-inch LCD.

# Quick Image

## SERIES 361 — Non-contact 2-D Vision Measuring System

### Double-telecentric optics enable efficient measurement with a wide field of view

Batch measurement with a wide field of view 1.259" x 0.945"(32 x 24mm) realized using a 0.2X magnification model can substantially improve measurement efficiency.
With a 0.5X magnification model, dimensions of very small workpieces and stepped workpieces easily can be measured.





Actual image acquired with a 0.2X magnification model

Quick Image is a new concept in 2-D vision measuring instruments. It provides unique features for improving measurement efficiency.

### FEATURES

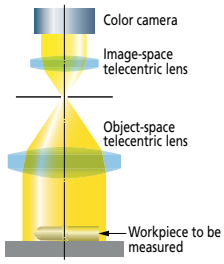
- Long focal depth and wide field of view
- Telecentric optical system
- 3 mega-pixel color CCD camera
- Large quadrant LED ring light
- Single-click measurement execution
- Displays measurement results on video window
- Orientation of part is automatically detected



QI-A2010D



QI-C2010D




### SPECIFICATIONS

| | | Manual stage model | | | | | Motorized stage model | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.2X | Model | QI-A1010D | QI-A2010D | QI-A2017D | QI-A3017D | QI-A4020D | QI-C2010D | QI-C2017D | QI-C3017D |
| 0.5X | Model | QI-B1010D | QI-B2010D | QI-B2017D | QI-B3017D | QI-B4020D | | | |
| Measuring range (X×Y) | | 3.94" x 3.94" 100×100mm | 7.87" x 3.94" 200×100mm | 7.87" x 6.69" 200×170mm | 11.8" x 6.69" 300×170mm | 15.7" x 7.87" 400×200mm | 7.87" x 3.94" 200×100mm | 7.87" x 6.69" 200×170mm | 11.8" x 6.69" 300×170mm |
| Effective stage glass size | | 6.69" x 6.69" 170×170mm | 9.53" x 5.51" 242×140mm | 10.2" x 9.06" 260×230mm | 14.2" x 9.06" 360×230mm | 17.3" x 9.13" 440×232mm | 9.53" x 5.51" 242×140mm | 10.2" x 9.06" 260×230mm | 14.2" x 9.06" 360×230mm |
| Maximum stage loading *1 | | Approx. 22 lbs.(10kg) | | Approx. 44 lbs.(20kg) | | Approx. 33 lbs. (15kg) | Approx. 22 lbs. (10kg) | Approx. 44 lbs.(20kg) | |
| Main unit mass | | Approx. 143 lbs. 65kg | Approx. 152 lbs. 69kg | Approx. 330 lbs. 150kg | Approx. 348 lbs. 158kg | Approx. 361 lbs. 164kg | Approx. 158 lbs. 72kg | Approx. 337 lbs. 153kg | Approx. 354 lbs. Approx. 161kg |

*1 Does not include extremely offset or concentrated loads

| | | | QI-A / QI-C | QI-B |
|---|---|---|---|---|
| View field | | | 1.26" x 0.94" (32×24mm) | 0.50" x 0.378" (12.8×9.6mm) |
| Measurement mode | | | High resolution mode / Normal mode *4 | |
| Travel range (Z axis) | | | 3.94"(100mm) | |
| Accuracy | Measurement accuracy within the screen *1 | High resolution mode | ±2μm | ±1.5μm |
| | | Normal mode | ±4μm | ±3μm |
| | Repeatability within the screen (±2σ) *2 | High resolution mode | ±1μm | ±0.7μm |
| | | Normal mode | ±2μm | ±1μm |
| | Measurement accuracy (E1xy) *1 | | ±(3.5+0.02)μm L: arbitrary measuring length (mm) | |
| Monitor magnification *3 | | | 7.6X | 18.9X |
| Optical system | Magnification (Telecentric Optical System) | | 0.2X | 0.5X |
| | Depth of focus | High resolution mode | ±0.6mm | ±0.6mm |
| | | Normal mode | ±11mm | ±1.8mm |
| | Working distance | | 3.54"(90mm) | |
| Camera | | | 3 million pixels, 1/2", full color | |
| Illumination | | | Transmitted light: Green LED telecentric illumination<br>Co-axial light: White LED<br>Ring light: 4-quadrant white LED | |
| Power supply | | | 100-240VAC 50/60Hz | |
| Accuracy guaranteed temperature range | | | 19-21°C | |

*1 Inspected to Mitutoyo standards by focus point position.
*2 The measuring accuracy is guaranteed to be accurate within the depth of focus.
*3 For 1X digital zoom (when using the 22-inch-wide monitor)
*4 Patent registered (Japan)



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# QV Active

## Compact CNC Vision Measuring Systems

### FEATURES

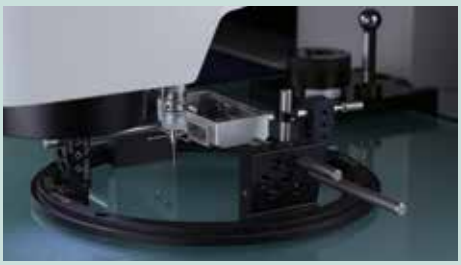
- High-quality zoom optics with interchangeable lenses
- High-resolution and high-speed color camera
- Compact design saves significant space—available in two sizes
- Powerful QVPAK 3D vision software
- Contact and noncontact measurement
- Touch-probe retrofittable
- Programmable LED stage, coaxial and 4-quadrant ring light



**1X, 1.5X and 2X interchangeable lens**

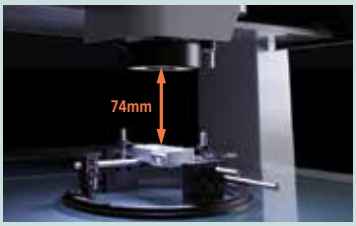


**QV Active 202**



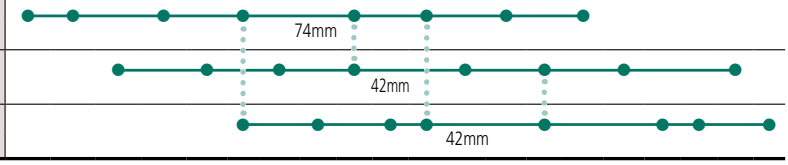
### Touch-Probe System

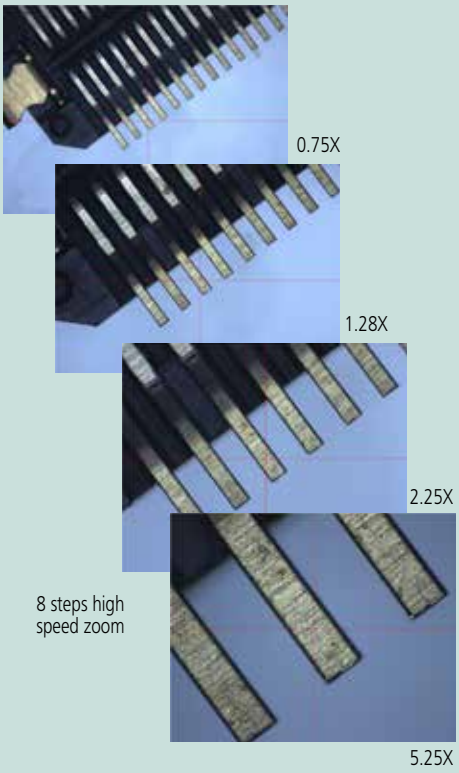
The QV touch-probe system is available on all the models. All touch-probe systems include probes, modules, calibration articles and installed software. (See page M-13)




Long working distance 74mm
*when using Z-objective 1X

| Optical magnification | 0.5X | 0.65X | 0.75X | 0.85X | 0.98X | 1X | 1.28X | 1.3X | 1.5X | 1.7X | 2X | 2.25X | 2.5X | 3X | 3.5X | 3.75X | 4X | 5X | 5.25X | 7X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| View field (mm) Horizontal (H) | 13.60 | 10.46 | 9.07 | 8.00 | 6.94 | 6.80 | 5.31 | 5.23 | 4.53 | 4.00 | 3.40 | 3.02 | 2.72 | 2.27 | 1.94 | 1.81 | 1.70 | 1.36 | 1.30 | 0.97 |
| Vertical (V) | 10.80 | 8.31 | 7.20 | 6.35 | 5.51 | 5.40 | 4.22 | 4.15 | 3.60 | 3.18 | 2.70 | 2.40 | 2.16 | 1.80 | 1.54 | 1.44 | 1.35 | 1.08 | 1.03 | 0.77 |




8 steps high speed zoom

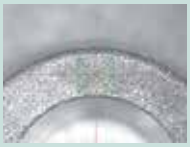
### SPECIFICATIONS

| Name | Quick Vision Active | |
|---|---|---|
| **Model No.** | **QV Active 202 / QV Active 202 TP** | **QV Active 404 / QV Active 404 TP** |
| Range (X,Y,Z-axis) with vision head | 9.84" x 7.87" x 5.91"<br>250 x 200 x 150 mm | 15.75" x 15.75" x 7.87"<br>400 x 400 x 200 mm |
| Resolution | 0.1 µm | |
| Accuracy (µm)* | $E_{1(X,Y)} = (2+3L/1000)$<br>$E_{1(Z)} = (3+5L/1000)$<br>$E_{2(X,Y)} = (2.5+4L/1000)$ | |
| Max. stage loading | 22 lbs. (10 kg) | 44 lbs. (20 kg) |
| Mass | 265 lbs. (120 kg) | 606 lbs. (275 kg) |
| Illumination | (White LED)<br>Contour / Coaxial / 4-quadrant ring light | |
| Magnification change system | Zoom optical system with 8 positions<br>(Standard 1.5X magnification lens) | |
| Sensor type | High-resolution CMOS color camera | |
| Optional objective lenses | 1X and 2X magnification | |
| Factory option | Series 364 (TP) Touch-Probe option (Page M-13) | |

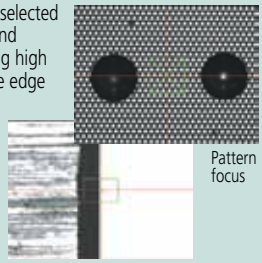
* L is arbitrary length in mm

## Image Multi-AutoFocus

The optimal focus can be selected for each surface texture and measured feature, realizing high reproducibility and reliable edge detection.



Surface focus

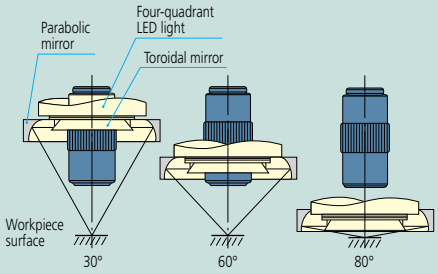


Pattern focus

Edge focus

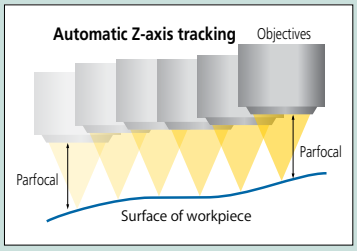
## Programmable Ring Light (PRL)

Fine control of obliquity and direction provides illumination optimal for measurement. Obliquity can be arbitrarily set in the range from 30° to 80°. This type of illumination is effective for enhancing the edge of inclined surfaces or very small steps. Illumination can be controlled independently in every direction, front and back, right and left. Measurement with edge enhancement is possible by forming a shadow with lighting from only one direction.




## Tracking Auto Focus (TAF)

The TAF feature focuses continuously, adjusting to changes in the height of the object being measured. Automatic tracking of surface waves and warpage (in the Z axis height direction) improves measurement throughput. The feature also eliminates the hassle of focusing during manual measurement.




**Tracking Auto Focus (TAF)**

| AF principle | Objective coaxial autofocusing (knife-edge method) | | | | |
|---|---|---|---|---|---|
| Suitable objectives | QV-HR1x | QV-SL1x | QV-HR2.5x | QV-SL2.5x | QV-5x |
| Tracking range*2 | 6.3mm (±3.15mm) | 6.3mm (±3.15mm) | 1mm (±0.5 mm) | 1mm (±0.5 mm) | 0.25mm (±0.125mm) |
| Spot diameter*3 | 5.2µm | 8.0µm | 2.1µm | 3.1µm | 1.5µm |
| Laser source | Semiconductor laser (peak wavelength: 690nm) | | | | |
| Laser power | 0.9mW | | | | |
| Laser safety | Class 2 (JIS C6802:2011, EN/IEC 60825-1:2007) | | | | |

*2 Varies according to workpiece surface texture and reflectance.
*3 These are design values.

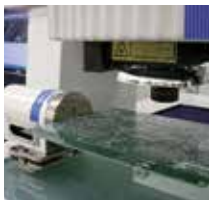
**Optional Accessories: Refer to page M-14.**

# QV Apex

## SERIES 363 — CNC Vision Measuring System



QV Apex 302 PRO



**Optional Index Table***

Automatic multi-plane measurement is possible with the optional index table. Refer to page M-14 for more details.
*Not available with QV ACCEL models



QV Apex 606 PRO

## SPECIFICATIONS

| Name | | Quick Vision Apex | | |
|---|---|---|---|---|
| Model No. | | QV Apex 302 PRO | QV Apex 404 PRO | QV Apex 606 PRO |
| | | QV Apex 302 (ISO10360-7) | QV Apex 404 (ISO10360-7) | QV Apex 606 (ISO10360-7) |
| | | QV Apex 302 (w/TAF) | QV Apex 404 (w/TAF) | QV Apex 606 (w/TAF) |
| Measuring Range | X-axis | 11.81" / 300mm | 15.75" / 400mm | 23.62" / 600mm |
| | Y-Axis | 7.87" / 200mm | 15.75" / 400mm | 25.59" / 650mm |
| | Z-Axis | 7.87" / 200mm | 9.84" / 250mm | 9.84" / 250mm |
| Resolution / Scale Unit | | 0.1µm / Reflective-type Linear Encoder | | |
| Resolution Z Scale Using Tracking Autofocus (TAF) | | 0.3 µm | | |
| Laser Auto Focus repeatability σ ≤ | | 0.8 µm | | |
| CCD camera | | B & W | | |
| Illumination Unit (LED) | Surface | White LED | | |
| | Contour | White LED | | |
| | Programmable Ring Light | White LED | | |
| Max. Drive Speed | X/Y Axis | 300 mm/s | 400 mm/s | |
| | Z-Axis | 300 mm/s | 300 mm/s | |
| Measuring Accuracy* | $E_{1X}$,$E_{1Y}$ | (1.5+3L/1000)µm | | |
| | $E_{1Z}$ | (1.5+4L/1000)µm | | |
| | $E_{2XY}$ | (2+4L/1000)µm | | |
| | $E_{U,MPE}$ (ISO10360-7:2011) | 3+5.5L/1000, 3+6L/1000** | | |
| | $P_{F2D,MPE}$ (ISO10360-7:2011) | 2.3µm | | |
| Magnification Change System | | Programmable Power Turret (1x, 2x, 6x) | | |
| Stage Glass Size | | 15.71" x 10.67" (399 x 271mm) | 19.41" x 21.69" (493 x 551mm) | 27.44" x 29.84" (697 x 758mm) |
| Maximum Stage Loading | | 44 lbs. (20kg) | 88 lbs. (40kg) | 110 lbs. (50kg) |
| Dimensions of Main Unit | | 37.44" x 33.82" x 41.06" ( 951 x 859 x 1043mm) | 55.39" x 40.43" x 54.37" ( 1407 x 1027 x 1381mm) | 78.15" x 51.54" x 61.81" ( 1985 x 1309 x 1570mm) |
| Mass of Main Unit (Including Machine Stand) | | 794 lbs. (360kg) | 1276 lbs. (579kg) | 3197 lbs. (1450kg) |

*The measuring accuracy defined under the following conditions:
Programmable Power Turret: 2x Position; Objective Lens: 2.5x (HR or SL); L=Dimension between two arbitrary points (mm)
**Accuracy 3.5+5.5L/1000 for 20 ± 2°C, Accuracy 3+6L/1000 from 18 to 23°C



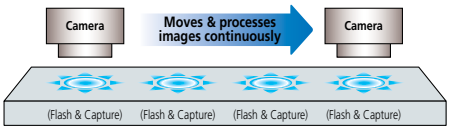
Mitutoyo

# QV Stream Plus

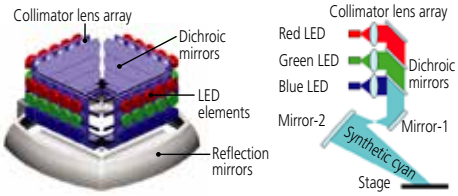
## SERIES 363 — CNC Vision Measuring System



QV Stream Plus 606 PRO




**High-density mounting of ultra-high intensity LED elements**




## SPECIFICATIONS

| Name | | Quick Vision Stream Plus | | |
|---|---|---|---|---|
| Model No. | | QV Stream Plus 302 PRO | QV Stream Plus 404 PRO | QV Stream Plus 606 PRO |
| | | QV Stream Plus 302 (w/TAF) | QV Stream Plus 404 (w/TAF) | QV Stream Plus 606 (w/TAF) |
| Measuring Range | X-axis | 11.81" / 300mm | 15.75" / 400mm | 23.62" / 600mm |
| | Y-Axis | 7.87" / 200mm | 15.75" / 400mm | 25.59" / 650mm |
| | Z-Axis | 7.87" / 200mm | 9.84" / 250mm | 9.84" / 250mm |
| Resolution / Scale Unit | | 0.1µm / Reflective-type Linear Encoder | | |
| Resolution Z Scale Using Tracking Autofocus (TAF) | | 0.3 µm | | |
| Laser Auto Focus repeatability σ ≤ | | 0.8 µm | | |
| CCD camera | | B & W, Progressive Scanning CCD | | |
| Illumination Unit (C: Continuous; S: Stroboscopic; PRL: Programmable Ring Light) | Surface (C) | Red, Green, Blue & White (LED) | | |
| | Surface (S) | Blue (LED) | | |
| | Contour (C) | Blue (LED) | | |
| | Contour (S) | Blue (LED) | | |
| | PRL (C) | Red, Green, Blue & White (LED) | | |
| | PRL (S) | Blue (LED) | | |
| Max. Drive Speed | X/Y/Z Axis | 300 mm/s | | |
| Measuring Accuracy* | $E_{1X}$,$E_{1Y}$ | (1.5+3L/1000)µm | | |
| | $E_{1Z}$ | (1.5+4L/1000)µm | | |
| | $E_{2XY}$ | (2+4L/1000)µm | | |
| Magnification Change System | | Programmable Power Turret (1x, 2x, 6x) | | |
| Stage Glass Size | | 15.71" x 10.67" (399 x 271mm) | 19.41" x 21.69" (493 x 551mm) | 27.44" x 29.84" (697 x 758mm) |
| Maximum Stage Loading | | 44 lbs. (20kg) | 88 lbs. (40kg) | 110 lbs. (50kg) |
| Dimensions of Main Unit | | 37.44" x 33.82" x 41.06" (951 x 859 x 1043mm) | 55.39" x 40.43" x 54.37" (1407 x 1027 x 1381mm) | 78.15" x 51.54" x 61.81" (1985 x 1309 x 1570mm) |
| Mass of Main Unit (Including Machine Stand) | | 794lbs. (360kg) | 1276 lbs. (579kg) | 3197 lbs. (1450kg) |

*The measuring accuracy defined under the following conditions:
Programmable Power Turret: 2x Position; Objective Lens: 2.5x (HR or SL); L=Dimension between two arbitrary points (mm)

## FEATURES



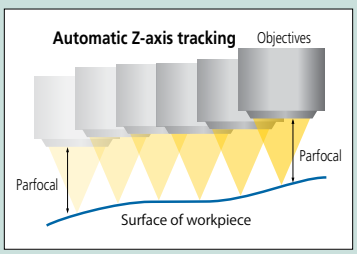
**Non-stop Vision Measurement**
**Extreme Improvement in Throughput***
Conventional vision measuring systems endlessly repeat the cycle of stage displacement, stage stop, measurement, stage start and stage displacement. This mode of operation is a fundamental limitation on improving measurement throughput.
In contrast, the Quick Vision Stream system uses an innovative image capture technique that avoids the need to repeatedly stop the stage, thereby allowing for continuous measurement while still maintaining accuracy.

**Measurement Throughput Comparison between QV STREAM and the Conventional System**
STREAM PLUS series: more than 5 times faster
* Comparison of measurement throughput using a Mitutoyo sample workpiece with that of conventional Mitutoyo systems.

**Newly Developed Stroboscopic Illumination System**
The development of a high-intensity LED flash illuminator makes non-stop vision measurement possible. At the precise moment the stage reaches a measurement point, the illuminator creates an extremely short, high-intensity flash that effectively freezes all motion. The illuminator turns on and off so quickly that no image blur occurs, and the image is captured in full and accurate detail.
This innovative design takes full advantage of high-density, high-intensity LED arrays aided by collimating lenses and dichroic mirrors to produce ultra bright, directional and efficient illumination.

## Tracking Auto Focus (TAF)

The TAF feature continuously focuses, adjusting to changes in the height of the object being measured. Automatic tracking of surface waves and warpage (in the Z axis height direction) improves measurement throughput. The feature also cuts out the hassle of focusing during manual measurement, reducing the work burden for measuring system operators.




**Tracking Auto Focus (TAF)**

| AF principle | Objective coaxial autofocusing (knife-edge method) | | | | |
|---|---|---|---|---|---|
| Suitable objectives | QV-HR1x | QV-SL1x | QV-HR2.5x | QV-SL2.5x | QV-5x |
| Tracking range*2 | 6.3mm (±3.15mm) | 6.3mm (±3.15mm) | 1mm (±0.5 mm) | 1mm (±0.5 mm) | 0.25mm (±0.125mm) |
| Spot diameter*3 | 5.2µm | 8.0µm | 2.1µm | 3.1µm | 1.5µm |
| Laser source | Semiconductor laser (peak wavelength: 690nm) | | | | |
| Laser power | 0.9mW | | | | |
| Laser safety | Class 2 (JIS C6802:2011, EN/IEC 60825-1:2007) | | | | |

*2 Varies according to workpiece surface texture and reflectance.
*3 These are design values.

## Programmable Power Turret (PPT)

The three tube lens selection provides three magnification levels with the same objective lens. Replacement objective lenses allow a wide range of magnifications to support a variety of measurements.



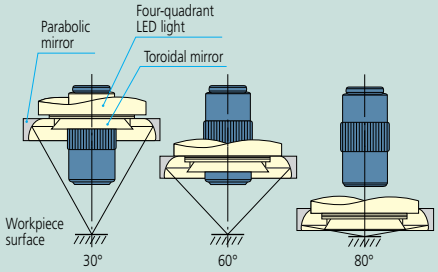
1X tube lens x 2.5X objective
View field: 2.5 x 1.88 mm



2X tube lens x 2.5X objective
View field: 1.25 x 0.94 mm



6X tube lens x 2.5X objective
View field: 0.41 x 0.31 mm




## Programmable Ring Light (PRL)

Fine control of obliquity and direction provides illumination optimal for measurement. Obliquity can be arbitrarily set in the range from 30° to 80°. This type of illumination is effective for enhancing the edge of inclined surfaces or very small steps. Illumination can be controlled independently in every direction, front and back, right and left. Measurement with edge enhancement is possible by forming a shadow by lighting from only one direction.

# QV Hyper

## SERIES 363 — High-accuracy CNC Vision Measuring System



QV Hyper 404 PRO

## SPECIFICATIONS

| Name | | Quick Vision Hyper | | |
|---|---|---|---|---|
| Model No. | | QV Hyper 302 PRO<br>QV Hyper 302 (ISO10360-7)<br>QV Hyper 302 (w/TAF) | QV Hyper 404 PRO<br>QV Hyper 404 (ISO10360-7)<br>QV Hyper 404 (w/TAF) | QV Hyper 606 PRO<br>QV Hyper 606 (ISO10360-7)<br>QV Hyper 606 (w/TAF) |
| Measuring Range | X-axis | 11.81" / 300mm | 15.75" / 400mm | 23.62" / 600mm |
| | Y-Axis | 7.87" / 200mm | 15.75" / 400mm | 25.59" / 650mm |
| | Z-Axis | 7.87" / 200mm | 9.84" / 250mm | 9.84" / 250mm |
| Resolution / Scale Unit | | 0.02µm / Reflective-type Linear Encoder | | |
| Resolution Z Scale using Tracking Autofocus (TAF) | | 0.26 µm | | |
| Laser Auto Focus repeatability σ ≤ | | 0.8 µm | | |
| CCD Camera | | B & W | | |
| Illumination Unit (LED) | Surface | White LED | | |
| | Contour | White LED | | |
| | Programmable Ring Light | White LED | | |
| Max. Drive Speed | X/Y/Z-Axis | 200mm/s | | |
| Measuring Accuracy* | $E_{1X}$,$E_{1Y}$ | (0.8+2L/1000)µm | | |
| | $E_{1Z}$ | (1.5+2L/1000)µm | | |
| | $E_{2XY}$ | (1.4+3L/1000)µm | | |
| | $E_{U,MPE}$ (ISO10360-7:2011) | 2.5+4L/1000, 2.5+4.5L/1000** | | |
| | $P_{F2D,MPE}$ (ISO10360-7:2011) | 1.7µm | | |
| Magnification Change System | | Programmable Power Turret (1x, 2x, 6x) | | |
| Stage Glass Size | | 15.71" x 10.67" (399 x 271mm) | 19.41" x 21.69" (493 x 551mm) | 27.44" x 29.84" (697 x 758mm) |
| Maximum Stage Loading | | 44 lbs. (20kg) | 88 lbs. (40kg) | 110 lbs. (50kg) |
| Dimensions of Main Unit | | 37.44" x 33.82" x 41.06"<br>( 951 x 859 x 1043mm) | 55.39" x 40.43" x 54.37"<br>( 1407 x 1027 x 1381mm) | 78.15" x 51.54" x 61.81"<br>( 1985 x 1309 x 1570mm) |
| Mass of Main Unit (Including Machine Stand) | | 794 lbs. (360kg) | 1276 lbs. (579kg) | 3197 lbs. (1450kg) |

*The measuring accuracy defined under the following conditions:
Programmable Power Turret: 2x Position; Objective Lens: 2.5x (HR or SL); L=Dimension between two arbitrary points (mm)
**Accuracy 2.5+4L/1000 for 20 ± 2°C, Accuracy 2.5+4.5L/1000 from 18 to 23°C



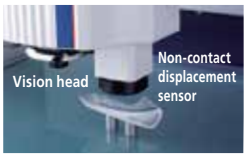
Mitutoyo

# QV Hybrid Type 1, Type 4

## SERIES 365 — CNC Vision Measuring System with Non-contact Displacement Sensor

### FEATURES

The Quick Vision Hybrid is an advanced machine that allows vision measurement with both a CCD camera and high-speed scanning by applying a vision measurement unit in parallel with a non-contact displacement sensor.



Type 4 Displacement Sensor


QVH4 606

### FEATURES: Hybrid Type 1

- The focusing point method minimizes the difference in the measuring face reflectance and realizes high measurement reproducibility.
- The double pinhole method (less directivity) is employed as the measurement principle.




CLASS 1 LASER PRODUCT

**Safety precautions regarding laser autofocus system (factory-installed option)**

This product uses a low-power visible laser (690nm) for measurement. The laser is a CLASS 1 EN/IEC60825-1 (2007) device. A warning and explanation label, as shown above, is attached to the product as appropriate.

### SPECIFICATIONS

| Name | | | Quick Vision Hybrid 302 | | Quick Vision Hybrid 404 | | Quick Vision Hybrid 606 | |
|---|---|---|---|---|---|---|---|---|
| Model No. | | | QVH Apex 302 | QV Hyper 302 | QVH Apex 404 | QV Hyper 404 | QVH Apex 606 | QV Hyper 606 |
| | | | QV Apex 302 (ISO10360-7) | QV Hyper 302 (ISO10360-7) | QVH Apex 404 (ISO10360-7) | QV Hyper 404 (ISO10360-7) | QVH Apex 606 (ISO10360-7) | QV Hyper 606 (ISO10360-7) |
| | | | QVH STREAM 302 | | QVH STREAM 404 | | QVH STREAM 606 | |
| Measuring Range (XxYxZ) | Vision | | 11.81″ x 7.87″ x 7.87″ (300x200x200mm) | | 15.75″ x 15.75″ x 9.84″ (400x400x250mm) | | 23.62″ x 25.59″ x 9.84″ (600x650x250mm) | |
| | Non-contact Displacement Sensor | TYPE1 | 7.09″ x 7.87″ x 7.87″ (180×200×200mm) | | 11.02″ x 15.75″ x 9.84″ (280×400×250mm) | | 18.90″ x 25.59″ x 9.84″ (480×650×250mm) | |
| | | TYPE4*1 | 6.92″ x 7.87″ x 7.87″ (176×200×200mm) | | 10.87″ x 15.75″ x 9.84″ (276×400×250mm) | | 18.74″ x 25.59″ x 9.84″ (476×650×250mm) | |
| Measuring Accuracy | (Vision)*2*3 | E1X, E1Y | (1.5+3L/1000)µm | (0.8+2L/1000)µm | (1.5+3L/1000)µm | (0.8+2L/1000)µm | (1.5+3L/1000)µm | (0.8+2L/1000)µm |
| | | E1Z | (1.5+4L/1000)µm | (1.5+2L/1000)µm | (1.5+4L/1000)µm | (1.5+2L/1000)µm | (1.5+4L/1000)µm | (1.5+2L/1000)µm |
| | | E2XY | (2.0+4L/1000)µm | (1.4+3L/1000)µm | (2.0+4L/1000)µm | (1.4+3L/1000)µm | (2.0+4L/1000)µm | (1.4+3L/1000)µm |
| | (Displacement Sensor)*2*3 | E1Z | (1.5+4L/1000)µm | (1.5+2L/1000)µm | (1.5+4L/1000)µm | (1.5+2L/1000)µm | (1.5+4L/1000)µm | (1.5+2L/1000)µm |
| | (ISO10360-7:2011) | $E_{U,MPE}$ | 3+5.5L/1000*4 3+6.0L/1000*5 | 2.5+4L/1000*4 2.5+4.5L/1000*5 | 3+5.5L/1000*4 3+6.0L/1000*5 | 2.5+4L/1000*4 2.5+4.5L/1000*5 | 3+5.5L/1000*4 3+6.0L/1000*5 | 2.5+4L/1000*4 2.5+4.5L/1000*5 |
| | | $P_{F2D,MPE}$ | 2.3µm | 1.7µm | 2.3µm | 1.7µm | 2.3µm | 1.7µm |
| Scale Resolution | | | 0.1µm | 0.02µm | 0.1µm | 0.02µm | 0.1µm | 0.02µm |
| Max. Drive Speed | | X/Y/Z Axis | 300 mm/s | 200 mm/s | 300 mm/s | 200 mm/s | 300 mm/s | 200 mm/s |
| Stage Glass Size | | | 15.71″ x 10.67″ (399 x 271mm) | | 19.41″ x 10.67″ (493 x 551mm) | | 27.44″ x 29.84″ (697 x 758mm) | |
| Maximum Stage Loading | | | 44 lbs. (20kg) | | 88 lbs. (40kg) | | 110 lbs. (50kg) | |
| Dimensions of Main Unit | | | 37.44″ x 33.82″ x 41.06″ ( 951 x 859 x 1043mm) | | 55.39″ x 40.43″ x 54.37″ (1407 x 1027 x 1381mm) | | 78.15″ x 51.54″ x 61.81″ (1985 x 1309 x 1570mm) | |
| Mass of Main Unit (Including Machine Stand) | | | 794 lbs. (360kg) | | 1276 lbs. (579kg) | | 3197 lbs. (1450kg) | |

| Name | | | Quick Vision ACCEL | | | |
|---|---|---|---|---|---|---|
| Model No. | | | QVH ACCEL808 | QVH ACCEL 1010 | QVH ACCEL 1212 | QVH ACCEL 1517 |
| Measuring Range (XxYxZ) | Vision | | 31.50x31.50x5.91″ (800x800x150mm) | 39.37x39.37x5.91″ (1000x1000x150mm) | 49.21x49.21x3.94″ (1250x1250x100mm) | 59.06X68.90X3.94″ (1500x1750x100mm) |
| | Non-contact Displacement Sensor | TYPE1 | 26.77x31.50x5.91″ (680x800x150mm) | 34.65x39.37x5.91″ (880x1000x150mm) | 44.49X49.21X3.94″ (1130x1250x100mm) | 54.33x68.90x3.94″ (1380x1750x100mm) |
| Measuring Accuracy | (Vision)*2*3 | E1X, E1Y | (1.5+3L/1000)µm | | (2.2+3L/1000)µm | |
| | | E1Z | (1.5+4L/1000)µm | | (2.5+5L/1000)µm | |
| | | E2XY | (2.5+4L/1000)µm | | (3.5+4L/1000)µm | |
| | (Displacement Sensor)*2*3 | E1Z | (2.5+4L/1000)µm | | (3.5+5L/1000)µm | |
| Scale Resolution | | | 0.1µm | | | |
| Max. Drive Speed | | X/Y Axis | 400 mm/s | | 300 mm/s | |
| | | Z Axis | 150 mm/s | | 150 mm/s | |
| Stage Glass Size | | | 34.76″x 37.72″ (883x958mm) | 46.69″ x 46.69″ (1186x1186mm) | 56.69″x56.69″ (1440x1440mm) | 67.48″ x 77.48″ (1714x1968mm) |
| Maximum Stage Loading | | | 22 lbs. (10kg) | 66 lbs. (30kg) | | |
| Dimensions of Main Unit | | | 58.07″ x 73.23″ x 62.13″ (1475 x 1860 x 1578mm) | 75.28″ x 84.29″ x 63.11″ (1912 x 2141 x 1603mm) | 85.28″ x 93.31″ x 61.18″ (2166 x 2370 x 1554mm) | 96.06″ x 114.09″ x 61.18″ (2440 x 2898 x 1554mm) |
| Mass of Main Unit | | | 4519lbs. (2050kg) | 6504 lbs. (2950kg) | 7937 lbs. (3600kg) | 9921 lbs. (4500kg) |

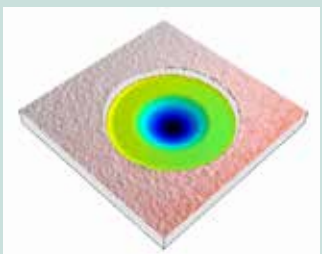
| Common Specifications | QV Apex | QV Hyper | QV Accel | QV Stream |
|---|---|---|---|---|
| CCD camera | Black & White | | | Black & White; Progressive Scanning |
| Magnification Change System | Programmable Power Turret (1x, 2x, 6x) | | | |
| Guide Method | Linear Motion Hard Bearing | | | |
| Illumination (Catalog Page Number Reference) | M-5 | M-7 | M-12 | M-6 |

* Specification of QVH1 ACCEL

*1 TYPE 4 is not supported by QVH STREAM
*2 L = arbitrary measuring length (mm)
*3 Inspected by Mitutoyo standard
*4 Accuracy for 20 ± 2°C
*5 Accuracy from 18 to 23°C

### FEATURES: Hybrid Type 4

- Enables detection of high inclination angles for both mirror and diffused surfaces.
- The automatic lighting adjustment function allows for high-accuracy measurements.
- Thickness measurement of thin and transparent objects such as film.


3-dimensional topographical result, data of plastic package by MCubeMAP

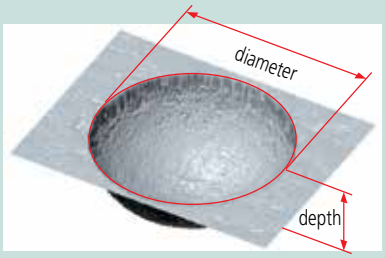
# QV WLI

## SERIES 363 — CNC Video Measuring System with White Light Interferometry

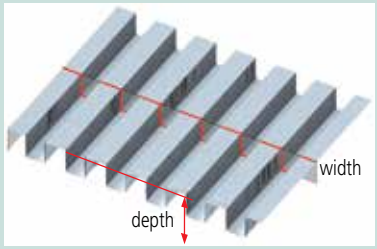
- QV WLI can measure coordinates and dimensions and assess micro-3D forms without contact.
- High-accuracy, dual-head vision measuring system equipped with a white light interferometer.
- The white light interferometer uses a high aspect ratio to accurately measure shapes.
- The standard vision measuring function can continuously perform coordinate, dimension and 3D shape measuring.
- Large work stage accurately handles over-sized work pieces such as a PCB.



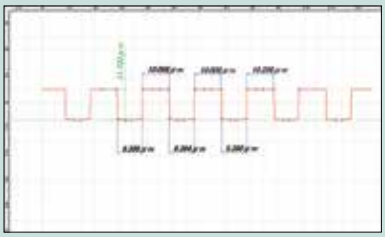
QV WLI 5x objective | QV WLI 10x objective | QV WLI 25x objective



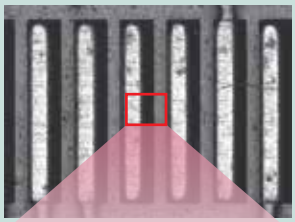

Application view of nano hole



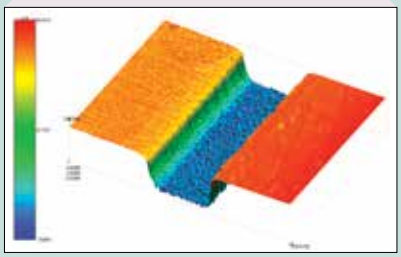

Application view of surface trace



FormTracePak AP



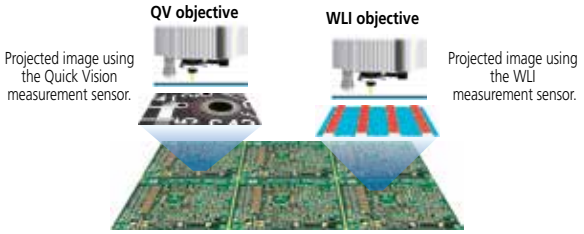
Region of interest evaluation



3-dimensional topographical result, data of micro-circuit

NEW-STYLE Vision Measuring Systems






## SPECIFICATIONS

| Name | | QV Hyper WLI 302 | QV Hyper WLI 404 | QV Hyper WLI 606 |
|---|---|---|---|---|
| **Model No.** | | **QV Hyper WLI 302 (ISO10360-7)** | **QV Hyper WLI 404 (ISO10360-7)** | **QV Hyper WLI 606 (ISO10360-7)** |
| Measuring Range (X×Y×Z) | Vision Measuring Area | 11.81" x 7.87" x 7.48" (300×200×190mm) | 15.75" x 1575" x 9.45" (400×400×240mm) | 23.62" x 25.59" x 8.66" (600×650×220mm) |
| | WLI Measuring Area*1 | 8.46" x 7.87" x 7.48" (215×200×190mm) | 12.40" x 15.75" x 9.44" (315×400×240mm) | 20.58" x 25.59" x 8.66" (515×650×220mm) |
| **WLI Optical Head Unit** | | | | |
| Field of View (H×V) | | 5X lens: approx. 0.64x0.48mm / 10X lens: approx. 0.32×0.24mm / 25X lens: approx. 0.13×0.10mm | | |
| Illumination | Co-axial Light | Halogen | | |
| Repeatability | | 2σ ≤ .08μm | | |
| Z-axis Scanning Range*2 | | 170μm | | |
| **Vision Optical Head Unit** | | | | |
| Magnification Change System | | Programmable Power Turret (1X-2X-6X) | | |
| Image Detection Method | | B&W CCD camera | | |
| Illumination | Co-axial Light | White LED | | |
| | Transmitted Light | White LED | | |
| | Programmable Ring Light | White LED | | |
| Measuring Accuracy | E1X, E1Y | (0.8+2L/1000)μm | | |
| | E1Z | (1.5+2L/1000)μm | | |
| | E2XY | (1.4+3L/1000)μm | | |
| | $E_{U,MPE}$ (ISO10360-7:2011) | 2.5+4L/1000 | | |
| | $P_{F2D,MPE}$ (ISO10360-7:2011) | 1.7μm | | |
| **Main Unit** | | | | |
| Resolution | | 0.01μm | | |
| Max. Stage Loading | | 33 lbs. (15kg) | 55 lbs. (25kg) | 77 lbs. (35kg) |
| Guidance System | | Linear Motion Hard Bearing | | |
| Dimensions (W×D×H) | | 33.82" x 37.40" x 63.23" (859×950×1606mm) | 40.43" x 55.39" x 70.11" (1027×1407×1781mm) | 51.54" x 78.15" x 70.55" (1309×1985×1792mm) |
| Mass (Vibration Isolator Stand Included) | | Approx. 1080 lbs. (490kg) | Approx. 2557 lbs. (1160kg) | Approx. 2275 lbs. (1031kg) |

*1: WLI head is moveable. Multiple fields of view can be stitched together.
*2: In standard mode. Applicable to max. 200μm by modifying scan pitch.



Mitutoyo

# ULTRA QV

## SERIES 363 — Ultra-high Accuracy CNC Vision Measuring System

## FEATURES

- Minimizes straightness errors through the use of a precision air-bearing linear guide system.
- Utilizes a 0.01µm resolution glass scale manufactured at an ultra-precision facility located 11 meters underground.
- In order to minimize error caused by temperature fluctuations, the linear encoder scale is made of special crystallized glass with an expansion coefficient that is almost zero.
- Optimizes the mechanical structure of the main unit in Finite Element Method analysis.
- Stabilizes the geometrical accuracy (i.e. straightness of each axis and perpendicularity) to lessen thermal effects.




ULTRA QV 404 PRO

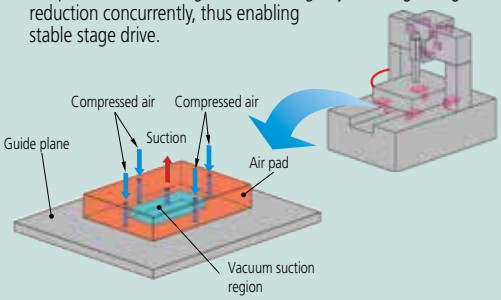
## SPECIFICATIONS

| Model No. | | ULTRA QV 404 PRO<br>ULTRA QV 404 PRO (ISO10360-7:2011) | ULTRA QV 404 PRO w/ TAF<br>ULTRA QV 404 PRO w/ TAF (ISO10360-7:2011) |
|---|---|---|---|
| Range | X x Y x Z | 16" x 16" x 8" (400x400x200mm) | |
| Magnification Change System | | Programmable Power Turret (Selectable from Magnifications of 1X, 2X and 6X) | |
| Resolution / Scale Unit | | 0.01µm / Linear Encoder*4 | |
| Resolution of Z-Scale Using TAF | | – | 0.25µm |
| High-sensitivity CCD Camera | | B&W | |
| Illumination (PRL: Programmable Ring Light) | Surface | Halogen | |
| | Contour | Halogen | |
| | PRL | Halogen | |
| Accuracy*1 (20˚C±0.2˚C) | E1XY | (0.25+L/1000)µm | |
| | E1Z (50mm Stroke)*2 | (1.0+2L/1000)µm | |
| | E1Z (Full Stroke) | (1.5+2L/1000)µm | |
| | E2XY Plane | (0.5+2L/1000)µm | |
| | $E_{U,MPE}$ (ISO10360-7:2011) | 1.3+3L/1000, 1.3+3.5L/1000*5 | |
| | $P_{F2D,MPE}$ (ISO10360-7:2011) | 1.0µm | |
| Accuracy Assurance Environments*3 | Temperature Range | 20±0.2˚C | |
| | Temperature Variation | 0.5˚C/1H | |
| | Temperature Gradient | 1˚C/m | |
| Repeatability within the Visual Field | | 3σ=0.2µm | |
| Repeatability of Auto-focus | | σ=0.4µm | |
| Stage Glass Size | | 19.4" x 21.7" (493x551mm) | |
| Max. Stage Loading | | 88lb (40kg) | |
| Dimensions (W x D x H) | | 46" x 68" x 75.2" (1172x1735x1910mm) | |
| Mass | | 4464 lb (2025kg) | |
| Used Air Pressure | | 0.4MPa*6 | |
| Supplied Air Flow Rate | | 150L/min*7 | |

*1: Accuracy when measured at the center of the video screen and in the middle of measuring stroke on a plane using the 5X objective and 1X tube lens
*2: Specified only for factory shipping inspection.
*3: Accuracy assurance environments in the case where no temperature compensation is performed. Those in the case where temperature compensation is performed are as follows.
– Accuracy-assured temperature range: 20±2˚C
– Temperature variation: 0.5˚C/H
– Temperature gradient: 1˚C/m
*4: Thermal expansion coefficient: (0±0.02)X10-6/K
*5: Accuracy 1.3+3L/1000 for 20 ± 2°C, Accuracy 1.3+3.50L/1000 from 18 to 23°C
*6: An air source is required to maintain the original air pressure between 0.5 and 0.9MPa.
*7: Indicates the flow rate under normal conditions.

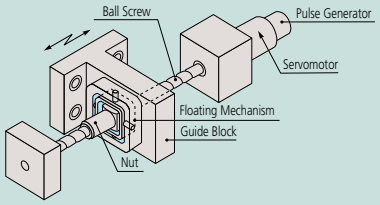
## Self-Suction Air Pad

If a normal air pad is used for the Y axis, it is necessary to increase the mass of the work stage to obtain appropriate rigidity. ULTRA QV (Quick Vision) employs a special air pad called a self-suction type that floats the air pad using compressed air and also generates an absorption power with a vacuum zone provided under negative pressure at the center of the pad. This achieves greater Y-axis rigidity and stage weight reduction concurrently, thus enabling stable stage drive.




## Ball Screw Floating Mechanism

ULTRA QV employs high-reliability ball screws in the floating mechanism. This floating mechanism will minimize the error due to axial fluctuation that adversely affects kinetic performance, such as straightness, and improves the driving speed.





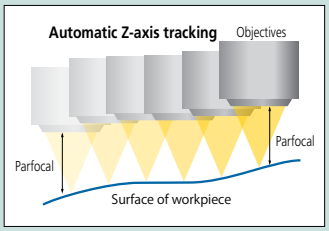


Ultra-high accuracy crystallized glass scale with virtually zero thermal expansion

The ULTRA Quick Vision is equipped with a crystallized glass scale having a resolution of 0.01µm and linear expansion coefficient of ±0.02x10$^{-6}$/K. Virtually zero thermal expansion means the ULTRA Quick Vision can minimize accuracy fluctuation resulting from thermal changes.

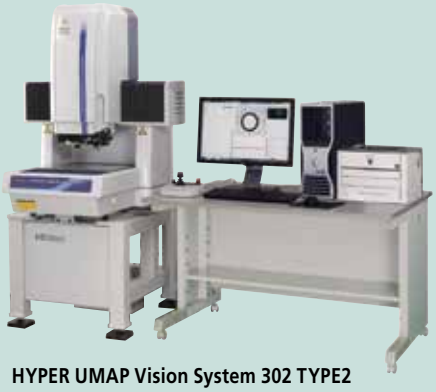
## Tracking Auto Focus (TAF)

The TAF feature focuses continuously, adjusting to changes in the height of the object being measured. Automatic tracking of surface waves and warpage (in the Z axis) improves measurement throughput. The feature also cuts out the hassle of focusing during manual measurement and reduces the burden for the operator.



# UMAP Vision System TYPE2

## SERIES 364 — Micro-form Measuring System



HYPER UMAP Vision System 302 TYPE2



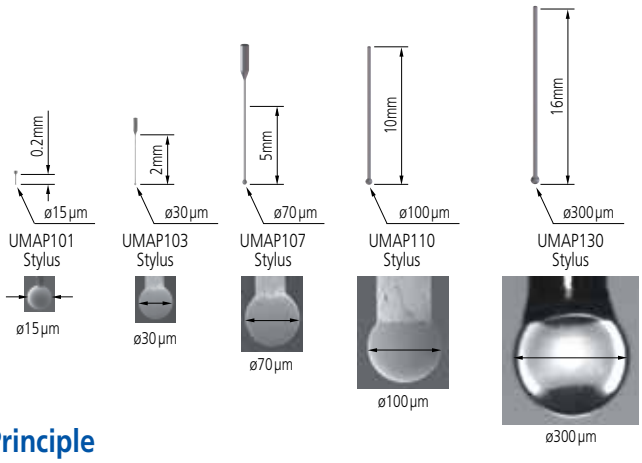
ULTRA UMAP Vision System 404 TYPE2

## FEATURES

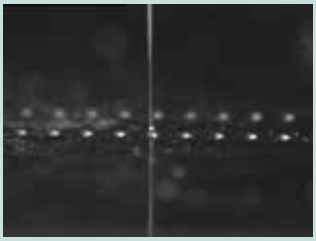
- **Ultrasonic micro probe, UMAP**
  The ultrasonic micro probe (UMAP) has the ability to sense the amplitude variability in a micro area, and the optional contact points (15 to 300µm diameter) provide high-accuracy measurements to meet a variety of specifications.
- **High-accuracy contact and non-contact measurement capabilities in one system**
  This unit includes the UMAP and the non-contact type vision head. Until now, it was difficult to measure minute areas, but it is now possible to do both contact and non-contact measurement on a single platform.



Micro probe, UMAP



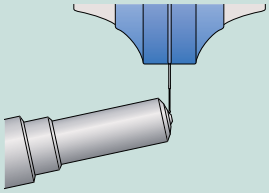

## Application examples



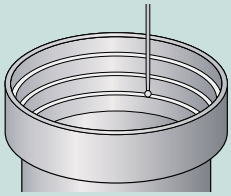
Contour measurement of a ø0.125 hole



Measuring form of micro gear teeth

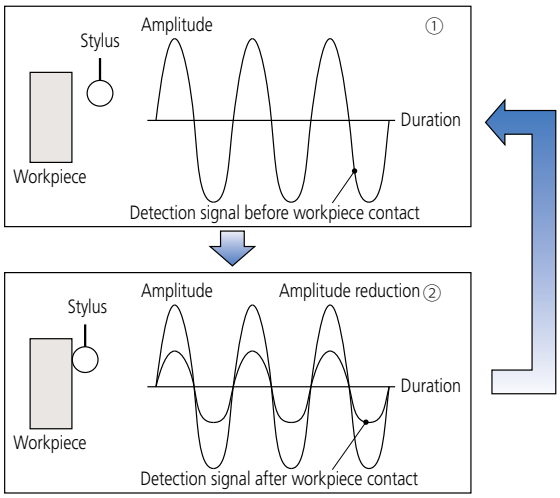


Measurement of a fuel injection nozzle hole's shape



Measurement of a lens barrel's shape

## Detection of Surface Principle




① In this drawing, the stylus is vibrating with a micro amplitude. When it does not come into contact with the workpiece, the vibration state is maintained.
② As the stylus comes into contact with the workpiece, the vibration amplitude decreases as the contact increases. When the decreasing amplitude falls below a certain level, a touch-trigger signal is generated.

## SPECIFICATIONS

| | | TYPE2 | |
|---|---|---|---|
| | | **Hyper UMAP302** | **ULTRA UMAP404** |
| Measuring range (common to vision and UMAP) | X-axis x Y-axis | 7.28 x 7.87" (185x200mm) | 11.22 x 15.75" (285x400mm) |
| | Z-axis | 6.89" (175mm): UMAP101/103<br>7.07" (180mm): UMAP107/110<br>7.28" (185mm): UMAP130 | |
| Measuring accuracy (Vision) | $E_{1X}$, $E_{1Y}$ | (0.8+2L/1000)µm | (0.25+L/1000)µm |
| | $E_{1Z}$ | (1.5+2L/1000)µm | |
| Repeatability | UMAP 101/103/107 | σ = 0.1µm | σ = 0.08µm |
| | UMAP 110/130 | σ = 0.15µm | σ = 0.12µm |



Mitutoyo

# QV ACCEL

## SERIES 363 — Large-format CNC Vision Measuring System

## FEATURES

**Moving-bridge type structure**

Designed with primary focus on measurement efficiency, the machine drives the X and Y axes at 400mm/s (QV ACCEL808, ACCEL1010).

The moving-bridge type structure eliminates the need for a moving stage. This facilitates a more simplified design of the workpiece fixture, resulting in a significant reduction in the man-hours required for fixture fabrication and inspection.



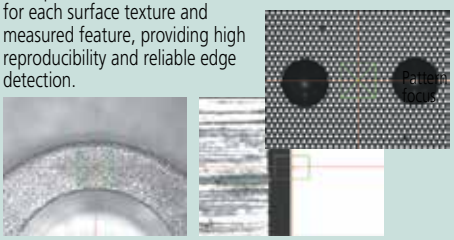
QV ACCEL 808 PRO



QV ACCEL 1212 PRO

## Image Multi-AutoFocus

The optimal focus can be selected for each surface texture and measured feature, providing high reproducibility and reliable edge detection.

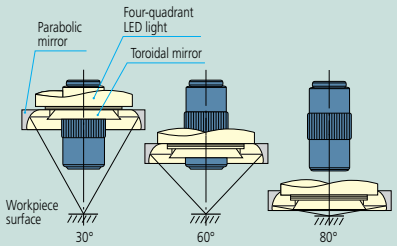



Surface focus

Edge focus

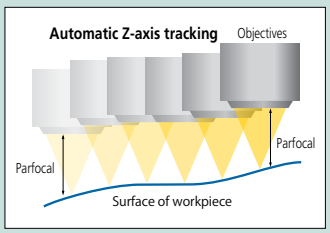
## Programmable Ring Light (PRL)

Fine control of obliquity and direction provides illumination optimal for measurement. Obliquity can be arbitrarily set in the range from 30° to 80°. This type of illumination is effective for enhancing the edge of inclined surfaces or very small steps. Illumination can be controlled independently in every direction, back and forth, right and left. Measurement with edge enhancement is possible by forming a shadow with lighting from only one direction.




## Tracking Auto Focus (TAF)

The TAF feature focuses continuously, adjusting to changes in the height of the object being measured. Automatic tracking of surface waves and warpage (in the Z axis) improves measurement throughput. The feature also removes the hassle of focusing during manual measurement.




## SPECIFICATIONS

| Model No. | | QV ACCEL 808 PRO | QV ACCEL 1010 PRO | QV ACCEL 1212 PRO | QV ACCEL 1517 PRO |
|---|---|---|---|---|---|
| Range | X-axis | 32″ / 800mm | 40″ / 1000mm | 50″ / 1250mm | 60″ / 1500mm |
| | Y-axis | 32″ / 800mm | 40″ / 1000mm | 50″ / 1250mm | 70″ / 1750mm |
| | Z-axis | 6″ / 150mm | 6″ / 150mm | 4″ / 100mm | 4″ / 100mm |
| Resolution | | 0.1µm | | | |
| Resolution of Z Scale using TAF | | 0.3µm | | | |
| High-sensitivity CCD camera | | B&W | | | |
| Accuracy* | $E_{1XY}$ | (1.5+3L/1000)µm | | (2.2+3L/1000)µm | |
| | $E_{1Z}$ | (1.5+4L/1000)µm | | (2.5+5L/1000)µm | |
| | $E_{2XY}$ | (2.5+4L/1000)µm | | (3.5+4L/1000)µm | |
| Max. Drive Speed | X/Y-axis | 400mm/s | | 300mm/s | |
| | Z-axis | 150mm/s | | 150mm/s | |
| Illumination (PRL: Programmable Ring Light) | Surface | LED, white | | | |
| | Contour | LED, white | | | |
| | PRL | LED, white (4 divisions) | | | |
| Magnification Change System | | Programmable Power Turret (1X, 2x, 6x) | | | |
| Stage Glass Size | | 34.8″ x 37.7″<br>883 x 958mm | 46.7″ x 46.7″<br>1186 x 1186mm | 56.7″ x 56.7″<br>1440 x 1440mm | 67.5″ x 77.5″<br>1714 x 1968mm |
| Dimensions (W x D x H) | | 58 x 67.5 x 62″<br>1475x1716x1578mm | 75.3 x 82 x 63″<br>1912x2086x1603mm | 85.3 x 92 x 61″<br>2166x2340 x1554mm | 96 x 113 x 61″<br>2440 x 2868 x 1554mm |
| Max Stage Loading | | 22 lbs / 10kg | 66.1 lbs / 30kg | 66.1 lbs / 30kg | 66.1 lbs / 30kg |
| Mass | | 5666 lbs / 2570kg | 6504 lbs / 2950kg | 7937 lbs / 3600kg | 9921 lbs / 4500kg |

* The measuring accuracy is defined at the following conditions, Programmable power turret: 1X, Objective lens: 2.5X (HR or SL), L = Dimension between two arbitrary points (mm)

**Tracking Auto Focus (TAF)**

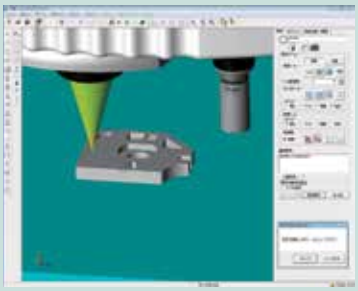
| AF principle | Objective Coaxial Autofocusing (Knife-edge method) | | | | |
|---|---|---|---|---|---|
| Suitable Objectives | QV-HR1x | QV-SL1x | QV-HR2.5x | QV-SL2.5x | QV-5x |
| Tracking Range*2 | 6.3mm (±3.15mm) | 6.3mm (±3.15mm) | 1mm (±0.5 mm) | 1mm (±0.5 mm) | 0.25mm (±0.125mm) |
| Spot Diameter*3 | 5.2µm | 8.0µm | 2.1µm | 3.1µm | 1.5µm |
| Laser Source | Semiconductor laser (peak wavelength: 690nm) | | | | |
| Laser Power | 0.9mW | | | | |
| Laser Safety | Class 2 (JIS C6802:2011, EN/IEC 60825-1:2007) | | | | |

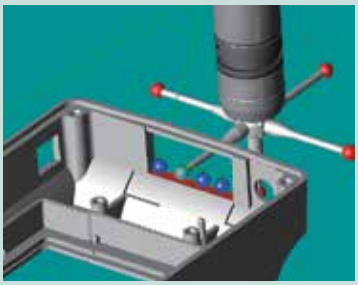
*2 Varies according to workpiece surface texture and reflectance.
*3 Design values.

# Quick Vision with Touch-Trigger Probe

## QV3DCAD-Online

QV3DCAD-Online uses 3D CAD models to easily create QVPAK part programs. QV measurements can be performed by specifying an element in the CAD data. This improves program creation efficiency more than using a joystick to perform teaching.





The interference check function can be used to prevent problems caused by the probe or objective lens colliding with the workpiece.

### Non-contact and contact measurement with one machine

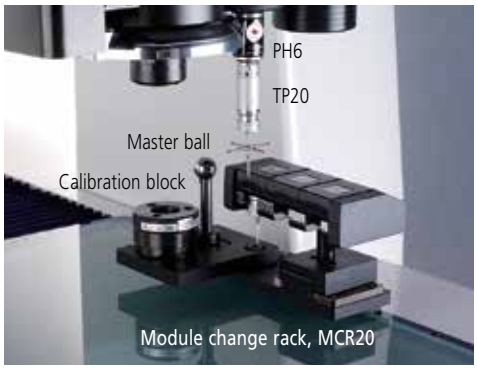
QV touch probe allows both vision measurement and touch-probe measurement.

### 3D workpiece measurement

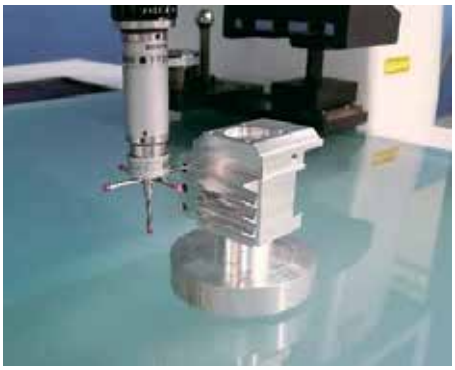
Measures three-dimensional workpieces such as molded products, resin-molded products, machined products and more.

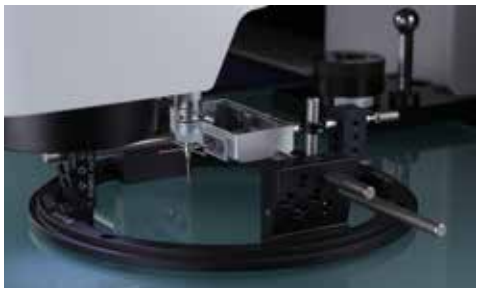
### Module change rack available

Easily change between vision and touch-probe measurement with a module change rack.



Module change rack, MCR20





**QV Active with optional Opti-fix clamping system**

## Supported CAD Formats

- SAT
- IGES*
- STEP*
- Parasolid*
- SolidWorks*
- Unigraphics*
- CATIA*

* optional

## Specifications with Touch-Probe Option

| | | QV TP Active 202 | QV TP Active 404 | QV TP Apex302<br>Hyper QV TP302 | QV TP Apex404<br>Hyper QV TP404 | QV TP Apex606<br>Hyper QV TP606 |
|---|---|---|---|---|---|---|
| Measuring Range*1 (XxYxZ) | Vision | 250x200x150mm | 400x400x200mm | 300x200x200mm | 400x400x250mm | 600x650x250mm |
| | Touch Probe | 131x200x150mm† | 284x400x200mm | 234x200x200mm | 334x400x250mm | 534x650x250mm |
| Measuring accuracy*2 (Touch Probe) | $E_{1X}, E_{1Y}, E_{1Z}$ | (2.4+3L/1000)µm | (2.4 + 3L/1000)µm | QV TP Apex:(1.8+3L/1000)µm<br>Hyper QV TP:(1.7+3L/1000)µm | | |

| | | QV TP ACCEL 808 | QV TP ACCEL 1010 | QV TP ACCEL 1212 | QV TP ACCEL 1517 |
|---|---|---|---|---|---|
| Measuring Range*1 (XxYxZ) | Vision | 800x800x150mm | 1000x1000x150mm | 1250x1250x100mm | 1500x1750x100mm |
| | Touch Probe | 734x800x150mm | 934x1000x150mm | 1184x1250x100mm | 1434x1750x100mm |
| Measuring Accuracy*2 (Touch probe) | $E_{1X}, E_{1Y}, E_{1Z}$ | (1.8+3L/1000)µm | (3+4L/1000)µm | (6+7L/1000)µm | |

*1: When a module change rack, a master ball and a calibration ring are mounted, the measurement ranges are smaller than those in the table. Other specifications are the same as those of QV ELF, QV Apex, Hyper QV, and QV ACCEL. Please contact our sales office for more details.

*2: Inspected by Mitutoyo standard. L = length between two arbitrary points (mm)

† : With calibration ring removed.

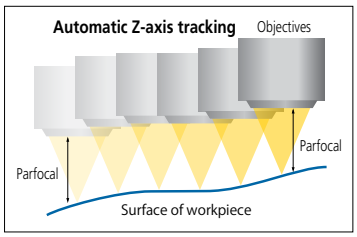


Mitutoyo

# Accessories for Quick Vision

## Tracking Auto Focus (TAF)

The TAF feature focuses continuously, adjusting to changes in the height of the object being measured. Automatic tracking of surface waves and warpage (in the Z axis) improves measurement throughput. The feature eliminates the hassle of focusing during manual measurement.



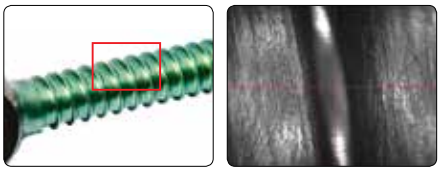

**Tracking Auto Focus (TAF)**

| AF principle | Objective Coaxial Autofocusing (Knife-edge Method) | | | | |
|---|---|---|---|---|---|
| Suitable Objectives | QV-HR1x | QV-SL1x | QV-HR2.5x | QV-SL2.5x | QV-5x |
| Tracking Range*2 | 6.3mm (±3.15mm) | 6.3mm (±3.15mm) | 1mm (±0.5 mm) | 1mm (±0.5 mm) | 0.25mm (±0.125mm) |
| Spot Diameter*3 | 5.2µm | 8.0µm | 2.1µm | 3.1µm | 1.5µm |
| Laser Source | Semiconductor laser (peak wavelength: 690nm) | | | | |
| Laser Power | 0.9mW | | | | |
| Laser Safety | Class 2 (JIS C6802:2011, EN/IEC 60825-1:2007) | | | | |

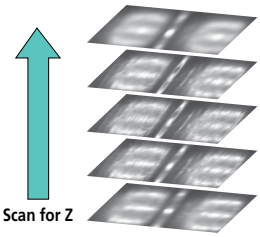
*2 Varies according to workpiece surface texture and reflectance.
*3 Design values.

## PFF (Points from Focus)

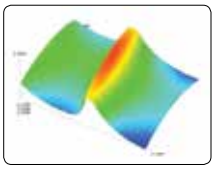
Mitutoyo-developed optical data collection method that stitches images together with high-resolution Z axis data.



Measuring Bone Screw Thread




Acquire Continuously



Form Data

## Calibration Glass Chart No. 02AKN020 †

A calibration chart is used to compensate for the pixel size of the CCD chip, autofocus accuracy and the optical axis offset at each magnification of the variable magnification unit (PPT).



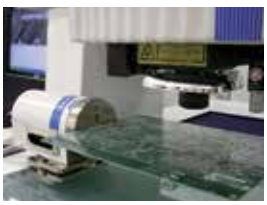
## Compensation Chart No. 02AKU400*

A compensation chart is used to decrease optical distortion and errors caused by difference of the pattern and texture on the workpiece surface.



## QV-Index Head*

Automatic multi-plane measurement is possible with the optional index table.



| | |
|---|---|
| Max. workpiece diameter | 5.51" / 140mm |
| Max. workpiece mass | 4.41 lbs / 2kg |
| Min. rotation angle | 0.1° |
| Positioning accuracy | ±0.5° |
| Max. rotation speed | 10rpm |

## Capable of Supporting ISO10360-7 Guaranteed Accuracy

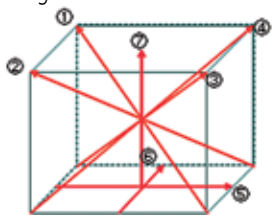
Some models in the Quick Vision Series support the ISO10360-7 guaranteed accuracy specifications.

Contact Mitutoyo for details on applicable models.

**Guaranteed accuracies**

- Length measurement error $E_{U,MPE}$
- Probing error $P_{F2D,MPE}$

Length measurement error E



## Objectives



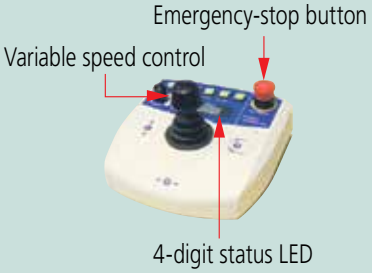
| Objective mag. | Turret lens mag. | Monitor mag. | Field of View |
|---|---|---|---|
| 0.5X | 1X | 16X | 12.54 x 9.40 |
| | 2X | 32X | 6.27 x 4.70 |
| | 6X | 96X | 2.09 x 1.56 |
| 1X | 1X | 32X | 6.27 x 4.70 |
| | 2X | 64X | 3.13 x 2.35 |
| | 6X | 192X | 1.04 x 0.78 |
| 2.5X | 1X | 80X | 2.50 x 1.88 |
| | 2X | 160X | 1.25 x 0.94 |
| | 6X | 480X | 0.41 x 0.31 |
| 5X | 1X | 160X | 1.25 x 0.94 |
| | 2X | 320X | 0.62 x 0.47 |
| | 6X | 960X | 0.20 x 0.15 |
| 10X | 1X | 320X | 0.62 x 0.47 |
| | 2X | 640X | 0.31 x 0.23 |
| | 6X | 1920X | 0.10 x 0.07 |
| 25X | 1X | 800X | 0.25 x 0.18 |
| | 2X | 1600X | 0.12 x 0.09 |
| | 6X | 4800X | 0.04 x 0.03 |

## Objective †

| Objective | Order No. | Working Distance |
|---|---|---|
| QV-SL0.5X | **02AKT199** | 30.5mm |
| QV-HR1X | **02AKT250** | 40.6mm |
| QV-SL1X | **02ALA150** | 52.5mm |
| QV-HR2.5X | **02AKT300** | 40.6mm |
| QV-SL2.5X | **02ALA170** | 60mm |
| QV-5XHR | **02AWD010** | 20mm |
| QV-10XHR | **02AKT650** | 20mm |
| QV-25X | **02ALG020** | 13mm |

The monitor magnification and field of view values are for the PRO machine.
QV-10X, QV-25X: Depending on a workpiece of illumination may be insufficient at a turret lens magnification of 2X and 6X.
QV-25X: The PRL illumination is restricted in its usable position.

## Multi-Function Control Box



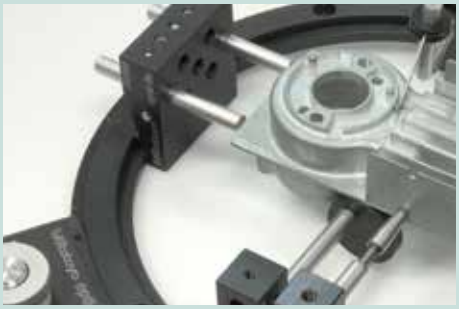
# OPTI-FIX Kits

## Modular Clamping System for Vision Measuring Systems

The modular opti-fix clamping system has been developed specifically for optical coordinate measuring systems.

Opti-fix guarantees safe part fixturing during measurement. This functional configuration also makes multiple part measurements considerably easier.

In order to reduce errant reflections of lighting systems and ambient light effects to a minimum, all important construction elements are anodized in flat-black or matte finish.

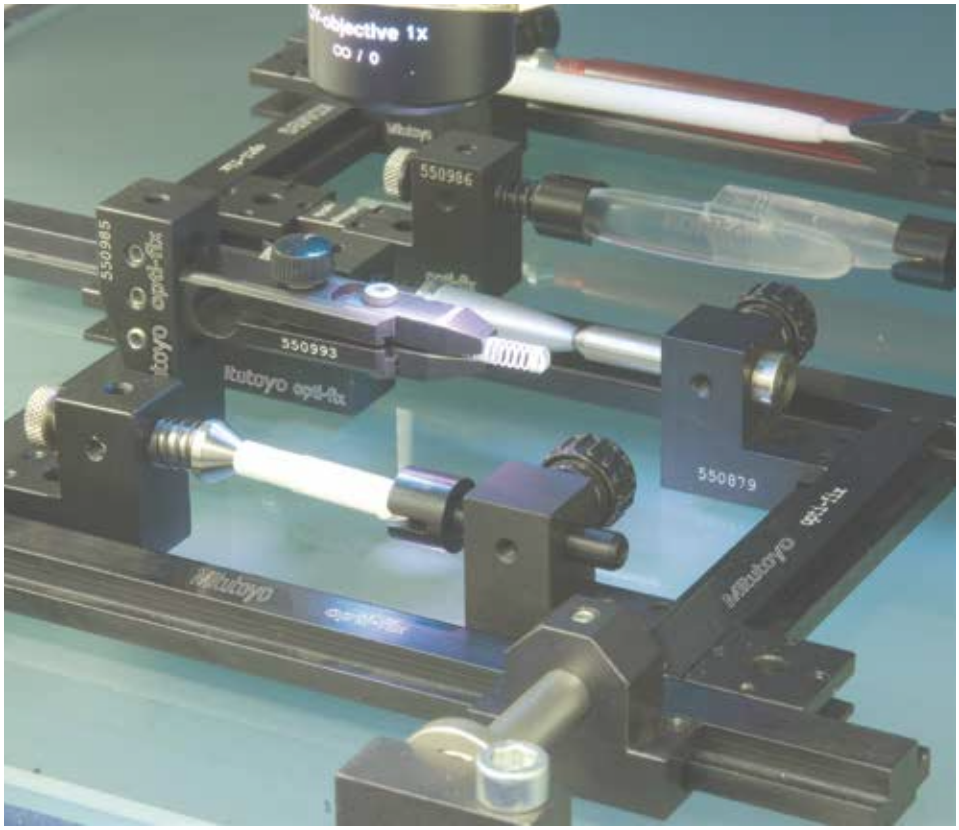


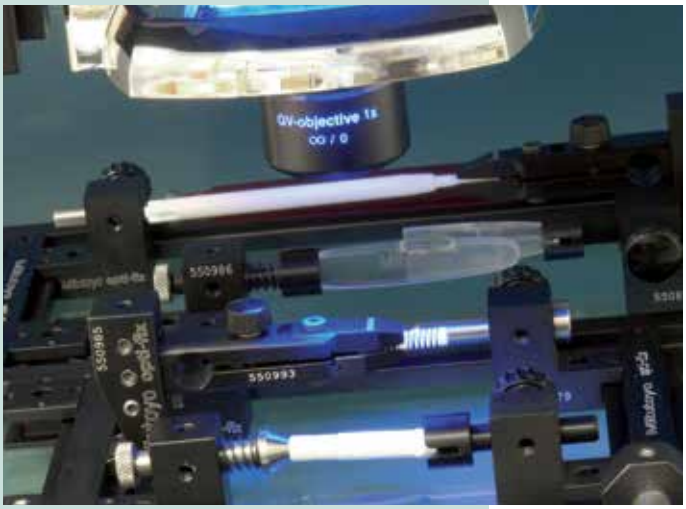
For mounting workpieces on the glass stage, different fixturing methods are available.

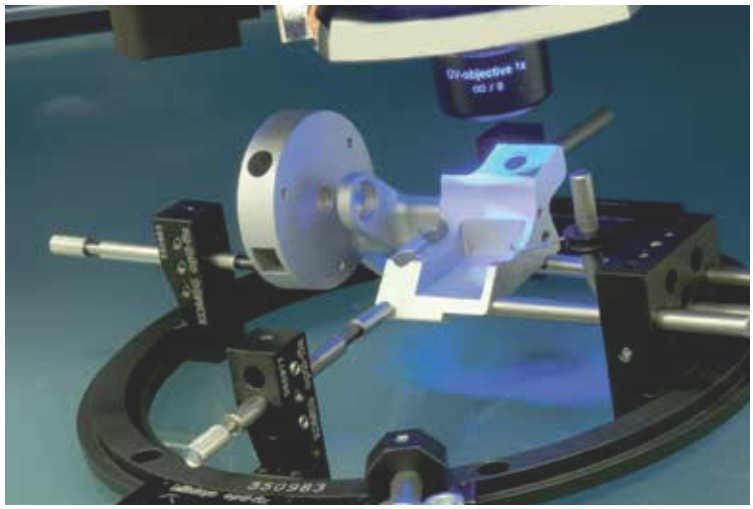
In the case of measuring methods using reflected, as well as transmitted light, for measurement of cubic, rotationally symmetrical and flat workpieces, the use of Opti-fix is a practical solution.

Furthermore, the spring clips and centering pins are integrated into the system to allow for tactile measuring. Opti-fix offers a large number of configurations for part fixturing, from clamping tweezers for miniature parts to a precision vice for large parts.

Fastening brackets, vacuum plates or magnetic holders for mounting the clamping system on the measuring machine, can be ordered separately.






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# OPTI-FIX Kits

## Opti-Set Start



K551056



For construction of a simple rail system with a length of 250 mm and for fixturing parts with simple part geometry. 16 parts.

## Opti-Set Basic



K551057





For construction of a basic frame with the dimensions of 200 mm x 100 mm and for fixturing parts with simple part geometry. 26 parts.

## Opti-Set Rotation



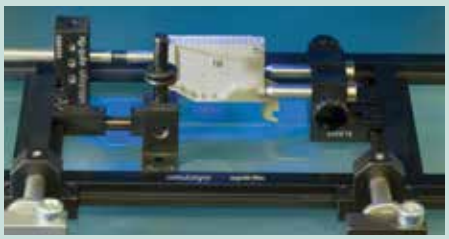
K551058



For construction of a basic frame with the dimensions of 250 mm x 200 mm and for fixturing parts that are rotationally symmetric with and without center holes. 23 parts.

# OPTI-FIX Kits

## Opti-Set Advanced

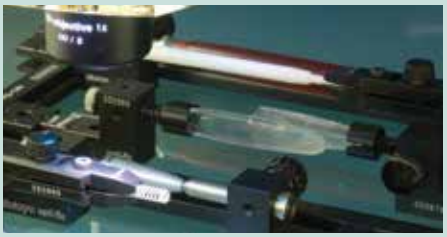




**K551059**

For construction of a basic frame with the dimensions of 400 mm x 250 mm and for fixturing parts with slightly more complex part geometry. 51 parts.

## Opti-Set Professional

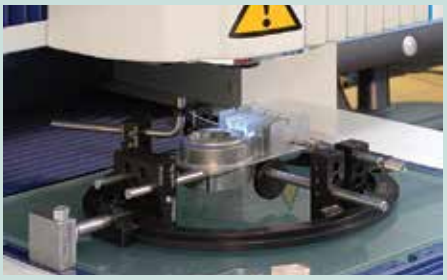




**K551060**

For construction of a basic frame with the dimensions of 400 mm x 250 mm and for fixturing parts with complex part geometry. The fixturing of parts with a rotational part geometry is also available. 115 parts.

## Opti-Set Round





**K550298**

With locating and clamping elements, included adaptor plates for adaptation to the basic frame of the rail system. 18 parts.



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## Vision Measurement

Vision measuring machines provide the following processing capabilities.

### Edge detection

Detecting/measuring edges in the XY plane



### Auto focusing

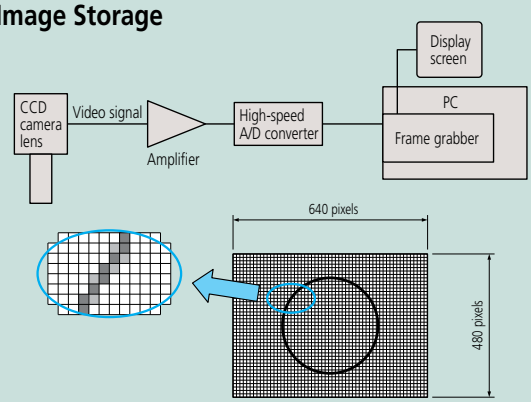
Focusing and Z measurement



### Pattern recognition

Alignment, positioning, and checking the presence of a feature

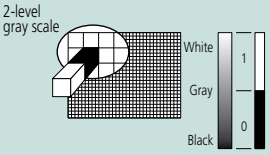
## Image Storage



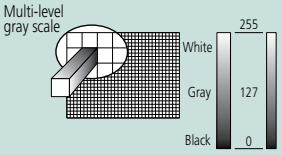

An image is comprised of a regular array of pixels, similar to the process that produces a printed image picture on fine plotting paper with each square solid-filled.

## Gray Scale

A PC stores an image after internally converting it to numeric values. A numeric value is assigned to each pixel of an image. Image quality varies depending on how many levels of gray scale are defined by the numeric values. The PC provides two types of gray scale: two-level and multi-level. The pixels in an image are usually displayed as the 256-level gray scale.




Pixels in an image brighter than a given level are displayed as white and all other pixels are displayed as black.




Each pixel is displayed as one of 256 levels between black and white. This allows high-fidelity images to be displayed.

## Difference in Image Quality

Difference between 2-level and 256-level gray-scale images



Sample image displayed in 2-level gray scale

Sample image displayed in 256-level gray scale

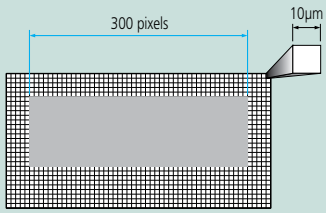
## Variation in Image Depending on Threshold Level



These three pictures are the same image displayed as 2-level gray scale at different slice levels (threshold levels). In a 2-level gray-scale image, different images are provided as shown above due to a difference in slice level. Therefore, the 2-level gray scale is not used for high-precision vision measurement since numeric values will change depending on the threshold level that is set.

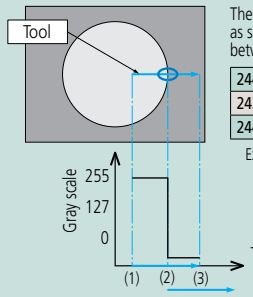
## Dimensional Measurement

An image consists of pixels. If the number of pixels in a section to be measured is counted and multiplied by the size of a pixel, then the section can be converted to a numeric value in length. For example, assume that the total number of pixels in the lateral size of a square workpiece is 300 pixels as shown in the figure below. If a pixel size is 10μm under a specific imaging magnification, the total length of the workpiece is given by 10μm x 300 pixels = 3000μm = 3mm.




## Edge Detection

How to detect a workpiece edge in an image is described using the following monochrome picture as an example. Edge detection is performed within a given domain. A symbol that visually defines this domain is referred to as a tool. Multiple tools are provided to suit various workpiece geometries or measurement data.



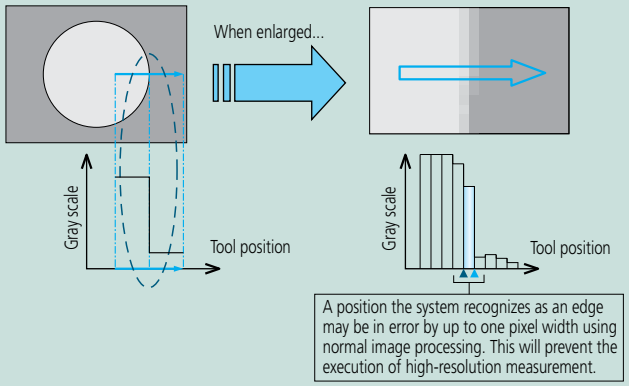

The edge-detection system scans within the tool area as shown in the figure at left and detects the boundary between light and shade.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 244 | 241 | 220 | 193 | 97 | 76 | 67 | 52 | 53 | 53 |
| 243 | 242 | 220 | 195 | 94 | 73 | 66 | 54 | 53 | 55 |
| 244 | 246 | 220 | 195 | 94 | 75 | 64 | 56 | 51 | 50 |

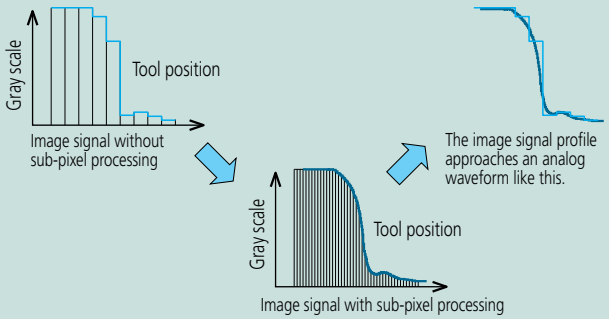
Example of numeric values assigned to pixels on the tool

(1) Scan start position
(2) Edge detection position
(3) Scan end position

## High-resolution Measurement

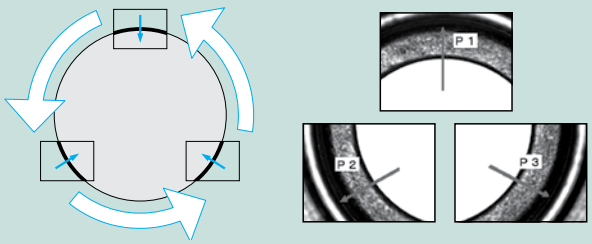



To increase the accuracy in edge detection, sub-pixel image processing is used.
An edge is detected by determining an interpolation curve from adjacent pixel data as shown below.
As a result, it allows measurement with a resolution higher than 1 pixel.

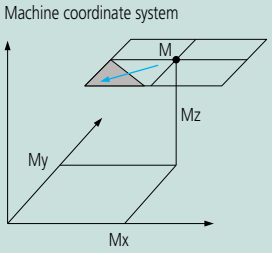



## Measurement along Multiple Portions of an Image

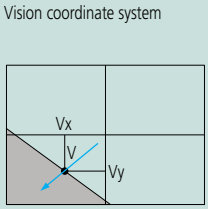
Large features that cannot be contained on one screen have to be measured by precisely controlling the position of the CCD sensor and stage so as to locate each reference point within individual images. By this means, the system can measure even a large circle, as shown below, by detecting the edge while moving the stage across various parts of the periphery.




## Composite Coordinates of a Point




Measuring machine stage position
M = (Mx, My, Mz)




Detected edge position (from the center of vision)
V = (Vx, Vy)

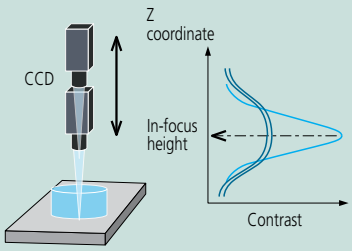
**Actual coordinates are given by X = (Mx + Vx), Y = (My + Vy), and Z = Mz, respectively.**

Since measurement is performed while individual measured positions are stored, the system can measure dimensions that cannot be included in one screen.

## Principle of Auto Focusing

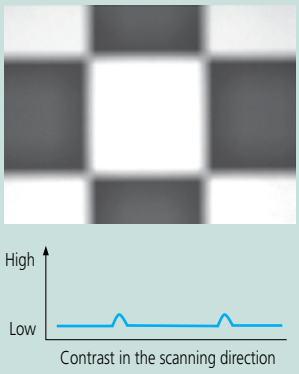
The system can perform XY-plane measurement, but cannot perform height measurement using only the CCD camera image. The system is commonly provided with the Auto Focus (AF) mechanism for height measurement. The following explains the AF mechanism that uses a common image, although some systems may use an AF laser.

The AF system analyzes an image while moving the CCD in the Z axis. In the analysis of image contrast, an image in sharp focus will show a peak contrast and one out of focus will show a low contrast. Therefore, the height at which the image contrast peaks is the just-in-focus height.

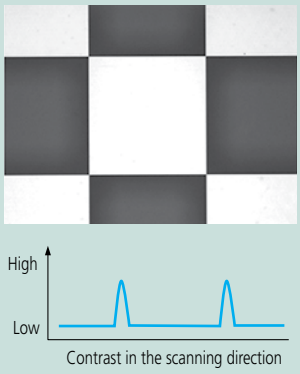



## Variation in Contrast Depending on the Focus Condition

Edge contrast is low due to out-of-focus edges.




Edge contrast is high due to sharp, in-focus edges.



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The simple acceptance decision rule, as defined in ASME B89.7.3.1-2001, ISO/IEC Guide 98-4:2012, and ISO/TR 14253-6:2012, applies when determining measuring equipment conformance to specified accuracy values in this catalog. In applying the simple acceptance decision rule, the measurement capability index, as defined in ISO/IEC Guide 98-4:2012 and ISO/TR 14253-6:2012, shall be equal to or greater than one and is recommended to be equal to or greater than four whenever practicable. Mitutoyo America Corporation recommends the use of ISO/IEC 17025 accredited calibration laboratories and that measurement uncertainty be evaluated in accordance with ISO/IEC Guide 98-3:2008 and ISO 14253-5:2015.

# APPLICATIONS INDEX

## STANDARDS


| | Page |
|---|---|
| Bore Gage Auxiliary Block Kit | E-27 |
| Bore Gage Zero Checker | C-29 |
| CERA Caliper Checker | D-49 |
| CERA Straight Master | E-30 |
| Check Master | E-29 |
| Depth Micro Checker | D-51 |
| Digital Height Master | E-26 |
| Gage Blocks | E-2-19 |
| Height Master | E-25 |
| High Precision Squares | E-33 |
| Inside Micro Checker | C-19 |
| Micrometer Standards | B-51 |
| Micrometer Stands | B-48 |
| Optical Flats | B-50 |
| Optical Parallels | B-50 |
| Setting Rings | C-29,30 |
| Square Master | E-31 |
| Standard Scales | E-32 |
| Universal Height Master | E-28 |
| Working Standard Scales | E-32 |
| Rockwell Hardness Tester Calibration Set | K-11 |
| Hardmatic Test Block Set | K-15 |
| Step Master | E-23 |
| Thickness / Feeler Gages | E-36 |


## MEASUREMENT OF INSIDE DIMENSIONS


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| ABSOLUTE Digimatic and Vernier Calipers (Offset) | D-15 |
| ABSOLUTE Digimatic Bore Gage | C-27 |
| ABSOLUTE Digimatic Calipers | D3-7,15,17,20-30 |
| Bore Gages | C-10-28 |
| Borematic | C-8-10 |
| Dial Caliper Gages | F-56,57 |
| Dial Calipers | D-8,9 |
| Digimatic Holtest | C-2,3,10 |
| Groove Micrometers | B-46 |
| Holtest | C-2-7,10 |
| Inside Micro Checker | C-19 |
| Inside Micrometers | C-11-18 |
| Small Hole Gage Set | B-47 |
| Telescoping Gage Set | B-47 |
| Tubular Inside Micrometers | C-11,12,14-17 |
| Vernier Calipers | D-10-16,22-27,29 |
| **■ TWO-DIMENSIONAL** | |
| Measuring Microscopes | I-16-22 |
| Profile Projectors | I-2-11 |
| QM-Data200 | I-25,26 |
| Quick Image Non-contact 2D Vision Measuring System | M-3 |
| Toolmakers' Microscopes | I-16 |
| Vision Unit | I-27 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## MEASUREMENT OF OUTSIDE DIMENSIONS


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| Calipers | D-2-32 |
| Dial Thickness Gages | F-50-52 |
| Digimatic Thickness Gages | F-50-52 |
| Dial Caliper Gages | F-56,57 |
| Dial Snap Gages | F-59 |
| Outside Micrometers | B-9,11-19 |
| Digital Outside Micrometers | B-42 |
| Digimatic Micrometers | B-2-8,18,20-24,27-29,31,32,34-36,38,45 |
| Quickmike | B-8 |
| Litematic | G-27 |
| Steel Rules | E-34,35 |
| Working Standard Scales | E-32 |
| Working Standard Scales | E-32 |
| **■ TWO-DIMENSIONAL** | |
| Measuring Microscopes | I-16-22 |
| Profile Projectors | I-2-11 |
| QM-Data200 | I-25,26 |
| Quick Image Non-contact 2D Vision Measuring System | M-3 |
| Toolmakers' Microscopes | I-16 |
| Vision Unit | I-27 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## ANGLE MEASUREMENT


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| Bevel Protractor | E-38 |
| Digital Universal Protractor | E-41 |
| Universal Bevel Protractor | E-38 |
| **■ TWO-DIMENSIONAL** | |
| Measuring Microscopes | I-16-22 |
| Profile Projectors | I-2-11 |
| QM-Data200 | I-25,26 |
| Quick Image Non-contact 2D Vision Measuring System | M-3 |
| Toolmakers' Microscopes | I-16 |
| Vision Unit | I-27 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |




Mitutoyo

# APPLICATIONS INDEX

## DEPTH MEASUREMENT


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| ABSOLUTE Digimatic Calipers | D3-7,15,17,20-30 |
| ABSOLUTE Digimatic Depth Gages | D-52, 53, 55,57,58 |
| Depth Base Attachment (Vernier Caliper) | D-33 |
| Depth Micrometers | D-50,51 |
| Dial Calipers | D-8,9 |
| Dial Depth Gage | D-56-58 |
| Digimatic Depth Micrometers | D-50 |
| Extension Bases (Optional accessory for Depth Gage) | D-56 |
| Vernier Calipers | D-10-16,22-27,29 |
| Vernier Depth Gages | D-54.55 |
| **■ TWO-DIMENSIONAL** | |
| Linear Height | D-36,37 |
| Measuring Microscopes | I-16-22 |
| Vision Unit | I-27 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## HEIGHT MEASUREMENT


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| Black Granite Surface Plates | E-45 |
| Dial Height Gages | D-42 |
| Digimatic Height Gages | D-40,41,43,44 |
| Height Master | E-25 |
| QM-Height | D-38,39 |
| Universal Height Master | E-28 |
| Vernier Height Gages | D-45,46 |
| **■ TWO-DIMENSIONAL** | |
| Linear Height | D-36,37 |
| Measuring Microscopes | I-16-22 |
| Vision Unit | I-27 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## MEASUREMENT OF COMPLEX 3D PARTS


| | Page |
|---|---|
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## COMPARISON MEASUREMENT


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| Bore Gages | C-10-28 |
| Borematic | C-8-10 |
| Calibration Tester | F-49 |
| Comparator Stands | F-64 |
| Dial Gage Stands | F-61 |
| Dial Indicators | F-15-32 |
| Dial Snap Gages | F-59 |
| Dial Snap Meters | B-44 |
| Dial Test Indicators | F-39-46 |
| Digimatic Height Gages | D-40,41,43,44 |
| Digimatic Holtest | C-2,3,10 |
| Digimatic Indicators | F-2-13 |
| Digimatic Micrometers | B-2-8,18,20-24,27-29,31,32,34-36,38,45 |
| Gage Block Comparator | E-24 |
| Gage Blocks | E-2-19 |
| Height Master | E-25 |
| Indicating Micrometers | B-43 |
| Laser Scan Micrometers | G-36-43 |
| Linear Gages | G-4-17 |
| Litematic | G-27 |
| Mu-Checker (In-process measurement) | G-30-33 |
| QM-Height | D-38,39 |
| Telescoping Gage Set | B-47 |
| QM-Height | D-38 - D-39 |
| Telescoping Gage Set | B-47 |
| **■ TWO-DIMENSIONAL** | |
| Linear Height | D-36,37 |
| Measuring Microscopes | I-16-22 |
| Profile Projectors | I-2-11 |
| QM-Data200 | I-25,26 |
| Quick Image Non-contact 2D Vision Measuring System | M-3 |
| Toolmakers' Microscopes | I-16 |
| Vision Unit | I-27 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |

## STEP MEASUREMENT


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| ABSOLUTE Digimatic Calipers | D3-7,15,17,20-30 |
| Dial Calipers | D-8,9 |
| Dial Height Gages | D-42 |
| Dial Indicators | F-15-32 |
| Dial Test Indicators | F-39-46 |
| Digimatic Height Gages | D-40,41,43,44 |
| Digimatic Indicators | F-2-13 |
| Linear Gages | G-4-17 |
| Mu-Checker (In-process measurement) | G-30-33 |
| QM-Height | D-38,39 |
| Uni-Mike | B-29 |
| Vernier Calipers | D-10-16,22-27,29 |
| Vernier Height Gages | D-45,46 |
| **■ TWO-DIMENSIONAL** | |
| Linear Height | D-36,37 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## MEASUREMENT OF ELASTIC PARTS


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| ABSOLUTE Low Force Caliper | D-28 |
| Litematic | G-27 |
| Litematic Head | G-27 |
| **■ TWO-DIMENSIONAL** | |
| Measuring Microscopes | I-16-22 |
| Profile Projectors | I-2-11 |
| Quick Image Non-contact 2D Vision Measuring System | M-3 |
| Toolmakers' Microscopes | I-16 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## MEASUREMENT OF SHEET METALS


| | Page |
|---|---|
| Laser Scan Micrometers | G-36-43 |
| Sheet Metal Micrometers | B-30 |


## NON-CONTACT MEASUREMENT


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| Laser Scan Micrometers | G-36-43 |
| **■ TWO-DIMENSIONAL** | |
| Measuring Microscopes | I-16-22 |
| Profile Projectors | I-2-11 |
| Toolmakers' Microscopes | I-16 |
| **■ THREE-DIMENSIONAL** | |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## MULTI-POINT MEASUREMENT


| | Page |
|---|---|
| Dial Indicators | F-15-32 |
| Digimatic Indicators | F-2-13 |
| Linear Gage Counter (EC, EG, EB, EV) | G-20-25 |
| Linear Gages | G-4-17 |
| Mu-Checker | G-30-33 |


## MEASURING INSTRUMENTS TO BE USED AS SENSORS


| | Page |
|---|---|
| ABSOLUTE Digimatic Scale Units | H-2-5 |
| Dial Indicators | F-15-32 |
| Dial Test Indicators | F-39-46 |
| Digimatic Indicators | F-2-13 |
| Laser Scan Micrometers | G-36-43 |
| Linear Gages | G-4-17 |
| Linear Scale | H-10-29 |
| MICSYS 2D Non-contact Encoder | H-18 |
| Mu-Checker (In-process measurement) | G-30-33 |


## MEASUREMENT OF FORM (SURFACE ROUGHNESS, ROUNDNESS), SQUARENESS, AND PARALLELISM


| | Page |
|---|---|
| Bench Centers | E-43 |
| Black Granite Surface Plates | E-45 |
| Contracer | J-28-31 |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Dial Test Indicators | F-39-46 |
| Formtracer | J-14-21 |
| High Precision Squares | E-33 |
| Mu-Checker (use together with Height Gages, etc.) | G-30-33 |
| Optical Flats | B-50 |
| Optical Parallels | B-50 |
| Precision Levels | E-36 |
| Roundtest | J-39-48 |
| Square Master | E-31 |
| Surftest | J-2-13 |

# APPLICATIONS INDEX

## MEASUREMENT OF CENTER-TO-CENTER DISTANCES


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| ABSOLUTE Digimatic and Vernier Calipers (Offset) | D-15 |
| Black Granite Surface Plates | E-45 |
| QM-Height | D-38,39 |
| **■ TWO-DIMENSIONAL** | |
| Linear Height | D-36,37 |
| Measuring Microscopes | I-16-22 |
| Profile Projectors | I-2-11 |
| QM-Data200 | I-25,26 |
| Quick Image Non-contact 2D Vision Measuring System | M-3 |
| Toolmakers' Microscopes | I-16 |
| Vision Unit | I-27 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## SCREW THREAD MEASUREMENT


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| 3-Wire Units | B-39 |
| Digimatic Micrometers | B-2-8,18,20-24,27-29,31,32, 34-36,38,45 |
| Digital Outside Micrometers | B-42 |
| Outside Micrometers | B-9,11-19 |
| Point Micrometers | B-21 |
| Screw Thread Micrometers | B-37,38 |
| Thread Pitch Gages | E-39 |
| V-Anvil Micrometers | B-23,24,29 |
| **■ TWO-DIMENSIONAL** | |
| Contracer | J-28-31 |
| Measuring Microscopes | I-16-22 |
| Profile Projectors | I-2-11 |
| QM-Data200 | I-25,26 |
| Quick Image Non-contact 2D Vision Measuring System | M-3 |
| Toolmakers' Microscopes | I-16 |
| Vision Unit | I-27 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |


## MEASUREMENT OF GEARS


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| Disk Micrometers | B-32-35 |
| Gear Tooth Micrometers | B-36 |
| **■ TWO-DIMENSIONAL** | |
| Measuring Microscopes | I-15 - I-20 |
| Profile Projectors | I-2 - I-11 |
| QM-Data200 | I-23 - I-24 |
| Quick Image Non-contact 2D Vision Measuring System | M-3 |
| Toolmakers' Microscopes | I-14 |
| Vision Unit | I-25 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3 - L-15 |
| Quick Scope Manual Vision Measuring System | M-11 |
| Quick Vision Series | M-2 |
| UMAP Micro-form Measuring System | M-4 - M-12 |


## HARDNESS MEASUREMENT


| | Page |
|---|---|
| Durometers | K-14 |
| Hardness Testing Machines | K-2-14 |


## MEASUREMENT ASSOCIATED WITH SEMICONDUCTOR/LCD FABRICATION


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| ABSOLUTE Digimatic Calipers | D3-7,15,17,20-30 |
| Dial Calipers | D-8,9 |
| Dial Indicators | F-15-32 |
| Dial Test Indicators | F-39-46 |
| Digimatic Indicators | F-2-13 |
| Digimatic Micrometers | B-2-8,18,20-24,27-29,31,32,34-36,38,45 |
| Linear Gages | G-4-17 |
| Litematic | G-27 |
| Mu-Checker | G-30-33 |
| Outside Micrometers | B-9,11-19 |
| Outside Micrometers | B-9,11-19 |
| Vernier Calipers | D-10-16,22-27,29 |
| **■ TWO-DIMENSIONAL** | |
| FS-70 Semiconductor Inspection Microscope Unit | I-26 |
| Measuring Microscopes | I-16-22 |
| Objectives and Eyepieces | I-28-32 |
| Profile Projectors | I-2-11 |
| QM-Data200 | I-25,26 |
| Quick Image Non-contact 2D Vision Measuring System | M-3 |
| Toolmakers' Microscopes | I-16 |
| Vision Unit | I-27 |
| VMU Video Microscope Unit | I-29 |
| Wide VMU | J-27 |
| **■ THREE-DIMENSIONAL** | |
| Quick Scope Manual Vision Measuring System | M-2 |
| Quick Vision Series | M-4-10,12,13 |
| UMAP Micro-form Measuring System | M-11 |

## DIGITAL READOUT AND POSITION FEEDBACK OF MACHINE TOOLS


| | Page |
|---|---|
| ABSOLUTE Digimatic Scale Units | H-2-5 |
| Linear Gages | G-4-17 |
| Linear Scale | H-10-29 |


## STATISTICAL PROCESS CONTROL


| | Page |
|---|---|
| Digimatic Mini-Processor DP-1VA | A-19 |
| Input Tool | A-11 |
| MeasurLink | A-2-10 |
| Multiplexer MIG8USB, MIG4USB | A-17 |
| USB Input Tool Direct: USB-ITN | A-12,13 |
| U-Wave System | A14-16 |


## MEASUREMENT IN ROLL FORMING


| | Page |
|---|---|
| **■ ONE-DIMENSIONAL** | |
| ABSOLUTE Digimatic Calipers | D3-7,15,17,20-30 |
| Black Granite Surface Plates | E-45 |
| Bore Gages | C-10-28 |
| Dial Calipers | D-8,9 |
| Dial Height Gages | D-42 |
| Dial Indicators | F-15-32 |
| Dial Test Indicators | F-39-46 |
| Digimatic Height Gages | D-40,41,43,44 |
| Digimatic Indicators | F-2-13 |
| Digimatic Micrometers | B-2-8,18,20-24,27-29,31,32,34-36,38,45 |
| Digital Outside Micrometers | B-42 |
| Laser Scan Micrometers | G-36-43 |
| Linear Gages | G-4-17 |
| Mu-Checker | G-30-33 |
| Outside Micrometers | B-9,11-19 |
| QM-Height | D-38,39 |
| Vernier Calipers | D-10-16,22-27,29 |
| Vernier Height Gages | D-45,46 |
| **■ TWO-DIMENSIONAL** | |
| Linear Height | D-36,37 |
| **■ THREE-DIMENSIONAL** | |
| Coordinate Measuring Machines (CMM) | L-3-15 |
| Quick Vision Series | M-4-10,12,13 |
| Roundtest | J-39-48 |
| Surftest | J-2-13 |
| UMAP Micro-form Measuring System | M-11 |




Mitutoyo

# NUMERICAL INDEX


| Series No. | Description | Page |
|---|---|---|
| **0-99** | | |
| 0 | Dial Indicators | F-15 |
| 0 | Dial Indicators | F-16 |
| 1 | Dial Indicators | F-17-19 |
| 1 | Back Plunger Dial Indicators | F-31,32 |
| 2 | Dial Indicators | F-20-27 |
| 2 | Back Plunger Dial Indicators | F-31,32 |
| 3 | Dial Indicators | F-28,29 |
| 4 | Dial Indicators | F-30 |
| 7 | Micro Jack | B-72 |
| 7 | ABSOLUTE Digimatic/Dial Depth Gage | D-57,58 |
| 7 | Thickness Gages | F-50-52 |
| 7 | Dial/Test Indicator & Magnetic Stand Sets | F-60 |
| 7 | Magnetic Stands | F-60 |
| 7 | Dial Gage Stands | F-61 |
| **100-199** | | |
| 101 | Outside Micrometers | B-9 |
| 102 | Ratchet-Thimble Micrometer | B-10 |
| 102 | Outside Micrometers | B-11 |
| 103 | Outside Micrometers | B-12-14 |
| 104 | Outside Micrometers | B-15,16 |
| 105 | Outside Micrometers | B-17 |
| 107 | Outside Micrometers | B-19 |
| 110 | Micrometer Heads | B-69 |
| 111 | Spline Micrometers | B-20 |
| 112 | Point Micrometers | B-21 |
| 112 | Crimp Height Micrometers | B-22 |
| 113 | Limit Micrometers | B-25 |
| 114 | V-Anvil Micrometers | B-23,24 |
| 115 | Spherical Face Micrometers | B-27 |
| 115 | Tube Micrometers | B-28 |
| 116 | Pana Micrometers | B-26 |
| 117 | Uni-Mike | B-29 |
| 118 | Sheet Metal Micrometers | B-30 |
| 119 | Sheet Metal Micrometers | B-30 |
| 122 | Blade Micrometers | B-31 |
| 123 | Disk Micrometers | B-32-35 |
| 124 | Gear-Tooth Micrometers | B-36 |
| 125 | Screw Thread Micrometers | B-37 |
| 126 | Screw Thread Micrometers | B-38 |
| 128 | Depth Micrometer | D-51 |
| 129 | Depth Micrometer | D-50 |
| 133 | Tubular Inside Micrometers | C-11-12 |
| 137 | Tubular Inside Micrometers | C-15 |
| 139 | Tubular Inside Micrometers | C-16 |
| 140 | Tubular Inside Micrometers | C-17 |
| 141 | Inside Micrometers | C-13 |
| 142 | Point Micrometers | B-21 |
| 142 | Crimp Height Micrometers | B-22 |
| 143 | Caliper-Type Micrometers | B-45 |
| 145 | Inside Micrometers | C-18 |
| 146 | Groove Micrometers | B-46 |
| 147 | Can Seam Micrometers | B-40 |
| 147 | Hub Micrometers | B-41 |
| 147 | Wire Micrometers | B-41 |
| 148 | Micrometer Heads | B-58-63 |
| 149 | Micrometer Heads | B-64 |
| 150 | Micrometer Heads | B-65 |
| 151 | Micrometer Heads | B-66 |
| 152 | Micrometer Heads | B-68,70 |
| 153 | Micrometer Heads | B-67,153 |
| 154 | Small-Hole Gage Set | B-47 |
| 155 | Telescoping Gage Set | B-47 |
| 156 | Micrometer Stands | B-48 |
| 157 | Optical Parallels | B-50 |
| 158 | Optical Flats | B-50 |
| 160 | Vernier Caliper | D-14 |
| 160 | ABSOLUTE Digimatic & Vernier Caliper | D-15 |
| 164 | Digimatic Micrometer Heads | B-56 |
| 167 | Micrometer Standards | B-51 |
| 167 | Standards for Screw Thread Micrometers | B-52 |
| 167 | Standards for V-Anvil Micrometers | B-52 |
| 169 | Disk Micrometers | B-32-35 |
| 169 | Paper Thickness Micrometers | B-33 |
| 170 | i-Checker | F-48 |
| 170 | UDT-2 Dial Gage Testers | F-49 |
| 172 | PH-A14 | I-8,9 |
| 172 | PH-3515F | I-10,11 |
| 172 | Accessories for Profile Projectors | I-12 |
| 174 | KA-200 Counter | H-7 |
| 174 | KLD200 Counter | H-7 |
| 176 | TM-505B/1005B Toolmakers' Microscopes | I-16 |
| 176 | MF Measuring Microscopes | I-17,18 |
| 176 | MF Motorized Type | I-19 |
| 176 | MF-U High-power Multi-function | I-20,21 |
| 176 | MF-U Motorized Type Universal | I-22 |
| 177 | Setting Rings | C-29,30 |
| 178 | Surftest SJ-210 | J-2 |
| 178 | Surftest SJ-310 | J-3 |
| 178 | Surftest SJ-210/310 Optional Accessories | J-4,5 |
| 178 | Surftest SJ-410 | J-6,7 |
| 178 | Surftest SJ-500/P, SV-2100 | J-8,9 |
| 178 | Surftest SV-3200 | J-10,11 |
| 178 | Surftest Extreme SV-3000CNC | J-12 |
| 178 | Surftest Extreme SV-M3000CNC | J-13 |
| 181 | V-Block Sets | F-58 |
| 181 | Magnetic V-Block | F-58 |
| 182 | Standard Scales | E-32 |
| 182 | Working Standard Scales | E-32 |
| 182 | Steel Rules | E-34,35 |
| 182 | Semi-Flexible Rules | E-35 |
| 183 | Pocket Magnifiers | I-39 |
| 183 | Pocket Comparators | I-39 |
| 183 | Zoom Loupe | I-39 |
| 183 | Clear Loupe | I-39 |
| 184 | Thickness/Feeler Gages | E-36 |

| Series No. | Description | Page |
|---|---|---|
| 186 | Radius Gages | E-39 |
| 186 | Radius Gages-Sets | E-40 |
| 187 | Digital Universal Protractor | E-37 |
| 187 | Universal Bevel Protractor | E-38 |
| 187 | Bevel Protractor | E-38 |
| 188 | Pitch Gages | E-39 |
| 191 | CRYSTA-Apex S 500/700/900/1200 S eries 191 — Standard CNC | L-4, 5 |
| 191 | CRYSTA-Apex EX 500T/700T/900T Series PH20-Equipped 5-Axis CNC CMM | L-6 |
| 191 | CRYSTA-Apex EX 1200R Series — REVO-Equipped 5-Axis CNC CMM | L-7 |
| 191 | CRYSTA-Apex S 1600/2000 Series 191 — Standard CNC CMM | L-8 |
| 192 | Digimatic Height Gage | D-40,41 |
| 192 | Dial Height Gage | D-42 |
| 193 | Digital Outside Micrometers | B-42 |
| 196 | CrystaPlus M Series 196 — Manual Floating CMM | L-3 |
| 197 | Micrometer Heads | B-71 |
| **200-299** | | |
| 201 | Dial Snap Gages | F-59 |
| 209 | Digimatic Caliper Gages | F-54,55 |
| 209 | Dial Caliper Gages | F-56,57 |
| 211 | Roundtest RA-120 / 120P | J-39,40 |
| 211 | Roundtest RA-1600 / RA-1600M | J-41,42 |
| 211 | Roundtest RA-2200AS / DS / AH / DH | J-43,44 |
| 211 | Roundtest RA-H5200AS / AH | J-45,46 |
| 211 | Roundtest Extreme RA-2200CNC / RA-H5200CNC | J-47,48 |
| 215 | Granite Comparator Stands | F-63 |
| 215 | Comparator Stands | F-64 |
| 218 | Contracer CV-2100 | J-28,29 |
| 218 | Contracer CV-3200 / CV-4500 | J-30,31 |
| 223 | Disk Micrometers | B-32-35 |
| 227 | ABSOLUTE Digimatic Micrometers | B-7 |
| 227 | Disk Micrometers | B-32-35 |
| 250 | Micrometer Heads | B-72 |
| 264 | Input Tools | A-11 |
| 264 | DP-1VA | A-19 |
| 264 | QM-Data200 2-D Processing Unit | I-25,26 |
| 293 | Coolant-Proof Micrometer | B-2,3 |
| 293 | Digimatic Micrometer | B-4 |
| 293 | Digimatic Micrometer- MDC- Lite | B-4 |
| 293 | MDH Micrometer | B-5 |
| 293 | QuantuMike | B-6 |
| 293 | Quickmike | B-8 |
| 295 | Spherical Face Micrometers | B-27 |
| 295 | Tube Micrometers | B-28 |
| **300-399** | | |
| 302 | PJ-A3000-Vertical | I-2,3 |
| 303 | PJ-H30-High Accuracy | I-4,5 |
| 304 | PV-5110 | I-6,7 |
| 311 | CERA Straight Master SM-C | E-30 |
| 311 | Square Master | E-31 |
| 311 | High-Precision Square | E-33 |
| 314 | V-Anvil Micrometers | B-23,24 |

| Series No. | Description | Page |
|---|---|---|
| 317 | Uni-Mike | B-29 |
| 318 | Litematic G-27 | G-27 |
| 323 | Disk Micrometers | B-32-35 |
| 324 | Gear-Tooth Micrometers | B-36 |
| 326 | Screw Thread Micrometers | B-38 |
| 329 | Depth Micrometer | D-50 |
| 331 | Spline Micrometers | B-20 |
| 337 | Digimatic Tubular Inside Micrometers | C-14 |
| 339 | Digimatic Tubular Inside Micrometers | C-14 |
| 340 | Outside Micrometers | B-15,16 |
| 342 | Point Micrometers | B-21 |
| 342 | Crimp Height Micrometers | B-22 |
| 343 | Caliper-Type Micrometers | B-45 |
| 345 | Inside Micrometers | C-18 |
| 350 | Digimatic Micrometer Heads | B-57 |
| 355 | STRATO-Apex 500/700/900 Series 355 — High-Accuracy CNC CMM | L-9 |
| 355 | STRATO-Apex 1600 Series 355 — High-Accuracy CNC CMM | L-10 |
| 355 | FALCIO-Apex 2000/3000 Series 355 — High-Accuracy Large CNC CMM | L-11 |
| 356 | LEGEX 500/700/900 Series 356 — Ultra-High Accuracy CNC CMM | L-12 |
| 359 | Vision Unit System Retrofit | I-27 |
| 359 | Quick Scope Series 359 — Manual Vision Measuring Sy stem | M-2 |
| 360 | MACH-V 9106 Series 360 – Inline CNC CMM | L-13 |
| 360 | MACH-3A 653 Series 360 – Inline CNC CMM | L-13 |
| 360 | MACH KO-GA-ME Series 360 – Inline CNC CMM | L-14 |
| 361 | Quick Image Series 361 — Non-contact 2D Vision Measuring System | M-3 |
| 363 | QV Apex Series 363 — CNC Vision Measuring System | M-5 |
| 363 | QV Stream Plus Series 363 — CNC Vision Measuring System | M-6 |
| 363 | QV Hyper Series 363 — High-Accuracy CNC Vision Measuring System | M-7 |
| 363 | QV-WLI Series 363 — CNC Video Measuring System with White Light Interferometry | M-9 |
| 363 | ULTRA QV Series 363 — Ultra-High Accuracy CNC Vision Measuring System | M-10 |
| 363 | QV ACCEL Series 363 — Large-Format CNC Vision Measuring System | M-12 |
| 364 | UMAP Vision System TYPE2 Series 364 — Micro Form Measuring System | M-11 |
| 365 | QV Hybrid Type 1, Type 4 Series 365 — CNC Vision Measuring System | M-8 |
| 368 | Holtest | C-4,5 |
| 368 | Holtest (Type II) | C-6,7 |
| 368 | Holtest/Digimatic Holtest/Boremat ic | C-10 |
| 369 | Disk Micrometers | B-32-35 |
| 377 | MSM-400 Stereo Microscopes | I-35-38 |
| 378 | FS-70 For Semiconductor Inspection | I-28 |
| 378 | VMU Video Microscope Unit | I-29 |
| 378 | Eyepieces | I-30 |
| 378 | Objectives | I-30-34 |
| 389 | Sheet Metal Micrometers | B-30 |
| 395 | Spherical Face Micrometers | B-27 |
| 395 | Tube Micrometers | B-28 |




Mitutoyo

# NUMERICAL INDEX


| Series No. | Description | Page |
|---|---|---|
| **400-499** | | |
| 406 | Outside Micrometers | B-18 |
| 422 | Blade Micrometers | B-31 |
| 468 | Digimatic Holtest | C-2,3 |
| 468 | Holtest/Digimatic Holtest/Boremetic | C-10 |
| **500-599** | | |
| 500 | Super Caliper-Solar Powered | D-2 |
| 500 | ABSOLUTE Solar Caliper | D-3 |
| 500 | ABSOLUTE Coolant-Proof Caliper | D-4,5 |
| 500 | ABSOLUTE Digimatic Caliper | D-6,7 |
| 505 | Dial Caliper | D-8,9 |
| 510 | Indicating Micrometers | B-43 |
| 511 | Bore Gages | C-20-26,28 |
| 511 | ABSOLUTE Digimatic Bore Gage | C-27 |
| 513 | Dial Test Indicators | F-39-43 |
| 513 | Pocket Dial Test Indicators | F-44,45 |
| 513 | Dial Test Indicators | F-46 |
| 514 | Vernier Height Gage | D-45,46 |
| 515 | Inside Micro Checker | C-19 |
| 515 | Bore Gage Zero Checker | C-29 |
| 515 | CERA Caliper Checker | D-49 |
| 515 | Depth Micro Checker | D-51 |
| 515 | Height Master | E-25 |
| 515 | Digital Height Master | E-26 |
| 515 | Riser Blocks | E-27 |
| 515 | Auxiliary Block Kit | E-27 |
| 515 | Universal Height Master | E-28 |
| 515 | High-Accuracy Check Master HMC-H | E-29 |
| 516 | Gage Blocks | E-2-4 |
| 516 | Metric Rectangular Gage Block Set | E-5,6 |
| 516 | Inch Rectangular Gage Block Set | E-7 |
| 516 | Micrometer Inspection Gage Block Sets | E-8 |
| 516 | Bore Gage Calibration Kit | E-8 |
| 516 | Rectangular Gage Block Accessories | E-13-15 |
| 516 | Metric Square Gage Block Set | E-16 |
| 516 | Inch Square Gage Block Set | E-17 |
| 516 | Square Gage Block Accessories | E-20,21 |
| 516 | Maintenance Kit for Gage Block | E-22 |
| 516 | Step Master | E-23 |
| 517 | Granite Surface Plate Accessories | E-43 |
| 517 | Black Granite Surface Plate | E-44,45 |
| 517 | Steel Stands | E-45 |
| 517 | Precision Granite Stands | F-65 |
| 518 | QM-Height | D-38,39 |
| 519 | Transfer Stands | F-62 |
| 519 | Mu-checker Probes | G-30,31 |
| 519 | Mu-checker | G-32,33 |
| 521 | Calibration Testers | F-49 |
| 523 | Snap Meters | B-43 |
| 523 | Dial Snap Meters | B-44 |
| 525 | Formtracer SV-C3200 / SV-C4500 | J-14,15 |
| 525 | Formtracer Extreme SV-C4500CNC | J-16,17 |
| 525 | Formtracer CS-3200 | J-18,19 |
| 525 | Formtracer Extreme CS-5000CNC / CS-H5000CNC | J-20,21 |
| 526 | Bore Gages | C-28 |
| 527 | Vernier Depth Gage | D-54,55 |
| 527 | Dial-Depth Gage | D-56 |
| 529 | Linear Scales AT216-T / AT217-TL | H-25 |
| 530 | Vernier Caliper | D-10,11 |
| 531 | Vernier Caliper | D-12 |
| 532 | Vernier Caliper | D-13 |
| 534 | Long-Jaw Vernier Caliper | D-16 |
| 536 | Offset Caliper | D-22 |
| 536 | Offset Centerline Caliper | D-23 |
| 536 | Point Caliper | D-24 |
| 536 | Blade-Type Caliper | D-25 |
| 536 | Neck Caliper | D-26 |
| 536 | Tube Thickness Caliper | D-27 |
| 536 | Scribing Caliper | D-29 |
| 536 | ABSOLUTE Inside Caliper | D-30,31 |
| 539 | Linear Scales ABS AT1100 | H-12 |
| 539 | Linear Scales ABS AT300 | H-13 |
| 539 | Linear Scales ABS AT715 | H-14 |
| 539 | Linear Scales ABS AT500 | H-15 |
| 539 | Linear Scales AT103 | H-19 |
| 539 | Linear Scales AT113 | H-20 |
| 539 | Linear Scales AT112-F | H-21 |
| 539 | Linear Scales AT116 | H-22 |
| 539 | Linear Scales AT402E | H-23 |
| 539 | Linear Scales AT203 | H-24 |
| 539 | AT211-A (Multipoint mounting), AT211-B (Double-end mounting) | H-26 |
| 539 | Pulse Signal Interface Unit PSU-200 | H-32 |
| 539 | Signal Conversion Adapter PSU-400E | H-33 |
| 542 | EC Counter | A-18 |
| 542 | EC Counter | F-14 |
| 542 | Linear Gage LGK | G-4 |
| 542 | Linear Gage LGF | G-5 |
| 542 | Linear Gage LGF-Z | G-6 |
| 542 | Linear Gage LGB-Slim | G-7 |
| 542 | Linear Gage LGB2-Slim | G-8,9 |
| 542 | Linear Gage LG-Long Range | G-10,11 |
| 542 | Linear Gage LGF-High Resolution | G-15 |
| 542 | Linear Gage LGB2-High Resolution | G-16 |
| 542 | Linear Gage LGH-High Resolution | G-17 |
| 542 | Laser Hologage LGH-High Resolution | G-18 |
| 542 | EH Counter-Multi Function | G-19 |
| 542 | EC Counter-Single-function | G-20 |
| 542 | EG Counter-Single-function | G-21 |
| 542 | EB Counter-Single-function | G-22 |
| 542 | EV Counter-Multi-function | G-23 |
| 542 | EV Counter System Configuration | G-24 |
| 543 | ABSOLUTE Solar Digimatic Indicator ID-S | F-2,3 |
| 543 | ABSOLUTE Digimatic Indicator ID-C | F-5,6 |
| 543 | ABSOLUTE Digimatic Indicator ID-C Calculation Type | F-7 |
| 543 | ABSOLUTE Digimatic Indicator ID-C With Max./Min. Value Holding Function | F-8 |

| Series No. | Description | Page |
|---|---|---|
| 543 | ABSOLUTE Digimatic Indicator ID-C Specially Designed for Bore Gage Application | F-9 |
| 543 | ABSOLUTE Digimatic Indicator ID-C With Green/Red LED and Go/No-go Signal Output Function | F-10 |
| 543 | ABSOLUTE Digimatic Indicator ID-H | F-11 |
| 543 | ABSOLUTE Digimatic Indicator ID-F | F-12 |
| 543 | ABSOLUTE Digimatic Indicator ID-N / B | F-13 |
| 544 | Laser Scan Micrometer Selection Guide | G-34,35 |
| 544 | Laser Scan Micrometer LSM-6902H | G-36 |
| 544 | Laser Scan Micrometer LSM-500S | G-37 |
| 544 | Laser Scan Micrometer LSM-501S | G-38 |
| 544 | Laser Scan Micrometer LSM-503S | G-39 |
| 544 | Laser Scan Micrometer LSM-506S | G-40 |
| 544 | Laser Scan Micrometer LSM-512S | G-41 |
| 544 | Laser Scan Micrometer LSM-516S | G-42 |
| 544 | Laser Scan Micrometer LSM-9506 | G-43 |
| 544 | LSM-6200 Display Unit | G-44 |
| 544 | LSM-5200 Display Unit | G-45 |
| 544 | Laser Scan Micrometer Optional Accessories | G-46-49 |
| 546 | Dial Tension Gages | F-58 |
| 547 | ABSOLUTE Digimatic/Dial Depth Gage | D-57,58 |
| 547 | Thickness Gages | F-50-52 |
| 549 | MICSYS | H-18 |
| 550 | ABSOLUTE Digimatic & Vernier Caliper | D-15 |
| 551 | ABSOLUTE Digimatic Caliper | D-17 |
| 552 | Digimatic Carbon-Fiber Caliper | D-18,19 |
| 552 | ABSOLUTE Coolant-Proof Carbon-Fiber Caliper | D-20 |
| 565 | Gage Block Comparator GBCD-250 | E-24 |
| 565 | Gage Block Comparator GBCD-100A | E-24 |
| 568 | Borematic | C-8,9 |
| 568 | Holtest/Digimatic Holtest/Borematic | C-10 |
| 570 | ABSOLUTE Digimatic Height Gage | D-43,44 |
| 571 | Tire Tread Depth Gage | D-53 |
| 571 | ABSOLUTE Point-Type Digimatic Depth Gage | D-53 |
| 571 | ABSOLUTE Digimatic Depth Gage | D-55 |
| 572 | SD ABSOLUTE Digimatic Scale Units | H-2,3 |
| 572 | ABSOLUTE Digimatic Scale Units | H-4,5 |
| 573 | ABSOLUTE Back-Jaw Centerline Caliper | D-21 |
| 573 | Offset Caliper | D-22 |
| 573 | Offset Centerline Caliper | D-23 |
| 573 | Point Caliper | D-24 |
| 573 | Blade-Type Caliper | D-25 |
| 573 | Neck Caliper | D-26 |
| 573 | Tube Thickness Caliper | D-27 |
| 573 | ABSOLUTE Low-Force Caliper | D-28 |
| 573 | ABSOLUTE Snap Caliper | D-28 |
| 573 | Scribing Caliper | D-29 |
| 573 | ABSOLUTE Inside Caliper | D-30,31 |
| 575 | ABSOLUTE Digimatic Indicator ID-U | F-4 |
| 575 | Linear Gage LGD | G-12,13 |
| 575 | Linear Gage LGS | G-14 |
| 579 | Linear Scales ABS ST700 | H-16 |
| 579 | Linear Scales ABS ST1300 | H-17 |
| 579 | Linear Scales ST422 | H-27 |
| 579 | Linear Scales ST46-EZA | H-28 |
| 579 | Linear Scales ST36 | H-29 |
| 579 | Fiber Scale ST-F11 | H-30,31 |

## 700-799

| | | |
|---|---|---|
| 700 | Quick-Mini | F-53 |

## 800-899

| | | |
|---|---|---|
| 810 | HM-210 / 220 Type A | K-3 |
| 810 | HM-200 Series with AVPAK Software | K-4 |
| 810 | MZT-500 | K-5 |
| 810 | HV-110 / 120 | K-6,7 |
| 810 | HR-530/530L | K-9 |
| 810 | HR-523/523L | K-10 |
| 810 | Hardmatic HH-411 | K-13 |
| 811 | Hardmatic HH-300 | K-14 |

## 900-999

| | | |
|---|---|---|
| 950 | Spring Dividers and Calipers | E-33 |
| 950 | Thickness/Feeler Gages | E-36 |
| 950 | Pitch Gages | E-39 |
| 950 | Digital Protractor | E-41 |
| 960 | Precision Levels | E-36 |
| 967 | Bench Center | E-43 |
| 982 | Multiplexers – MIG-8USB, MIG-4USB | A-17 |
| 982 | Digital Hand Tachometers | E-42 |
| 811 | Hardmatic HH-300 | K-14 |
| 950 | Digital Protractor | E-42 |
| 950 | Spring Dividers and Calipers | E-33 |
| 950 | Pitch Gages | E-40 |
| 950 | Thickness Gages | E-37 |
| 960 | Precision Levels | E-37 |
| 963 | HR-320MS / 430MR / 430MS | K-10 |
| 967 | Bench Center | E-44 |
| 982 | Digital Hand Tachometers | E-43 |
| 982 | Multiplexers – MIG-8USB, MIG-4USB | A-16 |
| 7000 | Dial Indicator Crystal Setter | F-38 |
| 7000 | Dial Indicator Repair Tool Kit | F-38 |




Mitutoyo

# ALPHABETICAL INDEX


| Description | Series No. | Page |
|---|---|---|
| **A** | | |
| ABSOLUTE Back-Jaw Centerline Caliper | 573 | D-21 |
| ABSOLUTE Coolant-Proof Caliper | 500 | D-4,5 |
| ABSOLUTE Coolant-Proof Carbon-Fiber Caliper | 552 | D-20 |
| ABSOLUTE Digimatic & Vernier Caliper | 550 | D-15 |
| ABSOLUTE Digimatic & Vernier Caliper | 160 | D-15 |
| ABSOLUTE Digimatic Bore Gage | 511 | C-27 |
| ABSOLUTE Digimatic Caliper | 500 | D-6,7 |
| ABSOLUTE Digimatic Caliper | 551 | D-17 |
| ABSOLUTE Digimatic Depth Gage | 571 | D-55 |
| ABSOLUTE Digimatic Height Gage | 570 | D-43,44 |
| ABSOLUTE Digimatic Indicator ID-C | 543 | F-5,6 |
| ABSOLUTE Digimatic Indicator ID-C Calculation Type | 543 | F-7 |
| ABSOLUTE Digimatic Indicator ID-C Specially Designed for Bore Gage Application | 543 | F-9 |
| ABSOLUTE Digimatic Indicator ID-C With Green/Red LED Go/No-go Signal Output Function | 543 | F-10 |
| ABSOLUTE Digimatic Indicator ID-C With Max./Min. Value Holding Function | 543 | F-8 |
| ABSOLUTE Digimatic Indicator ID-F | 543 | F-12 |
| ABSOLUTE Digimatic Indicator ID-H | 543 | F-11 |
| ABSOLUTE Digimatic Indicator ID-N / B | 543 | F-13 |
| ABSOLUTE Digimatic Indicator ID-U | 575 | F-4 |
| ABSOLUTE Digimatic Micrometers | 227 | B-7 |
| ABSOLUTE Digimatic/Dial Depth Gage | 547 | D-57,58 |
| ABSOLUTE Digimatic/Dial Depth Gage | 7 | D-57,58 |
| ABSOLUTE Inside Caliper | 573 | D-30,31 |
| ABSOLUTE Inside Caliper | 536 | D-30,31 |
| ABSOLUTE Low-Force Caliper | 573 | D-28 |
| ABSOLUTE Point-Type Digimatic Depth Gage | 571 | D-53 |
| ABSOLUTE Snap Caliper | 573 | D-28 |
| ABSOLUTE Solar Caliper | 500 | D-3 |
| ABSOLUTE Solar Digimatic Indicator ID-S | 543 | F-2,3 |
| ABSOLUTE Digimatic Scale Units | 572 | H-4,5 |
| Accessories for Measuring Microscope | | I-23,24 |
| Accessories for Profile Projectors | 172 | I-12 |
| Accessories for Quick Vision | | M-14 |
| AT211-A (Multipoint mounting), AT211-B (Double-end mounting) | 539 | H-26 |
| Auxiliary Block Kit | 515 | E-27 |
| **B** | | |
| Back Plunger Dial Indicators | 1, 2 | F-31,32 |
| Backs | | F-33 |
| Bench Center | 967 | E-43 |
| Bevel Protractor | 187 | E-38 |
| Black Granite Surface Plate | 517 | E-44,45 |
| Blade Micrometers | 422 | B-31 |
| Blade Micrometers | 122 | B-31 |
| Blade-Type Caliper | 573 | D-25 |
| Blade-Type Caliper | 536 | D-25 |
| Bore Gage Calibration Kit | 516 | E-8 |
| Bore Gage Zero Checker | 515 | C-29 |
| Bore Gages | 511 | C-20-27 |
| Bore Gages | 526 | C-28 |
| Borematic | 568 | C-8,9 |
| **C** | | |
| Calibration Testers | 521 | F-49 |
| Caliper-Type Micrometers | 343 | B-45 |
| Caliper-Type Micrometers | 143 | B-45 |
| Can Seam Micrometers | 147 | B-40 |
| CARBapex / CARBstrato Series – Car Body Measuring System CNC CMM | | L-15 |
| Carbide-Tipped Scriber | | D-47 |
| Center-Line Gage | | D-33 |
| CERA Caliper Checker | 515 | D-49 |
| CERA Straight Master SM-C | 311 | E-30 |
| Ceraston | | E-22 |
| Clear Loupe | 183 | I-39 |
| CMM Probe & Change Rack Options – Motorized Probe Heads | Probes | L-21 |
| CMM Probe & Change Rack Options – TouchTrigger Probe System | Probes | L-20 |
| CMM Surface Roughness Measuring – CMM Surftest Probe | Probes | L-27 |
| Color Ratchet & Color Speeder | | B-49 |
| Color Spindle Caps | | F-37 |
| Comparator Stands | 215 | F-64 |
| Contact Points | | F-34,35 |
| Contact Points and Clamp Holders | | F-47 |
| Contracer CV-2100 | 218 | J-28,29 |
| Contracer CV-3200 / CV-4500 | 218 | J-30,31 |
| Coolant-Proof Micrometer | 293 | B-2,3 |
| Crimp Height Micrometers | 342 | B-22 |
| Crimp Height Micrometers | 142 | B-22 |
| Crimp Height Micrometers | 112 | B-22 |
| CRYSTA-Apex EX 1200R Series — REVO-Equipped 5-Axis CNC CMM | 191 | L-7 |
| CRYSTA-Apex EX 500T/700T/900T Series PH20-Equipped 5-Axis CNC CMM | 191 | L-6 |
| CRYSTA-Apex S 1600/2000 Series 191 — Standard CNC CMM | 191 | L-8 |
| CRYSTA-Apex S 500/700/900/1200 Series 191 — Standard CNC | 191 | L-4, 5 |
| CrystaPlus M Series 196 — Manual Floating CMM | 196 | L-3 |
| **D** | | |
| Depth Base Attachment | | D-33 |
| Depth Micro Checker | 515 | D-51 |
| Depth Micrometer | 329 | D-50 |
| Depth Micrometer | 129 | D-50 |
| Depth Micrometer | 128 | D-51 |
| D-EV Display Unit | | G-25 |
| Dial Caliper | 505 | D-8,9 |

| Description | Series No. | Page |
|---|---|---|
| Dial Caliper Gages | 209 | F-56,57 |
| Dial Crystal Setter | | F-38 |
| Dial Gage Stands | 7 | F-61 |
| Dial Height Gage | 192 | D-42 |
| Dial Indicator Repair Tool Kit | | F-38 |
| Dial Indicators | 0 | F-16 |
| Dial Indicators | 1 | F-17-19 |
| Dial Indicators | 2 | F-20-27 |
| Dial Indicators | 3 | F-28,29 |
| Dial Indicators | 4 | F-30 |
| Dial Snap Gages | 201 | F-59 |
| Dial Snap Meters | 523 | B-44 |
| Dial Tension Gages | 546 | F-58 |
| Dial Test Indicators | 513 | F-39-43 |
| Dial Test Indicators | 513 | F-46 |
| Dial/Test Indicator & Magnetic Stand Sets | 7 | F-60 |
| Dial-Depth Gage | 527 | D-56 |
| Digimatic Caliper Gages | 209 | F-54,55 |
| Digimatic Carbon-Fiber Caliper | 552 | D-18,19 |
| Digimatic Height Gage | 192 | D-40,41 |
| Digimatic Holtest | 468 | C-2,3 |
| Digimatic Micrometer | 293 | B-4 |
| Digimatic Micrometer Heads | 164 | B-56 |
| Digimatic Micrometer Heads | 350 | B-57 |
| Digimatic Micrometer- MDC- Lite | 293 | B-4 |
| Digimatic Tubular Inside Micrometers | 337 | C-14 |
| Digimatic Tubular Inside Micrometers | 339 | C-14 |
| Digital Hand Tachometers | 982 | E-42 |
| Digital Height Master | 515 | E-26 |
| Digital Outside Micrometers | 193 | B-42 |
| Digital Protractor | 950 | E-41 |
| Digital Readout/ DRO packages 2-Axis/3-Axis Travels | | H-9 |
| Digital Universal Protractor | 187 | E-37 |
| Disk Micrometers | 323,223,123 | B-32-35 |
| Disk Micrometers | 369,227,169 | B-32-35 |
| DP-1VA | 264 | A-19 |
| **E** | | |
| EB Counter-Single-function | 542 | G-22 |
| EC Counter | 542 | F-14 |
| EC Counter-Single-function | 542 | G-20 |
| EC Counter | 542 | A-18 |
| Eco-Fix Kit Form-S & L | | J-52 |
| EG Counter-Single-function | 542 | G-21 |
| EH Counter-Multi Function | 542 | G-19 |
| EV Counter System Configuration | 542 | G-24 |
| EV Counter-Multi-function | 542 | G-23 |
| Extension Bases | | D-56 |
| Eyepieces | 378 | I-30 |

| Description | Series No. | Page |
|---|---|---|
| **F** | | |
| FALCIO-Apex 2000/3000 Series 355 — High-Accuracy Large CNC CMM | 355 | L-11 |
| Fiber Scale ST-F11 | 579 | H-30,31 |
| Fixtures for Micrometer Heads and Linear Gages | | B-74,75 |
| Formtracer CS-3200 | 525 | J-18,19 |
| Formtracer Extreme CS-5000CNC / CS-H5000CNC | 525 | J-20,21 |
| Formtracer Extreme SV-C4500CNC | 525 | J-16,17 |
| Formtracer SV-C3200 / SV-C4500 | 525 | J-14,15 |
| FS-70 For Semiconductor Inspection | 378 | I-28 |
| **G** | | |
| Gage Block Comparator GBCD-100A | 565 | E-24 |
| Gage Block Comparator GBCD-250 | 565 | E-24 |
| Gage Blocks | 516 | E-2-4 |
| Gage Heads / Display Units Selection Guide | | G-2,3 |
| Gage Selector 3 | | A-18 |
| Gear-Tooth Micrometers | 324 | B-36 |
| Gear-Tooth Micrometers | 124 | B-36 |
| Granite Comparator Stands | 215 | F-63 |
| Granite Surface Plate Accessories | 517 | E-43 |
| Groove Micrometers | 146 | B-46 |
| **H** | | |
| Hardmatic HH-300 | 811 | K-14 |
| Hardmatic HH-300 Test Block Set | | K-15 |
| Hardmatic HH-411 | 810 | K-13 |
| Height Master | 515 | E-25 |
| High-Accuracy Check Master HMC-H | 515 | E-29 |
| High-Precision Square | 311 | E-33 |
| HM-200 Series with AVPAK Software | 810 | K-4 |
| HM-210 / 220 Type A | 810 | K-3 |
| Holtest | 368 | C-4,5 |
| Holtest (Type II) | 368 | C-6,7 |
| Holtest/Digimatic Holtest/Boremetic | 368,468,568 | C-10 |
| HR-523/523L | 810 | K-10 |
| HR-530/530L | 810 | K-9 |
| Hub Micrometers | 147 | B-41 |
| HV-110 / 120 | 810 | K-6,7 |
| **I** | | |
| i-Checker | 170 | F-48 |
| Inch Rectangular Gage Block Set | 516 | E-7 |
| Inch Square Gage Block Set | 516 | E-17 |
| Indicating Micrometers | 510 | B-43 |
| Individual Inch Rectangular Gage Block | | E-11 |
| Individual Inch Square Gage Block | | E-19 |
| Individual Metric Rectangular Gage Block | | E-9,10 |
| Individual Metric Square Gage Block | | E-18 |




Mitutoyo

# ALPHABETICAL INDEX


| Description | Series No. | Page |
|---|---|---|
| Input Tools | 264 | A-11 |
| Inside Micro Checker | 515 | C-19 |
| Inside Micrometers | 141 | C-13 |
| Inside Micrometers | 345,145 | C-18 |
| Interface for LSM6200, LSM 6900 | | G-48 |
| **K** | | |
| KA-200 Counter | 174 | H-7 |
| KLD200 Counter | 174 | H-7 |
| **L** | | |
| Laser Hologage LGH-High Resolution | 542 | G-18 |
| Laser Scan Micrometer LSM-500S | 544 | G-37 |
| Laser Scan Micrometer LSM-501S | 544 | G-38 |
| Laser Scan Micrometer LSM-503S | 544 | G-39 |
| Laser Scan Micrometer LSM-506S | 544 | G-40 |
| Laser Scan Micrometer LSM-512S | 544 | G-41 |
| Laser Scan Micrometer LSM-516S | 544 | G-42 |
| Laser Scan Micrometer LSM-6902H | 544 | G-36 |
| Laser Scan Micrometer LSM-9506 | 544 | G-43 |
| Laser Scan Micrometer Optional Accessories | 544 | G-46-49 |
| Laser Scan Micrometer Selection Guide | 544 | G-34,35 |
| LEGEX 500/700/900 Series 356 — Ultra-High Accuracy CNC CMM | 356 | L-12 |
| Limit Micrometers | 113 | B-25 |
| Limit Stickers | | F-37 |
| Linear Gage LGB2-High Resolution | 542 | G-16 |
| Linear Gage LGB2-Slim | 542 | G-8,9 |
| Linear Gage LGB-Slim | 542 | G-7 |
| Linear Gage LGD | 575 | G-12,13 |
| Linear Gage LGF | 542 | G-5 |
| Linear Gage LGF-High Resolution | 542 | G-15 |
| Linear Gage LGF-Z | 542 | G-6 |
| Linear Gage LGH-High Resolution | 542 | G-17 |
| Linear Gage LGK | 542 | G-4 |
| Linear Gage LG-Long Range | 542 | G-10,11 |
| Linear Gage LGS | 575 | G-14 |
| Linear Height LH-600E | | D-36,37 |
| Linear Scales ST36 | 579 | H-29 |
| Linear Scale Counter | | H-8 |
| Linear Scales ABS AT1100 | 539 | H-12 |
| Linear Scales ABS AT300 | 539 | H-13 |
| Linear Scales ABS AT500 | 539 | H-15 |
| Linear Scales ABS AT715 | 539 | H-14 |
| Linear Scales ABS ST1300 | 579 | H-17 |
| Linear Scales ABS ST700 | 579 | H-16 |
| Linear Scales AT103 | 539 | H-19 |
| Linear Scales AT112-F | 539 | H-21 |
| Linear Scales AT113 | 539 | H-20 |
| Linear Scales AT116 | 539 | H-22 |
| Linear Scales AT203 | 539 | H-24 |
| Linear Scales AT216-T / AT217-TL | 529 | H-25 |
| Linear Scales AT402E | 539 | H-23 |
| Linear Scales ST422 | 579 | H-27 |
| Linear Scales ST46-EZA | 579 | H-28 |
| Linear Scales System Diagram | | H-10,11 |
| Lineup of Hardness Testing Machines | | K-2 |
| Litematic G-27 | 318 | G-27 |
| Long-Jaw Vernier Caliper | 534 | D-16 |
| LSM-5200 Display Unit | 544 | G-45 |
| LSM-6200 Display Unit | 544 | G-44 |
| **M** | | |
| MACH KO-GA-ME Series 360 – Inline CNC CMM | 360 | L-14 |
| MACH-3A 653 Series 360 – Inline CNC CMM | 360 | L-13 |
| MACH-V 9106 Series 360 – Inline CNC CMM | 360 | L-13 |
| Made-to-Order Block & Reference | | E-23 |
| Magnetic Stands | 7 | F-60 |
| Magnetic V-Block | 181 | F-58 |
| Maintenance Kit for Gage Block | 516 | E-22 |
| MCOSMOS Software for Manual / CNC Coordinate Measuring Machines | | L-16,17 |
| MDH Micrometer | 293 | B-5 |
| MeasurLink | | A-2-10 |
| Metric Rectangular Gage Block Set | 516 | E-5,6 |
| Metric Square Gage Block Set | 516 | E-16 |
| MF Measuring Microscopes | 176 | I-17,18 |
| MF Motorized Type | 176 | I-19 |
| MF-U High-power Multi-function | 176 | I-20,21 |
| MF-U Motorized Type Universal | 176 | I-22 |
| MiCAT Planner — Automatic Measurement Program Generation Software | | L-18,19 |
| Micro Jack | 7 | B-72 |
| Micrometer Head Selection Guide | | B-55 |
| Micrometer Heads | 148 | B-58-63 |
| Micrometer Heads | 149 | B-64 |
| Micrometer Heads | 150 | B-65 |
| Micrometer Heads | 151 | B-66 |
| Micrometer Heads | 153 | B-67 |
| Micrometer Heads | 152 | B-68,70 |
| Micrometer Heads | 110 | B-69 |
| Micrometer Heads | 197 | B-71 |
| Micrometer Heads | 250 | B-72 |
| Micrometer Heads for Profile Projectors and Toolmakers' Microscopes | | I-12 |
| Micrometer Inspection Gage Block Sets | 516 | E-8 |
| Micrometer Oil | | B-49 |
| Micrometer Standards | 167 | B-51 |
| Micrometer Stands | 156 | B-48 |
| MICSYS | 549 | H-18 |
| Mitutoyo CMM Accuracy Statements | | L-2 |
| Mitutoyo ECO-FIX Kit Fixture Systems | | L-29 |
| Mitutoyo Styli Kits | | L-28 |

| Description | Series No. | Page |
|---|---|---|
| MSM-400 Stereo Microscopes | 377 | I-35-38 |
| MSURF Software for Manual / CNC Coordinate Measuring Machines | | L-24,25 |
| Mu-checker | 519 | G-32,33 |
| Mu-checker Probes | 519 | G-30,31 |
| Multiplexers – MIG-8USB, MIG-4USB | 982 | A-17 |
| MyCAL-Lite | | D-32 |
| MZT-500 | 810 | K-5 |
| **N** | | |
| Neck Caliper | 536,573 | D-26 |
| Neck Caliper | 536 | D-26 |
| Non-Contact CMM Probe Options – QVP Quick Vision Probe | | L-26 |
| Non-Contact CMM Probe Options – SurfaceMeasure 606/610/1010/606T/201FS | | L-22,23 |
| **O** | | |
| Objectives | 378 | I-30-34 |
| Offset Caliper | 536,573 | D-22 |
| Offset Centerline Caliper | 536,573 | D-23 |
| Optical Flats | 158 | B-50 |
| Optical Parallels | 157 | B-50 |
| OPTI-FIX Kits — Modular Clamping System for Vision Measuring Systems | | M-15-17 |
| Optional Accessories for Automatic Measurement | | J-24 |
| Optional Accessories for Automatic Measurement | | J-35 |
| Optional Accessories for Contracer / Formtracer | | J-36 |
| Optional Accessories for Height Gages | | D-47 |
| Optional Accessories For Rockwell/Rockwell Superficial Hardness Testing Machine | | K-11,12 |
| Optional Accessories for Roundtest | | J-51 |
| Optional Accessories for Surftest / Formtracer | | J-25 |
| Optional Accessories Micro-Vickers/Vickers Hardness Testing Machine | | K-8 |
| Optional Arms and Styli for Contour Measurement | | J-32-34 |
| Optional Styli for Roundtest | | J-49,50 |
| Optional Styli for Surface Roughness Measurement | | J-22,23 |
| Outside Micrometers | 101 | B-9 |
| Outside Micrometers | 102 | B-11 |
| Outside Micrometers | 103 | B-12-14 |
| Outside Micrometers | 340,104 | B-15,16 |
| Outside Micrometers | 105 | B-17 |
| Outside Micrometers | 406 | B-18 |
| Outside Micrometers | 107 | B-19 |
| Overlay Chart Set | | I-14 |
| **P** | | |
| Pana Micrometers | 116 | B-26 |
| Paper Thickness Micrometers | 169 | B-33 |
| PH-3515F | 172 | I-10,11 |
| PH-A14 | 172 | I-8,9 |
| Pitch Gages | 188,950 | E-39 |
| PJ-A3000-Vertical | 302 | I-2,3 |
| PJ-H30-High Accuracy | 303 | I-4,5 |
| Pocket Comparators | 183 | I-39 |
| Pocket Dial Test Indicators | 513 | F-44,45 |
| Pocket Magnifiers | 183 | I-39 |
| Point Caliper | 573,536 | D-24 |
| Point Micrometers | 112,142,342 | B-21 |
| Precision Granite Stands | 517 | F-65 |
| Precision Lead Screw | | B-73 |
| Precision Levels | 960 | E-36 |
| Pulse Signal Interface Unit PSU-200 | 539 | H-32,33 |
| PV-5110 | 304 | I-6,7 |
| **Q** | | |
| QM-Data 200 2-D Processing Unit | 264 | I-25,26 |
| QM-Height | 518 | D-38,39 |
| QuantuMike | 293 | B-6 |
| Quick Guide to Precision Measuring Instruments | | B-76 |
| Quick Guide to Precision Measuring Instruments - Calipers | | D-34,35 |
| Quick Guide to Precision Measuring Instruments - Hardness Testing Machines | | K-16,17 |
| Quick Guide to Precision Measuring Instruments - Height Gages | | D-48 |
| Quick Guide to Precision Measuring Instruments - Profile Projectors | | I-15 |
| Quick Guide to Precision Measuring Instruments - Linear Scales | | H-34,35 |
| Quick Guide to Precision Measuring Instruments - Contracer | | J-37,38 |
| Quick Guide to Precision Measuring Instruments - Laser Scan Micrometers | | G-51 |
| Quick Guide to Precision Measuring Instruments - Linear Gages | | G-28,29 |
| Quick Guide to Precision Measuring Instruments - Microscopes | | I-40,41 |
| Quick Guide to Precision Measuring Instruments - Roundtest | | J-53,54 |
| Quick Guide to Precision Measuring Instruments - Surftest | | J-26,27 |
| Quick Image Series 361 — Non-contact 2D Vision Measuring System | 361 | M-3 |
| Quick Scope Series 359 — Manual Vision Measuring System | 359 | M-2 |
| Quick Guide to Precision Measuring Instruments | | M-18,19 |
| Quick Vision with Touch-Trigger Probe | | M-13 |
| Quickmike | 293 | B-8 |
| Quick-Mini | 700 | F-53 |
| Quill Kit with Absolute Encoder | | H-6 |
| QV ACCEL Series 363 — Large-Format CNC | 363 | M-12 |
| QV Hybrid Type 1, Type 4 Series 365 — CNC Vision Measuring System with a Noncontact Displacement Sensor | 365 | M-8 |
| QV Hyper Series 363 — High-Accuracy CNC Vision Measuring System | 363 | M-7 |
| QV Stream Plus Series 363 — CNC Vision Measuring System | 363 | M-6 |
| QV Active Compact CNC Vision Measuring Systems | | M-4 |
| QV Apex Series 363 — CNC Vision Measuring System | 363 | M-5 |
| QV-WLI Series 363 — CNC Video Measuring System with White Light Interferometry | 363 | M-9 |




Mitutoyo

# ALPHABETICAL INDEX


| Description | Series No. | Page |
|---|---|---|
| **R** | | |
| Radius Gages | 186 | E-39 |
| Radius Gages-Sets | 186 | E-40 |
| Ratchet-Thimble Micrometer | 102 | B-10 |
| Rectangular Gage Block Accessories | 516 | E-13-15 |
| Rectangular Gage Block with CTE | | E-12 |
| Riser Blocks | 515 | E-27 |
| Roundtest Extreme RA-2200CNC / RA-H5200CNC | 211 | J-47,48 |
| Roundtest RA-120 / 120P | 211 | J-39,40 |
| Roundtest RA-1600 / RA-1600M | 211 | J-41,42 |
| Roundtest RA-2200AS / DS / AH / DH | 211 | J-43,44 |
| Roundtest RA-H5200AS / AH | 211 | J-45,46 |
| **S** | | |
| Screw Thread Micrometers | 125 | B-37 |
| Screw Thread Micrometers | 126,326 | B-38 |
| Scribing Caliper | 573 | D-29 |
| Scribing Caliper | 536 | D-29 |
| SD ABSOLUTE Digimatic Scale Units | 572 | H-2,3 |
| Semi-Flexible Rules | 182 | E-35 |
| Sensorpak Software | | G-26 |
| Setting Rings | 177 | C-29,30 |
| Sheet Metal Micrometers | 118,119,389 | B-30 |
| Signal Conversion Adapter PSU-400E | 539 | H-33 |
| Small-Hole Gage Set | 154 | B-47 |
| Snap Meters | 523 | B-43 |
| SPC Connecting Cables | | A-20 |
| Spherical Face Micrometers | 115,295,395 | B-27 |
| Spindle Attachment Tip | | B-49 |
| Spindle Lifting Lever and Cable | | F-36 |
| Spline Micrometers | 111,331 | B-20 |
| Spring Dividers and Calipers | 950 | E-33 |
| Square Gage Block Accessories | 516 | E-20,21 |
| Square Master | 311 | E-31 |
| Standard Scales | 182 | E-32 |
| Standards for Screw Thread Micrometers | 167 | B-52 |
| Standards for V-Anvil Micrometers | 167 | B-52 |
| Steel Rules | 182 | E-34,35 |
| Steel Stands | 517 | E-45 |
| Step Master | 516 | E-23 |
| STRATO-Apex 1600 Series 355 — High-Accuracy CNC CMM | 355 | L-10 |
| STRATO-Apex 500/700/900 Series 355 — High-Accuracy CNC CMM | 355 | L-9 |
| Super Caliper-Solar Powered | 500 | D-2 |
| Surftest Extreme SV-3000CNC | 178 | J-12 |
| Surftest Extreme SV-M3000CNC | 178 | J-13 |
| Surftest SJ-210 | 178 | J-2 |
| Surftest SJ-210/310 Optional Accessories | 178 | J-4,5 |
| Surftest SJ-310 | 178 | J-3 |
| Surftest SJ-410 | 178 | J-6,7 |
| Surftest SJ-500/P, SV-2100 | 178 | J-8,9 |
| Surftest SV-3200 | 178 | J-10,11 |
| **T** | | |
| Telescoping Gage Set | 155 | B-47 |
| Thickness Gages | 547, 7 | F-50-52 |
| Thickness/Feeler Gages | 950,184 | E-36 |
| Tire Tread Depth Gage | 571 | D-53 |
| TM-505B/1005B Toolmakers' Microscopes | 176 | I-16 |
| Tool Kits | | B-53,54 |
| Transfer Stands | 519 | F-62 |
| Tube Micrometers | 115,295,395 | B-28 |
| Tube Thickness Caliper | 573,536 | D-27 |
| Tubular Inside Micrometers | 133 | C-11,12 |
| Tubular Inside Micrometers | 137 | C-15 |
| Tubular Inside Micrometers | 139 | C-16 |
| Tubular Inside Micrometers | 140 | C-17 |
| **U** | | |
| UDT-2 Dial Gage Testers | 170 | F-49 |
| ULTRA QV Series 363 — Ultra-High Accuracy CNC Vision Measuring System | 363 | M-10 |
| UMAP Vision System TYPE2 Series 364 — Micro Form Measuring System | 364 | M-11 |
| Uni-Mike | 317,117 | B-29 |
| Universal Bevel Protractor | 187 | E-38 |
| Universal Height Master | 515 | E-28 |
| USB Input Tool Direct: USB-ITN | | A-12,13 |
| U-WAVE Fit | | A-16 |
| U-WAVE | | A-14,15 |
| **V** | | |
| V-Anvil Micrometers | 114,314 | B-23,24 |
| V-Block Sets | 181 | F-58 |
| Vernier Caliper | 530 | D-10,11 |
| Vernier Caliper | 531 | D-12 |
| Vernier Caliper | 532 | D-13 |
| Vernier Caliper | 160 | D-14 |
| Vernier Depth Gage | 527 | D-54,55 |
| Vernier Height Gage | 514 | D-45,46 |
| Vision Unit System Retrofit | 359 | I-27 |
| VMU Video Microscope Unit | 378 | I-29 |
| **W** | | |
| Wire Micrometers | 147 | B-41 |
| Working Standard Scales | 182 | E-32 |
| Workpiece Fixtures for Profile Projectors and Measuring Microscopes | | I-13 |
| **Z** | | |
| Zero CERA Blocks | | E-12 |
| Zoom Loupe | 183 | I-39 |
| 3-Wire Thread Measuring System | | B-39 |



## In the Spirit of Mitutoyo

To become a complete man, one must acquire Wisdom, Benevolence and Valor. With Wisdom only, one tends to be cold. Benevolence alone makes one weaker. With valor only, one may reach beyond his capabilities. When the three qualities are combined, however, one will become a complete man. Similarly, success in enterprise lies in the knowledge of Heaven, Earth and Man. Business will succeed only when these factors, "heavensent" chances, natural opportunities, and harmony of man are present. Without even one factor, success is remote. In Buddhism, Butsu (Buddha), Po (Doctrine) and So (Priest) are three principle treasures for its promotion of the teaching. In Christianity, God, Bible and Minister.

The word MITUTOYO signifies three abundances. "Mitsu" means three, while "Toyo" stands for a state of abundance. The name MITUTOYO was selected, with a sincere wish to see more complete men, to create a prosperous enterprise and to introduce righteous religion to all, along with the lasting wish for a peaceful world and fulfillment of meaningful life.





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