Mitutoyo

Mitutoyo Quality

CNC Roundness/Cylindricity Measuring System
ROUNDTRACER EXTREME

Form Measurement

Bulletin No. 2311

Mitutoyo

ROUNDTRACER EXTREME

All-In-One

A high-end machine that integrates roundness, contour, and surface roughness measuring functions all in one.

This measuring machine not only delivers speed, accuracy and operability at the highest level, but also supports the measurement of workpieces of various shapes, such as camshafts and bearings.

Equipped with roundness, contour and surface roughness measuring functions the ROUNDTRACER EXTREME is a triple-feature Measuring System that consolidates processes to save you time and improve your productivity.

High-throughput roundness measurement

Higher reproducibility and best in class θ axis drive speed through increased turntable rigidity.

High-accuracy contour measuring

Dramatically improved contour measuring accuracy as a result of the guaranteed X and Z axes indication accuracy and support for stylus radius compensation.

Even more advanced surface roughness measurement

Increased maximum measuring diameter and support for 3D surface texture measurement and lead (twist) analysis.

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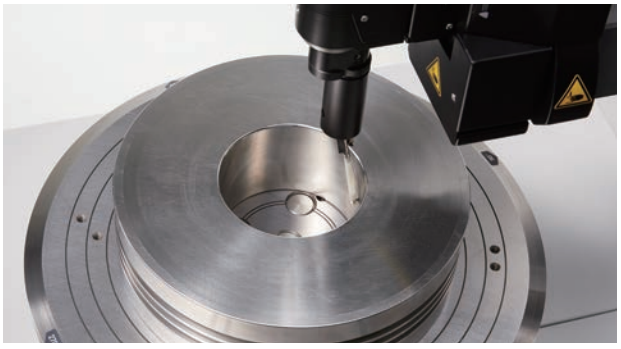
1 Improved Flexibility

Newly developed motorized sliding axis, detector, and detector holder help avoid workpiece interference while enabling continuous automatic measurement

A motorized sliding axis, a detector and detector holder capable of changing the stylus angle (0°, 10°) have been newly developed to enable measurement while avoiding workpiece interference.

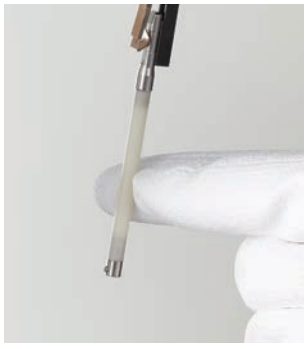
Motorized sliding axis



Easy measurement of inside diameter for thick workpieces

A 3-step motorized sliding axis enables easy inside diameter measurement of thick workpieces by avoiding interference, without having to replace the stylus as in conventional models. Furthermore, it allows for continuous automatic measurement of squareness, runout, etc. by combining inside diameter and upper surface measurements.

Detectors



Continuous small hole and outside diameter measurement

The stylus angle can be set to two orientations. 0° or 10° allows for continuous and combined measurement of small holes and outside diameters while avoiding workpiece interference. Furthermore, measurement can be conducted with the workpiece remaining in the same position when measuring repeatedly while changing the stylus angle since changes in stylus tip position are automatically recognized by ROUNDPAK.

2 Improved Drive Speed

Dramatically improved measurement throughput by reduced positioning times

Best in class maximum X, Z, and θ axes drive which greatly reduces positioning times compared with conventional models. Moreover, throughput has dramatically increased for curvilinear measurements since data can now be acquired independently of the turntable 0° position.

X and Z axes drive speed

Best-in-class maximum of 100 mm/sec. with improved positioning accuracy and greatly reduced positioning times compared with conventional models.

θ axis drive speed

Best-in-class maximum of 30 rpm. The ability to acquire measurement data without waiting for the 0° position in curvilinear measurements reduces the positioning time by about 40% compared with conventional models (in-house comparison), dramatically improving the performance.

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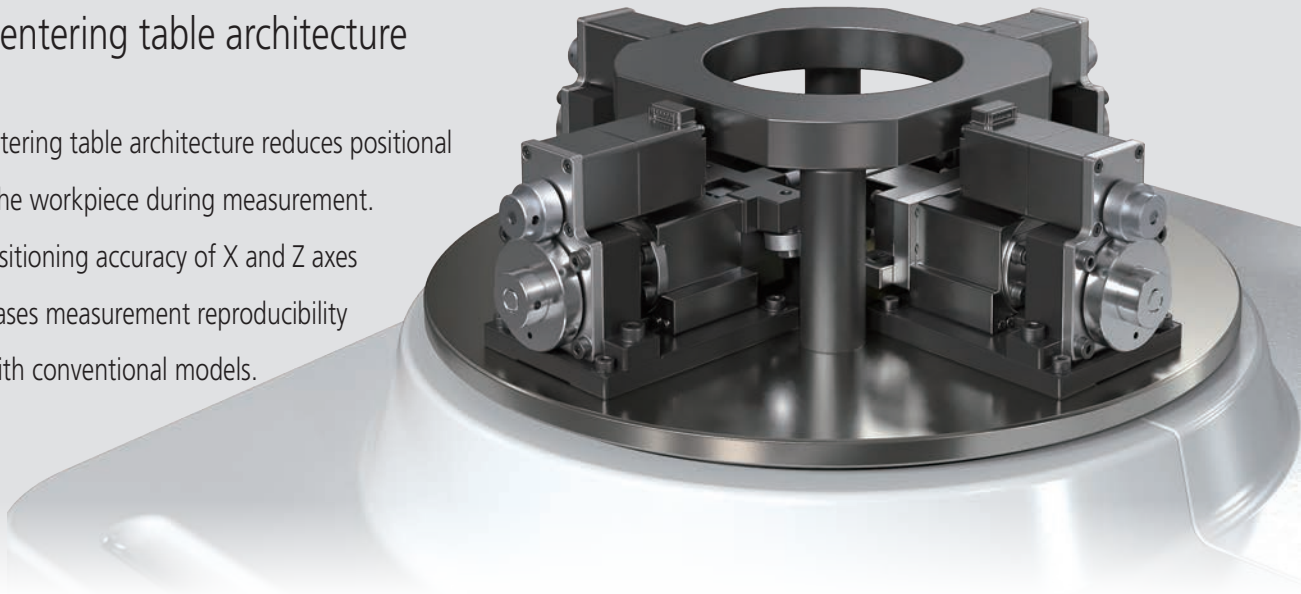
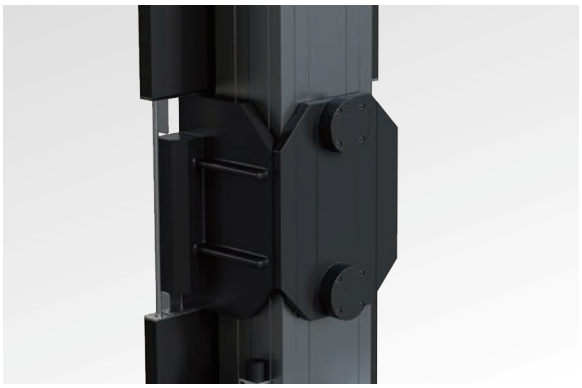
3 Improved Repeatability and Reproducibility

Highly reproducible measurement as a result of new centering table architecture

The new centering table architecture reduces positional changes of the workpiece during measurement. Improved positioning accuracy of X and Z axes greatly increases measurement reproducibility compared with conventional models.





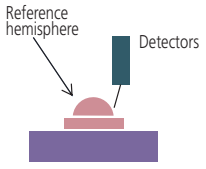
Internal architecture of the Z axis slider

In the Z axis, a hybrid guide comprising of a friction guide and air bearings is used.
The resultant slider is resistant to vibration and requires few positional changes.

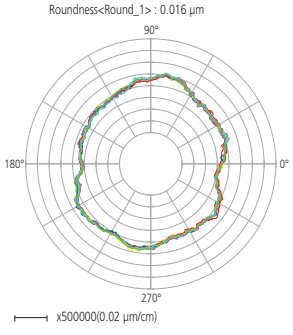
Internal architecture of the table

Reduced positional changes of the workpiece have been achieved by replacing all guides in the centering table with rolling guides.

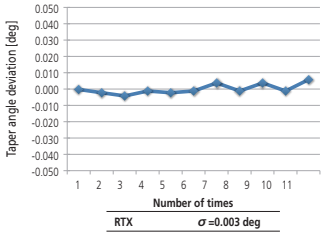
Result of repeating roundness measurement 11 times on reference hemisphere

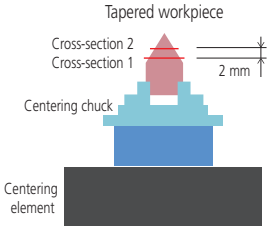


Rotational speed	6 rpm
Measurement points	14400 points
Measurement times	11 times
Calculation method	LSCI
Filter	2CRPC75
Cutoff	50 UPR



Repeatability of tapered workpiece measurement





4 Rich Additional Features

Pursuing functionality from the viewpoint of users

Design delivering both usability and innovation.
The ergonomic remote box enhances the user's experience with clearly laid out buttons and controls.

Remote box

Provides excellent operability as a result of newly added features, such as the override control that enables drive speed adjustment in real time, and the part program key that assists the creation of part programs.

- Outside diameter measuring position key
- Slide top position measuring position key
- Detector replacement key
- Curvilinear measurement item key
- Rectilinear measurement item key
- Auto-set key

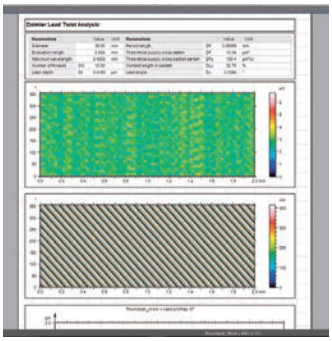
Additional measuring functions

Form / contour

Guaranteed X and Z axes indication accuracy and support for stylus radius compensation resulting in improved form / contour measuring accuracy.

Surface roughness

High-precision surface roughness measurement is enabled by a drive noise lower than 0.1 μm in Rz for rectilinear surface roughness measurement by X and Z axes and curvilinear surface roughness measurement by θ axis.



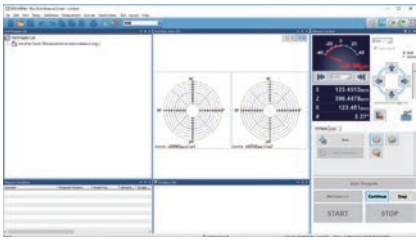
Lead (twist) analysis

Improved θ axis positioning accuracy enables lead (twist) analysis used for assessing the sealing performance.

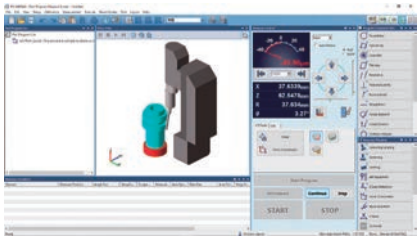
Video available here

ROUNDPAK

Provides a wide variety of parameters as standard features, including those for roundness/cylindricity, as well as flatness and parallelism.

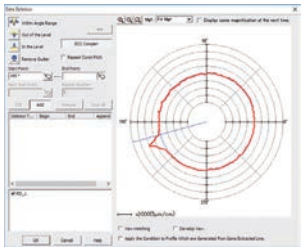


Allows for switching to measurement-only screen (run-only measurement screen), where operators are only allowed to run part programs.

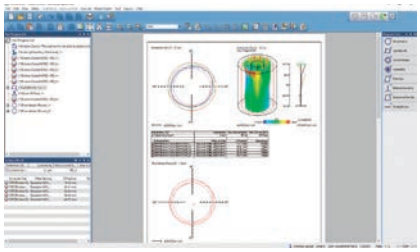


Equipped with an offline teaching function where part programs can be created without even having actual measurement workpieces, and measurements can be virtually ran in the 3D workpiece view window. Warnings regarding risk of collision can also be displayed.

Allows for setting of X and Z axes travel ranges to prevent collisions with workpieces as a result of operational errors. Travel ranges can be viewed at a glance by displaying the software limit information bar on the measurement control screen.



Allows for removing abnormal data in the measurement data (by mouse operation) due to scratches, dust or other contamination on the workpiece, which affect the analysis results. In addition, there is a function to automatically remove abnormal points based on set thresholds.

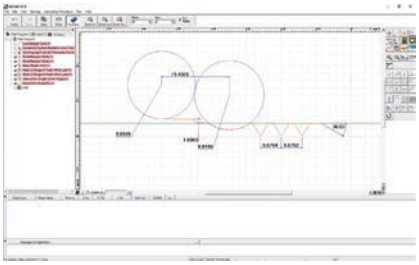


The customer can create measurement reports in custom formats by specifying how the analysis results will be displayed, as well as the sizes and positions of graphics.

FORMTRACEPAK-AP

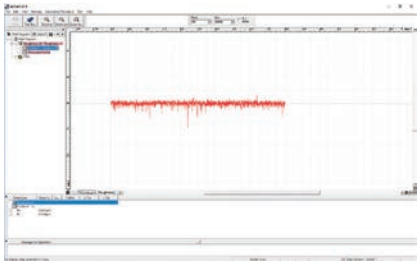
Contour analysis, surface roughness analysis and the creation of inspection certificates are included as standard features.

Contour analysis



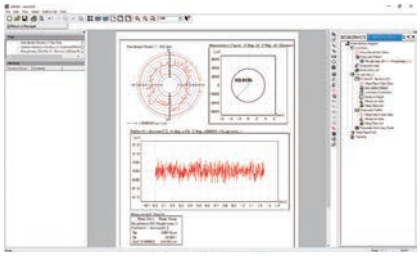
Provides not only a range of basic commands for analyzing points (10 types), lines (6 types), and circles (6 types), but also a wide variety of commands to calculate angles formed by a combination of items, pitches, distances, etc., contour matching function, and design value generation function as standard features.

Surface roughness analysis



Allows for surface roughness analysis according to standards, such as ISO, JIS, ANSI, VDA, etc. Provides a wide variety of functions not only for calculating parameters, but also for analyzing various graphs, removing (compensating) shapes such as slopes and curves, removing data, etc.

Layout

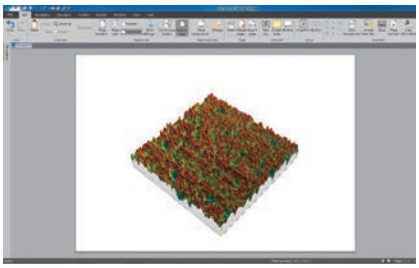


Allows for layout of contour, surface roughness, and/or roundness measurement results and graphics on a single sheet of paper by using simple operations. Furthermore, support for pasting from specified saved files allows results to be pasted from multiple files.

MCubeMap

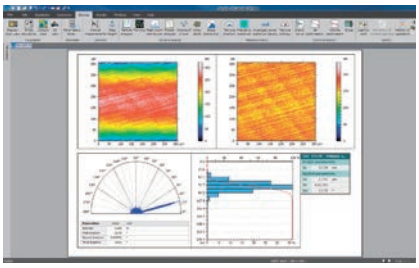
Visualizes analyzed surface roughness and contour by using a wide variety of graphic technologies.

Wide variety of data operation functions



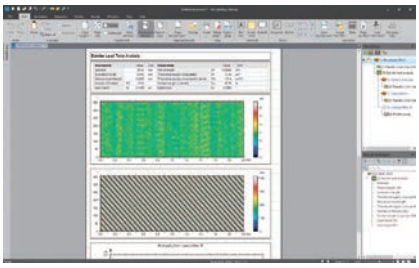
Allows for visualizing the measurement target in a 3D graphics view, as well as showing a section view at an arbitrary point.

3D parameter analysis



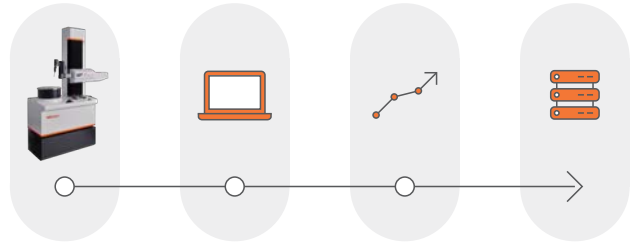
Supports the latest ISO 25178 3D surface texture parameter specifications. Allows for easy creation of reports with freely laid out results of analyses related to not only vertical directions, such as Sa and Sq, but also spaces, compounds, features, and graphics.

Lead (twist) analysis



Supports the lead (twist) analysis used for assessing the sealing performance of shafts.

MeasurLink



Reduction of defective products by "visualize product quality"

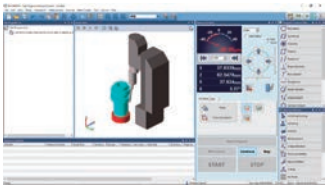
Measurement results enable various statistical processing operations. Furthermore, displaying the control chart in real time enables early detection of possible future failures (cutting tool wear, damage, etc.). In addition, connecting this program to an upstream network environment as a terminal enables the construction of a system for centralized management.

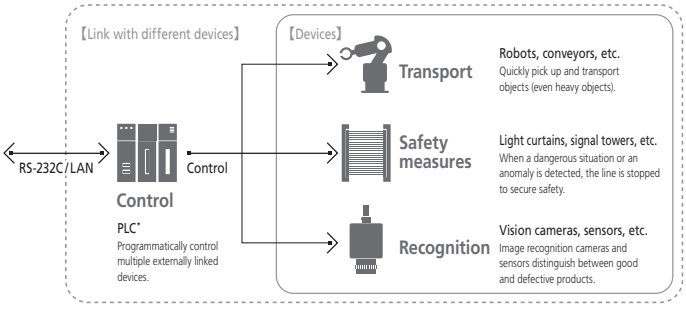
FORMEio

This is optional software for installing the external control function in the measuring instrument.

Remote status monitoring and control

With this function it is possible to monitor and control the measuring instrument conditions via RS-232C/LAN communication from the PLC (Programmable Logic Controller).





* Programmable Logic Controller

Efficient precision measurement for practically any workpiece

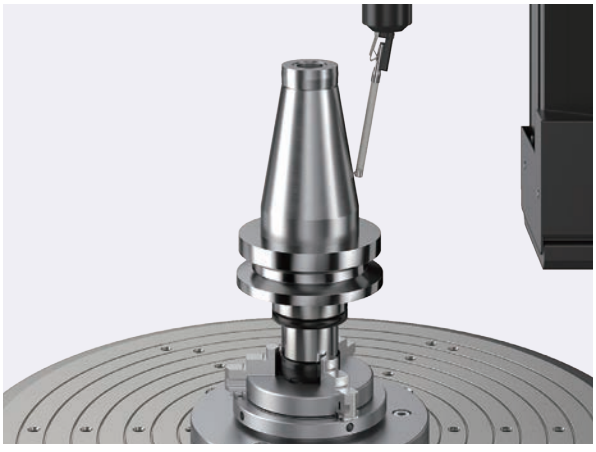
ROUNDTRACER EXTREME has applications supporting measurements for a wide variety of workpieces. It delivers efficient, high-precision measurements, such as continuous measurement of inside diameter and upper surface of thick workpieces suitable to the motorized sliding axis, or automatic recognition of the stylus tip position during continuous measurement of inside and outside diameters of small holes.

APPLICATION

Camshaft

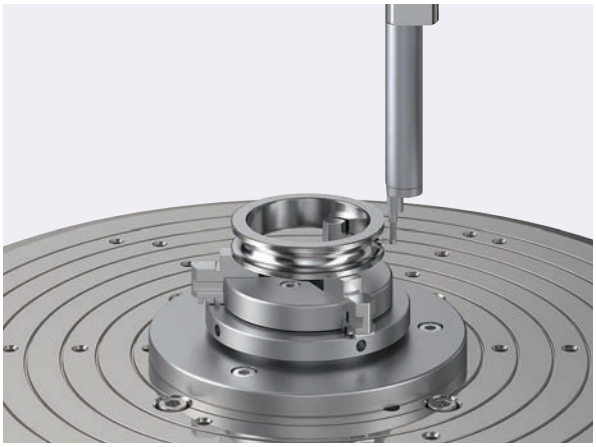
Camshafts require high-precision measurement because they control the opening and closing of inlet/outlet valves that improve the combustion efficiency of engines. Measurement of cam shape, surface roughness, and roundness, which previously required multiple measuring instruments and setup, can now be efficiently conducted using a single measuring machine.

Tool holder



The tapered portion of tool holders requires high-precision measurement since it needs to pair with the main axis of machine tools. High-precision positioning by the newly developed centering element and Z axis slider enables highly reproducible measurements.

Bearing

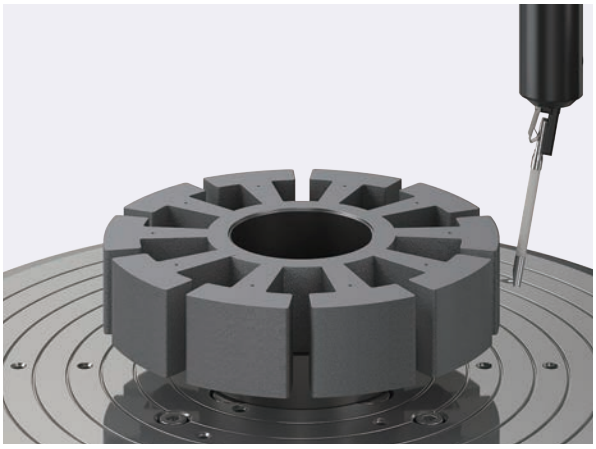


The surface roughness of bearings requires high-precision measurement since it has direct impact on the coefficient of friction. A single ROUNDTRACER EXTREME can not only efficiently measure roundness, but also surface roughness with high accuracy.

Pulley based CVT

Pulley based CVTs are components of automotive continuously variable transmissions that contribute to fuel efficiency and smooth travel. Provides measurement of surface roughness of the tapered portion, roundness, and contour. This previously required multiple measuring instruments and setup but can now be efficiently conducted using a single measuring machine.

Electric motor cores



Motor cores, which are the base of motor assemblies, require high machining accuracy. ROUNDTRACER EXTREME allows for efficient, high-precision workpiece setup for rectilinear contour measurement at multiple points.

Spline

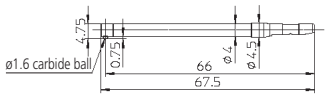
The rotating X-axis tracking measurement function enables all-round measurement and assessment* of splines exceeding the measuring range of the detector.

* Subject to tracking angle limitation of the stylus for contour measurement.

Styli for roundness measurement

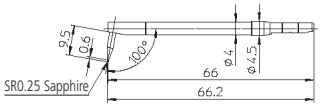
Unit: mm
25.4mm=1"

Standard stylus



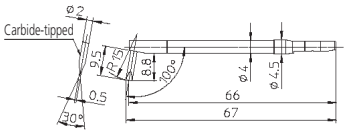
Order No.	**12AAV342**
Stylus tip	S ø1.6 mm
Material	Carbide-tipped
ID measuring range	ID ø7 mm or more Depth less than 50 mm
Remarks	Standard accessory

Deep groove A



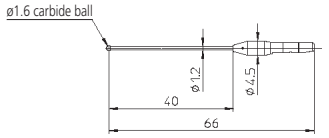
Order No.	**12AAV388**
Stylus tip	SR0.25 mm
Material	Sapphire
ID measuring range	ID ø14 mm or more Depth less than 50 mm

Stylus for filtering asperities



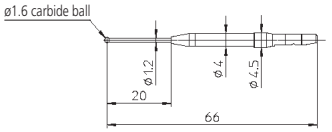
Order No.	**12AAV390**
Stylus tip	R15 mm
Material	Carbide-tipped
ID measuring range	ID ø15 mm or more Depth less than 50 mm
Remarks	Vertical position

Stylus for small holes (ø1.6)



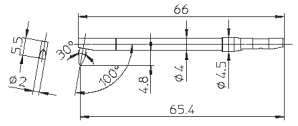
Order No.	**12AAV392**
Stylus tip	S ø1.6 mm
Material	Carbide-tipped
ID measuring range	ID ø3 mm or more Depth less than 38 mm ID ø8 mm or more Depth less than 50 mm

ø1.6 mm ball



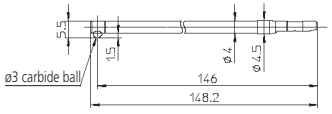
Order No.	**12AAV394**
Stylus tip	S ø1.6 mm
Material	Carbide-tipped
ID measuring range	ID ø3 mm or more Depth less than 18 mm ID ø8 mm or more Depth less than 50 mm

Stylus for flat surface



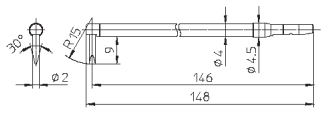
Order No.	**12AAV396**
Stylus tip	R1.0 mm
Material	Carbide-tipped
ID measuring range	——
Remarks	Horizontal position (Upper and lower surface measurements only)

2X-long type notch



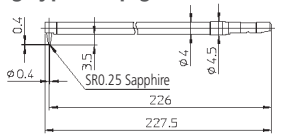
Order No.	**12AAV398**
Stylus tip	S ø3.0 mm
Material	Carbide-tipped
ID measuring range	ID ø8 mm or more Depth less than 130 mm
Remarks	Vertical position

2X-long type cutter mark



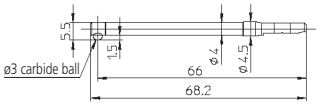
Order No.	**12AAV400**
Stylus tip	R15 mm
Material	Carbide-tipped
ID measuring range	ID ø13 mm or more Depth less than 130 mm
Remarks	Vertical position

3X-long type deep groove



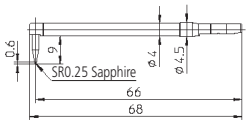
Order No.	**12AAV402**
Stylus tip	SR0.25 mm
Material	Sapphire
ID measuring range	ID ø12 mm or more Depth less than 210 mm
Remarks	Vertical position

Stylus for notched workpieces



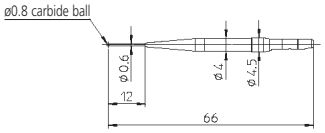
Order No.	**12AAV387**
Stylus tip	S ø3.0 mm
Material	Carbide-tipped
ID measuring range	ID ø8 mm or more Depth less than 50 mm

Deep groove B



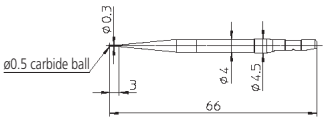
Order No.	**12AAV389**
Stylus tip	SR0.25 mm
Material	Sapphire
ID measuring range	ID ø15 mm or more Depth less than 50 mm

Stylus for small holes (ø0.8)



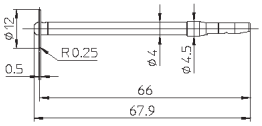
Order No.	**12AAV391**
Stylus tip	S ø0.8 mm
Material	Carbide-tipped
ID measuring range	ID ø1.5 mm or more Depth less than 10 mm ID ø8 mm or more Depth less than 50 mm

Stylus for extra small holes (ø0.5)



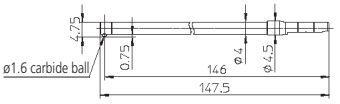
Order No.	**12AAV393**
Stylus tip	S ø0.5 mm
Material	Carbide-tipped
ID measuring range	ID ø1 mm or more Depth less than 2.5 mm ID ø8 mm or more Depth less than 50 mm

Disk stylus



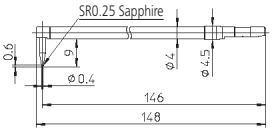
Order No.	**12AAV395**
Stylus tip	R0.25 mm
Material	Carbide-tipped
ID measuring range	ID ø14 mm or more Depth less than 50 mm

2X-long type



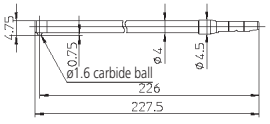
Order No.	**12AAV397**
Stylus tip	S ø1.6 mm
Material	Carbide-tipped
ID measuring range	ID ø7 mm or more Depth less than 130 mm
Remarks	Vertical position

2X-long type deep groove



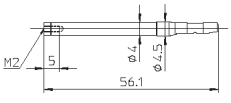
Order No.	**12AAV399**
Stylus tip	SR0.25 mm
Material	Sapphire
ID measuring range	ID ø12 mm or more Depth less than 130 mm
Remarks	Vertical position

3X-long type



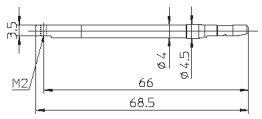
Order No.	**12AAV401**
Stylus tip	S ø1.6 mm
Material	Carbide-tipped
ID measuring range	ID ø7 mm or more Depth less than 210 mm
Remarks	Vertical position

Stylus shank



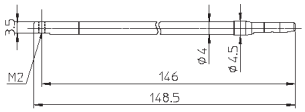
Order No.	**12AAV403**
Stylus tip	——
Material	——
ID measuring range	——
Remarks	Compatible with CMM stylus

Stylus shank (standard groove)



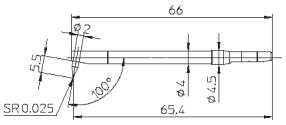
Order No.	**12AAV404**
Stylus tip	——
Material	——
ID measuring range	——
Remarks	Compatible with CMM stylus

Stylus shank (2X-long groove)



Order No.	**12AAV405**
Stylus tip	——
Material	——
ID measuring range	——
Remarks	Compatible with CMM stylus

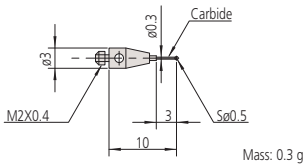
Contour (cone 30° H5.5)



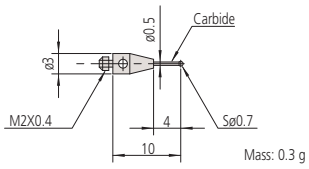
Order No.	**12AAV406**
Stylus tip	SR0.025 mm
Material	Carbide-tipped
ID measuring range	——

Using a stylus shank for roundness measurement described above enables the mounting of coordinate measuring machine (CMM) styli.

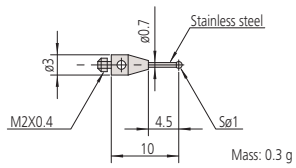
Styli for CMM's*



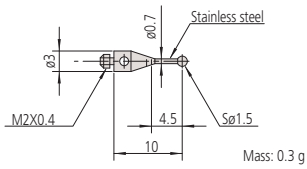
Order No.	**06ABN752**
Name	MS2-0.5R3
Material	Ruby



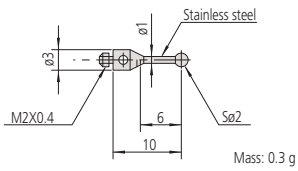
Order No.	**06ABN753**
Name	MS2-0.7R4
Material	Ruby



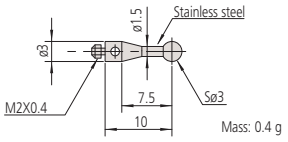
Order No.	**06ABN754**
Name	MS2-1R4.5
Material	Ruby



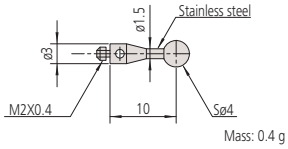
Order No.	**06ABN758**
Name	MS2-1.5R4.5
Material	Ruby



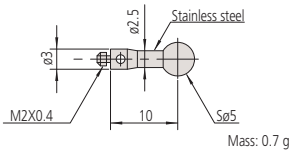
Order No.	**06ABN761**
Name	MS2-2R6
Material	Ruby



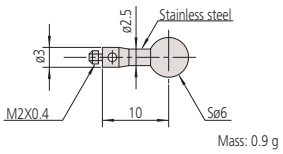
Order No.	**06ABN769**
Name	MS2-3R7.5
Material	Ruby



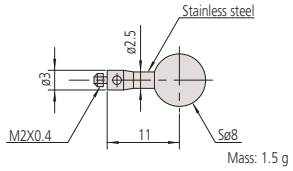
Order No.	**06ABN774**
Name	MS2-4R10
Material	Ruby



Order No.	**06ABN780**
Name	MS2-5R10
Material	Ruby



Order No.	**06ABN786**
Name	MS2-6R10
Material	Ruby



Order No.	**06ABN788**
Name	MS2-8R11
Material	Ruby

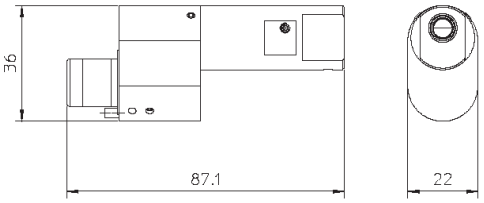
* **12AAV404** (stylus shank <standard groove>) or **12AAV405** (stylus shank <2X-long groove>) required separately.

Roughness detector adapter

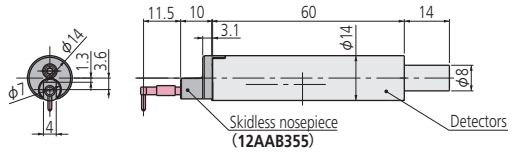
This product enables the mounting of a roughness detector (**178-396-2** or **178-397-2**) to ROUNDTRACER EXTREME.

Unit: mm
25.4mm=1"

12AAU418



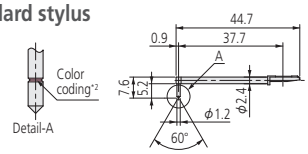
For Surface Roughness Measuring | Detectors



Order No.	Measuring force	
178-396-2	0.75 mN	'97ISO and '01JIS compliant detectors
178-397-2	4 mN	Detectors that comply with previous standards, for general use, etc.

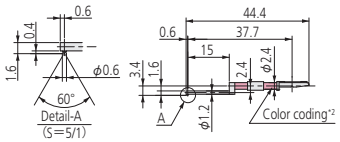
For Surface Roughness Measuring | Styli

Standard stylus



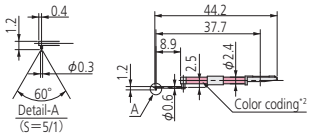
12AAE882 (1 µm)
12AAE924 (1 µm)*1
12AAC731 (2 µm)
12AAB403 (5 µm)*1
12AAB415 (10 µm)*1
12AAE883 (250 µm)*3
( ): Tip radius

For small hole



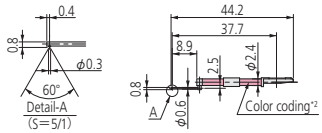
12AAC732 (2 µm)
12AAB404 (5 µm)*1
12AAB416 (10 µm)*1
( ): Tip radius

For extra-small hole



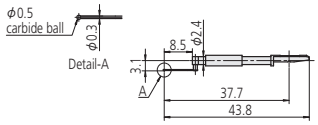
12AAC733 (2 µm)
12AAB405 (5 µm)*1
12AAB417 (10 µm)*1
( ): Tip radius

For extra-minute hole



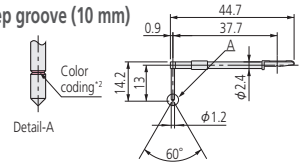
12AAC734 (2 µm)
12AAB406 (5 µm)*1
12AAB418 (10 µm)*1
( ): Tip radius

For ultra-small hole*3



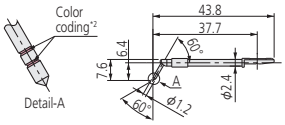
12AAJ662 (ø0.5 mm)

For deep groove (10 mm)



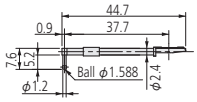
12AAC735 (2 µm)
12AAB409 (5 µm)*1
12AAB421 (10 µm)*1
( ): Tip radius

For gear tooth



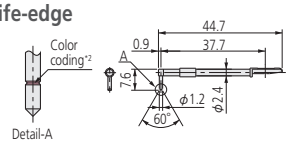
12AAB339 (2 µm)
12AAB410 (5 µm)
12AAB422 (10 µm)
( ): Tip radius

For rolling circle waviness surface*3



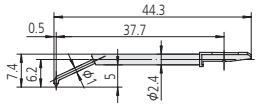
12AAB338 (ø1.588)

For knife-edge



12AAC738 (2 µm)
12AAB411 (5 µm)*1
12AAB423 (10 µm)*1
( ): Tip radius

For bottom surface



12AAE899 (2 µm)
12AAE915 (5 µm)*1
( ): Tip radius

*1 Tip angle 90°

*2

Tip radius	1 µm	2 µm	5 µm	10 µm	250 µm
Color coding	White	Black	No color	Yellow	No notch or color

*3 Used for calibration, a standard step gage (**178-611**, optional) is also required.

Note: Customized special interchangeable styli are available on request. Please contact any Mitutoyo office for more information.

Three-jaw chuck (key operated) **211-014**

Suitable for holding longer parts and those requiring a relatively powerful clamp.

- Holding capacity:
  Internal jaws: OD=ø2-ø35 mm
  ID=ø25-ø68 mm
  External jaws: OD=ø35-ø78 mm
- External size (D×H): ø157×70.6 mm
- Mass: 3.8 kg

Centering chuck (knurled ring operated) **211-032**

Unit: mm
25.4mm=1"

Suitable for holding small parts with easy-to-operate knurled-ring clamping.

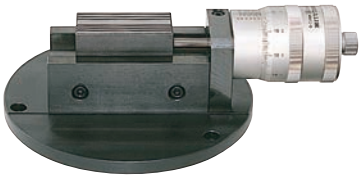
- Holding capacity:
  Internal jaws: OD=ø1-ø36 mm
  ID=ø16-ø69 mm
  External jaws: OD=ø25-ø79 mm
- External size (D×H): ø118×41 mm
- Mass: 1.2 kg

Micro chuck **211-031**

Used for clamping a workpiece (less than ø1 mm dia.) that the centering chuck cannot handle.

- Holding capacity: OD=ø0.2-ø1.5 mm
- External size (D×H): ø107×48.5 mm
- Mass: 0.6 kg

Magnification calibration gage **211-045**



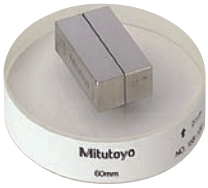
Used for normalizing detector magnification by calibrating detector travel against displacement of a micrometer spindle.

- Maximum calibration range: 400 µm
- Graduation: 0.2 µm
- External size (W×D×H): 235 (max.)×185×70 mm
- Mass: 4 kg

Cylindrical square **350850**

- Straightness: 1 µm
- Cylindricity: 2 µm
- External size (D×H): ø70×250 mm
- Mass: 7.5 kg

Gauge block set for calibration **997090**



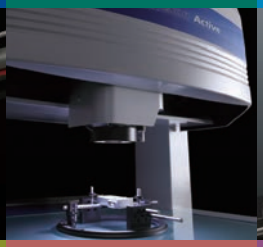
Auxiliary stage for a short workpiece **356038**

Side table **12AAV541**

The side table, designed to match the main unit, can house the controller supplied with the main unit, a PC, and a front feed/output printer.

Coordinate Measuring Machines

Vision Measuring Systems



Form Measurement

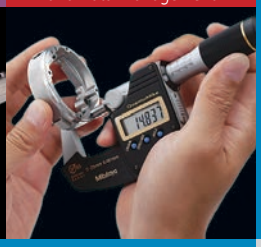
Optical Measuring

Sensor Systems

Test Equipment

Digital Scale and DRO Systems

Small Tool Instruments and Data Management



Whatever your challenges are, Mitutoyo supports you from start to finish.

Mitutoyo is not only a manufacturer of top quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed up comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.

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