



Accreditation# 93289

## CERTIFICATE OF CALIBRATION

ISSUED BY: WILLRICH PRECISION INSTRUMENT

CALIBRATION DATE: 2/12/2019

CALIBRATION DUE DATE: 2/28/2020

PURCHASE ORDER NUMBER: [REDACTED]

CERTIFICATION NUMBER: 2122019-2.1M

START TEMPERATURE: 68° F

END TEMPERATURE: 68° F

MEASUREMENT UNCERTAINTY: 100  $\mu$ in + 7.27  $\mu$ in/in

Willrich Precision Instrument

80 Broadway

Cresskill, NJ 07626

866-945-5742 TELEPHONE

201-567-7470 MAIN FAX

CUSTOMER: [REDACTED]

MANUFACTURER: STARRETT

MODEL: HE400

SERIAL NUMBER: [REDACTED]

GAGE NUMBER: [REDACTED]

AS FOUND RESULT: PASS

CORRECTIONS MADE: YES

AS LEFT RESULT: PASS

NOTES:

MACHINE COULD ONLY BE CALIBRATED TO 7 INCHES IN THE X AXIS DUE TO INTERFERENCE FROM THE WALL. MACHINE WAS FOUND TO BE IN SPEC. BUT WAS CORRECTED AS TO BE CLOSER TO ACCURACY SPECIFICATION. MACHINE IS NOW PERFECTLY NOMINAL IN "AS LEFT" STATE.

REPORT:

THIS MACHINE WAS MEASURED & VALIDATED FOR ACCURACY AND REPEATABILITY USING GLASS STANDARDS.

SIGNATURE: 

This is to certify that the following described Optical Comparator has been calibrated by this company and found to be within a range shown below and has been found to be within a tolerance of +/-0.00028 inch. Calibration is in accordance with ISO/IEC 17025:2005, ISO 9001:2008, and ANSI/NC SL Z540-1-1994. Machine is in good working condition. Machine has been calibrated with a 10X lens. This report shall not be reproduced except in full. Results relate only to the items calibrated. Supporting documentation relative to traceability is on file and available for examination upon request. The reported uncertainty value was calculated using mu at approximately a 95% confidence level and using a coverage factor of k=2. Reference WPI calibration procedure: WPI\_OC13.



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**ACCURACY VALIDATION RESULTS BEFORE CALIBRATION**

NOMINAL DISTANCE (in)	1.0000	2.0000	3.0000	4.0000	5.0000	6.0000	7.0000
<b>ACCURACY SPECIFICATION (in)</b>	<b>0.00028</b>	<b>0.00032</b>	<b>0.00036</b>	<b>0.00040</b>	<b>0.00044</b>	<b>0.00048</b>	<b>0.00052</b>

X Validation

RUN	0.9999	1.9998	2.9998	3.9998	4.9998	5.9998	6.9998
AVERAGE (in)	0.9999	1.9998	2.9998	3.9998	4.9998	5.9998	6.9998
<b>MEASURED ACCURACY (in)</b>	<b>0.00010</b>	<b>0.00020</b>	<b>0.00020</b>	<b>0.00020</b>	<b>0.00020</b>	<b>0.00020</b>	<b>0.00020</b>
<b>REMAINING TOLERANCE (in)</b>	<b>0.00018</b>	<b>0.00012</b>	<b>0.00016</b>	<b>0.00020</b>	<b>0.00024</b>	<b>0.00028</b>	<b>0.00032</b>
<b>PASS OR FAIL</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

Y Validation

RUN	1.0001	2.0001	3.0001	4.0001
AVERAGE (in)	1.0001	2.0001	3.0001	4.0001
<b>MEASURED ACCURACY (in)</b>	<b>0.00010</b>	<b>0.00010</b>	<b>0.00010</b>	<b>0.00010</b>
<b>REMAINING TOLERANCE (in)</b>	<b>0.00018</b>	<b>0.00022</b>	<b>0.00026</b>	<b>0.00030</b>
<b>PASS OR FAIL</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

**ACCURACY VALIDATION RESULTS AFTER CALIBRATION**

NOMINAL DISTANCE (in)	1.0000	2.0000	3.0000	4.0000	5.0000	6.0000	7.0000
<b>ACCURACY SPECIFICATION (in)</b>	<b>0.00028</b>	<b>0.00032</b>	<b>0.00036</b>	<b>0.00040</b>	<b>0.00044</b>	<b>0.00048</b>	<b>0.00052</b>

X Validation

RUN	1.0000	2.0000	3.0000	4.0000	5.0000	6.0000	7.0000
AVERAGE (in)	1.0000	2.0000	3.0000	4.0000	5.0000	6.0000	7.0000
<b>MEASURED ACCURACY (in)</b>	<b>0.00000</b>	<b>0.00000</b>	<b>0.00000</b>	<b>0.00000</b>	<b>0.00000</b>	<b>0.00000</b>	<b>0.00000</b>
<b>REMAINING TOLERANCE (in)</b>	<b>0.00028</b>	<b>0.00032</b>	<b>0.00036</b>	<b>0.00040</b>	<b>0.00044</b>	<b>0.00048</b>	<b>0.00052</b>
<b>PASS OR FAIL</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

Y Validation

RUN	1.0000	2.0000	3.0000	4.0000
AVERAGE (in)	1.0000	2.0000	3.0000	4.0000
<b>MEASURED ACCURACY (in)</b>	<b>0.00000</b>	<b>0.00000</b>	<b>0.00000</b>	<b>0.00000</b>
<b>REMAINING TOLERANCE (in)</b>	<b>0.00028</b>	<b>0.00032</b>	<b>0.00036</b>	<b>0.00040</b>
<b>PASS OR FAIL</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

**Q Encoder Before Calibration**

<b>Nominal</b>	<b>90.000</b>	<b>180.000</b>	<b>270.000</b>	<b>360.000</b>
Actual (1)	88.258	178.250	268.399	358.360
Actual (2)	88.257	178.250	268.250	358.360
Actual (3)	88.258	178.250	268.250	358.360

**Q Encoder After Calibration**

<b>Nominal</b>	<b>90.000</b>	<b>180.000</b>	<b>270.000</b>	<b>360.000</b>
Actual (1)	90.000	180.000	270.000	360.000
Actual (2)	90.000	180.000	270.000	360.000
Actual (3)	90.000	180.000	270.000	360.000