



ISO/IEC 10360-2:2009 Calibration Report



Select Calibration Incorporated

213 Fourth St. PO Box 96
Rodney, Ontario
NOL 2C0
(519) 902 7215
www.selectcalibration.ca

Customer: **Some Company**
Address: **1024 Binary Way**
Somewhere, Ontario
N0L 2C0
Contact: **Manager**
Phone: **519 929 9922 x256**

Machine Model: **Omega**
Machine Model Id: **24.06**
Serial Number: **90210**
Customer Gauge:
Temperature Min: **20.4 °C**
Temperature Max: **21.4 °C**

Calibration Date: **23 Jan 2019**
Certificate Number: **Sample8**
NRC CLAS Certification Number: **2015-02**
SCC Accreditation Laboratory: **811**

Remarks

Select Calibration Incorporated certifies the measurement performance of this equipment to the resolution of the measurement uncertainty estimated by SCI. SCI's quality system conforms to the requirements of ISO/IEC 17025:2017. The calibration procedure for testing the machine performance is ISO/IEC 10360-2:2009 with supplemental procedure SCI-011 defining methods followed by SCI to meet the requirements.

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and traceability to the International System of Units (SI) or to standards acceptable to the CLAS program. This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither CLAS nor SCC guarantee the accuracy of individual calibrations by accredited laboratories.

Reported results relate to only the items tested. Reported uncertainties are expanded using a coverage factor $k = 2$ for a confidence level of approximately 95%, assuming a normal distribution. Metrological traceability is achieved from a clear definition of the measured, the unbroken chain of comparisons of calibration artifacts to the applicable SI unit using laboratories that have demonstrated technical competence, and the accumulation of measurement uncertainty through each step in the calibration chain.

Results are reported as inside specification when the measurand increased by the expanded measurement uncertainty is contained within the specification limit. Results are reported as outside specification when the measurand reduced by the expanded measurement uncertainty is outside the specification limit. When neither condition applies the result will be reported as compliance unknown.

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Conditions

Environmental:

Manufacturer recommended requirements as described in the system User's Manual.
 Custom requirements. *

* Machines in poor thermal environments are likely to have errors which may not be completely revealed by testing in the same environment. Temperature measurements are from a subset of the entire machine volume.

Adjustments and Reporting:

No adjustment was necessary to meet specifications.
 Adjustments were done to improve performance.

Compliance statements included on report.
 Measurement uncertainty included on report.

Reference Standards and Unit Under Test

Description	Standard ID	CTE	Length	Cal. Date	Due Date
Laser	L-4975			Apr 17 2017	Apr 17 2019
Gauge Block	GB-131417	10.8	12.7	Apr 16 2018	Apr 16 2020
Step Gauge	SG-1520007	10.8	1010.0	Apr 20 2018	Apr 20 2019
Thermometer	T-75014120711-141732			Oct 4 2018	Oct 4 2019

Effective CTE of machine scales: **10.0**

Scale Resolution: **0.000780**

Probe Type: **SP25M**

Probe Stylus: **5 mm diameter, 30 mm length**

Signed By:

Tech: Ron Jaki

Date: Feb 3, 2019



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Point Repeatability (Rpt)

Position measurement of a centrally located precision sphere repeated ten times as rapidly as practical. For each axis the range of the sphere center coordinate is calculated as the difference between the maximum and minimum value. The point coordinate repeatability (Rpt) is the largest range of coordinate values measured. Note: Rpt is a functional test not defined in ISO/IEC 10360:2009

X Axis

Measurement:	1	2	3	4	5	6	7	8	9	10
Result:	0.0	0.5	-0.6	-0.3	-1.6	0.0	-0.4	0.2	0.3	0.1

Min	Max	Range
-0.0016	0.0005	0.0020

Rpt MPL: **0.0030**
 Rpt: **0.0029**

Y Axis

Measurement:	1	2	3	4	5	6	7	8	9	10
Result:	0.0	0.5	0.5	0.9	1.1	1.9	1.9	1.4	1.3	0.6

Min	Max	Range
0.0000	0.0019	0.0019

Uc (k=2): **0.0007**

Z Axis

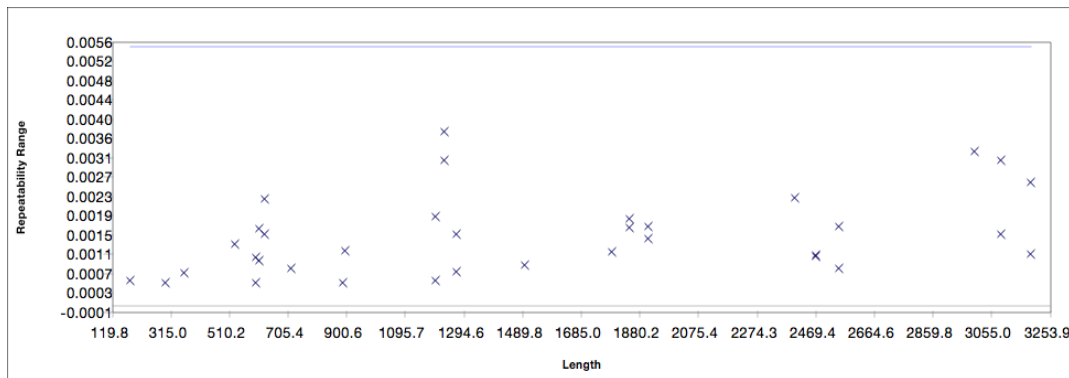
Measurement:	1	2	3	4	5	6	7	8	9	10
Result:	0.0	-0.6	-0.6	-2.5	-1.6	0.5	-0.9	-0.3	-0.4	-0.2

Min	Max	Range
-0.0025	0.0005	0.0029

Compliance is unknown (B89.4.10360 Section 5.4.1)

Length Repeatability (R0)

For each E0 length measurement the range is calculated as the difference between the maximum and minimum length. The repeatability range (R0) is the largest range of the measurement lengths.



R0 MPL: **0.0055**
 As Found R0: **0.0055**
 As Left R0: **0.0037**

As Found Average R0:
 As Left Average R0: **0.0015**

Uc (k=2): **0.0004**

Meets or exceeds specification (ISO 10360-2 Section 6.4)



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Calibration Date: **23 Jan 2019**
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Length Measurement Error (E0)

Five calibrated test lengths are measured three times with a zero (or minimal) tip offset. The length measurement error (E0) is the maximum length deviation from the fifteen length measurements. The compliance statement opinion is based on the maximum length deviation from the fifteen measurements, the expanded measurement uncertainty, and the machine specifications. Correction of the reference artifacts and machine scales for thermal expansion are done within the inspection software of the machine. No correction for thermal effects are performed external of the inspection software.

Position 1

As Left	X	1235.733
	Y	39.093
Translation:	Z	-892.256
	I	-0.390489160
	J	0.888644880
Meas. Axis:	K	0.240475560

Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)
630.0007	629.9969	-3.7	629.9992	-1.5	629.9989	-1.7	0.0014
1270.0000	1269.9984	-1.6	1269.9996	-0.4	1269.9999	-0.1	0.0024
1910.0001	1909.9984	-1.7	1909.9984	-1.7	1910.0001	-0.1	0.0036
2549.9982	2549.9990	0.7	2549.9993	1.0	2549.9985	0.3	0.0047
3190.0018	3189.9990	-2.8	3190.0007	-1.1	3189.9981	-3.7	0.0058

Meets or exceeds specification (ISO 10360-2 Section 6.3) E0: **0.0037**

Position 2

As Left	X	1139.732
	Y	2860.753
Translation:	Z	-801.304
	I	-0.369976650
	J	-0.903117970
Meas. Axis:	K	0.217933970

Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)
609.9999	610.0022	2.3	610.0006	0.7	610.0012	1.3	0.0014
1230.0001	1230.0027	2.5	1230.0009	0.8	1230.0001	-0.5	0.0024
1850.0001	1850.0030	2.8	1850.0011	1.0	1850.0022	2.0	0.0035
2470.0034	2470.0011	-2.3	2470.0021	-1.3	2470.0020	-1.4	0.0046
3090.0012	3090.0001	-1.1	3090.0016	0.4	3090.0016	0.4	0.0057

Meets or exceeds specification (ISO 10360-2 Section 6.3) E0: **0.0028**

Position 3

As Left	X	312.404
	Y	2869.281
Translation:	Z	-797.516
	I	0.356626390
	J	-0.908587890
Meas. Axis:	K	0.217452680

Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)
609.9986	610.0006	2.0	610.0001	1.5	609.9997	1.1	0.0014
1229.9987	1230.0012	2.6	1230.0001	1.5	1229.9975	-1.1	0.0024
1849.9977	1850.0006	2.9	1849.9989	1.2	1849.9992	1.5	0.0035
2470.0002	2470.0003	0.1	2469.9992	-1.0	2469.9997	-0.5	0.0046
3090.0040	3090.0028	-1.2	3089.9998	-4.3	3089.9998	-4.3	0.0058

Meets or exceeds specification (ISO 10360-2 Section 6.3) E0: **0.0043**

Position 4

As Left	X	106.725
	Y	64.291
Translation:	Z	-891.532
	I	0.409293790
	J	0.880263400
Meas. Axis:	K	0.240031130

Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)
629.9976	629.9999	2.3	629.9991	1.5	629.9984	0.8	0.0014
1269.9979	1269.9989	1.0	1269.9982	0.3	1269.9984	0.6	0.0025
1909.9966	1909.9986	2.0	1909.9989	2.3	1909.9975	0.9	0.0036
2550.0003	2549.9989	-1.4	2550.0000	-0.3	2550.0006	0.3	0.0048
3190.0037	3189.9999	-3.8	3189.9988	-4.9	3189.9989	-4.8	0.0059

Meets or exceeds specification (ISO 10360-2 Section 6.3) E0: **0.0049**

E0 MPE: **0.0040+0.0050L/1000**

Deration:

As Found Max E0:

As Left Max E0: **0.0049**



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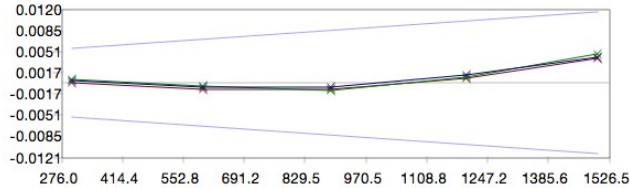
Calibration Date: **23 Jan 2019**
 Certificate Number: **Sample8**
 NRC CLAS Certification Number: **2015-02**
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Length Measurement Error (E0)

Five calibrated test lengths are measured three times with a zero (or minimal) tip offset. The length measurement error (E0) is the maximum length deviation from the fifteen length measurements. The compliance statement opinion is based on the maximum length deviation from the fifteen measurements, the expanded measurement uncertainty, and the machine specifications. Correction of the reference artifacts and machine scales for thermal expansion are done within the inspection software of the machine. No correction for thermal effects are performed external of the inspection software.

Position 5[X]

As Left X -46.800
 Y 879.101
 Translation: Z -676.338
 I 1.000000000
 J 0.000000000
 Meas. Axis: K 0.000000000



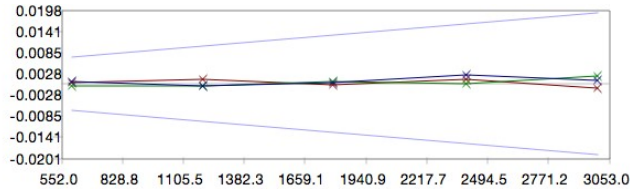
Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)
299.9999	299.9999	0.1	300.0004	0.5	300.0003	0.4	0.0009
600.0009	599.9999	-1.0	600.0004	-0.5	600.0002	-0.7	0.0013
890.0007	889.9996	-1.1	889.9995	-1.3	889.9999	-0.8	0.0018
1199.9990	1199.9998	0.8	1200.0000	1.0	1200.0003	1.3	0.0023
1499.9966	1500.0005	3.9	1500.0014	4.7	1500.0008	4.2	0.0028

Meets or exceeds specification (ISO 10360-2 Section 6.3)

E0: **0.0047**

Position 6[Y]

As Left X 754.375
 Y 2961.050
 Translation: Z -675.027
 I 0.000000000
 J -1.000000000
 Meas. Axis: K 0.000000000



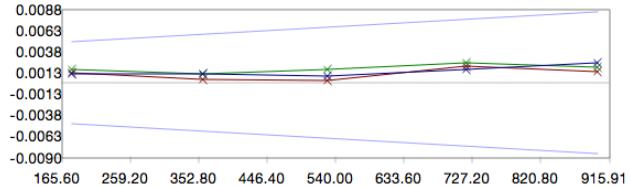
Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)
600.0004	600.0006	0.2	599.9999	-0.5	600.0009	0.5	0.0013
1199.9972	1199.9983	1.2	1199.9966	-0.6	1199.9965	-0.7	0.0023
1789.9999	1789.9995	-0.4	1790.0006	0.7	1790.0002	0.3	0.0034
2399.9983	2399.9994	1.1	2399.9985	0.1	2400.0007	2.4	0.0045
2999.9998	2999.9986	-1.2	3000.0019	2.1	3000.0007	0.9	0.0056

Meets or exceeds specification (ISO 10360-2 Section 6.3)

E0: **0.0024**

Position 7[Z]

As Left X 614.212
 Y 1092.599
 Translation: Z -952.695
 I 0.000000000
 J 0.000000000
 Meas. Axis: K 1.000000000



Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)
179.9999	180.0010	1.2	180.0014	1.6	180.0009	1.0	0.0008
360.0003	360.0007	0.4	360.0014	1.0	360.0014	1.1	0.0010
530.0001	530.0003	0.3	530.0016	1.6	530.0009	0.8	0.0012
719.9999	720.0020	2.0	720.0023	2.4	720.0015	1.6	0.0015
899.9990	900.0003	1.3	900.0009	1.9	900.0015	2.4	0.0018

Meets or exceeds specification (ISO 10360-2 Section 6.3)

E0: **0.0024**

E0 MPE: **0.0040+0.0050L/1000**

Deration:

As Found Max E0:

As Left Max E0: **0.0049**



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 Temperature Max: **21.4 °C**

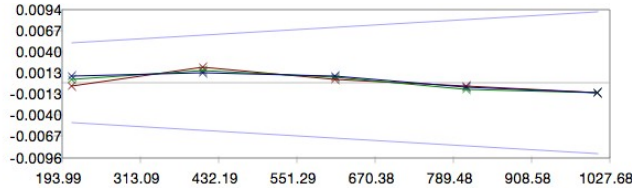
Calibration Date: **23 Jan 2019**
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Length Measurement Error (E150)

Five calibrated test lengths are measured three times with a tip offset of 150mm (5.9"). The length measurement error (E150) is the maximum length deviation from the fifteen length measurements. The compliance statement opinion is based on the maximum length deviation from the fifteen measurements, the expanded measurement uncertainty, and the machine specifications. Correction of the reference artifacts and machine scales for thermal expansion are done within the inspection software of the machine. No correction for thermal effects are performed external of the inspection software.

Position D1

As Left X 280.229
 Y 1721.098
 Translation: Z -923.526
 I 0.723527020
 J -0.007191760
 Meas. Axis: K 0.690258590



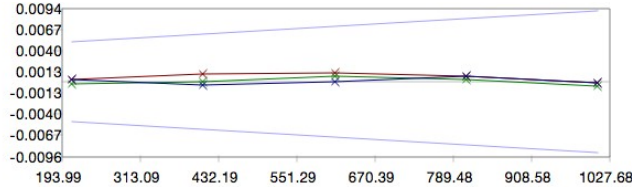
Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)
209.9934	209.9929	-0.5	209.9938	0.4	209.9943	0.9	0.0020
409.9964	409.9984	2.0	409.9980	1.6	409.9977	1.3	0.0022
610.0008	610.0012	0.4	610.0016	0.8	610.0016	0.8	0.0025
810.0027	810.0023	-0.5	810.0019	-0.8	810.0021	-0.6	0.0028
1010.0028	1010.0016	-1.2	1010.0015	-1.3	1010.0016	-1.2	0.0032

Meets or exceeds specification (ISO 10360-2 Section 6.5)

E150: **0.0020**

Position D2

As Left X 1063.075
 Y 1774.113
 Translation: Z -923.823
 I -0.722747980
 J 0.019025140
 Meas. Axis: K 0.690849770



Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)
209.9934	209.9937	0.3	209.9931	-0.3	209.9937	0.3	0.0020
409.9964	409.9973	0.9	409.9965	0.1	409.9960	-0.4	0.0022
610.0008	610.0019	1.1	610.0015	0.7	610.0009	0.1	0.0025
810.0027	810.0034	0.7	810.0029	0.2	810.0035	0.8	0.0028
1010.0028	1010.0027	-0.1	1010.0023	-0.5	1010.0027	-0.1	0.0032

Meets or exceeds specification (ISO 10360-2 Section 6.5)

E150: **0.0011**

E150 MPE: **0.0040+0.0050L/1000**

Deration:

As Found Max E150:

As Left Max E150: **0.0020**



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Temperature Min: **20.4 °C**
Temperature Max: **21.4 °C**

Measurement Summary

This page contains a summary of all measurement results. Complete information for all reported values is shown on the previous sections of this report. Compliance statement can be one of three conditions: inside specification, unknown, or outside specification and indicated as I, U, or O on this page of the report.

Point Repeatability (Rpt)

Position measurement of a centrally located precision sphere repeated ten times as rapidly as practical. For each axis the range of the sphere center coordinate is calculated as the difference between the maximum and minimum value. The point coordinate repeatability (Rpt) is the largest range of coordinate values measured.

Rpt MPL: **0.0030**
Rpt: **0.0029** U
Uc (k=2): **0.0007**

Length Repeatability (R0)

For each E0 length measurement the range is calculated as the difference between the maximum and minimum length. The repeatability range (R0) is the largest range of the measurement lengths.

R0 MPL: **0.0055**
R0: **0.0037** I
Uc (k=2): **0.0004**

Length Measurement Error (E0 and E150)

Five calibrated test lengths are measured three times with a zero (or minimal) tip offset for E0 and a 150 mm (5.9") tip offset for E150. The length measurement error is the maximum length deviation from the fifteen length measurements.

Max E0: **0.0049**
Max E150: **0.0020**
Percentage of maximum error relative to out of tolerance E0: **44.0%**
Percentage of maximum error relative to out of tolerance E150: **24.0%**

E0 MPE: **0.0040+0.0050L/1000**
E150 MPE: **0.0040+0.0050L/1000**

Deration:
Deration:

Position 1					
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)	
630.0007	-3.7	-1.5	-1.7	0.0014	
1270.0000	-1.6	-0.4	-0.1	0.0024	
1910.0001	-1.7	-1.7	-0.1	0.0036	
2549.9982	0.7	1.0	0.3	0.0047	
3190.0018	-2.8	-1.1	-3.7	0.0058	

Position 2					
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)	
609.9999	2.3	0.7	1.3	0.0014	
1230.0001	2.5	0.8	-0.5	0.0024	
1850.0001	2.8	1.0	2.0	0.0035	
2470.0034	-2.3	-1.3	-1.4	0.0046	
3090.0012	-1.1	0.4	0.4	0.0057	

Position 3					
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)	
609.9986	2.0	1.5	1.1	0.0014	
1229.9987	2.6	1.5	-1.1	0.0024	
1849.9977	2.9	1.2	1.5	0.0035	
2470.0002	0.1	-1.0	-0.5	0.0046	
3090.0040	-1.2	-4.3	-4.3	0.0058	

Position 4					
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)	
629.9976	2.3	1.5	0.8	0.0014	
1269.9979	1.0	0.3	0.6	0.0025	
1909.9966	2.0	2.3	0.9	0.0036	
2550.0003	-1.4	-0.3	0.3	0.0048	
3190.0037	-3.8	-4.9	-4.8	0.0059	

Position 5[X]					
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)	
299.9999	0.1	0.5	0.4	0.0009	
600.0009	-1.0	-0.5	-0.7	0.0013	
890.0007	-1.1	-1.3	-0.8	0.0018	
1199.9990	0.8	1.0	1.3	0.0023	
1499.9966	3.9	4.7	4.2	0.0028	

Position 6[Y]					
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)	
600.0004	0.2	-0.5	0.5	0.0013	
1199.9972	1.2	-0.6	-0.7	0.0023	
1789.9999	-0.4	0.7	0.3	0.0034	
2399.9983	1.1	0.1	2.4	0.0045	
2999.9998	-1.2	2.1	0.9	0.0056	

Position 7[Z]					
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)	
179.9999	1.2	1.6	1.0	0.0008	
360.0003	0.4	1.0	1.1	0.0010	
530.0001	0.3	1.6	0.8	0.0012	
719.9999	2.0	2.4	1.6	0.0015	
899.9990	1.3	1.9	2.4	0.0018	

Position D1					
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)	
209.9934	-0.5	0.4	0.9	0.0020	
409.9964	2.0	1.6	1.3	0.0022	
610.0008	0.4	0.8	0.8	0.0025	
810.0027	-0.5	-0.8	-0.6	0.0028	
1010.0028	-1.2	-1.3	-1.2	0.0032	

Position D2					
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)	
209.9934	0.3	-0.3	0.3	0.0020	
409.9964	0.9	0.1	-0.4	0.0022	
610.0008	1.1	0.7	0.1	0.0025	
810.0027	0.7	0.2	0.8	0.0028	
1010.0028	-0.1	-0.5	-0.1	0.0032	