



ASME B89.4.10360-2:2008 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: **21.5 °C**

Calibration Date: **26 Aug 2015**
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 9001:2008 and ISO/IEC 17025:2005. The calibration procedure for testing the machine performance is ASME B89.4.10360-2:2008 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.

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Conditions

Environmental Conditions:

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. It is always best to improve the environment. Temperature measurements are from a subset of the entire machine volume.

Machine Adjustments:

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

Statement of Compliance Required

Measurement Uncertainty Reported

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	May 13 2016	May 13 2018
Thermometer	T-75014120711-141732			Oct 5 2017	Oct 5 2018
Step Gauge	SG-1520007	10.8	1010.0	Apr 10 2017	Apr 10 2018

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

Date: Feb 24, 2018



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Point Repeatability (Rpt)

Repeated measurements 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.

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

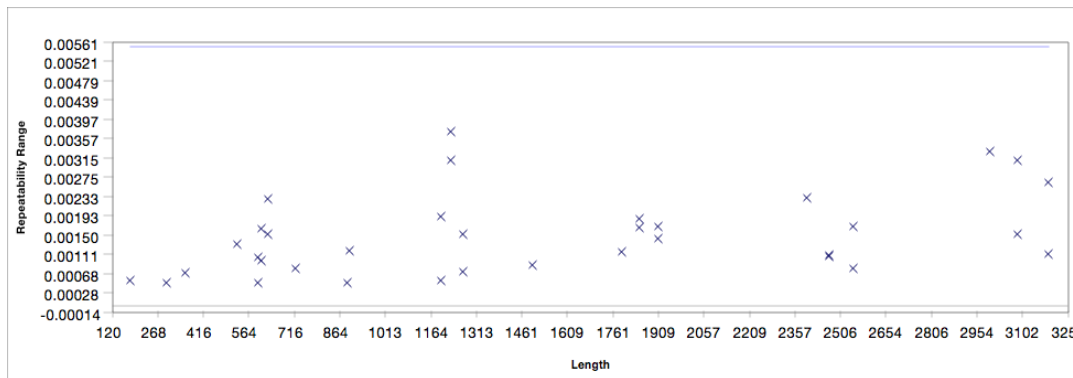
Measurement:	1	2	3	4	5	6	7	8	9	10
Result:	0.0	-0.6	-0.6	-2.5	-1.6	0.5	-0.9	-0.3	-0.4	-0.2

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: **0.0037**
As Left R0: **0.0037**

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

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

Meets or exceeds specification (B89.4.10360 Section 6.4)



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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				Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)	
As Left	X	1235.733		630.0007	629.9969	-3.7	629.9992	-1.5	629.9989	-1.7	0.0012	
	Y	39.093		1270.0000	1269.9984	-1.6	1269.9996	-0.4	1269.9999	-0.1	0.0021	
Translation:	Z	-892.256		1910.0001	1909.9984	-1.7	1909.9984	-1.7	1910.0001	-0.1	0.0031	
	I	-0.390489160		2549.9982	2549.9990	0.7	2549.9993	1.0	2549.9985	0.3	0.0041	
	J	0.888644880		3190.0018	3189.9990	-2.8	3190.0007	-1.1	3189.9981	-3.7	0.0051	
Meas. Axis:	K	0.240475560		Meets or exceeds specification (B89.4.10360 Section 6.3)								E0:

Position 2				Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)	
As Left	X	1139.732		609.9999	610.0022	2.3	610.0006	0.7	610.0012	1.3	0.0012	
	Y	2860.753		1230.0001	1230.0027	2.5	1230.0009	0.8	1230.0001	-0.5	0.0021	
Translation:	Z	-801.304		1850.0001	1850.0030	2.8	1850.0011	1.0	1850.0022	2.0	0.0030	
	I	-0.369976650		2470.0034	2470.0011	-2.3	2470.0021	-1.3	2470.0020	-1.4	0.0040	
	J	-0.903117970		3090.0012	3090.0001	-1.1	3090.0016	0.4	3090.0016	0.4	0.0049	
Meas. Axis:	K	0.217933970		Meets or exceeds specification (B89.4.10360 Section 6.3)								E0:

Position 3				Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)	
As Left	X	312.404		609.9986	610.0006	2.0	610.0001	1.5	609.9997	1.1	0.0012	
	Y	2869.281		1229.9987	1230.0012	2.6	1230.0001	1.5	1229.9975	-1.1	0.0021	
Translation:	Z	-797.516		1849.9977	1850.0006	2.9	1849.9989	1.2	1849.9992	1.5	0.0030	
	I	0.356626390		2470.0002	2470.0003	0.1	2469.9992	-1.0	2469.9997	-0.5	0.0040	
	J	-0.908587890		3090.0040	3090.0028	-1.2	3089.9998	-4.3	3089.9998	-4.3	0.0049	
Meas. Axis:	K	0.217452680		Meets or exceeds specification (B89.4.10360 Section 6.3)								E0:

Position 4				Nominal	Length 1	Dev 1	Length 2	Dev 2	Length 3	Dev 3	Uc (k=2)	
As Left	X	106.725		629.9976	629.9999	2.3	629.9991	1.5	629.9984	0.8	0.0012	
	Y	64.291		1269.9979	1269.9989	1.0	1269.9982	0.3	1269.9984	0.6	0.0021	
Translation:	Z	-891.532		1909.9966	1909.9986	2.0	1909.9989	2.3	1909.9975	0.9	0.0031	
	I	0.409293790		2550.0003	2549.9989	-1.4	2550.0000	-0.3	2550.0006	0.3	0.0041	
	J	0.880263400		3190.0037	3189.9999	-3.8	3189.9988	-4.9	3189.9989	-4.8	0.0051	
Meas. Axis:	K	0.240031130		Meets or exceeds specification (B89.4.10360 Section 6.3)								E0:

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

As Found Max E0:
 As Left Max E0: **0.0049**



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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	0.0012
890.0007	889.9996	-1.1	889.9995	-1.3	889.9999	-0.8	0.0016
1199.9990	1199.9998	0.8	1200.0000	1.0	1200.0003	1.3	0.0020
1499.9966	1500.0005	3.9	1500.0014	4.7	1500.0008	4.2	0.0025

Meets or exceeds specification (B89.4.10360 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	0.0012
1199.9972	1199.9983	1.2	1199.9966	-0.6	1199.9965	-0.7	0.0020
1789.9999	1789.9995	-0.4	1790.0006	0.7	1790.0002	0.3	0.0029
2399.9983	2399.9994	1.1	2399.9985	0.1	2400.0007	2.4	0.0039
2999.9998	2999.9986	-1.2	3000.0019	2.1	3000.0007	0.9	0.0048

Meets or exceeds specification (B89.4.10360 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	0.0009
530.0001	530.0003	0.3	530.0016	1.6	530.0009	0.8	0.0011
719.9999	720.0020	2.0	720.0023	2.4	720.0015	1.6	0.0014
899.9990	900.0003	1.3	900.0009	1.9	900.0015	2.4	0.0016

Meets or exceeds specification (B89.4.10360 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: **21.5 °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)

Repeated measurements 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**

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

Deration:
Deration:

Percentage of maximum error relative to out of tolerance E0: **44.6%**
Percentage of maximum error relative to out of tolerance E150: **24.3%**

Position 1				
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)
630.0007	-3.7	-1.5	-1.7	0.0012
1270.0000	-1.6	-0.4	-0.1	0.0021
1910.0001	-1.7	-1.7	-0.1	0.0031
2549.9982	0.7	1.0	0.3	0.0041
3190.0018	-2.8	-1.1	-3.7	0.0051

Position 2				
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)
609.9999	2.3	0.7	1.3	0.0012
1230.0001	2.5	0.8	-0.5	0.0021
1850.0001	2.8	1.0	2.0	0.0030
2470.0034	-2.3	-1.3	-1.4	0.0040
3090.0012	-1.1	0.4	0.4	0.0049

Position 3				
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)
609.9986	2.0	1.5	1.1	0.0012
1229.9987	2.6	1.5	-1.1	0.0021
1849.9977	2.9	1.2	1.5	0.0030
2470.0002	0.1	-1.0	-0.5	0.0040
3090.0040	-1.2	-4.3	-4.3	0.0049

Position 4				
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)
629.9976	2.3	1.5	0.8	0.0012
1269.9979	1.0	0.3	0.6	0.0021
1909.9966	2.0	2.3	0.9	0.0031
2550.0003	-1.4	-0.3	0.3	0.0041
3190.0037	-3.8	-4.9	-4.8	0.0051

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	0.0012
890.0007	-1.1	-1.3	-0.8	0.0016
1199.9990	0.8	1.0	1.3	0.0020
1499.9966	3.9	4.7	4.2	0.0025

Position 6[Y]				
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)
600.0004	0.2	-0.5	0.5	0.0012
1199.9972	1.2	-0.6	-0.7	0.0020
1789.9999	-0.4	0.7	0.3	0.0029
2399.9983	1.1	0.1	2.4	0.0039
2999.9998	-1.2	2.1	0.9	0.0048

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	0.0009
530.0001	0.3	1.6	0.8	0.0011
719.9999	2.0	2.4	1.6	0.0014
899.9990	1.3	1.9	2.4	0.0016

Position D1				
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)
209.9934	-0.5	0.4	0.9	0.0019
409.9964	2.0	1.6	1.3	0.0021
610.0008	0.4	0.8	0.8	0.0024
810.0027	-0.5	-0.8	-0.6	0.0027
1010.0028	-1.2	-1.3	-1.2	0.0031

Position D2				
Nominal	Dev 1	Dev 2	Dev 3	Uc (k=2)
209.9934	0.3	-0.3	0.3	0.0019
409.9964	0.9	0.1	-0.4	0.0021
610.0008	1.1	0.7	0.1	0.0024
810.0027	0.7	0.2	0.8	0.0027
1010.0028	-0.1	-0.5	-0.1	0.0031