- when it has to be right

Leica Geosystems

Leica Geosystems
Calibration Certificate Gold

Calibration Certificate Gold with measurement values issued by Swiss Accredited Calibration Laboratory SCS 0079

Product:	**MS60 1" R2000**	**Certificate No:**	887313-13112025
Article No:	898871	**Inspection Date:**	November 13, 2025
Serial No:	887313	**Order No:**	501786639
Equipment No:	9020173	**PO No:**	8799348/00010
Issued by:	Accredited Calibration Lab. SCS 0079 Leica Geosystems AG 9435 Heerbrugg Switzerland	**Ordered by:**	Leica Geosystems Inc. 555 North Point Center East Alpharetta Ga 30022 USA
Status:	After inspection	**Customer:**	Leica Geosystems Inc. LSC Duluth, Service Dept. 1550 Boggs Road / Duluth Ga 30096 USA

Compliance

The Calibration Certificate Gold with measurement values is issued by the Accredited Calibration Laboratory SCS 0079. The accreditation (SCS 0079) is in accordance with the standard ISO/IEC 17025 and is granted by the Swiss Accreditation Service (SAS). The Swiss Accreditation Service is a member of the International Laboratory Accreditation Cooperation (ILAC) and signatory of the Mutual Recognition Agreement (MRA) which assures international acceptance of calibration certificates. The Angle Measurement test results fulfil the requirements of the statistical test procedure as described in ISO 17123-3. The Distance Measurement test results fulfil the requirements of the statistical test procedure as described in ISO 17123-4.

The test equipment used is traceable to national standards or to recognized procedures. This is established by our Quality Management System, audited by SAS (Swiss Accreditation Authority) according to ISO/IEC 17025.

Certificate

We hereby certify that the product described has been tested with the following result:

☒ **Compliance** The test results are within the specification of the product

☐ Non-Compliance The test results are not within the specification of the product.

Note: The statement of compliance has been taken without consideration of the measurement uncertainty ("shared risk")

SWISS ACCREDITATION sas.admin.ch SCS 0079

ilac-MRA

Leica Geosystems AG

Lumni Gjura
Calibration Laboratories Surveying

November 13, 2025

Wolfgang Hardegen
Head of Accredited Laboratories

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Specifications

a) Distance Measurement (Prism)

Standard deviation of a single measurement (ISO 17123-4):	1.0 mm + 1.5 ppm

b) Distance Measurement (Non-Prism)

Standard deviation of a single measurement:	2.0 mm + 2.0 ppm

c) Angle Measurement

Standard deviation of a double face measurement (ISO 17123-3):	
Horizontal Hz:	s = 0.3 mgon [1"]
Vertical V:	s = 0.3 mgon [1"]

Test Results

a) Distance Measurement (Prism)

1. Standard deviation of a single distance measurement (ISO 17123-4): 0.30 mm ± 0.11 mm *)

Distance range:	19.5 m to 501.5 m
Temperature range:	13.8 °C to 15.9 °C
Atm. Pressure:	970 hPa
Reflector type:	GPH1P

The determination of the standard deviation is based on distance measurements in all combinations on a field base line.

2. Measured deviation: 0.0 mm ± 0.26 mm *)

Distance range:	3 m to 121 m
Temperature range:	20.5 °C
Atm. Pressure:	952 hPa
Reflector type:	GPH1P

The deviation is determined on a reference base line as differences between known and measured distances.

3. Relative EDM Frequency deviation:

Temperature:	21.0 °C	0.1 ppm + 0.10 ppm *)
Temperature:	-21.6 °C	0.1 ppm + 0.10 ppm *)
Temperature:	50.5 °C	0.2 ppm + 0.10 ppm *)

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b) Distance Measurement (Non-Prism)

Measured deviation: s = 0.0 mm ± 0.70 mm *)

Distance range:	2 m to 60 m
Temperature range:	20.9 °C
Atm. Pressure:	952.1 hPa
Reflector type:	Nuvovern ACR Enamel white silk mat (93% reflection)

The deviation is determined on a reference base line as differences between known and measured distances.

c) Angle Measurement

Standard deviation Horizontal Direction Hz: s = 0.22 mgon ± 0.06 mgon*)
(s = 0.7" ± 0.18" *)

Temperature:	20.6 °C
Measuring sector:	360°

Standard deviation Vertical Angle V: s = 0.22 mgon ± 0.05 mgon*)
(s = 0.7" ± 0.18" *)

Temperature:	20.6 °C
Measuring sector:	+ 126° zenith angle

Measurement Uncertainty

*) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for normal distribution corresponds to a coverage propability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA-4/02.

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Calibration Certificate Gold - Appendix

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Test Procedure

Distance Measurement

The standard deviation of a distance measurement is verified in accordance with ISO 17123-4. Measurements are carried out on the base line in the field with a range of more than 500m and on a laboratory reference base line, controlled by a Laser Tracker with Absolute Interferometer (AIFM). This is a combination of Interferometer and a high precision Absolute Distance Meter (ADM). The reference base line has a test-range of up to 122m.
The scale factor (ppm) is verified by the frequency difference between the EDM internal design frequency and the measured EDM modulation frequency of the emitted radiation at different temperatures.

Angle Measurement

The reported measuring results are based on single face measurements under laboratory conditions, propagated (under consideration of the influence of telescope and drive properties) to double face measurements under field conditions according to ISO 17123-3 in order to make them comparable to the specifications. Compliance statement meets the requirements of the statistical test procedure as described in ISO 17123-3.

Test Equipment

Distance Measurement

Leica Absolute Laser Tracker AT960-LR	Serial No.: 752055
Thermo-Sensor Ludwig Schneider - TE-MI-303-1K-I-30-So	Serial No.: 21-4630, (several units)
Manometer-Sensor Burster.de, 8227-5002 V2380	Serial No.: 2112228101004, (several units)
Humidity-Sensor Rotronic HC2A-S	Serial No.: 0020498139, (several units)
Thermo-/Hygrometer Shinko DFT-700	Serial No.: A51266, 076F90065, (several units)
Digital Manometer Huber Instruments HM35.00.ALJ1.00	Serial No.: E063005
Frequency Measurement Unit (HP 53181A)	Serial No.: 3548A02421, (several units)

Angle Measurement

Theodolite testing machine (Leica TPM-2)	Serial No.: 2
Theodolite testing machine (Leica TPM-3)	Serial No.: 3

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Measurement Report

a) Distance Measurement (Prism)
1. Field base line

Product	: **MS60 1" R2000**	**Temperature**	: 14.6 °C
Serial no.	: 887313	**Pressure**	: 970 hPa
Inspection date	: November 13, 2025	**Humidity**	: 61 % r.h.
Inspected by	: PEND	**Target**	: GPH1P

Additive constant valid for standard equipment (prism holder and circular prism)
Measuring procedure and calculations according to ISO 17123-4
Number of measured distances : 21
Degree of freedom : 14

	Measured distance [m]	Atm. & geom. corrected distance [m]	Residual [mm]	Adjusted distance [m]	Temperature [°C]	Weight
0-1	19.5	19.5	-0.4	19.5	14.0	1.0
0-2	48.5	48.5	0.4	48.5	13.8	1.0
0-3	116.5	116.5	0.4	116.5	14.2	1.0
0-4	284.0	284.0	-0.7	284.0	14.4	1.0
0-5	370.0	370.0	0.1	370.0	14.4	1.0
0-6	501.5	501.5	0.3	501.5	14.2	1.0
1-2	29.0	29.0	-0.1		14.0	1.0
1-3	97.0	97.0	0.1		15.3	1.0
1-4	264.5	264.5	0.0		15.1	1.0
1-5	350.5	350.5	0.0		14.8	1.0
1-6	482.0	482.0	-0.3		15.0	1.0
2-3	68.0	68.0	-0.1		15.9	1.0
2-4	235.5	235.5	0.3		14.4	1.0
2-5	321.5	321.5	0.0		14.5	1.0
2-6	453.0	453.0	0.1		14.2	1.0
3-4	167.5	167.5	0.3		14.4	1.0
3-5	253.5	253.5	0.0		14.6	1.0
3-6	385.0	385.0	0.1		14.2	1.0
4-5	86.0	86.0	0.0		15.2	1.0
4-6	217.5	217.5	-0.1		15.1	1.0
5-6	131.5	131.5	0.0		15.9	1.0

Standard deviation of a single measurement m_0 : 0.30 mm
Additive constant AC : 0.11 mm
Standard deviation of additive constant m_c : 0.14 mm

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Measurement Report

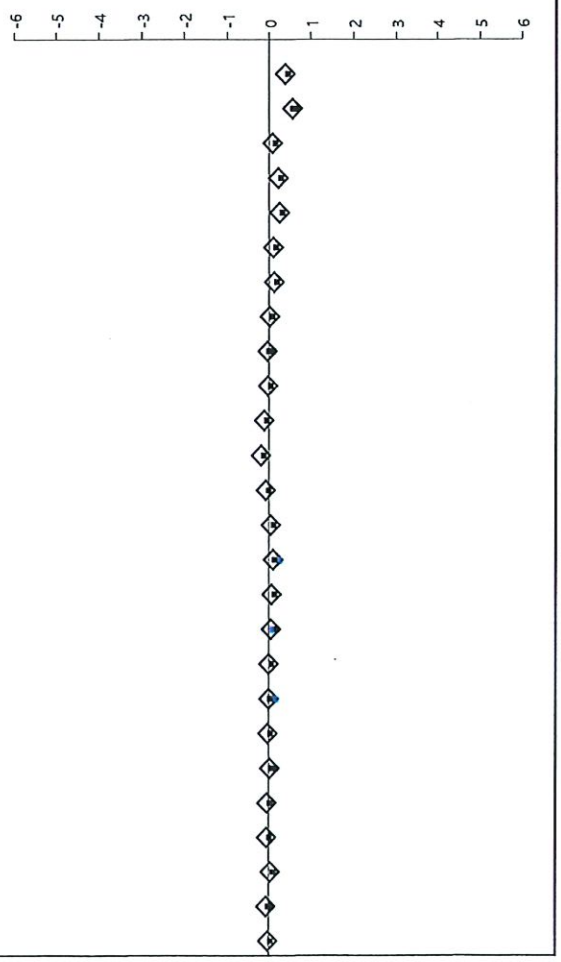
a) Distance Measurement (Prism)
2. Laboratory reference base line

Distance Linearity

Product	: **MS60 1" R2000**	**Temperature**	: 20.5 °C
Serial no.	: 887313	**Pressure**	: 952 hPa
Inspection date	: November 11, 2025	**Humidity**	: 33.6 % r.h.
Inspected by	: PEND	**Target**	: GPH1P

Additive constant for the Leica Geosystems circular prism GPH1P is set to zero (0mm).

No.	True distance [mm]	Measured distance (χ ,n=3) [mm]	Difference [mm]	Distance linearity (measured distance minus true distance) [mm]
1	3021.1	3021.4	0.3	
2	5021.2	5021.8	0.6	
3	10021.3	10021.4	0.1	
4	15021.7	15021.9	0.2	
5	20022.0	20022.3	0.3	
6	25022.7	25022.8	0.1	
7	30022.8	30022.9	0.1	
8	35022.9	35022.9	0.0	
9	40023.1	40023.0	-0.1	
10	45022.9	45022.9	0.0	
11	50023.5	50023.4	-0.1	
12	55023.0	55022.8	-0.2	
13	59023.5	59023.4	-0.1	
14	64903.6	64903.7	0.1	
15	68904.0	68904.1	0.1	
16	73903.6	73903.7	0.1	
17	78904.2	78904.3	0.1	
18	83904.1	83904.0	-0.1	
19	88904.2	88904.2	0.0	
20	93904.3	93904.3	0.0	
21	98904.5	98904.6	0.1	
22	103905.1	103905.1	0.0	
23	108905.4	108905.4	0.0	
24	113905.8	113905.8	0.0	
25	118905.9	118905.8	-0.1	
26	120906.1	120906.1	0.0	



▪ single measurement
◇ mean of three measurements

Distance Linearity : ± 0.6 mm

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Measurement Report

a) Distance Measurement (Prism)
3. Frequency Measurement

Product : **MS60 1" R2000**
Serial no. : 887313
Inspection date : November 10, 2025
Inspected by : PEND

	+ 20°C	- 20°C	+ 50°C
Date:	07.11.2025	07.11.2025	10.11.2025
Climate Chamber [°C]:	21.0	-21.6	50.5
Frequency (design) Intrument [Hz]:	2,016,124.61	2,016,124.61	2,016,124.61
Frequency (measured) Counter [Hz]:	2,016,124.47	2,016,124.48	2,016,124.29
Frequency f(d) - f(m) [Hz]:	0.14	0.13	0.32
PPM	0.1	0.1	0.2

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Measurement Report

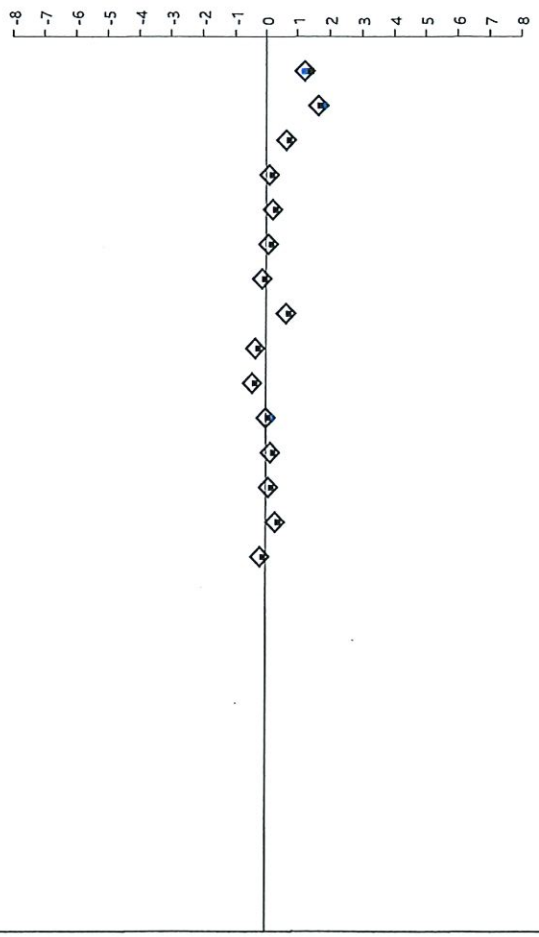
b) Distance Measurement (Non-Prism)
(Laboratory reference base line)

Distance Linearity

Product	: **MS60 1" R2000**	**Temperature**	: 20.9 °C
Serial no.	: 887313	**Pressure**	: 952.1 hPa
Inspection date	: November 11, 2025	**Humidity**	: 33.4 % r.h.
Inspected by	: PEND	**Target**	: Nuvovern ACR Enamel white silk mat (93% reflection)

No.	True distance [mm]	Measured distance (χ ,n=3) [mm]	Difference [mm]
1	2245.8	2247.0	1.2
2	3745.9	3747.6	1.7
3	5245.5	5246.1	0.6
4	6746.0	6746.1	0.1
5	9945.5	9945.7	0.2
6	14945.9	14945.9	0.0
7	19946.2	19946.1	-0.1
8	24946.9	24947.5	0.6
9	29947.0	29946.6	-0.4
10	34947.1	34946.7	-0.4
11	39947.2	39947.2	0.0
12	44947.2	44947.3	0.1
13	49947.8	49947.8	0.0
14	54947.2	54947.5	0.3
15	59947.8	59947.6	-0.2

Distance linearity (measured distance minus true distance)



▪ single measurement
◇ mean of three measurements

Distance Linearity : ± 1.7 mm
Standard deviation of a single measurement m0 : 0.6 mm

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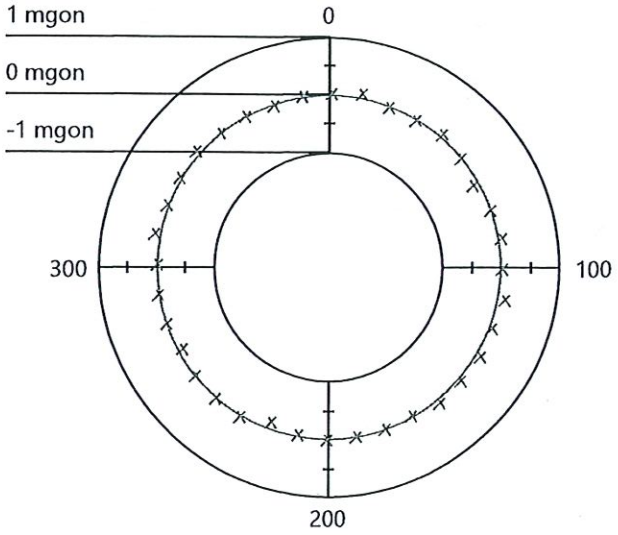
Measurement Report

c) Angle Measurement

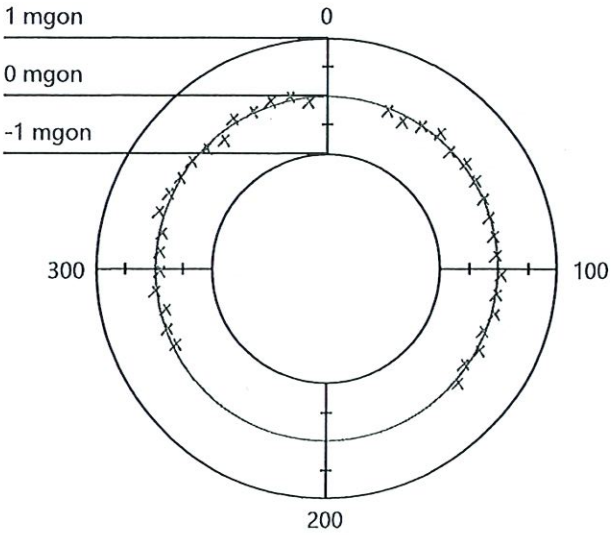
Product	: **MS60 1" R2000**	**Temperature**	: 20.6 °C
Serial no.	: 887313		
Inspection date	: November 10, 2025		
Inspected by	: PEND		

Horizontal Angle Hz



Standard deviation ISO 17123-3 (n=36): 0.22 mgon

Vertical Angle V



Standard deviation ISO 17123-3 (n=36): 0.22 mgon

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