

LASER TRACKER SERVICE

REPORT AND COMPENSATION DATA



Calibration Certificate Metrology

Calibration Certificate Metrology with measurement values issued by Manufacturer

Product : Leica Absolute Tracker AT401
Article No.: 576371
Serial No. : 391059

Certificate No. : 391059-00042019
Inspection Date: April 1, 2019
P.O. Number :

Customer : Haco A/S
Barrit Langgade 97
DK-7150 Barrit
DANMARK

Certification Location:
Leica Service Center, Göteborg

Status : After Inspection

Compliance

The Calibration Certificate Metrology with measurement values issued by Manufacturer corresponds to the Customer Certificate Metrology in accordance with DIN 55 350 Part 18-4.2.2.

Certificate :

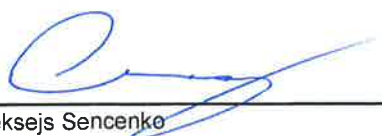
We hereby certify that the product described has been tested with the following result:

Compliance The test results are within the specification of the product.

The test equipment used is traceable to national standards or to recognized procedures.

This is established by our Quality Management System, audited and certified to ISO 9001 by an independent national accreditation authority.

Göteborg
April 1, 2019



Aleksejs Sencenko

Specifications

a) Measurement Uncertainty of a spatial length (MPE) of 2500 mm observed at a distance of:	3.5 m :	≤	± 0.050 mm
	7.0 m :	≤	± 0.080 mm
	9.0 m :	≤	± 0.097 mm
b) Measurement Uncertainty (MPE) of an ADM measurement throughout working range (Expanded Uncertainty (k=2)):		≤	± 0.014 mm
c) Repeatability of an ADM measurement throughout the entire working range (Expanded Uncertainty (k=2)):		≤	± 0.005 mm
d) Embedded Meteorological Temperature:		≤	± 0.3 °C
e) Embedded Meteorological Pressure:		≤	± 1.0 hPa
f) Embedded Meteorological Relative Humidity:		≤	± 5.0 %

Test Results

a) Maximum observed deviation of measurements at the spatial distance of:	3.5 m :	-0.040 mm
	7.0 m :	-0.033 mm
	9.0 m :	-0.052 mm
b) Maximum observed Uncertainty of ADM		-0.003 mm
c) Maximum observed Repeatability of ADM between 1.5 m and 80 m:		0.002 mm
d) Maximum observed deviation of Temperature:		0.1°C
e) Maximum observed deviation of Pressure:		0.2 hPa
f) Maximum observed deviation of Relative Humidity:		0.0 %

Calibration Certificate Metrology - Appendix

Calibration Certificate Metrology with measurement values issued by Manufacturer

Test Procedure

a) Process Documentation

The verification is performed per the Leica procedure.
 "Recertification Manual for Leica Laser Tracker, T-Scan and T-Probe"

b) Spatial Length Measurement (Scale Bar)

The spatial length measurements, respective the coordinate determination are carried out on a scale bar.
 The reference distances are determined with equipment traceable to national standards.

c) Embedded Meteostation (Temperature / Pressure / Humidity)

The reported measuring results are deviations to measurements of a reference meteo station traceable to national standards, which has been calibrated by an accredited body.

Test Equipment

a) Process Documentation

Leica Recertification Procedure Manual	Revision Nr.	2.1.60
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b) Spatial Length Measurement (Scale Bar)

Brunson Invar Kit SN: 11-MSP1-494	Calibration Certificate No.:	L180716TM1
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c) Embedded Meteostation (Temperature/Pressure/Humidity)

Lufft XA-1000	Serial No.: 026.0116.1001.003	Calibration Certificate No.: 13433
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Measurement Report



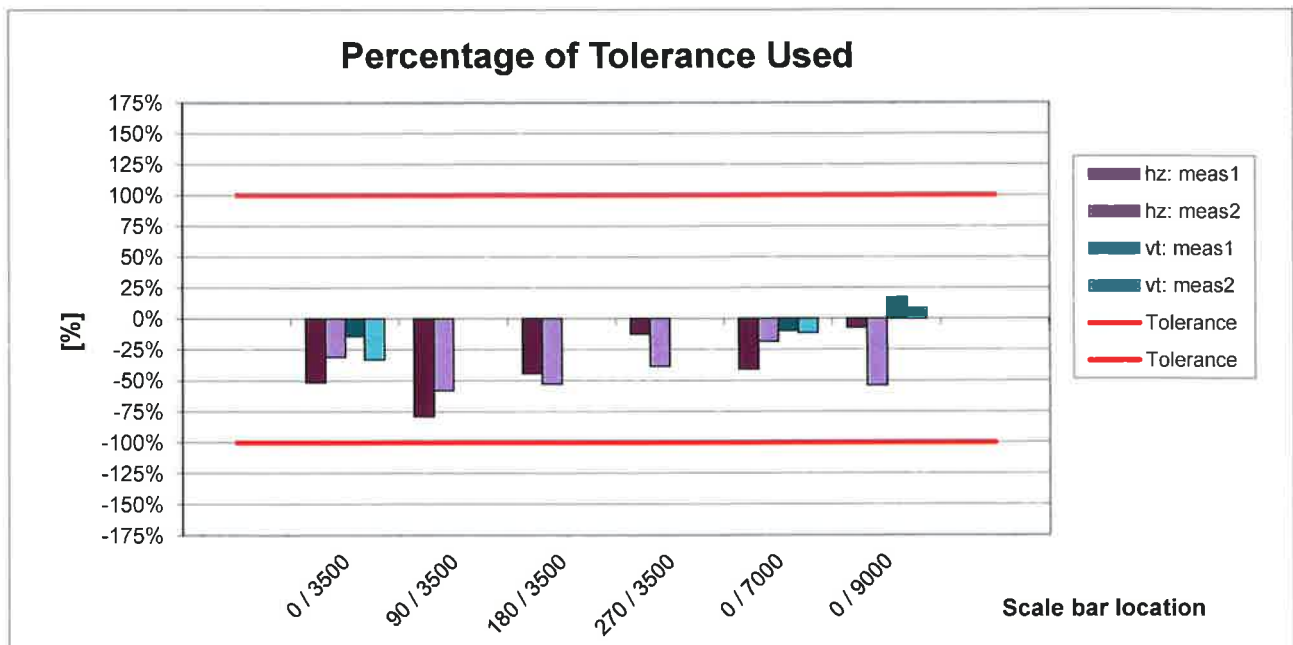
a) Spatial Length Measurement (Scale Bar)

Inspection Date: April 1, 2019
 Inspected by: Aleksejs Sencenko

Temperature: 22.0 °C
 Pressure: 1015.5 hPa
 Humidity: 30.0 %
 Reflector Serial No.: 11191

Product: Leica Absolute Tracker AT401
 Serial No: 391059

Scale bar setup		Actual measurements		Repeatability	Actual minus nominal		Tolerance	
Quadrant	Distance	Scale bar	meas 1	meas 2	$\Delta M1 - M2$	meas 1	meas 2	out-of-tol.
[deg]	[mm]	setup	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
0	3500	horizontal	2550.007	2550.017	-0.010	-0.026	-0.015	± 0.050
		vertical	2550.026	2550.016	0.010	-0.007	-0.017	± 0.050
90	3500	horizontal	2549.993	2550.004	-0.011	-0.040	-0.029	± 0.050
180	3500	horizontal	2550.011	2550.007	0.004	-0.022	-0.026	± 0.050
270	3500	horizontal	2550.027	2550.014	0.013	-0.006	-0.019	± 0.050
0	7000	horizontal	2550.000	2550.018	-0.018	-0.033	-0.015	± 0.080
		vertical	2550.025	2550.024	0.001	-0.008	-0.009	± 0.080
0	9000	horizontal	2550.026	2549.981	0.045	-0.007	-0.052	± 0.097
		vertical	2550.049	2550.041	0.008	0.016	0.008	± 0.097



Measurement Report



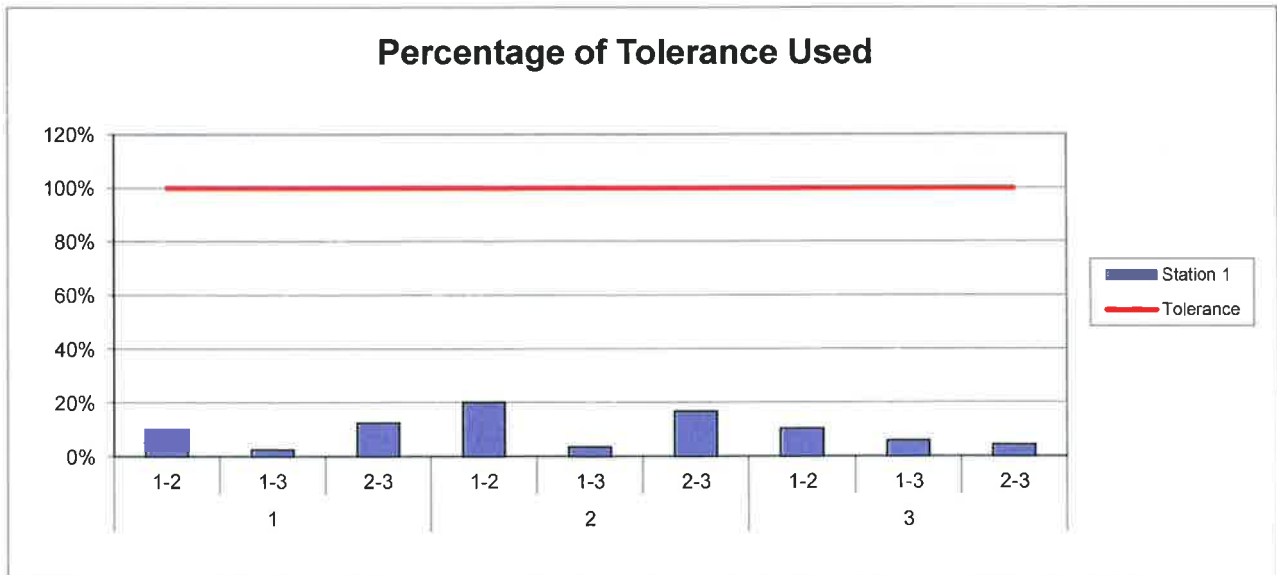
b) Distance Measurement (ADM)

Inspection Date: April 1, 2019
 Inspected by: Aleksejs Sencenko
 Product: Leica Absolute Tracker AT401
 Serial No: 391059

Temperature: 22.0 °C
 Pressure: 1015.5 hPa
 Humidity: 30.0 %
 Reflector Serial No.: 11191

Weighted Averaged Reference Lengths		
from Target	to Target	Length [mm]
1	2	4098.349
1	3	13094.715
2	3	8996.366

Station	from Target	to Target	Length [mm]	Residual [mm]	Tolerance	Percentage	Verdict
1	1	2	4098.350	0.001	0.014	10%	passed
	1	3	13094.714	0.000	0.014	2%	passed
	2	3	8996.365	-0.002	0.014	12%	passed
2	1	2	4098.346	-0.003	0.014	20%	passed
	1	3	13094.714	0.000	0.014	3%	passed
	2	3	8996.369	0.002	0.014	17%	passed
3	1	2	4098.351	0.001	0.014	10%	passed
	1	3	13094.715	0.001	0.014	6%	passed
	2	3	8996.366	-0.001	0.014	4%	passed



Measurement Report



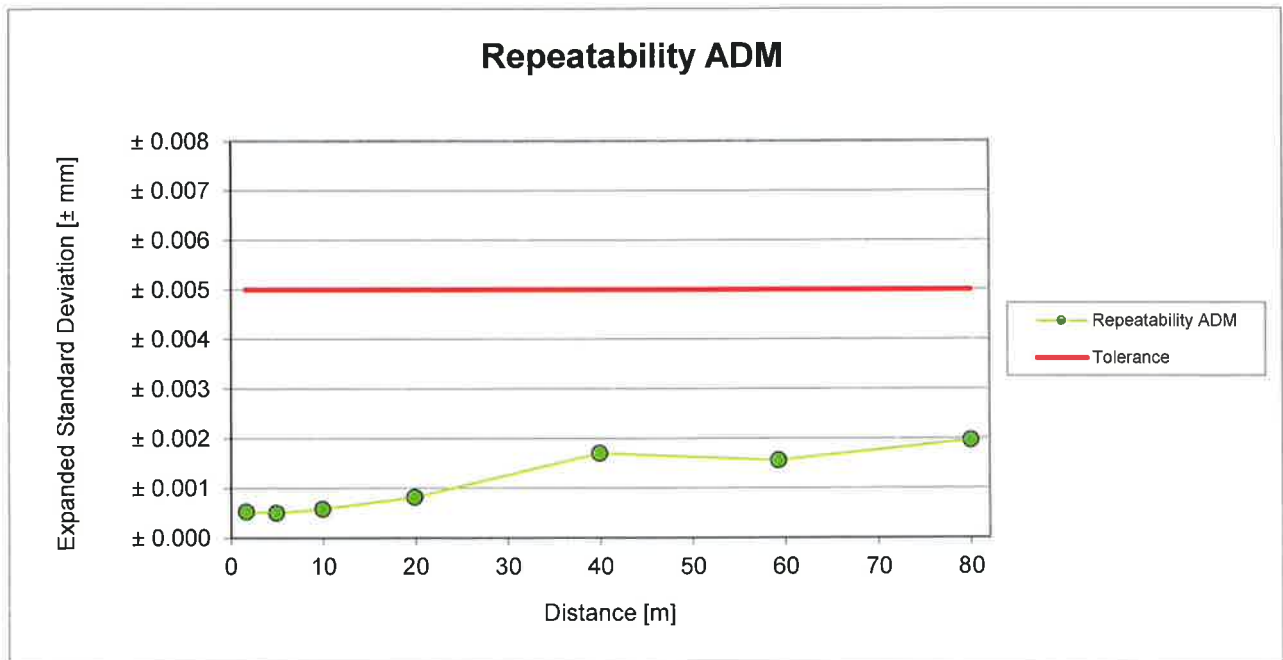
c) Distance Repeatability Measurement (ADM)

Inspection Date: April 1, 2019
 Inspected by: Aleksejs Sencenko
 Product: Leica Absolute Tracker AT401
 Serial No: 391059

Temperature: 22.4 °C
 Pressure: 1010.3 hPa
 Humidity: 34.2 %
 Reflector Serial No.: 11191

Repeatability

Distance approximate [m]	Distance average measured [mm]	Standard Deviation [mm]	Expanded Standard Deviation (k=2) [mm]	Verdict
1.5	1616.942	± 0.0003	± 0.0005	passed
5	4915.034	± 0.0002	± 0.0005	passed
10	9917.700	± 0.0003	± 0.0006	passed
20	19919.188	± 0.0004	± 0.0008	passed
40	39926.649	± 0.0009	± 0.0017	passed
60	59284.699	± 0.0008	± 0.0016	passed
80	79981.103	± 0.0010	± 0.0020	passed



Measurement Report



d) Embedded Meteostation (Temperature / Pressure / Humidity)

Inspection Date: April 1, 2019
Inspected by: Aleksejs Sencenko

Product: AT Controller 400
Serial No: 391059
Ext. Temp. Sensor Serial No: 338609/048

Results

	Reference value	Actual value	Deviation	Verdict
Temperature Air	22.3 °C	22.4 °C	0.1 °C	passed
Temperature Object	22.3 °C	22.3 °C	0.0 °C	passed
Pressure	1013.5 hPa	1013.7 hPa	0.2 hPa	passed
Relative Humidity	35.0 %	35.0 %	0.0 %	passed

Note: Accuracy of Air Temperature and Relative Humidity is valid with connected external Air temperature sensor only.



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