VAISALA

MEASUREMENT STANDARDS LABORATORY
ACCREDITED CALIBRATION LABORATORY

FINAS Finnish Accreditation Service
K008 (EN ISO/IEC 17025)

CERTIFICATE OF CALIBRATION no K008-B00426

Customer	SAMPLE SAMPLE SAMPLE SAMPLE
Item	Humidity and Temperature Transmitter
Manufacturer	Vaisala Oyj
Model	HMT120 / HMP110
Serial number	XXX1122XX / XX112233
Calibration performed	From February 14 to 16, 2018
Date	February 26, 2018
Signature	Antti Leivonen Technical Manager

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Documents attached

NOTES

Conditions when received Reported in Service Report.

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DESCRIPTION

The measurement results were obtained from the measured values or the results were calculated from the measured values by using adjustment coefficients.
The transmitter's configuration, settings and coefficients were read from the transmitter's memory.
Before measurements the transmitter was allowed to stabilize to the conditions of the laboratory for at least 1 hour with 24,0 VDC ± 0,3 VDC power supply on.

The calibration is valid only with configuration and settings:

Software 1.0.6.569

REFERENCES USED DURING TEMPERATURE CALIBRATION

Fluke 1594A Thermometer, serial number B26126, due date 2018-Jun
Hart 5626 Pt-100 Temperature Sensor, serial number 2008, due date 2018-Apr
Agilent 34970A Digital Multimeter, serial number MY41027146, due date 2018-May

REFERENCES USED DURING HUMIDITY CALIBRATION

Hart 1560/2560 Thermometer, serial number 9C625/9C432, due date 2018-Apr
Thunder 2500 Humidity Generator, serial number 9711111, due date 2018-May
Vaisala PTB330 Digital Barometer, serial number M1740208, due date 2018-Mar
Agilent 34970A Digital Multimeter, serial number MY41007614, due date 2018-Dec

TRACEABILITY

The measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST in USA or equivalent) or accredited calibration laboratories.

CALIBRATION PROCEDURE

DOC233127, temperature
DOC230528, humidity

UNCERTAINTY

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %. The standard uncertainty of measurement has been determined in accordance with EA Publication EA-4/02.
The measurement uncertainty represents the situation at the time and conditions of calibration. When using the UUC at different conditions and at different time the effect of the conditions and stability of the UUC shall be evaluated separately.
The measurement results and uncertainty are representing the measurement points only.

CALIBRATION CONDITIONS

Temperature	23 °C ± 3 °C
Humidity	35 %rh ± 25 %rh

TEMPERATURE CALIBRATION

The temperature calibration was done in the Measurement Standards Laboratory (MSL) of Vaisala Oyj on February 16, 2018.
The temperature readings of the transmitter were compared to the values of the reference thermometer from 20,1 to 40,1 °C in a stirred liquid calibration bath.
The probe was protected with a plastic cover before immersing to the bath liquid.
Temperature values were read via serial port with resolution of 0,01 °C.
Temperature values are given according to the International Temperature Scale of 1990, ITS-90.

Measurement results

The reference and the reading values are averages of ten independent observations.

Table 1. Final results, temperature, T

Reference [°C]	As found		As left		Uncertainty [°C]
	Reading T [°C]	Correction [°C]	Reading T [°C]	Correction [°C]	
20,06	20,06	0,00	20,07	-0,01	0,12
40,06	40,05	0,01	40,05	0,01	0,12

The correction shall be added algebraically to the reading.

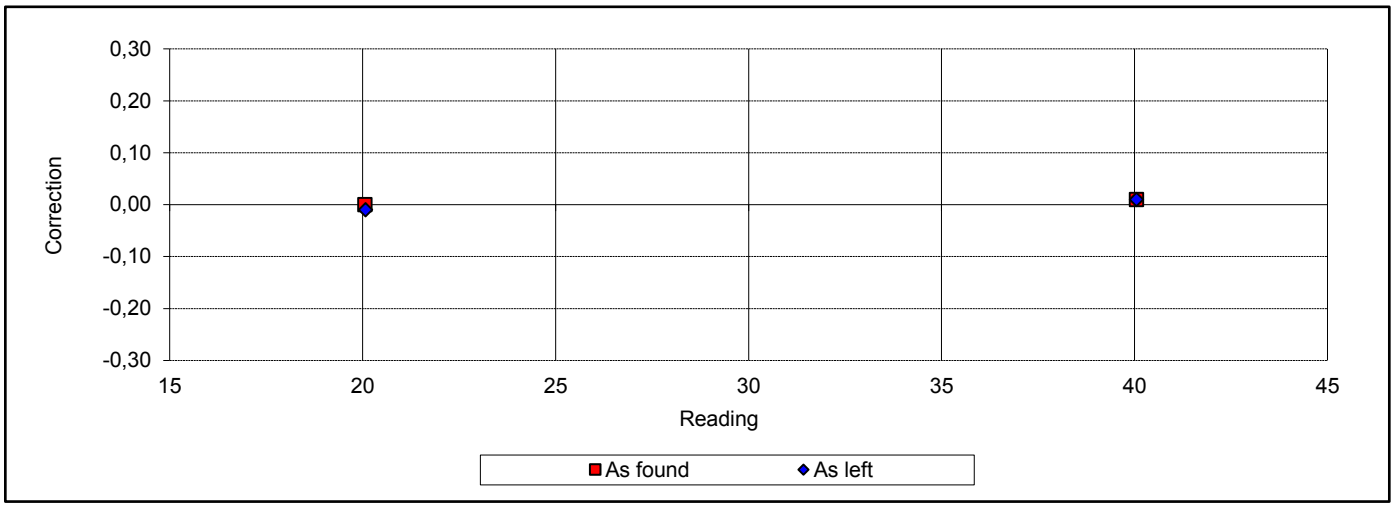

Figure 1. Final results, temperature [°C]

HUMIDITY CALIBRATION

The humidity calibration was done in the Measurement Standards Laboratory (MSL) of Vaisala Oyj on February 14 and 15, 2018.
The humidity readings of the transmitter were compared to the reference humidity values at climate chamber in the range from 10 to 80,2 %rh. The humidity readings were read via serial port with resolution of 0,01 %rh.

Measurement results

The probe was allowed to stabilize to each humidity for at least 60 minutes before the readings were read.
The reference and the reading values are averages of ten independent observations.

Table 2. Final results, humidity

Temperature [°C]	Reference [%rh]	As found		As left		Uncertainty [%rh]
		Reading RH [%rh]	Correction [%rh]	Reading RH [%rh]	Correction [%rh]	
23,2	10,0	10,0	0,0	10,1	-0,1	0,4
23,2	30,0	29,7	0,3	29,9	0,1	0,6
23,2	50,0	49,9	0,1	50,1	-0,1	0,8
23,2	80,2	80,0	0,2	80,2	0,0	1,0

The correction shall be added algebraically to the reading.

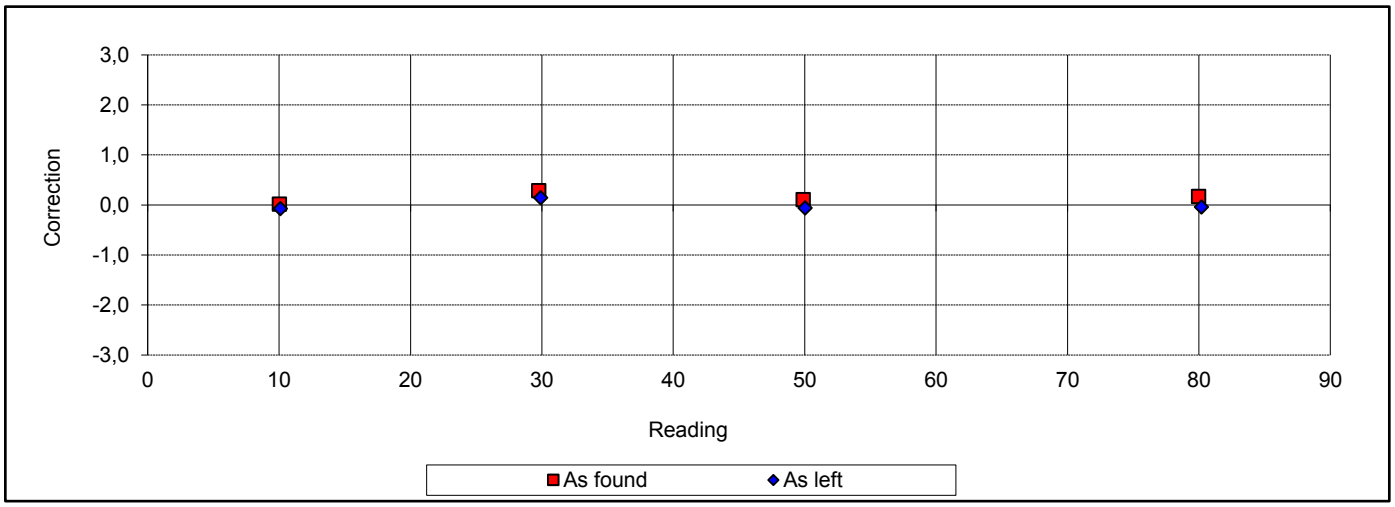

Figure 2. Final results, humidity [%rh]

Analog calibration

Calculations

Analog values were calculated from the measured analog output values using equation 1.

$$x_{analog} = \frac{x_{hi} - x_{lo}}{Output_{hi} - Output_{lo}} \cdot (Output - Output_{lo}) + x_{lo}, \text{ where} \quad (1)$$

x_{hi} is the maximum and x_{lo} is the minimum value of the range of the measured quantity and $Output_{hi}$ is the maximum and $Output_{lo}$ is the minimum output value of the output range.

Analog temperature calibration

The analog output of the transmitter was calibrated in the Measurement Standards Laboratory (MSL) of Vaisala Oyj on February 16, 2018.
The analog output values of the transmitter were measured and compared to the reference temperature values from 20,1 to 40,1 °C.
The current measurement method was voltage measurement over calibrated 100 ohm current shunt connected to the output of the transmitter.

Measurement results

The reference and the reading values are averages of ten independent observations.

Table 3. Measurement results, temperature, T

	As found			As left			
Reference [°C]	Output [mA]	T_{analog} [°C]	Correction [°C]	Output [mA]	T_{analog} [°C]	Correction [°C]	Uncertainty [°C]
20,06	10,4232	20,07	-0,01	10,4251	20,08	-0,02	0,12
40,06	16,8202	40,06	0,00	16,8221	40,07	-0,01	0,12

The correction shall be added algebraically to the reading.

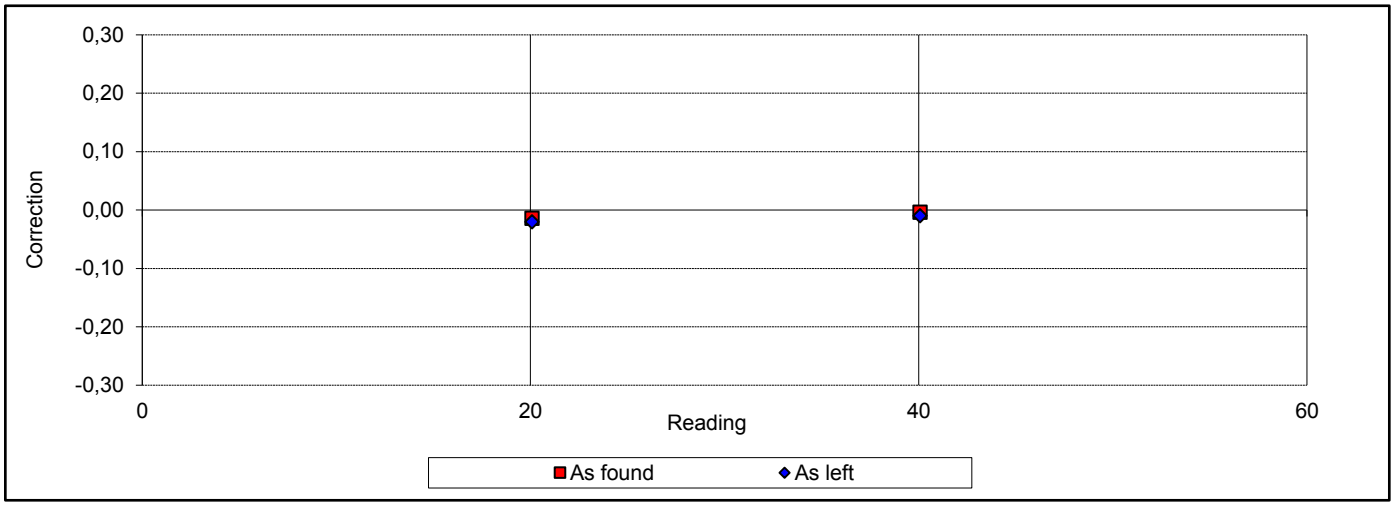

Figure 3. Final results, temperature [°C]

Analog humidity calibration

The analog output of the transmitter was calibrated in the Measurement Standards Laboratory (MSL) of Vaisala Oyj on February 14 and 15, 2018.
The analog readings of the transmitter were compared to the reference humidity values at climate chamber in the range from 10 to 80,2 %rh. The analog humidity readings were read with digital multimeter.
The measurement method was voltage measurement over calibrated 100 ohm current shunt connected to the output of the transmitter.

Measurement results

The probe was allowed to stabilize to each humidity for at least 60 minutes before the readings were read.
The reference and the reading values are averages of ten independent observations.

Table 4. Final results, humidity

Temperature [°C]	Reference [%rh]	As found Output [mA]	As found RH_{analog} [%rh]	As found Correction [%rh]	As left Output [mA]	As left RH_{analog} [%rh]	As left Correction [%rh]	Uncertainty [%rh]
23,2	10,0	5,6027	10,0	0,0	5,6174	10,1	-0,1	0,4
23,2	30,0	8,7634	29,7	0,3	8,7852	29,9	0,1	0,6
23,2	50,0	11,9829	49,9	0,1	12,0096	50,1	-0,1	0,8
23,2	80,2	16,8010	80,1	0,1	16,8338	80,3	-0,1	1,0

The correction shall be added algebraically to the reading.

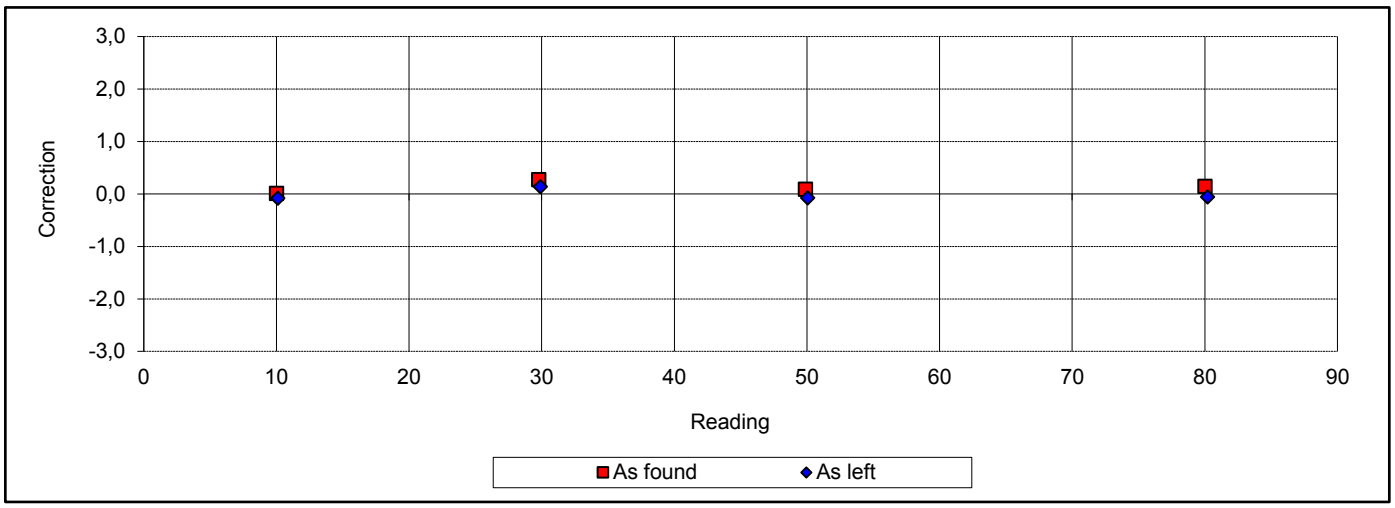

Figure 4. Final results, humidity [%rh]