VAISALA

MEASUREMENT STANDARDS LABORATORY
ACCREDITED CALIBRATION LABORATORY

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

CERTIFICATE OF CALIBRATION no K008-SAMPLE

Customer	NAME ADDR ADDR COUNTRY
Item	Dewpoint Transmitter Temperature calibrated at + 23 °C Dew point calibrated from - 59,9 to - 19,8 °C at temperature + 23 °C Read via serial port and analog outputs
Manufacturer	Vaisala Oyj
Model	DMT152
Serial number	xxxxxxxxxx
Instrument number	--
Calibration performed	From September 7 to 19, 2016
Date	September 20, 2016
Signature	Ilkka Kotamäki Technical Manager

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Documents attached

NOTES

Conditions when received Reported in Service Report.

Vaisala Oyj, PO Box 26, FI-00421 Helsinki, Finland
Telephone +358 9 894 91 • Fax +358 9 8949 2227
Email MeasStdLab@vaisala.com • www.vaisala.com
Domicile Vantaa, Finland • VAT FI01244162 • Business ID 0124416-2

CONFIGURATION

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 switched on.

REFERENCES USED DURING TEMPERATURE CALIBRATION

Vaisala DMT347 Dewpoint and Temperature Transmitter, serial number F4630128

REFERENCES USED DURING DEW POINT CALIBRATION

Vaisala DMT347 Dewpoint and Temperature Transmitter, serial number F4630127
Thunder 3900 Humidity Generator, serial number 212040
Vaisala PTB220 Pressure Transmitter, serial number U5220003
Agilent 34970A Digital Multimeter, serial number MY44027576

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.

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.

TEMPERATURE CALIBRATION

The temperature calibration was done in the Measurement Standards Laboratory (MSL) of Vaisala Oyj from September 9 to 19, 2016.
The temperature readings of the transmitter were compared to the values of the reference thermometer at + 23 °C in a calibration chamber.
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

As found				As left			
Reference [°C]	Reading T [°C]	Correction [°C]	Uncertainty [°C]	Reference [°C]	Reading T [°C]	Correction [°C]	Uncertainty [°C]
+ 23,32	+ 23,42	- 0,10	± 0,32	+ 23,45	+ 23,53	- 0,08	± 0,32

The correction shall be added algebraically to the reading.

Conditions	Temperature	+ 23,5 °C ± 0,3 °C
	Humidity	37 %rh ± 3 %rh

DEW POINT CALIBRATION

The dew point calibration was done in the Measurement Standards Laboratory (MSL) of Vaisala Oyj from September 7 to 16, 2016.
The dew point temperature readings of the transmitter were compared to the reference dew point temperature values in the range from - 59,9 to - 19,8 °C. The readings were read via serial port with resolution of 0,01 °C.
The readings are frost point temperature readings when dew point is below 0 °C.

Measurement results

The transmitter was allowed to stabilize to each dew point for at least 3 hours before the readings were read.
The reference and the reading values are averages of ten independent observations.

Table 2. Final results, dew point temperature

As found				As left			
Reference [°C]	Reading [°C]	Correction [°C]	Uncertainty [°C]	Reference [°C]	Reading [°C]	Correction [°C]	Uncertainty [°C]
- 59,9	- 58,2	- 1,7	± 0,7	- 59,9	- 60,5	+ 0,6	± 0,7
- 56,9	- 55,6	- 1,3	± 0,7	- 56,8	- 57,2	+ 0,4	± 0,7
- 49,9	- 49,1	- 0,8	± 0,7	- 49,8	- 50,3	+ 0,5	± 0,7
- 39,9	- 39,6	- 0,3	± 1,5	- 39,8	- 40,5	+ 0,7	± 1,5
- 29,9	- 29,1	- 0,8	± 2,6	- 29,8	- 30,6	+ 0,8	± 2,6
- 19,9	- 19,2	- 0,7	± 3,3	- 19,8	- 20,0	+ 0,2	± 3,3

The correction shall be added algebraically to the reading.

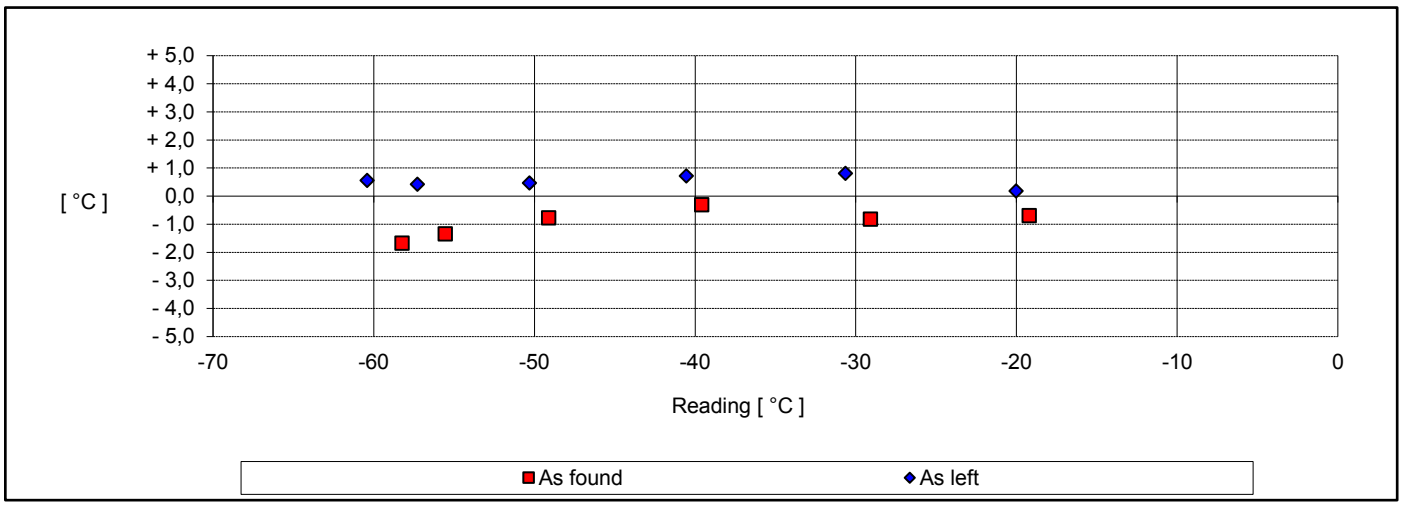

Figure 1. Final results, dew point temperature

Conditions	Pressure	1011,6 hPa ± 5,5 hPa
	Temperature	+ 23,4 °C ± 0,9 °C
	Humidity	37 %rh ± 3 %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.

Only the readings inside the analog range of the transmitter are shown in the results table(s).

Analog dew point calibration

The analog output of the transmitter was calibrated in the Measurement Standards Laboratory (MSL) of Vaisala Oyj from September 7 to 16, 2016.

The analog readings of the transmitter were compared to the reference dew point temperature values at a calibration chamber in the range from - 59,9 to - 19,8 °C. The analog dew point 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 dew point for at least 3 hours before the readings were read. The reference and the reading values are averages of ten independent observations.

Table 3. Final results, dew point temperature

As found						As left					
Reference [°C]	Output [mA]	Reading [ppm]	Reading [°C]	Correction [°C]	Uncertainty [°C]	Reference [°C]	Output [mA]	Reading [ppm]	Reading [°C]	Correction [°C]	Uncertainty [°C]
- 59,9	5,4419	13,52	- 57,9	- 2,0	± 0,7	- 59,9	5,0781	10,11	- 60,5	+ 0,6	± 0,7
- 56,9	6,0515	19,23	- 55,9	- 1,0	± 0,7	- 56,8	5,6395	15,37	- 57,2	+ 0,4	± 0,7
- 49,9	8,6227	43,34	- 48,9	- 1,0	± 0,7	- 49,8	7,9958	37,46	- 50,3	+ 0,5	± 0,7
- 39,9						- 39,8	16,6997	119,06	- 40,5	+ 0,7	± 1,5
- 29,9						- 29,8					
- 19,9						- 19,8					

The correction shall be added algebraically to the reading.

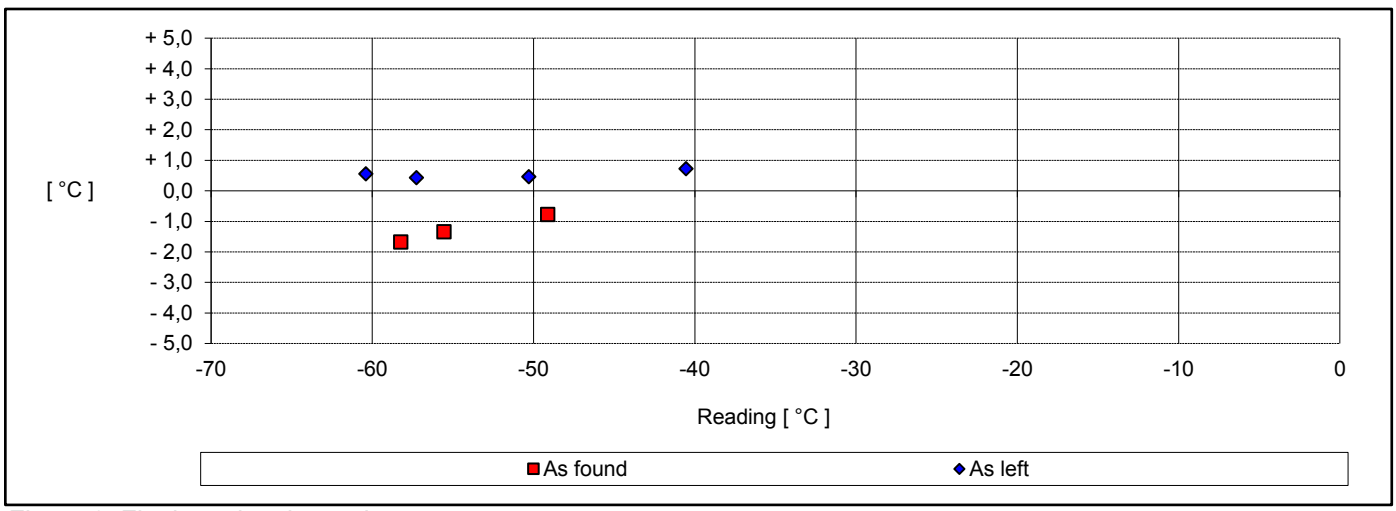

Figure 2. Final results, dew point temperature

Conditions		
	Pressure	1011,6 hPa ± 5,5 hPa
	Temperature	+ 23,4 °C ± 0,9 °C
	Humidity	37 %rh ± 3 %rh