

**Certificate Number:** B08-1050317

Page 1 (2)

**Customer:** K & S Technical Services  
941 New London Rd.  
Newark, DE 19711

**Manufacturer:** Vaisala Oyj

**Instrument:** VL-1416-44V Temperature Logger

**Serial Number:** 13031298

The external temperature sensor(s) of the above described temperature logger were calibrated by comparing the logger readings to a reference thermometer in Vaisala Boston Calibration and Repair Services (CRS).

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 calibration results relate only to the calibrated instrument and the calibration points. The measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or accredited calibration laboratories. Pass: Error less than Limit minus Uncertainty; Pass\*: Error less than or equal to Limit; Fail: Error more than Limit.

**Measurement results before adjustment:**

Reference		Channel 1				Channel 2					
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail	
°C	°C	°C	°C	°C		°C	°C	°C	°C		
-90.00	-89.97	0.03	0.09	±0.35	Pass	-89.98	0.02	0.09	±0.35	Pass	
-55.00	-55.00	0.00	0.06	±0.35	Pass	-55.01	-0.01	0.06	±0.35	Pass	
-20.01	-20.03	-0.02	0.05	±0.35	Pass	-20.05	-0.04	0.05	±0.35	Pass	
14.99	14.94	-0.05	0.05	±0.35	Pass	14.91	-0.08	0.05	±0.35	Pass	
49.98	49.96	-0.02	0.07	±0.35	Pass	49.83	-0.15	0.07	±0.35	Pass	
69.97	69.92	-0.05	0.08			69.68	-0.29	0.08			

Reference		Channel 3				Channel 4					
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail	
°C	°C	°C	°C	°C		°C	°C	°C	°C		
-90.00	-89.97	0.03	0.09	±0.35	Pass	-89.94	0.06	0.09	±0.35	Pass	
-55.00	-54.99	0.01	0.06	±0.35	Pass	-54.99	0.01	0.06	±0.35	Pass	
-20.01	-20.02	-0.01	0.05	±0.35	Pass	-20.02	-0.01	0.05	±0.35	Pass	
14.99	14.96	-0.03	0.05	±0.35	Pass	14.95	-0.04	0.05	±0.35	Pass	
49.98	49.97	-0.01	0.07	±0.35	Pass	49.97	-0.01	0.07	±0.35	Pass	
69.97	69.93	-0.04	0.08			69.94	-0.03	0.08			

**Measurement results after adjustment:**

Reference		Channel 1				Channel 2					
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail	
°C	°C	°C	°C	°C		°C	°C	°C	°C		
-90.00	-89.99	0.01	0.09	±0.25	Pass	-89.99	0.01	0.09	±0.25	Pass	
-55.00	-54.99	0.01	0.06	±0.25	Pass	-54.99	0.01	0.06	±0.25	Pass	
-20.01	-20.01	0.00	0.05	±0.25	Pass	-20.01	0.00	0.05	±0.25	Pass	
14.99	14.98	-0.01	0.05	±0.25	Pass	14.98	-0.01	0.05	±0.25	Pass	
49.98	50.00	0.02	0.07	±0.25	Pass	50.00	0.02	0.07	±0.25	Pass	
69.97	69.97	0.00	0.08			69.97	0.00	0.08			

Reference		Channel 3				Channel 4					
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail	
°C	°C	°C	°C	°C		°C	°C	°C	°C		
-90.00	-89.99	0.01	0.09	±0.25	Pass	-89.99	0.01	0.09	±0.25	Pass	
-55.00	-55.00	0.00	0.06	±0.25	Pass	-55.00	0.00	0.06	±0.25	Pass	
-20.01	-20.01	0.00	0.05	±0.25	Pass	-20.00	0.01	0.05	±0.25	Pass	
14.99	14.98	-0.01	0.05	±0.25	Pass	14.98	-0.01	0.05	±0.25	Pass	
49.98	49.99	0.01	0.07	±0.25	Pass	49.99	0.01	0.07	±0.25	Pass	
69.97	69.97	0.00	0.08			69.97	0.00	0.08			

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This instrument was calibrated in compliance with ISO/IEC 17025:2005.

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## Calibration Certificate

**Certificate Number:** B08-1050317

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**Reference(s):**

Fluke 2560/12005

**Instrument Number**

3013-0380-1

**Calibration Date**

2020-06-07

**Certificate**

200607-3013-0380-1

**Next Calibration**

2020-12-31

**Note(s):**

Service report as an attachment

This certificate replaces certificate number B08-1049754

**Calibration Date:** October 22, 2020

**Next Calibration:** October 22, 2021

**Issue Date:** November 04, 2020

**Ambient Condition(s):**

23.8 °C ±1.2 °C

40.3 %RH ±3.8 %RH

1020.7 hPa ±0.8 hPa

**Signature:**



Joey Yang  
Service Technician

**Certificate Number:** B08-1050314

Page 1 (2)

**Customer:** K & S Technical Services  
941 New London Rd.  
Newark, DE 19711

**Manufacturer:** Vaisala Oyj

**Instrument:** VL-1416-44V Temperature Logger

**Serial Number:** 13031342

The external temperature sensor(s) of the above described temperature logger were calibrated by comparing the logger readings to a reference thermometer in Vaisala Boston Calibration and Repair Services (CRS).

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 calibration results relate only to the calibrated instrument and the calibration points. The measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or accredited calibration laboratories. Pass: Error less than Limit minus Uncertainty; Pass\*: Error less than or equal to Limit; Fail: Error more than Limit.

**Measurement results before adjustment:**

Reference		Channel 1				Channel 2				
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail
°C	°C	°C	°C	°C		°C	°C	°C	°C	
-90.00	-89.96	0.04	0.09	±0.35	Pass	-89.99	0.01	0.09	±0.35	Pass
-55.00	-54.99	0.01	0.06	±0.35	Pass	-55.00	0.00	0.06	±0.35	Pass
-20.00	-20.01	-0.01	0.05	±0.35	Pass	-20.02	-0.02	0.05	±0.35	Pass
14.99	14.96	-0.03	0.05	±0.35	Pass	14.95	-0.04	0.05	±0.35	Pass
49.98	49.97	-0.01	0.07	±0.35	Pass	49.96	-0.02	0.07	±0.35	Pass
69.97	69.93	-0.04	0.08			69.93	-0.04	0.08		

Reference		Channel 3				Channel 4				
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail
°C	°C	°C	°C	°C		°C	°C	°C	°C	
-90.00	-89.98	0.02	0.09	±0.35	Pass	-89.96	0.04	0.09	±0.35	Pass
-55.00	-55.02	-0.02	0.06	±0.35	Pass	-54.99	0.01	0.06	±0.35	Pass
-20.00	-20.05	-0.05	0.05	±0.35	Pass	-20.01	-0.01	0.05	±0.35	Pass
14.99	14.92	-0.07	0.05	±0.35	Pass	14.95	-0.04	0.05	±0.35	Pass
49.98	49.93	-0.05	0.07	±0.35	Pass	49.96	-0.02	0.07	±0.35	Pass
69.97	69.88	-0.09	0.08			69.91	-0.06	0.08		

**Measurement results after adjustment:**

Reference		Channel 1				Channel 2				
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail
°C	°C	°C	°C	°C		°C	°C	°C	°C	
-90.00	-90.00	0.00	0.09	±0.25	Pass	-89.99	0.01	0.09	±0.25	Pass
-55.00	-55.00	0.00	0.06	±0.25	Pass	-54.99	0.01	0.06	±0.25	Pass
-20.00	-20.00	0.00	0.05	±0.25	Pass	-20.00	0.00	0.05	±0.25	Pass
14.99	14.98	-0.01	0.05	±0.25	Pass	14.98	-0.01	0.05	±0.25	Pass
49.98	50.00	0.02	0.07	±0.25	Pass	50.00	0.02	0.07	±0.25	Pass
69.97	69.96	-0.01	0.08			69.96	-0.01	0.08		

Reference		Channel 3				Channel 4				
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail
°C	°C	°C	°C	°C		°C	°C	°C	°C	
-90.00	-90.00	0.00	0.09	±0.25	Pass	-89.99	0.01	0.09	±0.25	Pass
-55.00	-55.00	0.00	0.06	±0.25	Pass	-54.99	0.01	0.06	±0.25	Pass
-20.00	-20.00	0.00	0.05	±0.25	Pass	-20.00	0.00	0.05	±0.25	Pass
14.99	14.98	-0.01	0.05	±0.25	Pass	14.98	-0.01	0.05	±0.25	Pass
49.98	50.00	0.02	0.07	±0.25	Pass	50.00	0.02	0.07	±0.25	Pass
69.97	69.96	-0.01	0.08			69.97	0.00	0.08		

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## Calibration Certificate

Certificate Number: B08-1050314

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**Reference(s):**

Fluke 2560/12005

Instrument Number

3013-0380-1

Calibration Date

2020-06-07

Certificate

200607-3013-0380-1

Next Calibration

2020-12-31

**Note(s):**

Service report as an attachment

This certificate replaces certificate number B08-1049887

**Calibration Date:** October 21, 2020

**Next Calibration:** October 21, 2021

**Issue Date:** November 04, 2020

**Ambient Condition(s):**

22.5 °C ±1.0 °C

42.4 %RH ±4.3 %RH

1018.8 hPa ±0.8 hPa

**Signature:**



\_\_\_\_\_  
Joey Yang  
Service Technician

**Certificate Number:** B08-1050315

Page 1 (2)

**Customer:** K & S Technical Services  
941 New London Rd.  
Newark, DE 19711

**Manufacturer:** Vaisala Oyj

**Instrument:** VL-1416-44V Temperature Logger

**Serial Number:** 13031373

The external temperature sensor(s) of the above described temperature logger were calibrated by comparing the logger readings to a reference thermometer in Vaisala Boston Calibration and Repair Services (CRS).

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 calibration results relate only to the calibrated instrument and the calibration points. The measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or accredited calibration laboratories. Pass: Error less than Limit minus Uncertainty; Pass\*: Error less than or equal to Limit; Fail: Error more than Limit.

**Measurement results before adjustment:**

Reference		Channel 1				Channel 2					
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail	
°C	°C	°C	°C	°C		°C	°C	°C	°C		
-90.00	-89.98	0.02	0.09	±0.35	Pass	-89.97	0.03	0.09	±0.35	Pass	
-55.00	-55.01	-0.01	0.06	±0.35	Pass	-55.00	0.00	0.06	±0.35	Pass	
-20.01	-20.04	-0.03	0.05	±0.35	Pass	-20.03	-0.02	0.05	±0.35	Pass	
14.99	14.94	-0.05	0.05	±0.35	Pass	14.96	-0.03	0.05	±0.35	Pass	
49.98	49.96	-0.02	0.07	±0.35	Pass	49.97	-0.01	0.07	±0.35	Pass	
69.97	69.93	-0.04	0.08			69.93	-0.04	0.08			

Reference		Channel 3				Channel 4					
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail	
°C	°C	°C	°C	°C		°C	°C	°C	°C		
-90.00	-89.98	0.02	0.09	±0.35	Pass	-89.97	0.03	0.09	±0.35	Pass	
-55.00	-55.00	0.00	0.06	±0.35	Pass	-55.00	0.00	0.06	±0.35	Pass	
-20.01	-20.03	-0.02	0.05	±0.35	Pass	-20.02	-0.01	0.05	±0.35	Pass	
14.99	14.96	-0.03	0.05	±0.35	Pass	14.96	-0.03	0.05	±0.35	Pass	
49.98	49.97	-0.01	0.07	±0.35	Pass	49.97	-0.01	0.07	±0.35	Pass	
69.97	69.92	-0.05	0.08			69.94	-0.03	0.08			

**Measurement results after adjustment:**

Reference		Channel 1				Channel 2					
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail	
°C	°C	°C	°C	°C		°C	°C	°C	°C		
-90.00	-89.99	0.01	0.09	±0.25	Pass	-90.00	0.00	0.09	±0.25	Pass	
-55.00	-54.99	0.01	0.06	±0.25	Pass	-55.00	0.00	0.06	±0.25	Pass	
-20.01	-20.01	0.00	0.05	±0.25	Pass	-20.01	0.00	0.05	±0.25	Pass	
14.99	14.98	-0.01	0.05	±0.25	Pass	14.99	0.00	0.05	±0.25	Pass	
49.98	50.00	0.02	0.07	±0.25	Pass	50.00	0.02	0.07	±0.25	Pass	
69.97	69.97	0.00	0.08			69.96	-0.01	0.08			

Reference		Channel 3				Channel 4					
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail	
°C	°C	°C	°C	°C		°C	°C	°C	°C		
-90.00	-90.00	0.00	0.09	±0.25	Pass	-89.99	0.01	0.09	±0.25	Pass	
-55.00	-55.00	0.00	0.06	±0.25	Pass	-55.00	0.00	0.06	±0.25	Pass	
-20.01	-20.01	0.00	0.05	±0.25	Pass	-20.00	0.01	0.05	±0.25	Pass	
14.99	14.98	-0.01	0.05	±0.25	Pass	14.98	-0.01	0.05	±0.25	Pass	
49.98	50.00	0.02	0.07	±0.25	Pass	49.99	0.01	0.07	±0.25	Pass	
69.97	69.96	-0.01	0.08			69.97	0.00	0.08			

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## Calibration Certificate

**Certificate Number:** B08-1050315

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**Reference(s):**

Fluke 2560/12005

**Instrument Number**

3013-0380-1

**Calibration Date**

2020-06-07

**Certificate**

200607-3013-0380-1

**Next Calibration**

2020-12-31

**Note(s):**

Service report as an attachment

This certificate replaces certificate number B08-1049755

**Calibration Date:** October 22, 2020

**Next Calibration:** October 22, 2021

**Issue Date:** November 04, 2020

**Ambient Condition(s):**

23.8 °C ±1.2 °C

40.3 %RH ±3.8 %RH

1020.7 hPa ±0.8 hPa

**Signature:**



Joey Yang  
Service Technician

**Certificate Number:** B08-1050316

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**Customer:** K & S Technical Services  
941 New London Rd.  
Newark, DE 19711

**Manufacturer:** Vaisala Oyj

**Instrument:** VL-1416-44V Temperature Logger

**Serial Number:** 13031375

The external temperature sensor(s) of the above described temperature logger were calibrated by comparing the logger readings to a reference thermometer in Vaisala Boston Calibration and Repair Services (CRS).

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 calibration results relate only to the calibrated instrument and the calibration points. The measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or accredited calibration laboratories. Pass: Error less than Limit minus Uncertainty; Pass\*: Error less than or equal to Limit; Fail: Error more than Limit.

**Measurement results before adjustment:**

Reference		Channel 1				Channel 2				
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail
°C	°C	°C	°C	°C		°C	°C	°C	°C	
-90.00	-89.96	0.04	0.09	±0.35	Pass	-89.97	0.03	0.09	±0.35	Pass
-55.00	-54.99	0.01	0.06	±0.35	Pass	-54.99	0.01	0.06	±0.35	Pass
-20.00	-20.00	0.00	0.05	±0.35	Pass	-20.01	-0.01	0.05	±0.35	Pass
14.99	14.96	-0.03	0.05	±0.35	Pass	14.97	-0.02	0.05	±0.35	Pass
49.98	49.98	0.00	0.07	±0.35	Pass	49.98	0.00	0.07	±0.35	Pass
69.97	69.95	-0.02	0.08			69.94	-0.03	0.08		

Reference		Channel 3				Channel 4				
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail
°C	°C	°C	°C	°C		°C	°C	°C	°C	
-90.00	-89.96	0.04	0.09	±0.35	Pass	-89.96	0.04	0.09	±0.35	Pass
-55.00	-54.99	0.01	0.06	±0.35	Pass	-54.99	0.01	0.06	±0.35	Pass
-20.00	-20.01	-0.01	0.05	±0.35	Pass	-20.01	-0.01	0.05	±0.35	Pass
14.99	14.95	-0.04	0.05	±0.35	Pass	14.95	-0.04	0.05	±0.35	Pass
49.98	49.96	-0.02	0.07	±0.35	Pass	49.96	-0.02	0.07	±0.35	Pass
69.97	69.94	-0.03	0.08			69.93	-0.04	0.08		

**Measurement results after adjustment:**

Reference		Channel 1				Channel 2				
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail
°C	°C	°C	°C	°C		°C	°C	°C	°C	
-90.00	-89.99	0.01	0.09	±0.25	Pass	-90.00	0.00	0.09	±0.25	Pass
-55.00	-55.00	0.00	0.06	±0.25	Pass	-55.00	0.00	0.06	±0.25	Pass
-20.00	-19.99	0.01	0.05	±0.25	Pass	-20.00	0.00	0.05	±0.25	Pass
14.99	14.98	-0.01	0.05	±0.25	Pass	14.99	0.00	0.05	±0.25	Pass
49.98	50.00	0.02	0.07	±0.25	Pass	50.00	0.02	0.07	±0.25	Pass
69.97	69.97	0.00	0.08			69.96	-0.01	0.08		

Reference		Channel 3				Channel 4				
Temperature	Observed	Error	Uncertainty	Limit	Pass/Fail	Observed	Error	Uncertainty	Limit	Pass/Fail
°C	°C	°C	°C	°C		°C	°C	°C	°C	
-90.00	-90.00	0.00	0.09	±0.25	Pass	-89.99	0.01	0.09	±0.25	Pass
-55.00	-55.00	0.00	0.06	±0.25	Pass	-55.00	0.00	0.06	±0.25	Pass
-20.00	-19.99	0.01	0.05	±0.25	Pass	-19.99	0.01	0.05	±0.25	Pass
14.99	14.98	-0.01	0.05	±0.25	Pass	14.98	-0.01	0.05	±0.25	Pass
49.98	49.99	0.01	0.07	±0.25	Pass	50.00	0.02	0.07	±0.25	Pass
69.97	69.97	0.00	0.08			69.97	0.00	0.08		

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## Calibration Certificate

Certificate Number: B08-1050316

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**Reference(s):**

Fluke 2560/12005

Instrument Number

3013-0380-1

Calibration Date

2020-06-07

Certificate

200607-3013-0380-1

Next Calibration

2020-12-31

**Note(s):**

Service report as an attachment

This certificate replaces certificate number B08-1049888

**Calibration Date:** October 21, 2020

**Next Calibration:** October 21, 2021

**Issue Date:** November 04, 2020

**Ambient Condition(s):**

22.5 °C ±1.0 °C

42.4 %RH ±4.3 %RH

1018.8 hPa ±0.8 hPa

**Signature:**



\_\_\_\_\_  
Joey Yang  
Service Technician