

Calibration Procedure

DeFelsko PosiTector DPM IR Dew Point Meter Infrared Probes

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1 Introduction and UUC Performance Requirements

1.1 This procedure describes the calibration of the DeFelsko PosiTector DPM IR Dew Point Meter Infrared probes with the following specifications:

Table 1-1 Measurement Ranges

| Function | Measurement Range | Resolution |
|---------------------|--------------------------------|------------------|
| Air Temperature | -40 to 80°C (-40 to 176°F) | 0.1°C (0.1°F) |
| Relative Humidity | 0 to 100% RH | 0.1% |
| Surface Temperature | -70 to 380°C (-94 to 716°F) | 0.1°C (0.1°F) |

1.2 The unit being calibrated will be referred to as the UUC (Unit-Under-Calibration).

2 Measurement Standards and Support Equipment Performance Requirements

2.1 The UUC accuracy requirements are based upon the published UUC performance specifications.

2.2 The test uncertainty ratio applied in this calibration procedure is 4:1 unless otherwise stated. The minimum surface temperature uncertainty ratio is 2:1.

2.3 Minimum-Use-Specifications are the minimum test equipment specifications required to meet all the UUC accuracy requirements and the test uncertainty ratio applied.

Table 2-1 UUC Accuracy Requirements and Description

| UUC Function | Range | Accuracy | Test Method |
|---------------------|--------------------------------|---|---------------------|
| Air Temperature | -40 to 80°C (-40 to 176°F) | ± 0.5°C ± (1.0°F) | Humidity Generator |
| Relative Humidity | 0 to 100% RH | ± 3.0% | |
| Surface Temperature | -70 to 380°C (-94 to 716°F) | ± (1.0 °C + 0.01°C per °C) ± (1.8 °F + 0.01°F per °F-32) | Infrared Calibrator |

Table 2-2 Minimum Use Specifications

| Function | Range | Accuracy |
|---------------------|--------------------------------|-------------------------|
| Air temperature | -40 to 80°C (-40 to 176°F) | ± 0.125°C ± (0.23°F) |
| Relative Humidity | 0 to 100% RH | ± 0.75% |
| Surface Temperature | -70 to 380°C (-94 to 716°F) | ± 0.25°C ± (0.45°F) |

Table 2-3 Actual Air Temperature & Relative Humidity Equipment Specifications

| Manufacturer/Model #’s Applicable | Function | Actual Equipment Specifications | |
|--|-------------------|---------------------------------|----------------------|
| | | Range | Accuracy |
| Thunder Scientific Model 1200 Humidity Generator | Air Temperature | 10 to 60°C (50 to 140°F) | ±0.05°C (±0.09°F) |
| | Relative Humidity | 10 to 95% RH | ± 0.5% |

Table 2-4 Actual Surface Temperature Test Equipment Specifications

| Manufacturer/Model #’s Applicable | Actual Equipment Specifications | |
|-----------------------------------|---------------------------------|----------------------|
| | Range | Accuracy |
| Fluke 4180 Infrared Calibrator | -15 to 0°C | ±0.40°C |
| | >0 to 100°C | ±0.50°C |
| | >100 to 120°C (5 to 32°F) | ±0.55°C (±0.72°F) |
| | (>32 to 212°F) | (±0.90°F) |
| | (>212 to 248°F) | (±0.99°F) |

Caution: The instructions in this Calibration Procedure relate specifically to the equipment and conditions listed in this section. If other equipment is substituted, the information and instructions must be interpreted accordingly.

Table 2-5 Calibration Environment and Warm-Up Requirements

| | |
|---|--|
| Measurement Standards & Support Equipment Environmental Requirements: | Temperature: 23 ± 5° C. Relative Humidity: Less than 95% Barometric Pressure 30 ± 1.5 in Hg (1016 ± 50mbar) |
| Measurement Standards & Support Equipment Warm-up and Stabilization Requirements: | Thunder Scientific Humidity Generator: 60 minutes Fluke 4180 Infrared Calibrator: 30 minutes |

3 IR Temperature Calibration Set-Up Discussion

To limit the effect of extraneous infrared (IR) radiation during the calibration process it is recommended that the calibration target be 2 to 3 times larger than the detecting spot size of the IR sensor. The Fluke 4180 has a 152.4mm (6”) diameter target so the IR sensor spot diameter needs to be between 50.8mm (2”) and 76.2mm (3”) to maintain the recommended ratio. The test set-up DeFelsko uses produces a 56mm (2.2”) diameter detector spot centered on the calibration target.

The IR sensor used in the DPM IR has a distance to spot ratio of 4:1 when measured at a 90% energy level. This means that 101.6mm (4”) from the target 90% of the IR energy from a 25.4mm (1”) spot is within the sensor field of view. To produce the previously mentioned 56mm (2.2”) detector spot the DPM IR probe needs to be 224mm (8.8”) from the target during calibration.

4 Preliminary Operations

Note: Review the entire document before starting the calibration process.

4.1 Visual Inspection

4.1.1 Damage or excess wear must be repaired prior to beginning the calibration process.

4.1.2 Visually inspect the UUC for:

- Wear or damage to the probe body or tip
- Missing parts
- Proper identification

4.1.3 If the probe has a protective cap, remove it before proceeding.

5 Humidity and Air Temperature Calibration Process

Refer to UUC and equipment instruction manual(s) for menu navigation instructions, details on features and operating instructions.

Note: Whenever a test requirement is not met as indicated in table 7-1, verify the results of the test and take corrective action before proceeding.

5.1 Attach the probe(s) to the adapter cable connectors in the humidity chamber. Multiple probes can be calibrated in the chamber simultaneously. Make note of what probe is attached to which body. Record the probe serial number(s) and the Barometric pressure (mbars).

Note: If adapter cables are not available, the entire Gage/Probe combination can be placed in the chamber. The gage would need to be set in data logging mode to obtain the readings. Refer to the gage user manual on how to set data logging mode.

5.2 Adjust the set point of the humidity chamber to 35%RH and allow to stabilize for at least 60 minutes. After the stabilization time turn on the gage(s), wait about 1 minute to verify the reading is stable, and record the UUC and the chamber relative humidity and the gage and chamber air temperature readings.

Note: When turning on the gage do not perform a full reset.

5.3 Adjust the set point of the humidity chamber to 65%RH and allow to stabilize for at least 60 minutes. After the stabilization time turn on the gage(s), wait about 1 minute to verify the reading is stable, and record the UUC and the chamber relative humidity readings. Turn off the gage and disconnect the probe(s) from the connectors in the chamber.

6 Surface Temperature Calibration

6.1 Verify the Fluke 4180 is set to an emissivity of 0.95 then set the temperature to 5°C and wait for the unit to beep indicating the set point has been achieved. Connect a PosiTector 6000 gage to the sensor fixture and turn on the gage.

Note: If moisture condenses on the target you cannot take readings, you will need to wait for the target to dry and the Dewpoint to decrease.

- 6.2 Place the UUC in the sensor fixture (to ensure the IR sensor is centered and perpendicular to the calibration target at a distance of 224mm (8.8")). Record the UUC and test equipment reading.

Figure 6-1



- 6.3 Adjust the Fluke 4180 to 100°C and wait for the unit to beep indicating the set point has been achieved. Record the UUC and test equipment reading.
- 6.4 Remove the UUC from the sensor fixture.

7 Performance Requirements

Note: The technician will collect the data needed to complete columns A and B. The technician shall then calculate the values for Column C and record all information as shown in table 7-1. Do not write in this procedure.

Table 7-1 Requirements and Calibration Data for DeFelsko PosiTector DPM IR Probes

| Reference | Units | Set Point | Test Equipment Reading (A) | Gage Reading (B) | Probe Measurement Accuracy (C) | Allowable Tolerance |
|--------------------------|-------|-----------|----------------------------|------------------|--------------------------------|---------------------|
| Relative Humidity | %RH | 35 | | | | ± 3.0 |
| Ambient Temperature | °C | N/A | | | | ± 0.5 |
| Relative Humidity | %RH | 65 | | | | ± 3.0 |
| Surface Temperature Low | °C | 5 | | | | ± 1.0 |
| Surface Temperature High | °C | 100 | | | | ± 2.0 |

Note: To convert from °C to °F → $T_{°F} = 1.8 * T_{°C} + 32$

