

January 1, 2008





Calibration Procedures for the ThermaViewer Firmware version 2.1.0 and later.

There are two different classes of sensors shipped with the ThermaViewer 2.1.0 and later.

1. Sensors that cannot be calibrated. The PDI-1 temperature-only sensor which uses a small digital temperature sensor which is specified as $\pm 1.0^\circ$ at 25°C and $\pm 1.5^\circ\text{C}$ accuracy from -20°C to $+100^\circ$ (typical). It has good long-term stability and should remain within these parameters for years. More information on this sensor can be found here: http://www.analog.com/en/prod/0,,764_814_TMP04,00.html

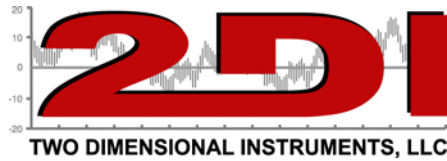


2. All other sensors (see below), which **can** be calibrated. Calibration data is stored on sensor board itself. Each sensor board carries a serial number by which the ThermaViewer identifies it. Any measurements taken by a calibrated sensor will be adjusted by the characterization entries entered into the sensor through the calibration menu.

PDI-2,	Thermistor $\pm 0.2^\circ\text{C}$	
PDIR-2	Thermistor and humidity $\pm 0.2^\circ\text{C}$ and $\pm 2\% \text{RH}$	
PDI-3	K, J, T, B, S, R, N, or E Thermocouple. (Accuracy depends on the type of thermocouple.)	
PDIB-1	Stainless Steel Thermistor	

Sensors used with the ThermaViewer may be periodically calibrated and the sensors characterized (adjusted) to ensure accuracy. In critical applications it is recommended that they be recalibrated once a year. The ThermaViewer display unit itself does not require calibration.

Sensors can be sent to Two Dimensional Instruments, LLC for calibration, calibrated on-site or at an independent calibration lab.



For those who wish to perform their own calibration, the calibration procedure is outlined as follows.

Equipment Needed

1. Temperature/humidity chamber to use as a relative humidity reference and a stable-temperature environment (0.37% RH uncertainty or better is recommended).
2. PRT and associated readout to use as the reference thermometer (0.03°C uncertainty or better is recommended)
3. ThermaViewer display unit to use to read the Two Dimensional Instruments sensors.
4. A Two Dimensional Instruments sensor wire to connect with the Two Dimensional Instruments sensor placed inside the temperature/humidity chamber

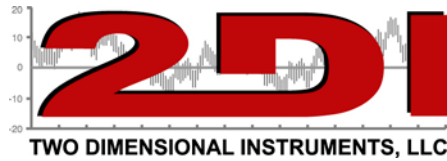
Preparation

1. Allow the ThermaViewer sensors to “dry out” in air with relative humidity between 20 and 50% and temperature between 16°C and 30°C for 24 hours before calibration.
2. Place the sensor(s) inside the temperature/humidity chamber, near the center, attached to a sensor wire that runs to the ThermaViewer outside the chamber.
3. On the ThermaViewer menu for the sensor being calibrated.
 - a. Clear out all calibration data on the sensor by removing all calibration points.
 - b. On sensor menu set the Averaging to Fast.
4. If you are calibrating the PDI-3 the I/O unit (small plastic box into which a thermocouple is plugged) should be placed outside the chamber. It can be placed in an antistatic bag and wrapped in insulating material (towel) to decrease any error from the cold junction.
5. Place the PRT inside the chamber with the tip close to the tip of the Two Dimensional Instruments sensor(s).
6. Run the sensor wire(s) to the outside of the chamber and connect it to the PRT readout.

Calibration Points

Each measurement parameter, both temperature and relative humidity, can be calibrated at one, two or three points throughout its range. These points can be any points you choose because the ThermaViewer will calculate an offset on the slope drawn between two of the three points. It is recommended that you choose your points carefully.

If the ThermaViewer normally monitors a static temperature such as a refrigerator, room, etc you should choose a chamber temperature close to that temperature. If the ThermaViewer monitors temperature that moves around such as in a manufacturing process you should choose points that lie on either side of the expected temperature range to be monitored.



Temperature and Humidity Calibration Procedure:

For each calibration point Temperature and/or Relative Humidity do the following:

1. Set the temperature and humidity set-point of the chamber. If you are only calibrating temperature the Relative Humidity should be set at 50%. This should be done while the Two Dimensional Instrument sensors and PRT are in the chamber. **At this point the chamber should not be opened again.**
2. Allow four hours for settling **after** the temperature and humidity set-points are reached before noting the temperature and humidity.
3. Note the temperature of both the PRT and the Two Dimensional Instrument sensor readings.
4. Note the Relative Humidity of both.
5. Repeat steps 1-4 for each temperature and/or RH point.

Entering Calibration Data in the ThermaViewer

Adjustments to the Two Dimensional Instruments sensors calibration parameters are required when measurement errors are excessive or outside of the specification. To characterize or adjust the sensor measurements access the Calibration menu for the appropriate sensor using the ThermaViewer sensor setup menu.

The temperature the ThermaViewer is measuring appears in both the 'measured' and the 'actual' field if no adjustments have been entered. Leave the temperature of the Two Dimensional Instruments sensor in the "Measured" field alone and enter the temperature of the PRT into the "Actual Field" on the calibration menu of sensor being calibrated. The ThermaViewer will automatically calculate the correction value and store that value on the Two Dimensional Instrument sensor. Enter the value for the Relative Humidity if applicable.

Reset the temperature and RH value for the chamber and follow the same procedures for a second and third point if desired. This procedure should be followed for each point in sequence.



How a Two Dimensional Instrument sensor computes offset error:

1. If one calibration point is entered
 - a. All measurements displayed and charted by the sensor will be offset by the difference between the measured and the actual temperature.
2. If two calibration points are entered.
 - a. All measurement displayed and charted will be scaled by an equation representing a point on a line drawn between the offset error of point one and the offset error of point two.
3. If three calibration pints are entered.
 - a. Two lines are calculated:
 - i. Between the offset of point one and the offset of point two.
 - ii. Between the offset of point two and the offset of point three.
 - b. All measurements displayed and charted will be scaled by an equation representing a point on a line drawn between the offset error of the middle point and the offset error of the point between which the measurement falls.