TWO DIMENSIONAL INSTRUMENTS, LLC

May 1, 2015

Calibration Procedures for the TV2

Wired sensors:

DD1,	Digital temperature sensor ± 0.5°C	
TSTMRH	Thermistor and humidity ±0.3°C and ±3%RH	
WDP-1	Differential Pressure (Range±1"WC) (±0.002"WC)	
TC-x	K, J, T, or E Thermocouple. (Accuracy depends on the type of thermocouple.)	

Wireless Sensors:

WS4HITM	Wireless Internal Thermistor ± 0.3°C	
WS4HITMIHM	Wireless Internal Thermistor and humidity ±0.3°C and ±3%RH	
WS4HETM	Wireless External Thermistor ±0.3°C	
WS4HETCx	Wireless External K, J, T, or E Thermocouple. (Accuracy depends on the type of thermocouple.)	

Sensors used with the TV2 may be periodically calibrated and the sensors characterized (adjusted) to ensure accuracy.

P O Box 159 • Crestwood, KY 40014 • (502) 243-0042 • (502) 243-0039 fax
www.e2di.com • info@e2di.com

TWO DIMENSIONAL INSTRUMENTS, LLC

How often a sensor needs to be re-calibrated is a difficult question to answer. The practical answer is that it should be re-calibrated as often as your business or any certifying agency that audits your business requires it. (This is often once a year).

From an electrical standpoint a thermistor or a digital sensor will not drift any appreciable amount over a ten year period. The same holds true for the humidity sensors we use. However the analog-to-digital converter used with the sensors and mounted on the sensor board can drift and should be re-calibrated after two years, and then every year after that. Thermocouples are a different matter as the thermocouple junction will oxidize over time. They should, also be calibrated or replaced after two years and then once a year after that.

Having said all that, your sensors should be re-calibrated as often as required by your business or the auditing agency which certifies your business. The TV2 display unit does not require calibration.

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

Calibration of differential pressure sensors.

1. These sensors should not need recalibration but should be zeroed out periodically.
2. Access the calibration menu under the 'Sensor Setup' menu
    a. Ensure the pressure sensor inputs are in the same pressure area.
    b. Highlight 'Auto Calibrate'
    c. Touch 'Enter'
3. This will cause the reading to be 0.000"wc.

Calibration of temperature only or temperature/RH sensors

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. TV2 display to read the Two Dimensional Instruments sensors.

Preparation

1. Allow the TV2 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 TV2 outside the chamber.
3. On the TV2 menu for the sensor being calibrated.

P O Box 159 • Crestwood, KY 40014 • (502) 243-0042 • (502) 243-0039 fax
www.e2di.com • info@e2di.com

   a. Clear out all calibration data removing all calibration points.
   b. On sensor menu **set the averaging to fast**.
4. If you are calibrating the TC-x (wired thermocouple) or the WS4HETC-x (wireless thermocouple) only the sensor itself should be placed in the chamber. The ATD module contains the cold junction thermistor and should remain outside the chamber in ambient air.
5. Place the PRT inside the chamber with the tip close to the tip of the Two Dimensional Instruments sensor(s). The closer the better.
6. Connect the PRT 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 TV2 will calculate an offset on the slope drawn between two of the three points.

If the TV2 normally monitors a static temperature such as a refrigerator, room, etc you should choose a chamber temperature close to that temperature. If the TV2 monitors changing temperatures 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 or Temperature/Relative Humidity do the following:

1. Set the temperature and humidity to a 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 2di 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 TV2

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 TV2 sensor setup menu.

The temperature which the TV2 sees appears in both the 'measured' and the 'actual' field if no adjustments have been entered. Leave the temperature shown in "Measured" alone and enter the temperature of the PRT into "Actual." The TV2 will automatically calculate the correction value and store that value on the 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 with an offset calculated 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 adjusted by an amount represented by a point on a line drawn between the error of the middle point and the offset error of the point between which the measurement falls.

Notes:
1. If calibrating a wireless sensor do not unlink the sensor while in the calibration menu/.
2. Do not unplug wired sensors while on the calibration menu.
3. Calibration data is stored in the non-volatile memory on the sensor, so that any sensor can be moved to a different TV2 without losing the calibration data.