

TECHNICAL INSTRUCTIONS FOR DataTrace® CALIBRATION PROCEDURES

HUMIDITY CALIBRATION

The following procedures provide instructions for performing field calibrations on DataTrace equipment. There are two types of calibrations that are possible. The first is for temperature in the Micropack III version temperature-only Tracers, and the second is for humidity in all Humidity Tracer versions.

Both procedures depend on a set of instruction screens to guide the user through the process. These screens present simple instructions to enter information and then the program automatically generates new field calibration coefficients for the target Tracer. The instruction sets for both the temperature-only and the humidity calibration procedure are very similar in order to avoid user confusion.

Normally, if the instructions are followed and the calibration environment is stable and appropriate there is no problem with the successful completion of the calibration procedure. However, if problems are encountered, you can abort the field calibration procedure at any time by clicking on Cancel.

Should you complete the field calibration procedure, and, for some reason, you are not satisfied with it, you can revert to the last factory calibration by pressing the "Reset Factory Calibration" button on the first Calibration Utility screen. The Reset Factory Calibration button removes any field calibration data from a Tracer and returns the Tracer to the last factory calibration. The button is active only if the current Tracer has been calibrated in the field. Otherwise, the button is dimmed. This procedure applies to both Temperature and Humidity Tracer field calibrations.

It is important to note that field calibration will invalidate the factory calibration certification (Report of Calibration) that was originally shipped with the Tracer. The best calibration results will be provided from a factory calibration.

Humidity Tracer Calibration Procedure

The following instructions allow you to perform a sensor field calibration on the DataTrace® Humidity Tracer. The procedure does not provide for calibrating Temperature or Pressure Tracers or the temperature sensor of Humidity Tracers.

We recommend that a field calibration be performed on a Tracer **only** when you detect and verify a drift in its humidity accuracy or when a humidity sensor needs to be replaced. Accuracy drift rate and sensor life expectancy are process related.

The DataTrace® Calibration Utility allows the user great flexibility with respect to selecting the appropriate procedure to match the requirements of the application and also accommodate changing needs and capabilities in the future. However, once a procedure is initiated, instructions must be followed explicitly to complete the calibration process successfully. Each procedure has advantages and disadvantages based on cost, time, and complexity. Therefore, it is incumbent on the user to select carefully the procedure to be implemented.

There are three elements that can help define the appropriate procedure:

- **Sensor Status** (Existing Humidity Sensor, New Humidity Sensor)

Sensor Status is defined by whether you are field calibrating an existing humidity sensor or calibrating a new, replacement humidity sensor.

- **Reference Environment** (Salt Solutions, Humidity Generator)

Reference Environment is defined by the reference standards and/or equipment you have available to perform the calibration process. Remember that a calibration can be no more accurate than the reference environment; use the best available references to obtain the best possible calibration.

- **Calibration Process** (One Point, Two Point, or New Sensor Calibration)

Calibration Process is defined by the application and the level of accuracy the application requires. One and Two Point Calibrations optimize the humidity sensor for use in a particular application, while a New Sensor Calibration is a special calibration to optimize a new humidity sensor to the Tracer's hardware.

Decide which Reference Environment and Calibration Procedure is right for you given the Sensor Status, available equipment, time, and required accuracy. The best possible calibration will require using not only the target humidity of the process but also the target temperature of the process. If it is not possible to calibrate at or near the process temperature, you should, at the very least, ensure that the temperature remains stable during the entire field calibration.

PLEASE NOTE THAT UNDER NO CIRCUMSTANCES SHOULD A HUMIDITY SENSOR THAT WAS CALIBRATED IN ONE HUMIDITY TRACER BE MOVED TO ANOTHER HUMIDITY TRACER!!

THE HUMIDITY CALIBRATION PROCESS WILL MOST LIKELY FAIL!!

The humidity calibration procedure is initiated from the Program Tracer window under the MAIN Tab of the DataTrace Control Panel. Select Calibrate Mode by clicking on that option. Calibrate Mode installs a special humidity field calibration program that is used to create, verify, and install new calibration coefficients into a humidity Tracer in either a One Point or a Two Point Calibration cycle. It also provides the field calibration for a replacement humidity sensor. The calibration process starts when the Program button is pressed. However, the field calibration procedure's operator screens will not appear until the Tracer is retrieved from the reference environment and then read in the UTILITIES|Calibration Utility.

CALIBRATION OF AN EXISTING HUMIDITY SENSOR:

A One or Two Point Calibration optimizes a Tracer to a particular process or application. A target humidity value (One Point) or a range (Two Point) is defined by the user on which to "focus" the calibration. If the critical humidity range of the process is $\pm 10\%$ rH, a One Point Calibration would be adequate. A wider process range would suggest a Two Point Calibration may be best.

When a One Point Calibration is used, a reference humidity value should be selected very close to the "most important" humidity value in the process. When a Two Point Calibration is used, the reference humidity values should bracket the complete process humidity range. Humidity reference values can be obtained from either salt solutions or a humidity generator.

A reference guideline for future calibrations would suggest that if an accuracy drift is detected that is consistently high or consistently low over the range, use a One Point Calibration. Use the Two Point Calibration if an accuracy drift varies over the range.

Note that if a humidity generator is to be used, turn it on, set the appropriate humidity value, and allow it to stabilize before you start the calibration procedure. If your humidity generator allows a temperature to be set, use a temperature close to your process temperature for best accuracy.

Procedure For a One or Two Point Calibration - Existing Sensor

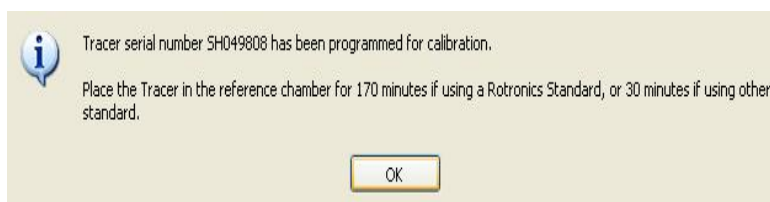
The procedure for a One or Two Point Calibration is virtually the same. These steps are listed in the following section of this document. The differences between the One and Two Point process are indicated in the following procedures.

- 1) Select the Calibrate Mode option on the Program Tracer screen. The humidity calibration procedure starts by automatically programming the Tracer with a special program called "CALBRATE". (Note the missing "i" in calibrate.) You can also just create a program normally with a one (1) minute Sample Interval and accomplish the same thing as the "CALBRATE" program. Press the Program button.

Tracer Type	Duration	Last Reading
1000 Reading	0:16:40:00	01/16/2004 00:32:00
2000 Reading	1:09:20:00	01/16/2004 17:12:00
4000 Reading	2:18:40:00	01/18/2004 02:32:00
8000 Reading	5:13:20:00	01/20/2004 21:12:00
16000 Reading	11:02:40:00	01/26/2004 10:32:00

- 2) When initiated, a dialog box appears, stating that the calibration program has been loaded into the target Tracer and that the Tracer must be placed into the appropriate reference environment(s). Do this as soon as possible as the Tracer starts taking readings once each minute beginning at the time it was programmed.

Note the different time requirements for each type of calibration reference environment. For Salt Solutions this is a minimum of 170 minutes. For a humidity generator it is at least 30 minutes, depending on the generator's capabilities. Remember that these are **minimum** time periods. Depending on the ambient environment, it may take longer to attain stability. For example, it is not uncommon for a much longer period of time to be necessary for stabilization to be achieved at a lower-than-ambient humidity level than it does when you calibrate at a higher humidity level. It is always best to error on the side of allowing too much time.

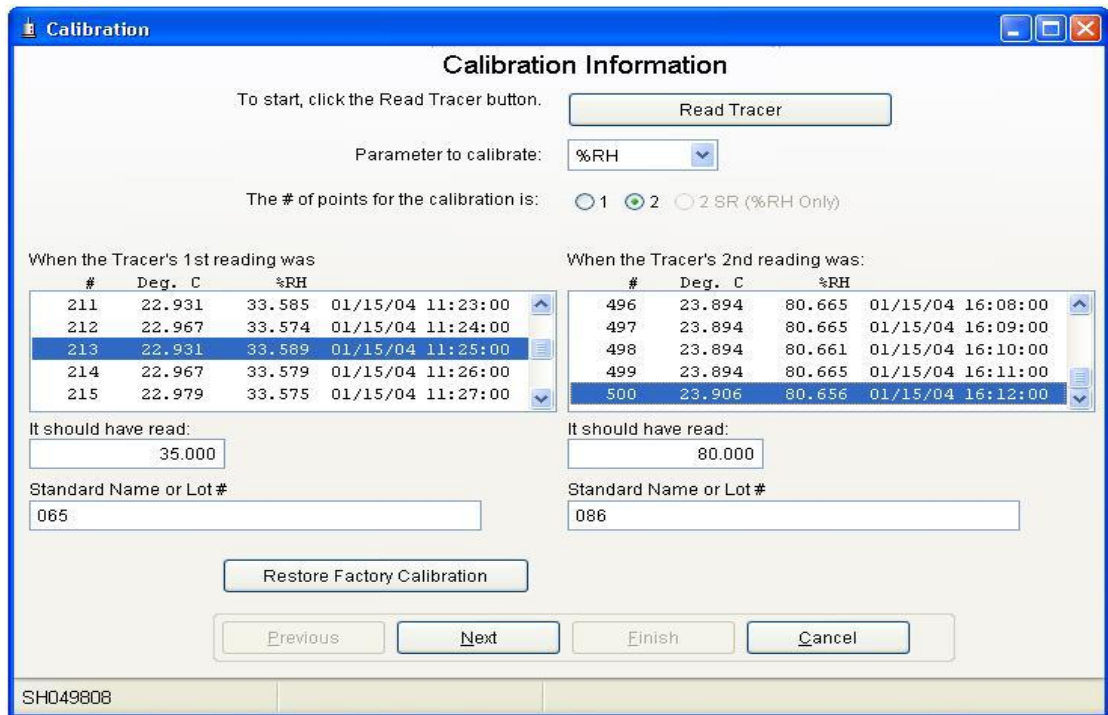


Please note the reference humidity value(s) to be used, the documentary information (such as Lot #, supplier, etc.) for the reference(s), the current computer time, and the minimum time requirement for stability. It is a good idea to write these values down so they are not forgotten. Press OK to continue the calibration process.

- Place the target Tracer into the selected calibration reference environment(s) for the specified amount of time. The temperature during the calibration procedure should be as stable as possible. Fluctuating temperatures will cause errors in the calibration.

Retrieve the target Humidity Tracer from the reference environment after the required stabilization time. If this is to be a two point field calibration, place the Tracer in the second environment. After final Tracer retrieval, prepare to read the Tracer.

- Go to the UTILITIES Tab of the DataTrace Control Panel, click on the Calibration Utility button. When the Calibration Information screen appears, place the Humidity Tracer in the PC Interface and press the Read Tracer button.
- On the Calibration Information screen, select the type of field calibration, either a Single Point, a Two Point, or a Sensor Replacement. Select either the One Point or the Two Point option. The 2 SR option is a special procedure that is used when a humidity sensor replacement is required.



- You will note two text boxes titled “When the Tracer’s X reading was:” which include a listing of the data collected during the field calibration run. Depending on your previous entry defining the number of points, either the first or both text boxes will contain entries.

Skip down to the next text box(es) titled “It should have read:” and enter the reference value(s) from the environment(s) that you placed the Tracer into.

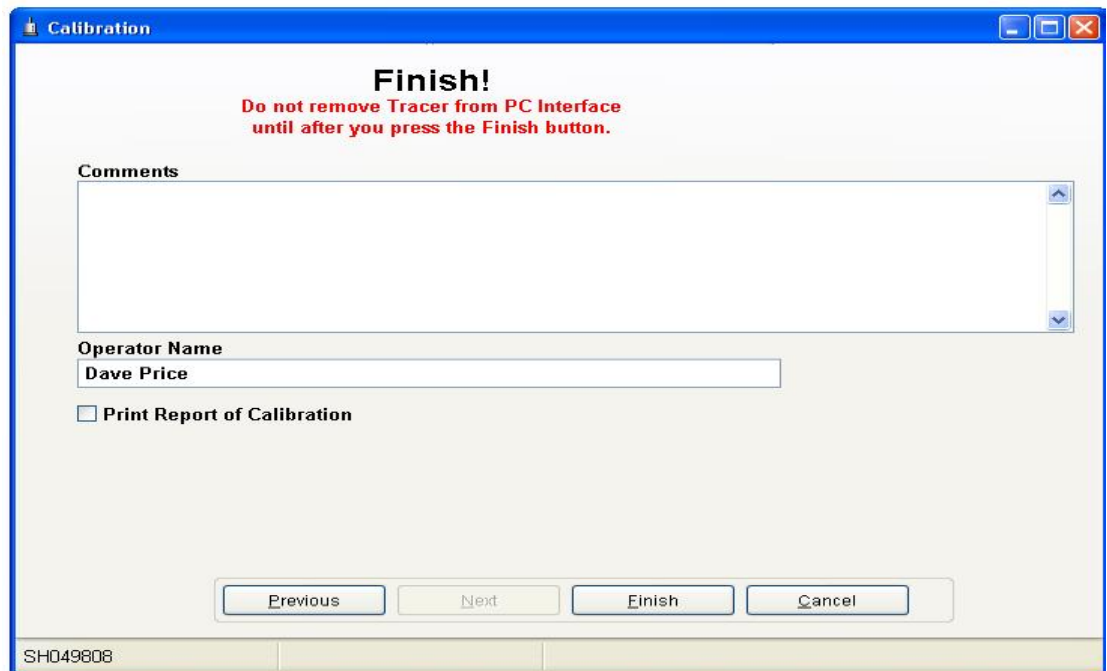
- 7) Now select from the data listing in the first text box the value that appears to demonstrate stability closest to the reference value entered. Click on that value to highlight it. Be sure that the value selected is near the middle of this stable range. If this is a two point field calibration, do the same for the second point.
- 8) Drop down to the last text box(es) and enter the references' identifying Lot # or Certification #. This data is used to document the calibration and will be stored in the Calibration History log located under the REPORTS Tab of the DataTrace Control Panel. Click Next.
- 9) On the second screen a summary appears that displays the results of the field calibration procedure. The first value is the reference that the field calibration was performed in. The second item in the list is the value that you selected as the most appropriate value from the Tracer's collected data. Next, the difference between the first two values is calculated and displayed. The Corrected Value is the new value following the field calibration. Lastly, the value that the last factory calibration would have reported is displayed. All of this information is also logged into the Calibration History log under the REPORTS Tab.

Reading 1		Reading 2	
Reference Value	35.00	Reference Value	80.00
As Found	33.5889	As Found	80.6562
Difference	-1.4110794067	Difference	0.65621948242
Corrected Value	35.0000000000	Corrected Value	80.0000000000
Factory Reading	33.5889206	Factory Reading	80.6562195

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- 10) On the Finish screen of the field calibration procedure, you may enter any comments you would like in the space provided. The program enters the Operator's Name automatically for documentation purposes. You may edit this if you wish.

You can also elect to have a calibration report generated for this Tracer. This report displays a summary of this Tracer's field calibration procedure; it is not the same as the Report of Calibration supplied following a factory calibration.



- 11) The field calibration procedure is now complete. Press Finish. A calibration complete message will appear, press OK. Please note the warning about removing the Tracer from the PC Interface before pressing the Finish button. The field calibration procedure is not complete until the Finish button is pressed and the Calibration Complete message appears.

If, for some reason the completed field calibration needs to be removed, you can restore the last factory calibration by placing the Tracer in the PC Interface and then start the Calibration Utility. At the bottom of the first calibration screen there is a Restore Factory Calibration button. When this button is clicked, the field calibration is removed and the last factory calibration is restored.

CALIBRATION OF A NEW HUMIDITY SENSOR:

While the physical replacement of a Humidity Sensor is simple, there are a number of important considerations of which you should be aware. The following instructions should be followed when the replacement of a humidity sensor is required.

DO NOT ALLOW THE HUMIDITY SENSOR TO BE CONTAMINATED BY DIRT, DUST, FINGER OILS, SALTS, OR LIQUIDS AS IT COULD DAMAGE THE SENSOR AND/OR IT'S CALIBRATION.

WE RECOMMEND THAT POWDER-FREE, LATEX SURGICAL GLOVES ARE WORN AFTER THE SENSOR COVER IS REMOVED TO AVOID SENSOR CONTAMINATION.

- 1) The new Humidity sensors are shipped with a cover to protect the sensor from mechanical shocks and contamination. Do not remove the cover until instructed to do so.
- 2) Unscrew the Tracer probe cover and gently remove the old humidity sensor. Avoid unnecessary contact with the temperature sensor (green bead) at the base of the humidity sensor.
- 3) On the new humidity sensor, partially remove sensor cover until the lead connections are visible. Do not completely remove the sensor cover.
- 4) Carefully insert the humidity sensor leads into the open sensor sockets from which the old sensor was removed.
- 5) Carefully remove the sensor cover.
- 6) Seat the sensor completely with gentle pressure on the top edge. Do not force the sensor as damage may result.
- 7) Reinstall Tracer probe cover.

The humidity sensor replacement is now complete. You may now calibrate the new sensor if desired. For many applications additional calibration may not be necessary.

When a new humidity sensor is installed, a special calibration is needed to configure and optimize the new sensor to the Tracer's hardware. The reference values for this special calibration should be a wide range, even if the target process does not require a wide range. The reference values used in this calibration process should be less than 45% rH for the low point and greater than 80% rH for the high point. Ideal new sensor calibration values would be 30% rH and 90% rH. Humidity reference values can be obtained from either salt solutions or a humidity generator.

The calibration procedure for a new humidity sensor is identical to that of the Two Point field calibration for an existing sensor described above. Instead of selecting the 2 point option on the Calibration Information screen, select the 2 SR option. Everything else is the same.