

INSTRUCTION MANUAL

UniCond® Conductivity Sensor Calibration Module 58 082 305 (US patent no. 8,513,956)

The patented Mettler-Toledo Thornton UniCond® Conductivity Sensor Calibration Module enables convenient calibration of the resistance and temperature measuring circuits within the sensor while also connected to a compatible transmitter using the Y-connector supplied. No additional equipment is required. Complete calibration takes only a few minutes. The accuracy of the Calibration Module is traceable to NIST (National Institute of Standards and Technology). The patented test and verification procedure can be performed periodically to verify that each resistance circuit has maintained its accuracy. For calibration of the sensor cell constant and RTD, a standard conductivity solution or a calibrated reference system and temperature standard are required.

UniCond Conductivity Sensor Calibration Module Structure

UniCond Conductivity/Resistivity sensors have 3 resistance circuits that require individual calibration. The resistance circuits require calibration at 2 or 3 values as defined in Table 1. The UniCond Conductivity Sensor Calibration Module is designed to fully calibrate these resistance circuits and contains precision resistors with the nominal values listed in Table 1, the actual values are located on the certificate and the calibrator label.

Sensors manufactured in November 2011 and after, starting with S/N 5811451916, also permit calibration of the temperature measurement circuit.

Part 1: Verification/Calibration of UniCond Conductivity Sensors

Each sensor and its resistance measuring circuits are calibrated separately. **For sensors with serial number before 5811451916, remove the sensor from the process, rinse with deionized water and allow it to completely dry. For sensors with a serial number above 5811451916, there is no need to remove it. It is possible to proceed with the sensor in the process.** To assure that all electronic circuitry has reached a stable operating temperature, power the transmitter and sensor at least 10 minutes prior to calibration. The procedure is initiated by disconnecting the conductivity sensor from its cable and installing the Y connector of the calibrator between the two.

CAUTION: The calibrator and Y connection to it have 5-pins. The other connections have 8 pins. Identify the correct connection locations. Locate the keys in each connector and carefully align them and the entire assemblies before screwing into place. Cross threading may cause damage.

I. Verification of UniCond Conductivity Sensor with M300 ISM

1. Press the Cal key . The meter will display "Calibrate Sensor".
2. Press the up arrow  while "Sensor" is flashing until "Electronics" flashes.
3. If using a single channel of measurement, skip to step 6
4. If using two channels, press the right arrow key  until "Channel A" flashes.
5. Press the up arrow  to select the desired channel.
6. Press the right arrow key  until "Resistance 1" flashes.
7. Press the down key  until "Verify" flashes.
8. Press the ENTER key .
9. Compare the Verify readings on the display to the values on the **UniCond Conductivity** Calibrator label and certificate. Verify all resistances in the calibrator.
10. If the reading is within $\pm 0.5\%$ of the values for the resistance listed on the calibrator label and certificate, the instrument is within proper calibration. However, a calibration may be performed to "fine tune" the measurement.
11. Repeat this procedure for the other channel as required.

II. Calibration of UniCond Conductivity Sensor with M300 ISM

Complete calibration covers the following ranges and resistance points.

Table 1

Resistance Range	Nominal Resistance Values (ohms)		
	Point 1	Point 2	Point 3
R1	100 K	1 M	4 M
R2	10 K	100 K	1 M
R3	10	1 K	
Temperature	10 K	1 K	

Calibrate Resistance Range 1

1. Press the Cal key  on the M300 ISM. The display will show the following:

Calibrate **Sensor**
Channel A Conductivity ↑

2. Use the up arrow key  to toggle to:

Calibrate **Electronics**
Channel A Resistance 1 ↑

3. Select the sensor channel to calibrate by pressing the right arrow key  until "Channel A" flashes. Press the up arrow key  to select channel B if desired.

Calibrate Electronics
Channel A Resistance 1 ↑

4. Set the dial on the Calibrator to the 100 K Resistance position. Press the ENTER key .

Point1 = 100.00 KΩ
R1 = XX.XXX KΩ ↑

5. Edit the Point1 value to equal the actual resistance value on the label/certificate of the Calibrator. Be sure to enter the appropriate units multiplier (M, K, or none).

6. Wait for the reading to stabilize and press the Enter key . Wait for the next screen.

7. Set the dial on the Calibrator to the 1 M position and using the arrow keys, edit the Point2 value to equal the actual resistance value on the label/certificate of the Calibrator.

Point2 = 1.0000 MΩ
R1 = X.XXXX MΩ ↑

8. Wait for the R1 value to stabilize and press the Enter key . Wait for the next screen.

9. Set the dial on the Calibrator to the 4 M position and using the arrow keys, edit the Point3 value to equal the actual resistance value on the label/certificate of the Calibrator.

Point3 = 4.0000 MΩ
R1 = X.XXXX MΩ ↑

10. Wait for the R1 value to stabilize and press the Enter key  twice.

You have now successfully completed calibration of Resistance Range 1.

Calibrate Resistance Range 2

- To calibrate Range 2 press the Cal key :

Calibrate **Sensor**
Channel A Conductivity ↑
- Use the up arrow key  to toggle to:

Calibrate **Electronics**
Channel A Resistance 1 ↑
- Select the sensor channel to calibrate by pressing the right arrow key  until "Channel A" flashes. Press the up arrow key  to select channel B if desired.

Calibrate Electronics
Channel A Resistance 1 ↑
- Select Resistance 2 by pressing the right arrow key  until "Resistance 1" flashes. Press the up arrow key  to select Resistance 2.

Calibrate Electronics
Channel A **Resistance 2** ↑
- Set the dial on the Calibrator to the 10 K Resistance position. Press the ENTER key .

Point1 = 10.000 KΩ
R2 = XX.XXX KΩ ↑
- Edit the Point1 value to equal the actual resistance value on the label/certificate of the Calibrator. Be sure to enter the appropriate units multiplier (M, K, or none).
- Wait for the reading to stabilize and press the Enter key . Wait for the next screen.
- Set the dial on the Calibrator to the 100 K position and using the arrow keys, edit the Point2 value to equal the actual resistance value on the label/certificate of the Calibrator.

Point2 = 100.00 KΩ
R2 = XX.XXX KΩ ↑
- Wait for the reading to stabilize and press the Enter key . Wait for the next screen.
- Set the dial on the Calibrator to the 1 M position and using the arrow keys, edit the Point3 value to equal the actual resistance value on the label/certificate of the Calibrator.

Point3 = 1.0000 MΩ
R1 = X.XXXX MΩ ↑
- Wait for the R2 value to stabilize and press the Enter key  twice.

You have now successfully completed calibration of Resistance Range 2.

Calibrate Resistance Range 3

- To calibrate Range 3 press the Cal key :

Calibrate **Sensor**
Channel A Conductivity ↑
- Use the up arrow key  to toggle to:

Calibrate **Electronics**
Channel A Resistance 1 ↑
- Select the sensor channel to calibrate by pressing the right arrow key  until "Channel A" flashes. Press the up arrow key  to select channel B if desired

Calibrate Electronics
Channel A Resistance 1 ↑

4. Select Resistance 3 by pressing the right arrow key  until "Resistance 1" flashes. Press the up arrow key  to select Resistance 3

Calibrate Electronics
Channel A **Resistance 3** ↑

5. Set the dial on the UniCond Conductivity Calibrator to the 10 ohm Resistance position. Press the ENTER key .

Point1 = 10.000 _Ω
R3 = XX.XXX _Ω ↑

6. Edit the Point1 value to equal the actual resistance value on the label/certificate of the Calibrator. Be sure to enter the appropriate units multiplier (M, K, or none).
7. Wait for the reading to stabilize and press the Enter key . Wait for the next screen
8. Set the dial on the Calibrator to the 1 K position and using the arrow keys, edit the Point2 value to equal the actual resistance value on the label/certificate of the Calibrator.

Point2 = 1.0000 KΩ
R3 = XX.XXX KΩ ↑

9. Wait for the R3 value to stabilize and press the Enter key  twice.

You have now successfully completed calibration of Resistance Range 3.

Calibrate Temperature Range

(Restricted to units manufactured November 2011 and after, starting with S/N 5811451916)

1. To calibrate Temperature Range press the Cal key .

Calibrate **Sensor**
Channel A Conductivity ↑

2. Use the up arrow key  to toggle to:

Calibrate **Electronics**
Channel A Temperature ↑

3. Select the sensor channel to calibrate by pressing the right arrow key  until "Channel A" flashes. Press the up arrow key  to select channel B if desired.

Calibrate Electronics
Channel A Resistance 1 ↑

4. Select Temperature by pressing the right arrow key  until "Resistance 1" flashes. Press the up arrow key  to select Temperature.

Calibrate Electronics
Channel A **Temperature** ↑

5. Set the dial on the Calibrator to the 10 K Resistance position. Press the ENTER key .

Point1 = 10.000 KΩ
T = XX.XXX KΩ ↑

6. Edit the Point1 value to equal the actual resistance value on the label/certificate of the Calibrator. Be sure to enter the appropriate units multiplier (M, K, or none).
7. Wait for the reading to stabilize and press the Enter key . Wait for the next screen

- Set the dial on the Calibrator to the 1 K position and using the arrow keys, edit the T value to equal the actual resistance value on the label/certificate of the Calibrator.

Point2 = 1.0000 KΩ
T = XX.XXX KΩ ↑.

- Wait for the T value to stabilize and press the Enter key  twice.

You have now successfully completed calibration of Temperature Range.

Disconnect the calibrator and y-connector, and reconnect the sensor to the transmitter to restore normal sensor operation. If the calibrator and y-connector remain attached while the sensor is in normal measuring mode, measurements will not be accurate.

III. Instructions for Use with M800

Verification of UniCond Conductivity Sensor with M800

Touch the Cal button  to access the calibration menu.

- Touch Calibrate Electronics.
- Touch the CHAN_ button and select the desired channel from the drop down menu.
- Touch the Verify button.
- Compare the Verify readings on the display to the values on the **UniCond Conductivity** Calibrator label and certificate. Verify all resistances in the calibrator.
- If the reading is within $\pm 0.5\%$ of the values for the resistance listed on the calibrator label and certificate, the instrument is within proper calibration. However, a calibration may be performed to "fine tune" the measurement.
- Repeat this procedure for the additional channels as required.

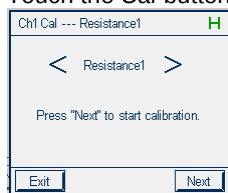
Calibration of UniCond Conductivity Sensor with M800

Complete calibration covers the following ranges and resistance points.

Table 2

Resistance Range	Nominal Resistance Points (ohms)		
	R1	R2	R3
Resistance 1	100 K	1 M	4 M
Resistance 2	10 K	100 K	1 M
Resistance 3	10	1 K	-
Temperature	10K	1K	-

- Touch the Cal button  to access the calibration menu.
- Touch Calibrate Electronics.
- Touch the CHAN_ button and select the desired channel from the drop down menu.
- Touch the Ca/ button on the M800. The display will show the following:



- Touch the arrow button  to select resistance range to be calibrated.
- Touch Next button to calibrate Resistance Range 1 (shown as R1 in Table 2).
- Set the dial on the UniCond Conductivity Calibrator to the 100 K Resistance position.

8. Touch the box to the right of R1. Edit the resistance value to match the resistance value on the label of the Calibrator. Be sure to enter the appropriate units multiplier. Units can be accessed by touching the "U" button.
9. Wait for the reading to stabilize and touch the Next button.
10. Set the dial on the UniCond Conductivity Calibrator to the 1 M Resistance position.
11. Touch the box to the right of R2. Edit the resistance value to match the resistance value on the label of the Calibrator. Be sure to enter the appropriate units multiplier.
12. Wait for the reading to stabilize and touch the Next button.
13. Set the dial on the UniCond Conductivity Calibrator to the 4 M Resistance position.
14. Touch the box to the right of R3. Edit the resistance value to match the resistance value on the label of the Calibrator. Be sure to enter the appropriate units multiplier.
15. Touch the SaveCal button to save the new calibration factors.
16. Touch the Done button to complete the calibration.

You have now successfully completed calibration of Resistance Range 1.

Repeat steps 5 through 16 for the three points for Range 2 and the two points for Range 3 and Temperature range as indicated in Table 2.

Disconnect the calibrator and y-connector, and reconnect the sensor to the transmitter to restore normal sensor operation. If the calibrator and y-connector remain attached while the sensor is in normal measuring mode, measurements will not be accurate.

Part 2: Verification/Calibration of TOC Sensor Electronics

I. Installation of the Calibration Module for use with 4000TOC or 5000TOCi

To assure that all electronic circuitry has reached a stable operating temperature, power the transmitter and sensor at least 10 minutes prior to calibration. Prior to installing the UniCond Calibration Module to the TOC Sensor, turn off the TOC UV lamp, open the TOC sensor door and disconnect C1 and C2 from the TOC Sensor PCBA as shown in **Figure 1**. To disconnect C1 and C2, gently lift the retaining clip on the top of the PCBA socket and pull the cable connector free.

NOTE: Make note of the positions of the C1 and C2 connectors to ensure they are properly re-connected after completion of the maintenance process.

To install the calibration module, disconnect the patch cord from the TOC sensor, install the single branch of the calibrator Y connector to the TOC sensor, and then attaching the patch cord to the remaining connection on the double-branch of the calibrator Y-connector.

DANGER: Hazardous AC voltages are present on the TOC PCBA. The maintenance process should only be performed by properly trained individuals. The clear protective cover should remain in place at all times during this maintenance procedure.

CAUTION: The calibrator and Y connector have 5-pins. The other connections have 8 pins. Identify the correct connection locations. Locate the keys in each connector and carefully align them and the entire assemblies before screwing into place. Cross threading may cause damage.

NOTE: The normal calibration process outlined in the TOC Sensor full calibration SOP's is adequate for calibration of the conductivity measurements used in TOC determination, and for normal indication of conductivity measurements. Calibration of TOC sensor conductivity electronics is required only for compliance with USP <645> requirements for conductivity measurement. If the TOC conductivity measurement is not being used for compliance purposes, an electronics calibration is not required.

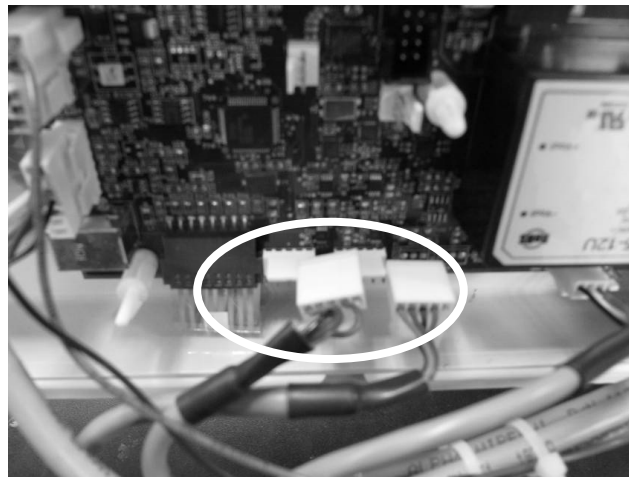


Figure 1

II. Calibration of 4000TOC Sensor with M300 TOC

Complete calibration covers the ranges and resistance points listed in **Table 3**.

Table 3

Resistance Range	Nominal Resistance Values (ohms)		
	Point 1	Point 2	Point 3
R1	100 K	1 M	4 M
R2	10 K	100 K	1 M
R3	1 K	10 K	N/A

Calibrate Resistance Range 1

1. Press the Cal key  on the M300 TOC. The display will show the following:

Calibrate **Sensor**
Channel A TOC ↑

2. Use the up arrow key  to toggle to:

Calibrate **Electronics**
Channel A Resistance 1 ↑

3. Select resistance range to be calibrated by pressing the right arrow key  until "Resistance 1" flashes. Press the up arrow key  to select Resistance 1, Resistance 2, or Resistance 3 as appropriate.

Calibrate Electronics
Channel A **Resistance 2** ↑

4. Referencing Table 3 above, set the dial on the Calibrator to the resistance value in the first column for the resistance range being calibrated. If calibrating Range 1, select the 100 K Resistance position then press the ENTER key .

Point1 = 100.00 KΩ
R1 = XX.XXX KΩ ↑

5. Edit the Point1 value to equal the actual resistance value on the label/certificate of the Calibrator. Be sure to enter the appropriate unit multiplier (M, K, or none).
6. Wait for the reading to stabilize and press the Enter key . Wait for the next screen.
7. Set the dial on the Calibrator to the resistance value in the next column. Using the arrow keys, edit the Point2 value to equal the actual resistance value on the label/certificate of the Calibrator.

Point2 = 1.0000 MΩ
R1 = X.XXXX MΩ ↑

If calibrating Range 3, skip to step 10.

8. Wait for the reading to stabilize and press the Enter key . Wait for next screen.
9. Set the dial on the Calibrator to the resistance value in the final column for the range being calibrated. Using the arrow keys, edit the Point3 value to equal the actual resistance value on the label/certificate of the Calibrator.

Point3 = 4.0000 MΩ
R1 = X.XXXX MΩ ↑

10. Wait for the reading to stabilize and press the Enter key  twice.

You have now successfully completed calibration of Resistance Range 1. Repeat steps 1 through 10 above for Range 2 and Range 3 to complete the electronics calibration process.

III. Restore the system to normal operation

Once the calibration process is complete, restore the system to normal operation as follows:

1. Disconnect the calibration module from the TOC Sensor, disconnect the patch cord from the calibration module, and reconnect the patch cord to the TOC sensor.
2. Open the TOC Sensor door, and re-connect C1 and C2 to the electronics board as shown in Figure 2.

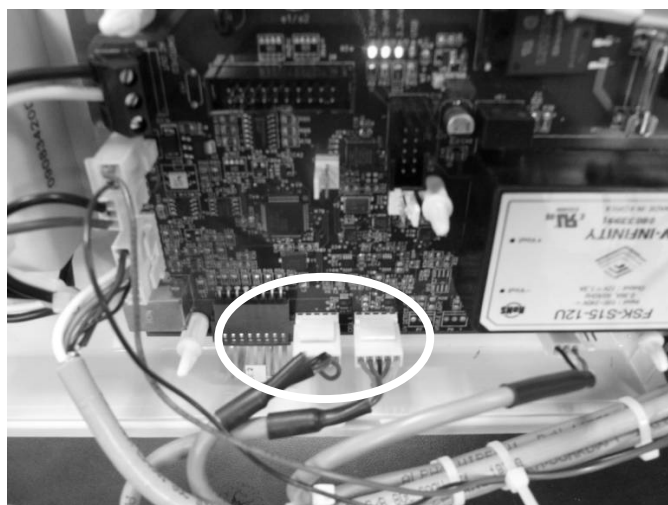


Figure 2

3. Close and secure the TOC Sensor front cover.
4. Verify proper sample flow is present to the 4000TOC sensor in accordance with the 4000TOC Sensor operating manual.
5. Ensure that the UV lamp is energized. If the UV Lamp On LED on the TOC Sensor front panel is not lit, press the UV Lamp button. The system is now back to normal operation.

IV. Instructions for Use with M800

Verification of UniCond Conductivity Sensor with M800

Touch the Cal button  to access the calibration menu.

1. Touch Calibrate Electronics.
2. Touch the CHAN_ button and select the desired channel from the drop down menu.
3. Touch the Verify button.
4. Compare the Verify readings on the display to the values on the **UniCond Conductivity Calibrator** label and certificate. Verify all resistances in the calibrator.
5. If the reading is within $\pm 0.5\%$ of the values for the resistance listed on the calibrator label and certificate, the instrument is within proper calibration. However, a calibration may be performed to "fine tune" the measurement.
6. Repeat this procedure for additional channels as required.

V. Calibration of 5000TOCi Sensor Electronics with M800

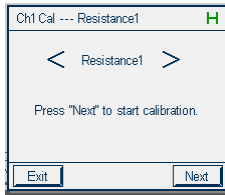
Complete calibration covers the following ranges and resistance points.

Table 4

Resistance Range	Nominal Resistance Values (ohms)		
	R1	R2	R3
Resistance 1	100 K	1 M	4 M
Resistance 2	10 K	100 K	1 M
Resistance 3	1 K	10 K	N/A

1. Touch the Cal button  to access the calibration menu.
2. Touch Calibrate Electronics.
3. Touch the CHAN_ button and select the desired channel from the drop down menu.

4. Touch the *Cal* button on the M800. The display will show the following:



5. Touch the arrow button  to select resistance range to be calibrated, beginning with Resistance1.
6. Touch Next button to calibrate the selected Resistance Range (shown as R1 in Table 4).
7. Set the dial on the UniCond Conductivity Calibrator to the value shown in the first column of Table 4 (100 K Resistance position for Resistance1).
8. Touch the box to the right of R1. Edit the resistance value to match the resistance value on the label of the Calibrator. Be sure to enter the appropriate unit multiplier. The unit multipliers can be accessed by touching the “U” button.
9. Wait for the reading to stabilize and touch the Next button.
10. Set the dial on the UniCond Conductivity Calibrator to the next resistance value (1 M Resistance position for Resistance1).
11. Touch the box to the right of R2. Edit the resistance value to match the resistance value on the label of the Calibrator. Be sure to enter the appropriate units multiplier.
12. Wait for the reading to stabilize and touch the Next button.
13. If calibrating Resistance 3, proceed to step 16.
14. Set the dial on the UniCond Conductivity Calibrator to the value in the third column of Table 4 (4 M Resistance position for Resistance 1).
15. Touch the box to the right of R3. Edit the resistance value to match the resistance value on the label of the Calibrator. Be sure to enter the appropriate units multiplier.
16. Touch the SaveCal button to save the new calibration factors.
17. Touch the Done button to complete the calibration.

You have now successfully completed calibration of Resistance Range 1.

Repeat steps 5 through 16 for the three points for Range 2 and the two points for Range 3 as indicated in Table 4.

VI. Restore the system to normal operation

Once the calibration process is complete, restore the system to normal operation as follows:

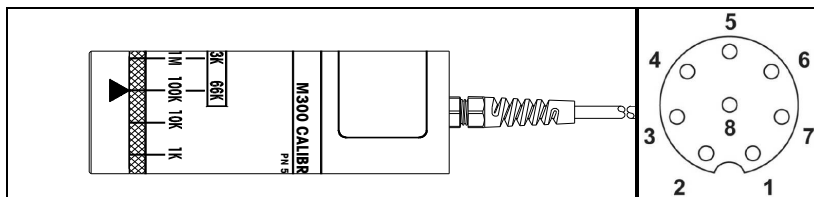
1. Disconnect the calibration module from the TOC Sensor, disconnect the patch cord from the calibration module, and reconnect the patch cord to the TOC sensor.
2. Open the TOC Sensor door, and re-connect C1 and C2 to the electronics board as shown in the image below.
3. Shut and secure the TOC Sensor front cover.
4. Verify proper sample flow is present to the 4000TOC sensor in accordance with the 4000TOC Sensor operating manual.
5. Ensure that the UV lamp is energized. If the UV Lamp On LED on the TOC Sensor front panel is not lit, press the UV Lamp button. The system is now back to normal operation.

VII. Verifying the UniCond Conductivity Sensor Calibration Module

If necessary, the UniCond Calibration Module should be returned annually to Mettler-Toledo Thornton for NIST traceable recertification and re-calibration. If desired it can be checked on site. A traceable resistance meter is needed to perform the verification. Each calibrator contains six precision resistors for the resistivity and temperature ranges, accessed from the end of the Y-connector.

Verify the Resistance Signal:

1. Leave the Y-connector in place and connect the ohmmeter to positions #6 and #7 of the sensor end of the Y-connector.
2. Set the knob to a specific resistance value and measure the resistance. Compare the ohmmeter reading to the actual value printed on the calibrator label and certificate.
3. Repeat for the other resistance ranges.



If the calibrator is within performance limits ($\pm 0.08\%$ or ± 0.03 ohms, whichever is greater), a verification label can be applied to the calibrator to show the last verification date.

Replacement Parts

Y-connector

Part No. 58 150 019

Limited Warranty

Mettler-Toledo Thornton, Inc. warrants products it manufactures against defects in materials or workmanship for 12 months from the date of shipment from Thornton. Items returned for warranty must be properly packaged, shipped prepaid and insured, and be accompanied by a Return Materials Authorization Number assigned by Mettler-Toledo Thornton Customer Service.

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