

## Verifying the Calibrators

Calibrators should be returned to Thornton periodically for "NIST Traceable" re-calibration. If desired, they can be checked on site. A precision "NIST Traceable" resistance meter is needed to perform the verification. Each calibrator consists of two precision resistors: one for the resistivity signal and the other for the temperature signal.

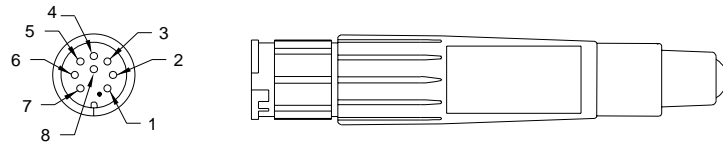
### A. Verify the Resistance Signal:

1. Connect the lead of the ohm meter to pin #3 of the calibrator.
2. Connect the other lead of the ohm meter to pin #8 of the calibrator.
3. Measure the resistance and compare it to the value listed on the calibrator label.

### A. Verify the Temperature Signal:

1. Connect the lead of the ohm meter to pin #4 of the calibrator.
2. Connect the other lead of the ohm meter to pin #6 of the calibrator.
3. Measure the resistance and compare it to the value listed on the calibrator label.

If the calibrator is within performance limits, a verification label can be applied to the calibrator system with space for the date and initials.



## INSTRUCTION MANUAL Conductivity / Resistivity Calibration System for use with 2000 and 200pH/CR Instruments

Mettler-Toledo Thornton, Inc. calibrators for the 2000 and 200pH/CR perform resistance and temperature calibration without removing the instrument from the installation and without any additional equipment. The calibration process takes only a few minutes. The accuracy of Thornton calibrators can be traced to NIST (National Institute of Standards and Technology) standards. A simple test and verification procedure can be performed periodically to verify that each calibrator has maintained its accuracy. This calibration system does not calibrate the voltage range used to measure pH or dissolved oxygen. The sensor calibrations are performed directly in NIST Traceable buffer solutions (pH) or air (dissolved oxygen), in lieu of voltage calibration. If it is desired to calibrate voltage for ORP measurements, refer to the 2000 or 200pH/CR manual meter calibration section.

Conductivity Calibration equipment is provided at three levels:

- complete (full range) calibration system including six calibrators
- low and high range calibration systems each containing three calibrators
- individual calibrators, as outlined below:

1865-07 Complete calibration system (6 calibrators)

1865-05 Low conductivity/high resistance calibration system consisting of:

1864-12 open (infinite  $\Omega$ ) calibrator; 25°C, Pt1000 RTD

1864-05 500k $\Omega$  calibrator; 104°C, Pt1000 RTD

1864-06 50k $\Omega$  calibrator; 0°C, Pt1000 RTD

1865-06 High conductivity/low resistance calibration system consisting of:

1864-09 short (0  $\Omega$ ) calibrator with 25°C, Pt1000 RTD

1864-07 5k $\Omega$  calibrator with 104°C, Pt1000 RTD

1864-08 500 $\Omega$  calibrator with 0°C, Pt1000 RTD

The Instrument has four internal ranges of resistance measurement. It automatically selects among these depending on the sensor and the conductivity/resistivity of the sample (see table). If the application requires measurements within only one range, then only this range need be calibrated. If measurements are made on multiple ranges, multiple calibrations are recommended. When a complete calibration is performed, the "open" and "short" calibrators should be used first. A temperature calibration is also recommended.

Measurement Range ( $\mu\text{S}/\text{cm}$ )			
2-electrode Sensor		4-electrode sensor	Applicable Calibrator
0.1cm <sup>-1</sup>	50 cm <sup>-1</sup>		
<0.67	<400	<2.0	1864-05
0.50 - 6.7	300 - 4,000	1.5 - 20	1864-06
5.0 - 67	3,000 - 40,000	15 - 200	1864-07
>50	>30,000	>150	1864-08

**CAUTION: Before connecting a calibrator, be certain the patch cord has been wired for conductivity / resistivity measurement. If it is wired for pH, ORP or dissolved oxygen measurement, circuit damage may result.**

### Verification/Calibration

NOTE: the 2000 or 200pH/CR will not give direct readings of calibrator values in the normal measuring mode. The "Calibrate Verify" mode should be used for this. The instrument provides two measurement channels, A and B, which are calibrated simultaneously when either is calibrated for conductivity/resistivity. Calibration of both channels for temperature is necessary, however. To assure that the electronic circuitry has reached a stable operating temperature, power the instrument at least two hours prior to calibration. The procedure is initiated by disconnecting the sensor on one channel and installing a calibrator.

### Verification

Press the calibrate key. The meter will read "Calibrate Sensor". Use the up or down arrow keys to select "Calibrate Verify". Press the OK/NEXT key. Select the desired channel and press the OK/NEXT key. If the instrument reading is within  $\pm 0.5\%$  of the values for resistance and temperature listed on the calibrator, the instrument is within proper calibration. However, a calibration may be performed to "fine tune" the instrument.

### Calibration

Calibration sequence should use the "Short" and/or "Open" calibrators first. Other calibrators may be used in any order. To perform a calibration, install the calibrator on the patch cord, press the calibrate key. The display will show the following:

Calibrate Sensor

Use the up arrow key to toggle to "Calibrate Meter". Then press the OK/NEXT key.

Cal Meter Ch A

Choose the channel on which the calibrator was installed. For example, press the down arrow key, then the OK/NEXT key to select channel B.

Cal B #1: R 500K

The calibrator can be selected using arrow keys. For the example of the "short" calibrator, press the down arrow key until "short" appears and press the OK/NEXT key:

Short chan B OK?

Press the OK/NEXT key and the calibration will be performed.

Done, press OK/NEXT

Press the OK/NEXT key:

Save Changes Yes

If calibration was performed correctly, press OK/NEXT. Normal operation will resume.

Repeat the procedure for additional calibrators. If the "open" calibration is to be done, it should be performed next.

The next example is for the calibrator at 500 $\Omega$  connected to channel B. From normal operation, press the calibrate key:

Calibrate Sensor

Use the up arrow key to toggle to: Calibrate Meter and press the OK/NEXT key.

Cal Meter Ch A

Choose the channel on which the calibrator was installed. Press the down arrow key and OK/NEXT key to select channel B.

Cal B #1: R 500K

The calibrator can be selected using arrow keys. Press the down arrow key until the following text appears and Press the enter key:

B R 500 = .50000K

Change the displayed value with the arrow keys to match the exact value on the connected calibrator, for example:

B R 500 = .49989K

Press OK/NEXT and see a display such as:

B= 500.4 $\Omega$  OK?

The value displayed at this point is the value the meter is reading before calibration. Allow approximately 15 seconds for this value to stabilize. This will NOT be the value input for the calibrator. (The value on the calibrator is only displayed in the "Calibrate Verify" mode.) Press OK/NEXT and the calibration will be performed:

Done, press OK/NEXT

Press OK/NEXT key:

Save Changes Yes

To accept the calibration value, press the OK/NEXT key. Normal operation will resume.

Repeat the procedure for additional resistance calibrators.

Then repeat the procedure for the temperature measurement using at least two of the 0°C, 25°C and 104°C temperature values included in the calibrators depending on the temperature range of actual measurements.