Model 1181T
Two-Wire Toroidal Conductivity Transmitter
ESSENTIAL INSTRUCTIONS
READ THIS PAGE BEFORE PROCEEDING!

Rosemount Analytical designs, manufactures, and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use, and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- Read all instructions prior to installing, operating, and servicing the product. If this Instruction Manual is not the correct manual, telephone 1-800-654-7768 and the requested manual will be provided. Save this Instruction Manual for future reference.
- If you do not understand any of the instructions, contact your Rosemount representative for clarification.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look alike substitutions may result in fire, electrical hazards, or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

DANGER
HAZARDOUS AREA INSTALLATION

INTRINSICALLY SAFE INSTALLATION
Installations in hazardous area locations must be carefully evaluated by qualified on site safety personnel. Transmitter and Sensor alone are not Intrinsically safe. To secure and maintain an intrinsically safe installation, a certified safety barrier must be used and the installation must comply with the governing approval agency (FM, CSA or BASEEFA/CENELEC) installation drawing requirements (see Section 2.0 - Installation).

EXPLOSION-PROOF INSTALLATION
Caution: Sensors are not explosion-proof. If the sensor must be installed in a hazardous location an intrinsically safe system must be implemented. To maintain the explosion-proof rating of the transmitter, the following conditions must be met:
- Discontinue power supply before removing enclosure covers.
- Transmitter covers must be properly installed during power on operation.
- Explosion proof “Y” fittings must be properly installed with sealing compound prior to applying power to the transmitter.
- Serial tag cover over the external Zero and Span adjustments must be in place.
- See Installation Section for details.

Proper installation, operation and servicing of this instrument in a Hazardous Area Installation is entirely the responsibility of the user.

About This Document
This manual contains instructions for installation and operation of Model 1181T Two-wire Toroidal Conductivity Transmitter. The following list provides notes concerning all revisions of this document.

<table>
<thead>
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<th>Date</th>
<th>Notes</th>
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<td>5/00</td>
<td>The initial release of the product manual. The manual has been reformatted to reflect the Emerson documentation style and updated to reflect any changes in the product offering.</td>
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<td>A</td>
<td>7/01</td>
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<td>B</td>
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MODEL 1181T
TWO-WIRE TRANSMITTER

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1.1 FEATURES AND APPLICATIONS

The Rosemount Analytical Two-Wire field mounted transmitters, with the appropriate sensors, are designed to continuously measure the pH, ORP, Conductivity, Dissolved Oxygen, or Free Residual Chlorine in industrial processes.

The Model 1181 Transmitters include all the circuitry necessary for the measurement and transmission of an isolated 4-20 mA linear signal. Measurement range selection is made through internal range switches that are easily accessed by removing a housing cover. No further disassembly is required. A matrix is provided which conveniently indicates the proper switch position. Range selection can be made without the use of the instruction manual. Fine calibration of the 4-20 mA signal is accomplished with the 20-turn external Zero and Span potentiometers.

The electronic printed circuits are protected from the environment by the NEMA 4X weatherproof, corrosion-resistant enclosure. The printed circuit cards plug into a moisture barrier which is isolated from the field wiring and calibration terminals. Routine field calibration does not require exposing the electronics to harsh industrial environments. All PCBs are conformal coated for maximum protection. The PCBs are removed as a unit and may be individually replaced. The transmitter housing covers are sealed with large cross-sectional O-rings and need not be replaced each time the cover is removed.

The Model 1181 is available blind or with an analog or digital display. The digital display may be calibrated in engineering units and the analog display features multiple scales in engineering units.

The transmitters are certified explosion-proof, NEMA 7B, and intrinsically safe when installed with an approved barrier and sensor. Hazardous area certificates are provided by BASEEFA to CENELEC regulations, FM, CSA, SAA, SEV, and TUV. CSA has determined that the moisture barrier qualifies as Factory Sealed which means Explosion Proof Y fittings and sealing compound are not required for installation when this approval is selected.

Accessory items are available for the two-wire transmitters. The Model 515 Isolated Power Supply provides power for up to 20 transmitters. Two transmitters may be wired directly to the power supply. For more than two transmitters, junction boxes are available, each accommodating wiring for a maximum of ten transmitters. Remote alarms are available with independently adjustable set points and hysteresis. Contacts of the Model 230A may be specified for high/low, high/high, or low/low operation. The impedance of the Model 230A Alarm Module is less than 100 ohms. For further information on the Models 515 and 230A, please refer to their respective product data sheet.

1.2 PHYSICAL SPECIFICATIONS – GENERAL

Enclosure: NEMA 4X, weatherproof and corrosion-resistant
NEMA 7B, explosion proof

Hazardous Area Classification:

Explosion Proof:
FM: Class I, Groups B, C, & D, Div. 1
  Class II, Groups E, F, & G, Div. 1
  Class III
  60°C Maximum
CSA: Class I, Groups C & D
  Class II, Groups E, F, & G
  Class III
  Class I, Groups A, B, C, & D, Div. 2
  Encl. Type 4, Factory Sealed

Intrinsic Safety:
FM: Class I, II, & III, Div. 1
  Temperature Code T4
CSA: Class I, Groups A, B, C, & D, Encl 4
  Temperature Code T4
CENELEC: Ex ia IIB T4

Display:
Analog: plug in, 90 degree, 2.5 inch diameter
  1181T: single scale, 0-100%
Digital: 3.5 digit, LCD, adjustable range in engineering units

EMI/RFI: EN-61326
Recommended

**Cable:** Transmitter to Power Supply Two Wire, 18 AWG, shielded, Belden 8760 or equal (Rosemount Analytical P/N 9200001)

**Weight/Shipping Weight:**
- Blind: 1.8 kg/2.25 kg (4.0 lbs/5.0 lbs)
- Analog/Digital: 2.48 kg/2.93 kg (5.5 lbs/6.5 lbs)

### 1.3 PERFORMANCE SPECIFICATIONS – GENERAL

**Power Supply Requirements:** (See Load/Supply Chart)

**Lift Off Voltage:**
- Blind & Analog: 10 VDC
- Digital: 12.5 VDC

**Maximum Operating Power:** 40 milliwatts

**Output:** Blind & Analog: Isolated 4-20 mA into 700 ohms at 24 VDC
- Digital: Isolated 4-20 mA into 575 ohms at 24 VDC

**Input/Output Isolation:** 600 Volts

**Ambient Temperature:** –25° to 70°C

**Relative Humidity:** 0-99%

**Digital Display Accuracy:** 0.1% reading ±1.0 count

**Analog Display Accuracy:** ±2.0%

**External Zero:** ±25%

**External Span:** ±50%

**Shock:** 10G maximum for 10 milliseconds

**Vibration:** 0.025 inches double amplitude 5 to 50 Hz for 2 hours

The **Model 1181T** Toroidal Transmitter measures conductivity over the range of 0-50 µS/cm to 0-1000 mS/cm. The Model 1181T uses an inductive principle of measurement and employs the use of toroidal or electrodeless conductivity sensors. Toroidal conductivity sensors have no exposed electrodes to the measured solution, which practically eliminates routine sensor maintenance in applications where electrode fouling may occur. A unique feature of the Model 1181T is the 0-4% temperature slope adjustment which provides greater accuracy in chemical concentration control. The 0-4% temperature slope adjustment eliminates the need for special temperature compensation circuits required for the calibration to a specific acid, base, or salt over a specific operating temperature range.
1.4 PERFORMANCE SPECIFICATIONS @ 25°C

Measurement Range: 0-80 µS/cm minimum
0-1000 mS/cm maximum

Internal Range Select: Multipliers X500, X1000,
X10,000 with jumper selectable
span X1 & X10 and internal
span adjust

Accuracy: ±0.5% full scale
Stability: ±0.1%/month, non-cumulative
Repeatability: ±0.1% full scale
Temperature Coefficient: 0.05% of F.S./°C
Temperature Slope Adjust: 0-4%/°C
Automatic Temperature Compensation: 0-200°C

1.5 ORDERING INFORMATION

Model 1181 Two Wire Transmitter is housed in a NEMA 7B explosion-proof, 4X weatherproof, corrosion-resistant enclosure and includes all the circuitry necessary for measurement and transmission of an isolated 4-20 mA signal. The transmitter may be selected with or without an analog or digital display.
SECTION 2.0
INSTALLATION

2.1 UNPACKING AND INSPECTION
Before opening the shipping carton, inspect the outside of the carton for any damage. If damage is detected, contact the carrier immediately. If there is no apparent damage, open the carton and inspect the instrument and hardware. Make sure all the items in the packing list are present and in good condition. Notify the factory if any part is missing. If the instrument appears to be in satisfactory condition, proceed to the transmitter installation.

NOTE
Save the original packing cartons and materials as most carriers require proof of damage due to mishandling, etc., also, if it is necessary to return the instrument to the factory, you must pack the instrument in the same manner as it was received. (refer to Section 8 for return instructions).

2.2 MECHANICAL INSTALLATION

IMPORTANT
Do not attempt to install and operate the Model 1181T without first reading this manual.

2.2.1 General. The transmitter may be installed in harsh environments. However, it should be installed in an area where sources of extreme temperature fluctuation, vibration and shock are at a minimum or non-existent. Select an installation site that (1) permits the use of the standard cable lengths of 20 feet (6.1 m) or 10 feet (3.0 m); (2) is easily accessed by operating and maintenance personnel; (3) is at least 12 inches (300 mm) from sources of high voltage.

2.2.2 Mounting. The Transmitter may be mounted on a flat surface using the two threaded mounting holes located on the bottom of the transmitter or through the use of an optional 2-inch pipe/wall mounting bracket, Code 07 (Figure 2-1).

2.3 HAZARDOUS LOCATIONS—EXPLOSION PROOF INSTALLATIONS
In order to maintain the explosion proof rating for the installed transmitter, the following conditions must be met:

1. The transmitter enclosure covers must be on hand tight and the threads must not be damaged.

NOTE
These covers seat on o-rings which serve to provide a dust proof enclosure for Class II and Class III installations.

2. Explosion proof "Y" fittings must be properly installed and plugged with a sealing compound to prevent explosive gases from entering the transmitter. CSA has determined that the transmitter housing is "Factory Sealed". Installation of "Y" fittings and the use of sealing compound is not required for CSA approved Explosion Proof installations.

NOTE
Do not install sealing compound until all field wiring is complete.

3. If one of the conduit connections on the housing is not used, it must be closed with a threaded metal plug with at least five threads engaged.

CAUTION
Sealing compound must be installed prior to applying power to the transmitter.

4. The serial tag cover on the external ZERO and SPAN adjustments must be in place.

5. Explosion proof installation must be in accordance with drawing number 1400155 (See Figure 2-6).

6. Due to the nature of the measurement, sensors cannot be designed to meet explosion proof certification. If the sensors must be installed in hazardous area locations, Rosemount Analytical Inc. recommends that an intrinsically safe system be installed.
FIGURE 2-1. Mounting and Dimensional Drawing
2.4 WIRING—GENERAL

The transmitter is equipped with two 1¼-inch conduit openings, one on each side of the housing. One is for the power supply/signal wiring and the other is for the sensor wiring.

The use of waterproof cable glands or conduit is recommended to prevent moisture from entering the housing. If conduit is used, it should be positioned to prevent condensation from draining into the housing.

Twisted pairs are recommended for the signal cable. The twisted pairs should also be shielded and grounded. The transmitter case shall be grounded.

Signal or sensor wiring should never be run in the same conduit or open tray with AC power, or relay actuated signal cables. Keep signal or sensor wiring at least 12 inches from heavy electrical equipment.

NOTE
For best EMI/REI protection the power supply/signal cable should be shielded and enclosed in an earth grounded rigid metal conduit. Connect the cable’s outer shield to the earth ground terminal near TB1, Figure 2-2.

The sensor cable should also be shielded. The cable’s outer shield shall be connected to the earth ground terminal provided near TB1, Figure 2-2. If the outer shield is braided an appropriate metal cable gland fitting may be used to connect the braid to earth ground via the instrument case.

A new addition to the suite of tests done to ensure CE compliance is IEC 1000-4-5. This is a surge immunity test that simulates overvoltages due to switching and lightning transients.

In order to meet the requirements of this test, additional protection must be added to the instrument in the form of a Transient Protector such as the Rosemount Model 470D. This is a 3½-inch tube with ½-inch MNPT threads on both ends. Inside the tube are gas discharge and zener diode devices to limit surges to the transmitter from the current loop. No additional protection is needed on the sensor connections.

2.4.2 Power and Signal Wiring. The power and signal wiring terminals are located directly above the Sensor wiring terminals and are designated TB1. TB1 also provides for plugging in the optional Analog display or wiring of the optional digital display.

2.5 HAZARDOUS LOCATIONS—INTRINSICALLY SAFE INSTALLATION

To secure and maintain intrinsically safe installation for the appropriate approval agency, the following conditions must be met:

1. Code 73 must be specified when ordering CENELEC units and installation must be performed in accordance with Drawing Number 6-012-BO26 (Figure 2-5).
2. Code 69 must be specified when ordering CSA (Canadian Standards Association) units. Installation must be performed in accordance with Drawing Number 1400150 (Figure 2-4).
3. Code 67 must be specified when ordering F.M. units. Installation must be accordance with Drawing Number 1400128 (Figure 2-3).

2.4.3 Sensor Wiring. The Sensor wiring terminals are located on the side of the housing designated TERM SIDE on the serial label. Remove the housing cover from the TERM SIDE to gain access to the terminals designated TB2. Remove the optional Analog or Digital display. The plug in analog display is held in by a spring clip and the digital display is held in by a locking screw. Connect the sensor wiring to TB2 terminals 1 through 4 as shown on drawing 40118121 (Figure 2-2).

NOTE
Sensors are supplied with a standard cable length of 20 feet (6.1 m) or 10 feet (3.0 m). If the standard cable length is not sufficient for the planned installation, the use of a junction box with extension cable is strongly recommended. Cutting or extending the cable may reduce performance and will void warranty.

CAUTION
Do not exceed 100 feet (30.5m) distance of total cable length between the Transmitter and the Sensor.
FIGURE 2-2. Transmitter Wiring

ELECTRICAL INTERCONNECTION

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<thead>
<tr>
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<tr>
<td>TB1-2 METER (+) RED</td>
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<tr>
<td>TB1-3 METER (-) BLACK &amp; LOOP SIGNAL (4-20 mA OUTPUT)</td>
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TO TOROIDAL SENSOR

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<tr>
<th>MODEL 221 222 224 OR 227</th>
<th>MODEL 225, 226 OR 228</th>
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<tr>
<td>TB2-1 SENSE (BLACK)</td>
<td>#1 GREEN</td>
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<tr>
<td>TB2-2 TC/SHEILD (GREEN)</td>
<td>#2 GREEN</td>
</tr>
<tr>
<td>TB2-3 TC (BOTH WHITES)</td>
<td>#3 WHITE &amp; #3 BLACK</td>
</tr>
<tr>
<td>TB2-4 PROBE DRIVE (BLACK) FROM BLACK AND WHITE PAIR</td>
<td>#4 WHITE</td>
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DWG. NO. 40118121 REV. J
FIGURE 2-3. Schematic System, F.M. I.S. Approved 1181T (1 of 3)

RECOMMENDED BARRIERS

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NOTE: UNLESS OTHERWISE SPECIFIED
I. BARRIER INSTALLATION
A. THE BARRIER MUST BE MOUNTED IN A SAFE AREA AND PROTECTED BY AN ADEQUATE ENCLOSURE WITHIN WHICH THE TEMPERATURE MUST NOT EXCEED THE MAXIMUM OPERATING TEMPERATURE OF THE BARRIER(S).
B. BARRIER'S GROUND MUST BE WITHIN ONE CM OF THE TRUE EARTH GROUND.
C. THE GROUND WIRE MUST BE CAPABLE OF CARRYING THE MAXIMUM POSSIBLE FAULT CURRENT(S). THIS GROUND WIRE MUST NOT BE SMALLER THAN 1/4 AWG, AND IT MUST BE MAINTAINED FREQUENTLY.

II. SAFE AREA WIRING
A. A CLEARANCE DISTANCE OF AT LEAST 2 INCHES (50mm) BETWEEN THE INTRINSICALLY SAFE AND NONINTRINSICALLY SAFE TERMINALS MUST BE MAINTAINED.
B. APPARATUS CONNECTED TO NON INTRINSICALLY SAFE TERMINALS OF BARRIER MUST NOT BE SUPPLIED FROM OR CONTAIN A SOURCE OF POTENTIAL EXCEEDING 250 VDC OR 250 VAC RMS (360V PEAK) WITH RESPECT TO EARTH.
C. NONINTRINSICALLY SAFE WIRING MUST BE SEPARATED FROM INTRINSICALLY SAFE WIRING BY ACCEPTABLE MEANS, PREFERABLY RACENWAY.
D. POWER SUPPLY CONNECTED TO THE NONINTRINSICALLY SAFE TERMINALS MUST BE ISOLATED FROM THE LINE VOLTAGE BY A DOUBLE WOUND TRANSFORMER. THE PRIMARY WINDING OF THE TRANSFORMER MUST BE PROTECTED BY AN APPROPRIATELY RATED FUSE OF ADEQUATE BREAKING CAPACITY.

III. HAZARDOUS AREA WIRING
A. ONLY THE CONDUCTORS CONNECTED TO THE INTRINSICALLY SAFE TERMINALS OF THE BARRIER MAY ENTER THE HAZARDOUS AREA. THE ABOVE INTRINSICALLY SAFE CONDUCTORS:
1. MUST NOT BE INTERCONNECTED TO ANY OTHER CIRCUIT, INCLUDING BARRIER-PROTECTED CIRCUITS OR SHARED EARTH RETURN CABLES WITH THEM.
2. MUST NOT SHARE ANY ELECTRICAL CONNECTOR WITH CABLES CONNECTED TO NONINTRINSICALLY SAFE TERMINALS.
3. ARE NOT REQUIRED TO BE SHIELDED. HOWEVER, IF THERE IS A SHIELD, THE SHIELD MUST BE GROUNDED AT THE BARRIER GROUND BUSBAR.
4. SHOULD BE MARKED EITHER BY WRITING OR BY COLORING BRIGHT BLUE.
5. MUST BE INSULATED FROM EARTH AND CAPABLE OF withstandiNG A TEST VOLTAGE OF 500 VAC TO EARTH.

B. FOR MULTIPLE BARRIERS WIRING,
1. DIFFERENT INTRINSICALLY SAFE WIRINGS OF THE SAME INTRINSICALLY SAFE SYSTEM SHALL NOT BE RUN IN THE SAME CABLE, UNLESS AT LEAST 0.25 mm THICKNESS INSULATION IS USED ON EACH CONDUCTOR AND BOTH WIRES OF EACH CIRCUIT ARE RUN AS A TWISTED PAIR.
2. DIFFERENT INTRINSICALLY SAFE SYSTEMS SHALL NOT BE RUN IN THE SAME MULTICONDUCTOR CABLE.
Exia
INTRINSICALLY SAFE / SECURITE INTRINSIQUE

1. The electrical circuit in the hazardous area must be capable of withstanding an d.c. test voltage of 500 volts r.m.s. to earth or frame of the apparatus for one minute.

2. The capacitance and inductance or inductance/resistance (L/R) ratio of the hazardous area cables must not exceed the values specified in the appropriate barrier certificate.

3. The installation must comply with the requirements of BS 5345 Part 4 1977.

4. Any shunt zener diode safety barrier certified by BASEEFA or any EEC approved certification body to (Ex ia) or (Ex ia) MB having the following output parameters:
   - \( U_z = 28 \text{V} \)
   - \( I_{\text{max.out}} = 294 \text{mA} \)
   - \( W_{\text{max.out}} = 0.92 \text{W} \)

   Other barriers having lower values than these are permitted, in any safety barrier used the output current must be limited by a resistor \( R \) such that
   \[
   I_{\text{max.out}} = \frac{U_z}{R}
   \]
FIGURE 2-6. 1181T FM Approved Explosion Proof Installation
SECTION 3.0
DESCRIPTION OF CONTROLS

3.1 DESCRIPTION OF CONTROLS

3.1.1 Internal Span Multiplier, R54, located on the temperature PCB. The internal Span Multiplier is a 20-turn potentiometer which provides a coarse span and is continuously adjustable from X1 to X10. The Internal Span Multiplier is used in conjunction with the Range Factor Switch. This adjustment is accessed by removing the cover on the CIRCUIT SIDE of the Transmitter (Figure 3-3).

3.1.2 External Zero Pot, R18, located on the driver PCB. The External Zero is a 20-turn potentiometer used for fine adjustment of the 4.0 mA isolated current output. This adjustment is accessed by removing the Serial Tag on the side of the housing and is designated by a "Z" (Figure 3-1).

3.1.3 External Span Pot, R16, located on the driver PCB. The External Span is a 20-turn potentiometer used for fine adjustment of the 20.0 mA isolated current output. This adjustment is accessed by removing the Serial Tag on the side of the housing and is designated by an "S" (Figure 3-1).

3.1.4 Range Factor Switch, located on the input PCB. The Range Factor Switch is comprised of three dip switches: S1, S2, and S3. Different full scale ranges may be obtained by setting the switches to the desired positions. The Range Factor Switches determine the maximum available full scale conductivity range (Figure 4-1).

3.1.5 Range Jumper, located on the driver PCB. This jumper increases the range of the Model 1181T. For a multiplier of X1, place the jumper in W2 position. For a multiplier of X10 place the jumper in W3 position (Figure 3-4).

3.1.6 Temperature Slope Adjustment, R46, located on the temperature PCB. Each conductive solution has its own set of conductivity vs percent concentration curves which change with temperature change. The function of the temperature slope adjustment is to calibrate the temperature compensation curve to a specific solution over the operating temperature range. The conductivity indication is corrected along the calibrated temperature slope to a 25°C reference temperature. When the temperature slope adjustment is set to 0% / °C, the temperature compensator is disabled. It is very important then that the process temperature be at or near 25°C (Figure 3-3).

3.1.7 Analog/LCD Operation Jumper, W1, located on the transmitter PCB. When the jumper is in the W1 position, the 1181T will operate only with an analog meter or as a blind unit. But when the jumper is in the opposite position or is removed, the 1181T will operate only with an LCD (Figure 3-5).

3.1.8 Sensor Zero, R11, located on the driver PCB. The Sensor Zero potentiometer is used to offset cable resistance measured as conductivity. The Sensor Zero is used upon completion of all field wiring and prior to fine calibration of the 4.0 mA output with the External Zero (Figure 3-4).
MODEL 1181T

SECTION 3.0
DESCRIPTION OF CONTROLS

FIGURE 3-1. External Span And Zero

SPAN and ZERO adjustment screws must be as shown for circuit board removal

SERIAL LABEL (REMOVE TO GAIN ACCESS TO EXTERNAL SPAN & ZERO CONTROLS)

FIGURE 3-2. Model 1181T PCB Stack

SIGNAL INPUT BD #4
TEMP BD #3
DRIVER BD #2
XMTR BD #1
FIGURE 3-3. Temperature Circuit Board

FIGURE 3-4. Driver Circuit Board

FIGURE 3-5. Transmitter Circuit Board
FIGURE 3-6. Signal Input Circuit Board
4.1 GENERAL
The Model 1181T is factory calibrated to measure 0-5,000 microsiemens/cm corresponding to 4-20mA and the temperature slope adjustment is set at 0%. The optional LCD display is calibrated to 0-100% corresponding to 4-20 mA.

NOTE
1 microsiemen/cm (µS/cm)=1 micromho/cm (µmho/cm)
1 millisiemen/cm (mS/cm)=1000 µmho/cm

NOTE
Do not attempt to adjust any sealed adjustment pots.

4.2 RANGE SELECTION
The sequence for changing the full scale measurement range of the Model 1181T is shown on a matrix. The matrix is accessed by removing the housing cover on the CIRCUIT SIDE of the Transmitter.

IMPORTANT NOTE
As an alternative to the following instructions, see Table 4-1.

### TABLE 4-1.
Full Scale Readings of the 1181T in Microsiemens/cm with Various Probe Constants

<table>
<thead>
<tr>
<th>SENSORS</th>
<th>SWITCH</th>
<th>INTERNAL SPAN POT</th>
<th>JUMPER</th>
</tr>
</thead>
<tbody>
<tr>
<td>226</td>
<td>225</td>
<td>228</td>
<td>S3 S2 S1 X1 X5 X10 X1 X10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>W-2 W-3</td>
</tr>
<tr>
<td>40</td>
<td>250</td>
<td>600</td>
<td>X X X</td>
</tr>
<tr>
<td>80</td>
<td>500</td>
<td>1,200</td>
<td>X X X</td>
</tr>
<tr>
<td>200</td>
<td>1,250</td>
<td>3,000</td>
<td>X X X</td>
</tr>
<tr>
<td>400</td>
<td>2,500</td>
<td>6,000</td>
<td>X X X</td>
</tr>
<tr>
<td>800</td>
<td>5,000</td>
<td>12,000</td>
<td>X X X</td>
</tr>
<tr>
<td>2,000</td>
<td>12,000</td>
<td>30,000</td>
<td>X X</td>
</tr>
<tr>
<td>4,000</td>
<td>25,000</td>
<td>60,000</td>
<td>X X X</td>
</tr>
<tr>
<td>8,000</td>
<td>50,000</td>
<td>120,000</td>
<td>X X X</td>
</tr>
<tr>
<td>40,000</td>
<td>250,000</td>
<td>600,000</td>
<td>X X X</td>
</tr>
<tr>
<td>80,000</td>
<td>500,000</td>
<td>1,200,000</td>
<td>X X X</td>
</tr>
<tr>
<td>X0.4</td>
<td>X2.5</td>
<td>X6.0</td>
<td>PROBE CONSTANT</td>
</tr>
</tbody>
</table>

Switch is closed where X appears
Span Pot is set to X1, X5 or X10 where X appears
Jumper W-2 or W3 is selected where X appears
External Span can multiply conductivity by 2.
4.2 RANGE SELECTION (CONTINUED)

The first three columns of the matrix list the sensor types available. Listed beneath each are the maximum values obtainable by that sensor group.

Switch settings required to achieve each maximum range are given in the next three columns. The X denotes a closed switch. Nothing in the column indicates the switch is open.

The Internal span pot positions to achieve the range are indicated in the next three columns. An X means to position the span pot in that position as shown on the matrix cover.

The Jumpers located on PCB #2 should be connected where the X is in the row of the maximum range desired.

Example: Starting at the left side of the matrix:
Sensor selected: Model 228
Full Scale range desired: 50,000 Microsiemens/cm (50K)
Set up switches, pot and jumpers as follows:
S1 - closed
S2 - open
S3 - closed

Internal Span Multiplier (R54): Adjust to X10 position.
Jumpers for X1 range: W-2 across both pins. W-3 jumper on only one pin.

NOTE:
Final adjustment of the Internal Span Multiplier should be accomplished prior to fine calibration of the 20 mA output with the External Span on full scale calibration of the Transmitter.
4.3 DIGITAL DISPLAY

The digital display is factory calibrated to indicate 0-100% corresponding to 4-20mA and is provided with independent zero and span potentiometers.

The LCD is a three and a half digit display and may be calibrated in engineering units (Conductivity) to indicate from 000 to 1999.

A decimal point switch is provided and may be accessed by removing three cover screws and the cover. The decimal point switch is located below and to the right of the LCD display. The dip switches are designated s1, s2, and s3. The decimal point adjustment is as follows:

<table>
<thead>
<tr>
<th>Decimal Point Position</th>
<th>s1</th>
<th>s2</th>
<th>s3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>open</td>
<td>open</td>
<td>open</td>
</tr>
<tr>
<td>199.9</td>
<td>open</td>
<td>open</td>
<td>closed</td>
</tr>
<tr>
<td>19.99</td>
<td>open</td>
<td>closed</td>
<td>open</td>
</tr>
<tr>
<td>1.999</td>
<td>closed</td>
<td>open</td>
<td>open</td>
</tr>
</tbody>
</table>

To calibrate the LCD display, adjust the zero potentiometer for 000 at 4.0 mA output and the span potentiometer for the full scale conductivity range at 20.0 mA output.
4.4 TEMPERATURE SLOPE ADJUSTMENT

Following are the typical temperature slopes for Acids, Bases and Salts. For greater accuracy the temperature slope for an unknown solution may be determined in a laboratory with a portable conductivity analyzer or for more precision with the Model 1181T and associated sensor.

- Acids: 1.0 - 1.6% / °C
- Bases: 1.8 - 2.2% / °C
- Salts: 2.2 - 3.0% / °C
- Neutral Water: 2.0% / °C

The operational limits of the Model 1181T with regard to measuring range vs maximum temperature slope adjustment at various operating temperatures is shown in the following table.

If the process temperature is expected to vary more than 10°C, adjust the SLOPE ADJUST as follows:

A. With the sensor immersed in the grab sample at the minimum process temperature allow approximately 15 minutes for the sensor to stabilize. After the temperature has stabilized, record the conductivity reading.

B. Elevate the grab sample temperature to the maximum process temperature.

C. Allow the temperature to stabilize and set the temperature SLOPE ADJUSTMENT, R46, so the conductivity reading is the same at the higher temperature as it was at the lower temperature. If it is impractical to immerse the sensor in a beaker or elevate the temperature of the grab sample, then:

D. Take a grab sample and measure its conductivity at the minimum process temperature in the laboratory. Record the conductivity value and the temperature.

E. Elevate the temperature of the grab sample to the maximum process temperature. Record the conductivity value and the temperature.

F. Then, calculate % slope adjustment by using the following formula:

\[
\text{% SLOPE/°C} = \left( \frac{\text{Conductivity } T_{\text{max}}}{\text{Conductivity } T_{\text{min}}} - 1 \right) \times 100
\]

Where: Conductivity \( T_{\text{max}} \) is the conductivity at the maximum process temperature, Conductivity \( T_{\text{min}} \) is the conductivity at lower process temperature, and the \( °T \) is the difference between the maximum temperature and minimum process temperature.

EXAMPLE:

\[
\left( \frac{45}{35} - 1 \right) \times 100 = 2.8/°C
\]

G. Set the Temperature Slope Adjustment, R46, to the correct slope adjustment as determined by computing the formula in Step F above.

---

**TABLE 4-2. Operational Limits vs. Slope**

<table>
<thead>
<tr>
<th>Range/Scale</th>
<th>25°C</th>
<th>50°C</th>
<th>75°C</th>
<th>100°C</th>
<th>125°C</th>
<th>150°C</th>
<th>175°C</th>
<th>200°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Siemens/cm</td>
<td>4%</td>
<td>4%</td>
<td>2%</td>
<td>1.3%</td>
<td>1%</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>0.5 Siemens/cm</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
<td>2.2%</td>
<td>2%</td>
<td>1.7%</td>
</tr>
<tr>
<td>0.2 Siemens/cm</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>3.2%</td>
<td>2.6%</td>
<td>2.2%</td>
</tr>
<tr>
<td>All Others</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
<td>3.2%</td>
<td>2.6%</td>
<td>2.2%</td>
</tr>
</tbody>
</table>
The Model 1181T may be calibrated by (1) using either a conductivity standard or a sample of the process, (2) in-situ calibration by grab sample analysis, or (3) calibration using decade box or resistors to simulate conductance. Calibration using a process sample will provide the greatest accuracy.

5.1 CALIBRATION USING A CONDUCTIVITY STANDARD OR PROCESS SAMPLE

1. Complete all field wiring as described in Section 2.0.
2. Configure the Transmitter as described in Section 4.0.
3. With the Sensor in Air
   A. Adjust the Sensor Zero, R11, for coarse calibration of the 4.0 mA current output.
   B. Adjust the External Zero for fine calibration of the 4.0 mA current output.
   C. Optional, Adjust the LCD Zero Potentiometer, R8, for 000.
4. Place the Sensor in a container filled with a Conductivity Standard or Process Sample.

NOTE
All sides of the sensor should be at least one sensor diameter from the walls of the sample container. It is important that the sensor position in the sample container approximate the actual mounting arrangement because the sensor cell constant is affected by its immediate environment.
Insure no air bubbles are trapped in the center hole.

5. Adjust the Internal Span Multiplier, R54, for coarse adjustment of the output current value in milliamps of the known Conductivity Standard or to the measured value of the process sample.

\[
\text{mA output} = \left( \frac{C_S}{C_{FS}} \times 16 \right) + 4
\]

\(C_S\) = Conductivity of Standard Solution or Process Sample.
\(C_{FS}\) = Full Scale Conductivity Range Selected.

EXAMPLE: The selected full scale conductivity range is 5000 microsiemens/cm and the standard solution used is 2000 microsiemens/cm.

\[
\text{mA Output} = \left( \frac{2000}{5000} \times 16 \right) + 4 = 10.4 \text{ mA}
\]

6. Adjust the Temperature Slope potentiometer, R46, to the calculated slope value.

7. Fine Adjust the current output calculated in Step 5 with the External Span.

8. Optional; Adjust the LCD display Span potentiometer, R4, either to (1) a percent indication or (2) to the value of the Conductivity Standard or the measured conductivity value of the process sample.

\[
\text{LCD or Analog Display} = \left( \frac{C_S}{C_{FS}} \right) \times 100
\]

EXAMPLE: \(\left( \frac{2000}{5000} \right) \times 100 = 40\%

9. Install the Sensor into the process. Final calibration may be done with the External Span to a process grab sample.
5.2 IN-SITU CALIBRATION BY GRAB SAMPLE ANALYSIS

1. Complete all field wiring as described in Section 2.0.

2. Configure the Transmitter as described in Section 4.0.

   NOTE
   If extension cable is used, disconnect the sense wire on the sensor side of the junction box. If extension cable is not used, disconnect the sense wire at the transmitter.

3. Adjust the External Zero for fine calibration of the 4.0 mA current output.

4. Optional; Adjust the LCD Zero Potentiometer, R8, for 000.

5. Re-connect the sensor sense wire at the junction box.

6. Take a grab sample of the process and measure its Conductivity value using a calibrated portable analyzer having a reference temperature of 25°C. Note the Transmitter Indication for reference.

   CAUTION
   Older portables may have a reference temperature of 18°C which will cause variance in the measured value.

7. Adjust the Internal Span Multiplier, R54 for coarse adjustment of the current output in milliamps to the measured value of the process sample.

\[
\text{mA Output} = \left( \frac{C_{GS}}{C_{FS}} \times 16 \right) + 4
\]

Where: \(C_{GS}\) = Calibration value or the Grab Sample conductivity.
\(C_{FS}\) = Full Scale Conductivity.

EXAMPLE:
(a) The 1181T Conductivity reading at sampling and prior to calibration has not changed.

Grab Sample Conductivity = 8,500 microsiemens /cm
Full Scale Conductivity = 10,000 microsiemens/cm

\[
\text{mA Output} = \left( \frac{8500}{10,000} \times 16 \right) + 4 = 17.6 \text{ mA}
\]

If the Transmitter Indication has changed from the time the grab sample was taken, use the following formula to calculate for the calibration value.

\[
C_{GS} = \frac{(C_M \times C_2)}{C_1}
\]

Where:
\(C_{GS}\) = True Grab Sample Conductivity
\(C_M\) = Grab sample conductivity measured by a calibrated lab meter.
\(C_1\) = Conductivity reading on the 1181T when the grab sample was taken.
\(C_2\) = Conductivity reading on the 1181T just prior to making span adjustment.

8. Adjust the Temperature Slope potentiometer, R46, to the calculated slope value.

9. Adjust the External Span for fine calibration of the current output in milliamps to the measured value of the process sample.

10. Optional; Adjust the LCD display Span potentiometer, R4, either to (1) a percent indication or (2) to the value of the Conductivity Standard or to the measured conductivity value of the grab sample.

\[
\text{LCD or Analog Display} = \left( \frac{C_{GS}}{C_{FS}} \right) \times 100
\]

The analog of LCD display should read:

\[
\left( \frac{8500}{10000} \right) \times 100 = 85\%
\]
5.3 FULL SCALE CALIBRATION USING A DECADE BOX OR RESISTORS

The 1181T transmitter may be calibrated by using a decade box or resistors to simulate a full scale conductivity indication. A decade box or resistor is wired in series with a wire looped through the toroids as shown in Figure 5-1. This method may be used for all sensors including the Model 222 Flow Through Sensor.

**NOTE**

Sensors must be out of the process, and flow tubes must be empty prior to performing this procedure.

Following are the approximate cell constants by Model Number. The cell constant is used in calculation of full scale resistance.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Cell Constant (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>222</td>
<td>6.00</td>
</tr>
<tr>
<td>224</td>
<td>0.81</td>
</tr>
<tr>
<td>225</td>
<td>3.00</td>
</tr>
<tr>
<td>226</td>
<td>0.40</td>
</tr>
<tr>
<td>228</td>
<td>2.50</td>
</tr>
</tbody>
</table>

\[
\text{Cell Constant} \times 1,000,000 = \text{Resistance in Ohms} \\
\frac{\text{Max. Conductivity Selected}}{2000} \\
\]

**EXAMPLE:**

1. Selected Full Scale Range, 2000 micro-siemens/cm
   
   Sensor Model: 225
   
   \[
   \frac{3.00 \times 1,000,000}{2000} = 1,500 \text{ Ohms}
   \]

2. Selected Full Scale Range, 100,000 microsiemens/cm
   
   Sensor Model: 228
   
   \[
   \frac{3.00 \times 1,000,000}{100,000} = 30 \text{ Ohms}
   \]

**CAUTION**

Is the sensor’s metal installation connector in contact with the measured process during normal installation? If so, to avoid an offset error during a bench calibration (sensor in air), the 1181T transmitter and the sensor’s (225; 226-81 or 82; 228-20) metal installation connector must be grounded to the same potential.

**FIGURE 5-1. 1181T Calibration Set-Up**
6.1 THEORY OF OPERATION

Conductivity is defined as “conductance” per unit length of a medium. It is measured electrically using the relationship \( I = GV \), where “G” is the conductance, “V” is the reference voltage and “I” is the resultant current, which is directly proportional to the conductance. The Model 1181T works according to this principle.

The toroids are used as two independent transformers that have a common turn, which is the path of the liquid being measured. The transmitter toroid (driver) induces a voltage across the toroid winding, divided by the number of turns in the winding. This voltage, times the conductance, results in a current that is equal to the current in the liquid loop divided by the number of turns in the windings of the toroid. The result is \( I = G \cdot \frac{V}{N1 \cdot N2} \), where \( N1 \) equals the number of turns of the transmitter toroid (driver) and \( N2 \) is equal to the number of turns of the receiver toroid.

The Transmitter Board (No. 1 or bottom board) of the Model 1181T stack, produces the reference voltage for the instrument. A shunt regulator in a bridge circuit with a reference element VR1 (LM385), amplifier AR1 and a Vmos pass transistor, are used to maintain a 7.5 volt positive reference supply. The voltage is used in the conductance measurement. All the excess current passes through this shunt circuit, which is designed to handle up to 30 mA before the protection diodes go to conduction. By measuring the voltage across R1 the current can be determined.

Other items found on this board include a triple set of 8.2 volt zeners for intrinsically safe protection, a current diode (CR1) used for start-up current, and Q2 which is P-channel Vmos transistor which regulates the current in the loop. Jumper W1 is open when the transmitter has an LCD option and closed when either Blind or Analog versions are used.

The Driver Board (No. 2 board) generates the power used to drive the transmitter toroid. A multivibrator (U2) runs at a frequency of 8K Hertz. The IC, U1, drives transformer T1 in a push-pull fashion simultaneously generating a negative supply voltage at CR5, CR6, C10 and C11. The capacitors are protected by R12 and R13. Transformer T1 steps the signal down to drive the low impedance of the toroid and also allows for a X10 multiplier. The transformer provides an important

![FIGURE 6-1. Toroidal Conductivity Principle](image-url)
6.1 THEORY OF OPERATION (CONTINUED)

isolation function enabling terminal TB2-3 to be used for
two signals (one for transmitter toroid return and the
other for an RTD input for temperature compensation.
The amplifier AR3 drives the P-channel Vmos transistor
on board No. 1. The external zero and span pots are
also located on this board at AR3.

The Temperature Board (No. 3 board) is the temperature
compensation board. It normalizes conductivity to a
25°C reading. The temperature compensation is
adjustable from 0 to 4 percent per degree Centigrade
with pot R46. Pots R34 and R44 are used to calibrate
the temperature circuit. Also found on this board is the
input signal demodulator which is driven synchronously
with the toroidal drive circuit. The resultant voltage is
scaled by the pot R54, from X1 to X10, before it is
processed by the temperature compensation circuit.

The Signal Input Board (No. 4 or top board) processes
the current from the receiver toroid. This current is less
than one microamp peak-to-peak on the lowest conduc-
tivity ranges. The circuit is a differential, low-powered,
high-speed, tight-looped, current-to-voltage amplifier,
with op-amp AR8 used to bias the circuit. The square-
wave current from the toroid passes through transistor
Q5 and appears across a resistor string for scaling. The
full scale signals of 500, 1000 and 10,000 micromhos
may be selected. The output is buffered by Q9 to drive
the demodulator on board No. 3.
6.2 CIRCUIT DESCRIPTION (Figure 6-3)

VR1 and the Vmos pass transistor are used to maintain the reference voltage (peak voltage of the square wave) at 7.5 volts D.C.

This voltage is sent to the multivibrator U2, which creates a square wave (8K Hertz frequency).

This square wave is passed to the power voltage driver V1 and is stepped-up by T1. It is then sent to the driver toroid.

The voltage through the driver coil induces a current into the process solution.

The current of the process induces a current flow in the receiver (pick-up) coil that is proportional to the conductivity of the process solution. This current is then differentially amplified by Q6, Q7, Q8 and Q9.

AR8 biases the circuit and Q5 passes the current, which is adjusted for ranges of 500, 1000 and 10,000 by a microswitch selection to a voltage divider (R64, R65, R66 and R67).

This adjusted current is passed through Q9, which is a buffer to the demodulator U4, AR6-D.

AR6-D and U14 converts the 8K hertz current to a direct current voltage which is still proportional to the conductivity of the process fluid.

The voltage is further adjusted by the setting of R54, which is the span factor adjust from X1 to X10.

The voltage is then passed to the output AR6-C. The voltage at that point is modified, based on the input from AR6-B (temperature compensation circuit).

As the resistance of the temperature compensator (T.C.) at the sensor changes with respect to the process temperature (input at TB-3), it causes a change to the feedback loop gain of the T.C. circuit. This, in turn, changes the gain of the T.C. circuit, which causes a change in the voltage output at AR6-C.

The T.C. corrected voltage output from AR6-C is further adjusted by the External Span and Zero Pots (R16 and R18), then passed from AR3 to the gate of Q2 (P-channel Vmos).

As the voltage changes at the gate of Q2 with respect to conductivity/temperature, Q2 changes current flow through the loop. This provides a 4 to 20 milliamp output.
FIGURE 6-3. Model 1181T Schematic
SECTION 7.0
DISASSEMBLY/REASSEMBLY PROCEDURE

7.1 DISASSEMBLY PROCEDURE
Disconnect the power to the transmitter prior to disassembly. (Refer to Figure 9-1 for item numbers also see Figure 3-1).

1. Remove covers (1) and (18) or meter housing cover (19) from housing (3). Save O-rings (2); discard if damaged.
2. Loosen screws retaining the serial label, and then rotate to gain access to the Span and Zero pots.
3. Align the Span and Zero adjusting screws (4), so the slots are horizontal, pointing end cap to end cap.
4. In circuit side of housing (3) remove the circuit board retaining screws, washers and matrix cover (10). The matrix cover is secured to screws by nylon split washers. Remove the screws in equal increments, so the matrix cover is not damaged.
5. Pull straight out on the signal conditioning board assembly (9) to remove circuit boards from housing (3).
6. To separate the individual boards, remove the retaining screw located on the terminal side of the transmitter board (6).
7. Remove each printed circuit board assembly by pulling straight out from their respective connectors.

7.2 REASSEMBLY PROCEDURE
1. Assemble the circuit board assemblies (6, 7, 8, 9) by first aligning the connectors with the respective pins, and then pushing straight in. Install screw which holds circuit board assemblies together.
2. Align the Zero and Span adjusting screws (4) on the housing (3) to the horizontal position, slots pointing end cap to end cap (see Figure 4-1).
3. Align the Zero and Span potentiometers located on the driver circuit board (7) to the horizontal position, with blades perpendicular to PCB's (6) and (7).
4. Place the circuit board assemblies (6, 7, 8, 9) into housing by first aligning the connector pins with the terminal receptacles in the base of the housing (3) and then pushing straight in on the signal conditioning board (9).
5. Install the matrix cover (10) and secure with screws and washers. The matrix cover is secured to the screws with nylon split washers, so install the screws in equal increments, so the matrix cover is not damaged.
6. Inspect the thread connections on housing (3) to make sure five undamaged threads will fully engage.
7. Replace O-rings (2) on housing (3). Use new O-rings if the old ones were damaged.
8. Install covers (1, 18) or meter housing (19) on transmitter housing (3).
9. Apply power to the transmitter and perform the appropriate calibration procedure if necessary.
8.1 GENERAL

This section covers the trouble-shooting and maintenance instructions for the Model 1181T. This transmitter has no moving parts and requires minimum maintenance. Procedures for calibrating the Model 1181T is given in Section 5.0 and generally the only operation type "maintenance" required to keep the units in good operating condition.

NOTE

If downtime is of critical concern, a full complement of spare parts is recommended. (See Section 9.0, spare parts).

8.2 TROUBLESHOOTING

Table 8-1 provides a general reference table for commonly encountered problems and suggested actions to be taken to correct those problems.

TABLE 8-1. Troubleshooting Guide

<table>
<thead>
<tr>
<th>TROUBLE</th>
<th>WHAT TO DO</th>
</tr>
</thead>
</table>
| Meter reads below zero and will not respond to conductivity change. | A. Check 24 VDC 1181T TB1-1,3.  
B. Check all wire connections.  
C. Check to see PCB's are fully seated into 1181T housing.  
D. Make sure display, if LCD, wired with correct polarity to TB1-2,3.  
E. Go back through calibration.  
F. Check Sensor Toroids. Refer to sensor manual |
| Meter pegged above full scale or full 20 mA output no response to conductivity change. | A. Check calibration.  
B. Check the range configuration used on the 1181T matrix.  
C. Replace PC Board stack. |
| Meter output cycles from zero to above full scale output and then back to zero again. This is done like a metronome. | A. Check resistance of T.C. in probe. Should be 3,000 ohms at 25°C.  
B. Check crimps on spade lug connectors T.C.  
C. Replace probe. |
| Meter rests at zero with slight oscillation. | A. Check probe wire crimps on spade lugs to TB2-1 TB2-3.  
B. Replace sensor (pick up coil open). |
| Meter output oscillates around 10% of full scale—No response to conductivity change.  
NOTE: When slope adjustment is set to below 1% problem goes away. | A. Check crimp single white wire to TB2-3 shield.  
B. Replace probe. |
9.1 SPARE PARTS. (Refer to Figure 9-1 for the following spare parts list for the Model 1181T.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3002425</td>
<td>Cover (for Blind Model)</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2002604</td>
<td>O-ring Kit</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>99550136</td>
<td>O-ring</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>2002528</td>
<td>Housing (Includes #4 below)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>2002598</td>
<td>Adjustment Screw Kit</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>9160299</td>
<td>Retaining Ring</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>9550137</td>
<td>O-ring</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3002422</td>
<td>Screw, Adjustment</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2002605</td>
<td>O-ring Kit</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>9550137</td>
<td>O-ring</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>22931-01</td>
<td>Transmitter PCB (Blind/Analog)</td>
<td>1</td>
</tr>
<tr>
<td>22931-02</td>
<td>Transmitter PCB (LCD)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>22932-01</td>
<td>Conductivity Driver PCB</td>
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<td>8</td>
<td>22933-01</td>
<td>Temperature PCB</td>
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<tr>
<td>9</td>
<td>22934-01</td>
<td>Signal Input PCB</td>
<td>1</td>
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<tr>
<td>10</td>
<td>22803-02</td>
<td>Matrix Cover Kit</td>
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<tr>
<td></td>
<td>32855-01</td>
<td>Cover, Matrix</td>
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<tr>
<td></td>
<td>9600634</td>
<td>Screw, Short</td>
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<tr>
<td></td>
<td>9600642</td>
<td>Screw, Long</td>
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<tr>
<td></td>
<td>9910404</td>
<td>Washer, Nylon (Split)</td>
<td>2</td>
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<tr>
<td></td>
<td>9910600</td>
<td>Washer, Flat</td>
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</tr>
<tr>
<td></td>
<td>9910610</td>
<td>Washer, Lock</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>2002518</td>
<td>Meter Cover Kit</td>
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<td></td>
<td>3002429</td>
<td>Housing</td>
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<td>20</td>
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<td>O-ring</td>
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<td>21</td>
<td>3002421</td>
<td>Window</td>
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<td></td>
<td>32491-00</td>
<td>Ring, Retainer</td>
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<tr>
<td>18</td>
<td>3002468</td>
<td>Cover, Tall (PCB Side)</td>
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<tr>
<td>12A</td>
<td>23122-00</td>
<td>Meter, LCD (Code 06)</td>
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<td>13</td>
<td>2002599</td>
<td>Meter Sleeve Kit (Codes 01, 03)</td>
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<td></td>
<td>3002433</td>
<td>Sleeve, Analog</td>
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<tr>
<td></td>
<td>9560185</td>
<td>Nut, Hex</td>
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<tr>
<td></td>
<td>9731003</td>
<td>Set Screw, Short</td>
<td>1</td>
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<tr>
<td></td>
<td>9730816</td>
<td>Set Screw, Long</td>
<td>4</td>
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<tr>
<td></td>
<td>32822-00</td>
<td>Sleeve for LCD Meter</td>
<td>1</td>
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<td>13</td>
<td>23110-01</td>
<td>Plug In Analog Meter Retrofit Kit (Code 01)</td>
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<tr>
<td>23110-07</td>
<td>Plug In Analog Meter Retrofit Kit (Code 03)</td>
<td>1</td>
<td></td>
</tr>
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</table>
TABLE 9-1. Spare Parts Continued

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12B</td>
<td>9170163</td>
<td>Analog Meter, Plug In (Code 01)</td>
<td>1</td>
</tr>
<tr>
<td>12B</td>
<td>9170167</td>
<td>Analog Meter, Plug In (Code 03)</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>32955-00</td>
<td>Mounting Plate</td>
<td>1</td>
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<tr>
<td>14</td>
<td>32955-00</td>
<td>Mounting Plate Screws</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>32996-00</td>
<td>Insulator</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>32961-00</td>
<td>Terminal Plug In Adaptor Screws</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>32997-00</td>
<td>Retainer Clip</td>
<td>1</td>
</tr>
</tbody>
</table>

FIGURE 9-1. Model 1181T Two-Wire Transmitter Parts
10.1 GENERAL
To expedite the repair and return of instruments, proper communication between the customer and the factory is important. Before returning a product for repair, call 1-949-757-8500 for a Return Materials Authorization (RMA) number.

10.2 WARRANTY REPAIR
The following is the procedure for returning products still under warranty.
1. Contact the factory for authorization.
2. To verify warranty, supply the factory sales order number or the original purchase order number. In the case of individual parts or sub-assemblies, the serial number on the mother unit must be supplied.
3. Carefully package the materials and enclose your “Letter of Transmittal”. If possible, pack the materials in the same manner as it was received.
4. Send the package prepaid to:
   Rosemount Analytical Inc., Uniloc Division
   2400 Barranca Parkway
   Irvine, CA 92606
   Attn: Factory Repair
   Mark the package:
   Returned for Repair RMA No. ______________
   Model No. ______________

10.3 NON WARRANTY REPAIR
1. Contact the factory for authorization.
2. Carefully package the materials and enclose your “Letter of Transmittal”. Include a purchase order number and make sure to include the name and telephone number of the right individual to be contacted should additional information be needed.
4. Do Step 4 of Section 10.2.

NOTE
Consult the factory for additional information regarding service or repair.
WARRANTY

Seller warrants that the firmware will execute the programming instructions provided by Seller, and that the Goods manufactured or Services provided by Seller will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first. Consumables, such as glass electrodes, membranes, liquid junctions, electrolyte, o-rings, catalytic beads, etc., and Services are warranted for a period of 90 days from the date of shipment or provision.

Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products.

If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, promptly correct any errors that are found by Seller in the firmware or Services, or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services.

All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources, unsuitable environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by an authorized Seller representative. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller.

Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller. Except as otherwise expressly provided in the Agreement, THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

RETURN OF MATERIAL

Material returned for repair, whether in or out of warranty, should be shipped prepaid to:

Emerson Process Management
Liquid Division
2400 Barranca Parkway
Irvine, CA 92606

The shipping container should be marked:
Return for Repair
Model _______________________________

The returned material should be accompanied by a letter of transmittal which should include the following information (make a copy of the "Return of Materials Request" found on the last page of the Manual and provide the following thereon):

1. Location type of service, and length of time of service of the device.
2. Description of the faulty operation of the device and the circumstances of the failure.
3. Name and telephone number of the person to contact if there are questions about the returned material.
4. Statement as to whether warranty or non-warranty service is requested.
5. Complete shipping instructions for return of the material.

Adherence to these procedures will expedite handling of the returned material and will prevent unnecessary additional charges for inspection and testing to determine the problem with the device.

If the material is returned for out-of-warranty repairs, a purchase order for repairs should be enclosed.