Installation and Operating Instructions

YC508-45-724 Level Transmitter with 700-5-29 Sensing Element for MC Pump Applications

Also includes information on 508-45-720 Level Transmitter with 700-5-28 Sensing Element
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YC508-45-724 Level Transmitter with 700-5-29 Sensing Element for MC Pump Applications

Also includes information on 508-45-720 Level Transmitter with 700-5-28 Sensing Element
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This instruction manual is for the Drexelbrook Universal II level measuring system model number 508-45-724. This level measuring system is specifically designed to measure the level of MC (medium consistency) paper pulp stock. The system is typically utilized to accurately maintain the level of stock in a standpipe. Reliable measurement of standpipe level allows precise throttling of the MC pump discharge, preventing pump damage and maximizing pump efficiency.

The 508-45-724 system consists of:

- **408-9100-89 Electronic Unit package**
  
  This package includes:
  a) 408-8232-001 Electronic unit and a
  b) 370-4000-001 Digital Loop Meter, 5-inch explosionproof housing with meter view port.

- **380-50-12** 50 feet of three-terminal interconnecting coax cable.

- **700-5-29 sensing element** (see section 1.2).

1.1 **Electronic Unit Specifications**

**Power requirement:**
11.5 to 50 Vdc

**Input range:**
6 to 40,000pF with 5 feet of cable.

**Output range:**
4-20 mA

**Linearity:**
±0.25%.

**Load resistance:**

\[ V_s - 11.5\, \text{V} \implies \text{(i.e. max 625 @ 24Vdc)} \]

\[ .02 \]

*Where \( V_s \) = power supply voltage.

**Temperature effect:**

±0.25% of full scale per 30°F
or ±0.1 pF whichever is larger.
1.1 Electronic Unit Specifications (cont.)

Supply voltage effect:
0.2% max. from 11.5 to 50 Vdc.

Effect of load resistance:
0.2% or less for full resistance range at 24 Vdc supply.

Fail-Safe:
Field selectable.
Low-Level Fail-Safe (LLFS) standard or
High-Level Fail-Safe (HLFS).

NOTE
THERE ARE NO DEVICES THAT ARE ABSOLUTELY “fail-safe”. “Fail-safe” means that in the event of the most probable failures, the instruments will fail safely. “Most probable failures” includes loss of power and most transistor and component failures. If your application needs absolute fail-safe, a backup instrument should be installed.

Ambient temperature:
-40° to +150°F (-40° to 65°C)

Calibration Adjustments:
Step Zero, Fine Zero,
Step Span, Fine Span,

Lowest permitted resistance:
(bare sensing element to ground)
causing 5% error in each model:
600Ω - 8202
100 KΩ - 8232
Electronic Unit Specifications (cont.)

Intrinsic Safety:
All electronic units are FM approved for intrinsic safety, Class I, II, III, Groups A-F, Division 1, when supplied from an approved source. They are suitable for Class I, II, III, Groups A-F, Division 2. All sensing elements are intrinsically safe, even with non-intrinsic electronic units.

Remote electronic units are FM approved in explosionproof housing. Integral electronics are not approved for explosionproof installations.

All electronic units and insulated sensing elements are CSA-certified for intrinsic safety, Class I, II, III, Division 1, Groups A-F, and safe for Class I, II, III, Division 2, Groups A-F in NEMA 4X and CSA 4X housings.

All electronic units are CENELEC approved: Ex ia II C T4. All sensing elements are certified EX ia II C T6--T3. Five-inch housings are IP 65.

All electronic units and sensing elements are SAA-certified: EX ia II C T4. Five-inch housings are IP 65 Class I, Zone 0, and DIP (Dust Ignition Proof) IP 66, Class II.

Independence of zero and span:
±1% maximum interaction.

RFI Protection:
Inherent with unit immunity to standard "walkie-talkie" interference; 5 ft. standard distance with proper installation.
1.2 Sensing Element Specifications

Sensing element type:
Two-terminal, ½-inch diameter, insulated flexible cable

Maximum recommended insertion length:
20 feet. Consult the factory for longer lengths.

Pressure and temperature limits:
1000 psi maximum @ 100 °F
500 psi maximum @ 250 °F

Mounting options:
700-5-28 1 ¼ inch NPT (male) top mount
700-5-29 1 ½ inch NPT (female) rear mount
700-5-29 (modification 91-138) Special flange rear mount

Materials of construction:
700-5-28 Metal Wetted Parts (MWP)
316 stainless steel (ss), and “X” cable insulation (“X” is a polyvinylidene fluoride material)
700-5-29 MWP 316 ss, and “X” cable insulation
700-5-29 (modification 91-138) MWP 316 ss, and “X” cable insulation
700-5-29 (modification 91-267) Combines special flange rear mount (modification 91-138) and FEP overlay covering “X” cable insulation
700-5-29 (modification 91-288) Combines special flange rear mount (modification 91-138), FEP overlay, MWP are alloy AL6XN. (This combination only available with chain style bottom anchor, 727-799-40.)
1.2 Sensing Element Specifications (cont.)

Sensing element anchors:

- **727-628-40** Flexible anchor assembly:
  MWP 316 ss

- **727-552-40** Chain type anchor assembly:
  MWP 316L ss

- **727-799-40** Chain type anchor assembly:
  MWP alloy AL6XN

1.3 Coax Cable Specifications

**Coax Cable Length:**
150 feet maximum

**General Purpose 380-XXX-12:**
.51" O.D. at largest point
160°F temperature limit
SECTION 2
INSTALLATION

2.1 Unpacking

Carefully remove the contents of the carton and check each item against the packing list before destroying any packing material. If there is any shortage or damage, report it immediately to the factory at 1-800-527-6297.

2.2 Mounting the Electronic Unit

The 408-8200 Series instrument was designed for field mounting, but it should be mounted in a location as free as possible from vibration, corrosive atmospheres, and any possibility of mechanical damage. For convenience at start-up, mount the instrument in a reasonably accessible location. Ambient temperatures should be between -40°F and 140°F. (-40°C and 60°C). See Figure 2-1.

![Figure 2-1]

*Typical Mounting Dimensions of Remote Unit*
2.3 Mounting the Sensing Element

The mounting location for the sensing element (probe) is often determined by the placement of nozzles or openings in the vessel.

The following sensing element mounting and installation instructions should be followed so that the equipment will operate properly and accurately:

- Be careful not to cut or abrade sensing element insulation during installation.

- Do not take a sensing element apart or loosen the packing glands.

- For 1 1/4-inch NPT top-mounted sensing elements (700-5-28), tighten the sensing element with the wrench flats nearest the mounting threads. See Figure 2-2.

- For rear-mount style sensing elements (700-5-29), use TFE tape to seal the 1 1/2-inch NPT threads. A waterproof connection at this point is critical. A pipe wrench may be used on the 2-inch body of the 700-5-29 sensing element. After the sensing element is tight, install the two 1/4-20 UNC set screws to lock the housing to the gooseneck mounting bracket. Refer to Figures 2-3 and 2-7.

- When installing special flange type rear-mount style sensing elements 700-5-29 (modifications 91-138, 91-267, or 91-288) with the O-ring flange mounting, make sure that the O-ring is properly seated in the O-ring groove. Refer to Figures 2-4, 2-5, 2-6 and 2-8.

**NOTE**

Special mounting bolts, O-ring, gooseneck and anchor brackets are not supplied by Drexelbrook.

- With rear-mount sensors, take care in feeding the cable through conduit pipes and goosenecks so as not to cut insulation or kink the coax cable.

- Pay particular attention to sealing the 285-1-71 conduit housing and all conduit leading to the conduit housing. They must be water-tight.
Figure 2-3
Rear-Mounted Sensing Element 700-5-29 and Related Parts
Figure 2-4
Rear-Mounted Sensing Element 700-5-29 Modification 91-138
and Related Parts

NOTE: ALL METAL WETTED PARTS. 316 STAINLESS STEEL.
Figure 2-5

Rear-Mounted Sensing Element 700-5-29 Modification 91-267
and Related Parts
Figure 2-6
Rear-Mounted Sensing Element 700-5-29 Modification 91-288
and Related Parts
NOTES:
1. SEAL 1½ NPT THREADS WITH TEFLOM TAPE
   USE PIPE WRENCH ON HOUSING ONLY, NOT ON GLAND HEX OR LOCKNUT.
2. TIGHTEN ¼ - 20 HEX SOCKET SET SCREWS AFTER SENSING ELEMENT IS INSTALLED.
3. HOLD FLEXIBLE ANCHOR AT WRENCH FLATS.
   TORQUE LOCKING HEX NUT TO 60 LBS., THEN TIGHTEN UPPER HEX NUT AGAINST BRACKET PLATE

Figure 2-7
Installation of 700-5-29 Sensing Element
Figure 2-8
Installation of 700-5-29 Modification 91-138, 91-267, 91-288 Sensing Elements

NOTES:
1. O-RING AND BOLTS ARE NOT SUPPLIED BY DREXELBROOK
2. HOLD FLEXIBLE ANCHOR AT WRENCH FLATS.
TORQUE LOCKING HEX NUT TO 60 LBS., THEN
TIGHTEN UPPER HEX NUT AGAINST BRACKET PLATE
3. CHAIN-TYPE BOTTOM ANCHOR NOT SHOWN
2.4 Wiring the Electronic Unit

The signal connections are made to the three terminal block on the front of chassis. Due to the low power consumption of the instrument, the wiring need only be light gauge (e.g. 20 AWG). See Figure 2-9 for proper connections. Twisted shielded pair wire is recommended.

**NOTE**
For maximum noise immunity, the shield wire should be connected at one end only.

![Image of electronic unit](image.png)

**Figure 2-9**
*Signal Connections to the Electronic Unit*

The coax cable from the sensing element is connected to the black, four terminal strip on the back of the instrument chassis. See Figure 2-10. The cable connections are center wire (CW), ground (gnd), and shield (SH). Only coaxial cables supplied by Drexelbrook Engineering Company should be used to connect the transmitter to the sensing element. Use of other cables can result in unstable calibration.
2.4 Wiring the Electronic Unit (cont.)

**Figure 2-10**
*Sensing Element Cable Connections to the Electronic Unit*

Before using Intrinsic Safety Barriers, read the manufacturers' instructions for barrier operation. Barriers supplied by Drexelbrook Engineering Company, and prewired to the power supply, have already been tested for proper operation. See Figure 2-11.

The 408-8200 has a built-in current limiter that holds the signal current to a maximum of 28 mA. Make sure that the voltage applied to the barrier will not exceed the barrier voltage rating, if barriers are used.

**Figure 2-11**
*Typical Intrinsic Safety Barrier*
2.4.1 Radio Frequency Interference

The 408-8200 series electronic units have Radio Frequency Interference (RFI) filtering built into the unit. In order to be effective:

- The electronic unit housing must be grounded to low impedance earth ground.

- The vessel wall needs to be grounded to reduce interference through the sensor.

- Place the sensor cable in a grounded metal conduit and shorten any excess cable.

- If additional RFI filtering is required, contact the factory for more information.
2.5 Wiring the Sensing Element

The cable connections to the 700-5-28 sensing element are shown in Figure 2-12.

The cable connections to 700-5-29 and 700-5-29 (modification 91-138, 91-267, 91-288) sensing elements are shown in Figure 2-13.

2.5.1 700-5-28 NPT Sensing Elements

See Figure 2-12. The coax shield wire is always connected at the transmitter.

700-5-28 sensing elements do not have a terminal to land the shield wire of the coax. Be sure to tape or insulate this wire; it is not used (leave floating). Connect it at the electronic unit end.

![Diagram of cable connections](image-url)

**Figure 2-12**

*Cable Connections to the 700-5-28 Sensing Element*
2.5.2 700-5-29 Rear Mounted Sensing Elements

See Figure 2-13. The short, tan coax cable from the sensing element is inserted through the gooseneck assembly (supplied by customer). Be careful not to cut or abrade this coax.

This cable is connected to one side of the terminal strip inside the junction conduit (supplied by Drexelbrook) at the end of the gooseneck assembly.

An additional three-terminal coax cable (supplied by Drexelbrook) is attached to the other side of the terminal strip and is used to connect the sensing element junction conduit to the electronic unit.

Be sure to land the shield wire coming from the short, tan coax cable of the sensing element and the shield wire of the black coax coming from the electronic unit.

![Diagram of cable connections](image)

*Figure 2-13*  
*Cable Connections to the 700-5-29 Sensing Element*
SECTION 3
OPERATING CONTROLS and START-UP

CAUTION

*Explosionproof Units in Hazardous Areas:*

Before the explosionproof conduit cover is removed, the area must be checked and known to be nonhazardous if barriers are not used. Each conduit from the explosionproof case must be equipped with an approved seal fitting.

*Avertissement: Risque D'Explosion: Avant de deconnecter l'équipment, couper le courant ou s'assurer que l'emplacement est designe non dangereux.*

3.1 Zero and Span Controls

There are two controls on the front panel of the electronic unit: Step Zero and Step Span. The Fine Zero and Fine Span controls are located on the top of the electronic unit. See Figure 3-1. The Step controls act as coarse adjustment. The Fine controls act as fine adjustment.

The Step Zero and Fine Zero controls work together to provide continuous adjustment of the minimum current point. Each Step Zero position advances the minimum current point approximately 25 pF, while the Fine Zero provides continuous adjustment between each step. The Fine Zero and Fine Span controls are 35-turn trim pots with no mechanical stops.

*NOTE*

Under normal circumstances, the interaction between zero and span should be less than 1%. If this interaction becomes greater than 1%, consult factory for assistance.

The Step Span and Fine Span controls also work together to provide continuous adjustment of the change in capacitance required to produce full scale current. Each Step Span position advances the range in inches or feet to approximately five times the previous setting. The Fine Span provides continuous adjustment between the Step Span positions.

*Figure 3-1*

Zero and Span Controls

20
3.2 Time Delay Control and Loop Current Testpoints

Time delay is standard on this transmitter. See Figure 3-2. It is an RC time constant circuit that is variable over a range of 0.5 to 30 seconds. For most applications requiring damping, five or ten seconds is usually sufficient. Calibration of the transmitter is done with the time delay turned off (full CCW).

![Figure 3-2 Time Delay Unit](image)

After calibration is complete, damping can be added, without affecting the calibration, by turning the control knob clockwise. Occasionally, when the time delay is first turned on, there is a temporary upset in the transmitter output until the circuit settles out. Two test points are provided so that loop current can be monitored without breaking the loop with a standard analog or digital multimeter set to measure 0 to 20 mA.

3.3 Factory-Set Adjustments

There are two adjustments on the electronic unit that are set by the factory and normally do not need to be changed. However, if necessary, they may be reset by field personnel. They are the fail-safe selector and a modification procedure for changing the 408-8202 to a 408-8232.
3.3.1 Fail-Safe Selector

Definitions
LOW-LEVEL FAIL-SAFE is also called DIRECT-ACTING. This is the most commonly used fail-safe position for continuous instruments. OUTPUT CURRENT INCREASES as the LEVEL INCREASES.

HIGH-LEVEL FAIL-SAFE is also called REVERSE-ACTING. OUTPUT CURRENT INCREASES as the LEVEL DECREASES. In the event of most probable failures, output current will drop, indicating high level.

Procedure
The fail-safe selector is a movable link located on a printed circuit board on the inside of the chassis. See Figure 3-3.

The instrument is supplied with low-level fail-safe unless otherwise specified. The fail-safe can be changed in the field, after which the unit must be recalibrated.

To change the fail-safe of the instrument, take the electronic unit out of the housing by loosening the two captive mounting screws and lifting unit up. See Figure 3-4. Note position of switch knob pointer for proper re-assembly. Remove the two knobs using an allen wrench, then remove the two screws on the top of the unit to remove the cover. Change the three-terminal jumper that is closest to the bottom of the PC board as shown in Figure 3-3. When the link has been changed, re-assemble the cover and knobs and install unit in housing.

Figure 3-3
Fail-Safe Link

Figure 3-4
Mounting Screws
The following procedure can be used to modify a basic 408-8200 electronic unit to a 408-8230 electronic unit. See Figure 3-5. It should only be used when the application makes it necessary. Consult Factory.

Take the electronic unit out of the housing by loosening the two chassis mounting screws and lifting unit up. See Figure 3-4. Remove the two knobs using an allen wrench, then loosen the two screws on the top of the unit to remove the cover. The modification link is the three-terminal jumper nearest the middle of the PC board as shown in Figure 3-5. When modification link has been changed, reassemble unit cover and knobs, and install unit in housing.

Similarly, a 408-8230 unit can be converted to a 408-8200 unit. After modification, recalibration (section 4) should be performed.

![Diagram of 408-8230 Modification Procedure]

**Figure 3-5**
*Modification Procedure for 408-8230*

3.4 Start-Up

Before applying power to the instrument, check all wiring connections, observing polarity of the output loop. (Unit will not function if polarity is reversed.)
CAUTION

Explosionproof Units in Hazardous Areas:
Before the explosionproof conduit cover is removed, the area must be checked and known to be nonhazardous if barriers are not used. Each conduit from the explosionproof case must be equipped with an approved seal fitting.

Calibrating the instrument in an immersion application for low-level fail-safe is the most common calibration method. See Figure 4-1.

Figure 4-1
Immersion Application

4.1 Using the Digital Loop Meter while Calibrating

The Digital Loop Meter (DLM4000) can be easily removed to allow access to the electronic unit calibration adjustments. A handheld meter can be clipped to the two banana posts that support the DLM4000 to read the loop current.

To use the DLM4000 while calibrating the electronic unit, a red jumper wire is supplied to allow connection of the DLM4000 off center.

Use the following procedure to offset the meter:

1) Remove meter from the electronic unit.
4.1 Using the Digital Loop Meter while Calibrating (cont.)

2) Connect the male end of the jumper to the middle female port labeled (+) on the back side of the DLM4000. See Figure 5-4.

3) Connect the female end of the jumper to the male banana plug labeled (+) on the meter support bracket.

4) Plug the meter back into the support bracket placing the male banana plug on the support bracket into one of the outer female ports labeled (-). Choose a port that allows a good view of the meter.

5) When finished calibrating the electronic unit (section 4.2), remove the jumper and replace the meter.

4.2 Calibration Procedure

Calibrate the electronic unit using the following procedure:

1) Set Fine Zero and Fine Span to extreme counterclockwise position. These controls are 35-turn pots with no mechanical stops. Slight clicking may be heard at the end of their travel. See Figure 4-2.

2) Set Step Span and Step Zero to Position #1.

3) With the vessel empty (or probe uncovered), adjust the Step Zero control clockwise, if necessary, until the output is close to 4 mA.
4.2 Calibration Procedure (cont.)

4) Turn Fine Zero control clockwise until output is exactly 4 mA.

5) Fill the vessel (or raise the level as much as possible). Output current will now exceed full scale current.

For all MC pump applications, calibration can be done with water or stock. It must be done with the sensing element permanently mounted in the standpipe. If this is impossible, a #401-6-81 calibrator may be used.

6) Turn the Step Span control clockwise until the output is less than full scale. (If current did not exceed full scale in Step 4, then leave Step Span in Position #1.)

7) Turn the Fine Span control clockwise until the output is full scale (20 mA) or reading actual level.

Calibration is now complete. Record the capacitance values that produce 4 mA and 20 mA outputs using a Drexelbrook 401-6-81 calibrator, if available.
SECTION 5
DIGITAL LOOP METER
(DLM4000)

The Drexelbrook DLM4000 meter provides a liquid crystal, digital display of a 4-20 mA, two-wire loop current. No separate line-power connections are needed, since the meter receives its power directly from the current loop.

The DLM4000 is available in a variety of standard Drexelbrook transmitter housings. The low voltage drop (1.6 volts at 20 mA) makes it ideal for replacing older, less accurate analog indicators.

The explosionproof housing is suitable for use in hazardous locations Class I, Groups B, C, D, Class II, Groups E, F and G, Class III, Nema 4.

Figure 5-1
Remote Mount 5" Transmitter Housing with DLM4000 visible through window
5.1 Digital Loop Meter Specifications

Measuring Range:
3.5 mA to 21 mA

Accuracy:
±0.1% of full scale ±1 digit

Voltage drop:
1.6 volts @ 20 mA maximum.

Operating Temperature:
-40°F to 140°F
(-40°C to 60°C)
*Unit will operate above 140°F with reduced component life.*

Temperature Effect:
0.05 counts/°C
0.03 counts/°F

Linearity:
± 2 counts

Overrange Protection:
200 mA normal
1000 mA reverse polarity

Digits:
3 ½ (1999 maximum full scale)

Digit Size:
0.5” high

Decimal Points:
Three positions, jumper-selectable
5.2 Meter Rotation  See Figure 5-2. The meter assembly can be indexed in any of four positions 90° apart. The display should be oriented so that it is readable to the user. With the meter removed, the current loop is kept intact by a continuity switch.

![TOP VIEW](image)

*Figure 5-2  Meter Rotation Positions*

5.3 Digital Loop Meter Wiring  Figure 5-3 shows the wiring of the Digital Loop Meter DLM4000.

![Diagram](image)

*Figure 5-3  Meter Wiring with Universal II 408-8200 Transmitter*
The following paragraphs describe the adjustments and controls of the meter.

There are two controls on the meter circuit board: Zero and Span. These controls are normally set at the factory for 4-20 mA = 0-100.0%.

Unless otherwise specified, the DLM4000 meter is supplied with the decimal point set between the 3rd and 4th digits (e.g., 100.0). The decimal point can be adjusted by removing the meter cover and plugging the decimal point selector into any one of three positions. As the jumper pin is rotated CCW (pivots around center pin), the decimal point moves one position to the left. See Figure 5-4.

In most instances the meter is factory calibrated to display 0 to 100% over a 4-20 mA range. To recalibrate the meter for other units, use the following procedure. Figure 5-4 shows the calibration settings for the DLM4000.

1. Choose one of the two zero setting ranges:
   L (Low) or H (High):
   L (Low) setting adjustment range: -300 to 900
   H (High) setting adjustment range: 700 to 1920

2. At 4 mA or minimum loop current, select the zero range of the minimum display number by moving the shorting shunt to either low or high setting.
   For example, if the zero number was “1000”, the range setting would be H (High).

3. With 4 mA or a minimum loop current, use a small screwdriver to adjust the zero control until the desired reading is reached on the LCD display.

4. With 20 mA or the maximum loop current, use a small screwdriver to adjust the span control until the desired reading is reached on the LCD display.

**NOTE**
Due to the voltage offset of the integrated circuit, it could be necessary to repeat steps 3 and 4 for precise calibration.
Digital Loop Meter
Zero and Span Controls and Decimal Point Adjustment

Figure 5-4
SECTION 6 TROUBLESHOOTING

The 408-8200 Series instruments are designed to give years of unattended service. No periodic or scheduled maintenance is required.

A spare chassis is recommended for every 10 units so that, in case of a failed unit, a critical application will not be held up while the unit is returned to the factory for repair.

If a difficulty occurs when operating your measurement system, mentally divide the system into its component parts and test each part individually for proper operation.

If attempts to locate the difficulty fail, notify your local factory representative or call the factory direct at 1-800-527-6297.

6.1 Testing the Electronic Unit

—Check the electronic unit using the following procedure.

• Remove the sensing element and signal wires from the transmitter.

• Be sure Fail-Safe link is in low-level fail-safe position. See Figure 3-3.

• With a pencil, mark the positions of all controls on the faceplate in order to return to them.

• Put the Step Span in Position #1 and the Fine Span in the full clockwise position. Put the Step Zero in Position #1 (most sensitive position). The Fine Span control is a 35-turn pot with no mechanical stops. See Figure 3-1.

• Observing polarities, connect a DC milliammeter and DC power supply (11.5 to 50 volts) in series, and complete the loop by connecting Terminals (-) and (+). See Figure 6-1.
6.1 Testing the Electronic Unit (cont.)

- Adjust the Fine Zero until the meter reads 0% (4 mA).

- Turn the Fine Zero one clockwise turn further. The output should read approximately between 33% and 100% (9-20 mA). Slightly greater than 20 mA is not a problem.

- If so, the instrument is probably working correctly. Each turn of the Fine Zero changes the input a known amount. This checks the operation and gain of the transmitter.

- If the difficulty has not been located at this point, proceed to the sensing element checkout procedure in paragraph 6.2.

* SEE FIGURE 6-5 FOR MAXIMUM LOOP RESISTANCE ALLOWABLE FOR A GIVEN POWER SUPPLY OUTPUT.

Figure 6-1
Power/Signal Wiring
6.1.1 Drift Check

If the output of a transmitter seems to be drifting, it is important to determine whether the drift is in the transmitter or in the sensing element.

- Remove the sensing element cable from the transmitter.

- Without disturbing the dial settings, connect a capacitance standard or an NPO capacitor* across the probe to ground input. Adjust the capacitance standard or select a capacitor value that will bring the unit on scale (preferably around 50%).

  *NPO capacitor remains stable with changes in temperature.

- Record meter reading.

- Observe the reading over a 24-hour period to see if it is stable.

- If the reading is stable, the sensing element or the application must be the source of the drift. If the reading drifted, return the instrument for repair. Be sure to mark on the tag that the problem is drift. (List the capacitor size and mA deviation.)

- Check the loop resistance connected to the electronic unit. Use the following equation and table to determine if the resistance is too large.

\[
R_{\text{max \ W}} = \frac{V_{\text{supply}} - 11.5 \text{ volts}}{0.02 \text{ amps}}
\]

*Table 6-1: Minimum Allowable Voltage*

<table>
<thead>
<tr>
<th>V(SUPPLY) (OHMS)</th>
<th>MAXIMUM LOOP RESISTANCE (VOLTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1925</td>
</tr>
<tr>
<td>40</td>
<td>1425</td>
</tr>
<tr>
<td>30</td>
<td>925</td>
</tr>
<tr>
<td>24</td>
<td>625</td>
</tr>
<tr>
<td>20</td>
<td>425</td>
</tr>
<tr>
<td>18</td>
<td>325</td>
</tr>
<tr>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>11.5</td>
<td>0</td>
</tr>
</tbody>
</table>
6.2 Testing the Sensing Element

---Check the sensing element using the following procedure.

With an analog ohmmeter*, check the sensing element resistance by:
• disconnecting the coax cable at the electronic unit
• measure the DC resistance between all three conductors:
  center wire (blue) to vessel ground (green)
  center wire (blue) to shield (red)
  shield (red) to center wire (blue)

All three readings should be infinite (open circuit).

If resistance is measured, repeat the above test by disconnecting the black coax at the junction conduit to measure the sensing element directly at the tan coax.

If the resistance is now normal (open or infinite ohms), then the black coax cable is damaged or submerged in water. Test the coax cable using section 6.3.

If the resistance is still low:
• then the sensing element may be defective,
• the insulation may be cracked,
• the packing gland may have failed allowing moisture to short out the sensor,
• or the gooseneck assembly has filled with water.

Remove and return the sensing element to the factory for rebuilding.

*A digital ohmmeter may produce erroneous readings.
6.3 Testing the Coax Cable

**NOTE**

Water or other conductive material in the conduit can change the electrical properties of the coax cable and cause the system to perform poorly. Moisture in the conduit may not be detected by the following test. Inspect the coax and associated conduit for trapped water.

1. Disconnect all three spade lugs of the coaxial cable at the electronic unit.

2. Disconnect all three spade lugs of the coaxial cable at the sensing element.

3. Check for short circuits. Using an ohmmeter, measure between two of the coaxial cable conductors. Repeat for all three conductors. All readings should show an open circuit, (infinite resistance).

   If resistance is measured, the coax cable insulation is punctured or damaged.

   ![Ohmmeter Diagram]

<table>
<thead>
<tr>
<th>Center - Ground</th>
<th>Center - Shield</th>
<th>Shield - Ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>∞ OHMS</td>
<td>∞ OHMS</td>
<td>∞ OHMS</td>
</tr>
</tbody>
</table>

   Correct Reading = Open Circuit

   ![Check for Shorts Diagram]

   No Connection

   Check for Shorts

4. Check for continuity of each conductor. Short out two of the coaxial cable conductors. Using an ohmmeter, measure between two of the coaxial cable conductors. Repeat for all three conductors. All readings should show less <1 ohm resistance.

   If no continuity is measured, check for corroded spade lug connections. Try reterminating spade lugs. Coax is defective if continuity is still not measured.

   ![Ohmmeter Diagram]

<table>
<thead>
<tr>
<th>Center - Ground</th>
<th>Center - Shield</th>
<th>Shield - Ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 OHMS</td>
<td>&lt;1 OHMS</td>
<td>&lt;1 OHMS</td>
</tr>
</tbody>
</table>

   Shorted wires should read <1 OHMS

   ![Check for Continuity Diagram]

   Check for Continuity

   Short out two conductors
6.4 Testing the System Loop

—Check the system loop using the following procedure.

- See Figure 6-2. Disconnect the power from (+) and (-) terminals and measure the open circuit voltage from the power supply. Voltage should be equivalent to source voltage. See Table 6-1 for minimum allowable voltage.

- Connect the signal wires to (+) and (-) terminals. Turn the Step Span and Step Zero to Position #1. Put Fine Span control completely clockwise and adjust the Fine Zero until 20 mA flows.

- Measure the voltage between (+) and (-) terminals. Voltage should be between 11.5 and 50 VDC. If there is less than the minimum 11.5 volts required, the loop has too much resistance or not enough power supply voltage.

- If the voltage is less than 11.5 VDC, disconnect the power supply and signal wires to the unit. Short the wires that were removed from the power supply (+) and (-) terminals.

Figure 6-2
Testing the System Loop
6.5 Testing the Digital Loop Meter

—Check the digital loop meter using the following procedure.

- Be sure the wiring connections are correct. Refer to Figure 5-4. If the polarity is reversed, the meter will not operate and the display will be blank.

- Check the loop current to be sure it is within the required range (3.5 mA to 21 mA).

- Check the voltage drop between the (+) and (-) terminals to be sure it is 1.4 ± .2 volts with 20 mA in the loop.

- Be sure the meter was calibrated correctly. Refer to Section 5.5.

- Check to see if the signal loop operates correctly when the meter is shorted out.

- If attempts to locate the difficulty fail, notify your local factory representative or call factory service at 1-800-527-6297.
### 6.5 Troubleshooting Possible Problems and Causes

<table>
<thead>
<tr>
<th><strong>Problem</strong></th>
<th><strong>Possible Cause</strong></th>
<th><strong>Reference Section</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter reads 20 mA or greater even when vessel is not full.</td>
<td>a. Transmitter malfunction.&lt;br&gt;b. Water in sensing element conduit.&lt;br&gt;c. Short in coax cable.&lt;br&gt;d. Cut in sensing element insulation.&lt;br&gt;e. Incorrect calibration.</td>
<td>a. Section 6.1&lt;br&gt;b. Section 6.2&lt;br&gt;c. Section 6.3&lt;br&gt;d. Section 6.2&lt;br&gt;e. Section 4</td>
</tr>
<tr>
<td>Transmitter never reaches 20 mA even though the vessel is full.</td>
<td>a. 4-20 loop resistance too high.&lt;br&gt;b. Incorrect calibration.&lt;br&gt;c. Transmitter malfunction.&lt;br&gt;d. Ground continuity to vessel is lost.</td>
<td>a. Section 6.1.2&lt;br&gt;b. Section 4&lt;br&gt;c. Section 6.1&lt;br&gt;d. Consult factory</td>
</tr>
<tr>
<td>Transmitter is drifting.</td>
<td>a. Moisture in sensing element gland.&lt;br&gt;b. Water in sensing element conduit.&lt;br&gt;c. Transmitter malfunction.&lt;br&gt;d. Water in coax cable or conduit.&lt;br&gt;e. Cut in sensing element insulation.&lt;br&gt;f. Incorrect calibration.&lt;br&gt;g. Material properties are changing.</td>
<td>a. Section 6.2&lt;br&gt;b. Section 6.2 and 6.3&lt;br&gt;c. Section 6.1.2&lt;br&gt;d. Section 6.3&lt;br&gt;e. Section 6.2&lt;br&gt;f. Section 4&lt;br&gt;g. Consult factory</td>
</tr>
<tr>
<td>Transmitter is erratic.&lt;br&gt;Output reading jumps anywhere from 0-100%.</td>
<td>a. Radio frequency interference.&lt;br&gt;b. Cut in sensing element insulation.&lt;br&gt;c. Waves in the liquid.</td>
<td>a. Need RFI filters&lt;br&gt;b. Section 6.2&lt;br&gt;c. Need time delay</td>
</tr>
<tr>
<td>As level increases, output reading decreases.</td>
<td>a. Fail-safe in HLFS position.&lt;br&gt;b. Transmitter malfunction.&lt;br&gt;c. Calibration performed using de-ionized water.&lt;br&gt;d. Ground continuity to vessel is lost.</td>
<td>a. Section 3.3.1&lt;br&gt;b. Section 5.1&lt;br&gt;c. Calibrate using dirty water.&lt;br&gt;d. Consult factory.</td>
</tr>
<tr>
<td>Transmitter reading 5-10% or greater in error.</td>
<td>a. Build-up on sidewall is touching sensing element.&lt;br&gt;b. Incorrect calibration.</td>
<td>a. Consult factory&lt;br&gt;b. Section 4</td>
</tr>
<tr>
<td>Output current reading is less than 3.5 mA.</td>
<td>a. Wiring short from shield-to-ground (sensing element).&lt;br&gt;b. Sensing element not connected to transmitter.</td>
<td>a. Section 2.5&lt;br&gt;b. Section 2.5 and 2.6</td>
</tr>
</tbody>
</table>
6.6 **Factory and Field Service Assistance**

If you are having difficulty with your Drexelbrook equipment, and attempts to locate the problem have failed, notify your local Drexelbrook representative, call the factory service department at 1-800-527-6297, or fax details of the problem to 1-215-674-5117. Drexelbrook Engineering Company is located at 205 Keith Valley Road, Horsham, Pa. 19044. To help us solve your problem quickly, please provide the following information:

- Instrument Model #408-8200
- Sensing Element Model # and Length
- Original P.O. #
- Coax Cable Length
- Material being measured
- Temperature
- Pressure
- Agitation
- Brief description of the problem
- Checkout procedures that failed

Do not return equipment without first contacting the factory for a return authorization number. Any equipment being returned must include the following information:

- Reason for return
- Return Authorization #
- Original P.O. #
- Drexelbrook order #
- Attention
- “Ship To” address

To keep the paperwork in order, please include a purchase order with returned equipment even though it may be coming back for warranty repair. You will not be charged if covered under warranty. Please return your equipment with freight charges prepaid. We regret that we cannot accept collect shipments.

Drexelbrook usually has a stock of reconditioned exchange units available for faster turnaround of a repair order. If you prefer your own unit repaired rather than exchanged, please mark clearly on the return unit, “DO NOT EXCHANGE”.

Spare instruments are generally in factory stock. If the application is critical, a spare chassis should be kept on hand.
"When the measurement matters"

DREXELBROOK

An ISO 9001 Certified Company

Printed in USA

World Headquarters: AMETEK Drexelbrook, 205 Keith Valley Road, Horsham, PA 19044 U.S.A. (Tel) 215/674-1234, (Fax) 215/674-2731

Europe Headquarters: Drexelbrook Instrumenten, Bedrijvencentrum Rede, Waalresegweg 17, 5554 HA Valkenswaard, Netherlands (Tel) +31-(0)40-208-9298, (Fax) +31-(0)40-204-7933

Japan Headquarters: Nihon Drexelbrook, 2 Chrome, 12-7 Minami Gyotoku, Ichikawa City, Chiba 272-01 Japan (Tel) 473-56-6513, (Fax) 473-56-6535