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# Installation and Operating Instructions

## Series CM3
## Cut Monitor
## with HART® Protocol
## using 409-1000 Electronics

ABLE Instruments & Controls

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509-0277-LM

# Series CM3
# Cut Monitor
# with HART® Protocol
# using 409-1000 Electronics

AMETEK®
DREXELBROOK

*An ISO 9001 Certified Company*


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# Table of Contents

## SECTION 1 INTRODUCTION

The instructions in this manual are for the Drexelbrook CM3 Series Cut Monitor used for measurement of water-in-oil (B.S.&W.) applications.

### 1.1 Description

Each Drexelbrook CM3 Cut Monitor consists of a Universal III™ (409-1000) series two-wire, 4-20 mA electronic unit and a 700 series sensing element (probe). A 380 series connecting cable is also supplied when the sensing element is mounted remotely from the electronic unit.

The CM3 Cut Monitor is a smart capacitance-to-current device. A change in oil composition produces a capacitance change that results in a change of signal current.

### 1.2 Models Available

The CM3 model number is 509-0277-X0X. The electronic unit model number is 409-1000. The sensing element model number is 700-20X-5X.

5 0 9 - 0 2 7 7 - X 0 X CM3 Cut Monitor

- **Sensing Element Reference Number:** See Table 1-1
- **Package:** 7 = Remote, 9 = Integral

4 0 9 - 1 0 0 0 - X 0 X Universal III Electronic Unit

- **Agency Approvals:** F = FM, C = CSA, K = KEMA
- **Housing:** 6 = Remote Nema 4X Explosionproof with Drexelcote; 8 = Integral Nema 4X Explosionproof with Drexelcote
- **Modification 91-38:** Adds local indicator (standard for remote electronics)

| Sensing Element Reference | Application | Sensing Element Model Number | Standard Material of Construction | OD and Standard Mounting | Insertion Length |
|---|---|---|---|---|---|
| 509-0277- | | | | | |
| X0A | 1 inch pipe | 700-201-51 | 316 SS with with TFE seals and insulators | Rod ¼" OD ¾" NPT | 18.7 inches |
| X0B | 2 inch pipe | 700-201-52 | 316 SS with with TFE seals and insulators | Rod ¼" OD ¾" NPT | 28.1 inches |
| X0C | 3 inch pipe | 700-202-53 | 316 SS with with TFE seals and insulators | Rod ½" OD 1" NPT | 29 inches |
| X0D | 4 inch pipe | 700-202-54 | 316 SS with with TFE seals and insulators | Rod ½" OD 1" NPT | 32.1 inches |
| X0E | 6 inch pipe | 700-202-56 | 316 SS with with TFE seals and insulators | Rod ½" OD 1" NPT | 38.4 inches |
| X0F | 8 inch or or larger pipe | 700-201-58 | 316 SS with with TFE seals and insulators | Concentric shield 1.66" OD 4"/150# RF flange mount | 37 inches standard (varies with nozzle length) |
| X0G | in-tank sensing element | 700-201-59 | 316 SS with with TFE seals and insulators | Perforated concentric shield 1.66" OD 2"/150# RF flange mount | 27 inches standard (varies with nozzle length) |

*Table 1-1*
*Sensing Element*
*Model Numbering*

## 1.2 Models Available (cont.)

The standard electronic unit (409-1000-X0X) is mounted in an explosionproof housing that meets the following classifications:

- NEMA 4X Waterproof/Corrosion Resistant.

- NEMA 7 Explosionproof FM Approved for:
  Class I Gr. A,B,C & D;
  Class II Gr. E, F, & G;
  Class III.

The remote electronic unit and sensing element are connected by a three-terminal coaxial cable (380-0xx-12).

- The xx in the model number indicates the length of the cable in feet.
- Maximum length is 25 feet.
- Shorter lengths are available.
- Cable can also be purchased in bulk lengths with termination kits.

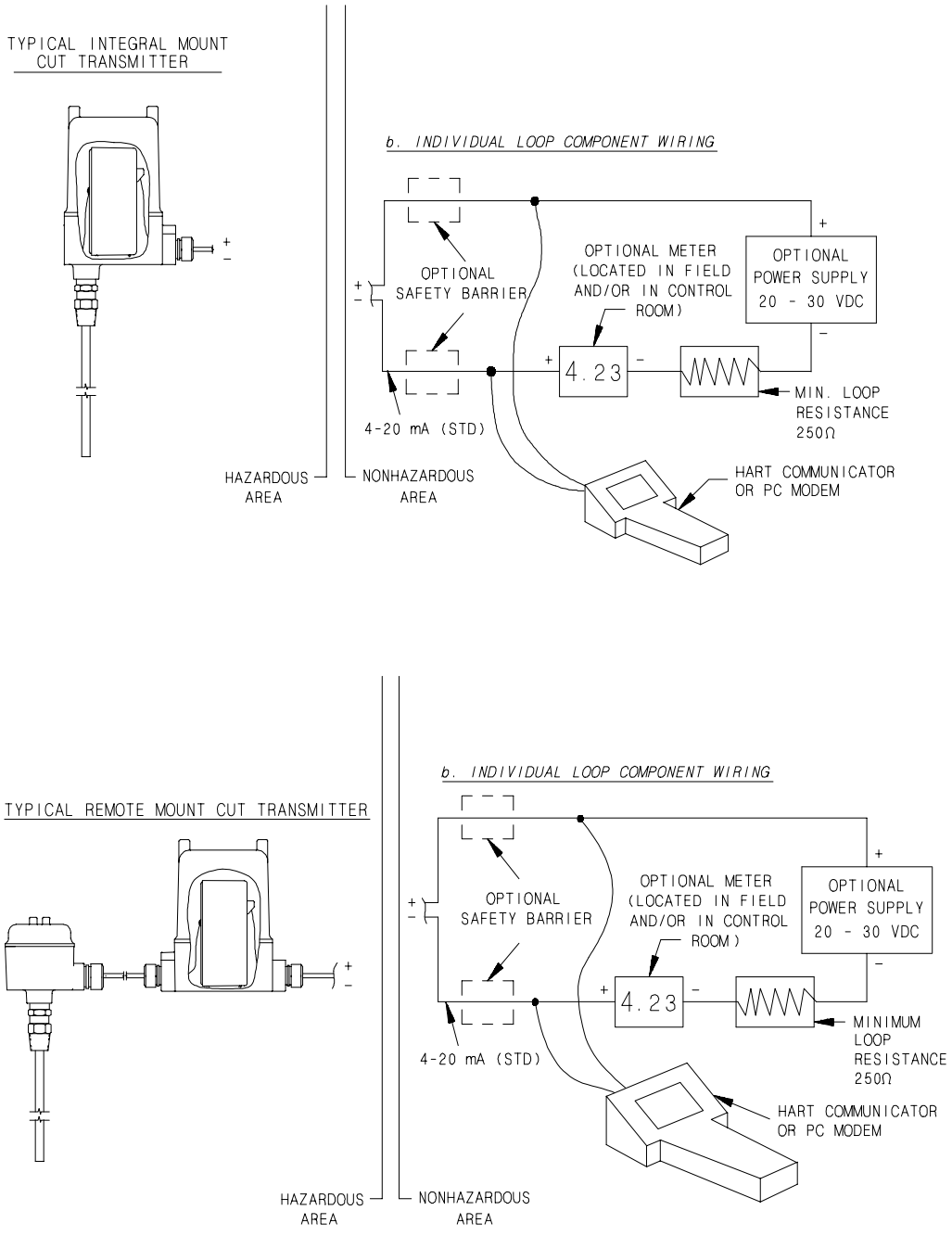



*Figure 1-1*
*HART® Universal III™ Transmitter*
*in Two-Wire Loop*

# 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.

## 2.2 Mounting the Electronic Unit

The integral electronic unit is mounted with the sensing element. The remote electronic unit is 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 185°F (-40°C and 85°C).

***NOTE***

When installing conduit to the electronic unit, be sure that vertical conduit runs will not cause water to enter the electronic unit housing, as shown in Figure 2-1.

Figure 2-1 shows the recommended conduit installation. See Figures 2-2 through 2-5 for mounting dimensions.

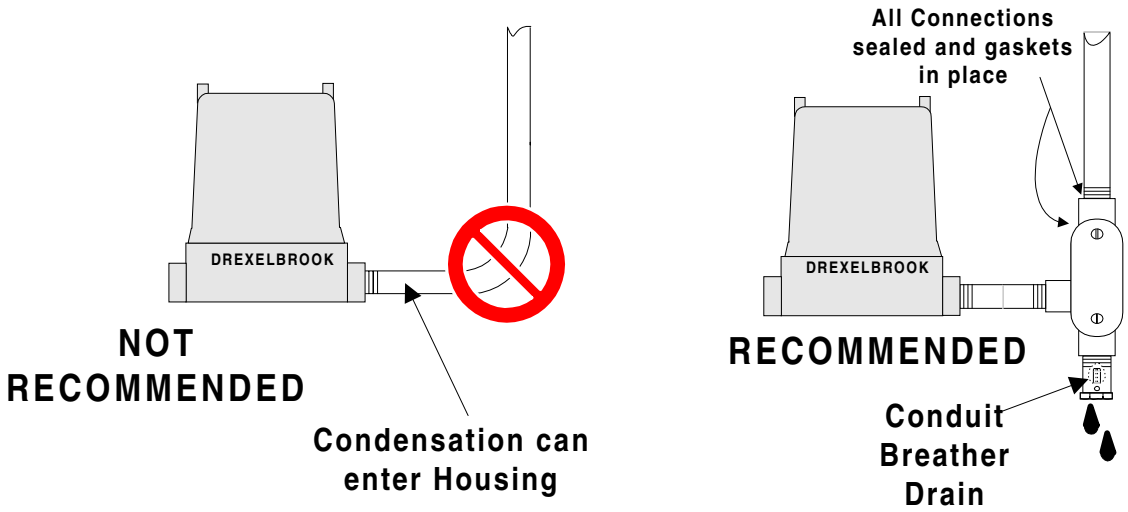
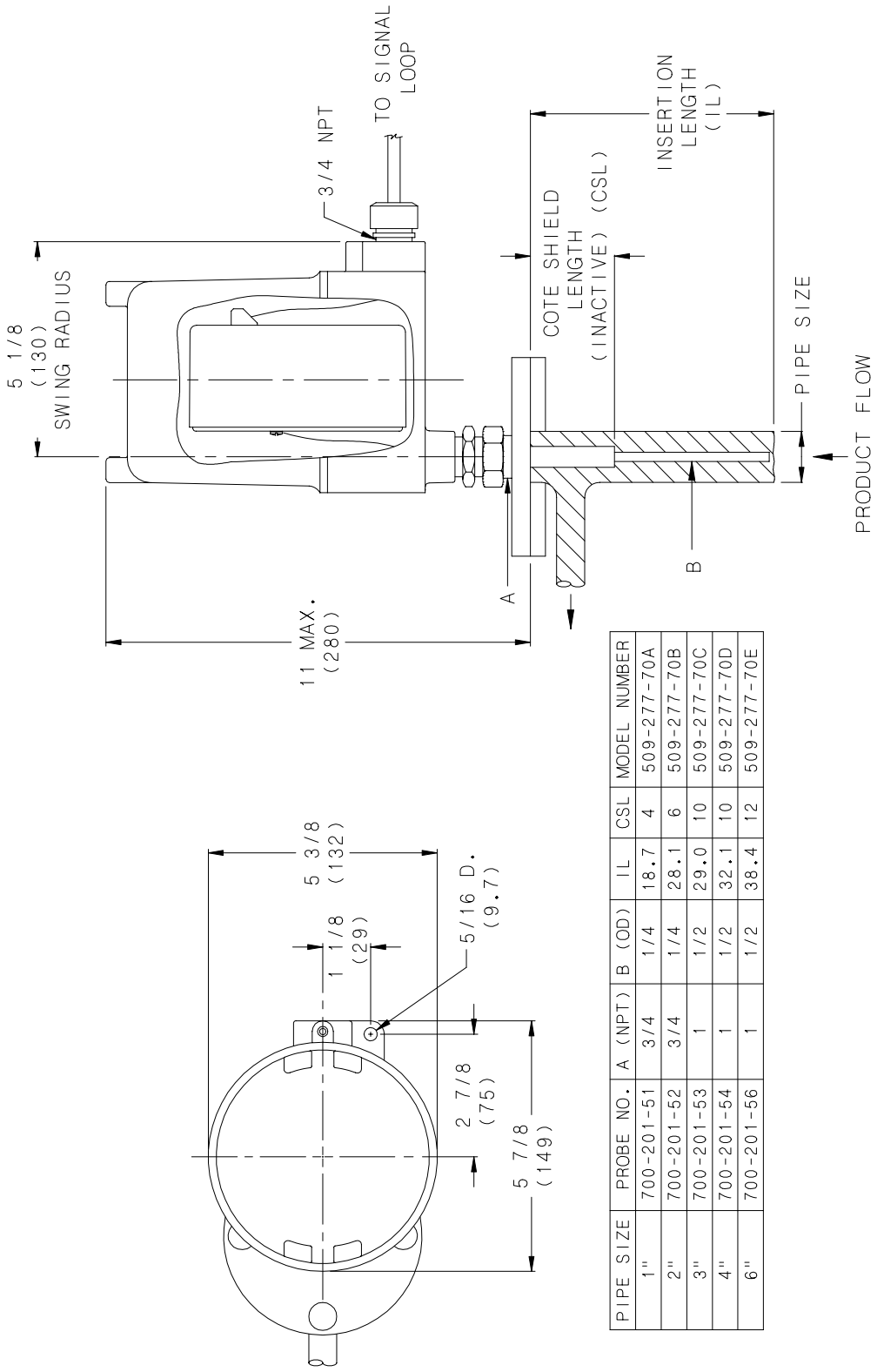
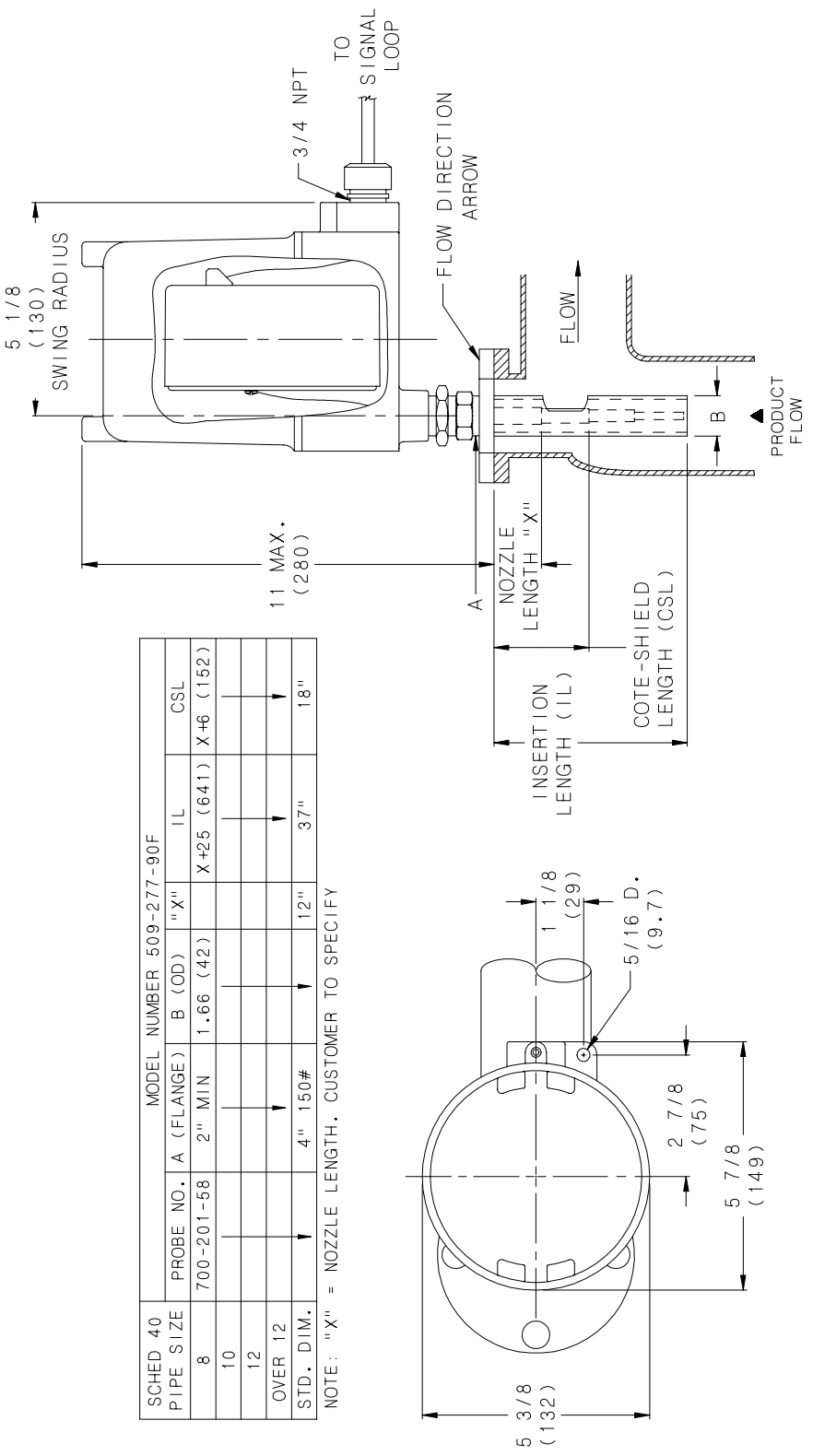



*Figure 2-1*
*Recommended Conduit Connection*




| PIPE SIZE | PROBE NO. | A (NPT) | B (OD) | IL | CSL | MODEL NUMBER |
|---|---|---|---|---|---|---|
| 1" | 700-201-51 | 3/4 | 1/4 | 18.7 | 4 | 509-277-70A |
| 2" | 700-201-52 | 3/4 | 1/4 | 28.1 | 6 | 509-277-70B |
| 3" | 700-201-53 | 1 | 1/2 | 29.0 | 10 | 509-277-70C |
| 4" | 700-201-54 | 1 | 1/2 | 32.1 | 10 | 509-277-70D |
| 6" | 700-201-56 | 1 | 1/2 | 38.4 | 12 | 509-277-70E |

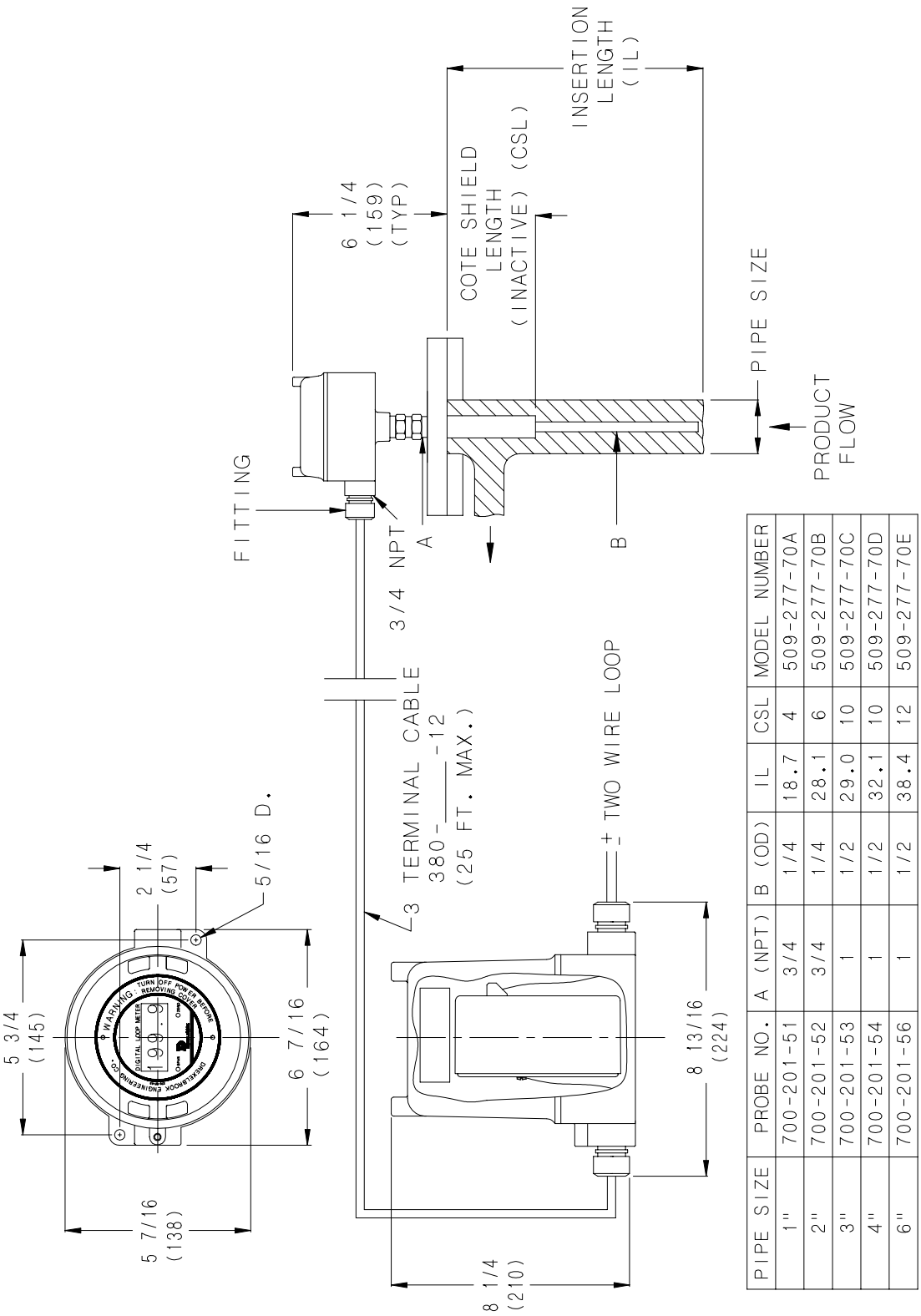
*Figure 2-2*
*Mounting Dimensions*
*Integral Electronics*
*1" through 6" Pipe Size*




| MODEL NUMBER 509-277-90F | | | | | |
|---|---|---|---|---|---|
| SCHED 40 PIPE SIZE | PROBE NO. | A (FLANGE) | B (OD) | "X" | IL | CSL |
| 8 | 700-201-58 | 2" MIN | 1.66 (42) | | X+25 (641) | X+6 (152) |
| 10 | | | | | | |
| 12 | | | | | | |
| OVER 12 | | | | | | |
| STD. DIM. | | 4" 150# | | 12" | 37" | 18" |

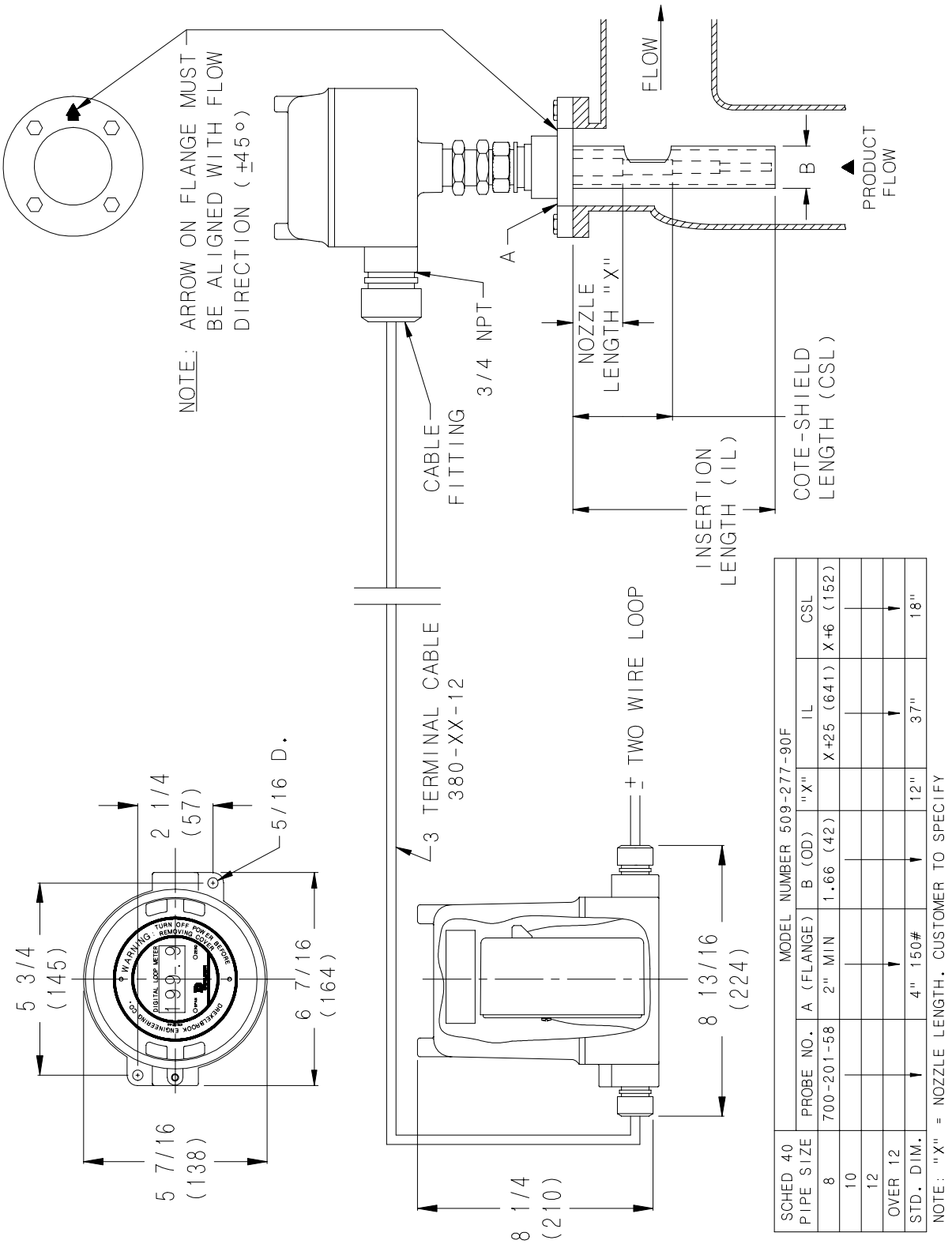
NOTE: "X" = NOZZLE LENGTH. CUSTOMER TO SPECIFY

*Figure 2-3*
*Mounting Dimensions*
*Integral Electronics*
*Greater than 8" Pipe Size*




| PIPE SIZE | PROBE NO. | A (NPT) | B (OD) | IL | CSL | MODEL NUMBER |
|---|---|---|---|---|---|---|
| 1" | 700-201-51 | 3/4 | 1/4 | 18.7 | 4 | 509-277-70A |
| 2" | 700-201-52 | 3/4 | 1/4 | 28.1 | 6 | 509-277-70B |
| 3" | 700-201-53 | 1 | 1/2 | 29.0 | 10 | 509-277-70C |
| 4" | 700-201-54 | 1 | 1/2 | 32.1 | 10 | 509-277-70D |
| 6" | 700-201-56 | 1 | 1/2 | 38.4 | 12 | 509-277-70E |

*Figure 2-4*
*Mounting Dimensions*
*Remote Electronics*
*1" through 6" Pipe Size*




| SCHED 40 PIPE SIZE | MODEL NUMBER 509-277-90F | | | | | |
|---|---|---|---|---|---|---|
| | PROBE NO. | A (FLANGE) | B (OD) | "X" | IL | CSL |
| 8 | 700-201-58 | 2" MIN | 1.66 (42) | | X+25 (641) | X+6 (152) |
| 10 | | | | | | |
| 12 | | | | | | |
| OVER 12 | | | | | | |
| STD. DIM. | | 4" 150# | | 12" | 37" | 18" |

NOTE: "X" = NOZZLE LENGTH. CUSTOMER TO SPECIFY

*Figure 2-5*
*Mounting Dimensions*
*Remote Electronics*
*Greater than 8" Pipe Size*

## 2.3 Mounting the Sensing Element

Use the following mounting and installation instructions so that the sensing element will operate properly and accurately:

a. The sensing element should be mounted in a section of pipe as close to the center and as parallel to the pipe as possible. Factory calibration assumes mounting on the pipe centerline and in the correct size pipe (see Figure 2-2).

b. Vertical mounting, with the tip down, is preferred, but not essential.

c. Gas bubbles **must** be excluded from the active area by maintaining pressure and, if necessary, a degasser upstream from the sensing element. Gas bubbles (whether from natural gas, air or steam) invalidate the accuracy of the transmitter.

d. For **in-tank mounting** installations, the standard length of the cote shield section is eight inches. If the nozzle is longer than six inches, a non-standard cote shield length should be used.

e. **Do not take the sensing element apart or loosen the packing glands.** Follow instructions in Figure 2-6.

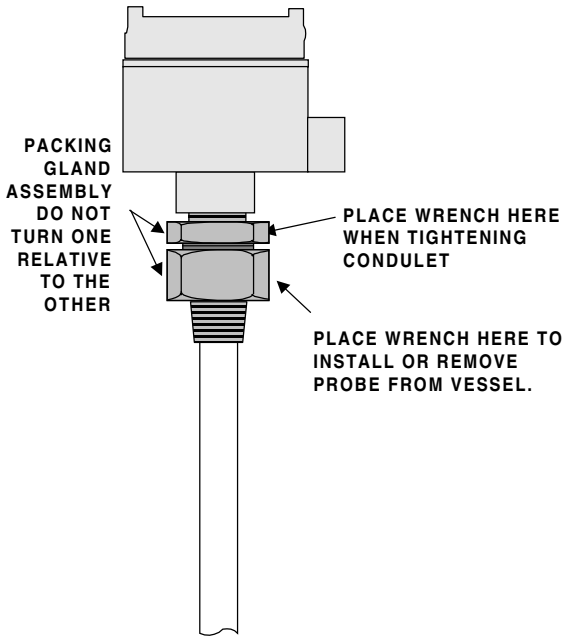



*Figure 2-6*
*Installing the Sensing Element*

**2.3 Mounting the Sensing Element (cont.)**

e. **In large pipe installations** (greater than eight inches), the length of the cote shield section must be long enough (i.e. length of nozzle short enough) that the cutout in the concentric tube is in the actual flow of oil. See Figure 2-7.

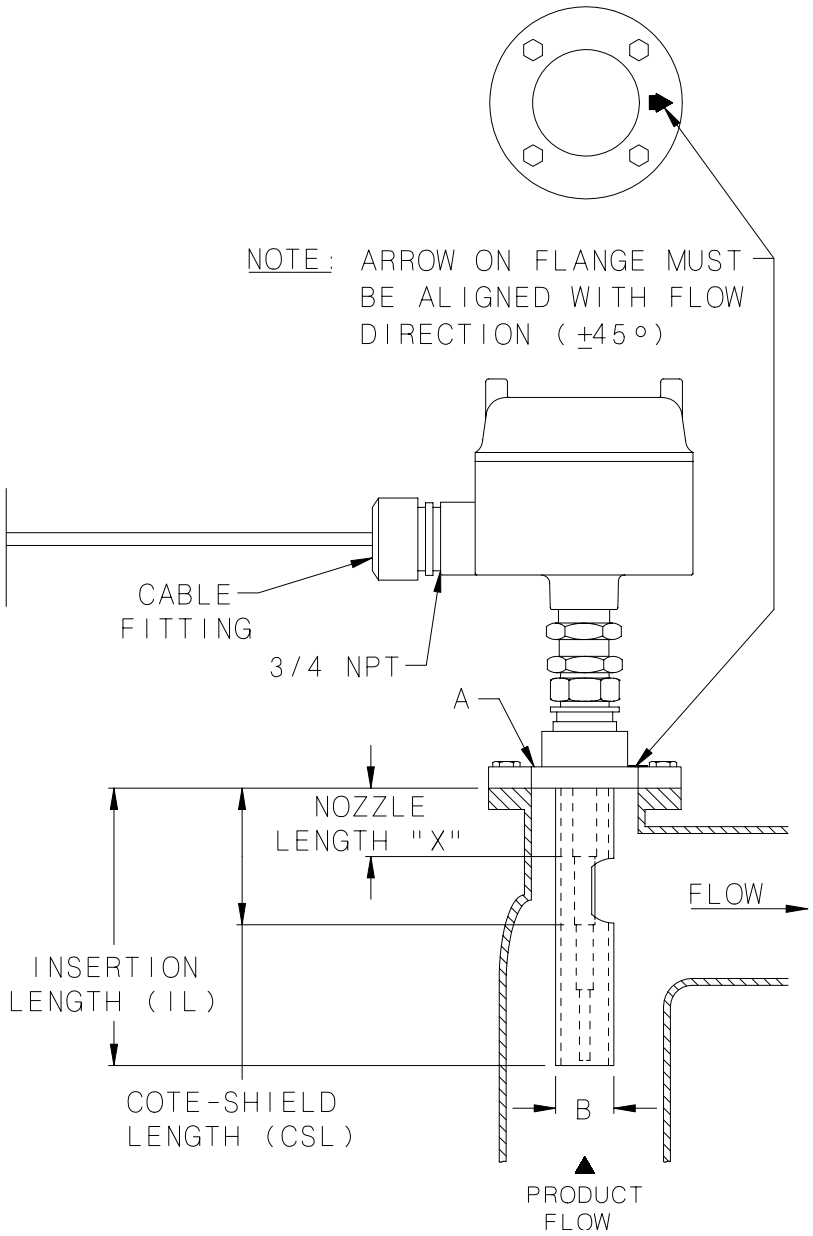



*Figure 2-7*
*Installation in a*
*Large Pipe (greater than eight inches)*

**2.3 Mounting the Sensing Element (cont.)**

f. For large pipes with no bends (18 inch and larger), it is possible to mount the sensing element at a 45 degree angle to provide sufficient flow through the shield of the sensing element. See Figure 2-8.

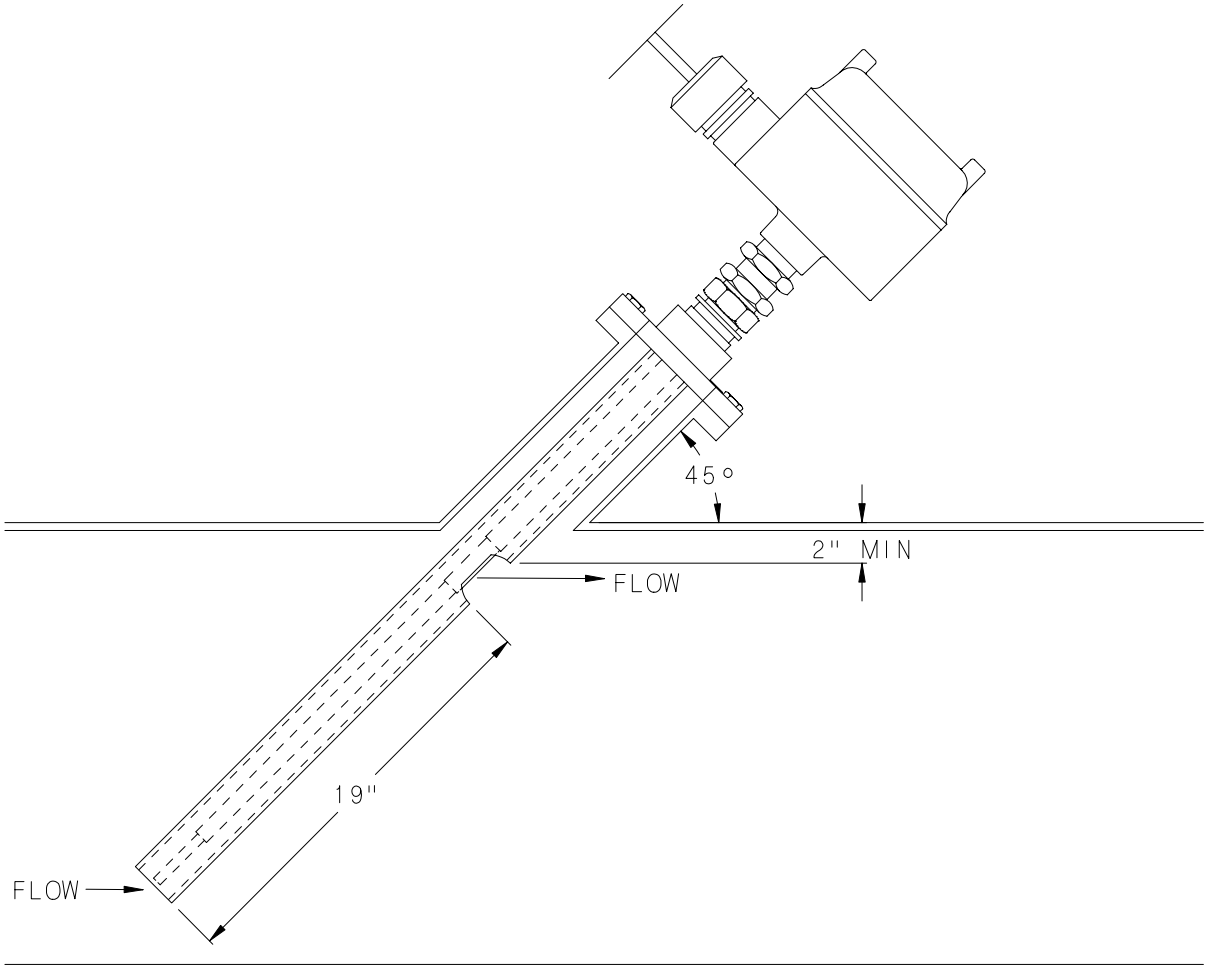



*Figure 2-8*
*Installation in a Pipe 18 inches or larger*

## 2.4 Wiring the Electronic Unit

*CAUTION*

**Before using Intrinsic Safety Barriers, read the manufacturer's instruction for barrier operation.**

*CAUTION*

**If welding anywhere on the piping or connected tanks, physically remove all connections from the electronic unit and remove the unit from its housing.**

Integral units are prewired at the factory. Figure 2-9 shows the wiring of the integral unit.

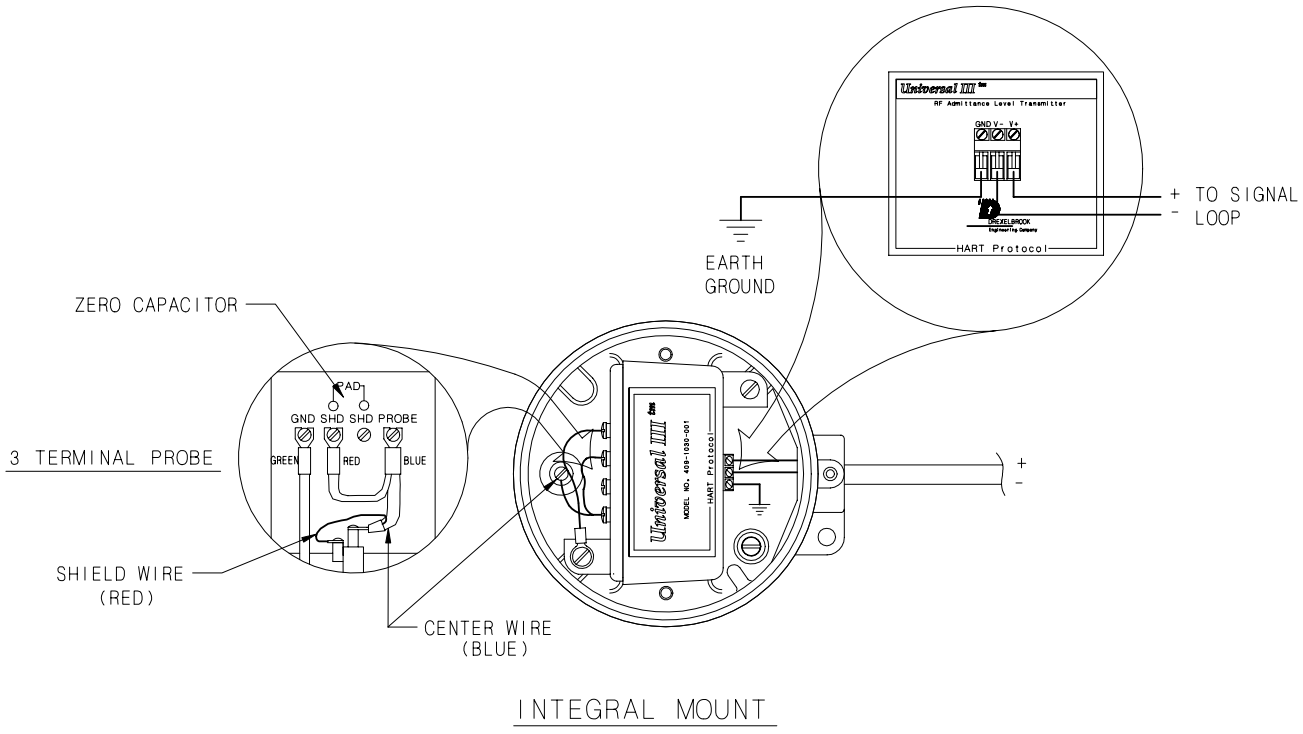



*Figure 2-9*
*CM3 Wiring Connections*
*(Integral Mounting)*

## 2.4 Wiring the Electronic Unit

For remote units, the signal connections are made to the three-terminal block on the front of the chassis. Due to the low power consumption of the instrument, the wiring need only be light gauge (e.g. 20 AWG). Twisted, shielded-pair cables are required.

The cable from the sensing element is connected to the four-terminal group on the back side of the instrument chassis. The cable connections are probe (Prb or Center Wire), ground (Gnd), and shield (Shd). See Figure 2-10

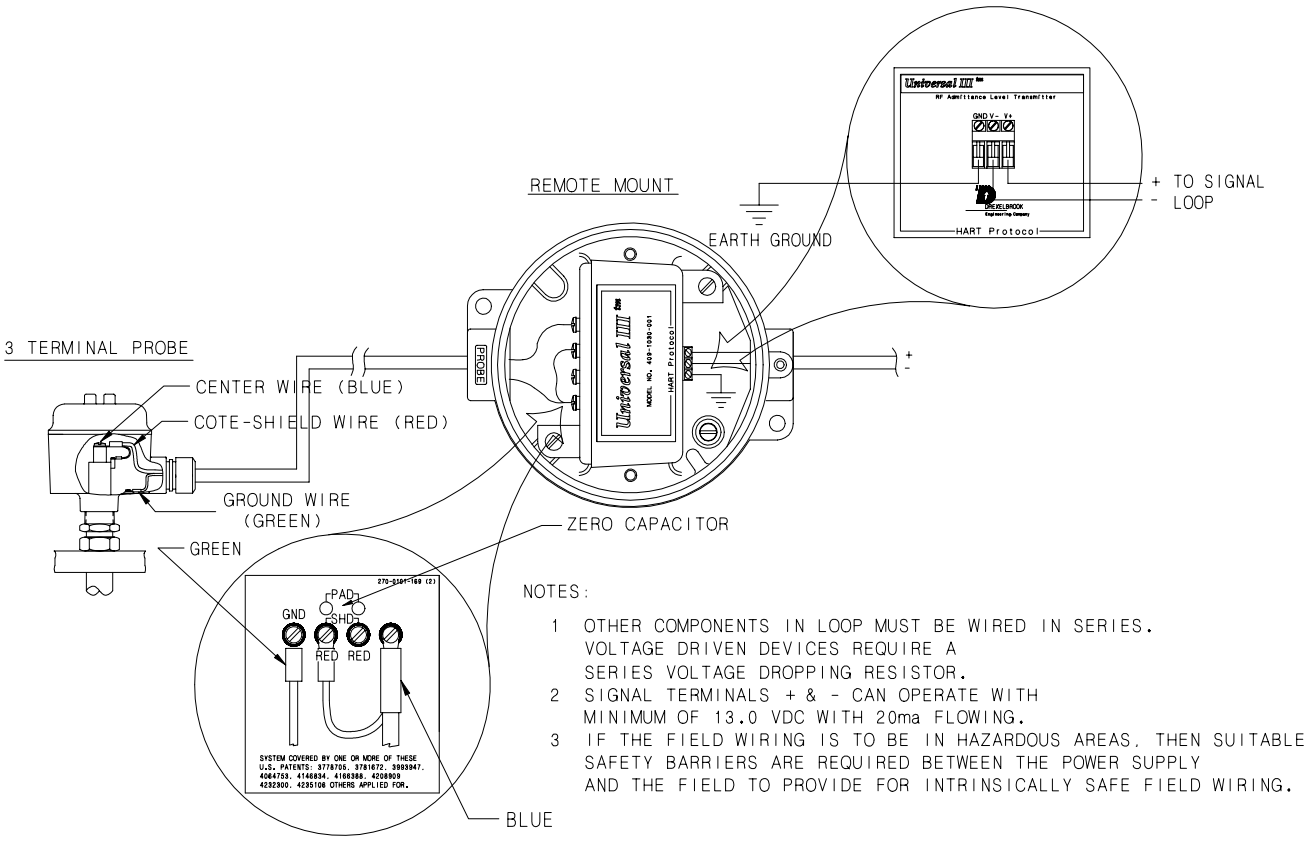



*Figure 2-10*
*CM3 Wiring Connections*
*(Remote Mounting)*

## 2.5 Wiring the Sensing Element (Remote Electronic Units)

Only coaxial cables supplied by AMETEK Drexelbrook should be used to connect the transmitter to the sensing element. Use of other cables can result in unstable calibration.

To prevent problems with radio frequency interference, the cable should be run in metallic conduit if walkie-talkies or variable speed drives are located within 25 feet of the electronic unit.

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

***NOTE***

Do not connect the cable to the sensing element until after the sensing element has been installed in the vessel and the condulet housing has been secured.

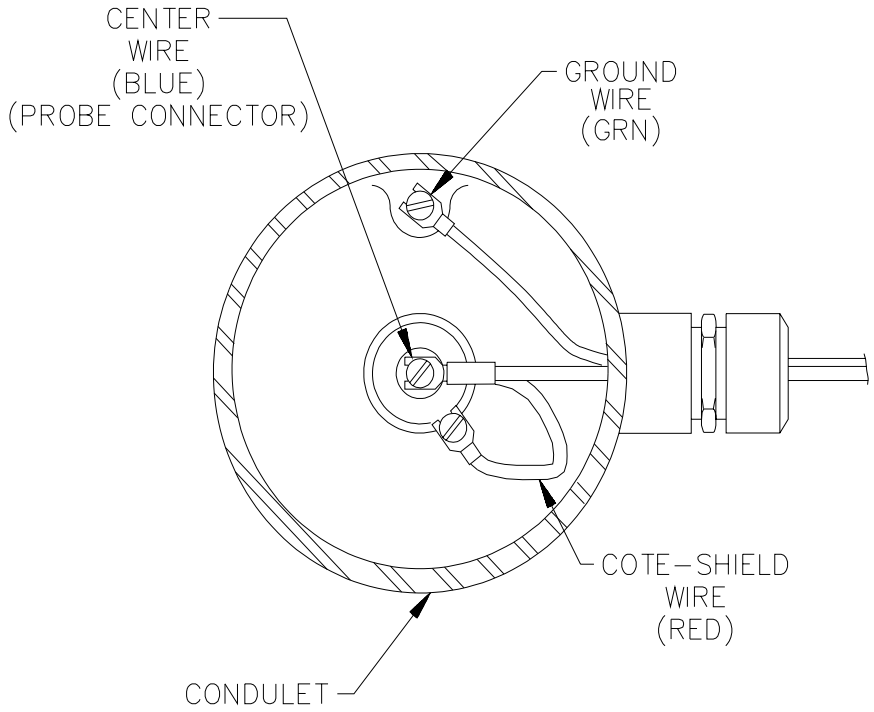



*Figure 2-12*
*Three-Terminal Cable Connections to Three-Terminal Sensing Element*

## 2.6 Surge Voltage (Lightning) Protection

Optional surge protection is sometimes supplied with transmitters that are expected to be exposed to surges or lightning on the two-wire loop. A Drexelbrook model 377-4-12 Surge Voltage Protector provides protection to the transmitter but is not absolute in its protection against a very close lightning strike. Refer to Figure 2-13 to properly connect the Surge Voltage Protector. In addition to surge voltage protection, connect the transmitter housing to a good ground.

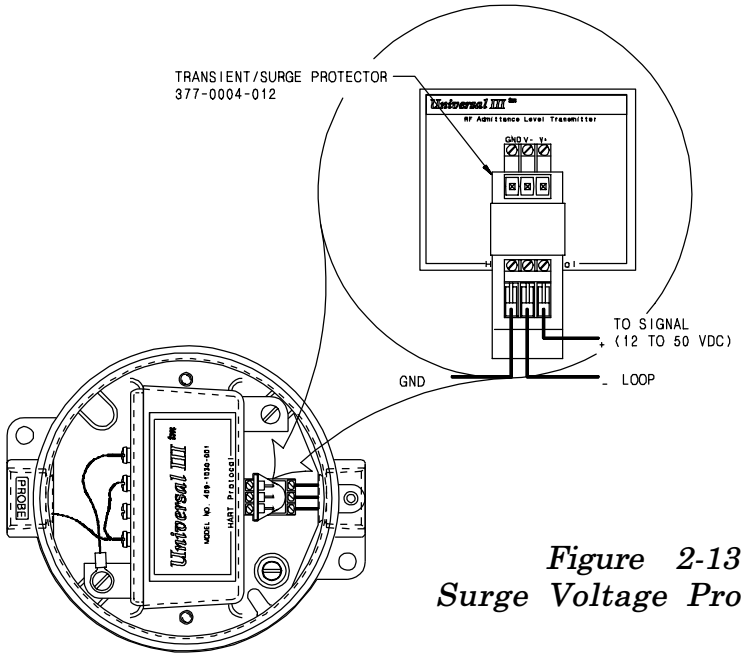



*Figure 2-13*
*Surge Voltage Protection*

## 2.7 RFI (Radio Frequency Interference)

When installing the Universal III transmitter, follow these recommendations to avoid problems with Radio Frequency Interference (RFI).

- Choose a location to mount the electronic unit at least 6 feet (2M) from a walkway where personnel using walkie-talkies may pass.

- For remote electronic units, connect the sensing element to the electronic unit by placing the coaxial cable in grounded metal conduit. (Integrally mounted electronic unit connections are already shielded.)

- Use twisted, shielded-pair wiring for all loop wiring connections. Loop connection wiring should also be in grounded metallic conduit.

## 2.7 RFI (Radio Frequency Interference) (cont.)

- Do not run power wiring in the same conduit with signal cables
- Ground the electronic unit and housing with a minimum of 14 gauge wire to a good earth ground. Make sure that conduits entering and leaving the housing have a good electrical ground connection to the housing.

The RFI recommendations listed above provide a degree of protection that is usually sufficient to protect against walkie-talkies used 3 feet (1M) or more from a typical electronic unit.

## SECTION 3 COMMUNICATION WITH DREXELBROOK PC SOFTWARE

This section instructs the user how to use the Drexelbrook 401-700-20 Series PC software to calibrate the Universal III transmitter.

### 3.1 General Description

The 401-700-20 software package allows the use of any DOS or Windows®-based personal computer to interface with the CM3 HART® protocol transmitter.

A PC and Drexelbrook software can be used in place of the Rosemount® handheld calibrator used for multi-PV transmitters.

### 3.2 PC Software Model Number

**4 0 1 - 0 7 0 0 - 0 2 X**

X=1 PC Software Package includes Modem Assembly shown in Figure 3-1 and cable.

X=2 PC Software Package includes Modem Assembly shown in Figure 3-1, cable, and PC software 3½-inch disk.

**4 0 1 - 0 7 0 0 - 0 0 6**

PC Software 3½-inch disk only.

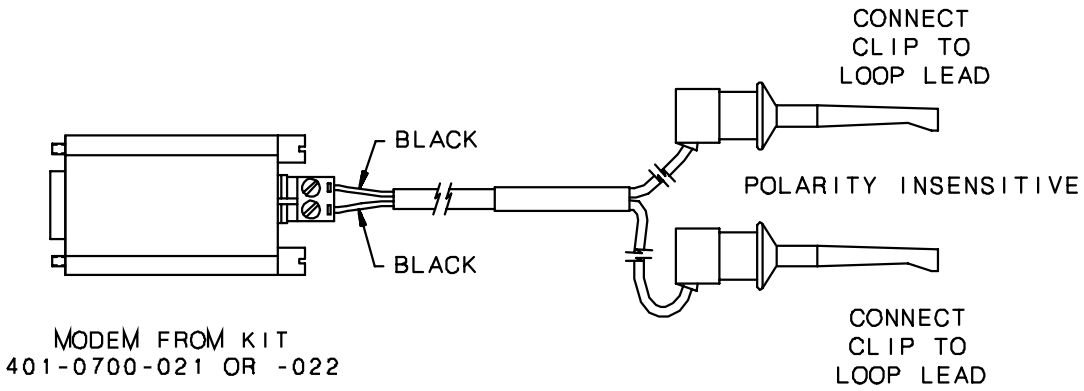



*Figure 3-1*
*Modem Assembly*

## 3.3 PC Software Specifications

*—PC Requirements*

8088 DOS-based PC or higher using DOS version 3.1 or higher. While it is possible to operate from the 1.44 megabyte floppy disk furnished with the 401-700-20 package, it is recommended that the software be installed on a hard drive with 0.5 megabytes or more of space available.

*—Input to Modem*

RS232 from the COM1 serial port. The PC provides operating power for the modem but not for the transmitter.

*—Cable (included with Modem)*

5-foot modem to transmitter loop connection

## 3.4 Installing the Modem

Refer to Figure 3-2 for a connection diagram and use the following procedure to install the hardware that is necessary to run the PC software.

a. Connect the Drexelbrook Modem 401-700-002 to the COM1 serial port of the computer.

b. Connect the 4-20 loop connectors to the transmitter loop. Modem is polarity insensitive.

c. Connect the loop wires to the modem.

d. Turn on the computer.

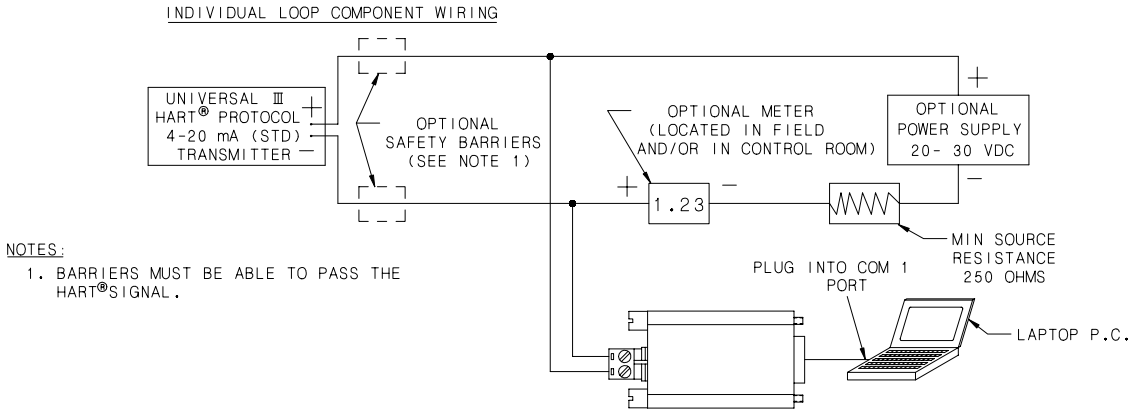



*Figure 3-2*
*Connecting the Modem*

### 3.5 Installing the Software on the Hard Drive

***NOTE***

While it is possible to operate from the 1.44 megabyte floppy disk furnished with the 401-700-20 package, it is recommended that the software be installed on a hard drive with 0.5 megabytes or more of space available.

***NOTE***

The PC software is a DOS-based program. It cannot be installed directly from Windows 3.1® or Windows 95®.

a. If you are using Windows®, go to the MS DOS prompt to install the PC software.

b. Place the 401-700-006 software disk into the drive (usually drive a:).

c. At the **c:>** prompt, type **a: install**. The program will create a directory on the hard drive called **HART60** and place the program file there.

d. At this point, the software is loaded onto the hard drive, you can:
•run the software from the DOS mode, or
•create a program icon (or shortcut) and run the software in Windows®.

### 3.5.1 Running PC Software from the Hard Drive as a DOS Program

To run the PC software from DOS:

a. Type cd:\HART60

b. Type HART60

### 3.5.2 Running PC Software from the Hard Drive in Windows 95®

To run the PC software from Windows 95:

a. Click the **Start** button, and then point to **Settings**.

b. Click **Taskbar**, and then click the **Start Menu Programs** tab.

c. Click **Add** and type c:\hart60\hart60.exe

d. Click **Next**, and then double-click the **Programs** menu where Hart60 is to appear.

e. Choose a name and icon and then click **Finish** and **OK**.

Steps a. through e. should have placed the DE LOGO icon in the Programs menu. 

f. Double click on the DE LOGO icon and the HART program should run under a window.

g. The software starts communicating with the HART protocol transmitter and returns with Tag ID and all existing configuration information. Press **F1** at any time for on-line Help.

***NOTE***

On new units the Tag ID is preset by the factory to the unit's serial number.

h. Press **F3** to read the HART Protocol transmitter's present database. It takes several seconds to upload the information in the transmitter. When the upload is complete, the screen shows the transmitter's data-base parameters.

### 3.6 Description of the Function Keys

Figure 3-3 shows a PC software menu display and the following paragraphs describe the data fields.

```
F2 Sys F3 Read  F4 View  F5 Write  F6 Pt.CAL  F7 Cm  F8 File  F9 Exit

Drexelbrook Engineering Co. HART Protocol Software Ver. 6.0 (c)1999

   Tag-ID..............CM-101                  Serial # 109
   Scratch Pad..........Calibrated 1/99       Software Ver.-.-
   Analog Loop Assign...Level                  Range Pos.  4
   Damping Time........0  Sec                  Type  XX

      LEVEL CONFIGURATION                 VESSEL CONFIGURATION
   Level Units..........cm              Vessel Units.........gallons
   Maximum Level........8 cm            Maximum Capacity.....1000 gal
   Level Type...........Standard        Vessel Type..........Vertical

                  LRV ( 4 mA ).........0 cm
                  URV ( 20 mA ).........5 cm

                                            LEVEL CALIBRATION
    Status:    * Demo *                  Lower Level..........1.87 cm
                                         Upper Level..........4.90 cm
                                         Lower Capacitance....43.15 pF
                                         Upper Capacitance....47.90 pF

                                            01-27-1999 15:17:31
Save data file to disk
F1 Help
```

*Figure 3-3*
*PC Software Menu Display*

*NOTE*

If the data field has been edited but not sent to the transmitter (**F5 Write**), an asterisk (*****) is displayed next to the data entry. Also, if an incomplete upload (**F3 Read**) has occurred, the data not received will have a question mark next to its data field. (Retry F3.)

F1 HELP
Accesses Help menu and Screens

F2 SYS
Accesses and configures System information.

### 3.6 Description of the Function Keys (cont.)

Service: Access toll-free service phone number.
Print: Print configuration screen.
Other items are not applicable.

**F3 READ (receive transmitter data)**
Reads all pertinent data from the transmitter and displays it on the screen. The Tag-ID is displayed in the communication window. Once the tag is read and a valid HART protocol transmitter is detected, you may use the **ESC** key to abort the interrogation if this is not the correct transmitter loop. However, if an incomplete upload has occurred, the data not received will have a question mark (?) next to its data field. The **READ** function also updates the real-time window level, vessel, capacitance, current and status after completing loading the data.

**F4 VIEW (monitor transmitter data)**
Displays the real-time values of cut, sensor capacitance in pF, loop current, and percent of range from the Universal III transmitter. If the transmitter status is anything other than OK, a detailed status message is displayed. Use the **ESC** key to abort the PV update.

**F5 WRITE (send data to transmitter)**
Sends new or edited configuration data to the transmitter. Data that has been edited but not sent to the transmitter has an asterisk next to its data field.

**F6 PT. CAL (point calibration)**
Calibrates the Universal III transmitter using Point calibration with two actual composition points. The high and low water percentage must be known.

**F7 CM**
Selects the Communication Port: COM1.

**F8 FILE**
This function loads or saves the data on the screen to a PC disk file with an .SLT and .TXT file extension.

**F9 EXIT**
Exit PC software.

## 3.7 Using the PC Software Menu

All Drexelbrook CM3 Series Cut Monitor instruments are configured and calibrated at the factory.

Two of the data fields in the menu can be changed to identify the instrument specifically for the application. To make an entry in these data fields, position the cursor and type over the existing entry.

- Use **Tag ID** (8 characters) to identify the unit or vessel.
- Use the **Scratchpad** (32 characters) to record the date of calibration or other similar notes.

Press **F5 Write**.

Other data fields on the menu relate to the cut monitor measurement. These data fields should not be changed unless instructed by a factory service engineer.

- The **Analog Loop Assign**ment is made at the factory according to the desired range set by the coarse span jumper on the side of the electronic unit. The jumper is set at the factory. **Do not change the factory setting**.
- For a cut monitor application, **Level Units** data field represents % Water Units, measured in **cm** (cut measurement).
- **Maximum Level** is factory set to coincide with the range set by the coarse span jumper. **Do not change the factory setting**.
- For a cut monitor application, the **LRV** (4 mA) corresponds to dry oil or 0% water (0.00 cm).
- For a cut monitor application, the **URV** corresponds to the full scale water percentage (e.g. 10.00 cm on the 10% water range).

## SECTION 4 CALIBRATION

All Drexelbrook CM3 Series Cut Monitor instruments are calibrated at the factory according to:

- •size of pipe, and
- •density of oil specified.

Specific factors could cause the factory calibration to be less accurate than is required. For example,

a. Pipe I.D. is smaller than nominal size (Sched. 80, 160, or extra heavy pipe)

b. Sensing element is not centered (parallel to axis) in pipe. This condition causes higher (never lower) readings.

c. Oil may be heavier (higher readings) or lighter (lower readings) than expected.

d. Major temperature deviations.

**Do not change the factory calibration** without obtaining data that indicates a calibration change is necessary.

If the output reading is low because of gas, steam, or air in the stream, then **no** amount of calibration will produce satisfactory performance. Eliminate the gas problem, or consult the factory at 1-800-527-6297. Once the gas is gone, a legitimate calibration check can be made.

### 4.1 Checking Calibration Data

The following equipment is required to check the calibration of a cut monitor application and record sample data:

- •A centrifuge (or other API-approved standard) to sample BS&W content.
- •If the stream temperature is greater than 150ºF (65ºC), a sampling bomb with a minimum capacity of 500 ml.
- •Temperature stabilization bath.

### 4.1 Checking Calibration Data (cont.)

To record the sample, proceed as follows:

a. With a personal computer connected to the loop, (as detailed in section 3.3), use key **F4** to display **Real-time View**. As sample is taken, record the
   - •output value (cm) and
   - •capacitance value (pF).

   Generally, these two values should be recorded at one or more different levels of water content (wetter or dryer).

b. If stream temperature is greater than 150ºF (65ºC), use the sampling bomb to take the sample and stabilize the temperature at 150ºF before attempting to spin the sample in the centrifuge.

Compare spin results to the output readings to determine if calibration needs to be trimmed.

- •If the deviation is less than 1.5% water, proceed to section *4.2 Trimming Calibration.*
- •If the deviation is greater than 1.5% water, proceed to section *4.3 Recalibration.*

### 4.2 Trimming Factory Calibration

Use the following procedure to trim (fine tune) the factory calibration.

a. On the Menu display of the PC software, move the cursor to the **LEVEL CALIBRATION** submenu.

b. Enter the deviation amount plus the present real-time value for **Lower Level** (zero calibration value). Press **Enter**.

   For example, if the sampled output was .85% lower than the spin reading; and the present real-time value is 1.02 cm; enter 1.87 cm for **Lower Level**.

c. Enter the deviation amount plus the present real-time value for **Upper Level** (fullscale calibration value). Press **Enter**.

   Using the same example, if the present real-time value is 10.05 cm; enter 10.90 cm for **Upper Level**.

## 4.3 Recalibration

If the sample data recorded in section *4.1 Checking the Calibration Data*, has a deviation greater than 1.5% water:

a. Record sample data and obtain the deviations at the high and low ends of the range--at least half of the span apart.

   For example, on a 0-1% range, the readings should differ by at least 0.50 cm. On a 0-50% range, the readings should differ by at least 25.00 cm.

b. Graph the results of cm readings against actual cut at those readings.

c. Determine from the graph, the deviation values at the zero and full scale points.

d. On the Menu display of the PC software, move the cursor to the **LEVEL CALIBRATION** submenu.

e. Enter the deviation amount plus the present real-time for **Lower Level** (zero calibration value). Press Enter.

   For example, if the sampled output was .85% lower than the spin reading; and the present real-time value is 1.02 cm; enter 1.87 cm for **Lower Level**.

f. Enter the deviation amount plus the present real-time value for **Upper Level** (fullscale calibration value). Press Enter.

   Using the same example, if the present real-time value is 10.05 cm; enter 10.90 cm for **Upper Level**.

If assistance is required, call the factory at 1-800-527-6297.

## SECTION 5 SERVICE

### 5.1 Telephone Assistance

If you are having difficulty with your Drexelbrook equipment, and attempts to locate the problem have failed, notify your local Drexelbrook representative, or call the factory toll free 1-800-527-6297. Drexelbrook Engineering Company is located at 205 Keith Valley Road, Horsham, PA 19044.

To help us solve your problem quickly, please have as much of the following information as possible when you call:

Instrument Model # _____
P.O. #_____
Date_____
Insertion Length_____
Application_____
Material being measured_____
Temperature_____
Pressure_____
Agitation_____
Brief description of the problem _____
Checkout procedures that failed _____

### 5.2 Equipment Return

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

Reason for Return_____
Return Authorization # _____
Person to contact at your company_____
"Ship To" address_____

If available, please also include the original P.O. number and the original Drexelbrook order number.

To keep the paperwork in order, you must include a purchase order with returned equipment, even though it may be coming back for warranty repair. You will not be charged if the equipment is covered under warranty. Please return your equipment with freight charges prepaid. We regret that we cannot accept collect shipments. Drexelbrook usually has exchange units available for faster turnaround of repair orders. 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.

### 5.3 Field Service

Trained field servicemen are available on a time-plus-expense basis to assist in start-ups, diagnosing difficult application problems, or in-plant training of personnel. Contact the service department for further details.

### 5.4 Customer Training

Periodically, Drexelbrook instrument training seminars for customers are held at the factory. These sessions are guided by Drexelbrook engineers and specialists, and provide detailed information on all aspects of level measurement, including theory and practice of instrument operation. For more information about these valuable workshops, write to Drexelbrook Engineering, attention: Communications/ Training Group, or call direct (215) 674-1234.

# SECTION 6
# SPECIFICATIONS

## 6.1 Specifications for Electronic Unit

—*Power Requirement*
20 to 30 Vdc
Minimum of 12 Vdc at 20 mA at transmitter terminals

—*Input Range*
409-1000: 1.0 to 45,000 pF

—*Output Range*
4-20 mA

—*Accuracy*
± .25% of range. Accuracy includes the combined effects of linearity, hysteresis, and repeatability. It refers to the transmitter only and is measured at reference conditions of 25 degrees C ±1°, 10-55% R.H. and 24 ±1.2 Vdc, using a capacitance standard (applied to the transmitter sensor terminals) in place of the sensor.

—*Load Resistance*
Maximum Load Resistance = 750 ohms
Minimum Load Resistance = 250 ohms

—*Temperature Effect*
±1% of range per 50°F (30°C)

—*Supply Voltage Effect*
< 0.1% from 12 to 30 Vdc

—*Effect of Load Resistance*
< 0.1% for full resistance range at 24 Vdc supply.

—*Response to Step Change*
1 second standard (to 90% of final value);
0-90 seconds available with delay

—*Ambient Temperature*
-40°F to +185°F (-40°C to 85°C)

## 6.1 Specifications for Electronic Unit

—*Lowest Permitted Resistance*
(bare sensing element to ground) causing 5% error in each model:

600 ohms - 409-1000
100K ohms - 409-1030

—*Intrinsic Safety*
Sensing element and cable: Designed to be intrinsically safe for Class I Groups A, B, C and D; Class II Groups E, F, and G, (Class III, Div. 1). Electronics and signal wires: Intrinsically safe for Class I Groups A, B, C, and D, Class II Groups E, F and G (Div. 1) when powered by an intrinsically safe power supply. Non-incendive for Class I Groups A, B, C, and D;Class II Groups E, F, and G, Class III, (Div. 2).

## 6.2 Specifications for Coaxial Cable

—*General Purpose 380-xxx-12*
.51" (13mm) OD at largest point,
160°F (70°C) temperature limit

—*Sensing Element Cable Length*
150 feet maximum

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