Installation and Operating Instructions

Series 506-6200
Level Control Transmitter (LCT)
using 406-6200 Electronics
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Series 506-6200
Level Control Transmitter (LCT)
using 406-6200 Electronics
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1.0 Introduction

The instructions in this book are for the Drexelbrook two-wire, 506-6200 Series Level Control Transmitter, LCTTM.

1.1 System Description

The LCT transmitter is a precision, point level, RF (Radio Frequency) analog output level control. The LCT is a two-wire control. It draws current from a remote power supply over a pair of signal wires. This current is both the output signal and the operating power for the point level transmitter. It provides a 4-10 mA output when the material being measured reaches the sensing element point in a vessel, and provides a 14-20 mA output when the sensing element is uncovered.

As an option, the 401-10-220 two-wire Verify circuit is used in conjunction with the 506-6200 Series point level controls for pushbutton verification that the entire control system is functioning properly.

An optional Drexelbrook Point Level receiver provides relay outputs for the LCT transmitter. See the appropriate receiver instruction manual.

The 506-6200 Series LCT transmitter consists of a 406-6200 Series electronic unit, a 700 Series sensing element, and a 380 Series connecting cable (if the unit is remote). See Figure 1-2. The center four digits in the transmitter model number refer to the electronic unit model. For example, 506-6200-8 indicates a standard 406-6200 electronic unit with a 700-221-2 sensing element.

The 700 Series Cote-ShieldTM sensing element is mounted in or near the material being measured and provides a change in impedance to indicate presence or absence of material. Cote-Shield allows the transmitter to ignore the effects of material build-up or coating on the sensing element.

The sensor consists of three sections: center rod (CW), ground (gnd), Cote-Shield (SH). The Cote-Shield terminal shields against the transmission of current, through a coating, from the center element to ground until the level reaches the sensing element. See Figure 1-3.

Two-Terminal insulated sensors (ground and center wire) are used when metallic contact with the process material is undesirable. See Figure 1-4.

![Fig. 1-1 TYPICAL LCT™ SYSTEM](image)

**Fig. 1-1** Typical Two-Wire Point Level Control

![Fig. 1-2 LCT Transmitter (Remote Version)](image)
The change in impedance indicated by the sensing element is transmitted to the point level electronic unit by a Drexelbrook 380 Series Cote-Shield cable. See Figure 1-5.

Transmitter output is one of two current levels; 15-20 mA when the level is in the normal condition, and 4-10 mA when the level is in the fail-safe (alarm) condition.

1.2 Verify System Description

The model #401-10-220 Verify circuit can be used with the LCT™ 506-6200 Series two-wire point level controls. The Verify circuit is designed to duplicate the same signal as a high-level alarm condition. Simulating a high level with the Verify circuit:

• confirms that the system will work in an actual high-level application.
• confirms that the calibration of the system is correct for ISO 9000 purposes.
• checks the integrity and continuity of all wiring connections.
• verifies that the sensing element is in place and properly connected.

1.2.1 Circuit Description

The 401-10-220 two-wire Verify circuit is used in conjunction with the 506-6200 Series point level controls for push-button verification that the control is functioning properly. The complete circuit contains both a 401-10-220 pulse recognition module which is mounted directly onto a 406-6200 Series transmitter, and a 401-10-210 switch module which is wired directly into the 4-20 mA two-wire signal loop.

The Verify circuit can be actuated manually by pushing the switch on the 401-10-210 switch module; or it can be actuated automatically by a computer or programmable controller. The Verify circuit can also be actuated from any of the LCT point level receivers. It is especially useful in point level control applications that involve flammable or explosive materials, toxic materials, environmental pollution control, or fully automated operations.

1.3 Models Available

1.3.1 Electronic Units

<table>
<thead>
<tr>
<th>Electronic Chassis</th>
<th>Model #</th>
</tr>
</thead>
<tbody>
<tr>
<td>with Verify system</td>
<td></td>
</tr>
<tr>
<td>standard sensitivity</td>
<td>406-6200</td>
</tr>
<tr>
<td>standard</td>
<td></td>
</tr>
<tr>
<td>sensitivity with time delay (0-90 seconds)</td>
<td>406-6202</td>
</tr>
</tbody>
</table>
Introduction

1.3.2 Connecting Cables

For all remote systems, the transmitter electronic unit and sensing element are connected by a three terminal coaxial cable. Drexelbrook cables are available in:

- General Purpose: 380-XXX-12
- High Temperature: 380-XXX-18
  (first 10 feet high temp.)

See Section 2.5 for temp ratings.

The XXX in the model number indicates the length of the cable. 5-foot increments up to 25 feet are standard, but cut lengths up to 150 feet are available.

1.3.3 Sensing Elements

The following sensing elements are most often recommended for use with the 506-6200 Series LCT transmitter. They are specified according to the application requirements. For identification, the last two digits of the sensing element model number are stamped on the mounting gland or flange. This listing does not include all of the sensing elements available for use with a 506-6200 Series transmitter. If you have additional questions about sensing elements, contact our local representative or the factory.

- 700-201-5 - rigid sensing element for liquids and light slurries.
  *(506-6200-5)

- 700-202-2 - rigid sensing element for liquids, light slurries, and granulars.
  *(506-6200-2)

- 700-202-19 - rigid sensing element for granulars.
  *(506-6200-15)

- 700-204-38 - rigid sensing element for liquids, slurries, and granulars in higher temperatures.
  *(506-6200-16)

- 700-205-15 - flexible sensing element for liquids and granulars.
  *(506-6200-35)

- 700-207-1
- 700-207-4
- 700-207-6
  *(506-6200-20)

- 700-221-2 - heavy-duty rigid sensing element for abrasive granulars.
  *(506-6200-8)

*System Number

1.3.4 Verify System

- 401-10-201 Verify system
  (includes the following)

- 401-10-220 Pulse recognition module

- 401-10-210 Switch module
Packing Gland Assembly
Do Not Disturb!

Hold here while tightening condulet.

Hold here to install or remove sensing element from vessel.

Wrong
Allows Moisture Infiltration

*Fill Pipe Ends with silicone sealant.

Wrong
Use only cable supplied by AMETEK Drexelbrook

*Fill Pipe Ends with silicone sealant.

Correct
All conduit connections are sealed. Gaskets are in place.

Conduit Breather Drain

Correct

Page 5A
2.0 Specifications

2.1 Electronic Unit

A. Power Requirements
   15 to 28 Vdc

B. Operating Temperature: -40°F to 140°F.
   System will operate above 140°F, but with reduced component life.

C. Sensitivity:
   0.1 pF (406-6200)
   0.01 pF (406-6220)

D. Operating Point Range:
   0 to 90 pF (406-6200)
   0 to 9 pF (406-6220)

E. Output
   4-10 mA (Fail-Safe/Alarm State)
   14-20 mA (Normal State)

F. Fail-Safe:
   Switchable to either Low-Level Fail-Safe
     (LLFS) or High-Level Fail-Safe (HLFS).

G. Signal Wire Spark Protection:
   10 Amperes standard.
   100 Amperes optional.

H. Standard Housings for the 406-6200
   Series electronic units meet the following classifications:

   NEMA 1  General-Purpose
   NEMA 2  Drip-Tight
   NEMA 3  Weather-Resistant
   NEMA 4  Waterproof
   NEMA 5  Dust-Tight
   NEMA 12 Industrial Use

   Explosionproof for Class 1, Div. 1 & 2,
   Groups A, B, C, D, and Class 11, Div. 1 & 2,
   Groups E, F, and G.

I. Intrinsic Safety

   WARNING
   Substitution of components may impair intrinsic safety. All FM
   approved units should be returned to factory for repairs or FM approval
   may be nullified.

   Sensing element and cable: Intrinsically safe in accordance with ISA standard

   SP12 and NFPA standard 493 for Class I,

   Transmitters: Signal wires are intrinsically safe with or without separate
   entity approved barriers per FM and CSA Reference 420-1-587 CD, 420-1-588 CD
   and 420-1-813 CD for specific wiring requirements and details.

J. Entity Approval:
   a. Model No. 406-6200 transmitters
      have Factory Mutual approval as
      being intrinsically safe when
      supplied from an approved
      intrinsically safe power source.
      Transmitter Entity Parameters
      are:

      \[
      V_{\text{max}} = 40 \text{ Vdc} \quad C_i = 0.02\mu F
      I_{\text{max}} = 225 \text{ mA} \quad L_i = 0 \text{ mH}
      \]

      These are the maximum voltage
      and current from the power
      source, and the internal capacity
      and inductance of the
      transmitter.

   b. Entity approved power sources
      may have the following
      maximum values (max. voltage
      and current not to be combined):

      For Groups A, B, C, D:

      \[
      V_{\text{DC}} = 36 \text{ V} \quad C_A = 0.14\mu F
      I_{\text{SC}} = 157 \text{ mA} \quad L_A = 3.4 \text{ mH}
      \]

      For Groups C, D only:

      \[
      V_{\text{DC}} = 40 \text{ V} \quad C_A = 0.45\mu F
      I_{\text{SC}} = 224 \text{ mA} \quad L_A = 7 \text{ mH}
      \]

2.2 Verify System

A. Power Requirements: 4-20 mA recommended.

B. Operating Temperature: -40° to 140°F.
   Units will operate above 140°F, but with
   reduced component life

C. Adjustment Range (401-10-220):
   .3-92 pF high range
   .3-10 pF low range
### Specification

D. Approvals: PTB approved for use in intrinsically safe loop.  
Switch module: Ex ia, Group IIC  
Pulse module: Ex ia, Group IIC

2.3 Three-Terminal Connecting Cables

A. General Purpose (380-XXX-12): .51" O.D. at largest point. 160°F temp. limit.

2.4 Sensing Elements

<table>
<thead>
<tr>
<th>Model</th>
<th>Standard Mat’ls of Const.</th>
<th>Sensor Dia. &amp; Mtg.</th>
<th>Temp. &amp; Pressure Limits</th>
<th>Recommended Insertion Length</th>
<th>Probe Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>700-201-5 (506-6200-5)*</td>
<td>Bare SS with teflon insulators</td>
<td>1/4&quot; Dia. 3/4&quot; NPT</td>
<td>100°F @ 1000 psi 450°F @ 200 psi</td>
<td>6 ft max. 18- in &amp; 36-in std.</td>
<td>3-term. rigid</td>
</tr>
<tr>
<td>700-202-2 (506-6200-2)*</td>
<td>Bare SS with teflon insulators</td>
<td>3/8&quot; Dia. 3/4&quot; NPT</td>
<td>300°F @ 50 psi 450°F @ 20 psi</td>
<td>6 ft max. 18-in &amp; 36-in std.</td>
<td>3-term. rigid</td>
</tr>
<tr>
<td>700-202-19 (506-6200-15)*</td>
<td>Bare SS with silicone &amp; rubber insulators</td>
<td>3/8&quot; Dia. 3/4&quot; NPT</td>
<td>300°F @ 50 psi 450°F @ 20 psi</td>
<td>6 ft max.</td>
<td>3-term. rigid</td>
</tr>
<tr>
<td>700-202-23 (506-6200-6)*</td>
<td>Bare SS with teflon insulators</td>
<td>1/2&quot; Dia. 1 1/2&quot; NPT</td>
<td>100°F @ 1000 psi 450°F @ 200 psi</td>
<td>10 ft max. 18-in &amp; 36-in std.</td>
<td>3-term. rigid</td>
</tr>
<tr>
<td>700-204-38 (506-6200-16)*</td>
<td>Bare SS with ceramics insulators</td>
<td>1/2&quot; Dia. 1 1/4&quot; NPT</td>
<td>200°F @ 2000 psi 500°F @ 1000 psi</td>
<td>6 ft max.</td>
<td>3-term. rigid</td>
</tr>
<tr>
<td>700-205-15 (506-6200-35)*</td>
<td>Bare SS with teflon insulators.</td>
<td>3/16&quot; Dia. 1&quot; NPT</td>
<td>450°F @ 0 psi</td>
<td>200 ft max.</td>
<td>3-term. flexible</td>
</tr>
<tr>
<td>700-207-1 (506-6200-20)*</td>
<td>Bare SS with rubber insulators.</td>
<td>12&quot; X 12&quot; (10&quot; X 10&quot; cutout)</td>
<td>180°F @ 1 psi</td>
<td>-----</td>
<td>3-term. flush</td>
</tr>
<tr>
<td>700-207-4 (506-6200-24)*</td>
<td>410 or 416 heat treated s.s. with rubber insulators</td>
<td>12&quot; X 12&quot; (10&quot; X 10&quot; cutout)</td>
<td>180°F @ 1 psi</td>
<td>------</td>
<td>3-term. flush</td>
</tr>
<tr>
<td>700-207-6 (506-6200-26)*</td>
<td>Bare SS with rubber insulators.</td>
<td>8&quot; X 8&quot; (7&quot; X 7&quot; cutout)</td>
<td>180°F @ 1 psi</td>
<td>-----</td>
<td>3-term. flush</td>
</tr>
<tr>
<td>700-221-2 (506-6200-8)*</td>
<td>Bare SS with teflon insulators.</td>
<td>1&quot; Dia. 2&quot; NPT</td>
<td>300°F @ 50 psi 450°F @ 20 psi</td>
<td>6 ft max.</td>
<td>3-term. rigid</td>
</tr>
<tr>
<td>700-1-4 (506-6200-400)*</td>
<td>Teflon insulated with SS mounting</td>
<td>3/8&quot; Dia. 3/4&quot; NPT</td>
<td>100°F @ 1000 psi 300°F @ 500 psi</td>
<td>6 ft max.</td>
<td>2-term. rigid</td>
</tr>
<tr>
<td>700-2-57 (506-6200-401)*</td>
<td>&quot;X&quot; ** insulated with SS mounting</td>
<td>.84&quot; Dia. 1&quot; NPT</td>
<td>100°F @ 1000 psi 250°F @ 500 psi</td>
<td>20 ft max. 3 ft, 4 ft, 6 ft, 8 ft, and 10 ft std.</td>
<td>2-term. rigid</td>
</tr>
</tbody>
</table>

* System number  
** "X" is a fluorcarbon-type insulation.
3.0 Theory of Operation

3.1 Electronic Unit

As a two wire electronic unit, the LCT transmitter receives its power from and transmits its signal to a receiver over the same pair of signal wires. This signal wire input voltage is applied to a power supply which supplies both an unregulated potential (B+) and a 10 volt regulated potential which powers all other circuit blocks. See Figure 3-1.

The material in the tank is seen as an admittance in the bridge circuit. During calibration, the variable capacitor marked “operating point adjustment” is set to the point where the bridge is balanced with the material at the level where indication is desired. The balance condition exists when the probe and shield outputs of the bridge are at the same potential. The shield output is connected to the sensing element’s CoteShield electrode via the shield conductor of the 3-terminal cable, thus enabling the sensing element to ignore coatings.

(This is discussed more fully in paragraph 3.2.)

A 110 khz sinusoidal oscillator drives the bridge circuit producing a small error signal whose amplitude is directly proportional to the degree of bridge unbalance. This signal is amplified in the error amp to a level that can be processed by the detector. At the detector, the amplified error signal is compared to a signal of fixed amplitude and phase shift. The detector’s output is a signal whose state is directly determined by the presence or absence of material at the sensing element trip point. An optical isolation circuit couples the output of the detector to the transmitter output circuitry while providing high voltage isolation between the probe and power circuits. The fail-safe selector includes a switch which selects the polarity of signal applied to the current sink. With the fail-safe switch, the customer can select whether he wants relay actuation at the receiver with the material level above (LLFS) or below (HLFS) the sensing element trip point. (See Section 5.2.4 for more information on the fail-safe selector.) Finally, the output of the fail-safe selector drives a current sink which draws the appropriate

---

**Fig. 3-1**
Block Diagram of 506-6200 Series Transmitter
current from the receiver and lights the LED in the normal material condition.

3.2 Cote-Shield™ Action

Figure 3-2A shows an exaggerated view of how a coating may look in a level control system. Figure 3-2B shows an electrical equivalent circuit of this coating left on the sensing element. The center wire of the coax is connected to the center rod of the sensing element, and the shield of the coax is connected to the middle element of the sensing element, called the Cote-Shield element. The ground wire of the cable is connected to the conduit and, therefore, to the vessel body. As in the case of the coax, since there is no difference in voltage between the center element and the Cote-Shield element, there can be no current flow through any resistance due to the coating that may exist on the insulator. The electronic instrument measures only the current that travels from the sensing element center wire to ground, and this can only occur through the actual material being measured. There will be a current flowing from the Cote-Shield element to the vessel wall because of the potential difference that exists there.

However, this current is not measured. When the level in the vessel does rise and touch the center rod of the sensing element, it causes a current to flow that is sensed by the demodulator. The current is transmitted to a remote receiver containing a level alarm. The current received causes the alarm’s relay to change states.

An advantage of the two-wire LCT system is that by using the approved Drexelbrook receiver, or approved power supply the output wires can be made intrinsically safe and need not be in conduit. The transmitter is also intrinsically safe.

3.3 Sensing Element

The necessary change in capacitance is provided by the sensing element which is mounted in or near the material being measured. It is a conductive rod or plate that changes electrical impedance to ground when the material being measured changes level on or near the active portion of the sensing element.

Sensing elements are available in many forms, depending chiefly on the application factors of temperature, pressure, insertion length, and the characteristics of the product being measured, such as viscosity, coating, corrosion, conductivity, and dielectric constant. When these properties are known, the factory will select the correct sensing element for the application.

Because of the ability to electrically ignore material build-up on the sensor, three terminal Cote-Shield sensing elements should always be used in applications where the material being measured is conducting and leaves behind a coating. In such applications, the sensing element is mounted either horizontally at the desired level or vertically with the insertion length stopping at the desired level. For conducting materials, the operate point will be the lowest point on the active sensing element.

For insulating materials, a vertically mounted three-terminal sensing element may have the operating point adjusted over the entire active length of the rod (between the Cote-Shield length and the insertion length). See Figure 3-3.
A horizontally mounted sensing element has the advantage of much greater capacitance change per inch, but will always operate within a fraction of an inch from its lowest active point.

3.4 Connecting Cables

Drexelbrook LCT controls typically use three-terminal coaxial cables for connecting the sensing element to the transmitter electronic unit (406-6200 Series). The center wire of the cable carries the change in impedance signal from the sensing element to the electronic unit, while the coaxial shield eliminates any stray capacitance from the center wire to ground. As a result, the cable capacitance does not interfere with the impedance signals from the sensing element.

3.5 Verify System (optional)

The function of the 2-wire verification system is to momentarily confirm the complete operation of the high level alarm on a 506-6200 Series On/Off system. Refer to Figures 3-4 and 3-5.

By pressing the Verify switch on the 401-10-210 switch module or on any LCT receiver (optional), a momentary short circuit is created on the signal wires. The short circuit is recognized by the pulse module as a negative-going pulse. (Note that the pulse module requires a minimum voltage drop of 6.0 volts.) The pulse module will then add a predetermined (calibrated) amount of capacitance to the probe-to-ground terminals on the transmitter in order to simulate a high-level alarm condition in a tank. If the system is functioning properly, the added capacitance forces the transmitter to change its output state from normal to alarm.

When activated, the Verify function will confirm that the point level control is functioning properly. If there are any faults or malfunctions associated with the point level control or the calibration on the transmitter has been desensitized, no alarm signal will be generated when the switch is activated. The LED on the transmitter will remain "ON."

The predetermined amount of capacitance that is switched in during the system verify operation is controlled by means of an adjustment potentiometer, shown in Figure 3-6. The Verify system has the ability to check if there are defects in the coaxial cable and/or the sensing element.
Fig. 3-4

Block diagram of 506-6200 LCT™ control with 401-10-201 Verify™ Circuit and intrinsically-safe switch module. (Per PTB EX-90.C.2077X)

Fig. 3-5

Block diagram of 506-6200 LCT™ control with 401-10-201 Verify™ Circuit and non-hazardous switch module.
4.0 Installation

4.1 Unpacking

Carefully remove the contents of the shipping 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.

4.2 Mounting the Electronic Unit

The 406-6200 Series electronic unit 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, place the instrument in a reasonably accessible location. Ambient temperatures should be between -40°F and 140°F (-40°C and 60°C). Integral electronics and sensor are available for quick and easy installation in application where temperature and vibration are not prohibitive. See Figures 4-1A and 4-1B.

4.2.1 Installation Locations and Approval Codes

Non-Intrinsically Safe Transmitter Installations

a. These transmitters have Factory Mutual approval as associated equipment, having intrinsically safe connections to the sensing element, even if the transmitter and signal leads are not intrinsically safe.

b. With a non-intrinsically safe DC supply (which will not use or generate more than 250V_{max}) the transmitter may be used in Class I Division 2 or in Class I Division 1 if the installation is explosionproof.

c. In Class I Division 2 the signal leads must be run in medal conduit, but conduit seals are not required except where conduit enters the non-hazardous area.

d. For Class II Group E Division 1 installations, wiring must enter the transmitter housing through dust tight cable fittings or threaded conduit for NEC.

Hazardous Area Classification

a. When connected to approved 406-6200 transmitters, Series 700 sensing elements and cable are all intrinsically safe for Division 1, Class I, II, III, Groups A-F, whether the transmitters are or are not intrinsically safe.

b. When connected to approved power sources, approved model 406-6200 transmitters are intrinsically safe for Division 1, Class I, II, III, Groups A, B, C, D or Groups C, D, depending on the power source classification.

Explosionproof Installations

For explosionproof installations, the 406-6200-F01 chassis is approved only when mounted in one of the FM approved explosionproof housings: NEMA 1, 4, 4X, 7ABCD, 9 EFG, 12, 13.
Installation

Electrical Codes

Installation of this equipment in an area where there may be hazardous materials, such as explosive gases, dusts or fibers, must comply with one of the following in U.S.A. or Canada.

a. Article 500-504 of the National Electrical Code (NEC) NFPA 70 for U.S.A.

b. Section 18 of the Canadian Electrical Code, Part 1, C22.1 for Canada.

I.S.A. RP12.6


4.3 Mounting the Sensing Element

The mounting location of the sensing element, whether remote, integral or close-coupled to the electronic unit, often depends on the placement of nozzles or openings into the vessel. **Note:** Do not mount the sensing element through a nozzle which exceeds the first insulator. Be sure the Cote-Shield extends through the nozzle, through the wall buildup, and at least 2” (50mm) into the vessel. See Figure 4-2. In all cases, it is important to protect the insulation on the sensing element against cuts and scrapes during installation. All Series 700 sensing elements may be installed in hazardous areas.

Rigid sensing elements can be mounted either vertically or horizontally. However, flexible sensors must be mounted from the top of the vessel with either an anchor or weight at the bottom. See Figure 4-3.
4.3.1 Flush Sensing Element

The flush sensing element should be mounted in the flow stream. Mounting the sensing element in the flow stream prevents excessive build-up of material on the face of the sensing element. Excessive build-up can occur if sensing element is protected from falling material, as shown in Figure 4-3A. The sensing element is built to withstand the impact of coal, rock, wood, chips, etc. Figure 4-3B shows the recommended sensor location at top of chute. For recommended sensor location at bottom of chute see Figure 4-3C. Low level sensors typically see enough flowing material that location is not as critical. Figure 4-3D shows the recommended sensor location in an angle chute.

Fig. 4-3A
Flow Build-up on Sensor

Fig. 4-3B
Vertical Chute, High Level Sensing Element Location

Fig. 4-3C
Vertical Chute, Low Level Sensing Element Location

Fig. 4-3D
Sensor Location, Angle Chute
Installation

4.4 Mounting the Verify System:
401-10-220 Pulse Recognition Module
401_10_210 Verify Switch Module

For mounting, see Figures 4-4 and 5-5. The 401-10-220 pulse recognition module is mounted directly onto the 406-6200 Series transmitter on the power/signal connection side.

The 401-210 Verify Switch module can be mounted on a standard 35mm DIN rail or screw-mounted to a panel.

4.5 Wiring the Electronic Unit

Note: The electronic unit has a grounding link between the ground and common terminals. The link is required for hazardous area operation and should not be removed before consulting the factory.

All signal and power connections are made to the terminal strip on the 406-6200 Series chassis. These connections are (+), (-), comm, and ground. See Figure 4-6. If signal wires cannot be referenced to circuit ground, please consult factory.

The sensing element cable connections are made to the back of the instrument chassis. These connections are labeled ground (GND), shield (SH), and center wire (CW). See Figure 4-7.

Wiring to PLC or DCS w/ Non-isolated Inputs
The negative side of loop is grounded to the chassis (housing) at the electronic unit. If connecting this product to an instrument that is grounded OTHER THAN at the negative input terminal, contact Drexelbrook Service Department at 1-800-527-6297 (US & Canada; all others call 1-215-674-1234).

For wiring diagrams with With Verify System, see Figures 4-10 and 4-11

Fig. 4-4
Mounting the 401-10-220 Pulse Recognition Module

Fig. 4-5
Mounting the 401-10-210 Verify Switch Module

Fig. 4-6
Signal Wiring to Electronic Unit

Fig. 4-7
Sensing Element Connections to the Electronic Unit
4.6 Wiring the Sensing Element

Note: Only Drexelbrook coaxial cables (Series 380) should be used to connect the electronic unit to the sensing element. Use of other cables could result in damage to the unit. Never splice cables. Do not shorten or reterminate cables without using the Drexelbrook termination kit (#389-1-6).

For sensing elements that are to be mounted remotely from the electronic unit cable connections are made to the sensing element after it has been installed in the vessel, with the conduit attached. Again, these connections are GND, SH, and CW. See Figures 4-8A and 4-8B. For two-terminal insulated sensing elements, the SH connection must be clipped and insulated at the sensing element conduit so it cannot short to either terminal. Integral and close-coupled models are wired at the factory prior to shipping.

Applications involving insulating granulars and some insulating liquids may require extra spark protection against the discharge of static sparks that can damage the electronic unit. Heavy duty spark protection circuits are typically mounted in the sensing element conduit. See Figure 4-9.

Fig. 4-9
Installing the Spark Protection Circuit

If spark protection is supplied, use the following instructions for installing the spark protector in the sensing element conduit.

A. Attach the mounting link on the spark protector to the sensing element center connection screw.

B. Connect the green wire from the spark protector to the conduit ground screw.

C. Feed the cable into the conduit.

D. Connect the cable centerwire (CW) to the spark protector, and the cable ground wire (GND) to the ground screw as shown.

E. Connect the shield wire (SH) to the Cote-Shield terminal.*

*For sensing elements that do not have shield connections, clip the shield wire at the conduit and tape it so it will not short to anything.
4.7 Wiring the Verify System:
401-10-220 Pulse Recognition Module
401-10-210 Verify Switch Module

The power/signal wires are connected to the 401-10-220 unit as shown in Figure 4-10. Figure 4-11 shows the wiring to the 401-10-210 Verify switch module.

![Diagram of Wiring](image)

Fig. 4-10
Wiring the 401-10-220 Pulse Recognition Module

![Diagram of Wiring](image)

Fig. 4-11
Wiring the 401-10-210 Verify Switch Module

<table>
<thead>
<tr>
<th>Switch Module Input Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO.</strong></td>
</tr>
<tr>
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</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
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<td>7</td>
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<tr>
<td>8</td>
</tr>
</tbody>
</table>

LOOP RESISTANCE (2–5) = 50 ohms
5.0 Calibration/Operation

5.1 Start-Up

Before applying power to both the transmitter and receiver, check the wiring connections. See Sections 4.5 through 4.7. Also see Receiver Instruction Manual.

**Note:** For maximum overfill security, verify system should be checked and certified by a Drexelbrook authorized technician.

**Warnings:** Units in Hazardous Areas. If the signal wiring is not intrinsically safe, the area must be checked and known to be non-hazardous before removing the explosion-proof housing cover to calibrate the unit. When calibration is complete, the cover must be replaced.

Each lead from the explosion-proof case must be equipped with an approved seal fitting.

Signal wiring and instruments are not intrinsically safe unless: (1) The power source is approved as intrinsically safe for this instrument in the hazardous atmosphere in which it will be used; and (2) the signal wiring is done in accordance with the National Electrical Code.

5.2 Control and Adjustments

5.2.1 Setpoint Adjustment Without Verify System

There is a single adjustment located on top of the electronic unit chassis that controls the level at which the LED on the top of the electronic unit operates. See Figure 5-1.

**Fig. 5-2**
Verify Adjustment

5.2.2 Setpoint Adjustment with Verify System

Each revolution of the setpoint adjustment will change the operating point approximately 3 pF (3 pF if using a 406-6220, high sensitivity unit). Turning the adjustment clockwise will raise the level at which the LED operates, and turning it counterclockwise will lower the level at which the LED operates.

The system verify adjustment is located on the front of the transmitter. The verify adjustment is activated by simultaneously holding down the CAL button on the transmitter and rotating the screw adjustment. Refer to Figure 5-2. See Section 5.5 for complete calibration procedures.

5.2.3 Time Delay Control

The time delay control is located on top of the electronic unit, across from the setpoint adjustment. See Figure 5-3. It is used to help stop variations in output due to agitation or frothing in the vessel. The standard time delay is 0-90 seconds, and is represented by a number 2 in the seventh digit from the left in the electronic unit model number. Example: 406-62X2-XX.
The delay applies only to recovery from the alarm condition. On a High-Level Fail-Safe unit, the delay will be effective only on falling level. The output will indicate high level as long as waves are touching the sensing element. The unit will stop indicating high level only after the time delay period has stopped.

5.2.4 Fail-Safe Selector

NOTE
Units with Verify system must not be used in LLFS mode.

Fail-safe describes the level condition which causes the output signal to change states. High-Level Fail-Safe (HLFS) means the output signal will change to the alarm state under high level conditions (indicating high level upon loss of power). Low-Level Fail-Safe (LLFS) means the output signal will change to the alarm state under low level conditions (indicating low level upon loss of power). The instrument is supplied in the fail-safe requested when the order is placed. (HLFS, if not specified).

The fail-safe may be field selected by moving a slide switch, accessible through a hole in the side of the chassis when the chassis is removed from the housing.

5.3 Calibration Procedures

All 506-6200 Series controls with bare metal sensing elements are factory set to switch in all water-based conducting materials. No calibration adjustment is needed when used in water-based conductive materials. See paragraphs 5.3.1 through 5.3.3 for calibration of other applications.

NOTE
If unit has Verify system and maximum overfill security is required, then Verify system should be checked by a Drexelbrook authorized technician. Also see Section 5.5.

5.3.1 Calibration of all horizontal sensing elements in insulating materials, or horizontal insulated sensing element.

NOTE
LED on indicates that the output is in the normal condition 14-20 mA (not alarm). Do not turn any adjustment past its mechanical stops; damage to the unit may occur. Be sure to use the insulated calibration tool. See Figure 5-5.
**Calibration/Operation**

C. Turn the adjustment slowly clockwise (CW) until the LED just changes states.

D. Mentally note the position of the adjustment tool pointer.

E. Increase the material level until it is well above the sensing element. See Figure 5-7.

---

**Fig. 5-5**
绝缘校正工具

A. Be sure that the level is well below the end of the sensing element. See Figure 5-6.

---

**Fig. 5-6**
水平安装具有水平线水平感应元件

B. Using the insulated tool supplied with the instrument, turn the setpoint adjustment to the full counterclockwise (CCW) position. See Figure 5-5.

---

**Fig. 5-7**
水平安装具有水平线水平感应元件

F. Counting the number of turns, turn the adjustment slowly clockwise (CW) until the LED once again just changes states (or you come to the end of the adjustment travel).

G. Turn the adjustment back counterclockwise (CCW) half the number of turns that were counted.

H. For recalibration purposes, record half the number of turns that were counted as “Preload”. See Section 5.6.

Calibration is complete.

**Note:** if less than 1/4 turn of the adjustment was observed between the points where the sensing element was covered and uncovered, please consult factory.
5.3.2. Calibration of all vertical sensing elements in insulating materials, or vertical insulated sensing elements.

Note: LED on indicates that the output is in the normal condition 14-20 mA (not alarm). Do not turn any adjustment past its mechanical stops; damage to the unit may occur. Be sure to use the insulated calibration tool. See Figure 5-5.

A. Set the level to a point on the sensing element where control is desired. (Recommend 3 inches of coverage minimum.) See Figure 5-8.

![Diagram of vertical mount with level at the point of control]

B. With the insulated tool supplied, start from the full counterclockwise (CCW) position and, counting the number of turns, turn the adjustment clockwise (CW) until the LED on top of the unit just comes on (HLFS) or just goes out (LLFS). Record the number of turns from the full CCW position for recalibration.

Note: If the dielectric constant of material changes, the point of operation will change accordingly.

Calibration is complete.

5.3.3 Emergency Method of Calibration

This method is only recommended when it is not possible to follow one of the standard methods of calibration.

Note: LED on indicates that the output is in the normal condition 14-20 mA (not alarm). Do not turn any adjustment past its mechanical stops; damage to the unit may occur. Be sure to use the insulated calibration tool.

A. In either HLFS or LLFS when it is not possible to lower the level below the sensing element, find the operating point in the material and rotate the adjustment 1/2 turn counterclockwise (CCW). (If no operate point is found, then continue to the end of the adjustment travel.)

B. In either HLFS or LLFS when it is impossible to cover the sensing element with material, find the operating point in air and turn the adjustment clockwise (CW) 1/2 turn.

Calibration is complete.

5.3.4 Calibration of Time Delay Units.

0-90 Seconds is the standard time delay. See Section 5.2.3. AutoVerify feature is not available with transmitters that have time delay.

A. Turn the time delay adjustment to the extreme counterclockwise position (i.e., minimum time delay). See Figure 5-3).

B. Proceed with the appropriate calibration procedure.

C. After the instrument is adjusted to the desired operating point, turn the time delay adjustment clockwise until the required delay is achieved. Standard time delay instruments are adjustable over the range of approximately (0-90) seconds delay. If the instrument is Low-Level Fail-Safe, the delay will be with increasing level.
5.3.5 Calibration of Flush Sensing Element

A. Blind Calibration High Level Fail Safe: (Alarm when chute is full at sensor). See Figure 5-9.

When calibrating a high level fail safe system it is important to follow the correct procedure. Start with the sensing element uncovered (no material at sensing element) and the tuning adjustment full counter clockwise. At this point the LED will be out. Start turning the adjustment clockwise until the LED turns on.

Test unit by turning the adjustment counter clockwise, then clockwise to determine the differential of the electronics. If the turn-on and turn-off of the LED is greater than 1/4 turn, the unit is not operating correctly, call the factory service department at 1-800-527-6297. This is a simple function test of the electronics.

If this operation is satisfactory, then continue turning the tuning adjustment:

A. Clockwise (1) one turn for granulars containing moisture.

B. Clockwise (1/2) one half turn for dry insulating powders.

This completes calibration of the high level fail safe flush system.

B. Blind Calibration Low Level Fail Safe: (Alarm when chute is empty at sensor). See Figure 5-9.

When calibrating a low level fail safe system, start with the sensing element uncovered (no material at sensing element) and the tuning adjustment full counter clockwise. At this point the LED will be on. Turn tuning adjustment clockwise until the LED is off.

---

Fig. 5-9  
Calibration of Flush Sensing Element
5.5 Calibrating the LCT Point Level Control with Verify System

The point level control must be properly calibrated before calibration of the Verify circuit.

For Verify calibration, transmitter must be in high level fail safe mode and sensing element must be in air.

A. Begin with the element uncovered. The LED on top of the 506-6200 unit should be “ON”.

B. Locate verify adjustment screw slot on front of transmitter. See Figure 5-10.

C. Activate the Verify adjustment by pressing the CAL switch located on the pulse recognition module attached to the front of the transmitter. See Figure 5-10.

D. Using a small screwdriver, and starting from the full counterclockwise (CCW) position, slowly turn the adjustment clockwise (CW) until the LED on the transmitter just turns “OFF”.

E. Add 1/8 turn clockwise (CW) and release the “CAL” switch, and calibration of the Verify circuit is complete.

**NOTE:** If calibration was done correctly, the LED on the transmitter will be “ON”. If there are any faults or malfunctions associated with the point level control, no alarm signal will be generated when the remote Verify switch is activated. The LED on the transmitter will remain “ON”.

5.4 Recalibration

If the amount of preloading was recorded at the time of initial calibration, you can replace the instrument without experimentally determining the proper amount of preload.

A. For recalibration using the procedure in Section 5.3.1, follow steps A, B, C, then turn the adjustment clockwise (CW) the amount of the preload.

B. For recalibration using the procedure in Section 5.3.2., turn the adjustment clockwise (CW), from the full CCW position, the amount of the preload.

**NOTE:** LCT transmitters that have time delay cannot also use the AutoVerify system. The Auto Verify circuitry disables the alarm outputs for 3.5 seconds. If a time-delayed transmitter is used with AutoVerify, the alarm would remain past the Verify test and fire the alarm relays after every test.
6.0 Troubleshooting

6.1 Introduction

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

A spare electronic 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 should occur when operating your measurement system, divide the system into its component parts and test each part individually for proper operation.

The troubleshooting procedures listed here should be followed in checking out your system. If attempts to locate the difficulty fail, notify your local factory representative or call the factory direct and ask for the service department.

**WARNING**

Any adjustment of the operating point on the Verify system will invalidate Drexelbrook overfill certification. Please contact factory for information.

6.2 Testing the LCT Electronics (406-6200 Series)

a. Remove the sensing element cable and the two signal wires.

b. Connect a 15-28 VDC power supply and meter or calibration system as shown in Figure 6-1.

c. Starting from the full counterclockwise (CCW) position of the operating point adjustment, start turning clockwise until the LED indicator changes state.

d. The meter should indicate 4-10mA with the LED off, and 14-20 mA with the LED on.

e. The rotation of the adjustment should be approximately 1/8-turn between LED ON and LED OFF.

6.3 Testing 406-6200 Electronics with Verify System

The primary function of the Verify system is to check operation of complete on-off overfill system.

If system fails to respond to Verify input:
Troubleshooting

a. Confirm tank is empty and LED on transmitter is "ON".

b. If tank is confirmed empty and transmitter LED is "OFF", proceed to Section 6.4.

c. Add capacitor (C \geq 100 \text{ pF}) across probe-ground terminals on transmitter.

d. If transmitter operates (LED turns "OFF"), check sensing element and coaxial cable.

6.4 Testing the Cote-Shield™ Sensing Element

Visually check the cable connections at the sensing element and the transmitter electronic unit. See Section 4.5 and 4.6. It is a common error to ground the Cote-Shield wire.

6.4.1 Level Below the Sensing Element

a. With an analog ohmmeter*, measure across the sensing element terminals and record these values. See Figure 6-2.

* A digital ohmmeter may give erroneous readings.

Resistance, center wire to shield

Resistance, shield to ground

Resistance, center wire to ground

b. With the sensing element in air and no coating interference, the resistance measured should be infinite in all three cases. Resistance less than one megohm indicates leakage, probably due to product or condensation in the conduit, around the gland/packing nut area. (Consult factory.)

c. If low resistance readings are caused by a coating on the sensing element, those readings will be infinite when the coating is removed.

d. For proper function, the minimum resistance with a coating on the sensing element should be:

Center wire to ground - 1000\Omega
Center wire to shield - 600\Omega
Shield to ground - 300 \Omega

e. If the measurement resistance figures are lower than recommended, contact the factory service department.

Fig. 6-2  
Testing the Sensing Element with Level Below the Probe
6.4.2 Level Above the Sensing Element

a. Repeat Step A in Section 6.4.1 with level covering the sensing element. See Figure 6-3.

![Diagram of Level Above the Sensing Element]

Fig. 6-3
Testing the Sensing Element with Level Above the Probe

b. Compare these resistance values with the minimum resistance numbers in Step D, Section 6.4.1.

c. If the measurement resistance values are lower than recommended, contact the factory service department.
6.5 Checking the Sensing Element Cable

**NOTE**
If there is water or other conductive material in the conduit, it could cause the instrument to fail. If this is the case, it will not be detected by this test.

1. DISCONNECT CABLE AT BOTH ENDS. BE SURE ALL TERMINALS ARE STANDING CLEAR

   ![Diagram of Instrument End]

   **GROUND WIRE**

   **INSTRUMENT END**

   **CENTER (PROBE) WIRE**

   **COTE-SHIELD WIRE**

   **PROBE END**

2. MEASURE RESISTANCE FROM CENTER WIRE TO COTE-SHIELD. RESISTANCE SHOULD BE INFINITY (OPEN CIRCUIT)

   ![Diagram of Measurement]

3. SHORT PROBE AND COTE-SHIELD TERMINALS TOGETHER AT ONE END.

4. MEASURE RESISTANCE FROM PROBE TO COTE-SHIELD TERMINALS AT OTHER END. RESISTANCE SHOULD BE NEAR ZERO OHMS (SHORT CIRCUIT).

   ![Diagram of Measurement]

5. REPEAT STEP 2 FOR COTE-SHIELD AND GROUND TERMINALS

   ![Diagram of Measurement]

6. SHORT COTE-SHIELD AND GROUND TERMINALS AT ONE END

7. REPEAT STEP 4 FOR COTE-SHIELD AND GROUND TERMINALS
### 6.6 Possible Problems with Probable Causes

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Possible</th>
<th>Checkout</th>
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<tbody>
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<td>1. Transmitter can't be calibrated.</td>
<td>a. Open in coax cable.</td>
<td>a. Sec. 6.5</td>
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<tr>
<td></td>
<td>b. Coax cable not properly connected.</td>
<td>b. Sec. 4.5 &amp; 4.6</td>
</tr>
<tr>
<td></td>
<td>c. Insufficient signal from sensing element.</td>
<td>c. Sec. 6.4</td>
</tr>
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<td>d. Transmitter needs padding capacitor.</td>
<td>d. Sec. 6.2</td>
</tr>
<tr>
<td>2. Transmitter gives false alarm.</td>
<td>a. Improper calibration.</td>
<td>a. Sec. 5.3</td>
</tr>
<tr>
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<td>b. Lose wiring.</td>
<td>b. Sec. 4.5 &amp; 4.6</td>
</tr>
<tr>
<td>3. Transmitter operates intermittently</td>
<td>a. Improper calibration.</td>
<td>a. Sec. 5.3</td>
</tr>
<tr>
<td></td>
<td>b. Loose wiring.</td>
<td>b. Sec. 4.5 &amp; 4.6</td>
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</table>
7.0 Factory Support

7.1 Factory Assistance

AMETEK Drexelbrook can answer any questions about your level measurement system. Call Customer Service at 1-800-553-9092 (US and Canada), or + 215-674-1234 (International).

If you require assistance and attempts to locate the problem have failed:
• Contact your local Drexelbrook representative,
• Call the Service department toll-free at 1-800-527-6297 (US and Canada) or + 215-674-1234 (International),
• FAX the Service department at + 215-443-5117, or
• E-Mail to drexelbrook.service@ametek.com

Please provide the following information:

Instrument Model Number __________________________
Sensing Element Model Number and Length ___________
Original Purchase Order Number _____________________
Material being measured ____________________________
Temperature ____________________________________
Pressure _________________________________________
Agitation _________________________________________
Brief description of the problem ____________________
________________________________________________________________________________________
Checkout procedures that have failed __________________
________________________________________________________________________________________

7.2 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.

7.3 Customer Training

Periodically, AMETEK 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 AMETEK Drexelbrook, attention: Communications/Training Group, or call direct + 215-674-1234.
7.4 Equipment Return

In order to provide the best service, any equipment being returned for repair or credit must be pre-approved by the factory.

In many applications, sensing elements are exposed to hazardous materials.

- **OSHA mandates** that our employees be informed and protected from hazardous chemicals.
- **Material Safety Data Sheets (MSDS)** listing the hazardous materials to which the sensing element has been exposed **MUST** accompany any repair.
- It is your responsibility to fully disclose all chemicals and decontaminate the sensing element.

**To obtain a return authorization (RA#)**, contact the Service department at 1-800-527-6297 (US and Canada) or +215-674-1234 (International).

**Please provide the following information:**

Model Number of Return Equipment ____________________

Serial Number ________________________________

Original Purchase Order Number __________________

Process Materials that equipment has been exposed to______________________________

MSDS sheets for any hazardous materials

Billing Address ________________________________

Shipping Address ________________________________

Purchase Order Number for Repairs ________________

*Please include a purchase order even if the repair is under warranty. If repair is covered under warranty, you will not be charged.*

Ship equipment freight prepaid to:

AMETEK-DREXELBROOK.
205 KEITH VALLEY ROAD
HORSHAM, PA 19044-1499
COD shipments will not be accepted.
APPENDIX A

Shortening or Lengthening Sensing Element

**CAUTION:**
The insulation length of either **Flush Sensing Elements** or **Insulated Sensing Elements** can NEVER be changed. **Cable sensing elements** can only be shortened and instructions are included with each unit.

The Need
Sometimes your application calls for probe lengths other than the standard 18-inch or longer insertion lengths supplied. Shortening the sensing element is quite simple and can be done in the field. Lengthening the sensing element, however, is more difficult because the metal rod, typically 304SS or 316SS, must be welded.

Before making any Adjustments:
1) Read the following instructions thoroughly.
2) Remove Power
3) Disconnect the electronics.
4) Protect electronics from any static discharge.
5) Protect electronics from any heat.

Shortening
The bare metal center rod of the sensing element can be shortened with a hacksaw. Be careful not to cut either of the two insulators. See Figure on this page.

In applications using conductive or water-based materials, shortening is not a problem. Leave a minimum bare metal center rod length of two (2) inches.

For dry granular materials, such as powder, sand, corn, clinker, etc., you must leave a minimum bare metal center rod length of eight (8) inches. Consult the factory before shortening beyond this point.

Lengthening
To lengthen the sensing element, an extension rod can be welded onto the end of the bare metal center rod. Make sure that the extension rod is the same metal as the sensing element.

An alternate option is to add a pipe coupling and a section of metal pipe after threading the tip of the sensing element. In this case, the metal pipe need not be identical to the metal of the sensing element.
APPENDIX B
APPROVAL DRAWINGS

These drawings are on the the pages following this sheet:

CSA Control Drawings for 406-6200 Series Transmitter 420-0001-588-CD

FM Control Drawings for 406-6200 Series Transmitter 420-0001-813-CD
DIV. 2 LOOP, NO BARRIERS

REMOTE 700 SERIES PROBE

380 SERIES CABLE

DREXELBROOK 406-6200 SERIES TRANSMITTER

- CW
- SH
- GND

WARNING:
DO NOT REMOVE GROUNDING LINK.

OPTIONAL INTEGRAL PROBE

13-28 V DC POWER SOURCE

REMOTE AND INTEGRAL PROBES AND CABLE
INTRINSICALLY SAFE FOR
CLASS I GROUPS A, B, C, D.
CLASS II GROUPS E, F, G.
CLASS III.

DIVISION I

NON-INCENDIVE FOR
CLASS I GROUPS A, B, C, D.
CLASS II GROUP E, F, G.
CLASS III.
(SEE NOTE FOR CLASS II AND III)

DIVISION 2

MODEL NUMBERS OF CERTIFIED
TRANSMITTERS SHOWN ON SHEETS 1-9
406-62ab-c MODIF. 91-d
a = SENSITIVITY 0.2
b = ADJUSTMENTS 0.2, 3
C = HOUSING 1, 4, 9
D = MODIFICATIONS 5, 23, 24

NOTE FOR CLASS II AND III:
406-6200-1 MUST BE MOUNTED IN
SUITABLE DUST-TIGHT ENCLOSURE.

WARNING FOR SHEETS 1-9:
IF PROBE IS LOCATED IN HAZARDOUS AREA, DO NOT
REMOVE GROUNDING LINK BETWEEN TERMINALS 182 UNLESS
SIGNAL LEADS AND TRANSMITTER ARE INTRINSICALLY SAFE.

DREXELBROOK ENGINEERING CO.  •  HORSHAM, PA. 19044  •  COPYRIGHT 1985  •  DREXELBROOK ENG. CO.

INSTALLATION OF 406-6200 SERIES

SCALE: NONE UNLESS OTHERWISE STATED
ALL DIMENSIONS IN INCHES (MM)

NO 420-1-588-CD  SHT 1 OF 9  ISSUE 3  EDD DATE

CERTIFIED by

NO. 420-1-588-CD
REMOTE
700 SERIES
PROBES
CW +
SH +
GND +
380 SERIES
CABLE
CW 
SH 
GND 
GND
INTEGRAL AND REMOTE PROBES
AND CABLE ARE INTRINSICALLY
SAFE FOR CLASS I GROUPS ABCD,
PROBE
CLASS II GROUPS EFG, CLASS III.

1-6
406-6200 SERIES
TRANSISTORS
CW +
SH +
GND +
380 SERIES
CABLE
CW 
SH 
GND 
GND
1-6 FIELD
TERMINALS
GROUND BUS
120V 50/60 Hz
FOR 401-3004.
120/240V 50/60Hz
FOR 401-3011.
L1 +
L2 +
+IN +
GND 
HOT
NEUT 

401-3004 OR 401-3011 RECEIVER
HERMETICALLY SEALED RELAYS
(MODIF. 91-16) (NOTE 3)

1-6 FIELD
TERMINALS
GND 
L1 +
L2 +
+IN +
GND 
GROUND BUS
120V 50/60 Hz
FOR 401-3004.
120/240V 50/60Hz
FOR 401-3011.

1-6 FIELD
TERMINALS
GND 
L1 +
L2 +
+IN +
GND 
GROUND BUS
120V 50/60 Hz
FOR 401-3004.
120/240V 50/60Hz
FOR 401-3011.

RECEIVERS ARE CERTIFIED FOR CLASS I
GROUPS A.B.C.D.
RECEIVERS IN 12 X 14 AND 24 X 24 (J=2)
HOUSINGS ARE ALSO CERTIFIED FOR
CLASS II GROUPS E.F.G. CLASS III.
(SEEN NOTE 2)

SAFE AREA

DIVISION I AREA

NOTE 1: 406-62XX-1 IS INTRINSICALLY SAFE IN CLASS I, GROUPS A.B.C.D ONLY.
NOTE 2: MUST HAVE CONDUIT HUBS CSA CERTIFIED FOR CLASS II GROUPS E.F.G. CLASS III.
NOTE 3: WITHOUT MODIF.91-16, RECEIVER MUST BE IN SAFE AREA ONLY, BUT
FIELD CONNECTIONS ARE STILL INTRINSICALLY SAFE.

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NO. 401-3-588-CD

INSTALLATION OF
406-6200 SERIES

SCALE NONE
UNLESS OTHERWISE
STATED ALL DIMENSIONS
IN INCHES (IMM)

DR. 10-3-86
86-90
DIE
CMK
APP'D
CRANE
11-26-86

NO. 420-1-588-CD
SHT 3
OF 9
ISSUE 3
11-90-122
11-26-86
1985

EDD DATE

DE#
I. INTRINSIC SAFETY LOOP DIAGRAMS FOR
SINGLE BARRIER LOOP WITH GROUNDED RETURN

TRANSMITTER

380 CABLE

GND

SH

CW

INTEGRAL AND REMOTE
PROBES AND CABLE
INTRINSICALLY SAFE
FOR CLASS I GROUPS
ABCD, CLASS II GROUPS
E.F.G, CLASS III.

REMOTE PROBE

OPTIONAL INTEGRAL PROBE

GROUND

GROUNDED BUS BAR

RECEIVER

24V DC
POWER SUPPLY

GROUND LEAD SHOWN MUST BE
1 OHM OR LESS TO EARTH GROUND.

DIVISION 1 AREA

SAFE AREA

NOTE 1: 406-62XX-1 IS INTRINSICALLY SAFE FOR CLASS I ONLY.

USED WITH THE FOLLOWING BARRIERS:

<table>
<thead>
<tr>
<th>TRANSMITTER CLASS AND GROUP</th>
<th>TRANSMITTER CLASS AND GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAYLOR 1130FG21000 I.C.D, I.II E-G.III</td>
<td>TAYLOR 5851FL81200 I.C.D, I.II E-G.III</td>
</tr>
<tr>
<td>TAYLOR 1135FG21000 I.C.D, I.II E-G.III</td>
<td>HONEYWELL 38545-0000-0110-111-C5D5 I.C.D, I.II E-G.III</td>
</tr>
<tr>
<td></td>
<td>8901/31-280/165/80 I.C.D, I.II E-G.III</td>
</tr>
</tbody>
</table>

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INSTALLATION OF 406-6200 SERIES

SCALE UNLESS OTHERWISE STATED ALL DIMENSIONS IN INCHES (MM)

<table>
<thead>
<tr>
<th>NO.</th>
<th>DRAWING</th>
<th>CRANE</th>
</tr>
</thead>
<tbody>
<tr>
<td>420-1-588-CD</td>
<td>9-86-121</td>
<td>II-90</td>
</tr>
</tbody>
</table>

CSA MUST APPROVE ALL REVISIONS TO THIS DRAWING
UNGROUND LOOP, 1-5 VOLT RECEIVER

III UNGROUND LOOP WITH 250Ω IN SERIES WITH BOTH BARRIERS

TRANSMITTER

SUPPLY BARRIER

RETURN BARRIER

RECEIVER

POWER SUPPLY

380 CABLE

SH

GND

REMOTE PROBE

INTEGRAL AND REMOTE PROBES AND CABLE INTRINSICALLY SAFE FOR CLASS I GROUPS A, B, C, D
CLASS II GROUPS E, F, G,
CLASS III.

DIVISION 1 AREA

EACH GROUND LEAD SHOWN MUST BE 1 OHM OR LESS TO EARTH GROUND

SAFE AREA

NOTE 1: 406-62XX-1 IS INTRINSICALLY SAFE FOR CLASS I ONLY.

USED WITH THE FOLLOWING BARRIERS:

<table>
<thead>
<tr>
<th>SUPPLY BARRIER</th>
<th>RETURN BARRIER</th>
<th>TRANSMITTER CLASS AND GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAHL 8903/31-315/050/70</td>
<td>8901/33-086/000/00</td>
<td>I A-D, II E-G, III</td>
</tr>
<tr>
<td>8903/31-280/165/80</td>
<td>8903/33-086/000/00</td>
<td>I C-D, II E-G, III</td>
</tr>
<tr>
<td>8903/51-200/050/70</td>
<td>8903/33-092/000/79</td>
<td>I A-D, II E-G, III</td>
</tr>
<tr>
<td>*MTL 2441</td>
<td>PART OF 2441</td>
<td>I A-D, II E-G, III</td>
</tr>
</tbody>
</table>

* CONNECTIONS: TRANSMITTER + TERMINAL 3 - 5 LOAD + TERMINAL 13 - 14 SUPPLY + TERMINAL 15 - 16 (GND NOT REQD)

DREXELBROOK ENGINEERING CO. • HORSHAM, PA. 19044

INSTALLATION OF 406-6200 SERIES

SCALE UNLESS OTHERWISE STATED ALL DIMENSIONS IN INCHES (MM)

DR. UG

CMK CRUNCH

APPD

CRUNCH

NO. 420-1-588-CD SHT. 6 OF 9 ISSUE 3 EDO 9-86-121

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FOXBORO BARRIERS

IV

UNGROUNDED LOOP USING 4-20mA/O-10V CONVERTER AND 4-20mA/DIGITAL CONVERTER

TRANSMITTER

REMOTE PROBE

OPTIONAL INTEGRAL PROBE

INTEGRAL AND REMOTE PROBE AND CABLE INTRINSICALLY SAFE FOR CLASS I GROUPS ABCD, CLASS II GROUPS E,F,G CLASS III.

DIVISION I AREA

NEST INPUT TERMINALS:

1. FOR 2AS-131-FGB - A
2. AND 2. FOR OTHERS

SAFE AREA

USED WITH THE FOLLOWING BARRIERS:

TRANSMITTER INTRINSICALLY SAFE FOR CLASS & GROUP

FOXBORO 2AI-12V-CGB I A-D, II E-G, III

2AI-13V-CGB I A-D, II E-G, III

2AS-131-CGB - A I A-D, II E-G, III

3A2-12D CS-E/CGB-A I A-D, II E-G, III


NOTE 1: 406-6200-1 IS INTRINSICALLY SAFE FOR CLASS I ONLY.
HONEYWELL BARRIER, GROUNDED RETURN, 1-5 Volt GROUNDED RECEIVER

V GROUNDED LOOP USING 4-20mA/1-5V CONVERTER.

TRANSMITTER

BARRIER

C-TB100 INTERFACE MODULE

3 4 2 1

24V

GND

COMMON

1-5V

REMOTE PROBE

380 CABLE

OPTIONAL INTEGRAL PROBE

EACH GROUND LEAD SHOWN MUST BE 1 OHM OR LESS TO EARTH GROUND.

INTEGRAL AND REMOTE PROBES AND CABLE INTRINSICALLY SAFE FOR CLASS I GROUPS ABCD, CLASS II GROUPS EFG, DIVISION 1 AREA CLASS III.

NOTE 1: 406-62XX-1 IS INTRINSICALLY SAFE FOR CLASS I ONLY.

USED WITH THE FOLLOWING BARRIER:
HONEYWELL 38545-0000-0110-113-C5D5 BARRIER

TRANSMITTER INTRINSICALLY SAFE FOR:
CLASS I GROUPS A-D AND CLASS II GROUPS E-G AND CLASS III
EXPLOSION-PROOF INSTALLATION

DIVISION 1 CLASS I GROUPS A-D, CLASS II GROUPS E,F,G, CLASS III.

NOTE 1: 406-62XX-4 AND 406-62XX-9 HAVE EXPLOSIONPROOF/DUST-IGNITION
PROOF CSA ENC. 4 HOUSINGS.

13-28V DC POWER SUPPLY
NOTES ON ASSOCIATED APPARATUS

1. MAY BE IN DIV. 2 LOCATION IF SO APPROVED.
2. CABLE CAPACITANCE AND INDUCTANCE
   (C = 60pf/FT. AND L = 0.2uh/FT. MAY
   BE USED) PLUS TRANSMITTER CI AND
   LI MUST NOT EXCEED Ca AND La OF ASSOCIATED
   APPARATUS.
3. VOC OF BARRIER MUST BE LESS THAN OR EQUAL
   TO Vmax OF TRANSMITTER. ISC OF BARRIER MUST
   BE LESS THAN OR EQUAL TO Vmax OF TRANSMITTER.
4. MUST BE INSTALLED PER MANUFACTURER'S
   INSTRUCTIONS.
5. MUST NOT BE CONNECTED IN PARALLEL.
6. MUST BE INSTALLED IN ACCORDANCE WITH
   NEC IN AN ENCLOSURE MEETING THE
   REQUIREMENTS OF ANSI/ISA S82.

CLASS II AND III HOUSING NOTE:

GROUND LINK MAY BE REMOVED IN INTRINSICALLY SAFE CIRCUITS.
FOR PROPER OPERATION, IT MUST BE REMOVED IF SUPPLY IS
GALVANICALLY ISOLATED AND/OR LOAD RL IS CONNECTED IN RETURN LOOP.
700 SERIES SENSING ELEMENT

406-6200 SERIES TRANSMITTER WITH VERIFY OPTION

PULSE MODULE 401-0010-220

SWITCH MODULE 401-0010-210

50 Ω

- MOUNTED SEPARATELY
(PULSE INPUT MUST NOT BE CONNECTED TO I.S. SWITCH MODULE.)

DIVISION I AREA

OPTIONAL SENSING ELEMENT WITH INTEGRAL ELECTRONICS

- REMOVED GROUND LINK

- MOUNTED ON TRANSMITTER CHASSIS

SENSING ELEMENTS AND CABLE INTRINSICALLY SAFE FOR
CLASS I GROUPS A, B, C, D.
CLASS II GROUPS E, F, G.
CLASS III.

WARNING
SWITCH MODULE MOUNTING
DIN RAIL MOUNTED SWITCH MODULE MUST BE IN SUITABLE
HOUSING MEETING AT LEAST NEMA-1 SPECS.

GROUND LINK MAY BE REMOVED IN INTRINSICALLY SAFE CIRCUITS.

FM CONTROL DRAWING FOR 406-6200 SERIES TRANSMITTER

AMETEK DREXELBROOK

205 KEITH VALLEY RD
HORSHAM, PA 19044-9998
215-674-1204
FAX 215-674-2731

420-0001-813-CD

No. 420-0001-813-CD
SHT. 3
ISS. 3

CERTIFIED

PO #

ENG

USER

DE #

ISS

EDO/DSR NO.

APP'D

DATE

OK. 

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All drawings are subject to change without notice.
NOTES:
1. SENSING ELEMENTS AND CABLE ARE INTRINSICALLY SAFE FOR CLASS I GROUPS A-D, CLASS II GROUPS E-G, CLASS III.
2. ONLY REMOTE D.E. TRANSMITTER HOUSINGS ARE APPROVED EXPLOSION PROOF FOR CLASS I GROUPS A, B, C, D WHERE D IN MODEL NUMBER IS 2, 3, 4, OR 6.
3. FOR CLASS II GROUP E INSTALLATIONS, WIRING MUST ENTER TRANSMITTER HOUSING THROUGH DUST TIGHT CABLE FITTINGS OR THREADED CONDUIT.
4. SINCE SENSING ELEMENTS ARE NOT APPROVED AS EXPLOSION PROOF, EXPLOSIONPROOF APPROVAL DOES NOT APPLY TO INTEGRAL ELECTRONIC ASSEMBLIES WHERE D IN MODEL NUMBER IS 8, 9, A, C, D, OR E.
5. IF SENSING ELEMENT IS LOCATED IN HAZARDOUS AREA, DO NOT REMOVE GROUND LINK BETWEEN TERMINALS 1 AND 2 UNLESS LEADS AND TRANSMITTER ARE INTRINSICALLY SAFE.