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DREXELBROOK

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Installation and Operating Instructions

Series 505-1500
Continuous Ultrasonic Transmitter using 405-1500 Electronics

+ 215-674-1234 Outside North America
1-800-553-9092 US and Canada
www.drexelbrook.com
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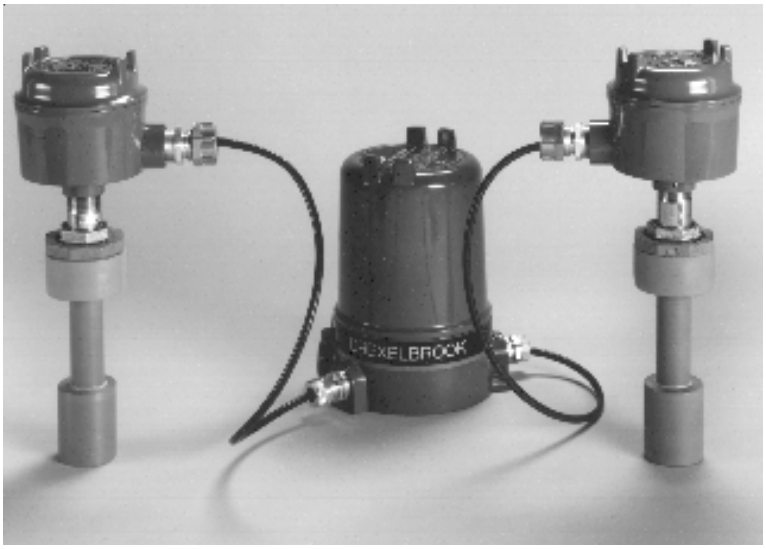
EDO # 12-02-243
505-1500-LM

Series 505-1500
Continuous Ultrasonic Transmitter using 405-1500 Electronics



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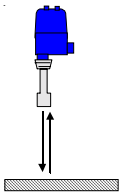
SECTION 1
INTRODUCTION

1.1 Product Description

The AMETEK Drexelbrook Series 505-1500 Continuous Level Transmitter is an integral assembly which accurately measures differential level, using traveling screen ultrasonic technology. The level measurement output is a 4-20 mA dc signal that directly represents the differential level.

The ultrasonic sensor does not contain moving components. It is not affected by electrical or physical parameters and has a wide range of temperature operation. The sensor is made of CPVC or PFA for compatibility with a wide range of process materials.

1.2 Technology



Ultrasonic transmitters work on the principle of sending apulsed, high-frequency sound wave from a peizo electric transducer to the contents of the vessel. The device measures the length of time it takes for the reflected sound wave to return to the transducer. A successful measurement depends on reflection from the process material in a straight line back to the transducer.

The two basic modes of operation are the “delta level” and “delta distance.” In the delta level mode, the current output (4-20 mA dc) increases as the liquid level rises. In the delta distance mode, the current output increases as the level falls (distance to the transducer increases). The desired span range may be set from a minimum of 3 inches up to 30 feet.

To ignore obstructions in the channel, Autoprofiling™ mapping has been developed, which allows a “sonic snapshot” of an empty channel. The transducer transmits a sound burst and the echo is recorded as a signature of the channel bottom and sides. Any obstructions will send an echo and create a profile. Later on, this signature or profile is locked into the ultrasonic unit’s memory so it will not respond to echoes created by these obstructions.

1.3 Models Available

5 0 5 - 1 5 0 0 - 0 0 X - Continuous Ultrasonic Transmitter with 4-20 mA

Transducer Material:
2 - CPVC
6 - PFA

Diagram on following page identifies components.

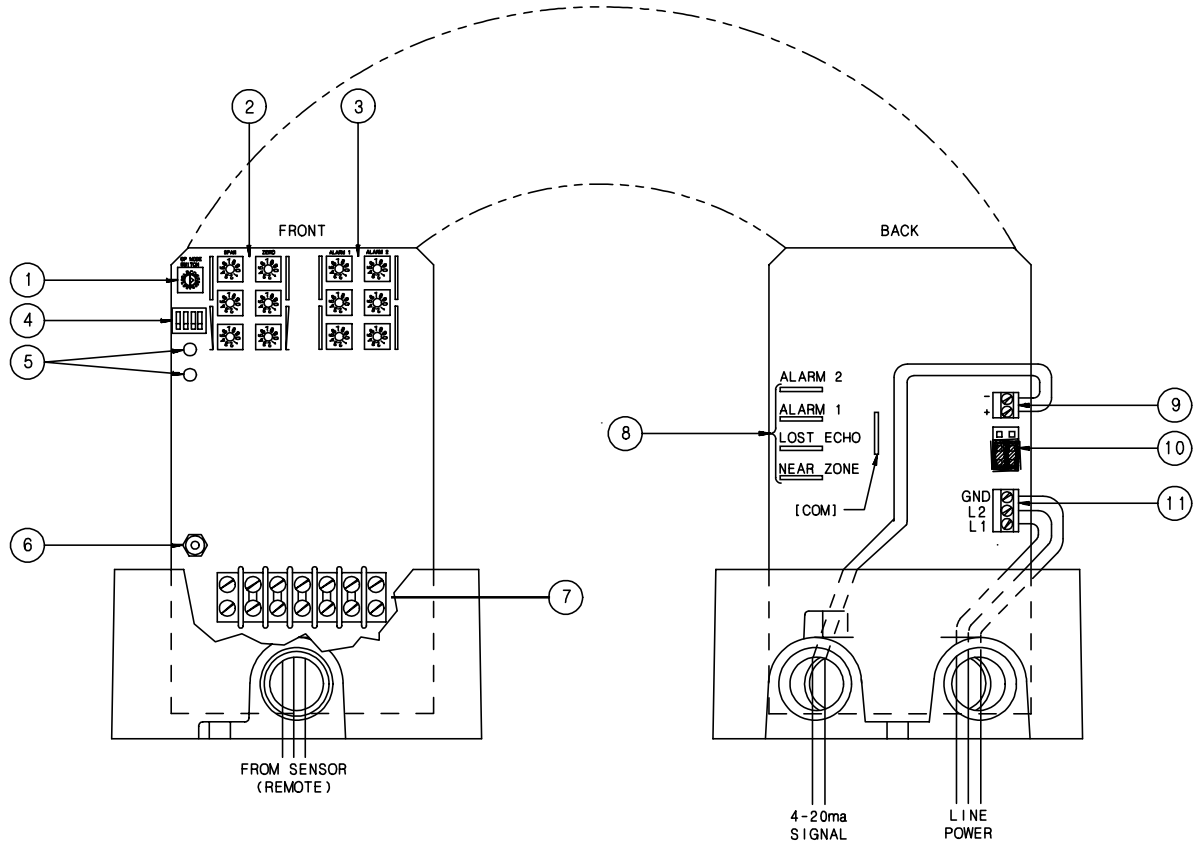


Figure 1-1
Ultrasonic 505-1500 Components

—Legend

① Operating Mode Switch
(Time Delay/Rep Rate Control)
see section 3.1

② Calibration Switches
see sections 3.1, 4.2, and 4.3

③ Optional Setpoint Switches
see section 4.4

④ Switch 8
see sections 3.2, 4.1, and 4.2

⑤ Near Zone and Lost Echo LEDs
see sections 2.2 and 3.1

⑥ Calibration Pushbutton
and System Reset
see sections 3.1 and 4.3

⑦ Sensor Terminal Strip
see section 2.3

⑧ 24 VDC Alarm Outputs
see sections 4.3

⑨ Signal Loop Terminals
see section 2.3

⑩ Sink/Source Mode Selector
Jumper Block
see section 2.3

⑪ Power Terminals
see section 2.3

1.4 Key Terms

Figure 1-2

Zero: The level point at which the output is to equal 4 mA (0% level). For calibration, the zero range is the distance from the transducer face to the 0% level (channel floor).

Span: In traveling screen measurement, the span range is the differential.

Range: Maximum distance from the transducer face.

Differential: Change in level between Transducer 0 and Transducer 1 or difference between the upstream level and the downstream level.

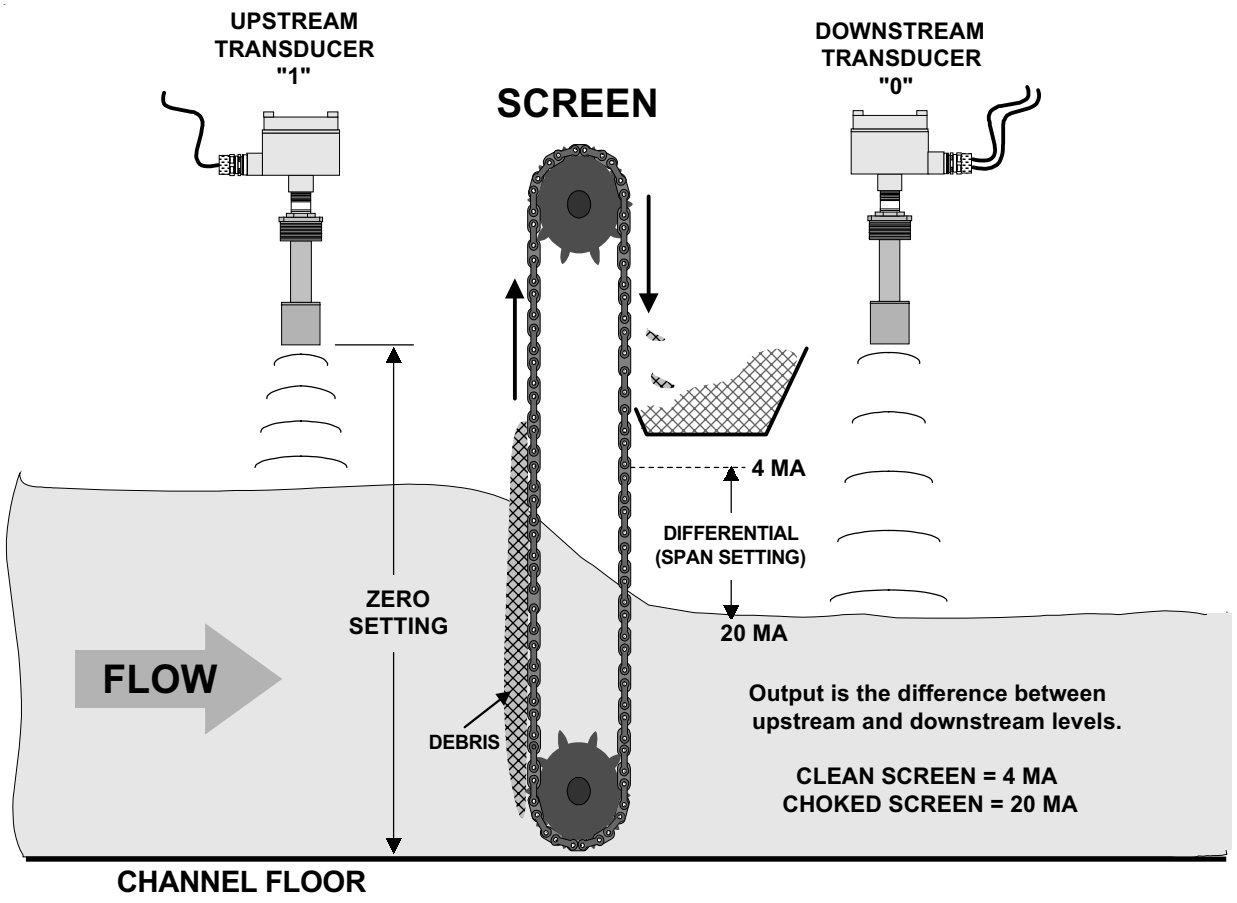


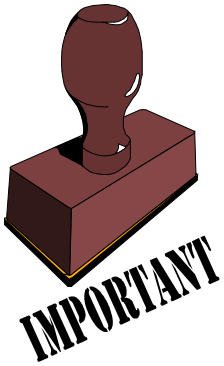
Figure 1-2
Ultrasonic 505-1500 Series
System Diagram

SECTION 2
INSTALLATION

2.1 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 to the factory immediately.

2.2 Mounting Transmitter



Thee 505-1500 Series transmitter is available with the electronic unit and two transducers separated by 3 coaxial cables. Extended sensor lengths and special mountings can be provided to fit specific mounting applications.

Refer to *Figure 2-1* for standard mounting dimensions.

- The 505-1100 Series transmitter 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, place the instrument in a reasonably accessible location. Ambient temperature should be between -40°F and 160°F (-40°C to 70°C).

- The transducers must be mounted vertical.

- Ensure that the sensing element face is not recessed into a mounting nozzle, as stray reflections can cause faulty operation.

- When mounting the transducer, consideration must be given to the 12-inch Near Zone. If the level rises to within 12 inches of the sensing element face, a 20 mA signal will be generated; the Near Zone LED will light; and the Near Zone Alarm Output will drop from 24 vdc to 0 vdc.

- The typical conical beam angle of the ultrasonic signal is 12 degrees. Therefore, it is necessary to ensure that a tank wall, ladder, or other obstruction is not within this beam, and is not causing erroneous reflections that can affect the system operation. As a rule of thumb, allow 1.25 inches per foot of distance. For example:

If maximum range distance is 30 feet,
1.25 x 30 = 37.5 inches
Transducer should be located at least 3 feet
from the side of the wall or another object.

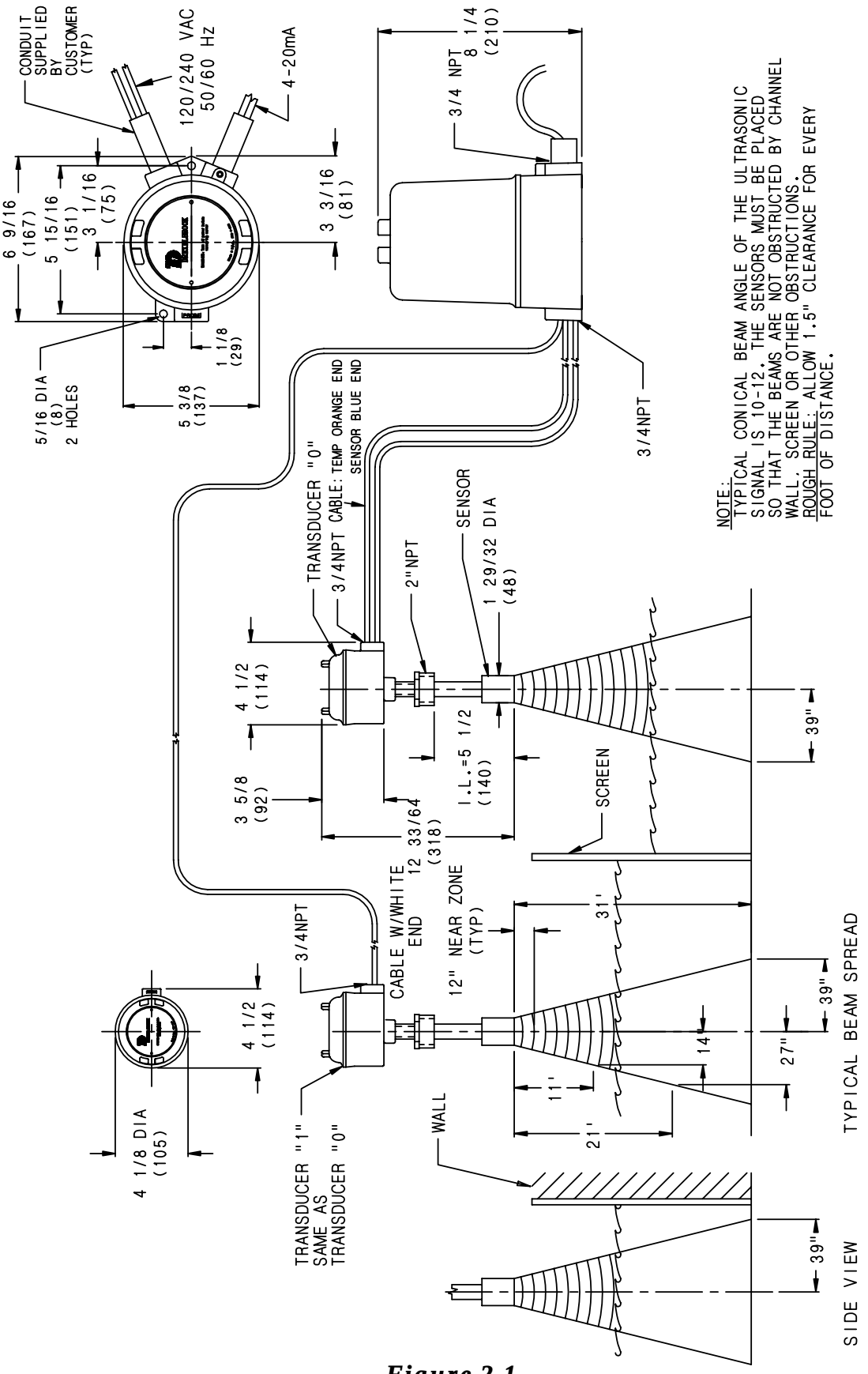
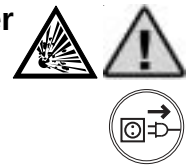


Figure 2-1
505-1500 Series Mounting Dimensions

2.3 Wiring Transmitter



CAUTION

If the Series 505-1500 is located in a hazardous environment, do not open enclosure cover or make/break any electrical connections without first disconnecting electrical power at the source. Ensure that wiring, electrical fittings and conduit connections conform to electrical codes for specific location and environment.

- Refer to *Figures 2-2 through 2-4* for the wiring diagrams of the 505-1500 transmitters.
- Connect input power and output leads to terminal block (TB1) as shown.
- The 505-1500 is shipped with the Output Select jumper block set to source (the unit will supply all power to the signal loop.)
- If an external power supply is used, jumper should be moved to sink position.
- *Section 3 - Operation* describes the other indicators and controls.

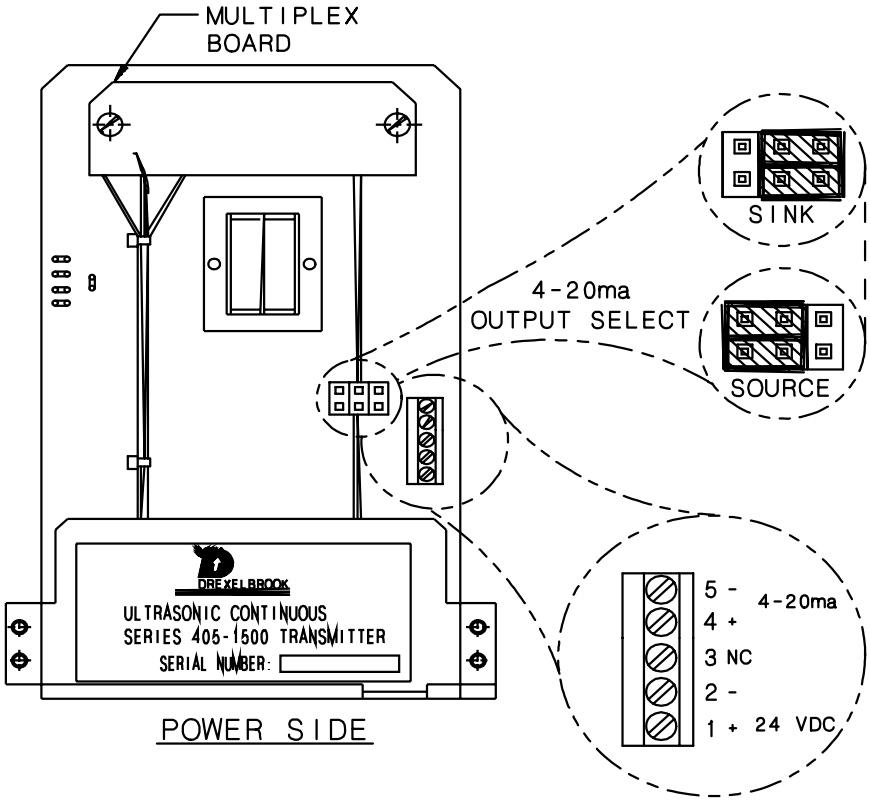


Figure 2-2
Output Select Jumper Block and Input Power Terminal Block (TB1)
24 VDC Unit

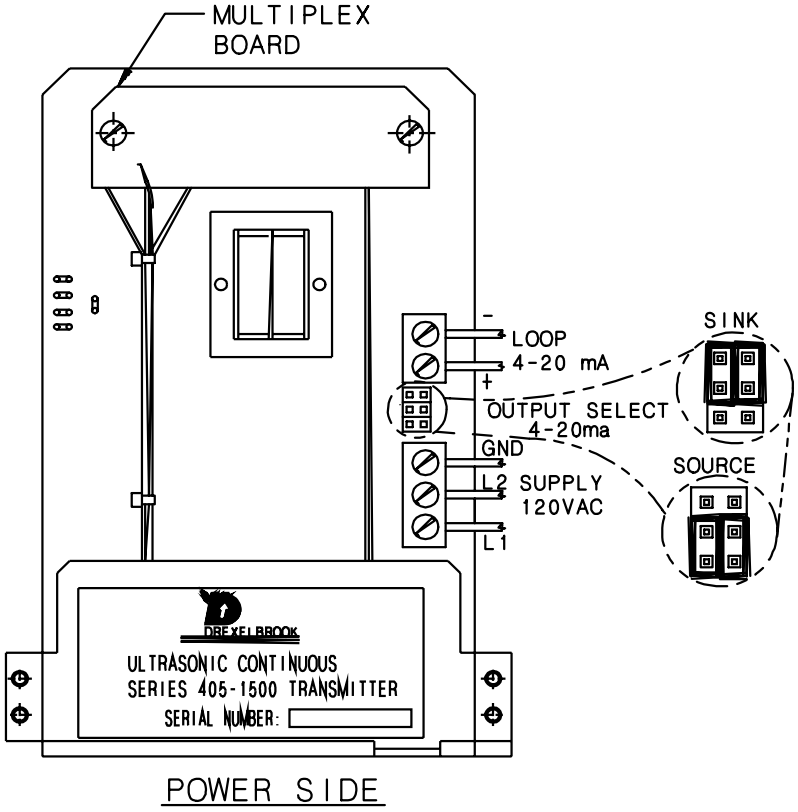


Figure 2-3
Output Select Jumper Block and Input Power Terminal Block (TB1)
120/240 VAC Unit

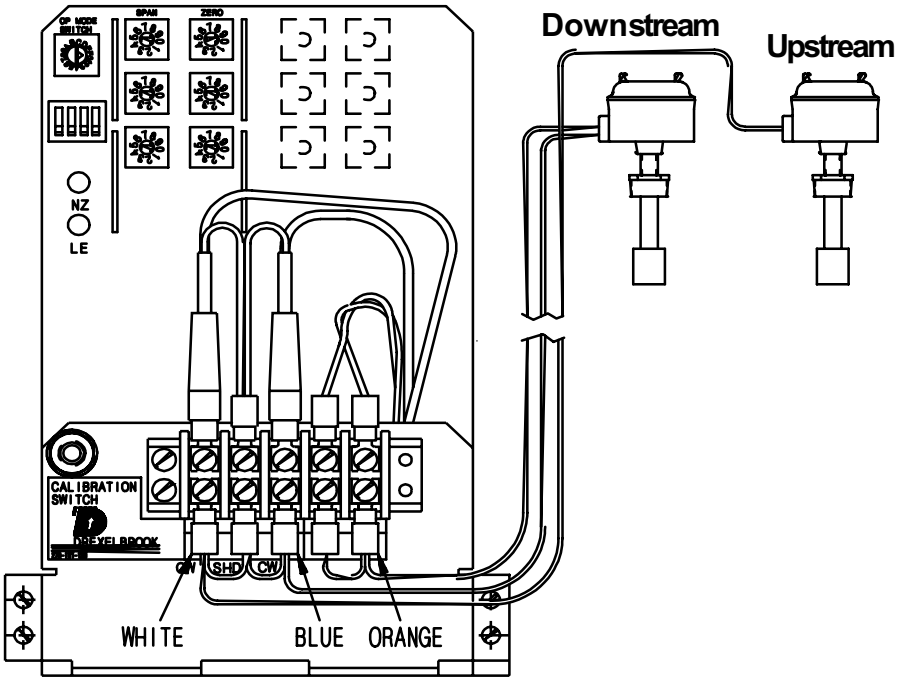


Figure 2-4
Sensor Wiring Connections, Remote Transmitter

SECTION 3
OPERATION

3.1 Indicators & Controls

Refer to *Figure 3-1* for the location of indicators and controls.

—SW8 Level or Distance Mode
The selection of single or dual transducers and "delta level" or "delta distance" mode is accomplished by changing the positions of switches 1-4 on SW8. The switch positions are discussed in paragraph 3.2.

—Time Delay Control (Operating Mode Switch)
The time delay control is located above SW8. The time delay can be set to 0,15, or 45 seconds.

- A 0-second time delay (position 2) is the factory-set default.

Figure 3-1 details the switch positions and the associated time delay.

—Zero and Span Calibration Switches
The zero and span are each set using three, ten-position rotary switches. Zero and span settings are made in inches with 1-inch resolution. Zero and span switches are used to calibrate the unit, discussed in section 3.3.

—LED Indicators
Two LED indicators are located on the transmitter to alert the user to a "near zone" or "lost echo" condition or improper calibration.

—Calibration Pushbutton
The calibration pushbutton is used in conjunction with SW8 for maximum calibration accuracy.

—Alarm Relays
Outputs (24 volts @ 35 mA) for "Near Zone,""Lost Echo" and 2 alarm setpoints are provided to activate external relays or alarms. The separate relay packages are purchased as an option.

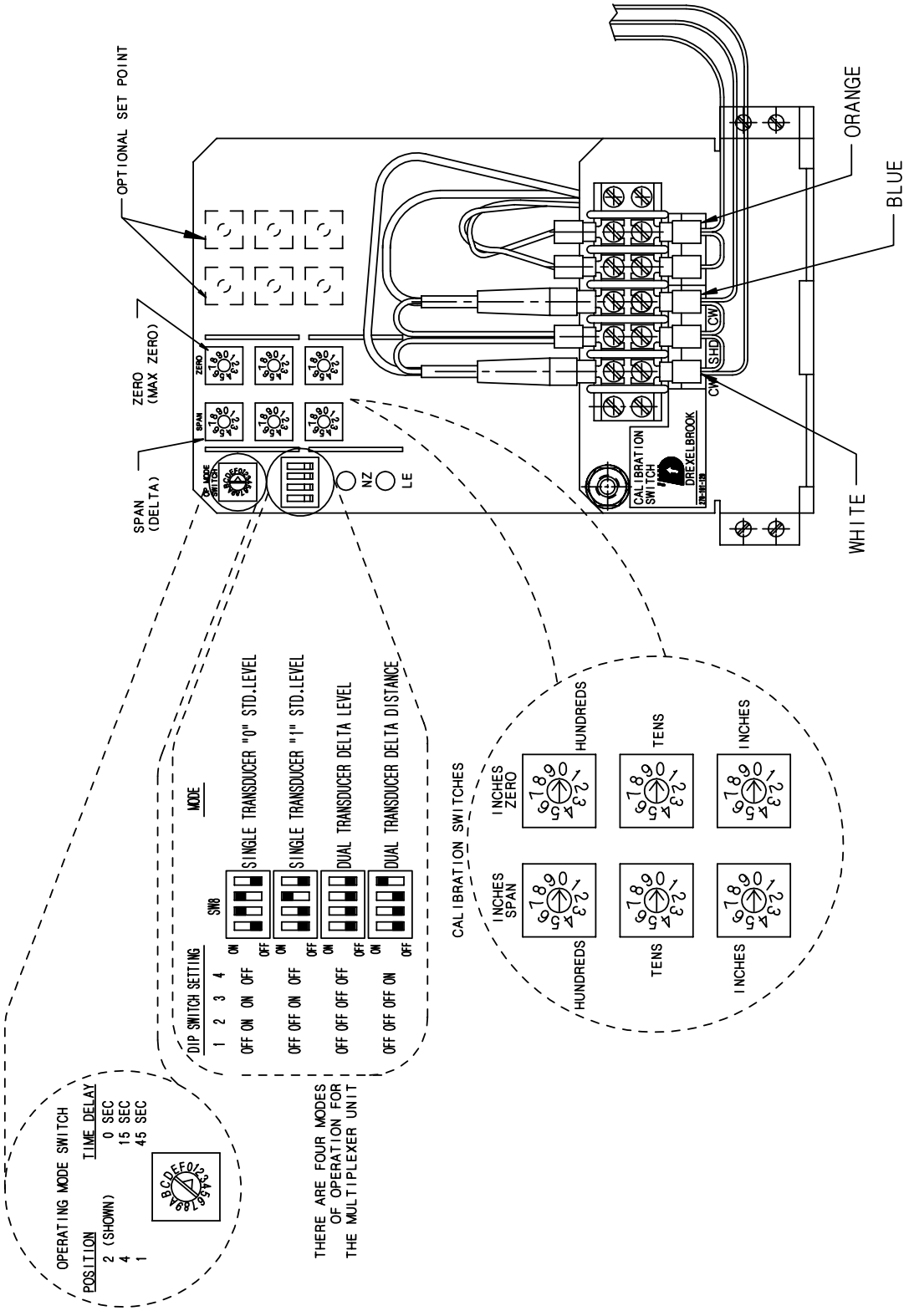


Figure 3-1
Indicators and Controls

3.2 Modes of Operation

There are two modes of operation for the 505-1500 Traveling Screen unit. The single transducer mode is used for trouble-shooting or setting the zero point. The dual transducer mode is used for traveling screen measurement.

- Turn off power to the unit.
- Remove cover.
- Set the four switches on SW8 as follows (refer to *Figure 3-1*):

—Single Transducer "0", Standard Level (LLFS) (Upstream)
—Single Transducer "1", Standard Level (LLFS) (Downstream)

Dip Switch Setting Off (Down) On (Up)				Mode
1	2	3	4	
Off	On	On	Off	Single Transducer "0" Level Mode (LLFS)
Off	Off	On	Off	Single Transducer "1" Level Mode (LLFS)

—Dual Transducer Differential Level (LLFS)
—Dual Transducer Differential Distance (HLFS)

Dip Switch Setting Off (Down) On (Up)				Mode
1	2	3	4	
Off	Off	Off	Off	Dual Transducers Differential Level (LLFS)
Off	Off	Off	On	Dual Transducers Differential Distance (HLFS)

- Replace cover and restore power to the unit.

SECTION 4
CALIBRATION

4.1 Calibrating for Traveling Screen Measurement

The dual transducer mode is used for traveling screen measurement.

—Dual Transducer Differential Level (LLFS)
—Dual Transducer Differential Distance (HLFS)

—Calibration for Differential Level (LLFS) (current increases as differential increases)

- Turn off power to the unit and remove cover.

- Set span switches to the maximum difference that you want to measure. See *Figure 4-1*.

- Set zero switches to equal distance from transducer face to channel floor **or** distance from transducer face to lowest expected level. The lower the zero value, the better the resolution.

- Set SW8 as follows:

Off (Down)				On (Up)
1	2	3	4	
Off	Off	Off	Off	Dual Transducers Differential Level (LLFS)

- Replace cover and restore power to the unit.

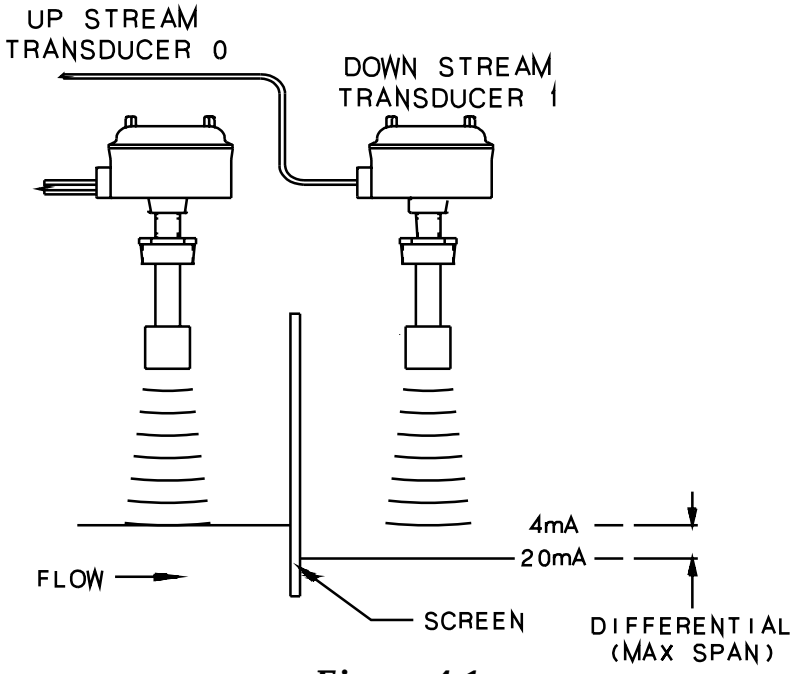


Figure 4-1
Calibration Example
Differential Level Mode

4.1 Calibrating for Traveling Screen Measurement
(continued)

—Calibration for Differential Distance (HLFS) (current decreases as differential increases)

- Turn off power to the unit and remove cover.
- Set span switches to the maximum difference that you want to measure. See *Figure 4-2*.
- Set zero switches to 12 inches (0-1-2)
- Set SW8 as follows:
  Off (Down) On (Up)

1	2	3	4	
Off	Off	Off	On	Dual Transducers Differential Distance (HLFS)

- Replace cover and restore power to the unit.

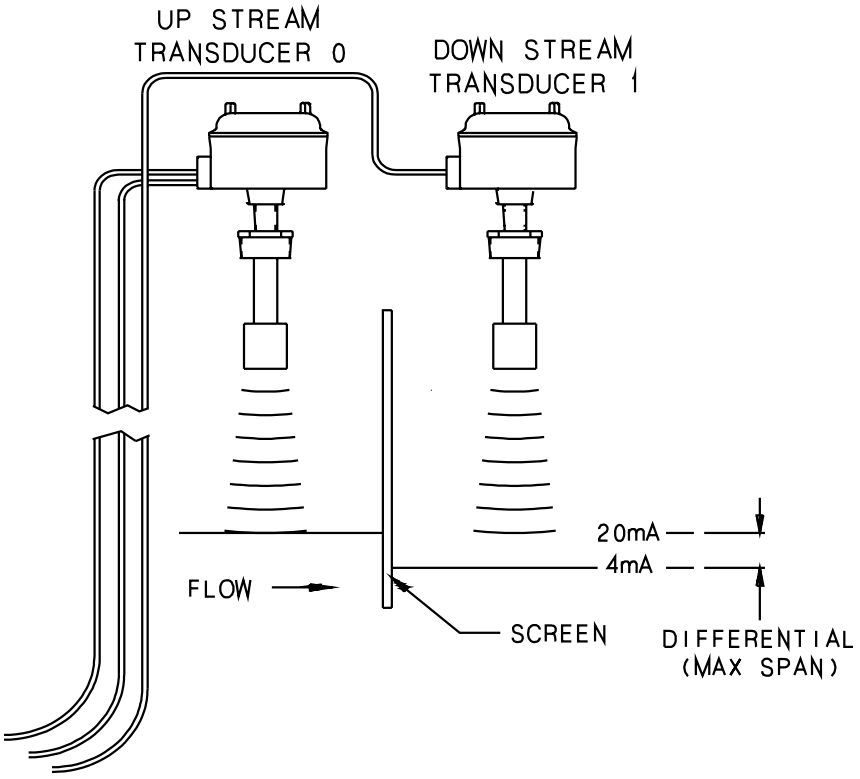


Figure 4-2
Calibration Example
Differential Distance Mode

4.2 Calibrating Single Transducer

The single transducer mode is used for troubleshooting or setting the zero point.

—Single Transducer "0", Standard Level (LLFS) (Upstream)
—Single Transducer "1", Standard Level (LLFS) (Downstream)

—Level Mode (current increases as level increases)

- Turn off power to the unit.
- Remove cover.
- Set the Zero calibration switches to 12 inches plus maximum span. The maximum span is the difference that you want to measure (the difference in inches from the 4 mA point to the 20 mA point).
- Set the Span calibration switches to equal the maximum distance in inches from the minimum level to the maximum level—100% point or 20 mA.

- Replace cover and restore power to the unit.

—Distance Mode (current decreases as level increases)

- Turn off power to the unit.
- Remove cover.
- Set the Zero calibration switches to 12 inches. The switches are set to 0-1-2 starting with the top switch.
- Set the Span calibration switches to equal the maximum distance in inches from the minimum level (100% point or 20 mA) to the maximum level (0% or 4 mA).

- Replace cover and restore power to the unit.

4.3 Setpoint Calibration (only for those units equipped with optional 24 VDC outputs)

a. Refer to *Figure 3-1* for location of relay switches (ALM1 and ALM2).

b. Alarm points are set directly in inches up from zero point.

c. Alarm settings ALM1 and ALM2 can be set to alarm at any point in the calibrated range.

d. Connections are made to the transmitter on jumpers J6, J7 and common connection as shown in *Figure 4-3.*

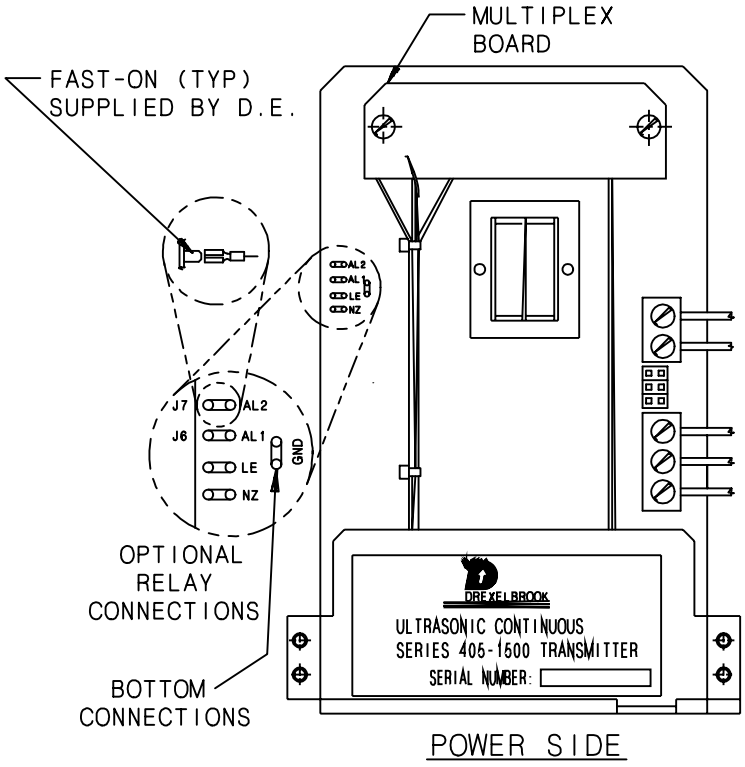


Figure 4-3
Alarm Relay Connections (J6 and J7)

SECTION 5 TROUBLESHOOTING

The 505-1500 Transmitter is designed to give years of unattended service. No periodic or scheduled maintenance is required.

5.1 Troubleshooting Procedures

If a problem should occur with the operation of the transmitter, use the following procedure for troubleshooting.

a. Ensure wiring connections are correct.

b. If the liquid surface has severe turbulence in the area where the ultrasonic beam hits, consider setting SW4 to add 15 or 45 seconds damping to 4-20 loop.

c. Any continuous ultrasonic transmitter signal/echo can be adversely affected by significant foam on the liquid level surface. If this condition exists, please consult the factory for further application review and advice.

d. Ensure that the transducer face is not recessed into a mounting nozzle. Stray reflections from the nozzle openings into the vessel can cause faulty operation.

e. If attempts to locate the difficulty fail, notify the local factory representative, or call the factory toll-free at 1-800-527-6297. To aid in troubleshooting, please complete the information on *Table 5-1* before calling the factory service department.

Table 5-1
ULTRASONIC PHONE TROUBLESHOOTING

Transmitter Model Number _____Serial Number_____

Process Material_____Temperature_____Pressure_____

What is the Loop Current? _____ Is it stable?_____

Test the ability of the electronic unit to produce 4 and 20 mA. Place switch 3 of SW8 to the ON position (up). Now by alternating switch 2, ON (up) position should =4 mA. OFF (down) position should =20 mA.

Are either of the 2 red LEDs illuminated? _____ (if yes, which one?)_____

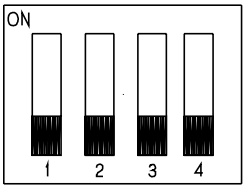
Check for 110 VAC on TB1 (see Figure 2-3) _____

Loop supply voltage is measured at TB2 (with no load) should be 24-30 VDC.

What is the position of the hex switch SW4 (factory setting is zero)?

What are the switch positions of SW8?
(All should be OPEN (down) with the exception of position 4—it can be either ON (up) or OPEN (down).

SW8



List the positions of the Span and Zero rotary switches
SW1, SW2, SW3, SW5, SW6, AND SW7?
In level mode Zero must always be larger than Span.

SW1____ SW5____
SW2____ SW6____
SW3____ SW7____

Transducer Temperature Check:

- Expect to find 0.65 Vdc between brown terminal [BRN] and housing.
- Should be able to measure approximatly 290 µA on digital meter placed in series with orange lead and its terminal [ORG].

With sensing element disconnected, expect reading of 12K ohm between center wire terminal [CW] and shield [SHD], using an analog meter.

5.2 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 _____

_____

_____

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, 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.

5.5 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 _____

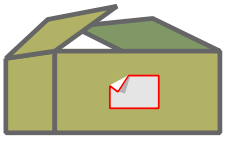
_____

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.

SECTION 6
SPECIFICATIONS

6.1 Transmitter Specifications

Near/Dead Zone:	12 inches (0.3 meter)
Minimum Span:	3 inches (7.62 cm) or 10% of range (whichever is greater)
Maximum Span:	30 feet (9.14 meters), 40 feet (12.19 meters)
2-Wire Signal Loop:	4-20 mA DC (isolated) source or sink
•Load Voltage:	Source Mode, 24 VDC output Sink Mode, 6-60 VDC input
•Loop Resistance: (@ 24 VDC)	Source Mode, 0-1000 ohms Sink Mode, 0-725 ohms
Repeatability:	0.1 inch
Resolution:	0.1 inch
Linearity:	0.5% of full scale for spans less than 3 feet. 0.25% of full scale for spans more than 3 feet.
Ambient Temperature:	-40° to 160°F (-40° to 70°C)
Temperature Compensation:	Automatic
Calibration:	To nearest 1 inch Zero and Span range switches, ranges are set directly in inches. Convert mm to inches and then set switches.
Power Requirement:	120 VAC, 50/60 Hz; 240 VAC, 50/60 Hz; or 24 VDC
Power Consumption:	6 watts @ 120 VAC

6.1 Transmitter Specifications (continued)

Response Time:	2 seconds (approx.)
Damping:	0,15, or 45 second response time (field-selectable)
Lost Echo:	LED indication, loop current 4 mA Additional output: 24 VDC 35 mA maximum
Near Zone:	LED indication, loop current 20 mA Additional output: 24 VDC 35 mA maximum
Alarm Outputs:	2 outputs: 24 VDC 35 mA maximum Alarm points are set in inches.
Pulse Repeat Rate:	140 ms

6.2 Transducer Specifications

Mounting:	Remote 2" NPT fitting (flange mounts available)
Sensor Material:	CPVC and PFA (Other materials consult factory)
Beam Angle:	Conical, 12° typical, 3dB down
Process Temperature:	-40°F to 160°F(CPVC) (-40°C to 70°C) -40°F to 300°F(PFA) (-40°C to 145°C)
Process Pressure:	-10 to 50 PSIG
Cable:	Lengths up to 250 feet. Consult factory for longer lengths.

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