



Leader in
Level Measurement

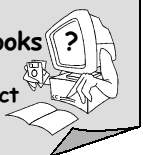
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Installation and Operating Instructions

Series 505-1320
Continuous Ultrasonic Transmitter
using 405-1302 Electronics

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EDO # 12-02-243
505-1302-LM

Series 505-1320
Continuous Ultrasonic Transmitter
using 405-1302 Electronics

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1.4 Types of Flumes&Weirs Figures 1-1 through 1-8 show the 505-1320 Ultrasonic Open Channel Flowmeter mounted in different types of flumes and weirs.

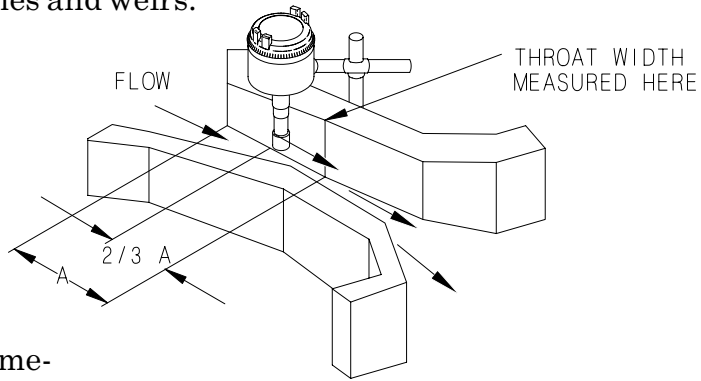


Figure 1-1
Parshall Flume



NOTE

The open channel flowmeter location is a function of the primary measuring device. Consult the flume/weir manufacturer for the proper sensor location.

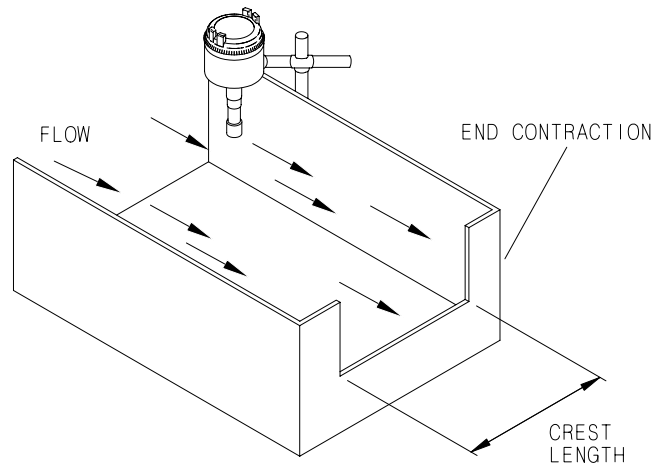


Figure 1-2
Rectangular Weir

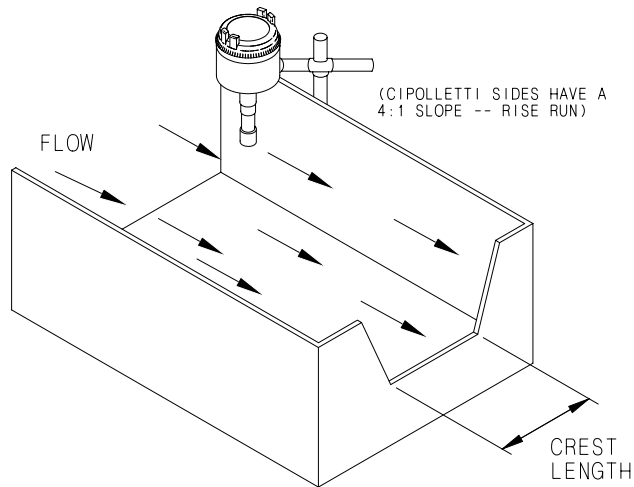


Figure 1-3
Cipoletti Weir

1.4 Types of Flumes & Weirs

(continued)



NOTE

The open channel flowmeter location is a function of the primary measuring device. Consult the flume/weir manufacturer for the proper sensor location.

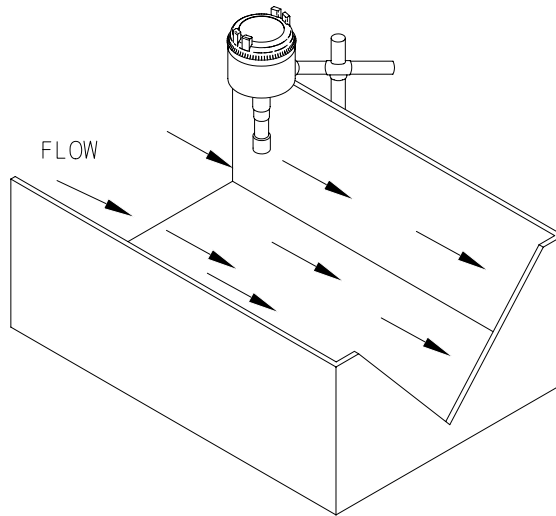


Figure 1-4
V-Notch Weir

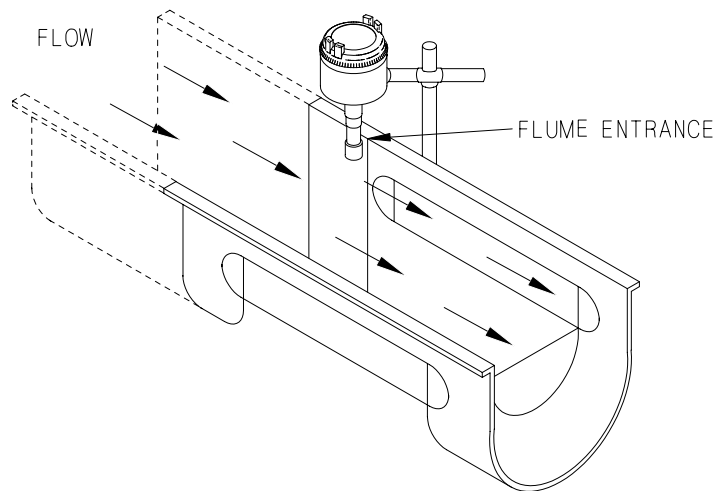


Figure 1-5
Palmer Bowls Flume

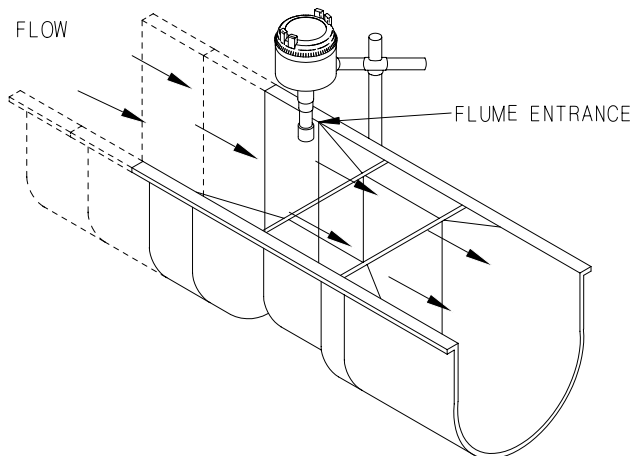


Figure 1-6
Leopold Lagco Flume

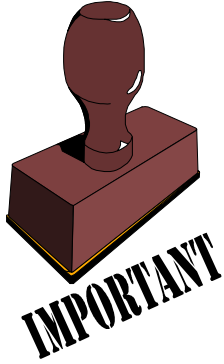
SECTION 2 INSTALLATION

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 Instrument



Refer to *Figures 2-1 and 2-2* for mounting dimensions of the integral and remote instruments, respectively.

- The Series 505-1302 Series transmitter is designed for field mounting, but it should be mounted in a location free 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 505-1302 Series transmitter is available with the electronic unit and transducer as either a single integral assembly or separated by two coaxial cables in the remote configuration.
- The transducer must be mounted vertically in either configuration.
- Extended sensor lengths and special mountings can be provided to fit specific mounting applications.
- When mounting the transducer, consideration must be given to the 12-inch Near Zone. If the level rises to within 12 inches of the sensor face, a 20 mA signal is generated; the Near Zone LED lights; and the Near Zone Alarm Output drops from 24 Vdc to 0 Vdc.
- The typical conical beam angle of the ultrasonic signal is 10-12 degrees. Therefore, it is necessary to ensure that a channel wall, ladder, or other obstruction is not within this beam, and is not causing erroneous reflections that can affect the system operation.
- An optional mounting kit (285-1-176) is available for both integral and remote mounted units. The mounting stand is used to hold the unit in place above the flowstream. The mounting kit moves vertically and horizontally for maximum placement.

505-1320 Series Ultrasonic Open Channel Flowmeter™

2.2 Mounting Instrument

(continued)

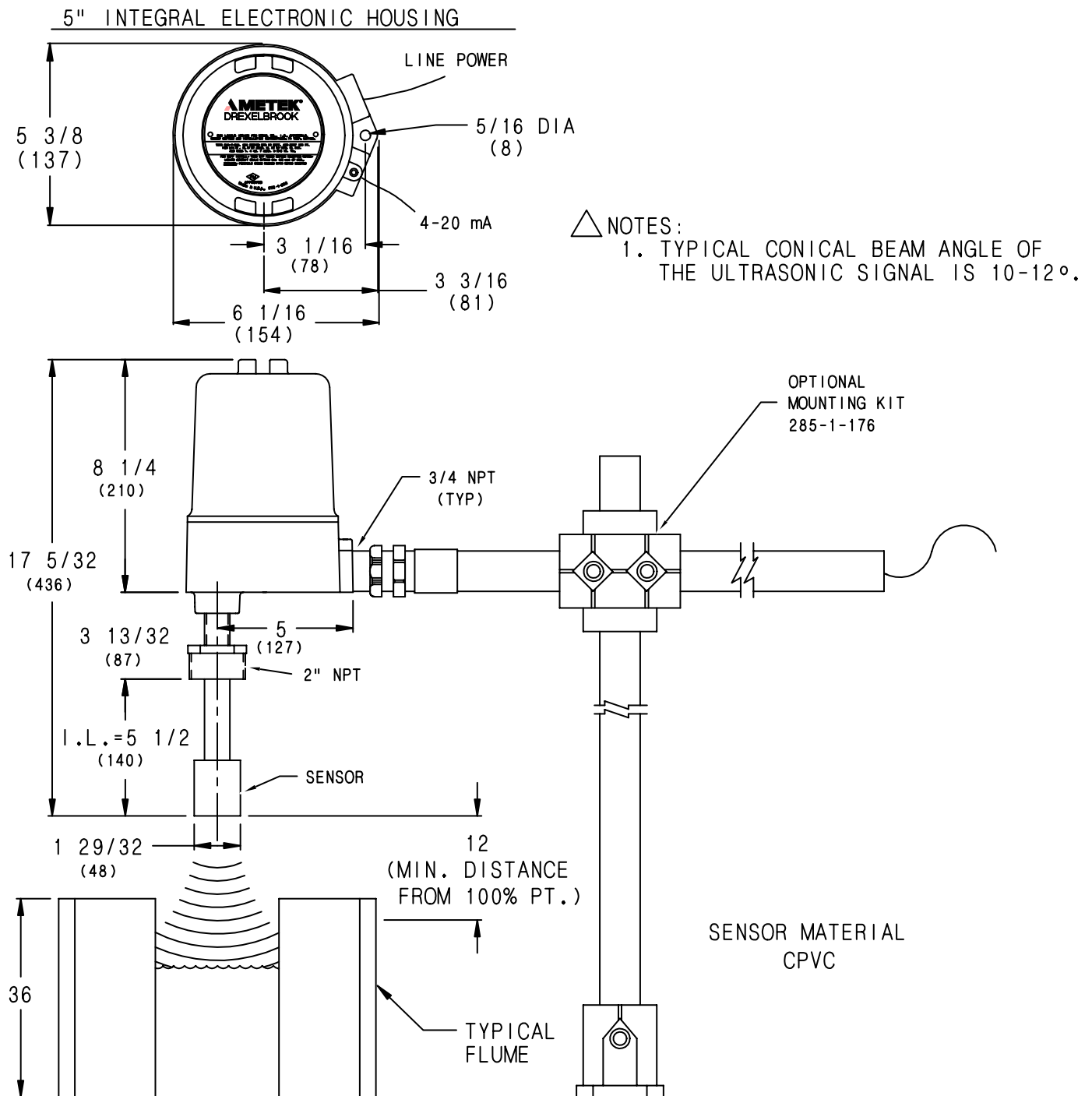


Figure 2-1
Mounting Dimensions
Integral Unit

2.2 Mounting Instrument

(continued)

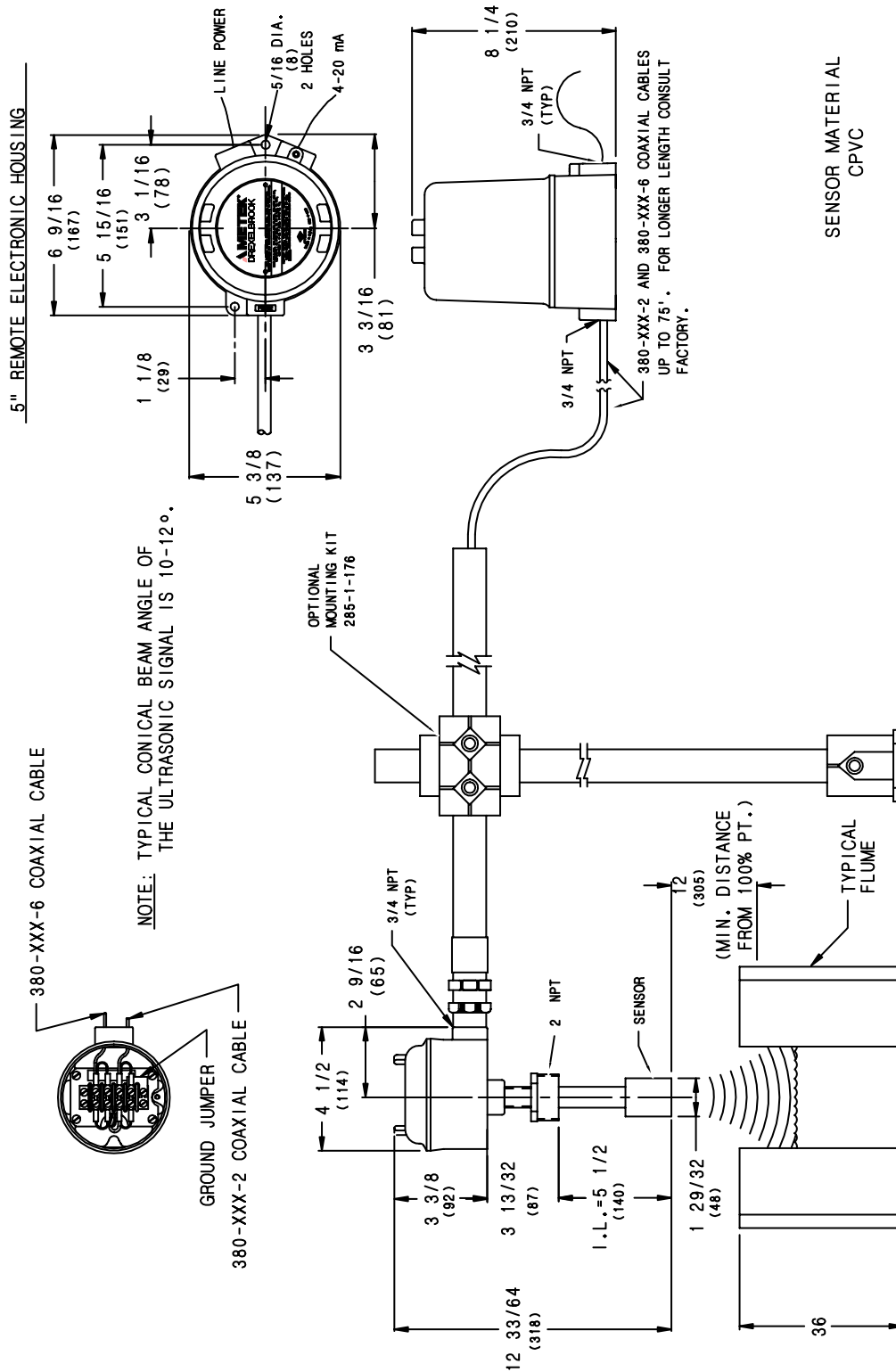
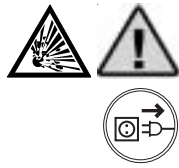


Figure 2-2
Mounting Dimensions
Remote Unit

2.3 Wiring



CAUTION

If the Series 505-1302 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 2-4 and 2-5* for the wiring diagram of the 505-1302 integral and remote instruments, respectively.

For integral transmitters, the level measuring cable and temperature compensation wires are prewired.

- Connect input power and output leads to terminal block (TB1) as shown.
- The 505-1302 is shipped with the Output Select jumper block set to **Source** output (the instrument supplies 24 Vdc power to the signal loop). If an external power supply is used, the jumper should be moved to **Sink** output position. See *Figure 2-3* for an example of a loop wiring diagram.
- For loop wiring, it is recommended to use twisted, shielded pair to eliminate noise. The shield or drain wire should be grounded at the power supply end and left floating at the ultrasonic transmitter end.

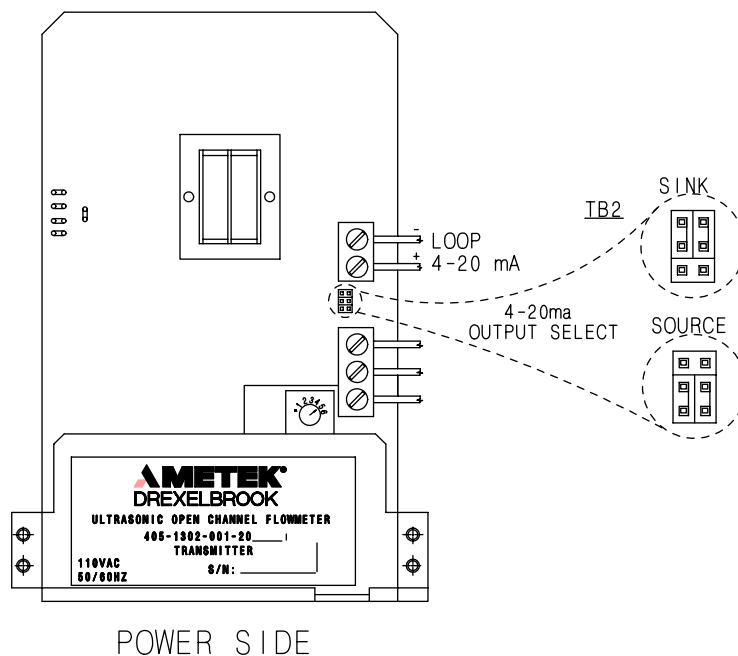
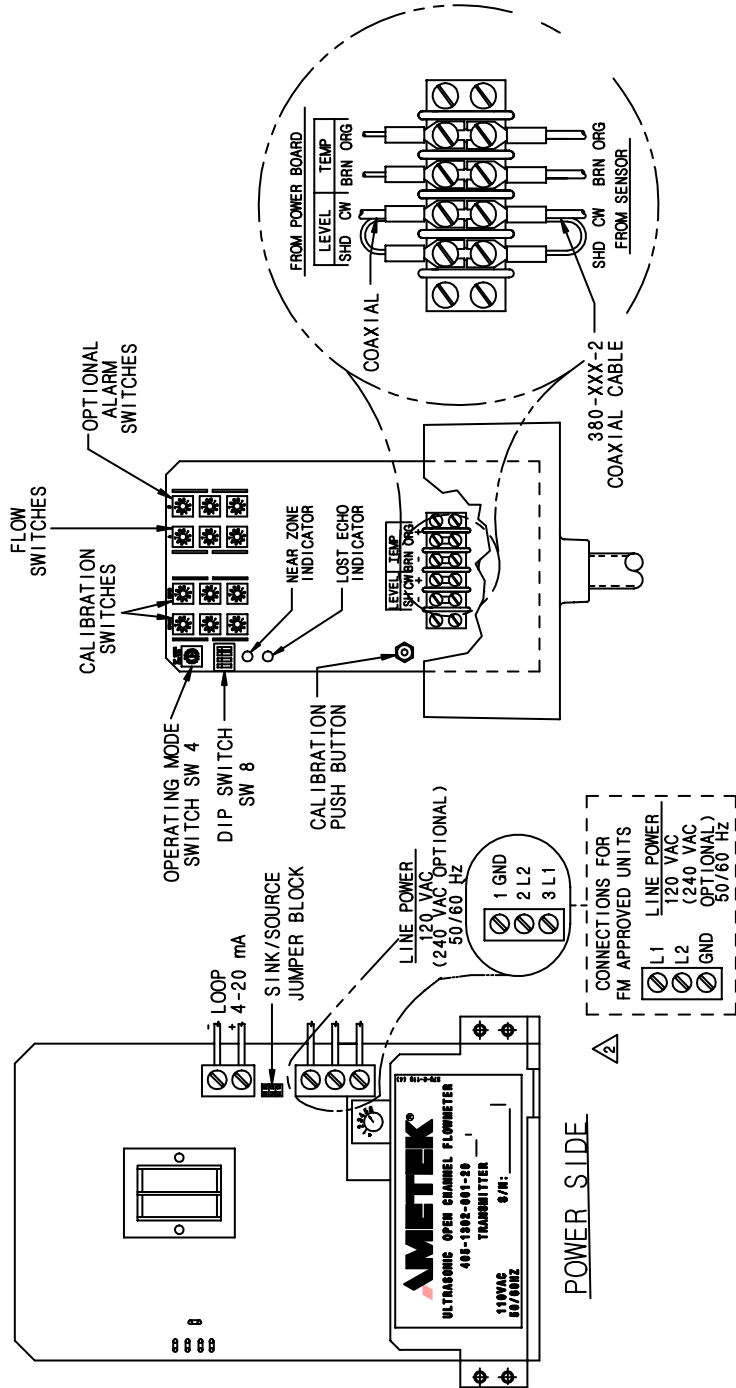


Figure 2-3
Output Select Jumper

2.3 Wiring (continued)



△ NOTE:
2. FOR CORRECT UNIT WIRING. NOTE SCREENING ON P.C. BOARD.

Figure 2-3
Wiring Diagram of Line-Powered Transmitter

2.3 Wiring (continued)

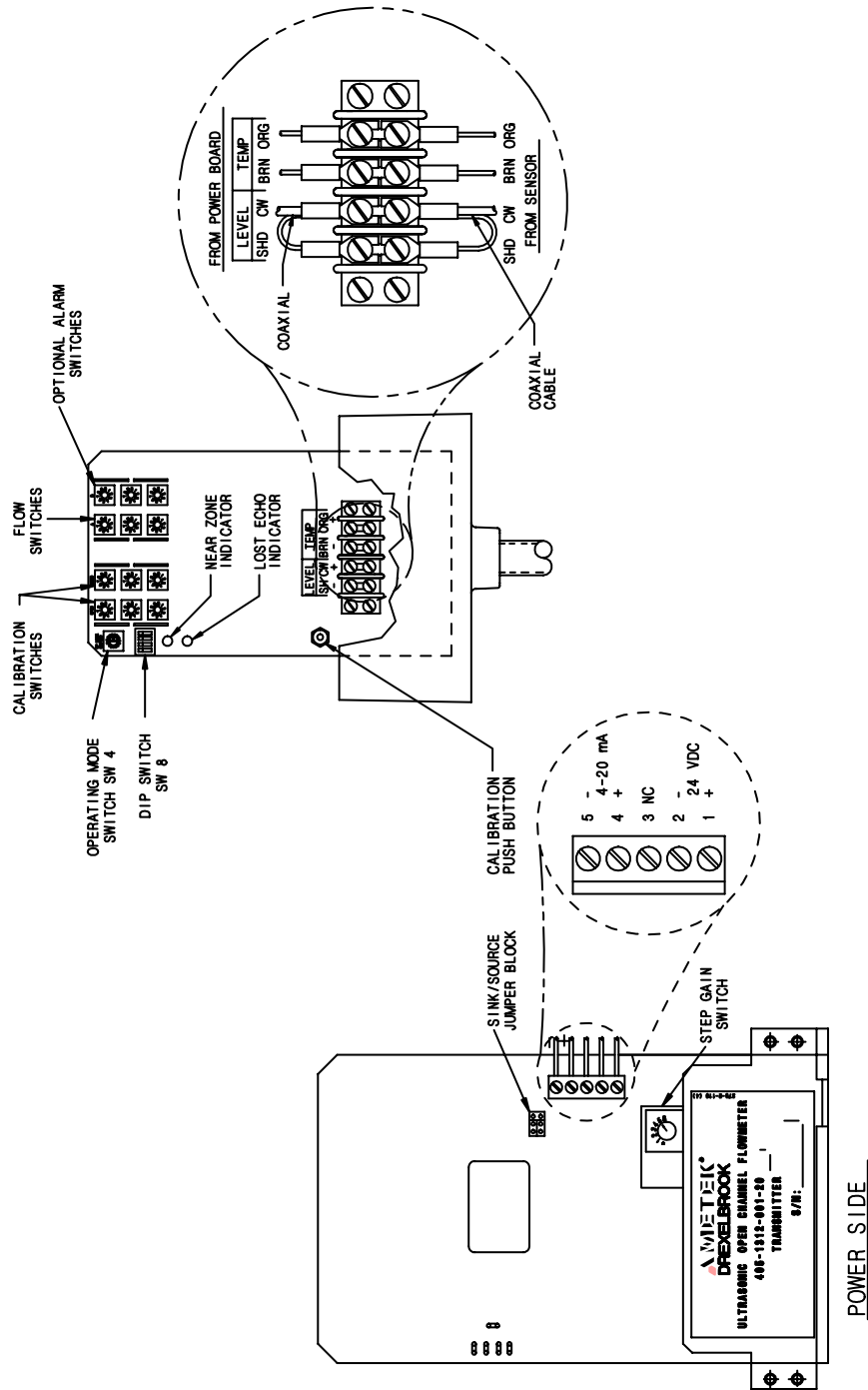


Figure 2-5
Wiring Diagram of 24 Vdc Transmitter

SECTION 3 OPERATION

3.1 Modes of Operation When using the 505-1320 Open Channel Flowmeter, there are two modes of operation: flow or distance mode.

- In the flow (or level) mode, the current output (4-20 mA) increases as the liquid level rises.
- In the 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 3.0 inches up to 87.9 inches (99.9 inches minus 12-inch near zone).

3.2 Indicators & Controls Refer to *Figures 3-1 and 3-2* for the location of indicators and controls.

—*SW8 Flow or Distance Mode*

Normal operation, and the selection of either flow or distance mode is accomplished by changing the position of switch 4 on SW8. See *Section 3.1 Modes of Operation*.

—*Time Delay Control*

The time delay control is located above SW8. A zero-second time delay (position 2) is the default selection that is set at the factory. Position 4 sets a 15-second time delay. Position 1 sets a 45-second 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 0.1-inch resolution. Zero and span switches are used to calibrate the unit. See *Section 4.2 Standard Calibration*.

—*LED Indicators*

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

—*Calibration Pushbutton*

The calibration pushbutton is used in conjunction with SW8 for maximum calibration accuracy. See *Section 4.4 Secondary Calibration*. This button can also be used as a system reset.

—*Flow Switches*

Three, ten-position rotary switches are used to set the type and size of the flume or weir. The top switch sets the type and the two lower switches set the flume or weir size in degrees or inches. See *Section 4.2 Primary Device Selection*.

3.2 Indicators & Controls

(continued)

—Alarm Relays

Outputs for Near Zone and Lost Echo are provided to activate external relays or alarms. These are separate relay packages purchased as an option.

—Step Gain Switch

Changes the gain of the ultrasonic transmitter to lessen any effect due to noise or obstruction.

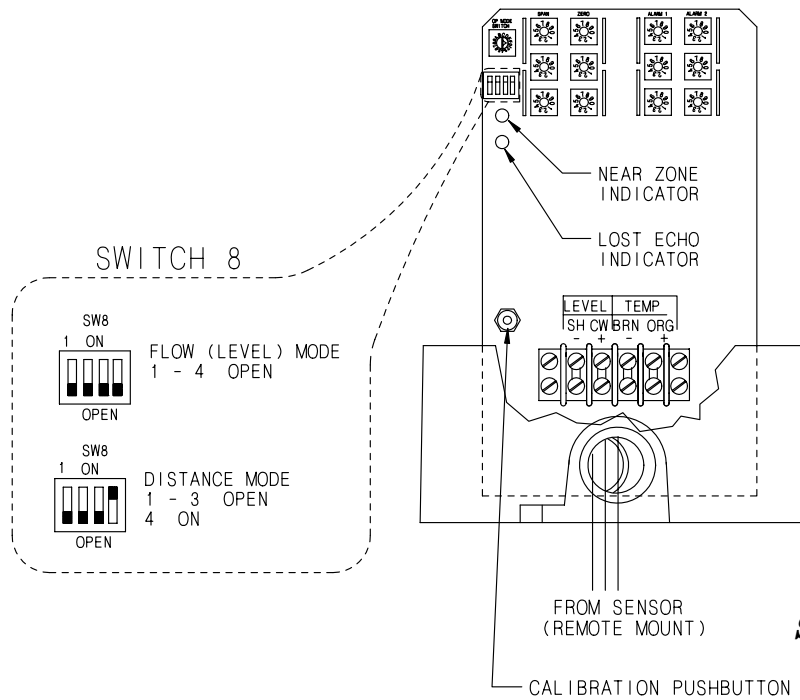


Figure 3-1
Switch 8-Flow and Distance Mode

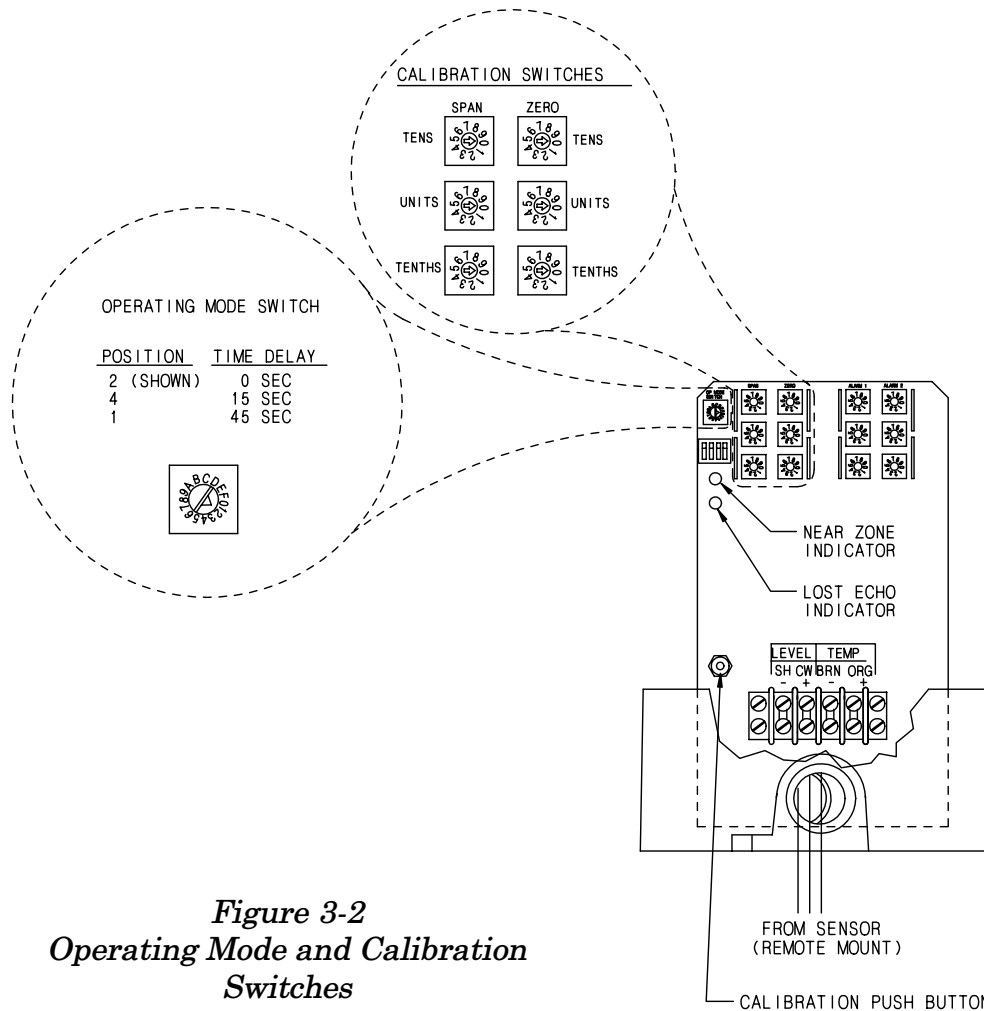


Figure 3-2
Operating Mode and Calibration
Switches

3.3 Time Delay Increasing time delay to either 15 or 45 seconds will smooth out a jumpy output signal caused by wave action or turbulence.

3.4 Step Gain Switch The step gain switch can be used to decrease the acoustic signal and avoid noise interference. See *Figure 4-4* for the location of the step gain switch.

The standard instrument is capable of shooting to a distance of 40 feet. Most open channel flow installations shoot a distance of less than 36 inches. The excess power can cause measurement inaccuracies due to the 12 degree beam angle. On small throat width Parshall flumes (1,2, and 3-inch), the acoustic signal hits the sidewall of the flume. Any slime or surface irregularities sends a false signal back to the receiver. By reducing the gain of the transmitter (using the step gain switch) the measurement inaccuracies can be eliminated.

The factory setting is position 3.

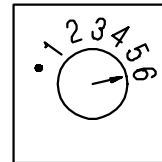
This setting should be adequate for most applications.

If false high readings occur, *decrease* the gain.

If loss of echo occurs, *increase* the gain

Step Gain Switch

6	100% gain
5	84 % gain
4	67% gain
3	50% gain
2	32% gain
1	17% gain
●	8% gain



NOTE

If the step gain is adjusted, the instrument should be recalibrated using the secondary calibration procedure described in *Section 4.4 Secondary Calibration*.

SECTION 4 CALIBRATION

4.1 Introduction

The 505-1302 Series transmitter must be set for the type and size of the primary device and the actual zero and span values for the specific application. This procedure is outlined in *Sections 4.1 through 4.3*. After standard calibration, the flowrate reading should be approximately within the 0.5% accuracy specification.

4.2 Primary Device Selection

Use this procedure to select the type and size of the primary device. See *Figure 4-1* and *Table 4-1*.



NOTE

If type 0 (linear) is selected, set both switches for primary device size to zero (0).



NOTE

When an invalid primary device type or size is selected, Near Zone and Lost Echo indicators will flash. If this happens, enter correct values or reset device using calibration pushbutton shown in *Figure 3-2*.



- a. With the power off, select the Type of Primary Device switch for the specific type of flume or weir.
 - 0 - Standard (linear)
 - 1 - Parshall Flume
 - 2 - Rectangular Weir with End Contractions
 - 3 - Rectangular Weir without End Contractions
 - 4 - Cippoletti Weir
 - 5 - V-Notch Weir
 - 6 - Leopold Lagco Flume
 - 7 - Palmer Bowlus Flume

- b. Now set the Size of Primary Device switch in inches (or degrees for V-notch weir applications). The middle switch represents the tens and the lower switch represents the units. For example, 36 inches is set 3 for tens and 6 for units.

Primary Device	Valid Sizes									
Parshall	1"	2"	3"	6"	9"	12"	18"	24"	30"	36"
	48"	60"	72"	96"	c					
Rectangular Weir with End Contractions	12"	18"	24"	30"	36"	48"	60"	72"	96"	
	(greater than 96", set to 96")									
Rectangular Weir without End Contractions	12"	18"	24"	30"	36"	48"	60"	72"	96"	
	(greater than 96", set to 96")									
Cipoletti Weir	12"	18"	24"	30"	36"	48"	60"	72"	96"	
	(greater than 96", set to 96")									
V-notch Weir	22°	(22.5°)	30°	45°	60°	90°				
Leopold-Lagco Flume	4"	6"	8"	10"	12"	15"	18"	21"	24"	30"
	36"	42"	48"	54"	60"	66"	72"			
Palmer Bowlus Flume	4"	6"	8"	10"	12"	15"	18"	21"	24"	27"
	30"	36"	42"	48"	60"	72"				

*Table 4-1
Primary Device Selection*

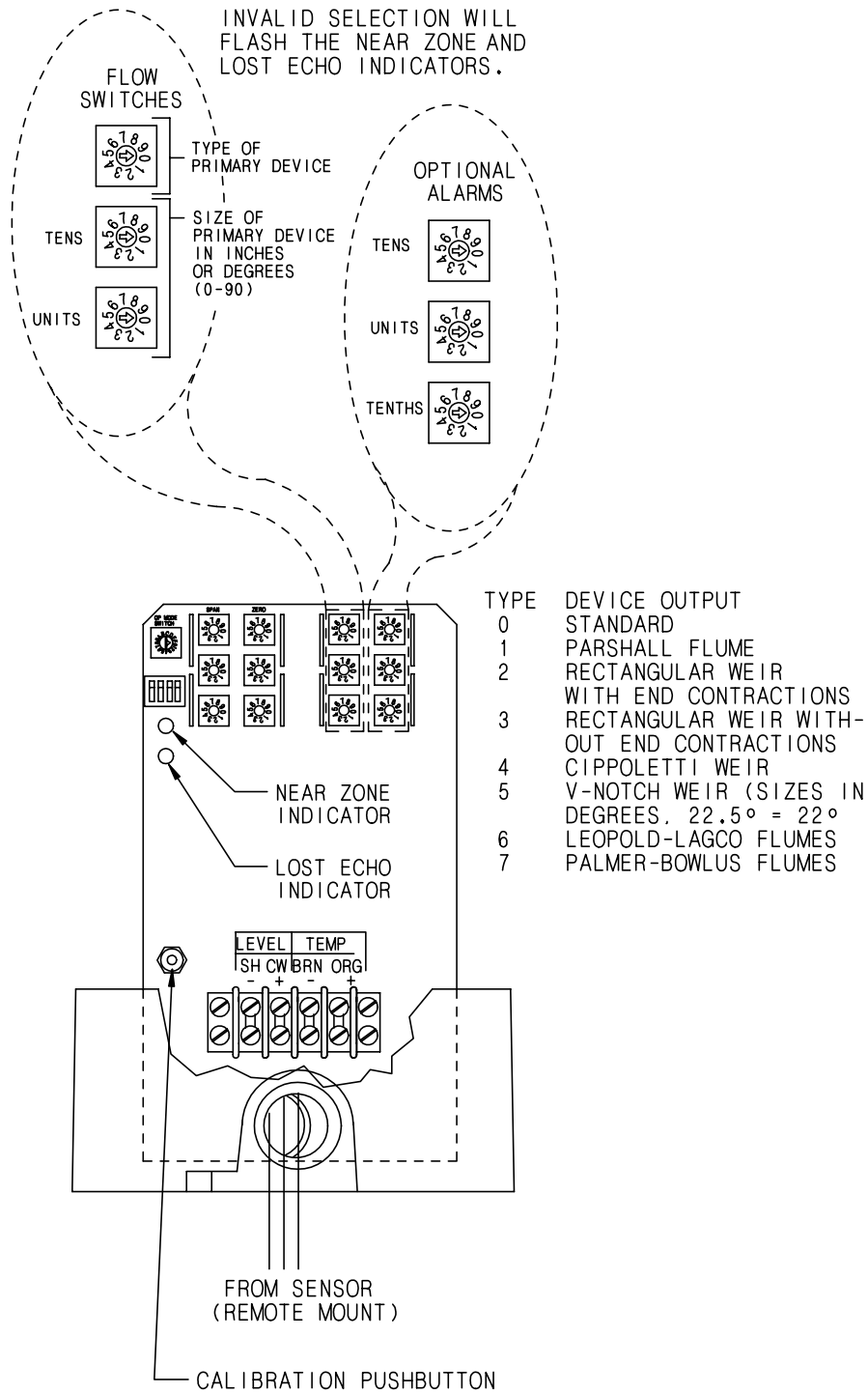


Figure 4-1
Flow and Relay Switches

4.3 Standard Calibration Use this procedure to set the Zero and Span values.



- a. With the power off, set the Zero switches in inches (to the nearest 0.1 inch) to equal the distance from the transducer face to the level that represents 0% flowrate (4mA). See *Figure 4-2*.

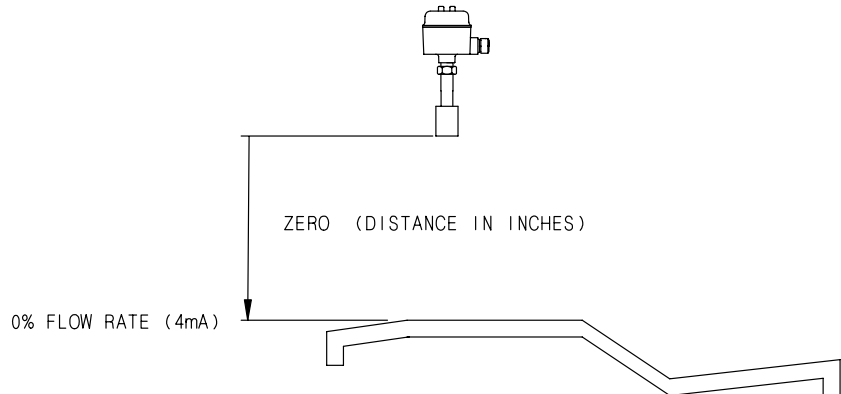


Figure 4-2
Setting Zero

- b. Now set the Span switches in inches (to the nearest 0.1 inch) to equal the distance from the zero flow point (e.g. bottom of the flume) to the level which represents 100% flowrate (20 mA). See *Figure 4-3*.

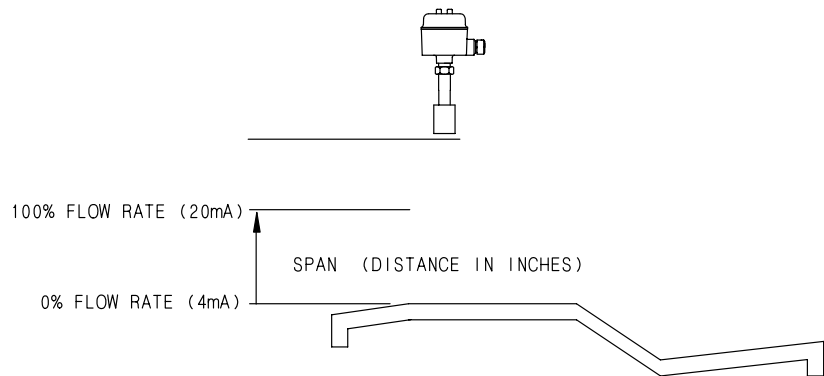


Figure 4-3
Setting Span



NOTE

The level that represents the 100% flowrate point (20 mA) must be at least 12 inches from the transducer face to allow for the Near Zone.



- c. Apply power to the transmitter. The 4-20 mA signal now represents the 0-100% flow rate range.

4.4 Secondary Calibration



CAUTION

Secondary calibration procedure permanently overwrites factory calibration.

- a. Perform the standard calibration per *Section 4.3*.
- b. Record the Zero switch settings.
- c. Measure the distance from the transducer face to the liquid level as accurately as possible (to the nearest 0.1 inch). Set the Zero calibration switches to this measured distance. For example, if you measured 20.5 inches from the transducer face, set the Zero calibration switches to 2-0-5.
- d. Observe both LEDs flashing.
- e. Push and hold the black calibration pushbutton. Place SW8, switch position 1 to the ON (up) position.
- f. Release the calibration pushbutton, both LED indicators will come on and light steady. Wait approximately 60 seconds until they begin to flash. Flashing LEDs now indicate the memory update is complete.
- g. Push and hold the black calibration pushbutton. Place SW8, switch 1 in the OFF (down) position.
- h. Release the calibration pushbutton.
- i. Return the Zero switch settings (if necessary) to the value corresponding to the level which represents 0% (4 mA).
- j. The secondary calibration is now complete.

- 4.5 Setpoint Calibration (only for those units equipped with optional 24 Vdc output)**
- a. Refer to *Figure 4-1* for location of relay switches.
 - b. Alarm points are set directly in tenths of inches from zero point.

As an example, an alarm point could be set 6 inches from the zero point or minimum level. Starting with the top switch of “B” (or ALM2), the settings would be 0-6-0.

- c. Alarm settings can be set to alarm at any point in the calibrated range.
- d. Connections are made to the transmitter on jumper J6 as shown in *Figure 4-4*.

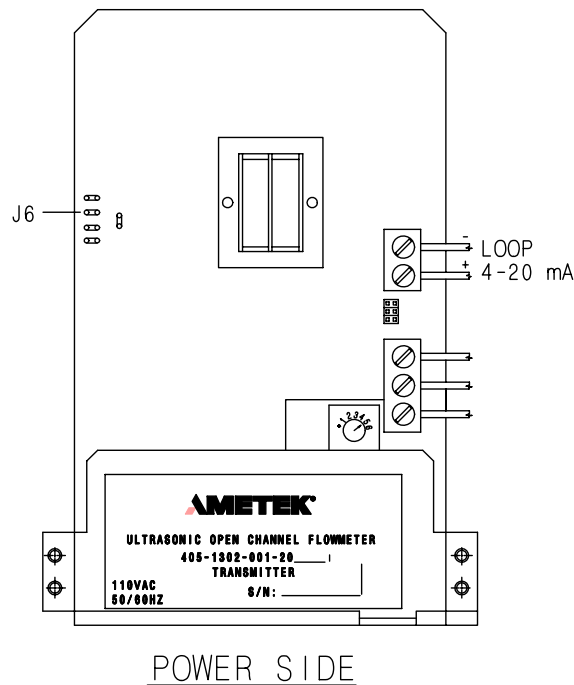


Figure 4-4
Alarm Relay Jumper (J6)

505-1320 Series Ultrasonic Open Channel Flowmeter™

4.6 Accessory Packages

Several accessories are available for the 505-1320 Ultrasonic Open Channel Flow instrument.

4.6.1 401-600 Series Relay Package

As an option, a 401-600 external relay package is available. This package provides a remote-mounted relay outputs for Alarm 1, Alarm 2, Lost Echo and Near Zone. This package can also be equipped with remote LEDs to indicate Loss Echo or Near Zone.

A short cable (*Figure 4-5*) is available to connect the 401-600 relay package to the ultrasonic instrument. Cable 380-5000-053 contains 36 inches of ribbon cable with 5 colored crimp connectors (labeled 2 through 6 on *Figure 4-5*) and 1 non-crimped connector (labeled 1 on *Figure 4-5*). The non-crimped connector is only required if using a relay package that contains remote LEDs for indicating Lost Echo or Near Zone.

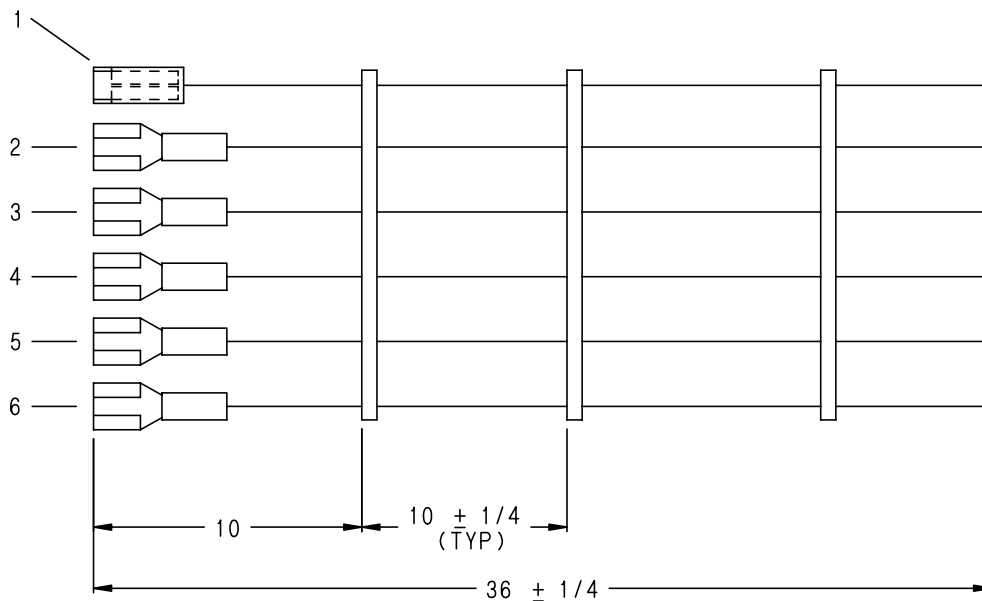


Figure 4-5
Relay Package Cable

505-1320 Series Ultrasonic Open Channel Flowmeter™

4.6.1 401-600 Series Relay Package

(continued)

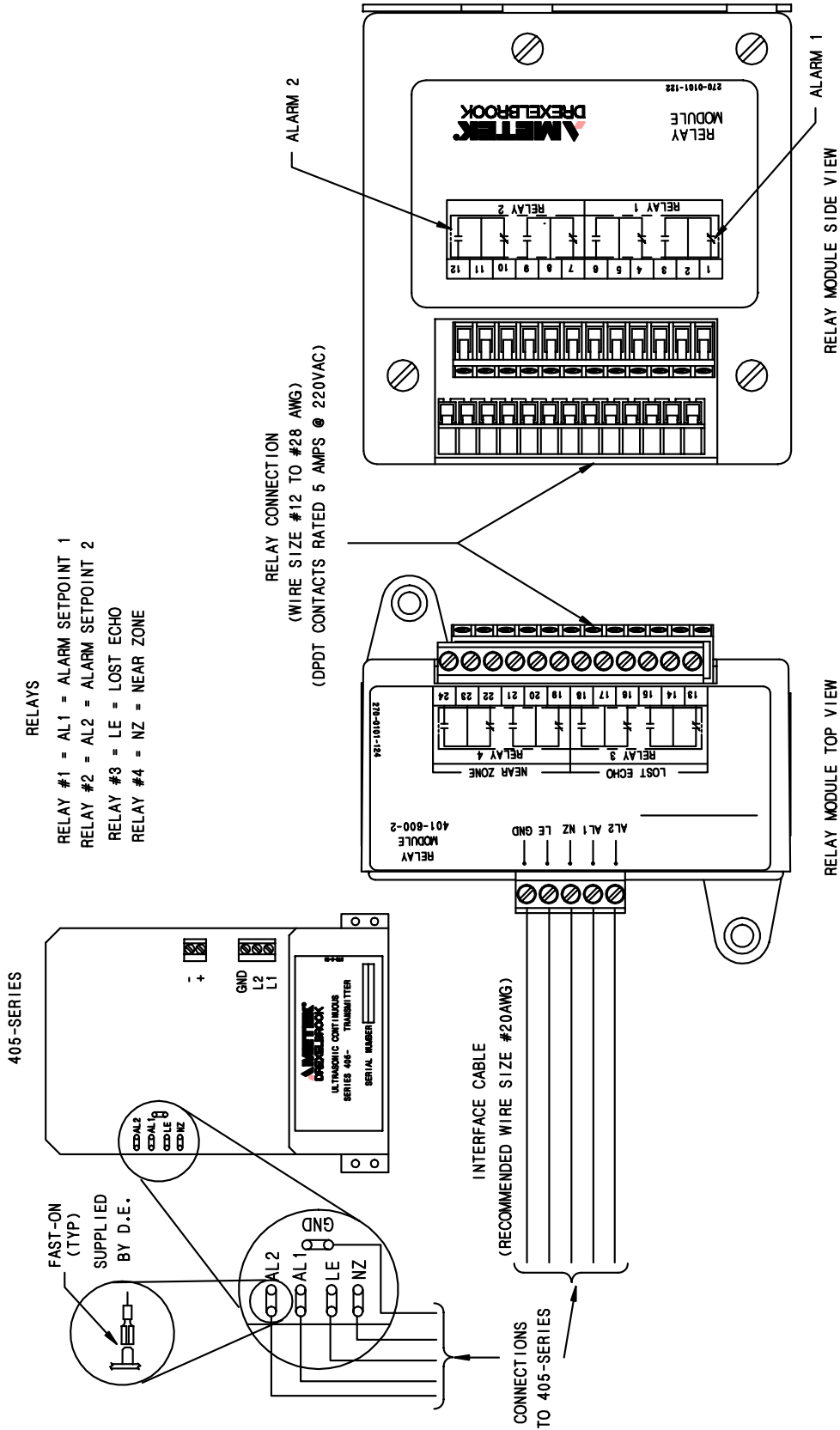
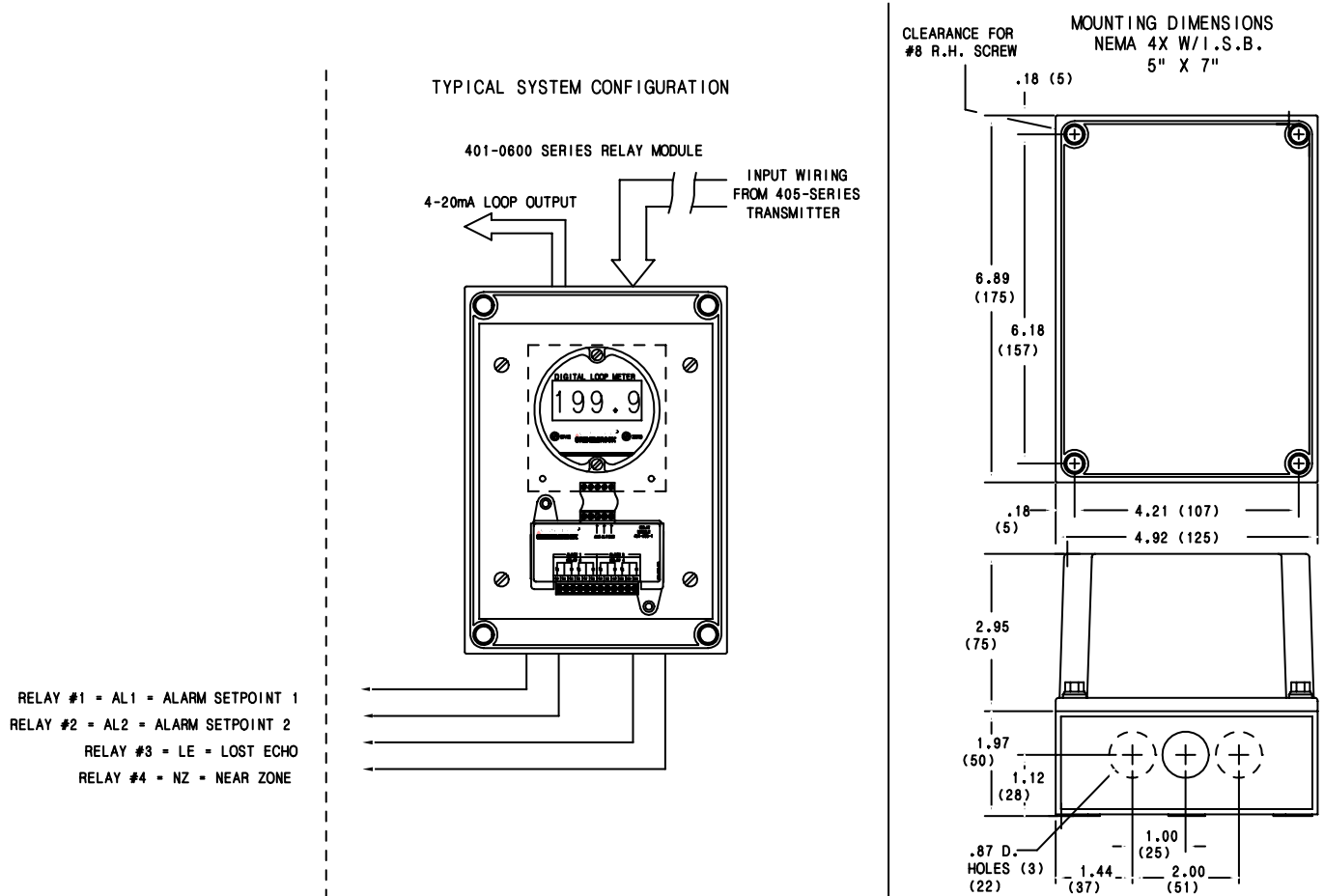


Figure 4-7
Relay Package
Wiring Diagram

505-1320 Series Ultrasonic Open Channel Flowmeter™

4.6.1 401-600 Series Relay Package

(continued)



*Figure 4-8
 Relay Package
 NEMA 4X Housing
 with Intrinsic Safety Barriers*

505-1320 Series Ultrasonic Open Channel Flowmeter™

4.6.1 401-600 Series Relay Package

(continued)

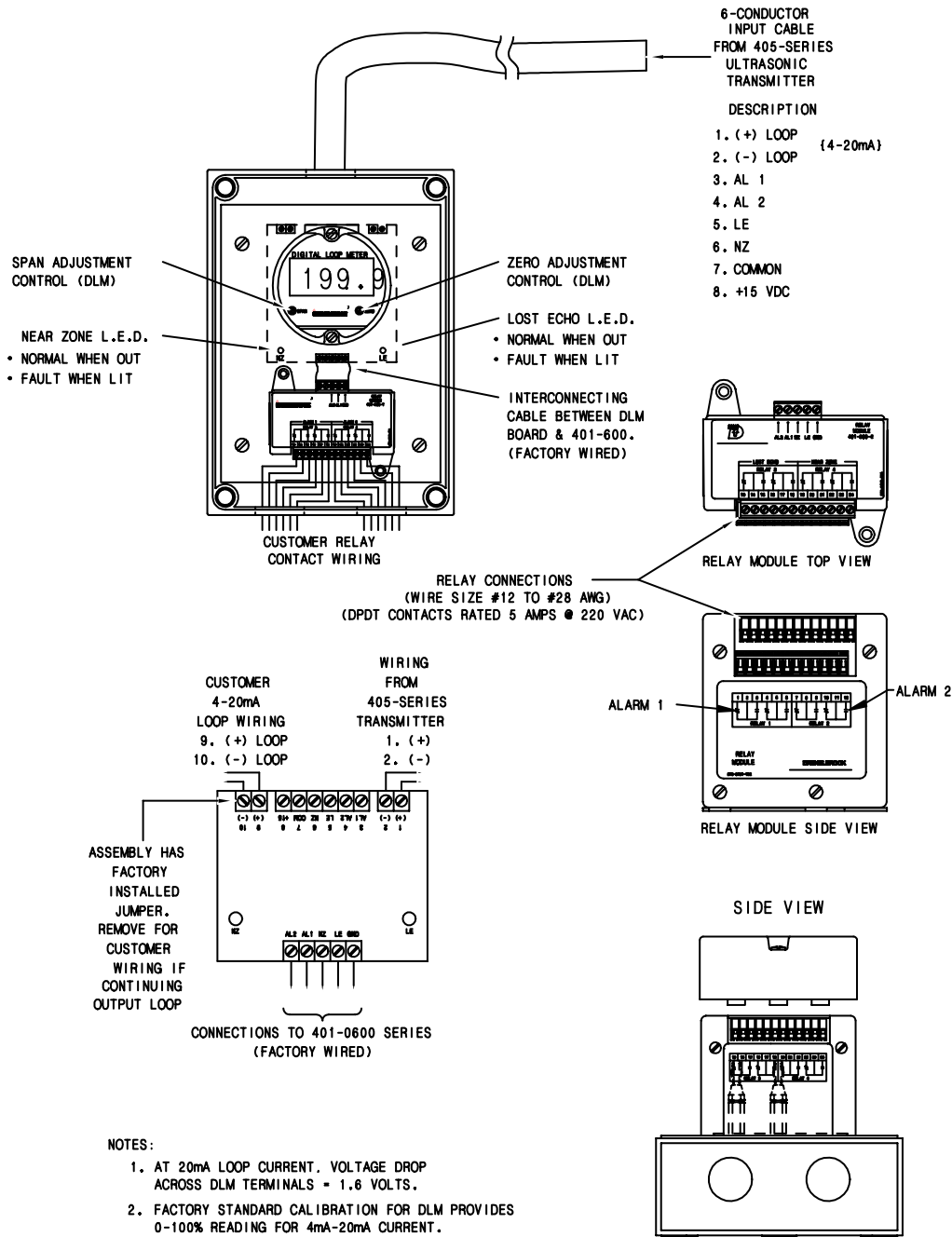
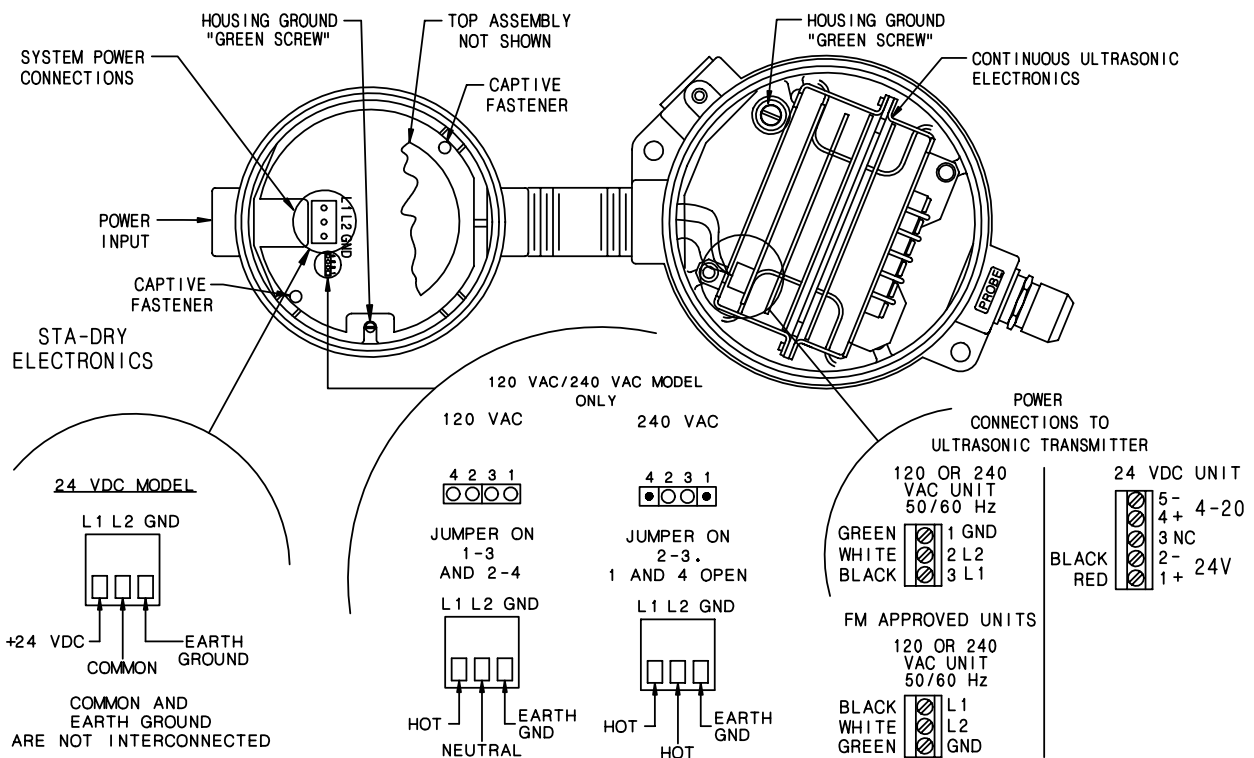


Figure 4-9
Relay Package with
Digital Loop Wiring

505-1320 Series Ultrasonic Open Channel Flowmeter™

4.6.2 Sta-Dry™ Option (Modification 9128)

In some applications, condensation or ice can build up on the transducer face causing a reduction or loss of the acoustic signal. The Sta-Dry option maintains the temperature of the transducer face at a level that prevents condensation or ice from forming. The Sta-Dry option consists of a heating element in the face of the transducer and the temperature control unit close coupled to the ultrasonic transmitter housing.



NOTE:

1. LOOSEN CHASSIS SCREWS ON ULTRASONIC ELECTRONICS AND ROUTE "STA-DRY" LEADS AROUND ELECTRONICS BRACKETS TO AVOID LID THREADS.

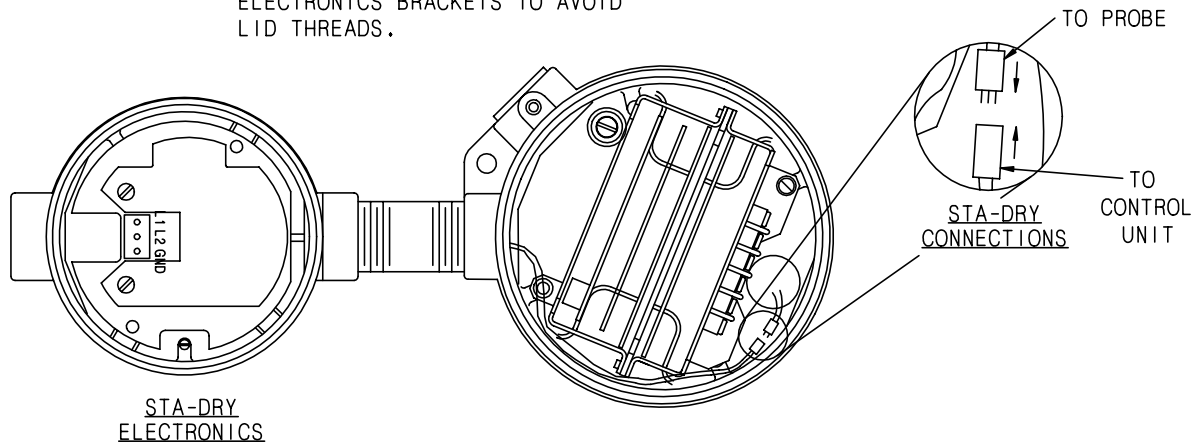


Figure 4-10
Sta-Dry Modification Wiring

505-1320 Series Ultrasonic Open Channel Flowmeter™

4.6.3 Universal Process Meter (401-90X-2)

As an option, the universal process meter is available with flow rate, totalizer and batch control capabilities.

Before wiring the the universal process meter in the loop, check the output mode of the transmitter. See *Section 2.3 Wiring the Instrument, Output Select Jumper*. Refer to *Figures 4-11 and -12* for loop wiring in the sink and source modes respectively.

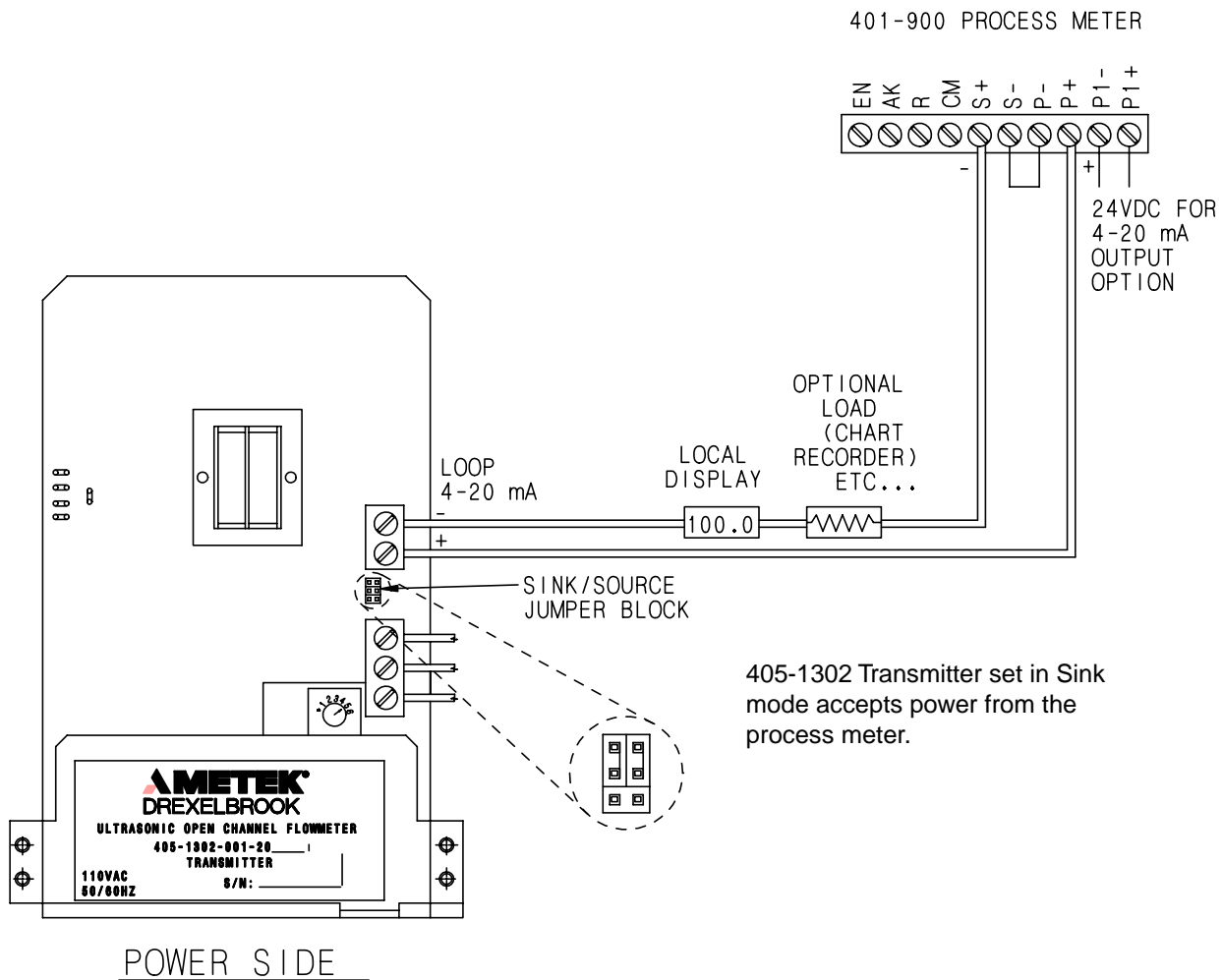
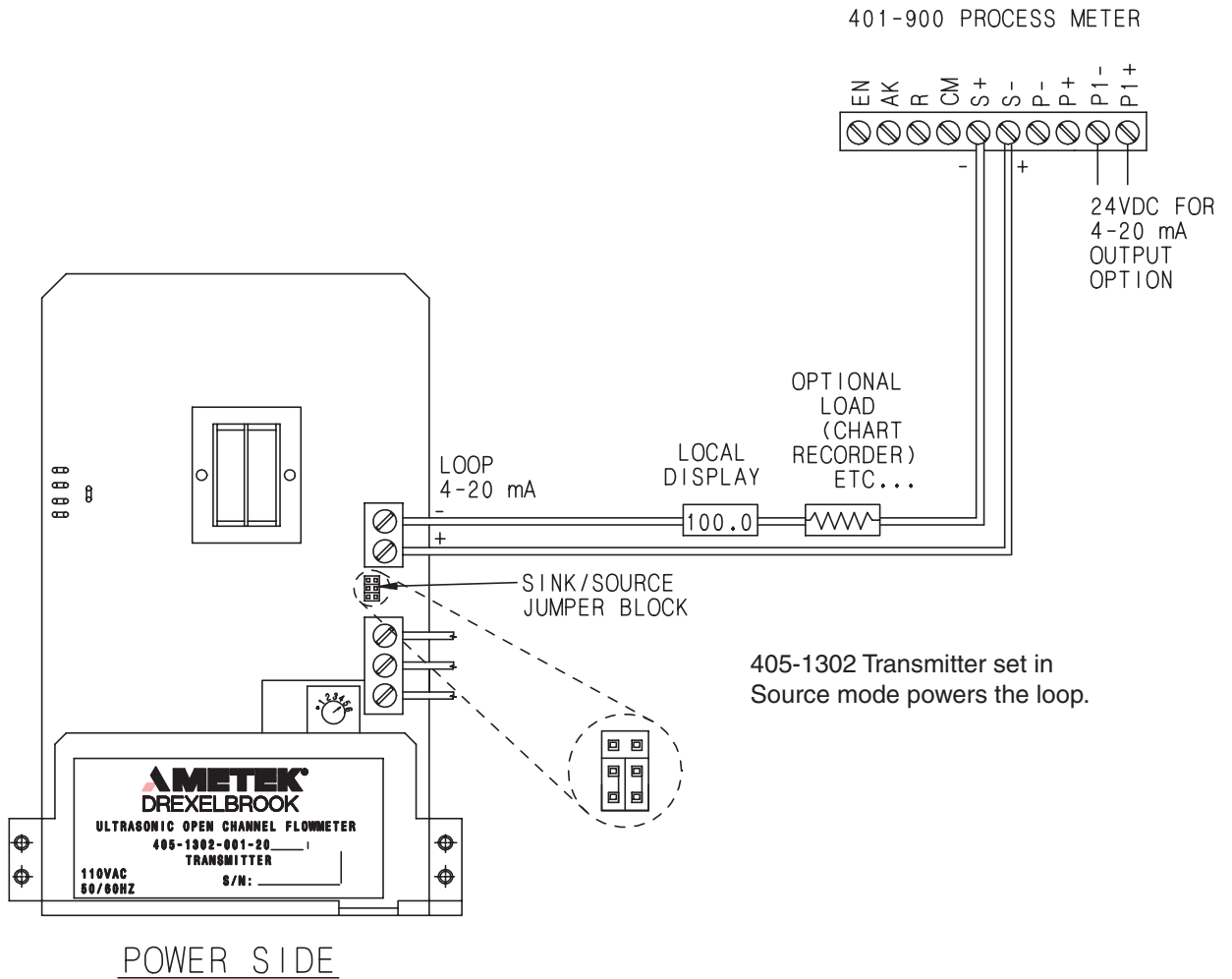


Figure 4-11
Loop Wiring, Sink Mode

505-1320 Series Ultrasonic Open Channel Flowmeter™

4.6.3 Universal Process Meter (401-90X-2)

(continued)



*Figure 4-12
Loop Wiring, Source Mode*

SECTION 5 TROUBLESHOOTING

The 505-1302 instrument is designed to give years of unattended service. No periodic or scheduled maintenance is required.

5.3 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, a stilling well installation may be required. Consult factory.
- c. Any continuous ultrasonic transmitter signal/echo will be adversely affected by significant foam on the liquid level surface. If this condition exists, please consult the factory for further application review.
- d. Ensure that the transducer face is not recessed into a mounting nozzle. Spurious 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.



5.2 Checking Transducer

An ohmmeter test is used to check the transducer crystal. It can also be used to verify that the wires from the transducer to the sensor (on a remote system) are not reversed, shorted, or open.

Using a digital ohmmeter, a reading of 9-13K ohms should be present between Center Wire [CW] to Shield [SHD].

5.3 Checking Temperature Sensor

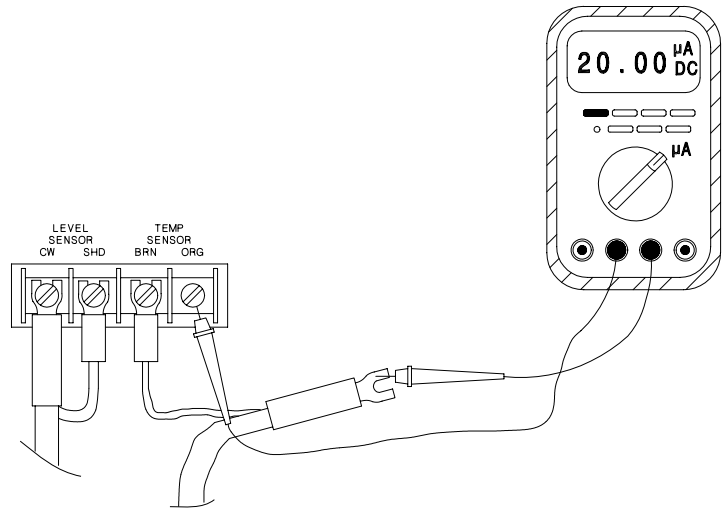
—Resistance Check

- a. Disconnect the temperature transducer wires (brown and orange) leading to the transducer.
- b. Using a digital ohmmeter, a good transducer measures 12 to 35 megohms with the positive test lead on the orange lead and the negative test lead on the brown lead (standard sensor). The negative test lead attaches to the brown and white striped wire on the high temperature sensor (703-6-1).
- c. Reverse the meter leads and an open circuit (infinite ohms) should be observed.

5.3 Checking the Temperature Sensor (continued)

—Operation Check

A more precise way to check the temperature sensor is to measure the current flow while the unit is on. Refer to *Figure 5-1*.



- a. Shut power off.
- b. Loosen the screw holding the orange wire at the transmitter.
- c. Remove the orange wire.
- d. Place a multimeter (capable of measuring microamps) in series with the orange wire and empty screw.



- e. Re-apply power.
- f. The microammeter should read:
 - 273 µamps @ 32°F
 - 293 µamps @ 68°F
 - 311 µamps @ 100°F

Readings outside these listed ranges indicate a failed temperature sensor. Call Factory Service at 1-800-527-6297.

If you have questions about your Drexelbrook equipment:



- Contact your local Drexelbrook representative,
- Call the Service department toll-free at 1-800-527-6297 (in US and Canada) or 1-215-674-1234 (outside North America),
- Fax the following information to the Service department at 1-215-443-5117.

505-1320 Series Ultrasonic Open Channel Flowmeter™

*Table 5-1
Troubleshooting Sheet for Continuous Ultrasonic Instruments*

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 position should = 4 mA. OFF position should = 20 mA.

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

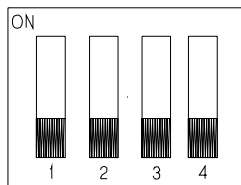
Check for 110 Vac on TB1 (see Figure 2-3)
or check for 24 Vdc on TB1 (see Figure 2-4) _____

Loop supply voltage is measured at TB2 on 110 Vac unit or TB1-terminals 4 and 5 on a 24 Vdc unit. Loop supply voltage (with no load) should be 24-30 Vdc.

What is the position of the hex switch SW4 (located directly above SW8)?



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



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 μ A 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.

SECTION 6 CUSTOMER ASSISTANCE

6.1 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 _____

6.2 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.

6.3 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.

6.4 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 _____

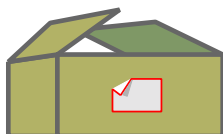
MSDS sheets for any hazardous materials

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.

SECTION 7 SPECIFICATIONS

7.1 Transmitter Specifications	Near/Dead Zone:	12 inches
	Minimum Span:	3 inches or 10% of maximum span (whichever is greater)
	Maximum Span:	87.9 inches
	Maximum Zero:	99.9 inches
	Repeatability:	0.1 inch
	Resolution:	0.1 inch
	Linearity:	0.5% of full scale for spans above 3 feet. 0.25% of full scale for spans below 3 feet.
	Accuracy ¹ :	+/- 0.5% of full scale range.
	Ambient Temperature:	-40° to 160°F
	Temperature Compensation:	Automatic
	Calibration:	Nearest 0.1 inch Zero and Span range switches, ranges are set directly in inches.
	Input Power:	120 Vac, 50/60 Hz; 240 Vac, 50/60 Hz; or 24 Vdc
	Output Signal:	4-20 mA dc (isolated)
	Output Load:	0-1000 ohms
Response Time:	2 seconds (approx.)	
Electrical Enclosure:	NEMA 4X cast aluminum standard NEMA 4X fiberglass optional 5-inch explosionproof	
7.2 Transducer Specifications	Mounting:	Integral or Remote 2" NPT fitting (flume/weir mounting bracket available)
	Sensor Material:	CPVC or Teflon (Other materials consult factory)
	Beam Angle:	Conical, 12° typical
	Process Temperature:	-40°F to 160°F(CPVC) -40°F to 200°F(Teflon)

¹Accuracy includes linearity, hysteresis, repeatability, resolution, & temperature effect, at reference conditions of atmospheric pressure & still air above liquid surface.

AMETEK[®]
DREXELBROOK

An ISO 9001 Certified Company

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