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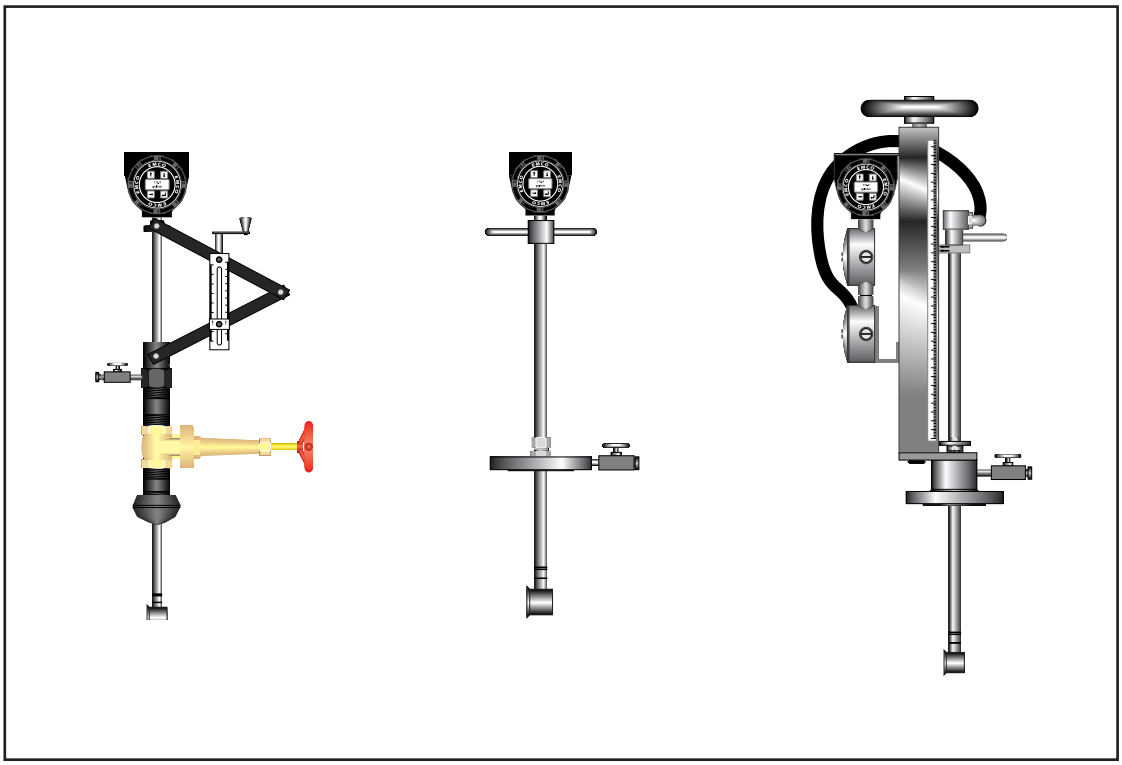
INSTALLATION AND MAINTENANCE INSTRUCTIONS

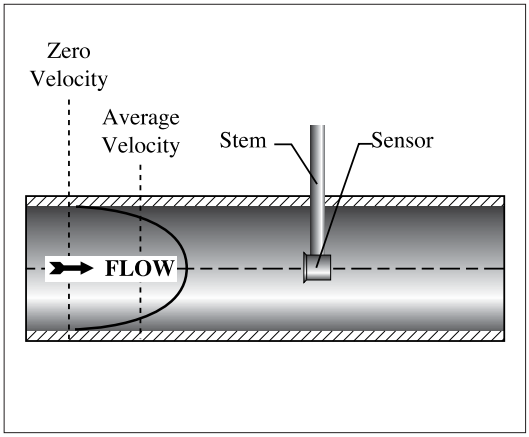
IM-8-602-US **May 2009**

V-BAR



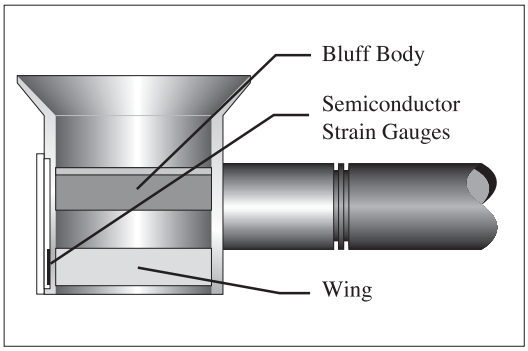
Section 1

PRINCIPLE OF OPERATION

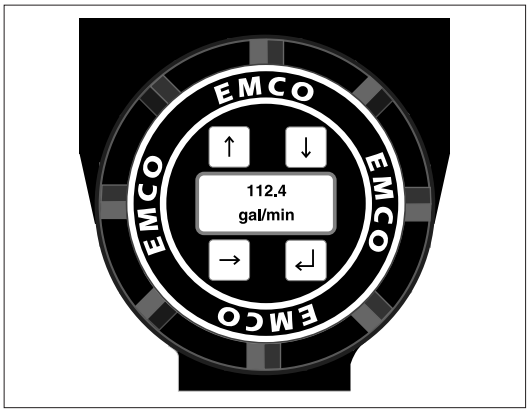


The V-BAR is an insertion vortex flowmeter. Unlike a full-bore flowmeter which replaces a section of pipe, an insertion meter is inserted into the pipe line and can be installed without process shutdown.

The V-BAR™ measures the volumetric flowrate by measuring the local velocity, at the sensor insertion depth, and converting it to an average velocity and then to an average flowrate.



The local velocity is determined by detecting the frequency at which vortices are alternately shed from the sensor's bluff body. The vortices pass the sensor wing causing a slight deformation in the wing which is detected by semiconductor strain gauges. These strain gauges generate an electrical frequency signal which is proportional to the local velocity.

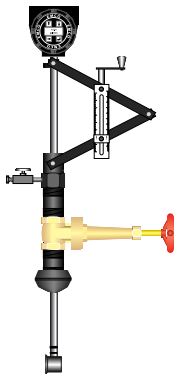


Microprocessor based electronics amplify, filter and convert the sensor input into the volumetric flowrate. The electronics then provide a 4-20 mA and/or frequency output proportional to the flowrate. The flowrate can also be locally displayed and totalized in user selectable, engineering units.

- EZ Logic User Interface
- Smart transmitter/HART protocol
- Simultaneous 4-20 mA and frequency outputs
- Line sizes from 3" to 80" (75 to 2000 mm)
- Negligible pressure loss
- Optional, integral pressure and/or temperature transmitter

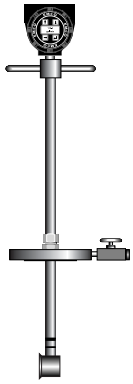
FEATURES
(continued)

V-BAR 600 SERIES



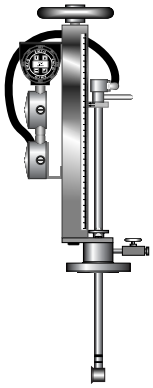
- Line pressures up to 125 psig (8.62 barg)
- Temperature range from -40 to 400 °F (-40 to 204 °C)
- Hot tappable
- Bronze isolation valve included
- Retractable using screw thread rising stem design
- Mounting: 2" NPT with Thread-o-Let
- Integral scale for accurate sensor positioning

V-BAR 700 SERIES



- Line pressures up to 2000 psig (138 barg)
- Temperature range from -40 to 500 °F (-40 to 260 °C)
- Not hot tappable
- Mounting: 2" NPT or 2" raised face 150#, 300#, 600#, or 900# ANSI flanges

V-BAR 900 SERIES



- Line pressures up to 900 # flange rating
- Temperature range from -40 to 500 °F (-40 to 260 °C)
- Hot tappable
- Retractable using ACME, non-rising stem
- All stainless steel construction
- Integral scale for accurate sensor positioning
- Mounting: 2" raised face 150#, 300#, 600#, or 900# ANSI flanges

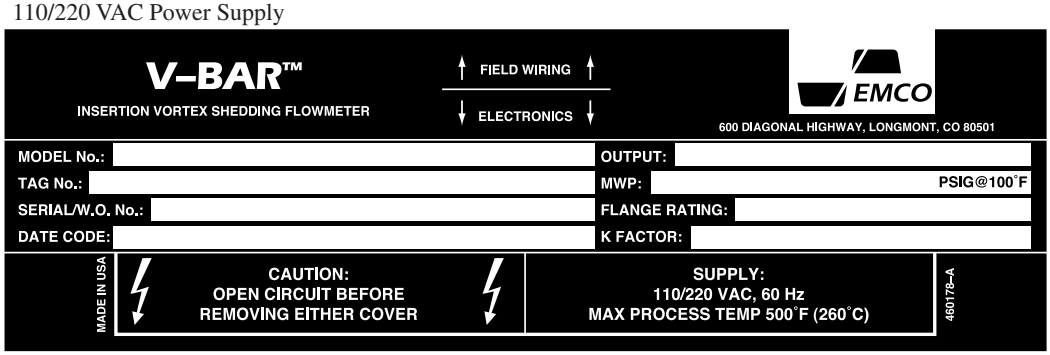
EQUIPMENT

Upon receiving your Spirax Sarco equipment, verify that all materials on the packing list are present. In addition, check for possible shipping damage, and notify the freight carrier or your Spirax Sarco representative if any has occurred.

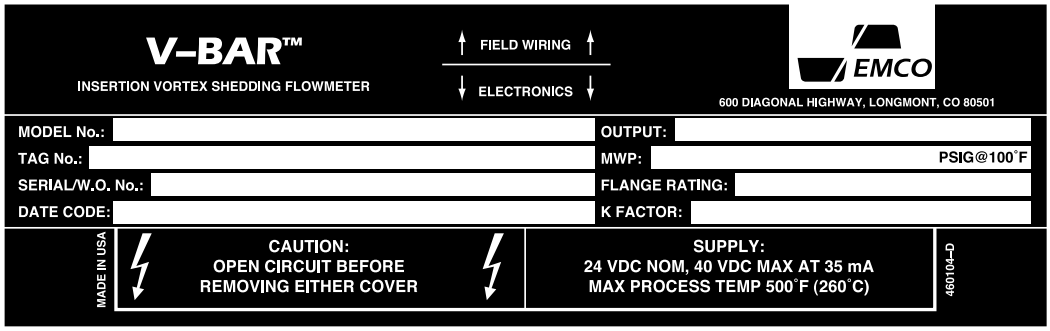
I.D. PLATE

A permanent identification plate is attached to your V-BAR flowmeter. This I.D. plate contains information on Model, Serial/W.O., date, pressure, temperature, and tag (if supplied by customer). Verify that this information is consistent with your metering requirements. This I.D. plate also shows applicable approvals.

110/220 VAC Power Supply



24 VDC Power Supply



CALIBRATION SHEET

Make sure to save the calibration data sheet when unpacking your new meter. This is important for monitoring the performance of your meter.

EZ LOGIC INTERFACE MAP

This map shows how the meter has been programmed at the factory. If your application changes, contact your Spirax Sarco representative for an updated map.

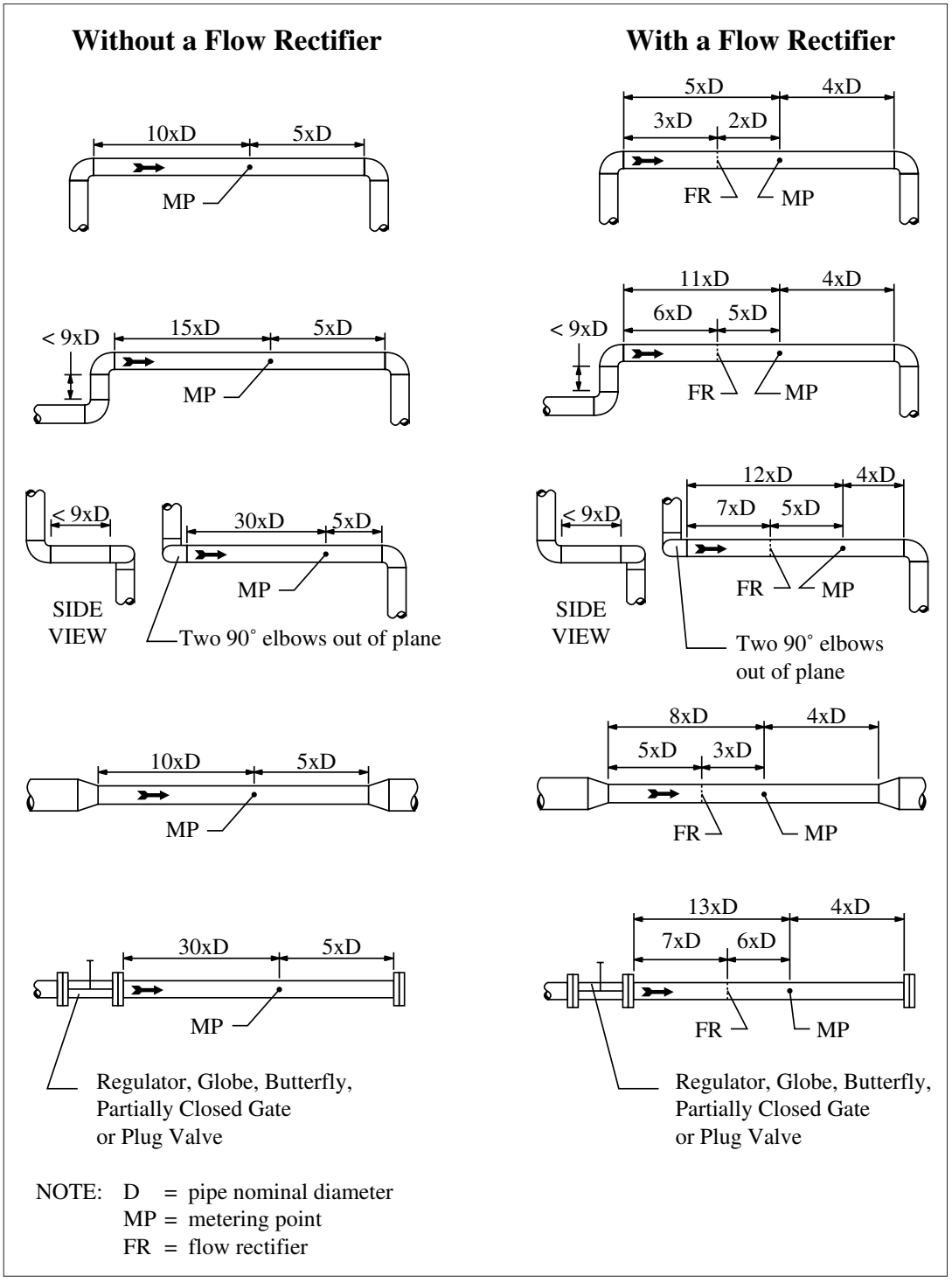
NOTE

For CE approved meter/installations, see notes regarding wiring, DC power and remote electronics.

PIPING

Straight Run Requirements

The minimum requirements for straight run piping are shown.

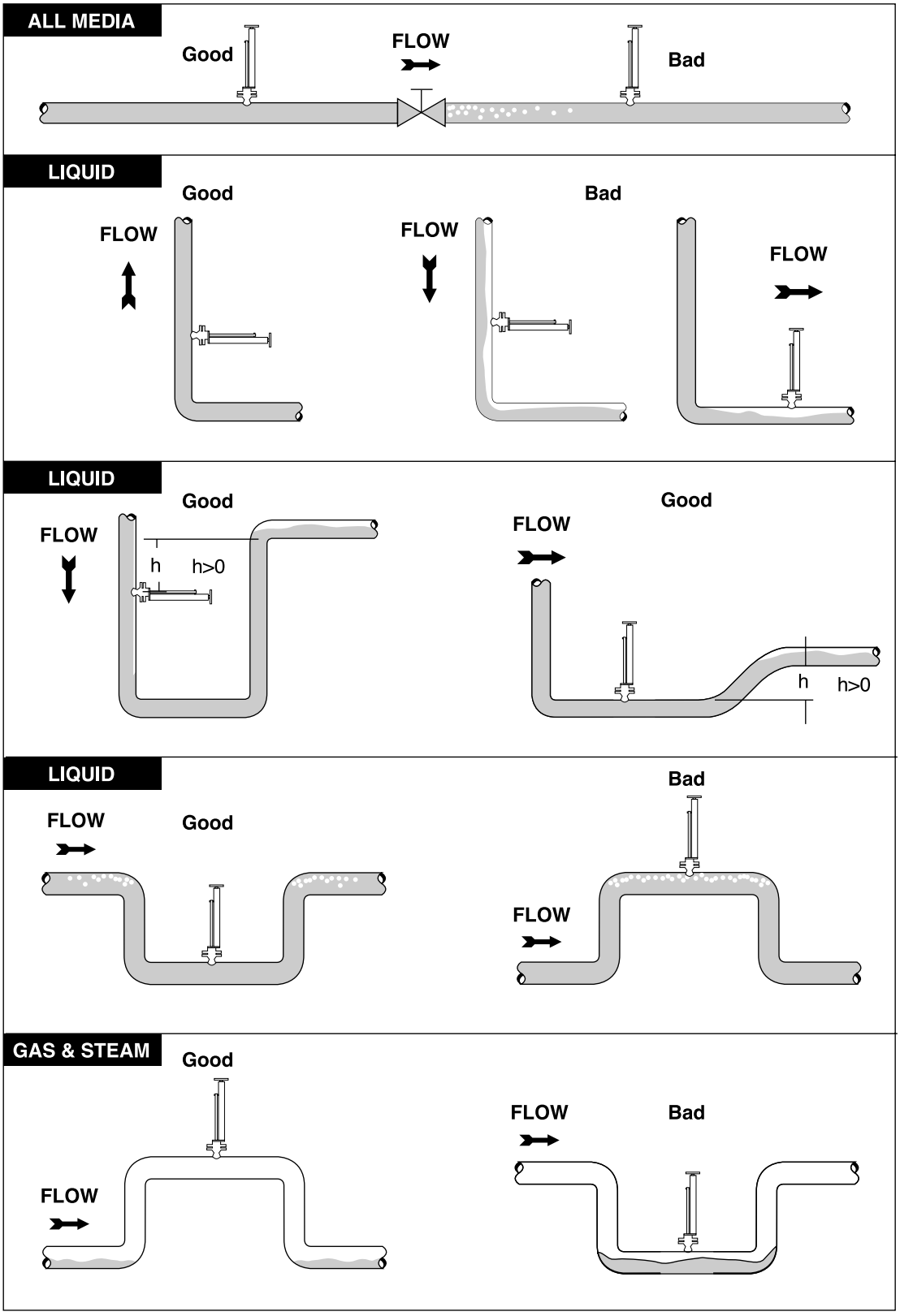


NOTE: D = pipe nominal diameter
MP = metering point
FR = flow rectifier

PIPING
(continued)

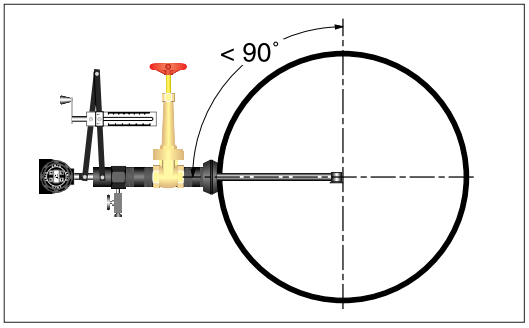
Meter Location

Recommended meter locations are shown.



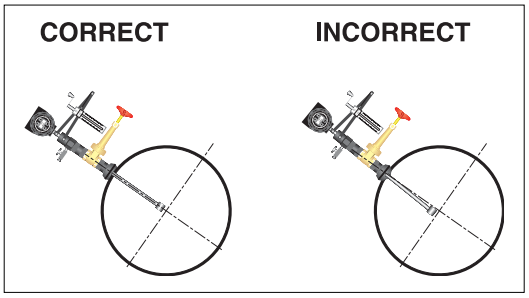
MOUNTING

Non-Vertical



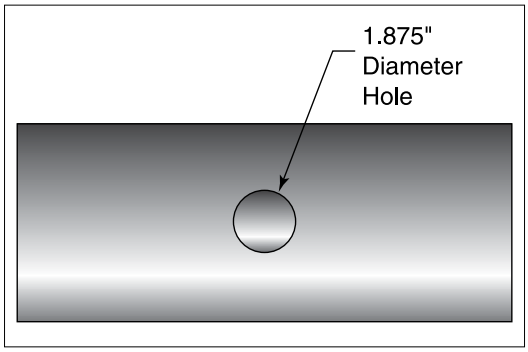
If non vertical mounting is necessary, the deviation from vertical should not exceed 90°.

Meter Alignment



Ensure that the flowmeter is correctly aligned to avoid measurement errors.

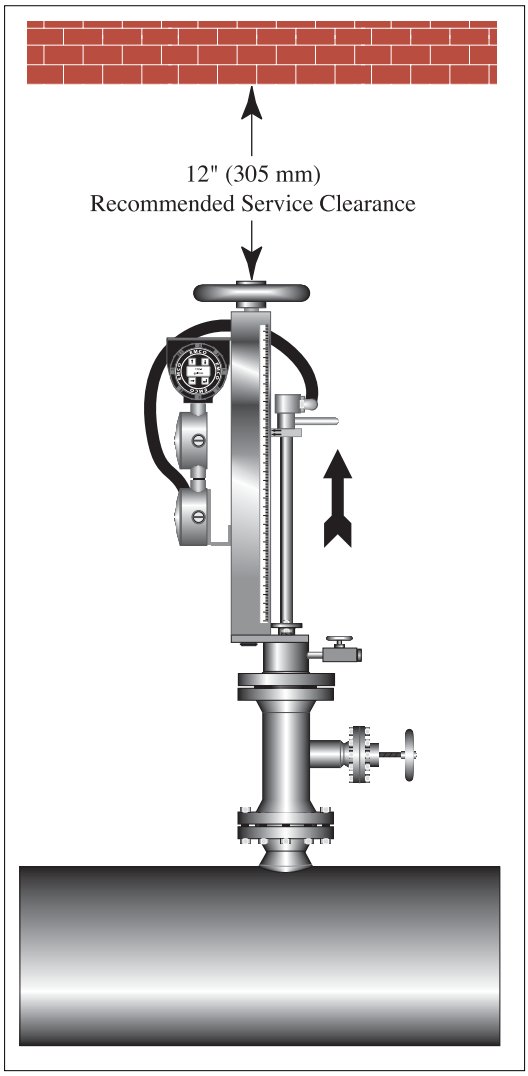
Pipe Tapping



The pipe may be either hot or cold tapped. Hot tapping can be done under full flow conditions. Cold tapping requires process shutdown and line depressurization. For proper installation ensure that tap is at least 1.875" in diameter. Remove all burrs and/or weld slag around opening.

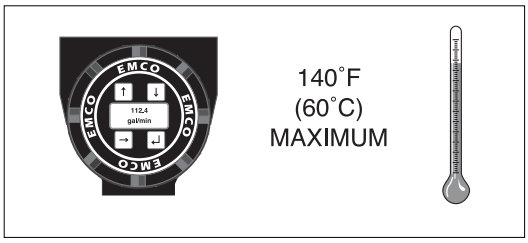
MOUNTING
(continued)

Overhead Clearance



A minimum of 12" (305 mm) of overhead clearance is recommended for ease of installation.

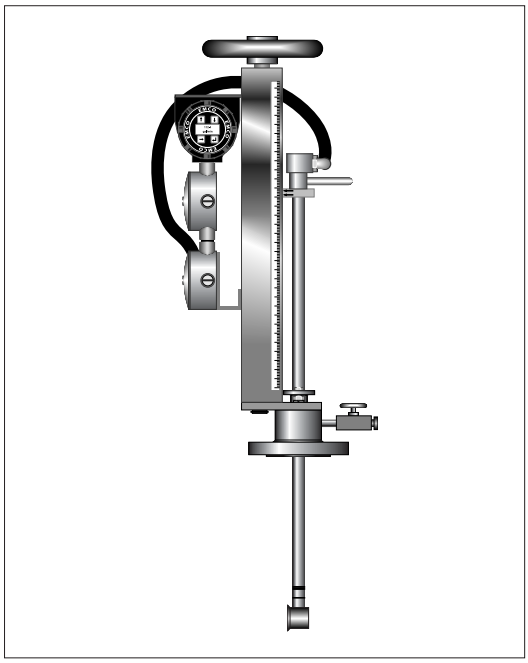
Integral/Remote Mounting



Electronics can be mounted either integral or remote. The ambient temperature must be less than 140 °F for integral mounting.

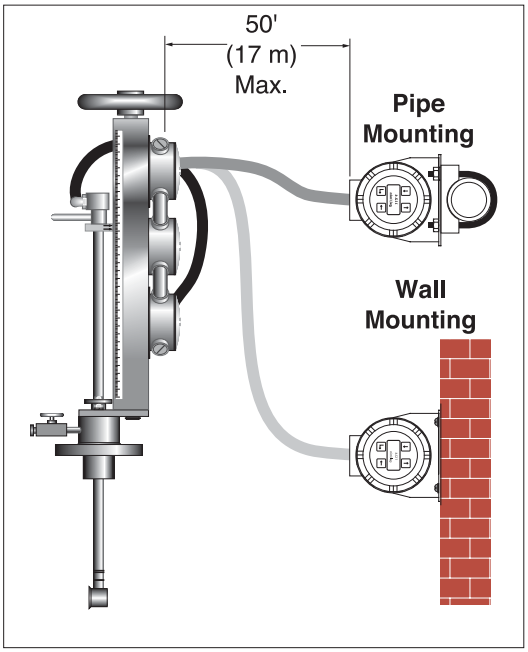
MOUNTING
(continued)

Integral Mounting



Sensor and electronics are mounted as one unit.

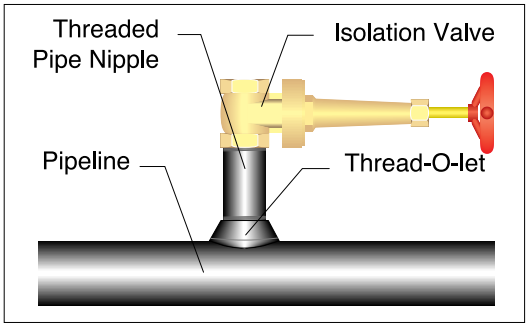
Remote Mounting



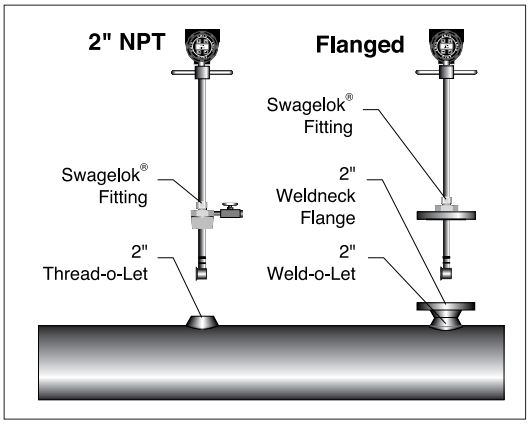
There are two options for remote mounting: Pipe or wall. The distance between the sensor and the electronics must not exceed 50'. If remote mounting is specified in an order, Spirax Sarco will supply 30' of cable and pipe mounting clamps.

MOUNTING
(continued)

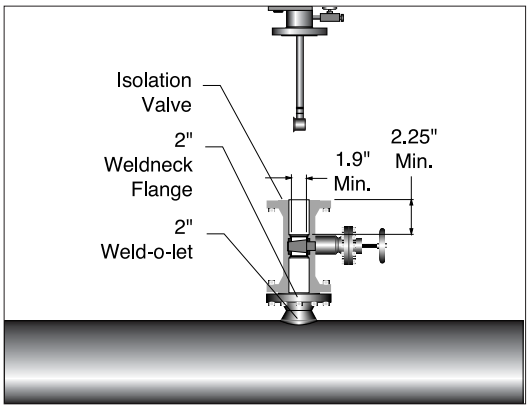
Pipe Connections



600 series: The 600 series can be installed and removed without shutting down the process. A mounting kit which includes a 2" bronze isolation valve, a pipe nipple, and a Thread-o-Let comes standard with each meter.



700 series: Since the 700 series uses a Swagelok® fitting, it is non retractable and can only be installed and removed with process shut down. The 2" NPT connection requires a 2" Thread-o-Let for installation. The flanged connection requires a 2" Weld-o-Let and a 2" raised face, weld-neck flange with the same pressure rating as the meter flange. These mounting connections are not included with the meter, but may be ordered separately.



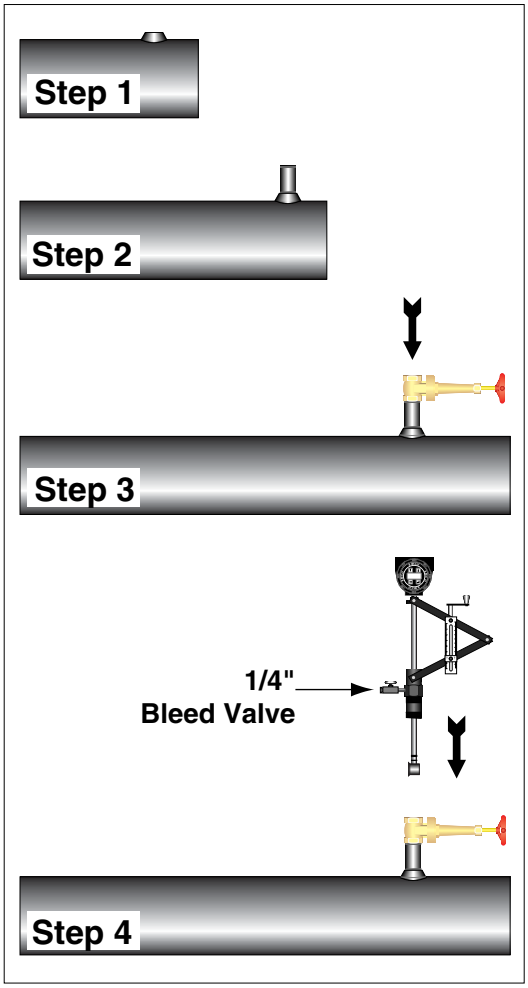
900 series: The 900 series can be installed or removed without process shut down. Installation requires a 2" Weld-o-Let and a 2" raised face, weld-neck flange with the same pressure rating as the meter flange. A 2", double flanged, fully ported ball or gate valve that adheres to the dimensions shown may be used as the isolation valve. These mounting connections are not included with the meter, but may be ordered separately.

V-BAR 600 SERIES

Hot Tapping

The flowmeter can be installed without process shutdown or line depressurization.

Hot tapping must be performed by a trained professional. Local state regulations often require a hot tap permit. The manufacturer of the hot tap equipment and/or the contractor performing the hot tap is responsible for providing proof of such a permit.



Weld 2" Thread-o-Let to pipe.

Attach 2" NPT pipe nipple.

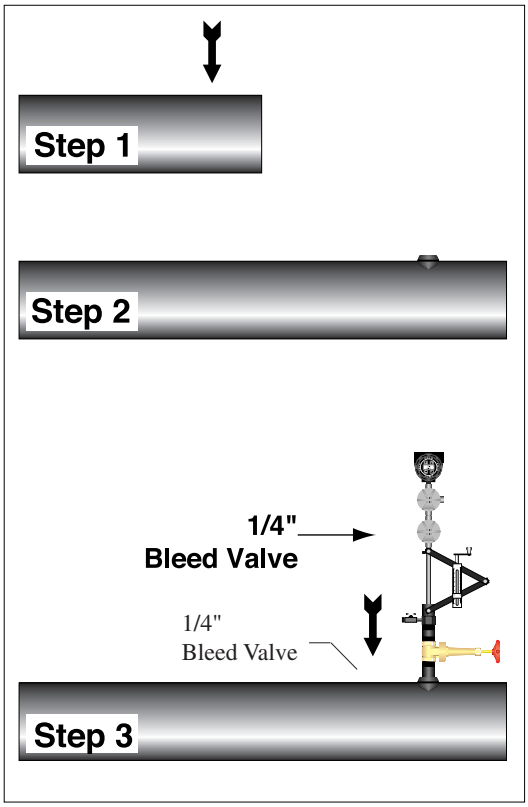
Attach 2" bronze, isolation valve. Attach hot tap tools fully open valve and hot tap pipe. **Minimum hole opening required is 1.875 inches.** Close valve after hot tap tool has been retracted into the upper portion of the valve. Remove hot tap tool.

Connect meter to 2" isolation valve. Use teflon tape or PST on threads to improve seal and to prevent seizing. Make sure 1/4" bleed valve is completely closed. Fully open 2" bronze, isolation valve. If the meter is supplied with a pressure transmitter, open 1/4" bleed valve.

V-BAR 600 SERIES (continued)

Cold Tapping

Process shutdown and line depressurization required for cold tapping.



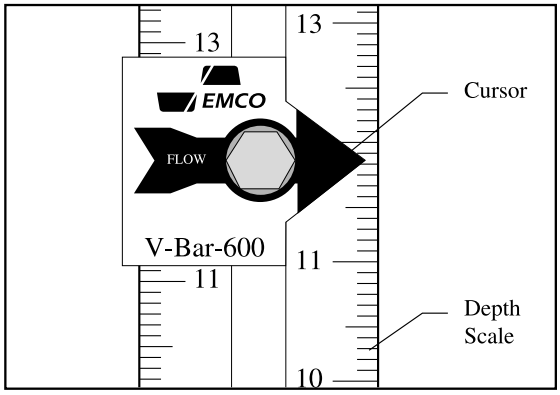
Tap pipe. **Minimum hole opening required is 1.875 inches.**

Weld Thread-o-Let to pipe.

Connect meter to Thread-o-Let. Use teflon tape or PST on threads to improve seal and to prevent seizing. Fully open 2" bronze, isolation valve. If the meter is supplied with a pressure transmitter, open 1/4" bleed valve.

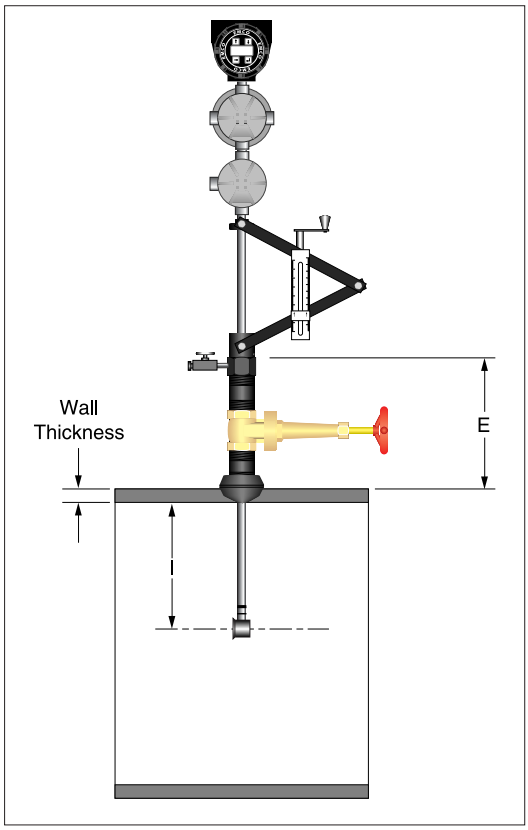
V-BAR 600 SERIES
(continued)

Insertion Depth Calculation



To properly position the sensor within the pipe, the scale reading must be calculated.

The scale reading is the value that the cursor should be set to on the depth scale.



Scale Reading = I + E + Wt

Where:

Scale reading = The value to be set on the depth scale
I = pipe diameter ÷ 2 for pipes 10.5" and smaller
I = 5" for pipes greater than 10
E = The distance from the top of the stem housing to the outside pipe wall. This distance varies depending on how tightly the pipe nipples are screwed into the isolation valve and Thread-o-Let.
Wt = The thickness of the pipe wall which can be determined by measuring the disk cut out of the pipe from the tapping procedure. This number can also be obtained from a piping handbook.

The sum of I + E + Wt is used as the depth scale setting. Example: A S-V-BAR 600 is to be installed on a 12" schedule 40 pipe. The following measurements have been obtained:

I = 5"
E = 12.5"
Wt = 0.406"

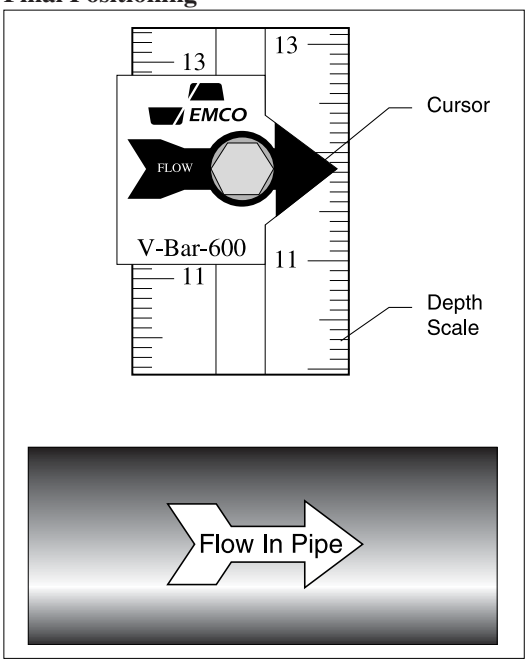
Determine the scale reading...

Scale reading = I + E + Wt
Scale reading = 5" + 12.5" + 0.406 = 17.906"

Note: The distance the fully retracted sensor travels before becoming visible has been figured into the factory adjustment of the depth scale.

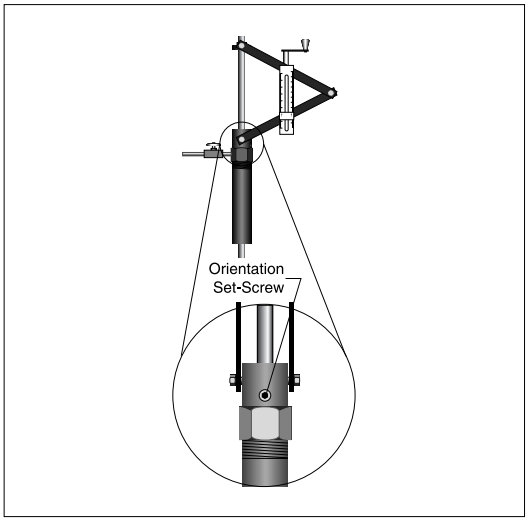
V-BAR 600 SERIES
(continued)

Final Positioning



Carefully crank the retractor handle clockwise to insert the sensor down into the pipe until the calculated insertion depth figure on the depth scale lines up with the cursor. Warning: Do not force stem into pipe. If the handle stops turning, retract and remove the meter from the pipe line, checking to make sure the opening conforms with the guidelines listed in the mounting guidelines.

Align the retractor bar assembly so the flow direction is parallel to the pipe, pointed downstream.

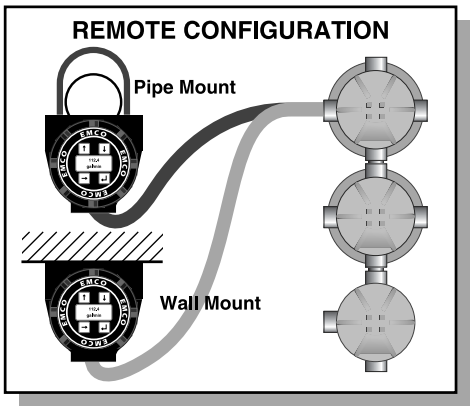


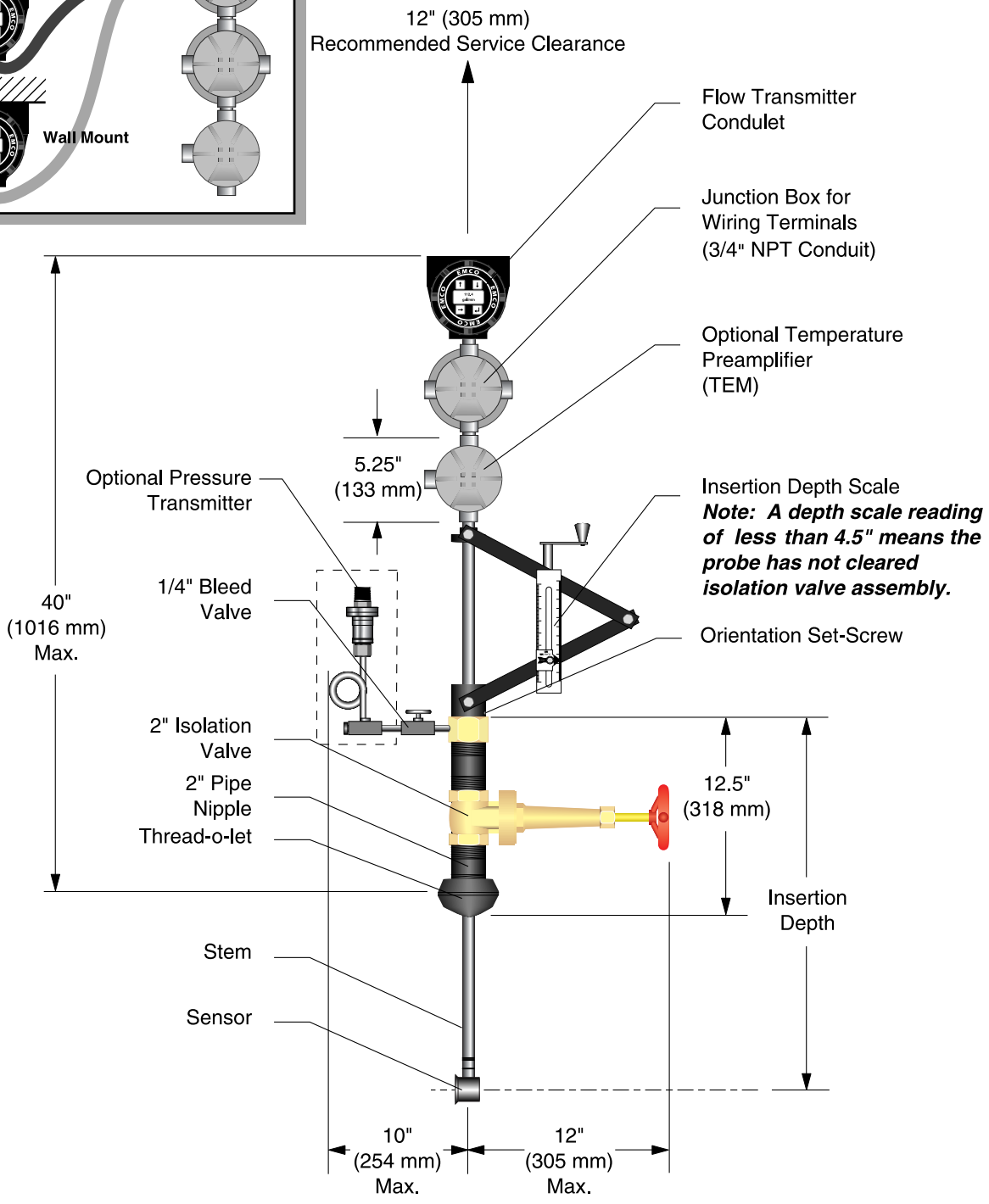
Lock the stem in position by tightening the orientation set screw.

CAUTION: Do not allow the orientation of the meter or the insertion depth to change after insertion is complete. A change in insertion depth or alignment will cause inaccurate readings.

V-BAR 600/60S DIMENSIONAL OUTLINE

Insertion Depth		Weight
Minimum	Maximum	Maximum
4.5" (114 mm)	18" (457 mm)	28 lbs. (12.7 kg)

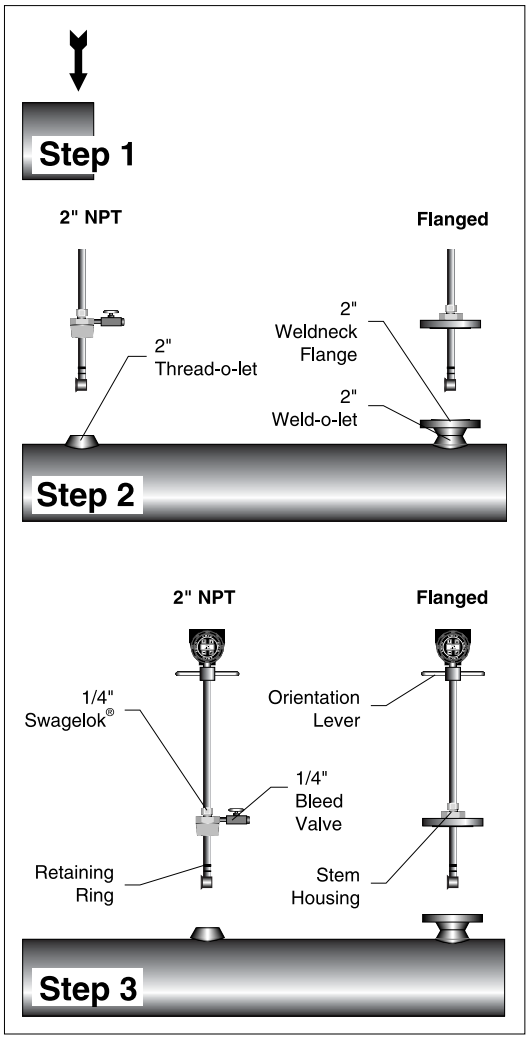




V-BAR 700 SERIES

Cold Tapping

The 700 series is non-retractable and must be cold tapped. Process shutdown and line depressurization is required for this procedure. There are two mounting connections available: flanged or 2" NPT.



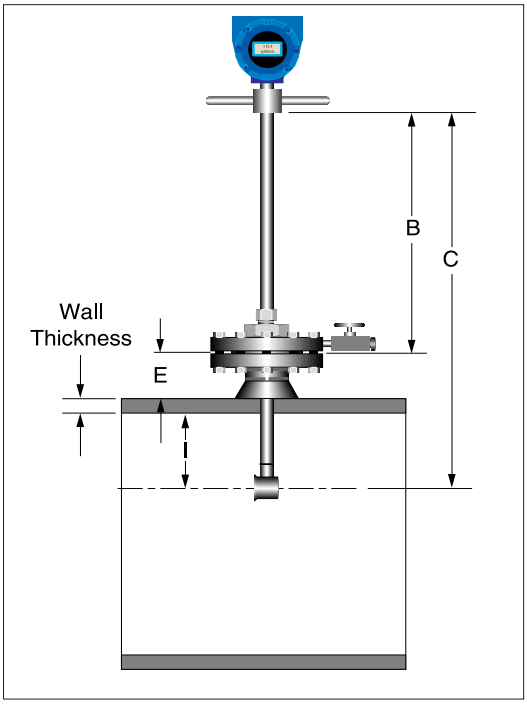
Tap pipe. **Minimum hole opening required is 1.875 inches.**

Mount connections.

Retract the stem by manually pulling the orientation levers so the retaining ring is just below the base of the stem housing. Attach meter to mounting connection. For NPT connection only: Use teflon tape or PST on threads to improve seal and prevent seizing. If the meter is supplied with a pressure transmitter, open 1/4" bleed valve.

V-BAR 700 SERIES (continued)

Insertion Depth Calculation Flanged Connection



To properly position the sensor within the pipe, the insertion depth must be calculated.

Insertion Depth = B = C - I - E - Wt

Where:

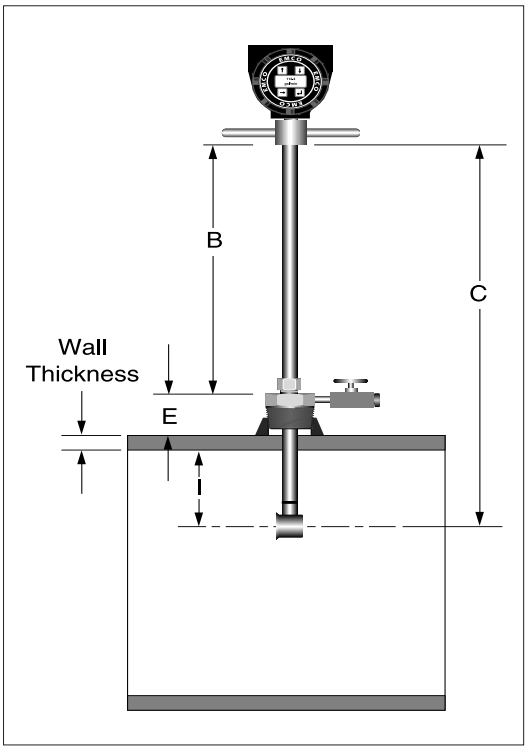
B = The insertion depth.
C = The distance from the center of the sensor to the base of the condulet mount.
I = Pipe diameter ÷ 2 for pipes 10.5" and smaller.
I = 5" for pipes greater than 10.5".
E = The distance from the raised face of the flange to the outside pipe wall.
Wt = The thickness of the pipe wall which can be determined by measuring the disk cut out of the pipe from the tapping procedure. This value can also be obtained from a piping handbook.

Example: A S-V-BAR 700 is to be installed on a 12" schedule 40 pipe. The following measurements have been obtained:

C = 14"
I = 5"
E = 4.5"
Wt = 0.406"

Determine the insertion depth B...
B = C - I - E - Wt
B = 14" - 5" - 4.5" - 0.406" = 4.094"

Insertion Depth Calculation 2" NPT Connection



Insertion Depth = B = C - I - E - Wt

Where:

B = The insertion depth.
C = The distance from the center of the sensor to the base of the condulet mount.
I = Pipe diameter ÷ 2 for pipes 10.5" and smaller.
I = 5" for pipes greater than 10.5".
E = The distance from the raised face of the flange to the outside pipe wall.
Wt = The thickness of the pipe wall which can be determined by measuring the disk cut out of the pipe from the tapping procedure. This value can also be obtained from a piping handbook.

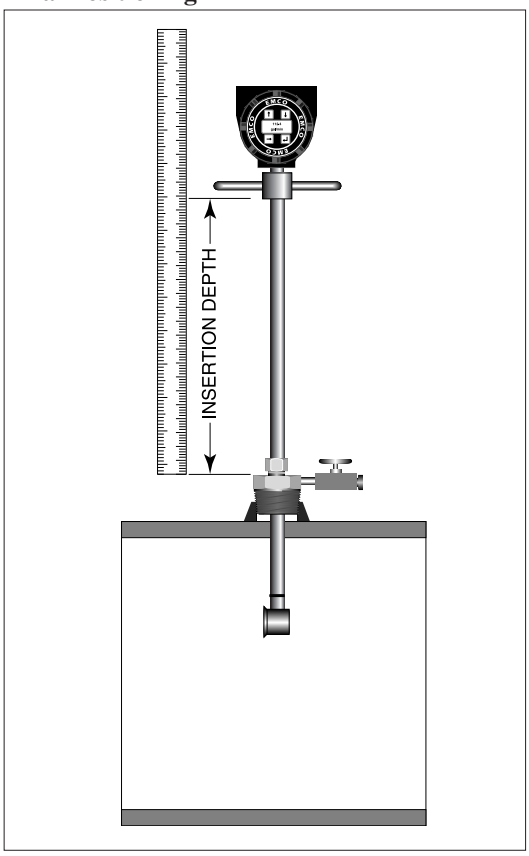
Example: A S-V-BAR 700 is to be installed on a 6" schedule 40 pipe. The following measurements have been obtained:

C = 14"
I = (6.065"/2) = 3.033"
E = 4.5"
Wt = 0.280"

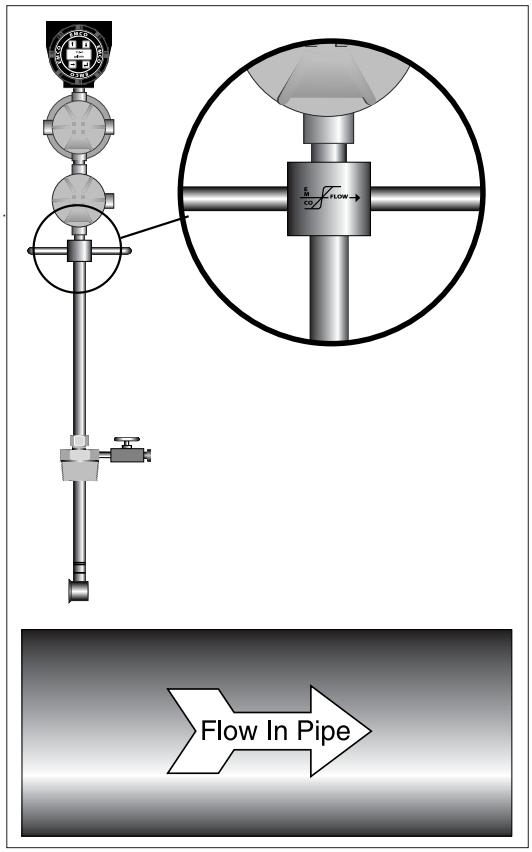
Determine the insertion depth B...
B = C - I - E - Wt
B = 14" - 3.033" - 4.5" - 0.280" = 6.19"

V-BAR 700 SERIES (continued)

Final Positioning



Manually insert the stem into the pipe until the calculated insertion depth is obtained. Warning: Do not force stem into pipe. If the stem insertion is blocked, retract and remove the meter from the pipe line, checking to make sure the opening conforms with the guidelines listed in the mounting guidelines.



Align orientation levers parallel to the pipe with the arrow in the direction of flow.

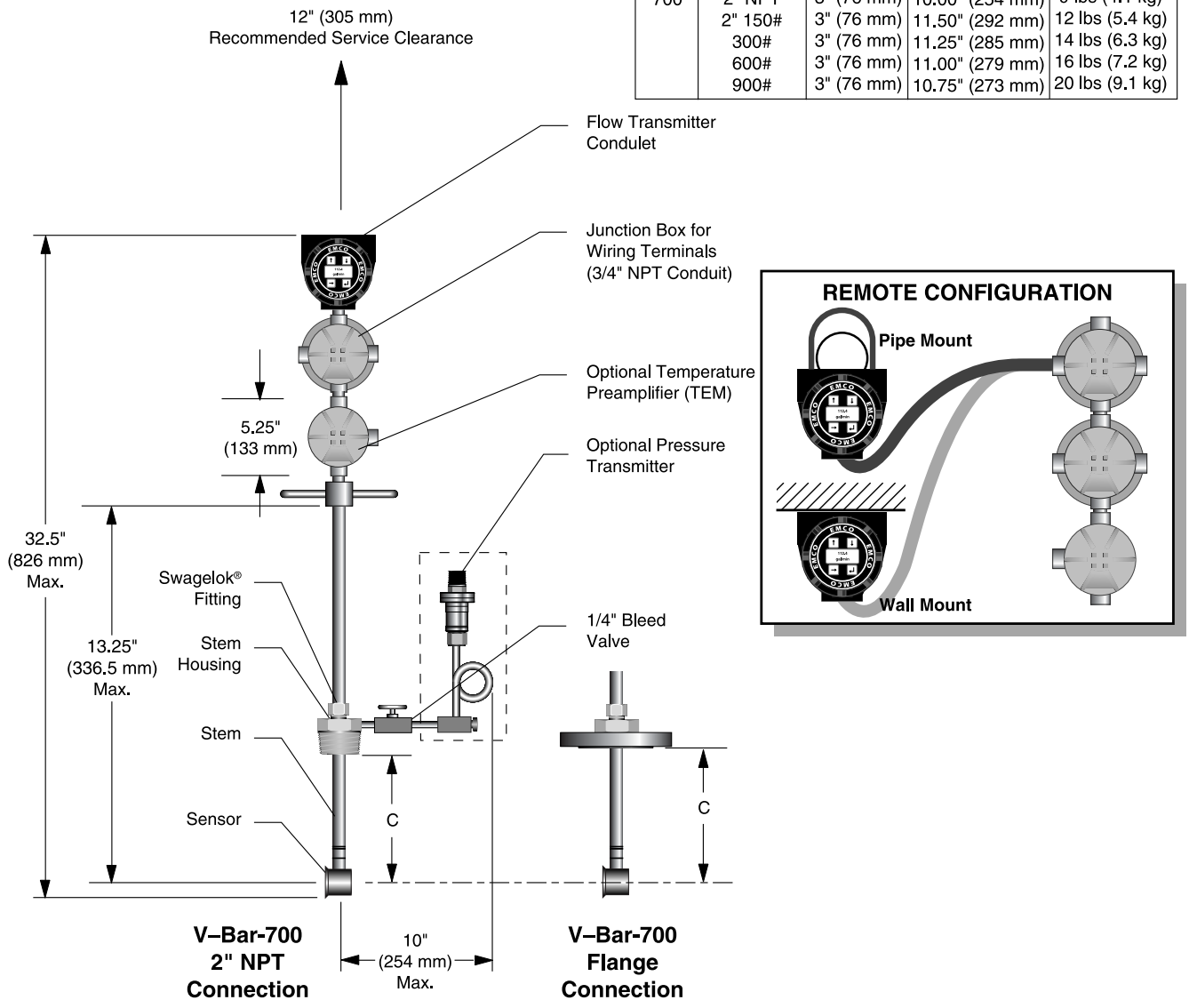
Lock the stem in position by tightening the Swagelok® fitting. Note: Once the fitting has been tightened, the stem position becomes permanent and cannot be changed. Verify insertion depth prior to final tightening of the fitting.

Warning

Do not loosen the Swagelok® fitting under pressure. Doing so may cause serious injury.

V-BAR 700 DIMENSIONAL OUTLINE

Model	Connection	Insertion Depth (Dim. "C")		Weight
		Minimum	Maximum	
700	2" NPT	3" (76 mm)	10.00" (254 mm)	9 lbs (4.1 kg)
	2" 150#	3" (76 mm)	11.50" (292 mm)	12 lbs (5.4 kg)
	300#	3" (76 mm)	11.25" (285 mm)	14 lbs (6.3 kg)
	600#	3" (76 mm)	11.00" (279 mm)	16 lbs (7.2 kg)
	900#	3" (76 mm)	10.75" (273 mm)	20 lbs (9.1 kg)

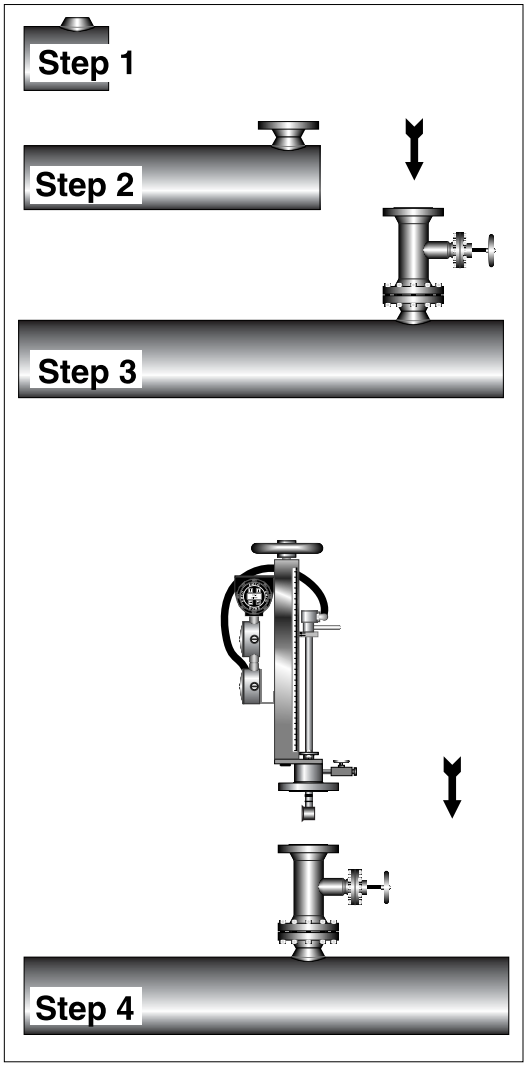


V-BAR 900 SERIES

Hot Tapping

Flowmeter can be installed without process shutdown or line depressurization.

Hot tapping must be performed by a trained professional. Local state regulations often require a hot tap permit. The manufacturer of the hot tap equipment and/or the contractor performing the hot tap is responsible for providing proof of such permit.



Weld Weld-o-Let to pipe.

Weld weldneck flange to Weld -o-Let.

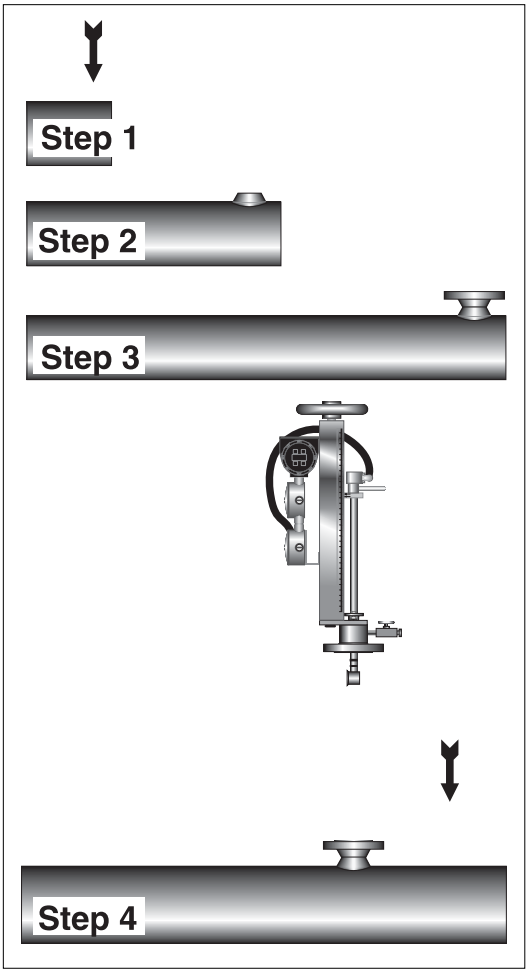
Attach isolation valve. Fully open valve. Hot tap pipe. **Minimum hole opening required is 1.875 inches.** Close valve after hot tap tool has been retracted. Remove hot tap tool.

Connect meter to isolation valve. Make sure 1/4" bleed valve is completely closed. Fully open isolation valve. If the meter is supplied with a pressure transmitter, open 1/4" bleed valve.

V-BAR 900 SERIES
(continued)

Cold Tapping

Process shutdown and line depressurization is required for this procedure.



Tap pipe. **Minimum hole opening required is 1.875 inches.**

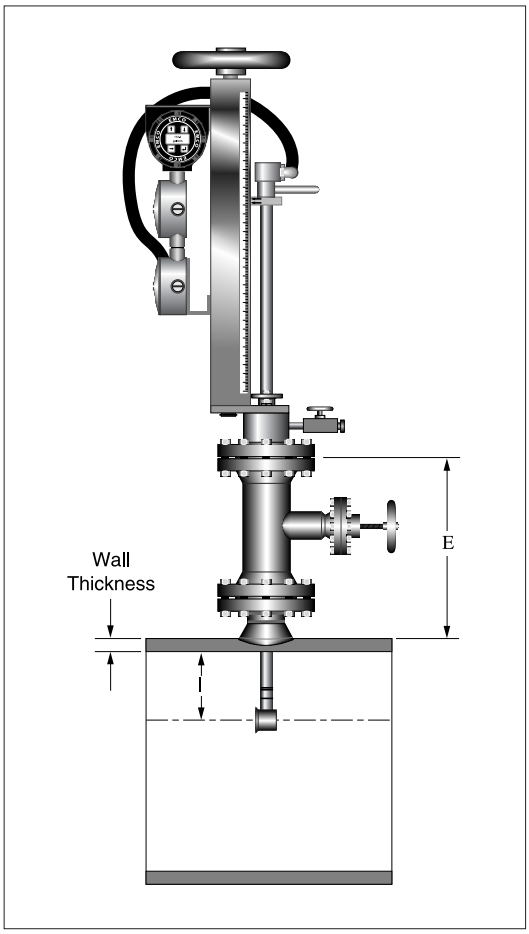
Weld Weld-o-Let to pipe.

Weld 2" weldneck flange to Weld-o-Let.

Connect meter to weldneck flange. If the meter is supplied with a pressure transmitter, open 1/4" bleed valve.

V-BAR 900 SERIES
(continued)

Insertion Depth Calculation



To properly position the sensor within the pipe, the scale reading must be calculated.

Scale Reading = I + E + Wt

Where:
Scale reading = The number to be set on the depth scale by the 1.0 →)
I = Pipe diameter ÷ 2 for pipes 10.5" and smaller.
I = 5" for pipes greater than 10.5".
E = Distance from the raised face of the flange to the outside pipe wall.
Wt = The thickness of the pipe wall which can be determined by measuring the disk cut out of the pipe from the tapping procedure. This number can also be obtained from a piping handbook.

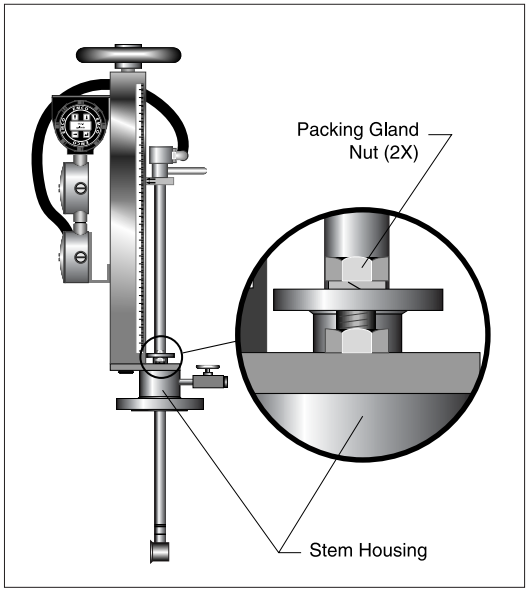
Example: A S-V-BAR 910 is to be installed on a 12" schedule 40 pipe. The following measurements have been obtained:

I = 5"
E = 12.5"
Wt = 0.406"

Determine the scale reading...

Scale reading = I + E + Wt
Scale reading = 5" + 12.5" + 0.406"
Scale reading = 17.906"

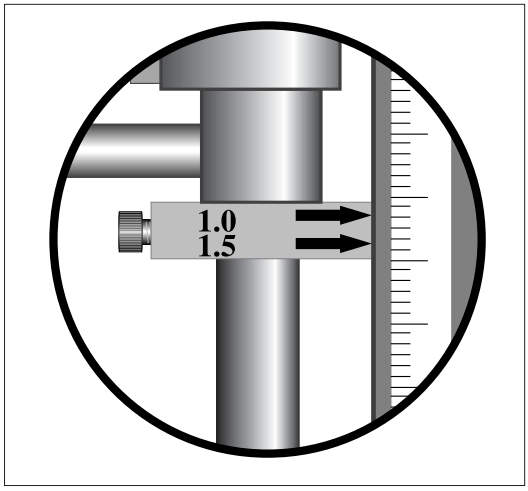
Final Positioning



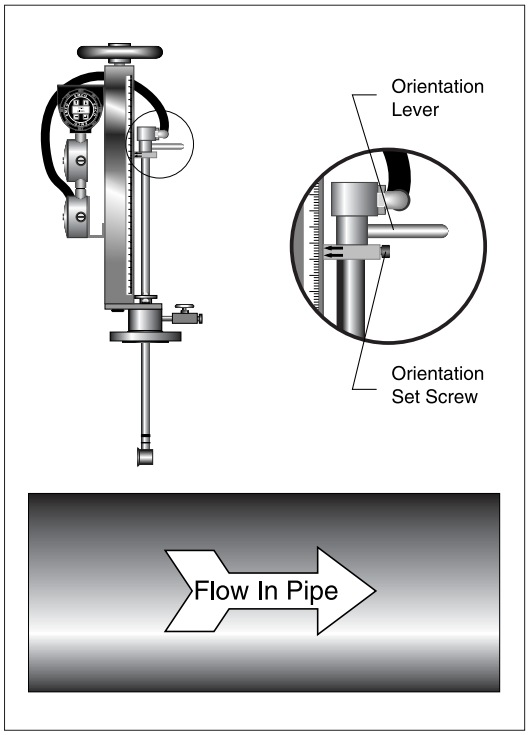
Loosen the two packing gland nuts on the stem housing of the meter.

V-BAR 900 SERIES
(continued)

Final Positioning



Turn handwheel clockwise to insert the stem into the pipe. Do so until the calculated scale reading lines up with the **1.0 arrow** on the retractor bar assembly. Warning: Do not force stem into pipe. If the stem insertion is blocked, retract and remove the meter from the pipe line, checking to make sure the opening conforms with the pipe tapping guidelines.



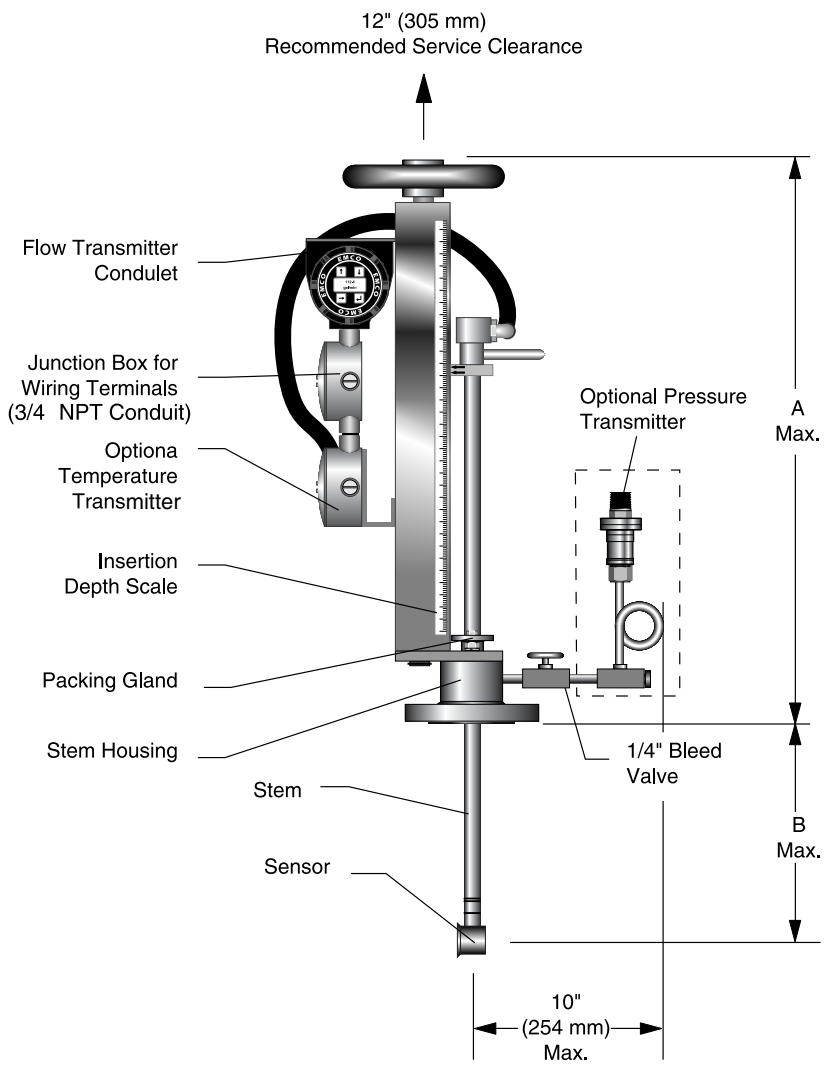
Align the sensor by using the orientation lever so the flow direction is parallel to the pipe and pointed downstream.

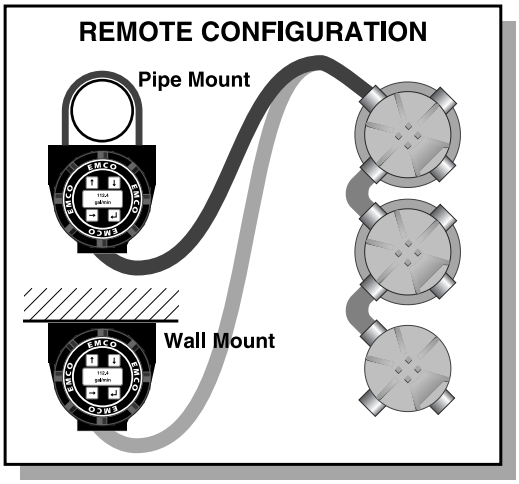
Tighten the packing gland nuts to stop leakage around the stem. Do not torque over 25 ft-lbs.

Lock the stem into position by tightening the orientation lock screw.

CAUTION: Do not allow the orientation of the meter or the insertion depth to change after insertion is complete. A change in insertion depth or alignment will cause inaccurate readings.

V-BAR 910/960 DIMENSIONAL OUTLINE





Stem Length	Retractor Length (Dim. A)	Insertion Depth* (Dim. B)
Standard	30" (762 mm)	20" (508 mm)
1' Extended	42" (1067 mm)	32" (813 mm)
2' Extended	54" (1372 mm)	44" (1120 mm)

*Minimum insertion depth is 1.5" (38 mm)

Connection	Weight**
2" 150#	30 lbs (13.6 kg)
2" 300#	35 lbs (15.8 kg)
2" 600#	40 lbs (18.1 kg)
2" 900#	47 lbs (21.3 kg)

**Add 5 lbs (2.3 kg) for each additional foot of retractor length

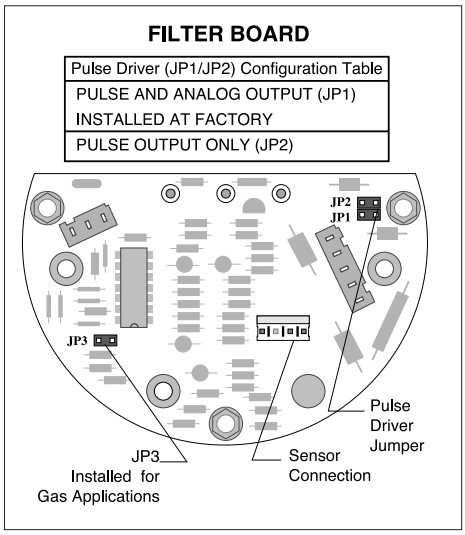
ELECTRICAL

General

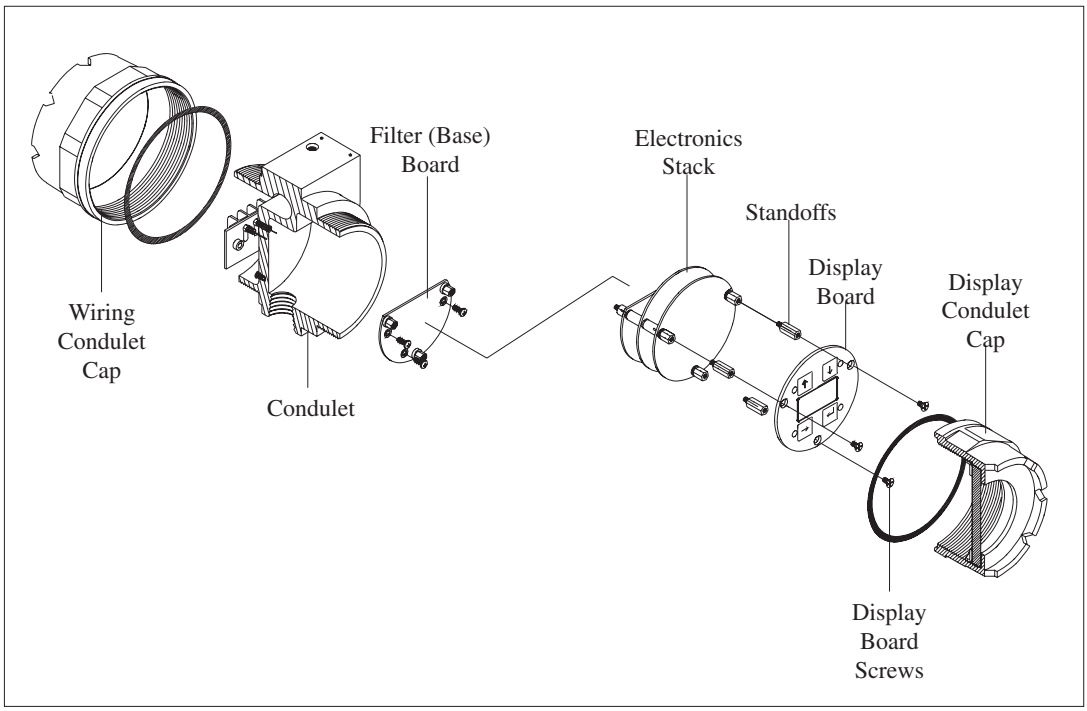
To avoid personal injury or property damage from electrical shock or contact with live electrical systems, or from combustible material or explosive gases which can be ignited by electrical arcing, wiring and conduit must be installed in accordance with national, local laws, standards, codes, and industry practices.

Hardware Configuration

The flowmeter hardware is factory configured for each specific application. Additional configuration should not be required unless application changes. Jumper position JP3 selects fluid type. JP3 should be installed for gas applications and removed for liquid applications. Jumper positions JP1 and JP2 indicate pulse output configuration. JP1 is installed at the factory . These jumpers are located on the filter board (the base board of the electronic stack).

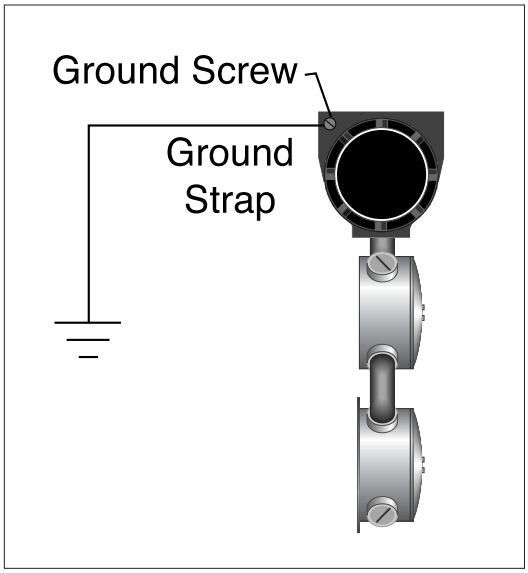


Jumper configuration can be accomplished by exposing the filter board located in the flow transmitter condulet. Disassembly should be done using proper ESD precautions. To get to the filter board, remove condulet cap, then unscrew the display board screws. Gently remove the display board form the electronics stack. Unscrew hex standoff bolts to remove electronics stack from filter board.

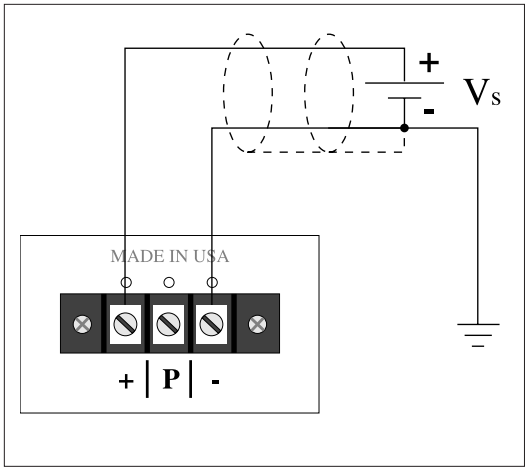


ELECTRICAL
(continued)

Grounding



Meter
To ensure proper electrical noise rejection, connect ground strap (size 8 AWG or larger wire) from the ground screw attached to the outside of the electronics enclosure to a known earth ground (not the pipe).



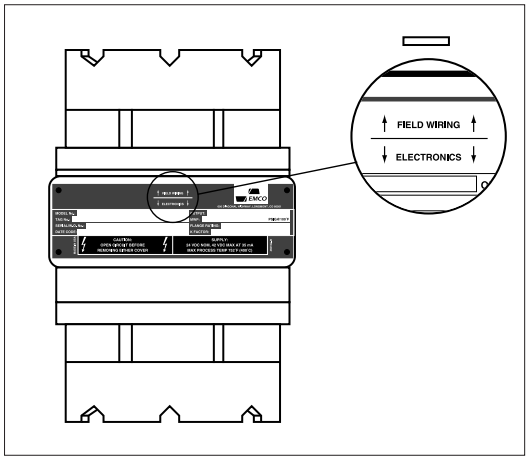
Power Supply
Shielded cable should be at least 18 AWG or larger for proper power and signal wiring. Connect shield wire from shielded cable to earth ground at power supply. Insulate other end of shield wire from electrical condulet at the meter.

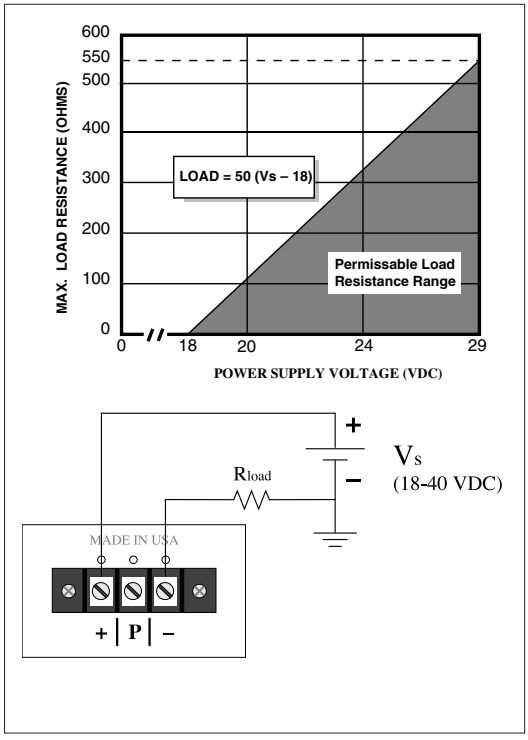
ELECTRICAL
(continued)

D.C. Power and Signal Wiring

The V-BAR may be operated using a 24 volt power supply. It is unique in its ability to supply both the 4-20 mA output and the pulse output simultaneously. The installation of jumpers JP1 and JP2 on the filter board control the output selection. JP1 is installed at the factory.

The field wiring terminal for power and signal wiring may be accessed by removing the field wiring condulet.

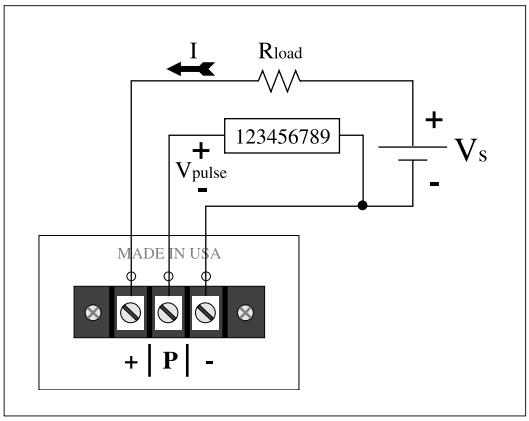




Analog Output (JP1 installed or no jumpers)
Scalable 4-20 mA output, 2 wire principle. Load resistor may be installed on supply or return line. Permissible load resistance values shown in graph.

Note: Maximum voltage is 30 V with pressure transmitter option.

ELECTRICAL
(continued)



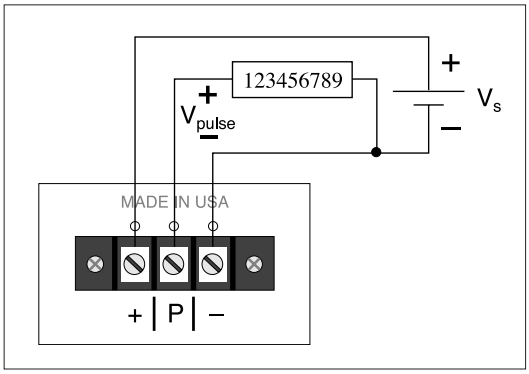
Simultaneous Pulse and Analog Output (JP1 installed)
The diagram shows simultaneous 4-20 mA and pulse output for a high impedance electronic counter. The load resistor is in the supply line. Pulse output will vary from:

$$0\text{-}1 \text{ V to } V_{pulse}=V_s - (I \bullet R_{load})$$

Note: Load resistor may also be placed in the return line. Pulse output will vary from $V_{pulse}= (I \bullet R_{load}) + 1$ to V_s.

where:

V_{pulse}	=	output voltage
V_s	=	power supply voltage
I	=	current (4-20 mA)
R_{load}	=	load resistance



Pulse Output Only (JP2 installed)
This option is for pulse output only using a low impedance electromechanical counter. V_{pulse} will vary from 0-1 V to

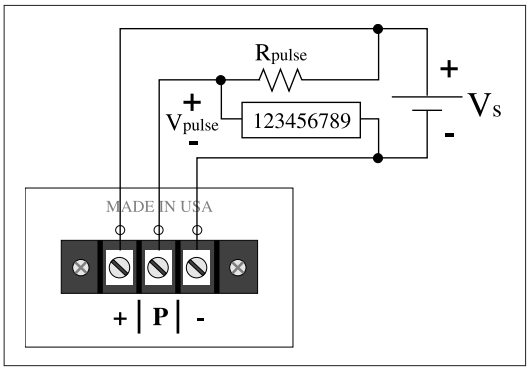
Note:

$$R_c \geq 6800\left(\frac{V_c}{V_s - V_c}\right)$$

$$V_{pulse} = V_s\left(\frac{R_c}{R_c + 6800}\right)$$

Where:

V_{pulse}	=	output voltage
R_c	=	counter impedance
V_s	=	power supply voltage
V_c	=	minimum required voltage to trip counter



Pulse Output Only (No Jumpers)
This is an open collector pulse output using a high impedance electronic counter. V_{pulse} will vary from 0-1 V to 24V.

Note:

$$V_{pulse} = V_s\left(\frac{R_c}{R_c + R_{pulse}}\right)$$

$$R_{pulse} \geq \left(\frac{V_s}{0.16}\right)$$

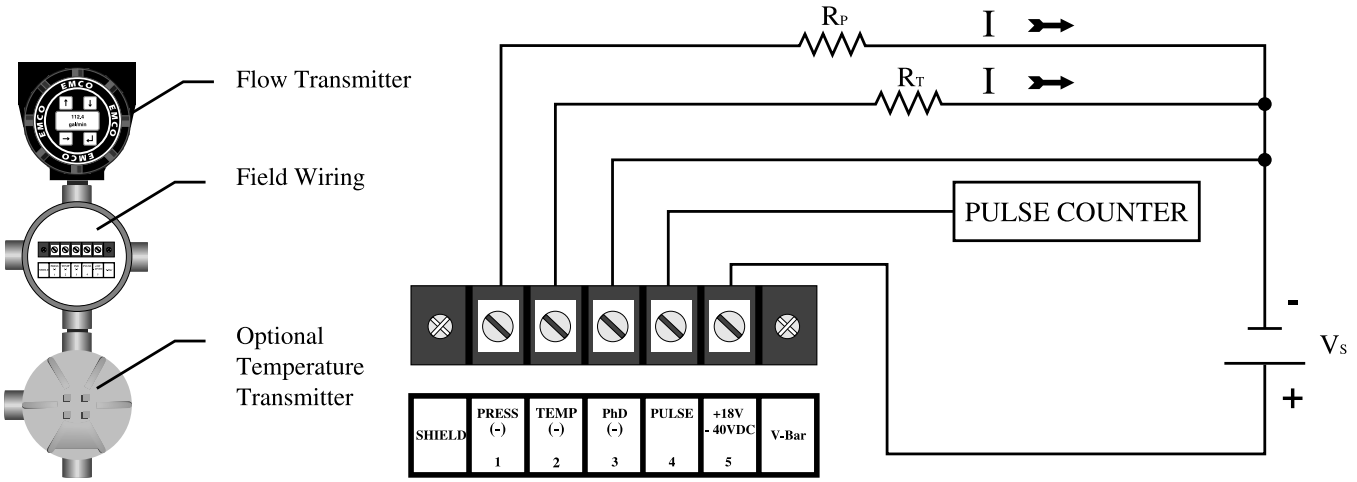
ELECTRICAL
(continued)

Pressure and Temperature Transmitter Wiring

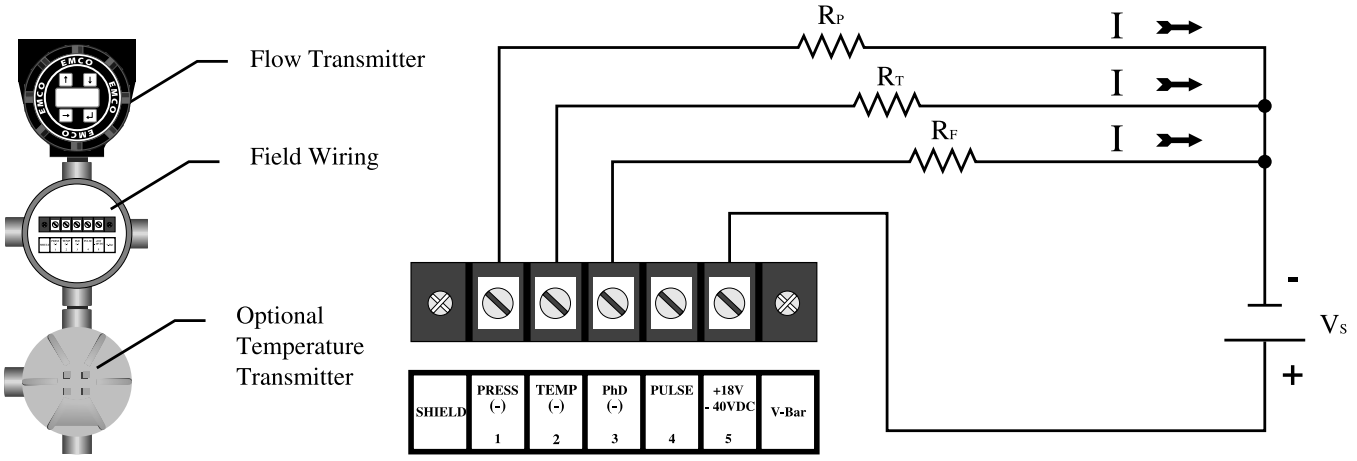
Power and signal wiring may be accomplished by removing the field wiring condulet cap to expose the field wiring terminal block. This terminal block will allow connections to be made for flow, pressure, and temperature outputs. Refer to the previous section on 24 VDC power and signal wiring for appropriate load resistance and power supply values. Pressure and temperature transmitters are scaled to the appropriate ranges at the factory. If span and zero adjustments need to be made, see the service section.

Note: 110 VAC power supply is not available with pressure and/or temperature transmitters.

Frequency Flow Output



Analog Flow Output



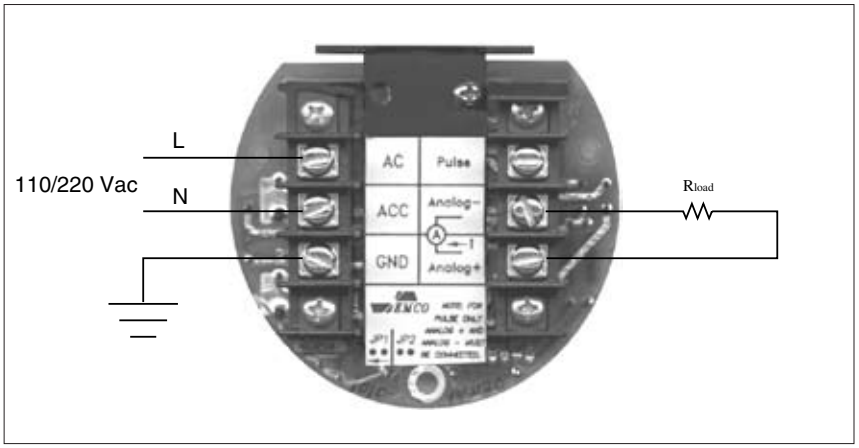
where:

R_P = Pressure measuring resistance
R_T = Temperature measuring resistance
R_F = Flowrate measuring resistance

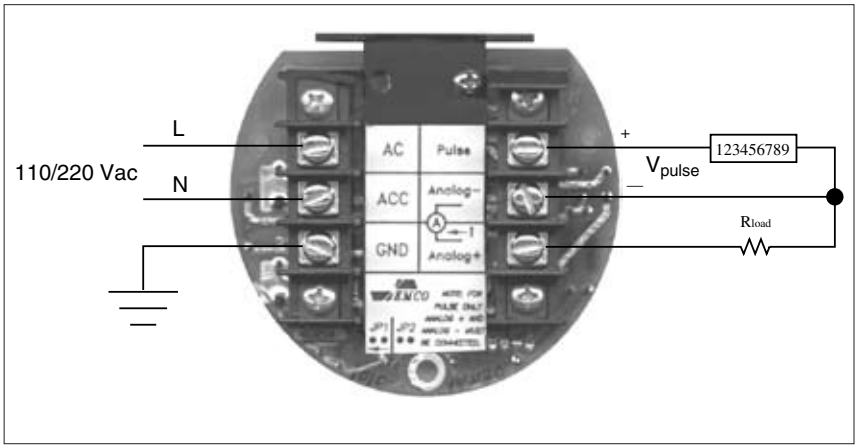
ELECTRICAL (continued)

110 VAC Power and Signal Wiring

The V-BAR may be operated using 110 VAC power supply. The power supply converts the 110 VAC to 24 VDC. It is unique in its ability to supply both the 4-20 mA output and the pulse output simultaneously. The installation of jumpers JP1 and JP2 on the bottom of the 110 V power supply control the output selection. JP1 is installed at the factory.



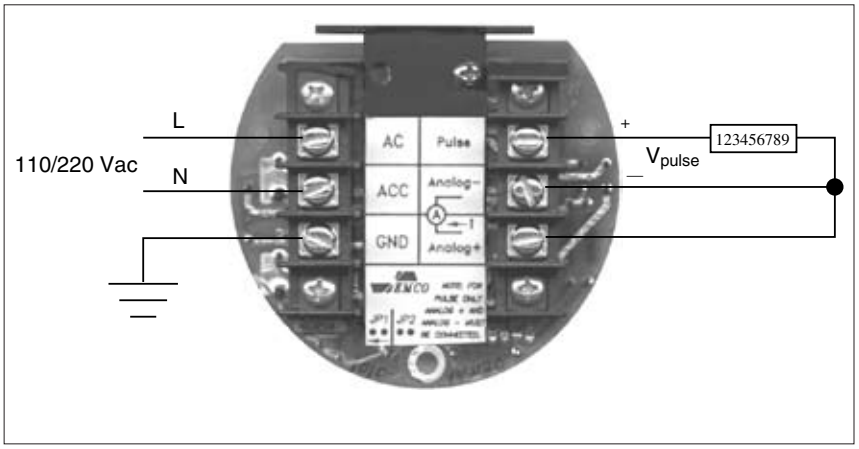
Analog Output (JP1 installed or no jumpers)
Scalable 4-20 mA output, 2 wire principle. Load resistor may be installed on supply or return line. R_{load} must be 250 .



Simultaneous Pulse and Analog Output (JP1 installed)
Simultaneous 4-20 mA and pulse output for a high impedance electronic counter. Load resistor in the supply line. Pulse output will vary from:

$$0\text{-}1\ V \text{ to } Vp_{ulse=}24 - (I \bullet Rl_{oad})$$

where:
Vp_{ulse} = pulse output amplitude
I = current (4-20 mA)
Rl_{oad} = load resistance (250)



Pulse Output Only (JP2 installed and analog jumper installed)
This option is for pulse output only. V_{pulse} will vary from:

$$0-1V \text{ to } V_{pulse} = 24\left(\frac{R_C}{R_C + 6800}\right)$$

Note:
$$\text{Note: } R_C \geq 6800\left(\frac{V_C}{24 - V_C}\right)$$

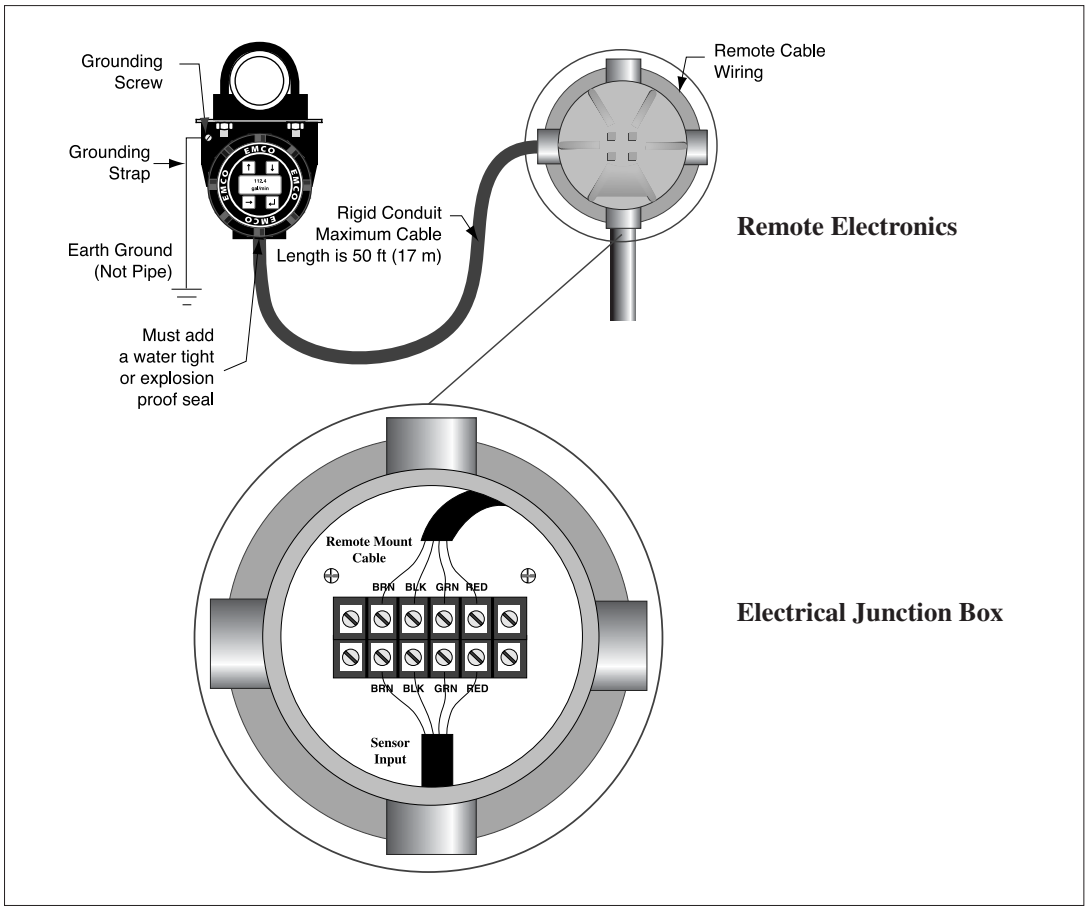
Where:
V_{pulse} = pulse output amplitude
R_C = counter impedance
V_C = minimum required voltage to trip counter

ELECTRICAL
(continued)

Remote Wiring

Output wiring from the remote electronics is identical to the integral output wiring. However, the wiring from the remote electronics condulet to the electrical junction box must be performed in the field. Connect the remote cable to the terminal block in the junction box as shown. If nonconductive conduit is used attach a ground strap from the ground screw on the remote electronics condulet to the ground screw on the sensor condulet. If the remote cable is cut to a shorter length, insulate shield with tape at electrical junction box.

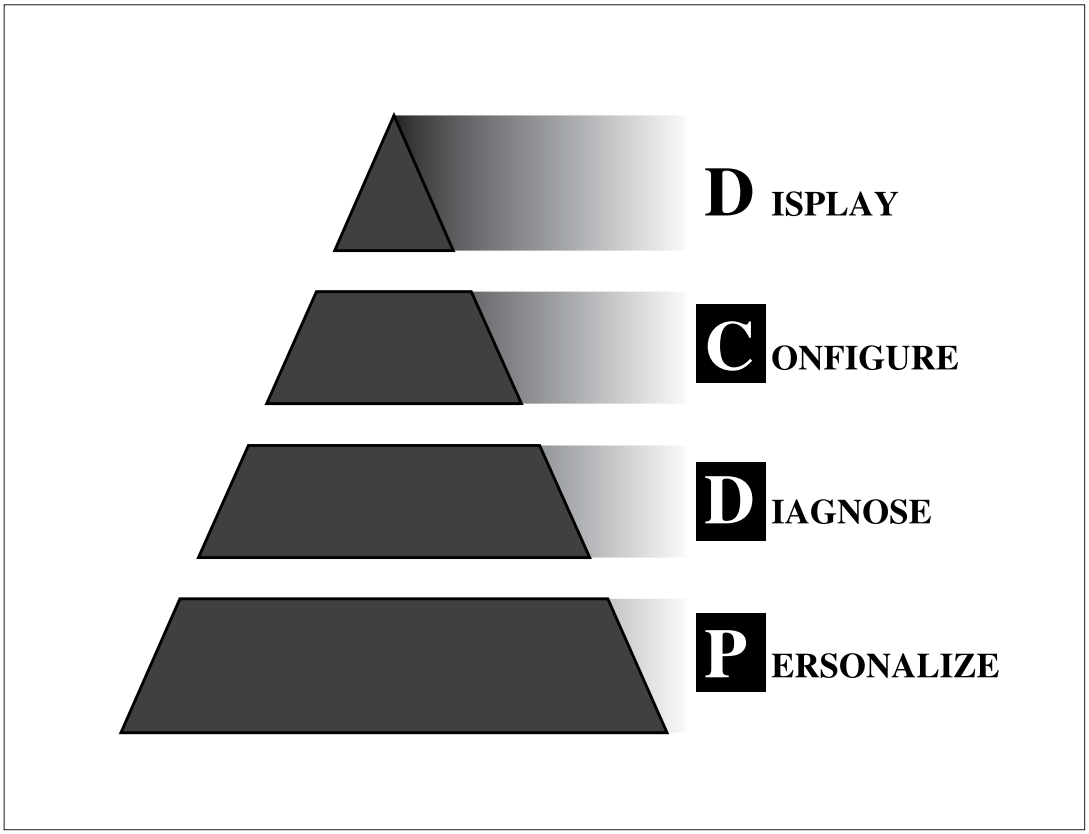
Note: If remote mounting is required with a pressure and/or temperature transmitter, two power supplies are required for operation. One for the remote flow transmitter and one for the pressure and/or temperature transmitter.



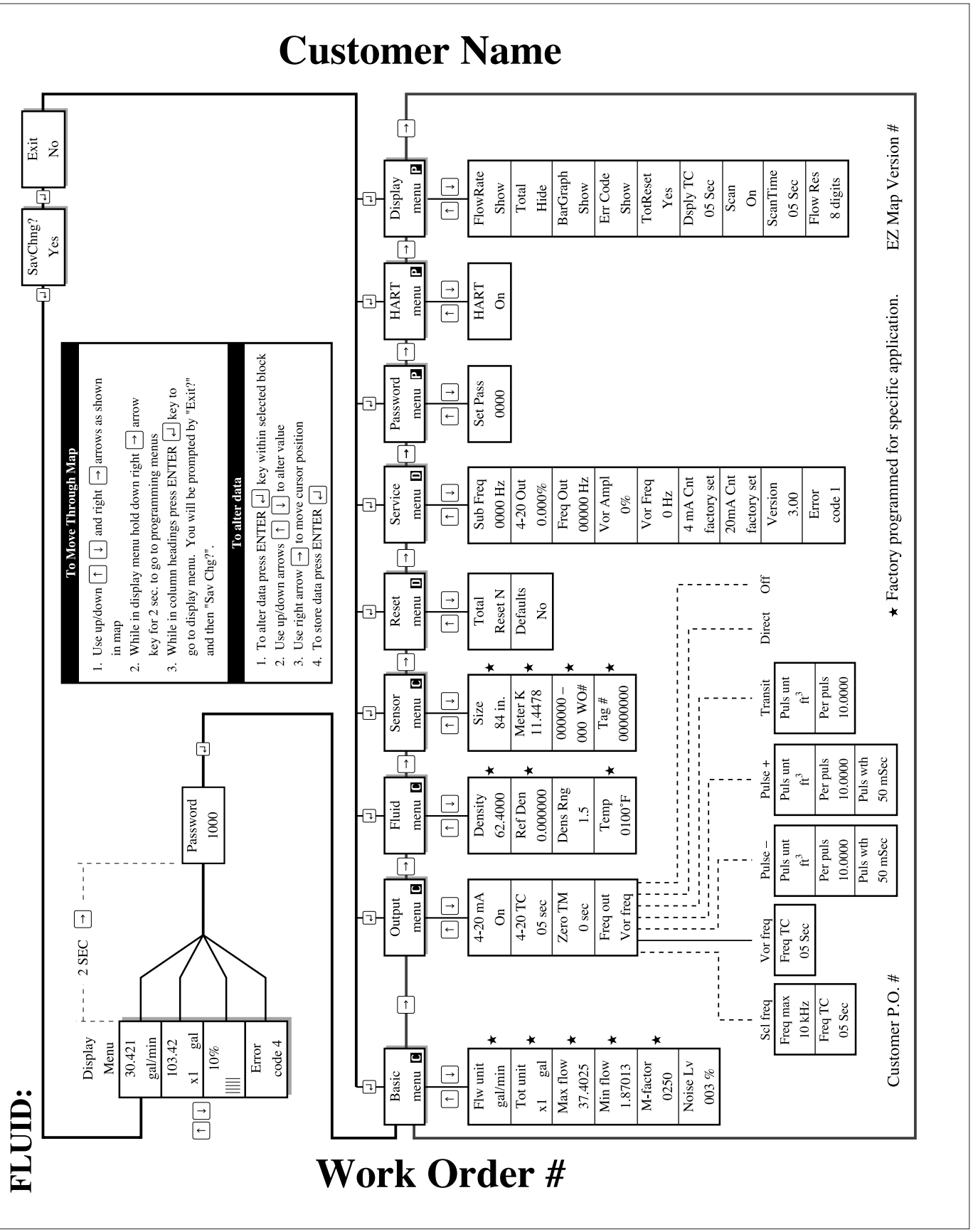
EZ LOGIC USER INTERFACE

General

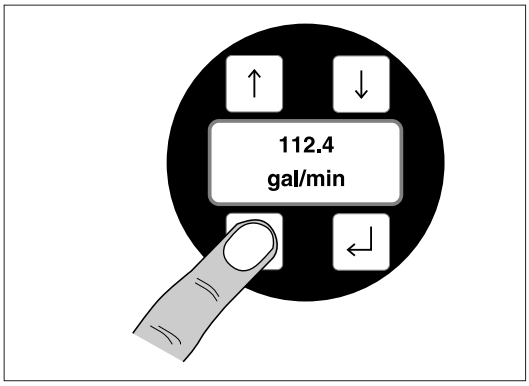
The EZ Logic User Interface is a menu driven interface that consists of the top display menu and nine programming submenus. The submenus are called: **Basic, Output, Fluid, Sensor, Reset, Service, Password, HART**, and **Display**. These submenus are grouped by functionality. The first is the Configure group, the second is Diagnose, and the third is Personalize. The Configure group is comprised of the Basic, Output, Fluid, and Sensor submenus. These submenus configure the flowmeter for operation in a specific application. The Diagnose group is comprised of the Reset and Service submenus, which contain information relating to flowmeter maintenance. Finally, the Personalize group is comprised of the HART and Display submenus. This group allows the user to customize the flowmeter by choosing display parameters or changing the password. Each group has it's own icon; Configure "**C**", Diagnose "**D**", and Personalize "**P**". The user can identify the location within the interface map from the displayed icon in the upper or lower, right hand corner.



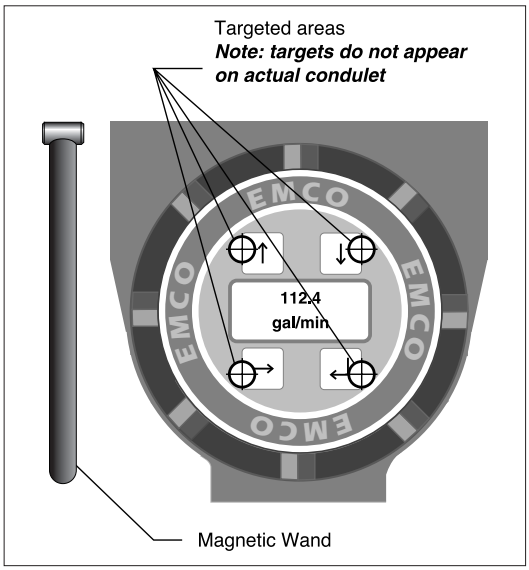
INTERFACE MAP



KEYPAD ACTIVATION



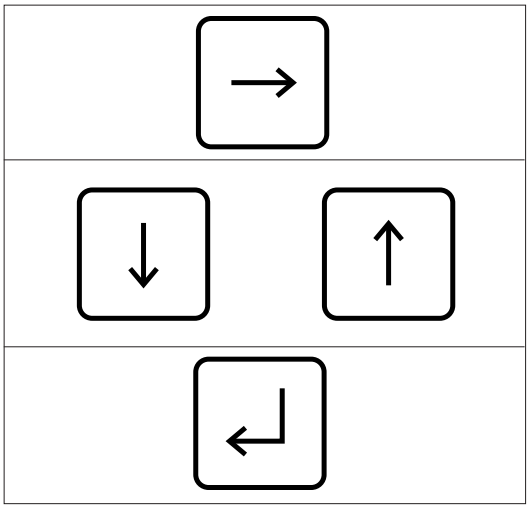
Keypad can be manipulated in two different ways. The first way is to remove the condulet cap and depress the membrane keys using your fingers.



The second method of keypad manipulation is to use the magnet wand. The keys may be activated through the condulet cap, without sacrificing the explosion proof rating. To activate keys place magnet wand on the targeted area and remove. Note: The magnet wand is only supplied as a standard tool with the explosion proof meters.

Caution: Do not place magnet wand near magnetically sensitive items such as: credit cards, card key, etc...

MOVEMENT THROUGH INTERFACE



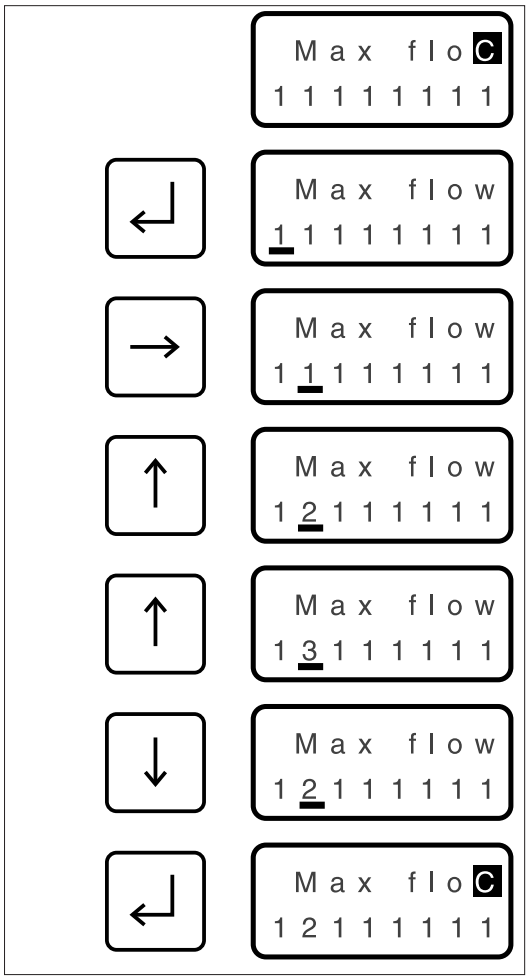
The interface was designed to be simple. For example; if you would like to go right across the column headings press the right arrow key.

To move up or down through each column use the up or down arrow keys. Note: Each column is setup as a loop. Once you reach the bottom (using the down arrow key) depressing the same key will move you to the column heading.

The enter key is used to exit the programming submenus.

ALTERING REAL NUMBER DATA

Keys are also used to alter data within a selected block in the programming mode. Note: The example shown below is only a specific example. Refer to submenu descriptions for detailed information.



In order to alter data in a selected block, press the enter key. A cursor will appear under the first digit. Note: The blinking icon will disappear when altering data.

Pressing the right arrow key moves the cursor to the desired digit.

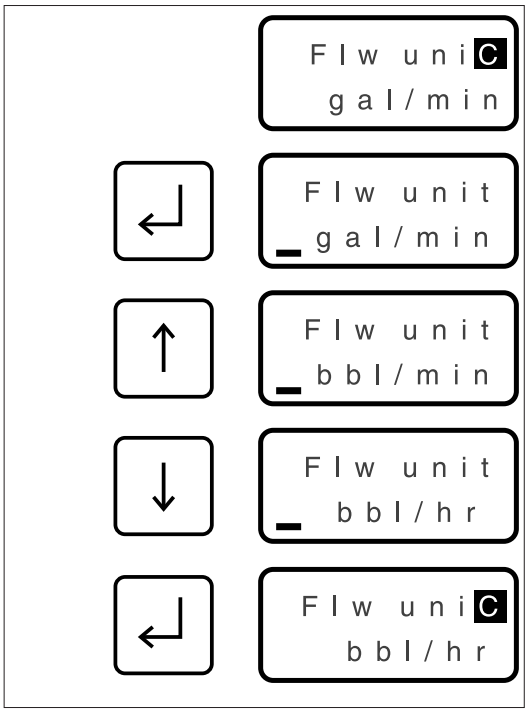
Pressing the up arrow key alters the value of the digit. Possible values for each position are: 0-9, blank space, or a decimal point.

The values may also be changed by pressing the down arrow key.

After the desired alterations are made, pressing the enter key will store the new value and the blinking icon will reappear.

ALTERING PRESET DATA

Some data in the programming submenus have default selection values. This example describes flowrate unit selection. For complete list of specific submenu options refer to submenu descriptions.



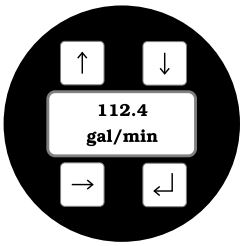
Depress the enter key to alter value. A blinking cursor will appear. After the enter key is depressed, the blinking icon will disappear.

To change the volume unit depress the up key.

To change the time unit depress the down key.

After desired alterations are made, depressing the enter key will store new value. After enter key is depressed the blinking icon will reappear.

DISPLAY MENU

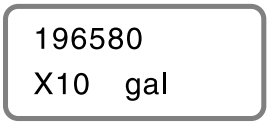


The display menu will appear as soon as the meter is powered up. The display menu has four displays.

Flowrate

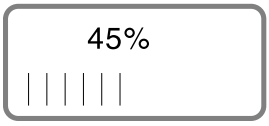
Continuously displays the actual flowrate in the units selected in Flow unit.

Totalized Flow



Continuously displays the totalized flow in the units selected in Totalizer unit.

Bar Graph



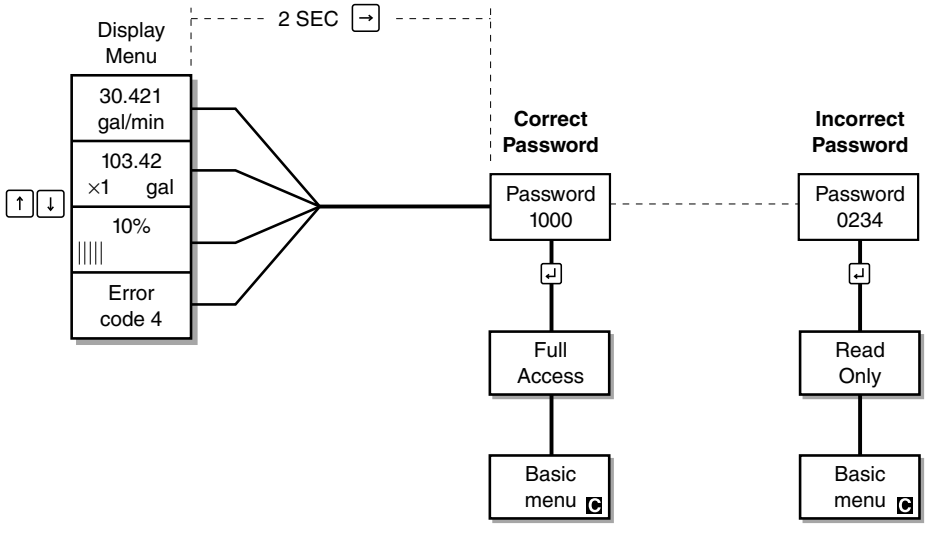
Displays the percentage of full scale flow and a corresponding bar graph.

Error Code

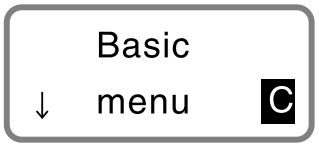
The electronics monitor and record several possible errors that may occur during operation. Push right arrow key to scroll through errors. See the troubleshooting section for error codes.

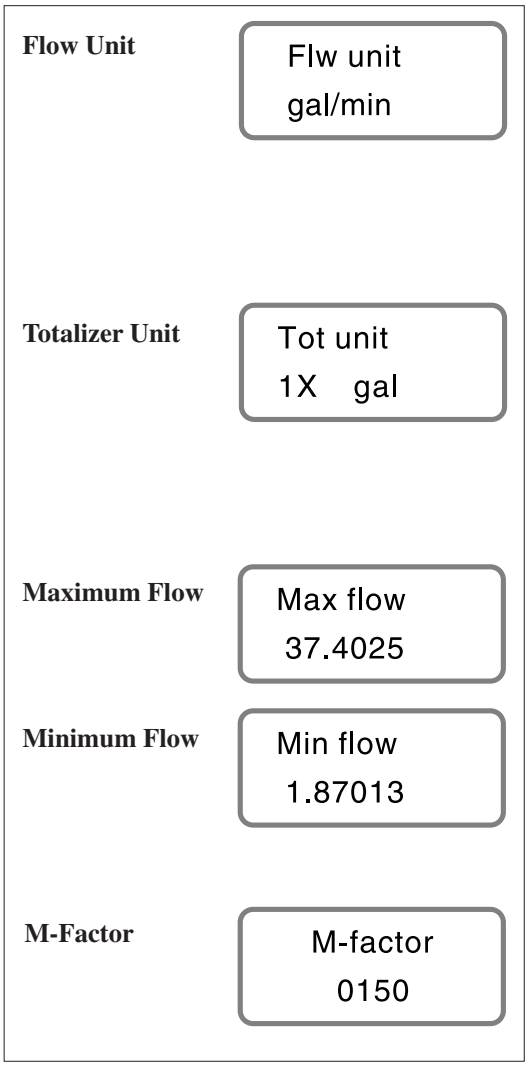
ACCESSING PROGRAMMING SUBMENUS

In order to enter the programming submenus the user must hold down right arrow key for 2 seconds. The user must then enter the correct password to access the submenus. If the correct password is entered the display will read "Full Access". If an incorrect password is entered the display will read "Read Only" and the user will not be able to alter the programming. **The flowmeter comes from the factory without a password so once the right arrow key is held down for 2 seconds "Full Access" will automatically be permitted**. Refer to the Personalize group to change the password. Note: When in the programming submenus the meter will be "off line". The last values of the totalizer and the flowrate will be stored until the meter is returned to the display menu.



CONFIGURE GROUP





This value will be displayed as the units for flowrate in the display menu. Also, this will be the engineering units used to set the max flow and min flow for scaling the 4-20 and the frequency output. Up to scroll through the volume units, down to scroll through time units. Possible flow units : gallons, bbl, cm^3, liters, m^3, lb, tons, grams, kilograms, metric tons, standard ft^3, normal m^3, ft^3, and in^3. Possible time units: minutes, hours, days, and seconds.

This value will be displayed as units for the totalizer in the display mode. A multiplier may also be selected in order to slow the counting of the totalizer. Press the up arrow key to scroll through multipliers, down arrow key to scroll through units. Possible units: gallons, bbl, cm^3, liters, m^3, lb, tons, grams, kilograms, metric tons, standard ft^3, normal m^3, ft^3, and in^3. Possible multipliers: x1, x10, x100, $x10^3$.

Maximum flow is entered in the Flow Units previously programmed. This value sets the 20 mA point, and the scaled frequency output to correspond to Freq Max.

Minimum flow is entered in the Flow Units previously programmed. This value sets the cutoff point where the output drops to 4 mA and/or the scaled frequency output drops to 0 Hz. This value can not be programmed below the published minimum flowrate of the meter.

M–factor is a value that sets the signal input filter. The M–factor has been factory programmed during calibration. However for best performance the M–factor can be set during actual flow conditions within a specific application. If the value is set to 0000, the meter will perform an automatic M-factor setting. This will take approximately 5 seconds to perform. **If an automatic setting is made, the flowmeter must be operating at least 1/10 of the meter's maximum flowrate (3.2 ft/sec for liquids, 300 ft/sec for gases)**. If the sensor input signal is too weak (due to the flowrate not being at least 1/10 of the meter's maximum flowrate) the electronics will not auto set the M-factor. The display will read "Too Low NOT SET" (for 1 second) and the previous M–Factor will be displayed.

The nominal M–factor for all V-BAR flowmeters is 150.

CONFIGURE GROUP
(continued)

Basic
↓ menu C

Noise Level

Noise Lv
010 %

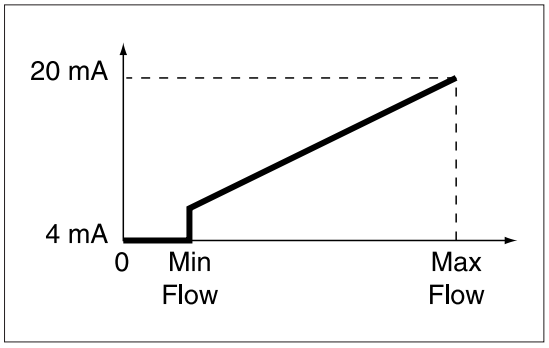
This value sets the no flow cutoff level. If the input signal level drops below this value, the meter will not output or display a flowrate. The Noise level can be set from 1-100%. 0% represents no flow, 100 % represents 100% of the meter's maximum flow. (**Not maximum flow for specific application which is programmed in the Basic Menu**). If the value is programmed as 000, the meter will perform an automatic Noise Level setting. After 5 seconds the meter will return with the new calculated value. For best result auto set the noise level with pump on and down stream valve closed to ensure no flow conditions.

Output
↓ Menu C

Analog Output

4-20 mA
On

Linear analog output set by min. and max. flow.



4-20 TC
05 sec

Toggle on/off with the up and down keys.
Analog Output Time Constant
Dampens the analog output. Analog time constant can be set from 0-99 sec.

Output Zero Time

Zero TM
0 sec

Number of seconds before output drops to 0 after the actual flow drops below the programmed, minimum flow.

Frequency/Pulse Output Setup

Freq out
00000 Hz

Type of Frequency/Pulse output can be selected here. The possible output options are: Scaled Frequency, Vortex Frequency, Direct Frequency, Pulse –, Pulse +, and Transition. The frequency/pulse output can be disabled by choosing "off" as the output selection. The display changes below depending on output option selected. Refer to EZ Logic Map. Note: When connecting the V-BAR to the flow processor, select Vortex Frequency as OUTPUT SETUP.

CONFIGURE GROUP
(continued)

Output
↓ Menu C

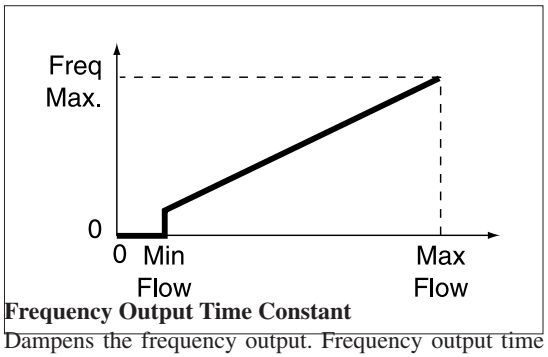
Scaled Frequency Output

Freq out
00000 Hz

Linear output frequency scaled between minimum and maximum flow, and maximum output frequency. (see graph)

Freq max
10 kHz

Maximum Output Frequency
Sets the maximum output frequency. Available settings: 500 Hz, 1kHz, 3 kHz, 5 kHz, or 10 kHz.



Freq TC
05 sec

Frequency Output Time Constant
Dampens the frequency output. Frequency output time constant can be set from 0-99 sec.

Vortex Frequency Output

Freq out
Vor freq

Output frequency will be equal to average pipe velocity (1 Hz = 1 ft/s). Use this output when connecting to a flow processor. The flow processor's programmed K-factor should be 1/Area (ft^2)

Freq TC
05 sec

Frequency Output Time Constant
Frequency output time constant can be set from 0-99 sec. Default is 5 seconds.

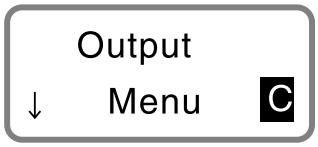
Direct Frequency Output

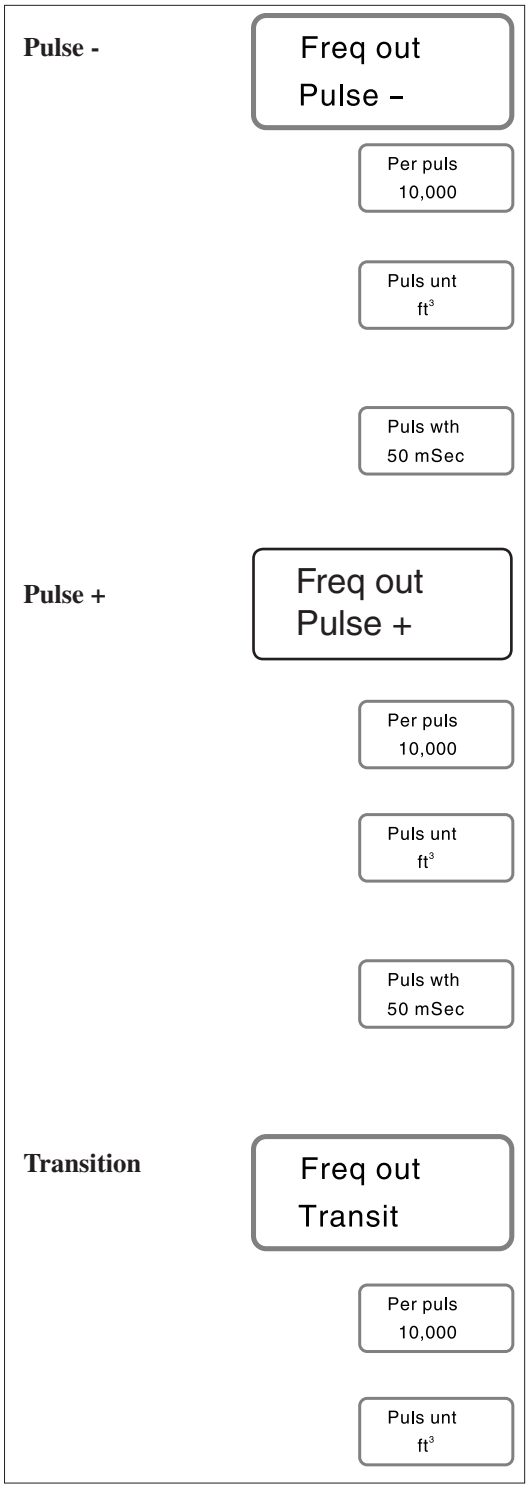
Freq out
Direct

The output frequency will be the true shedding frequency at the sensor head. This is an instantaneous representation of the flow. The local velocity may be calculated using the following equation:

$$\text{Velocity} = \frac{\text{Frequency}}{\text{K-factor}} \left(\tfrac{ft}{sec}\right)$$

CONFIGURE GROUP
(continued)





One negative pulse each time the totalizer increments. The increment is set by the Per pulse and pulse unit.

Per pulse
This number represents the amount of fluid that passes the meter per pulse.

Pulse Unit
Possible units: gallons, bbl, cm^3, liters, m^3, lb, tons, grams, kilograms, metric tons, standard ft^3, normal m^3, ft^3, and in^3. Possible multipliers: x1, x10, x100, $x10^3$.

Pulse Width
Possible pulse width settings: 5 msec, 50 msec, 500 msec, 1 sec, 5 sec. Note: Programmed pulse must be less than actual output signal pulse width at maximum flowrate.

One positive pulse each time the totalizer increments. The increment is set by the Per pulse and pulse unit.

Per pulse
This number represents the amount of fluid that passes the meter per pulse.

Pulse Unit
Possible units: gallons, bbl, cm^3, liters, m^3, lb, tons, grams, kilograms, metric tons, standard ft^3, normal m^3, ft^3, and in^3. Possible multipliers: x1, x10, x100, $x10^3$.

Pulse Width
Possible pulse width settings: 5 msec, 50 msec, 500 msec, 1 sec, 5 sec. Note: Programmed pulse must be less than actual output signal pulse width at maximum flowrate.

One transition from low state to high state each time totalizer increments. The increment is set by Per pulse and Pulse unit.

Per pulse
This number represents the amount of fluid that passes the meter per pulse.

Pulse Unit
Possible units: gallons, bbl, cm^3, liters, m^3, lb, tons, grams, kilograms, metric tons, standard ft^3, normal m^3, ft^3, and in^3. Possible multipliers: x1, x10, x100, $x10^3$.

CONFIGURE GROUP
(continued)

Fluid
↓ Menu C

Fluid Density	Density 62.4000	Actual fluid density of application in lbm/ft^3.
Reference Density	Ref Den 0.000000	The reference density is programmed in lbm/ft^3. The reference density is the density of fluid at standard conditions. It is used for displaying and scaling standard or normal flowrates. If the reference density is set to zero, the reference density will be the fluid density.
Density Range	Dens Rng 1.5	Maximum density divided by minimum density. Used to set input filter. (M-factor)
Fluid Viscosity	Viscos 1 cP	Fluid viscosity used to calculate Reynolds number.
Fluid Temperature	Temp 0100° F	The temperature is used to compensate for changes in internal diameter of the sensor, by shifting the K-Factor.

Sensor
↓ Menu C

Size	Pipe ID 84	Pipe inside diameter, 3 to 80" (75 to 2000 mm).
Calibration Factor	Meter K 2400.00	Calibrated meter K-factor in pulses/ft.
Serial	000000	Meter Body serial number. (Cannot be changed)
Tag Number	Tag # 00000000	Meter tag number. (Cannot be changed)

DIAGNOSE GROUP

Reset
↓ Menu D

Totalizer Reset	Total Reset N	User can reset the totalizer by selecting yes. (Y)

DIAGNOSE GROUP
(continued)

Reset
↓ Menu D

Set Defaults — Defaults No

User can reset meter to original programmed defaults shown below. Note: Choosing "Yes" will erase existing meter programming.

Programmed Defaults

Basic menu C	Output menu C	Fluid menu C	Sensor menu C	Reset menu D	Service menu D	Password menu P	HART menu P	Display menu P
Flw unit gal/min	4-20 mA On	Density 62.4000	Pipe ID –	Total Reset N	Sub Freq 0000 Hz	Set Pass 0000	HART On	FlowRate Show
Tot unit ×1 gal	4-20 TC 05 Sec	Ref Den 0.000000	Meter K –	Defaults No	4-20 Out 0.000%			Total Hide
Max flow –	Zero TM 0 Sec	Dens Rng 1.5	000000 – 000 WO#		Freq Out 00000 Hz			BarGraph Show
Min flow –	Freq out Vor freq	Viscos 1 cP	Tag # 00000000		Vor Ampl 0%			Err Code Show
M-factor 0150		Temp 0100°F			Vor Freq 0 Hz			TotReset Yes
Noise Lv 003 %					4 mA Cnt 1270			Dsply TC 05 Sec
	Vor freq: Freq TC 05 Sec				20 mA Cnt 7150			Scan On
					Version 3.00			ScanTime 05 Sec
					Error code 1			Flow Res 8 digits

Service
↓ Menu D

Substitute Frequency — Sub freq 0000 Hz

This frequency will simulate the vortex shedding frequency for the display and the output. Note: Value must be set to zero before meter returns to actual frequency input.

Simulated Analog Output — 4-20 Out 0.000%

Simulation of the analog output 0% = 4 mA and 100% = 20 mA. Can be set at any value between 0 and 100%. Operates only while in this display.

Simulated Frequency Output — Freq out 00000 Hz

Simulation of the frequency output, 0-10,000 Hz. Only possible if pulse output is selected to be either scaled or vortex frequency. Operates only while in this display.

DIAGNOSE GROUP
(continued)

Service
↓ Menu D

Input Signal Amplitude

Vor Ampl
0%

Input signal level 0-100% of meter's maximum. (Not maximum flow of specific application which is programmed in the Basic Menu).

Vortex Frequency

Vor Freq
0 Hz

The raw input frequency from the sensor.

4 mA Calibration Value

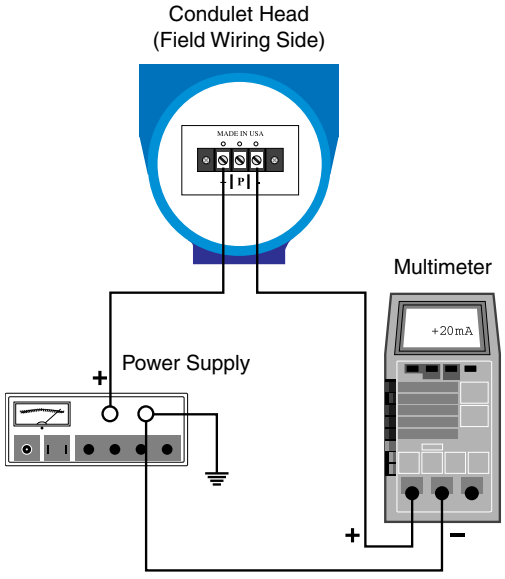
4 mA Cnt
1270

Sets the # of units the microprocessor must send to the current output circuit to generate 4 mA.

20mA Calibration Value

20mA Cnt
7150

Sets the # of units the microprocessor must send to the current output circuit to generate 20 mA.



Wiring diagram for 4-20 mA output calibration To calibrate mA counts, move display to 4 mA count , press enter. Read current value from multimeter. Value should be within ±0.012 mA. If value deviates by more than ±0.012 mA, adjust microprocessor count until multimeter value equals 4 mA, press enter. Repeat steps for 20 mA count.

Software Revision

Version
2.10

Revision of the software used is displayed.

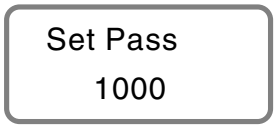
Self Diagnostics

Error
code 1

Displays current errors. Once error condition no longer exists, error code is cleared. Push right arrow key to scroll through arrows. See trouble shooting section for error code descriptions.

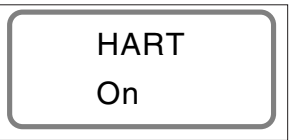
PERSONALIZE GROUP

Set New Password

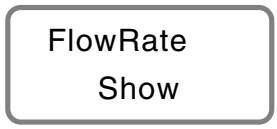


Program the password for future protection of the meter. If 0000 is selected, there will be no password.

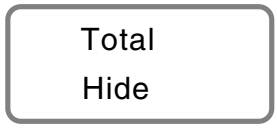
HART Enable/Disable



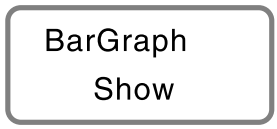
User may turn meter's HART communication abilities on or off.



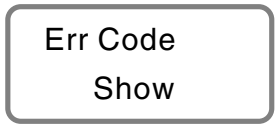
Show or Hide the flowrate from the display menu.



Show or Hide the totalizer from the display menu.

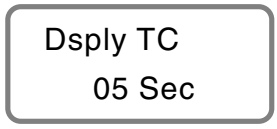


Show or Hide the bar graph from the display menu.

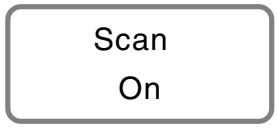


Show or Hide the error codes from the display menu.

If set to yes, one push of the enter key will reset the totalizer, when the totalizer is displayed, in the display mode.

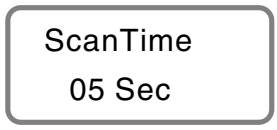


Dampens the displayed flowrate.



Turns the automatic scrolling of the display menu off or on.

Scan Time



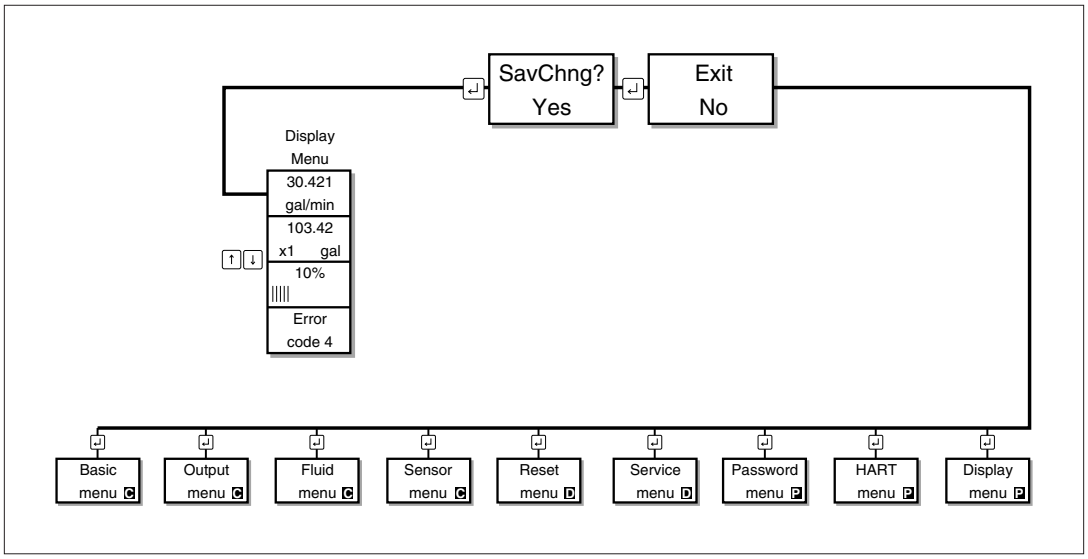
The amount of time that each display is shown is the display mode if scan is turned on.

Flow Resolution

Selects how many significant digits to display for the flowrate.

EXITING PROGRAMMING SUB-MENUS

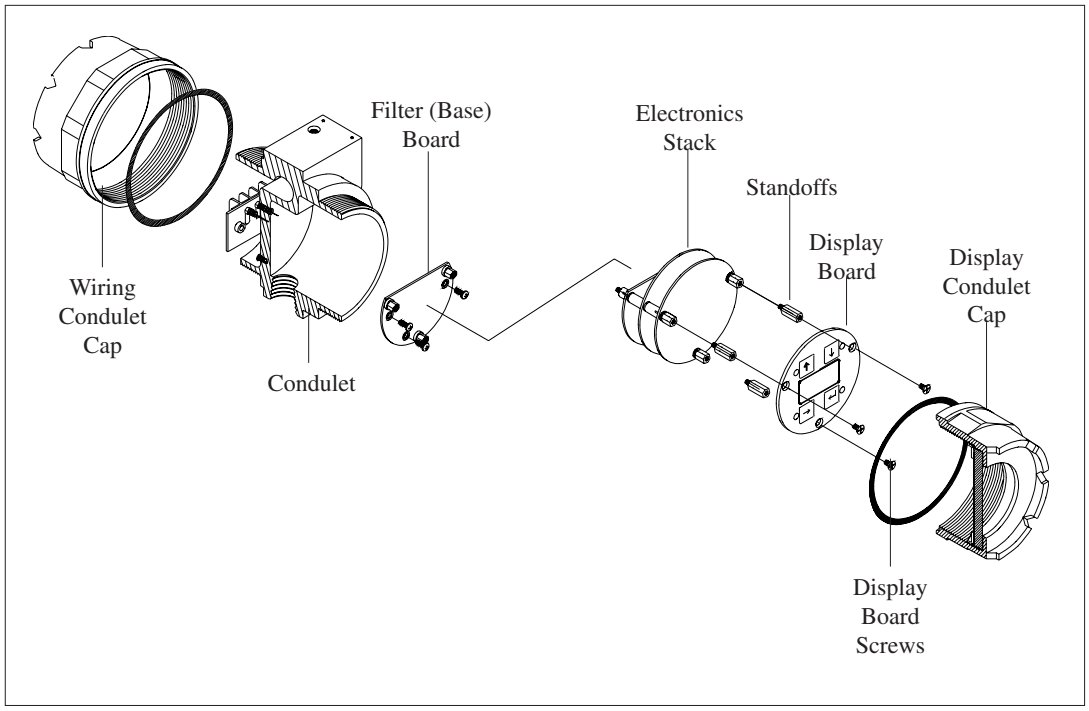
The programming submenus can be exited only at the top of each submenu heading, by pressing the enter key. The display will read "Exit". Toggle to "Yes" with the up or down arrow key, press enter. If you have made any changes and want to save them, press enter when prompted by "Save Changes", if not toggle to "No" and press enter .



TROUBLE SHOOTING CHART

Symptom	Output Signals	Error Code	Possible Reason	Solution
Blank display	0-4 mA or 0 Hz		Supply voltage	Check supply voltage on the terminal board of the meter.
				Check resistance of the current loop. Refer to analog output section for permissible values.
			Defective Electronics	Replace electronics stack in the meter.
Displays flow without output signal	<4 mA		Current output deselected	Turn 4-20 mA to "On" in output menu.
	0 Hz		Frequency output deselected	Select frequency/pulse output option in output menu.
No flow display or output at flow	4 mA or 0 Hz	1	Minimum flow setting too high	Reduce minimum flow in basic menu.
			M—factor set too low	Auto set noise level in Basic menu.
		1, 2	No signal from sensor	Check resistance across sensor wires: see sensor functionality section.
			No flow in line	
Shows flow without flow in pipe	Undefined		Pipe vibration or media pulsations disturbing the flow signal	Auto set noise level in Basic menu.
				Increase minimum flow until output goes to 4 mA or 0 Hz.
				Support pipe to reduce vibration.
Unstable flow signal	Unstable		Pipe vibration and/or flow pulsations disturb flow measurement	Auto set M-factor in Basic menu.
			Air bubbles in the media	Follow piping guidelines.
			Pulsating flow	Increase the time constant for outputs and display.
Measuring error	>20 mA	3	Flow exceeds 110% of Maximum flow	Make sure the sensor is correctly sized and check maximum flow in Basic menu.
	>10 kHz max	4	Flow exceeds 110% of Maximum flow	Make sure the sensor is correctly sized and check maximum flow in Basic menu.
	0 Hz	5	Volume/pulse too low or pulse width too long	Check volume/pulse and pulse width in Output menu for the flow measured.
			Wrong calibration constant	Check that the K-factor in the Sensor menu corresponds to the value on the nameplate of the meter.
			The sensor is not correctly positioned	Check calculation of insertion depth. Ensure that sensor is inserted to correct depth. Ensure that sensor is aligned correctly.
	4 mA offset at no flow		4 mA calibration value incorrect	Calibrate 4 mA point in Service menu.
	20 mA offset at max. flow		20 mA calibration value incorrect	Calibrate 20 mA point in Service menu.

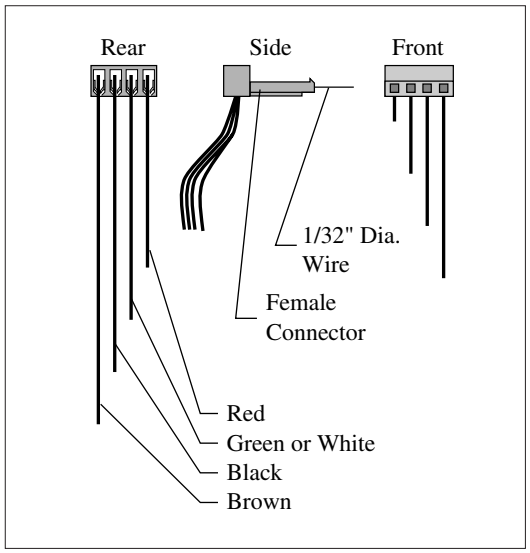
ELECTRONICS REMOVAL



The electronics used in the V-BAR are CMOS and can be susceptible to electrostatic discharge. It is recommended that a wrist strap be used to ground the technician during service work.

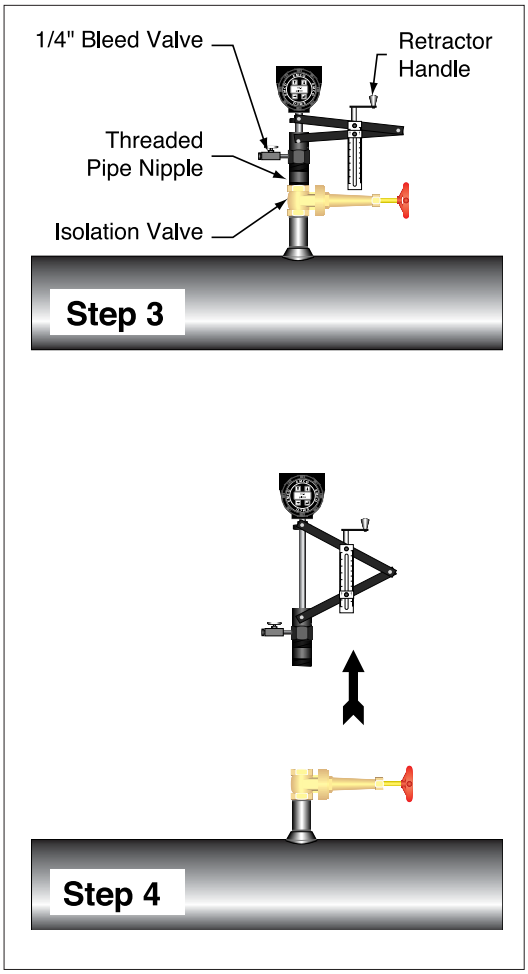
Turn the power supply off. Remove condulet cap, unscrew the three phillips display board screws. Gently remove the display board from the electronics stack. Unscrew hex standoff bolts to remove electronics stack from filter board. Carefully pull the electronics board set from the condulet and set them aside in an anti-static bag. Remove sensor female connector from the filter board male connector. Loosen the three phillips filter board screws. Remove filter board from condulet taking care not to bend the three feed through pins. Electronics replacement should be done by reversing the steps described above. Replace the condulet cap when done.

SENSOR FUNCTIONALITY TEST



Functionality test should be performed at the electronics condulet regardless of mounting configuration (integral or remote). Use proper ESD precautions at all times. Disconnect the power. Remove the electronics stack from the condulet and place into an anti–static bag. Verify the sensor is properly connected to the filter board. Disconnect the sensor from the filter board. Insert solid wire (approx. 1/32" diameter) into the sensor female connector to serve as leads. Check the resistance between the red wire and green (or white) wire. The resistance should be between 500 and 2500 . Check the resistance between the green (or white) and black wire. The resistance should be between 500 and 2500 . The two previous resistance measurements should be within 30 of each other. Check the resistance between all four wires and earth ground (the condulet or meter body). The resistance should also be at least 20 M.

V-BAR 600/60S REMOVAL



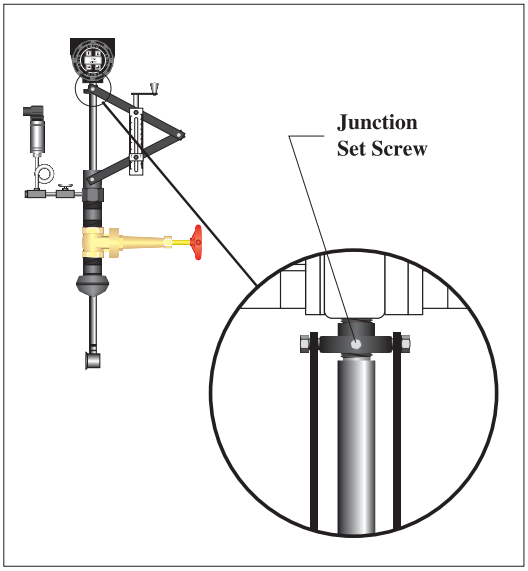
Remove the power to the meter. Loosen the orientation set screw.

Retract the stem fully into the threaded pipe nipple by turning the retractor handle counterclockwise. Close the 2" isolation valve. Remove plug in 1/4" bleed valve. Slowly open the 1/4" bleed valve to release entrained fluid pressure.

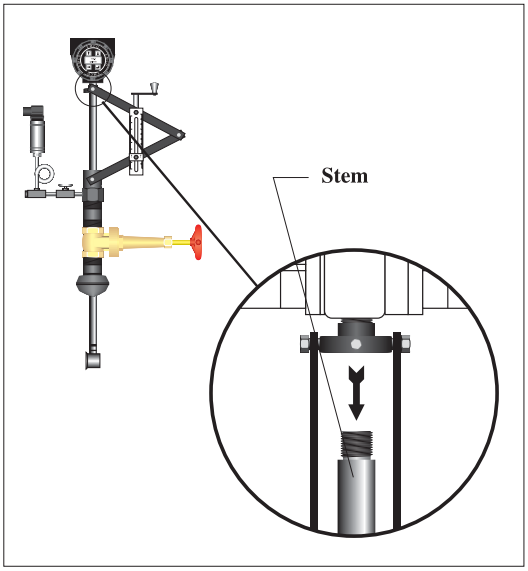
Remove the meter from the isolation valve by unscrewing the meter out of the isolation valve. Reinstall the flowmeter as described in the installation process.

V-BAR 600/60S SENSOR REMOVAL

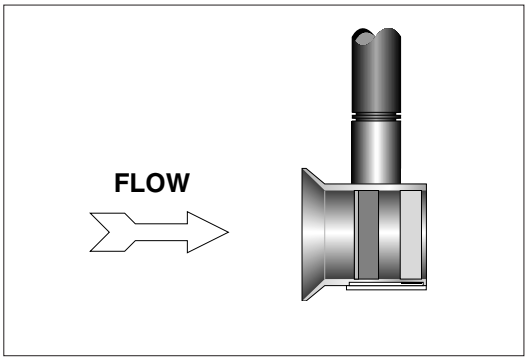
Remove power to the meter. Remove the meter from the pipe. Disconnect sensor filter board connection as outlined previously.



Loosen the junction set screw. For the temperature or pressure transmitter options remove the two Phillips head screws in the wiring condulet holding the field wiring in place. Pull the terminal block out far enough to clear a path for the sensor connector. If the meter is equipped with the pressure option only, remove the cover plate to allow a path for the sensor connector.

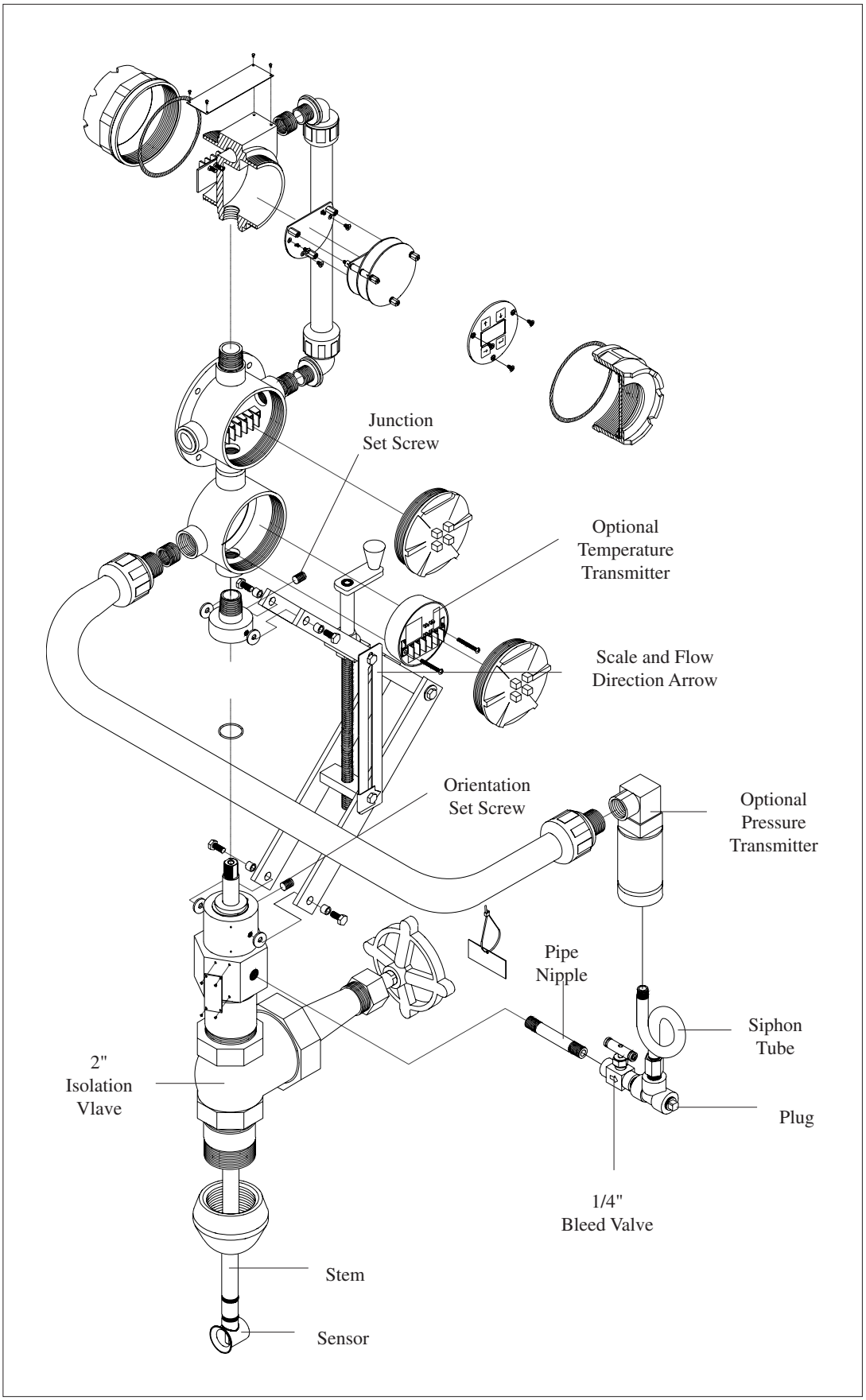


Unscrew the stem from the junction mount and remove the stem by pulling it out from the bottom of the meter. Replace stem in reverse order.

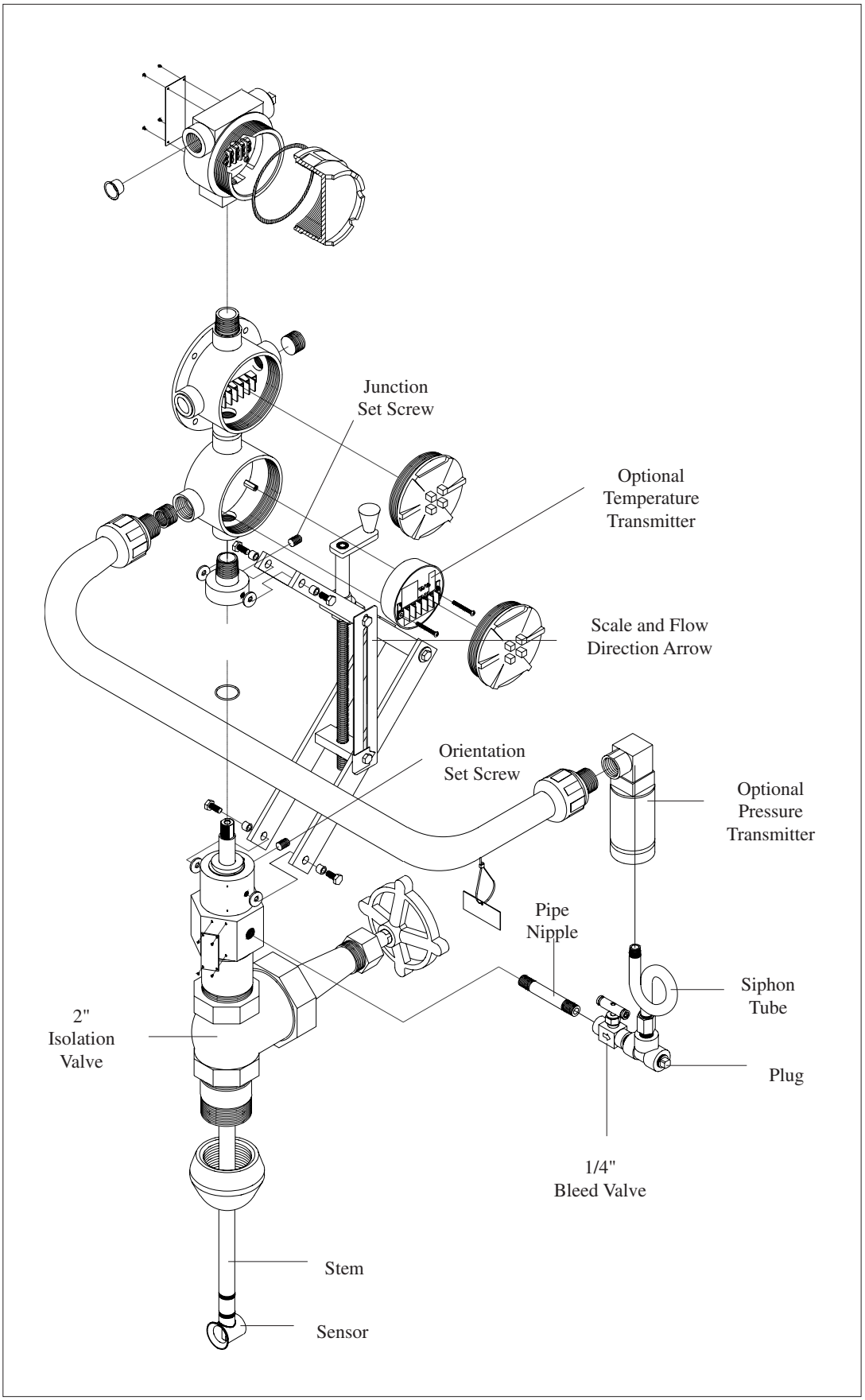


Warning:
When reassembling the stem, make sure that the flow direction arrow and Vortex sensor head input (flared side) are in opposite directions.

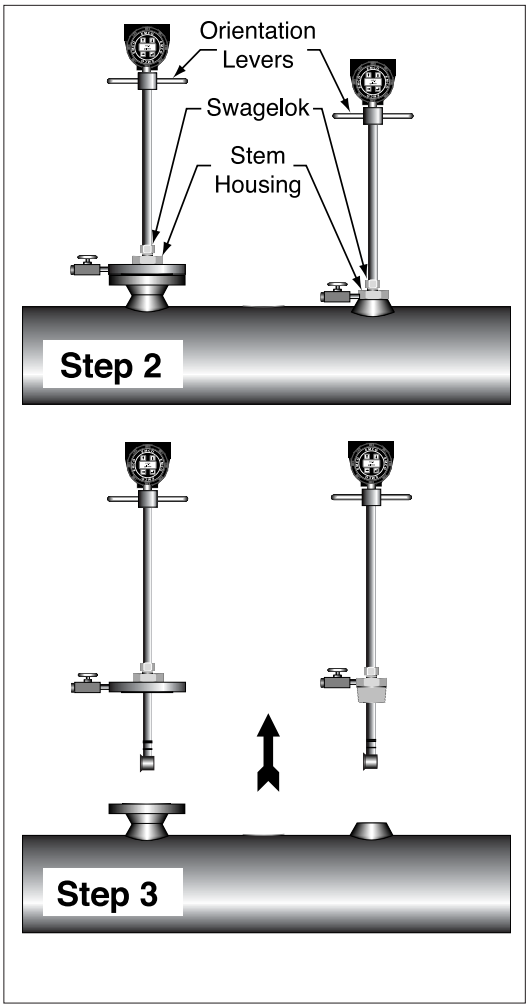
V-BAR 600/60S
INTEGRAL ASSEMBLY



V-BAR 600/60S
REMOTE ASSEMBLY



V-BAR 700 REMOVAL



WARNING

Do not loosen the Swagelok® fitting under pressure. Doing so may result in serious injury.

Remove the power to the meter. Depressurize the system. Loosen the Swagelok® fitting.

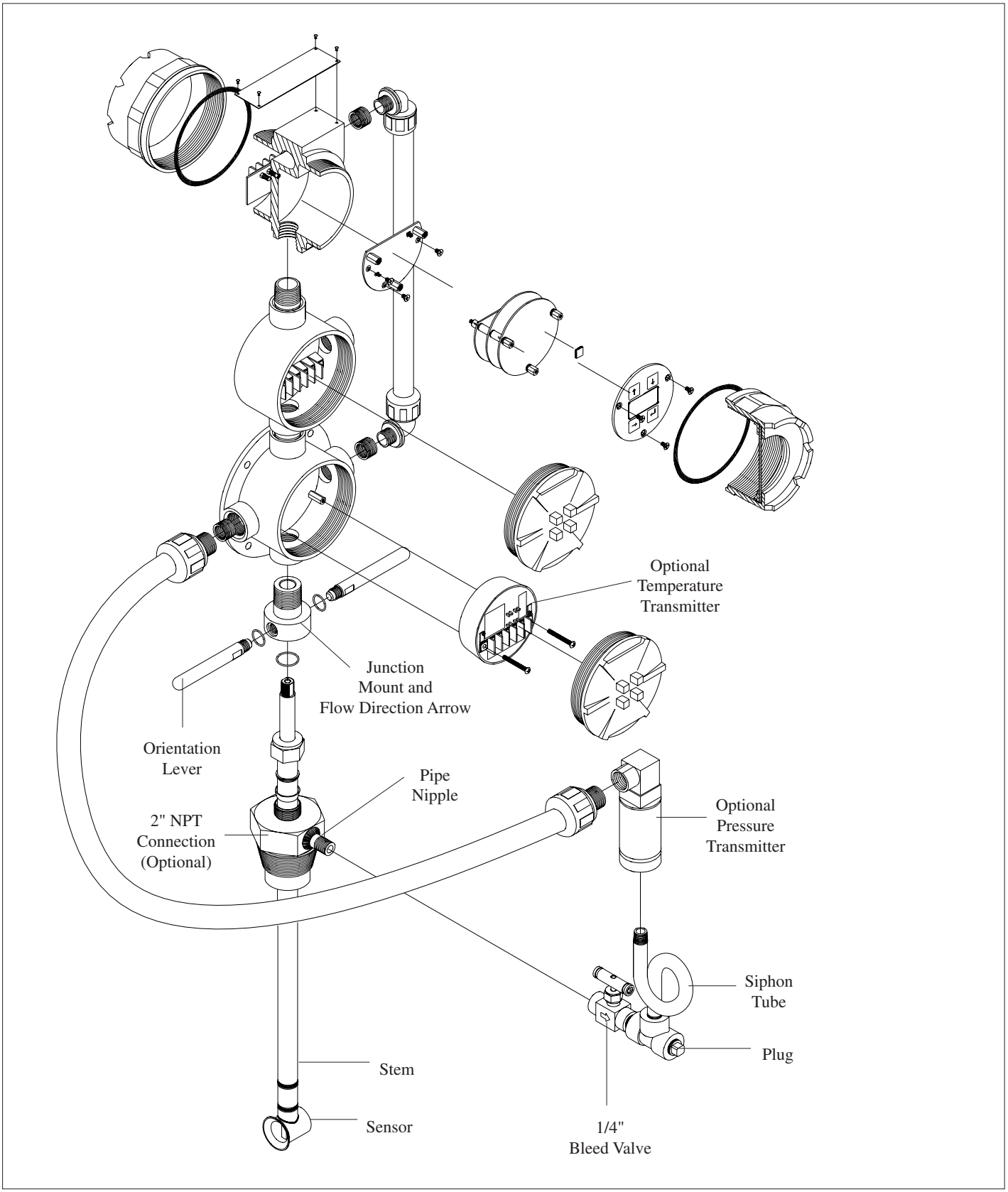
Manually pull up on the orientation levers to retract the stem so the retaining ring contacts the base of the stem housing. Lightly tighten the Swagelok® fitting to hold stem in place.

Carefully detach the meter from the nipple or flange assembly. Reinstall the flowmeter as described in the installation process.

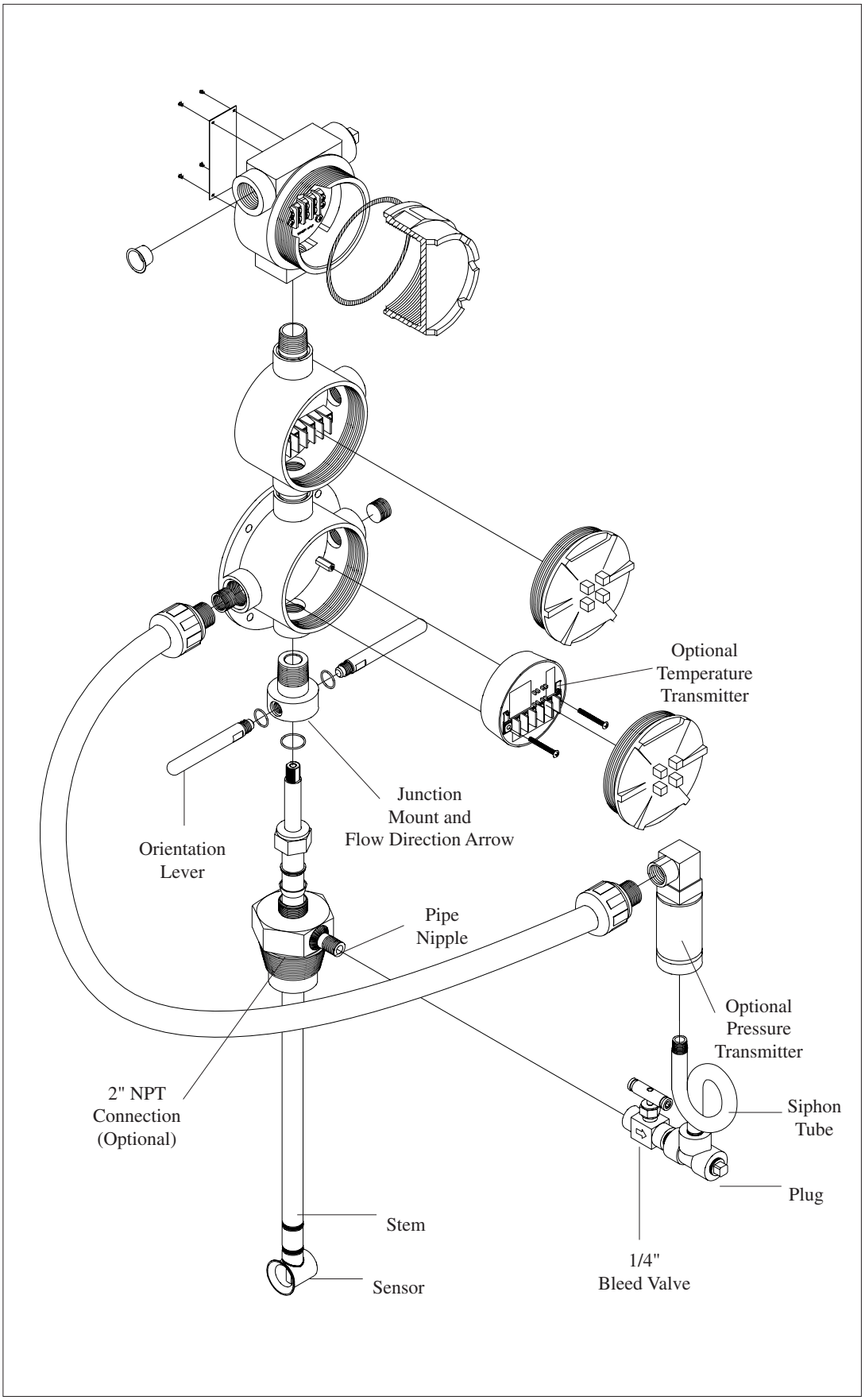
V-BAR 700 SENSOR REMOVAL

To order a replacement sensor, contact your local sales representative.

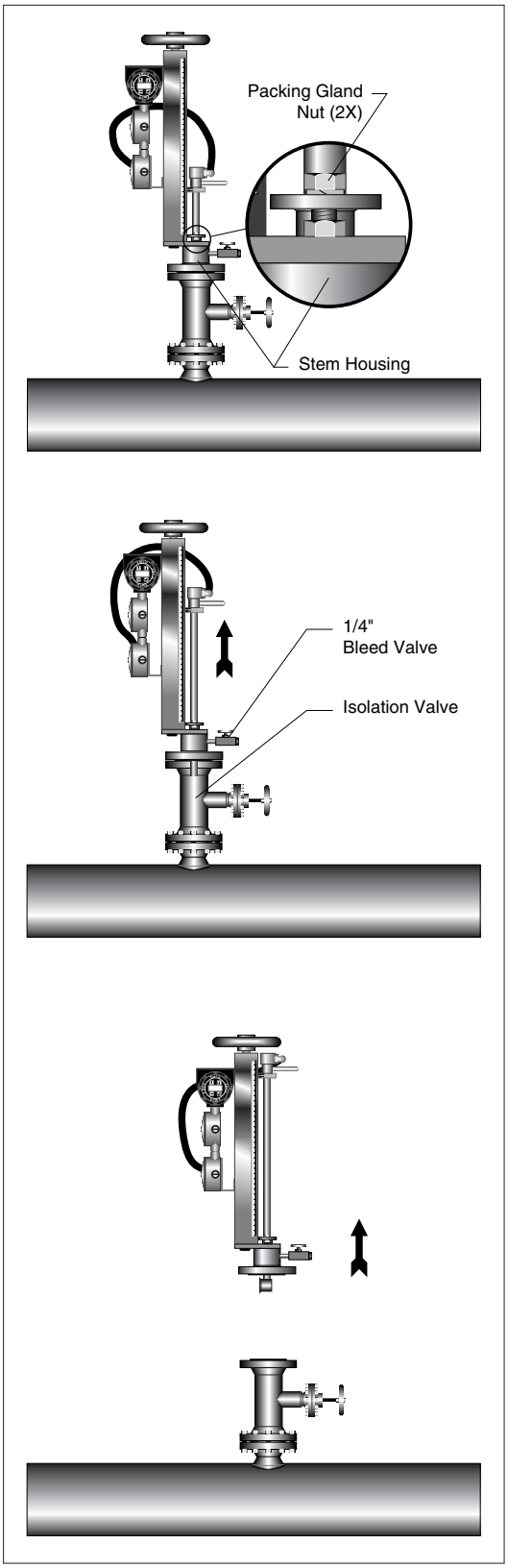
V-BAR 700
INTEGRAL ASSEMBLY



V-BAR 700
REMOTE ASSEMBLY



V-BAR 910/960 REMOVAL



WARNING

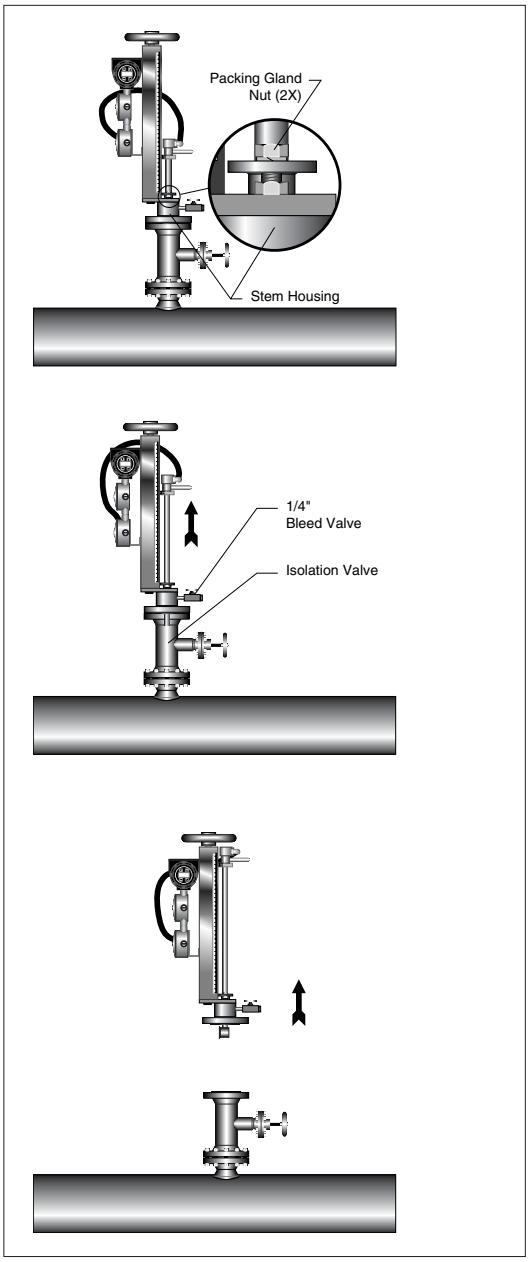
For a meter without an isolation valve, the system needs to be depressurized.

Remove the power to the meter. Loosen packing gland nuts.

Turn the handwheel counterclockwise to retract the stem out of the pipe. Close isolation valve. Slowly open 1/4" bleed valve to remove entrained fluid pressure.

Detach the meter from the isolation valve. Reinstall the flowmeter as described in the installation process.

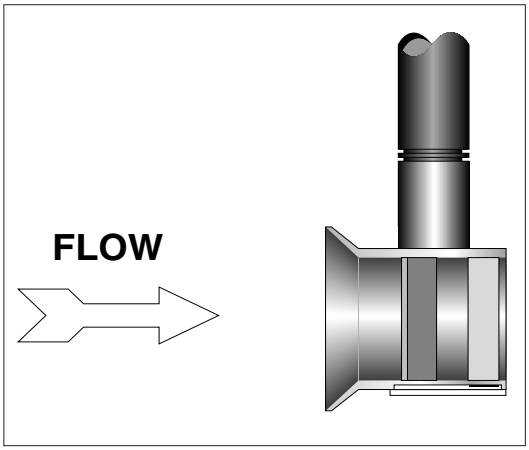
V-BAR 910/960 SENSOR REMOVAL



Remove power to the meter. Remove the meter from the pipe. Disconnect sensor as outlined previously.

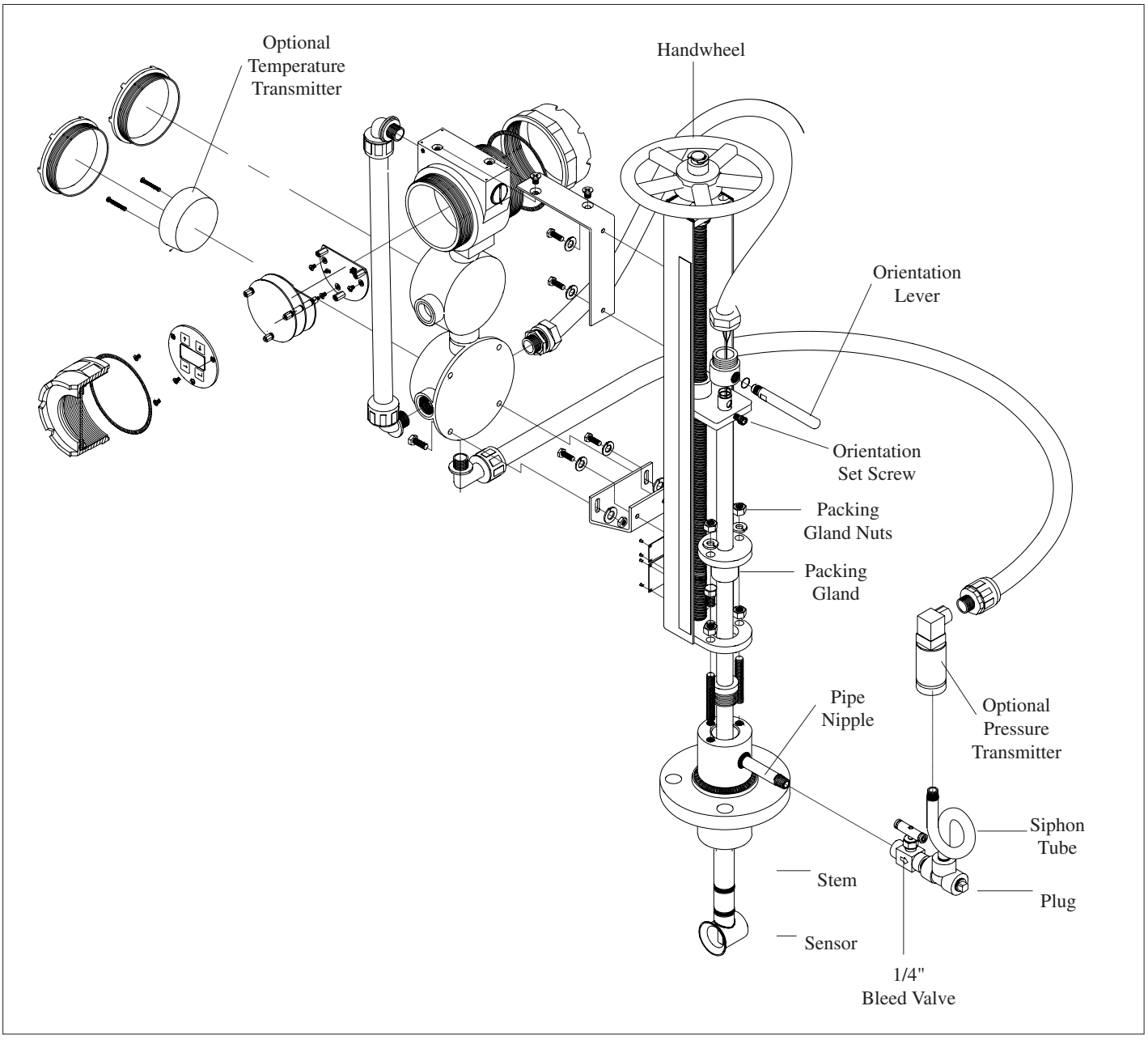
Loosen the orientation lever and the orientation set screw. For the temperature or pressure transmitter options remove the two Phillips head screws in the wiring condulet holding the field wiring in place. Pull the terminal block out far enough to clear a path for the sensor connector. If the meter is equipped with the pressure option only, remove the cover plate to allow a path for the sensor connector.

Unscrew the stem from the junction mount and remove it by pulling it out from the bottom of the meter. Replace stem in reverse order.

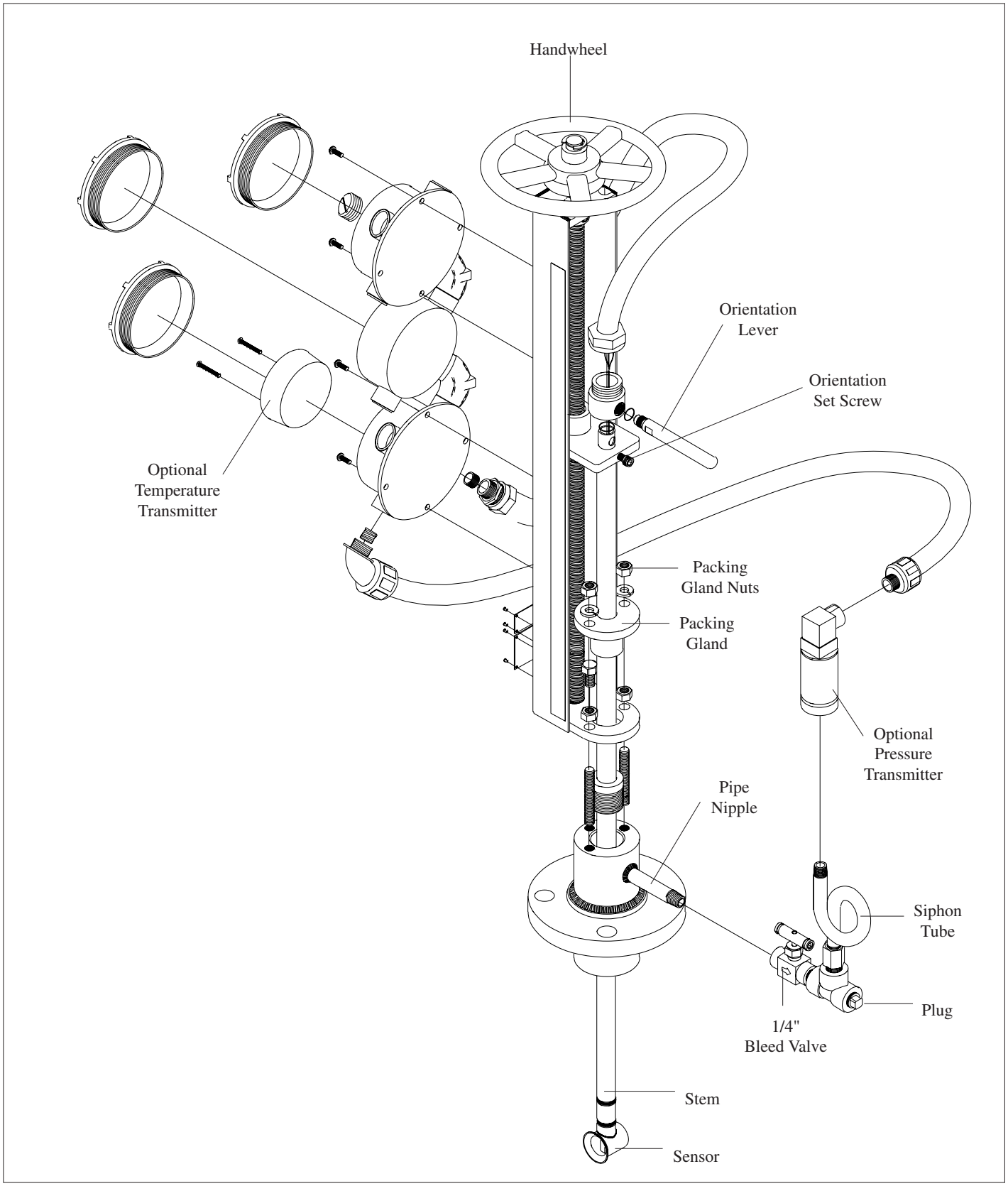


Warning:
When reassembling the stem, make sure that the flow direction arrow and Vortex sensor head input (flared side) are in opposite directions.

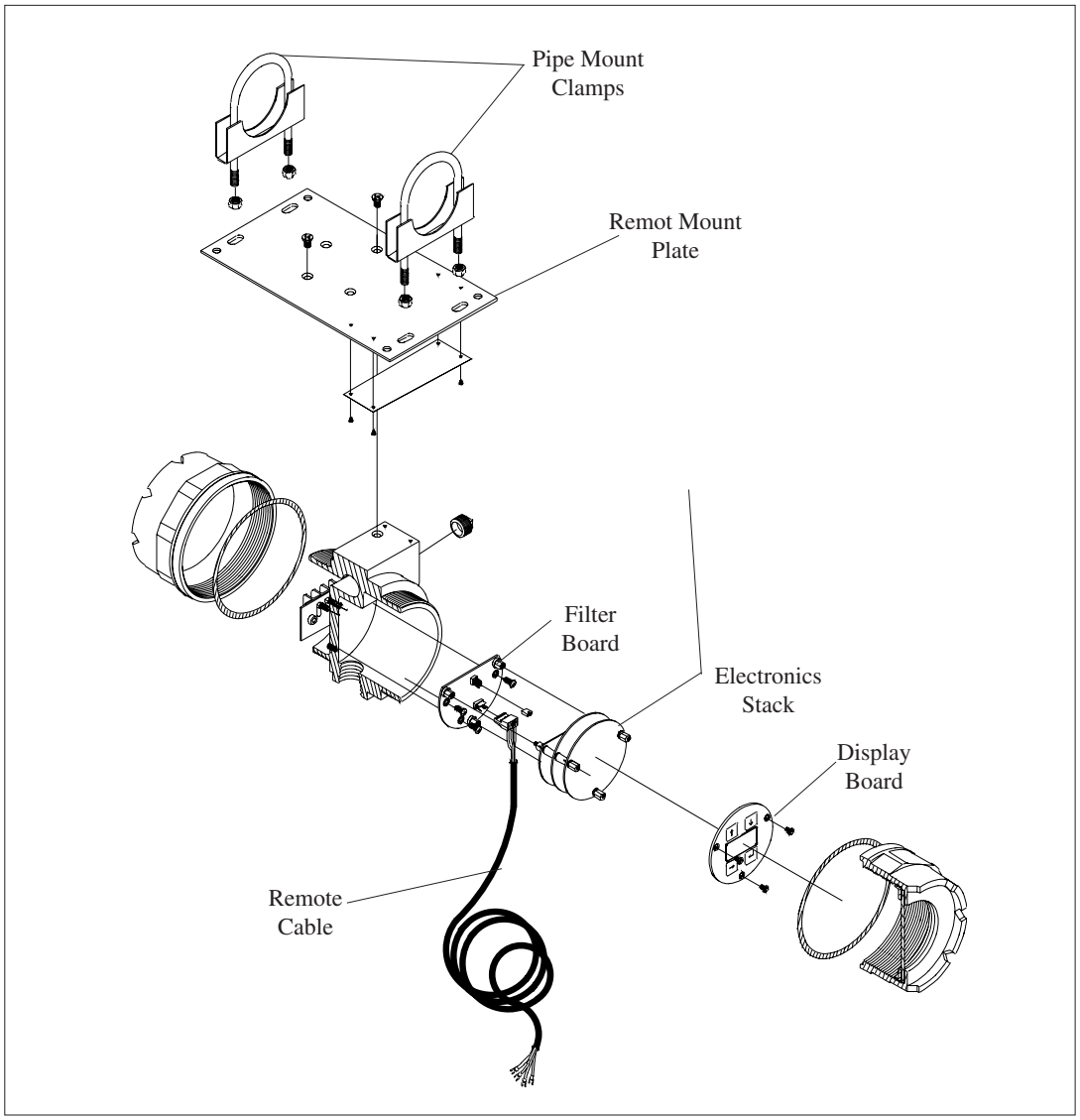
V-BAR 910/960
INTEGRAL ASSEMBLY



V-BAR 910/960
REMOTE ASSEMBLY

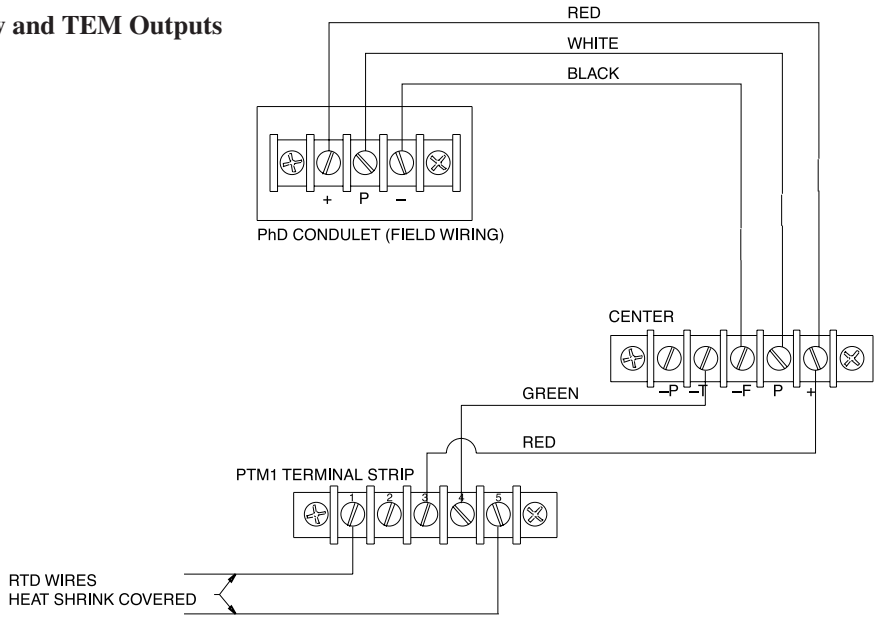


REMOTE ELECTRONICS ASSEMBLY

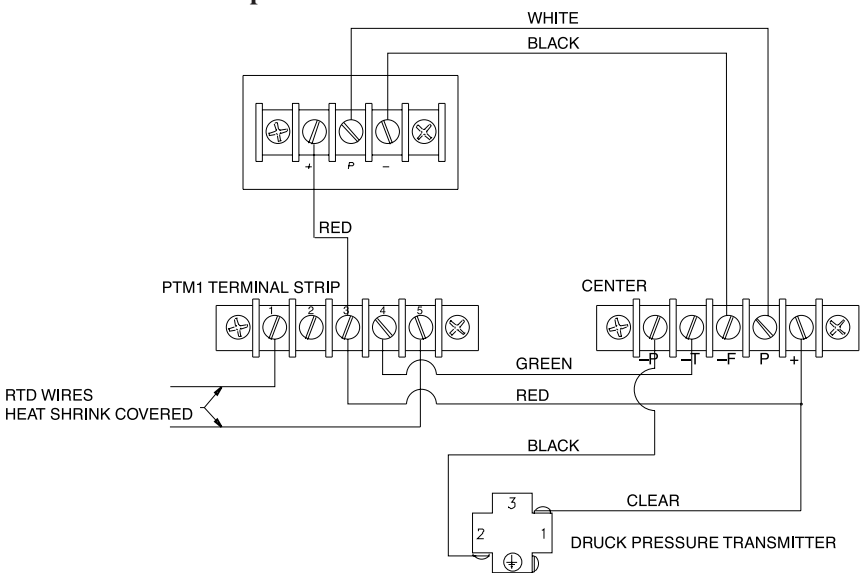


INTERNAL WIRING

Flow and TEM Outputs

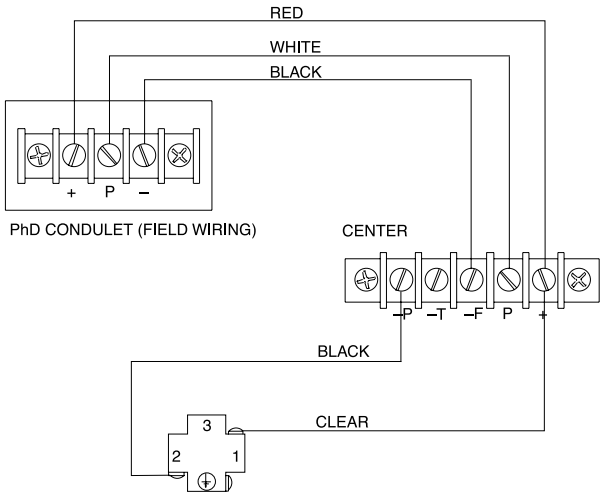


Flow, Pressure and TEM Outputs

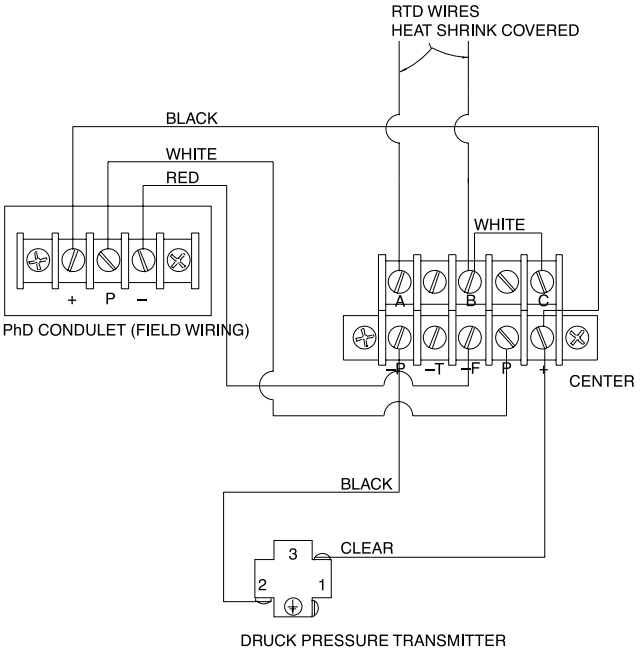


INTERNAL WIRING
(continued)

Flow and Pressure Outputs

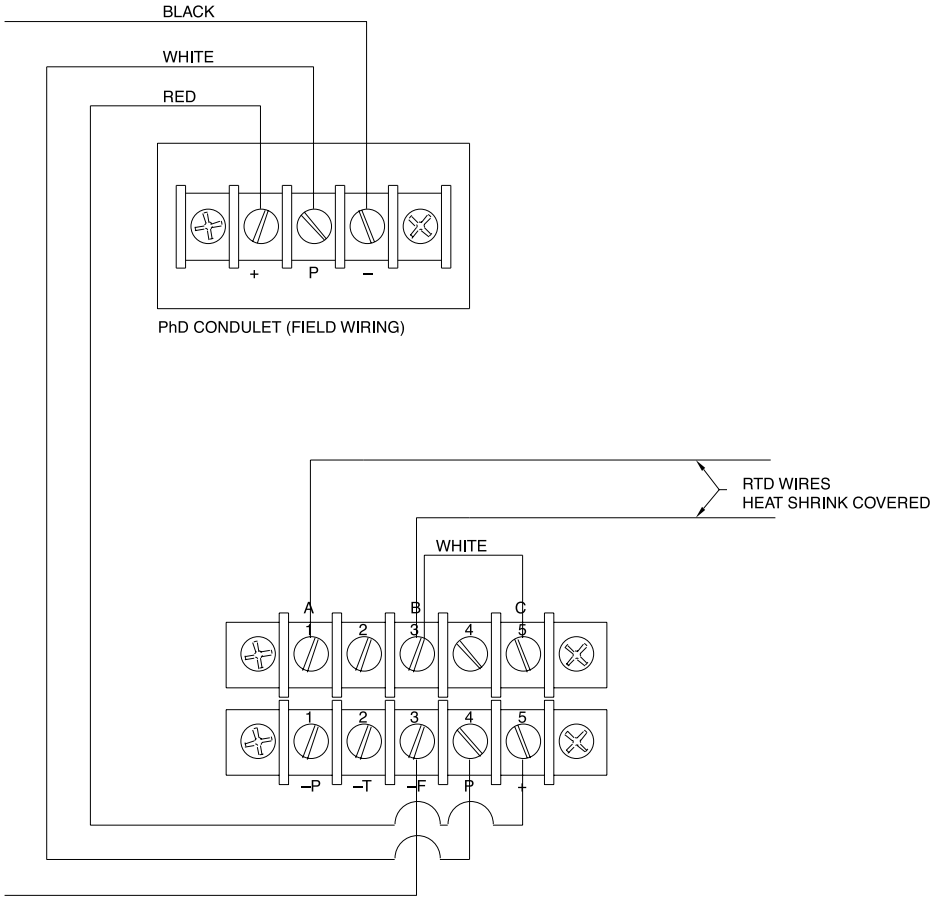


Flow, RTD, and Pressure Outputs

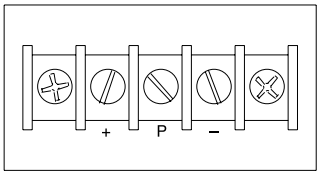


ELECTRICAL
(continued)

Flow and RTD Outputs



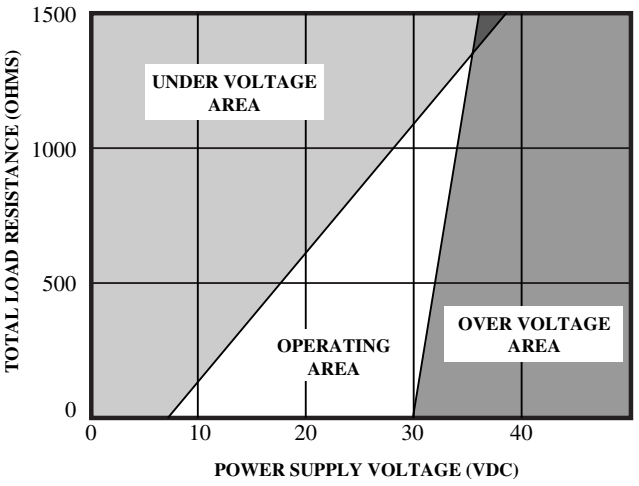
Flow Outputs



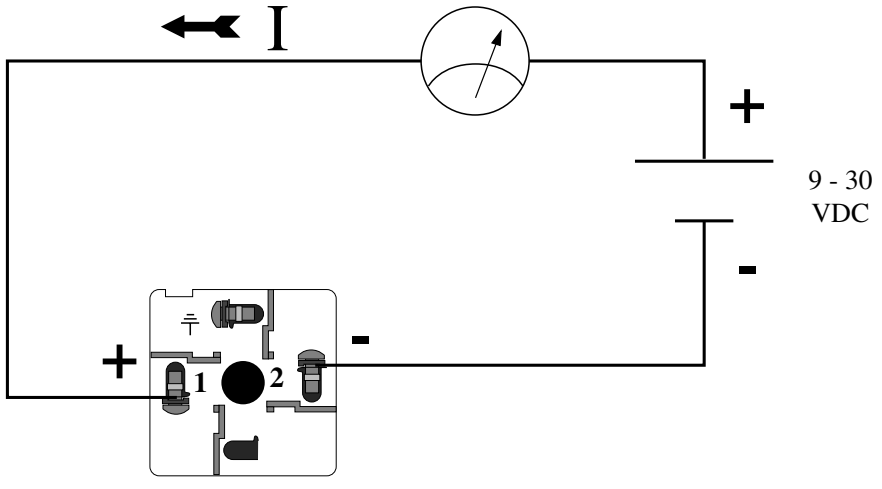
PRESSURE TRANSMITTER

The PT combines micro machined silicon diaphragms with fully welded stainless steel and hastelloy pressure ports to provide a highly accurate, stable pressure transmitter with the materials and environmental protection required for industrial applications. The silicon sensors incorporate developments derived from aerospace applications to improve output noise, non–linearity, hysteresis and long term stability. A detachable industrial electrical connector provides access to the independent zero and span trim controls, and if a configuration change to the electrical or pressure connections are required on–site, replacement parts and screw in pressure adaptors are available. Each transmitter incorporates RFI/EMC and electrical spike protection.

Output Requirements



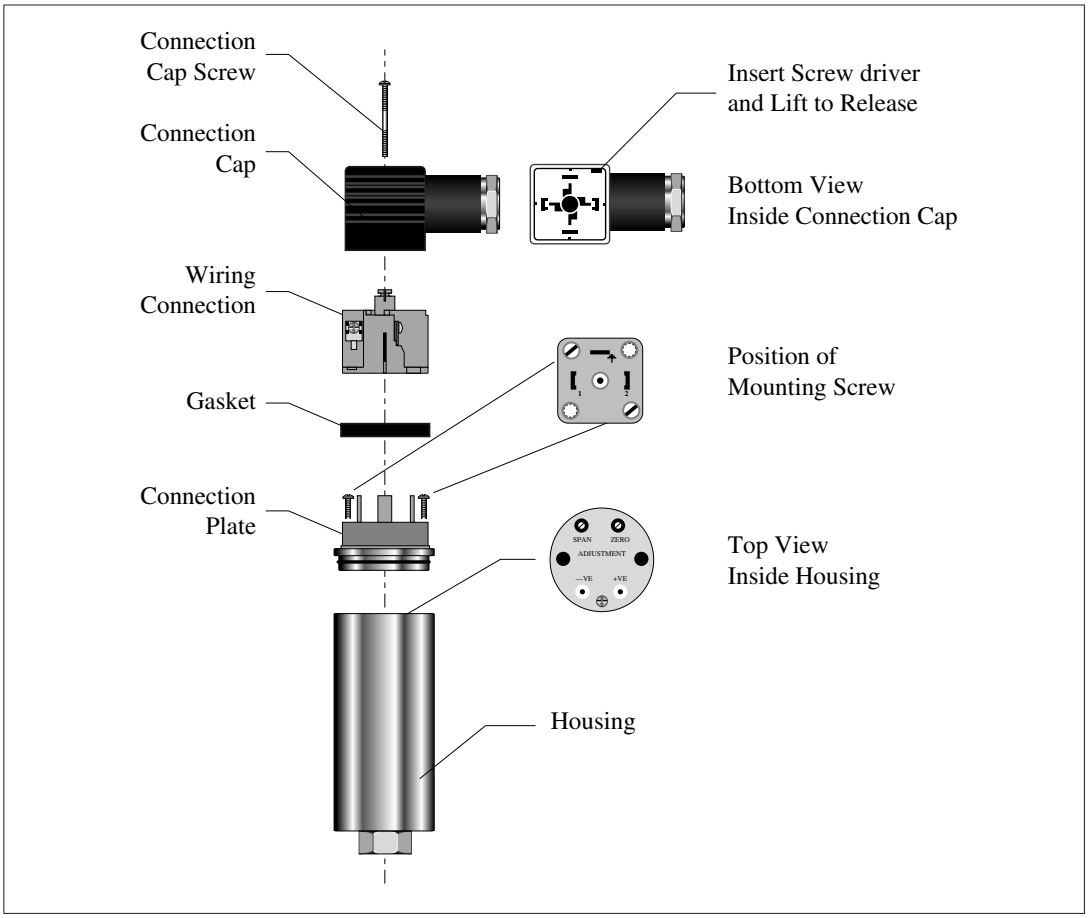
Output Wiring Diagram



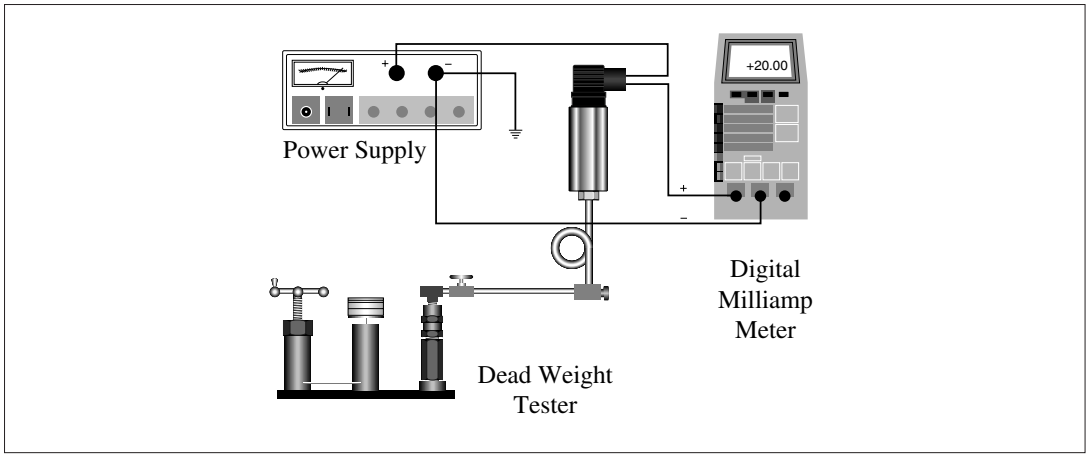
PRESSURE TRANSMITTER (continued)

Zero and Span Adjustments

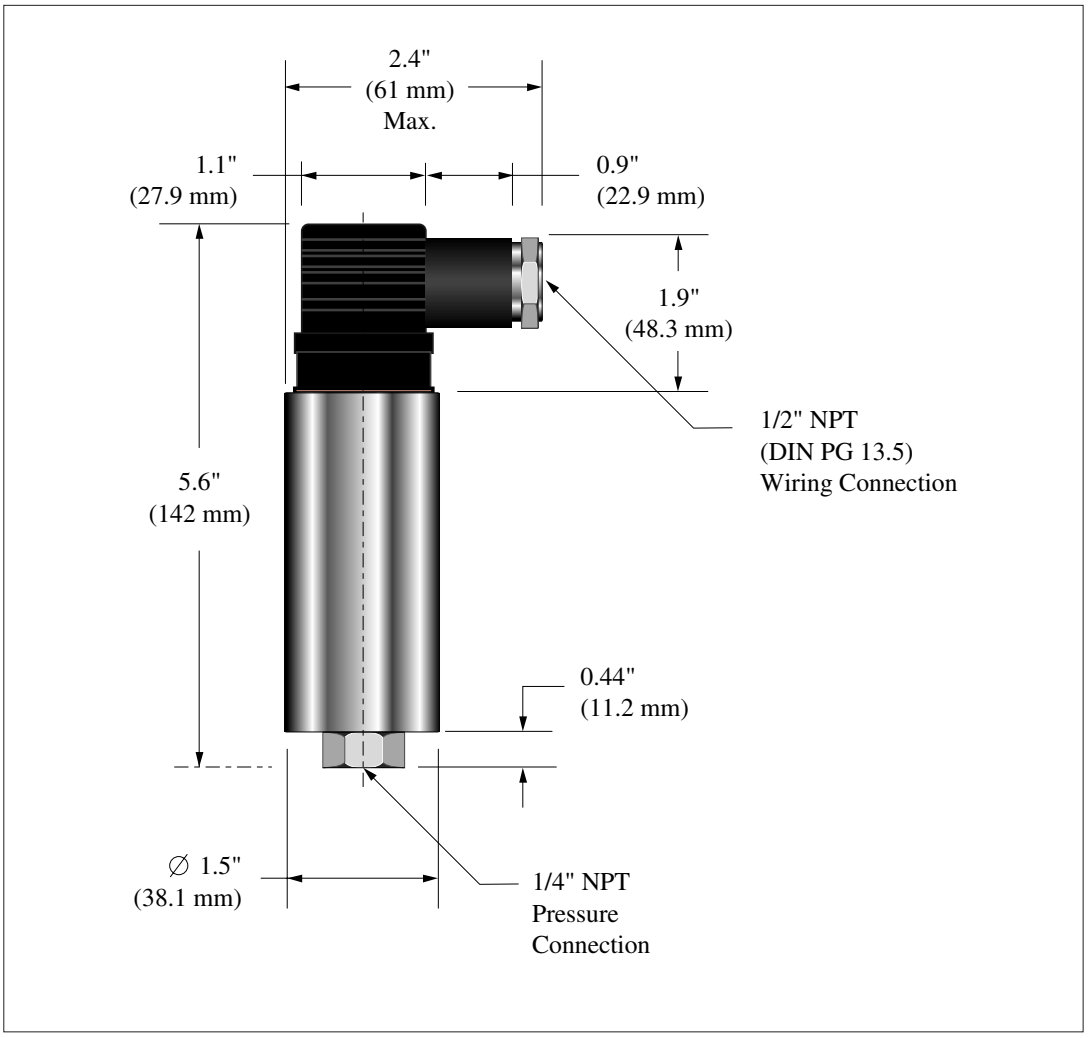
Zero and span adjustments can be carried out using the trimpots. To gain access to trimpots disassemble PT as follows: Remove connection cap screw. Remove connection cap. Loosen the two mounting screws. Gently remove connection plate. Adjust Zero and Span as needed. Place the connection plate back on the housing. For easier assembly, make sure to use the alignment guides on the side of the housing.



Using a 24 VDC power supply, dead weight tester, and digital multi-meter, make connections shown. With zero pressure applied to the transmitter, turn the zero adjustment screw until the output reads 4 ± .08 mA. With full-scale pressure applied to the transmitter, turn the span adjustment screw until the output reads 20 ± .08 mA. Because the span adjustment affects the zero point, steps 2 and 3 must be repeated until the readings are within ± 0.8 of zero and full scale.



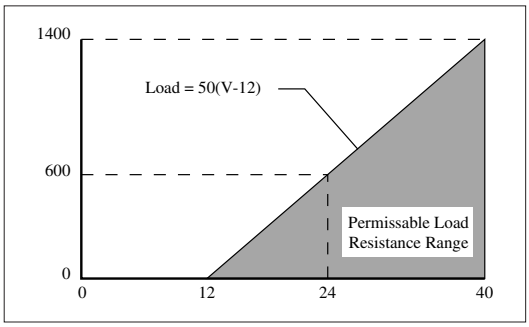
PRESSURE TRANSMITTER DIMENSIONAL OUTLINE



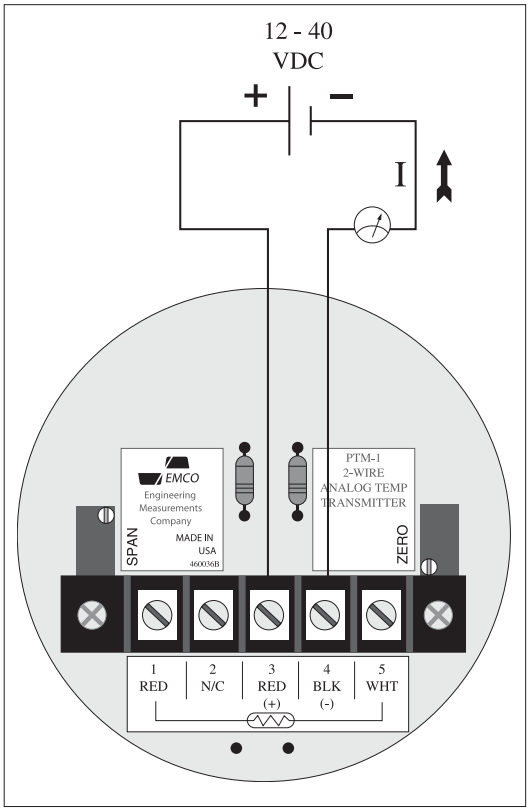
TEMPERATURE TRANSMITTER

The TEM may be selected with a direct RTD output or with an industry standard 4 to 20 mA output. The current output includes a preamplifier (PTM1) that is factory scaled and calibrated to one of several standard temperature ranges in either Fahrenheit or Celsius. The TEM is mounted within the V-BAR stem.

Output Requirements



Output Wiring Diagram

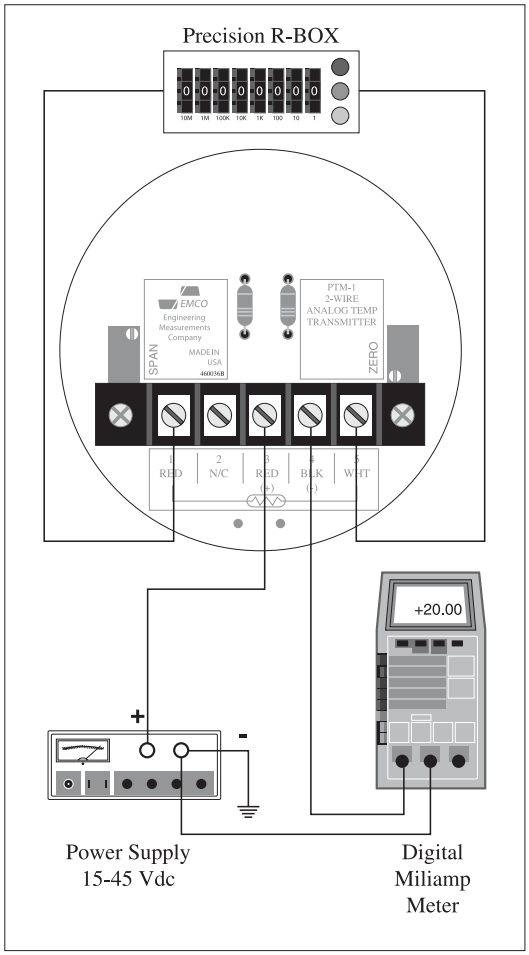


The preamplifier is factory prewired to the junction box terminal block of the V-BAR. No wiring to the TEM itself is required. There are four terminals on the TEM terminal strip:

1&5	Terminals 1 and 5 are the RTD terminals. The leads from the RTD are connected to these terminals.
3	Terminal 3 is the supply voltage terminal. This terminal is connected to terminal 5 of the junction box terminal block.
4	Terminal 4 is the return 4-20 mA signal. This terminal is connected to terminal 2 of the junction box terminal block.

TEMPERATURE TRANSMITTER
(continued)

Zero and Span Adjustments



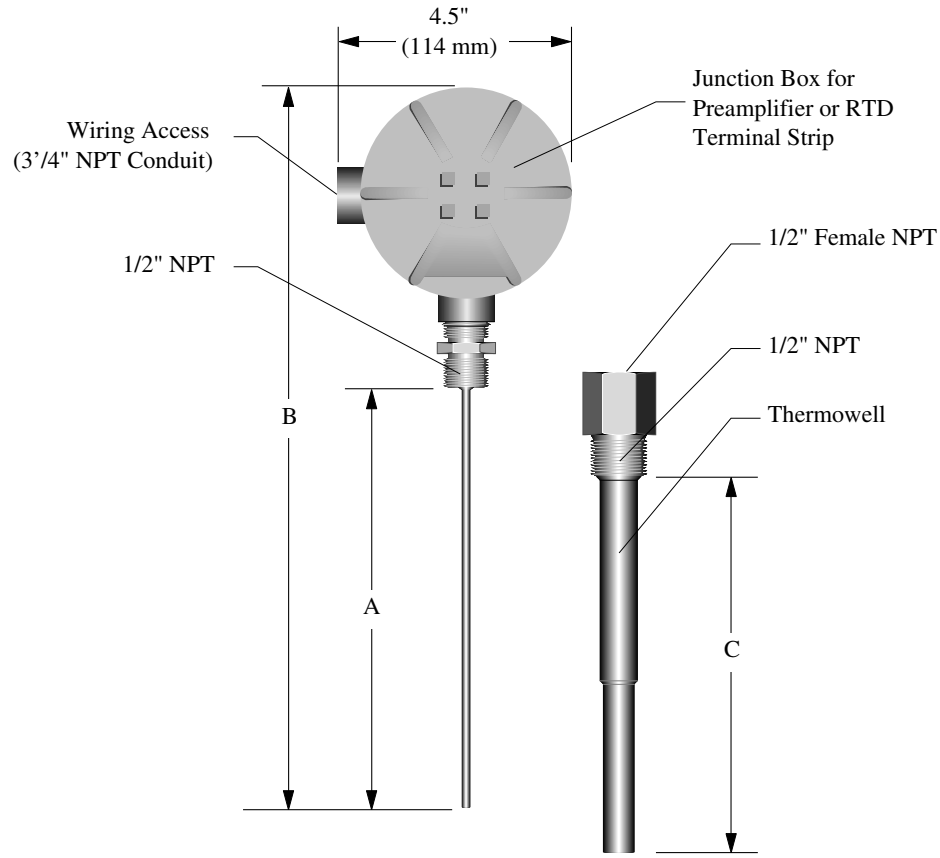
Using a 24 VDC power supply, precision R-box, and digital multimeter, make connections to the PTM 1. Refer to the TEM calibration data supplied with the instrument. (A copy is also inside the condulet). The table below is an example of this data sheet.

Calibration Data
4.00 mA: 32 °F = 1000.00Ω
8.00 mA: 41 °F = 1019.03Ω
12.0 mA: 50 °F = 1038.04Ω
16.0 mA: 59 °F = 1057.02Ω
20.0 mA: 68 °F = 1075.96Ω

Set the R-box to zero scale (4 mA), according to the resistance value in the calibration data. Turn the zero adjustment potentiometer until the output reads 4 ± .016 mA. Set the R-box to full-scale (20 mA), according to the resistance value on the calibration data. Turn the span adjustment potentiometer until the output reads 20 ± .016 mA. Because the span adjustment affects the zero point, steps 3 and 4 must be repeated until the readings are within ± .016 of zero and full- scale.

TEMPERATURE TRANSMITTER DIMENSIONAL OUTLINE

The TEM can be ordered in two mounting configurations: Internal to the flowmeter (inside the stem), or external, inside a thermowell. The dimensional outline shows the external mount.



Model Code	Probe Length -A	Probe Length -B	Thermowell Length -C
2	2.5" (64 mm)	9.5" (241 mm)	2" (51 mm)
25	3" (76 mm)	10" (254 mm)	2.5" (64 mm)
3	3.5" (89 mm)	10.5" (268 mm)	3" (76 mm)
4	4.5" (114 mm)	11.5" (292 mm)	4" (102 mm)
6	6.5" (165 mm)	13.5" (343 mm)	6" (152 mm)
8	8.5" (216 mm)	15.5" (394 mm)	8" (203 mm)
10	10.5" (268 mm)	17.5" (444 mm)	10" (254 mm)
12	12.5" (318 mm)	19.5" (495 mm)	12" (305 mm)

MODEL AND SUFFIX CODES

V-BAR™ Insertion Vortex Flowmeter							
Category	**Description**	**Suffix Codes**					
Model	Liquid or gas service, 400°F (204°C)	600	. . .	. . .	. . .	. . .	. . .
	Steam service, 400°F (204°C)	60S	. . .	. . .	. . .	. . .	. . .
	Liquid, gas or steam service, 500°F (260°C)	700	. . .	. . .	. . .	. . .	. . .
	Liquid, gas or steam service, 400°F (204°C)	910	. . .	. . .	. . .	. . .	. . .
	Liquid, gas or steam service, 500°F (260°C)	960	. . .	. . .	. . .	. . .	. . .
Connection	2", male NPT (model 700)	. . .	2NPT	. . .	. . .	. . .	. . .
	2", 150# flange (model 700, 910, 960)	. . .	2F150	. . .	. . .	. . .	. . .
	2", 300# flange (model 700, 910, 960)	. . .	2F300	. . .	. . .	. . .	. . .
	2", 600# flange (model 700, 910, 960)	. . .	2F600	. . .	. . .	. . .	. . .
	2", 900# flange (model 700, 910, 960)	. . .	2F900	. . .	. . .	. . .	. . .
	Thread-o-let, xx = 03 - 80 inches (models 600, 60S) (includes 2" isolation valve)	. . .	VXX	. . .	. . .	. . .	. . .
Pressure Transmitter	No pressure transmitter	. . .	. . .	XX	. . .	. . .	. . .
	Pressure sensor with scaled preamplifier:						
	0 - 50 psig (0 - 3.44 barg)	. . .	. . .	50	. . .	. . .	. . .
	0 - 100 psig (0 - 6.89 barg)	. . .	. . .	100	. . .	. . .	. . .
	0 - 150 psig (0 -10.34 barg)	. . .	. . .	150	. . .	. . .	. . .
	0 - 200 psig (0 -13.79 barg)	. . .	. . .	200	. . .	. . .	. . .
	0 - 250 psig (0 -17.24 barg)	. . .	. . .	250	. . .	. . .	. . .
	0 - 500 psig (0 -34.47 barg)	. . .	. . .	500	. . .	. . .	. . .
	0 -1000 psig (0 -68.95 barg)	. . .	. . .	1000	. . .	. . .	. . .
	The transmitters can be scaled to accommodate special requests and bar scaling (see below).	. . .	. . .	PXX	. . .	. . .	. . .
Temperature Sensor or Transmitter	No temperature transmitter	. . .	. . .	. . .	XXX	. . .	. . .
	Temperature sensor without preamplifier (RTD only)						
	Teflon, -200 to 400°F (-129 to 204°C)	. . .	. . .	. . .	RTD-T	. . .	. . .
	Fiberglass, 150 to 500°F (65 to 260°C) (models 700 and 960 only)	. . .	. . .	. . .	RTD-F	. . .	. . .
	Temperature sensor with scaled preamp:						
	32 to 68°F	. . .	. . .	. . .	T09	. . .	. . .
	0 to 250°F	. . .	. . .	. . .	T10	. . .	. . .
	-40 to 150°F	. . .	. . .	. . .	T11	. . .	. . .
	212 to 400°F	. . .	. . .	. . .	T12	. . .	. . .
	212 to 500°F	. . .	. . .	. . .	T14	. . .	. . .
	-18 to 121°C	. . .	. . .	. . .	T20	. . .	. . .
	-40 to 65°C	. . .	. . .	. . .	T21	. . .	. . .
	100 to 204°C	. . .	. . .	. . .	T22	. . .	. . .
	100 to 260°C	. . .	. . .	. . .	T24	. . .	. . .
	Other - consult factory	. . .	. . .	. . .	Other	. . .	. . .
Electronics	EZ Logic with local rate and total	. . .	. . .	. . .	. . .	. . .	LOC-TOT
	Remote mount electronics	. . .	. . .	. . .	. . .	. . .	RMT
	Integral 110 VAC input	. . .	. . .	. . .	. . .	. . .	110
	Integral 220 VAC input	. . .	. . .	. . .	. . .	. . .	220

MODEL AND SUFFIX CODES EXAMPLE:

V-BAR (Insertion Vortex Flowmeter)
- 910 (For liquid, gas or steam service 400°F (204°C))
- 2F900 (2", 900# ANSI flange rating)
-200 (Pressure transmitter, 0-200 psig (0-13.79 barg))
- T12 (Temperature sensor 212° to 400°F)
- LOC-TOT (local indicator and totalizer)

V-BAR - 910 - 2F900 -200 - T12 - LOC-TOT

ORDERING INSTRUCTIONS

Please specify the following information with your order:

- Fluid type or composition
- Maximum, minimum, and normal operating flow rate
- Maximum, minimum, and normal operating temperatures
- Maximum, minimum, and normal operating pressures
- Specific weight and viscosity at normal operating conditions

EMCO™

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EMCO is the brand of precision flow meters for liquid, gas, and steam applications, accommodating a wide range of pipe sizes. Field proven for over 40 years, the EMCO product line offers solutions for measurement, including industrial inline vortex, industrial insertion vortex and turbine, and variable area flow products. EMCO products provide a wide range of metering solutions to diverse industries, including the military, hospitals, universities, and many Fortune 500 companies.

Our aim is to provide a metering solution that helps our customers achieve operational improvement through their production capability, usually in the form of reduced energy usage, improved product quality, lower emissions and greater production throughout. Reducing emissions, carbon footprint, and your company's impact on the environment is our goal. Not only will this have a strong social and environmental impact but also a positive economic impact today and well into the future.

For more information on EMCO products, contact:
EMCO 2150 Miller Drive, Longmont, CO 80501
T: 800.356.9362 or 303.682.7060
F: 303.682.7069

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