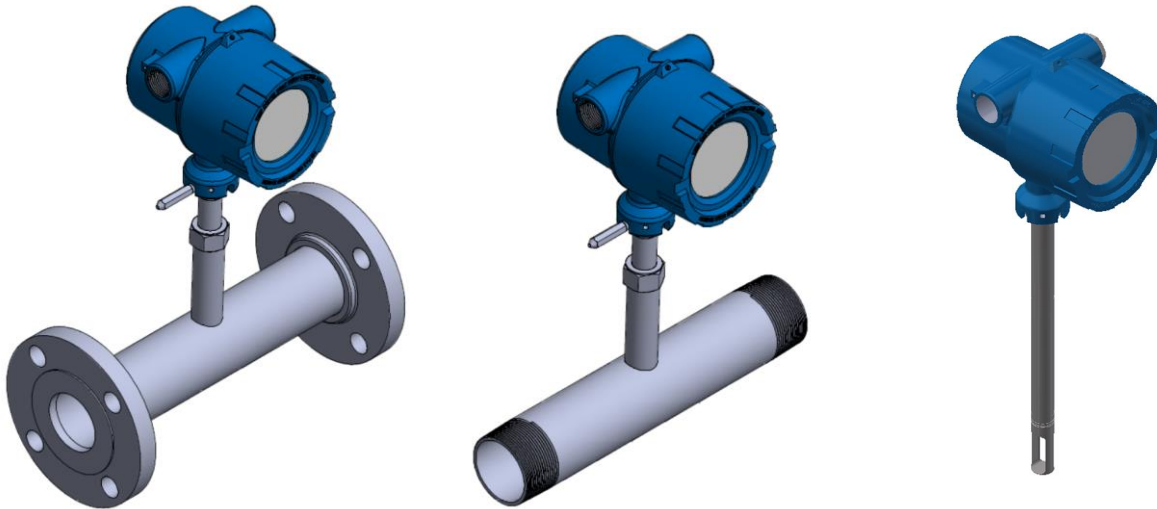


FMP Series

Gas Flow Meters for Permanent Installation



Product Information

The FMP Series flow meters measure and display the pressure / temperature compensated instantaneous flow of common fuel gases. Both an insertion type meter and an inline type meter (with flow straightening) are available.

Calibration of the meter can be automatically checked. Yearly re-calibrations are typically not required.

Recommended Installation Tools

For insertion:

1. Pipe dope or PTFE tape
2. Tape measure
3. Open end wrenches: 1-1/8", 1-1/4", 1-3/8", 8mm
4. 2.5mm hex key
5. Wiring tools – cutter, stripper, ferrule crimper, liquid tight conduit tools
6. Marker or pencil

Recommended Installation Tools (continued)

For inline (NPT):

1. Pipe dope
2. Two pipe wrenches (12", 18", 24" or 36" depending on meter pipe size)
3. Open end wrenches: 1-1/8", 8mm
4. 2.5mm hex key
5. Wiring tools – cutter, stripper, ferrule crimper, liquid tight conduit tools

For inline (ANSI #150):

1. Open end wrenches: 15/16" (x2) or 1-1/8" (x2), 8mm
2. 2.5mm hex key
3. Wiring tools – cutter, stripper, ferrule crimper, liquid tight conduit tools

Note: Flange gaskets, bolts, nuts, and washers will also be necessary to install the ANSI #150 flanged meter. Choose gasket material appropriate for gas to be measured.

Additional, useful information for the FMP flow meters can be found in the FMP Technical Instructions (FMP-1000). It is highly recommended to have this document available while installing any of the FMP... flow meters.

Components Supplied

Figure 1 shows the components included with an FMP109... or FMP112... insertion flow meter for permanent installation. See Technical Instructions FMP-1000 for additional information.



Figure 1: Components Included with the FMP109... or FMP112... Insertion Flow Meter

1. Insertion flow meter FMP109... (9" probe) or FMP112... (12" probe)
2. Tube to pipe adapter - 3/4" tube to 1" NPT
3. Tube to pipe adapter - 3/4" tube to 3/4" NPT
4. Not shown – PTFE (Teflon) ferrule kit
5. Not shown – FT1 flow meter manual
6. Not shown – two spare flow meter fuses

Note: Meter requires an external DC power source (typically 24VDC – 30W) for operation

Components Supplied (continued)

Figure 2 shows the components included with an FMP36... or FMP46... inline flow meter for permanent installation. See Technical Instructions FMP-1000 for additional information.

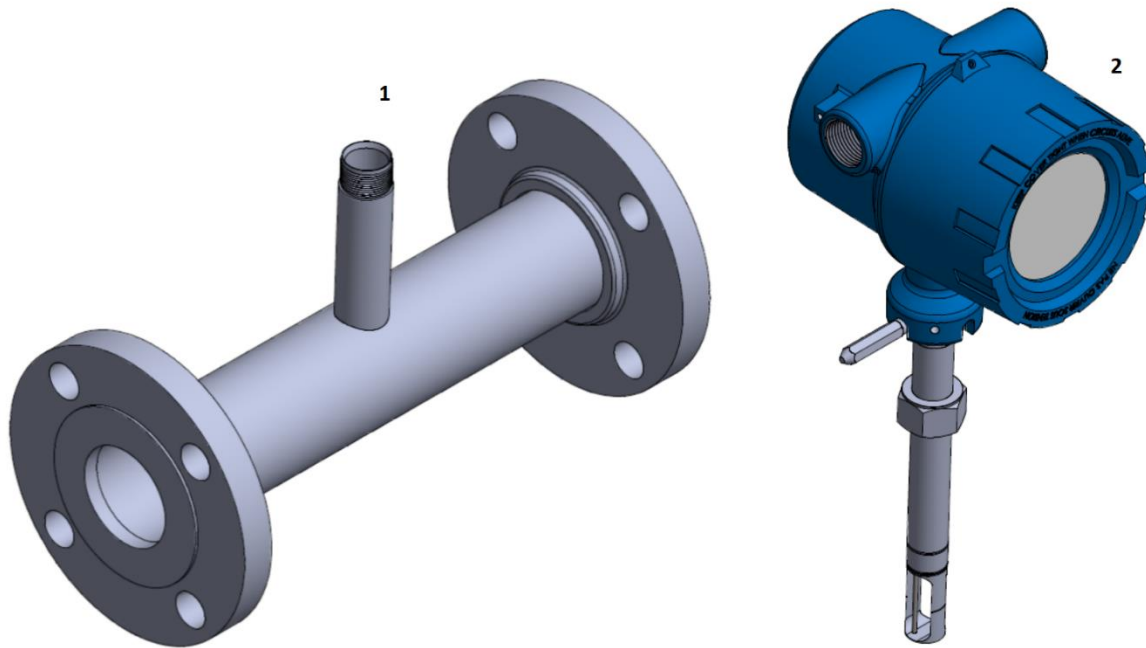


Figure 2: Components Included with the FMP36... or FMP46... Inline Flow Meter

1. Spool piece with integral flow straightener – ANSI #150 shown
2. Flow meter matched to flow straightener
3. Not shown – FT1 flow meter manual
4. Not shown – two spare flow meter fuses

Note: Meter requires an external DC power source (typically 24VDC – 30W) for operation

Note: Some inline meters ship in two pieces, as shown above. Both the meter and the spool piece are labeled with a matching serial number. Ensure that the serial number on the meter matches the serial number on the flow section when assembled especially when multiple, identical meters are ordered and installed.

Installation Procedure

1. The gas flow meter may be mounted in horizontal or vertical piping. See Figure 3 below for the necessary distance of straight pipe upstream and downstream of the meter. If the meter is not mounted per the requirements below, unstable and inaccurate flow readings are likely to result.

Note: Proper upstream and downstream pipe diameters are critical to achieve accurate and stable flow readings.

Note: Gas must be dry (non-condensing) – moisture droplets in the flow stream will also cause inaccurate and erratic flow readings.

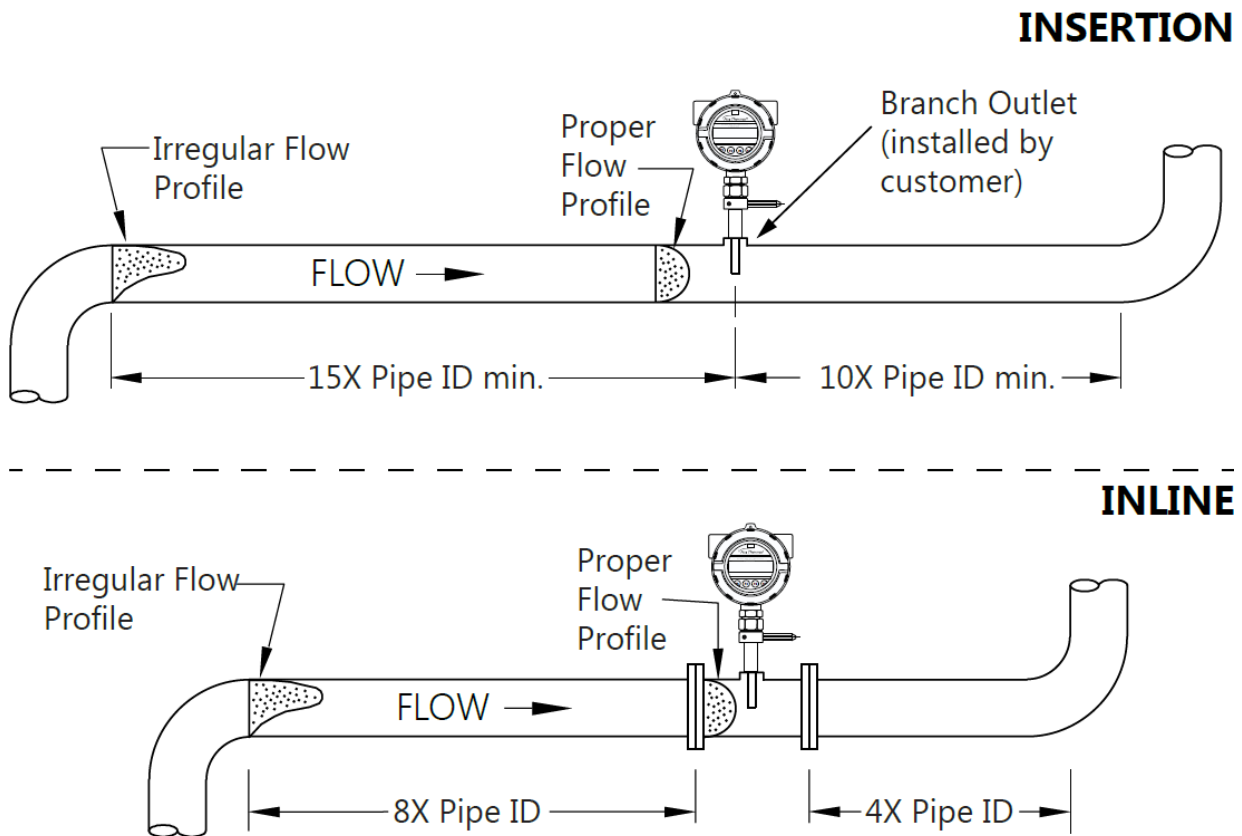


Figure 3: Necessary Amount of Straight Pipe for Mounting Flow Meter

Installation Procedure (continued)

2. Verify that the static pressure in the pipe is less than:
 - 740 PSIG [51 bar] for insertion meters with stainless steel ferrules in fitting
 - 300 PSIG [20.7 bar] for inline meters with NPT threads
 - 285 PSIG [19.7 bar] for carbon steel inline meters with ANSI #150 flanges
 - 230 PSIG [15.9 bar] for stainless steel inline meters with ANSI #150 flanges

Note: The maximum pressures above assume a 100°F [37.8°C] pipe and meter probe temperature. Gas temperature range for the meter is -40 to 250°F [-40 to 121°C]. See FMP Flow Meter Technical Instructions (FMP-1000) for full specifications.

3. Verify that the gas piping to be worked on is depressurized. If not, close the upstream gas valve and bleed off any residual trapped gas in a safe manner. **If welding on the pipe is to be done, the piping must be thoroughly purged with an inert gas.** Skip to step 9 if an inline type meter is being installed.
4. For insertion type meters - if a 3/4" NPT or larger half coupling is not available in a suitable location, one will need to be welded onto the pipe with a 13/16" (0.813") or larger hole drilled through the pipe wall in the center of the half coupling. The coupling must be parallel to the pipe centerline, as shown in Figure 4, so that the probe can be inserted into the center of the pipe at a later step. The pipe should look similar to Figure 5 before the tube fitting and meter probe are installed.

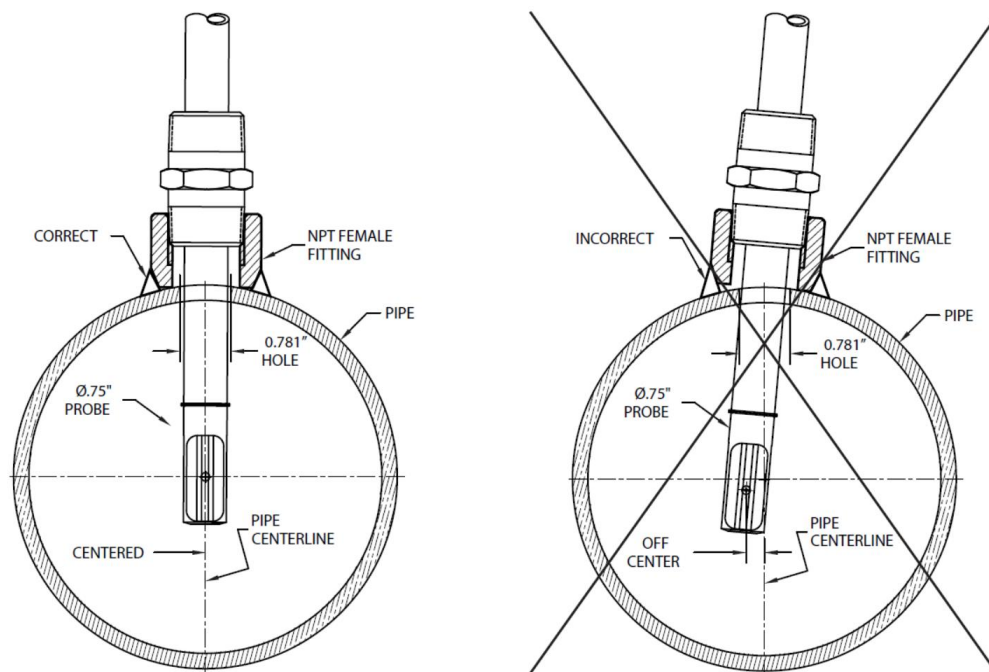


Figure 4: Mounting a 3/4" NPT Half Coupling on the Pipe Centerline

Installation Procedure (continued)

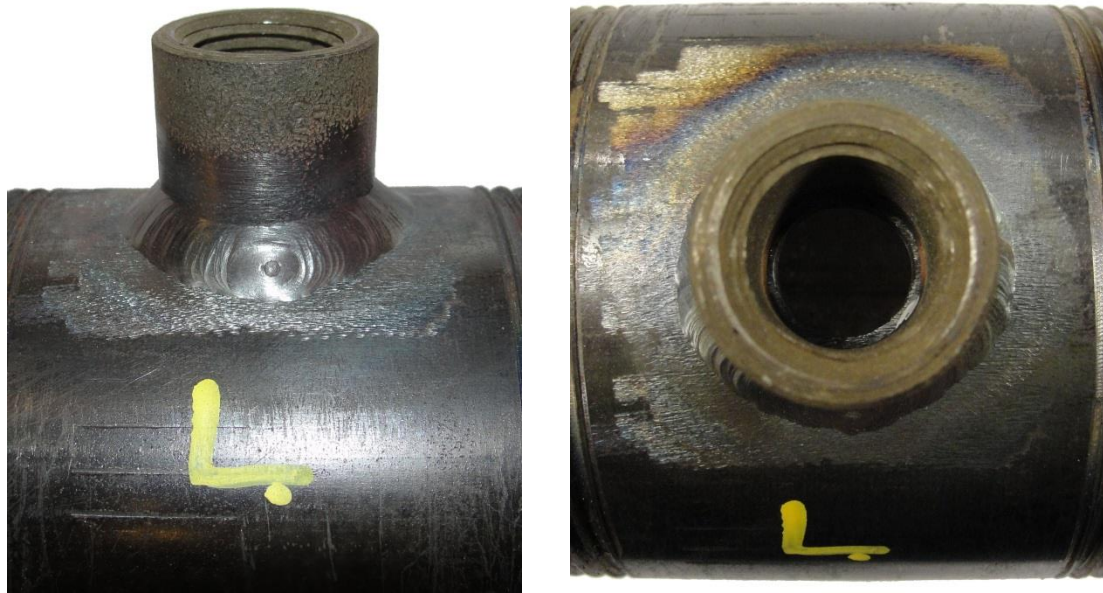


Figure 5: 3/4" NPT Half Coupling Welded to Pipe with 13/16" Hole Drilled Through Center

Notes:

- One method to ensure that the 13/16" or larger hole is concentric with the 3/4" female NPT thread is to use a 2.5" long Schedule 40 pipe nipple as a drill bit guide. A 53/64" (0.828") drill bit fits snugly inside the 3/4" Schedule 40 pipe nipple. This drill bit can be used to accurately mark the center of the hole so a smaller, concentric pilot hole can be drilled. If using this method, the half coupling must be welded to the pipe before the hole is drilled.
 - The inside of the hole must be burr-free – burrs can cause a disruption in the flow.
 - A larger half coupling with a threaded reducing bushing or the larger 1" NPT tube fitting can also be used if desired.
5. For insertion type meters - screw the tube fitting into the 3/4" NPT half coupling and tighten with the 1-1/4" or 1-3/8" open end wrench. Pipe dope or PTFE tape should be used to seal the NPT threads of the tube fitting.

Installation Procedure (continued)

- For insertion type meters - insert the meter sensing tube into the tube fitting. Using Table 1 and Figure 6, center the meter's sensing element in the pipe by setting distance "X" (distance from the outer diameter of the pipe to the bottom of the pointer edge). This can be done carefully with a tape measure. Ensure that the pointer on the flow meter is pointing in the direction of flow.

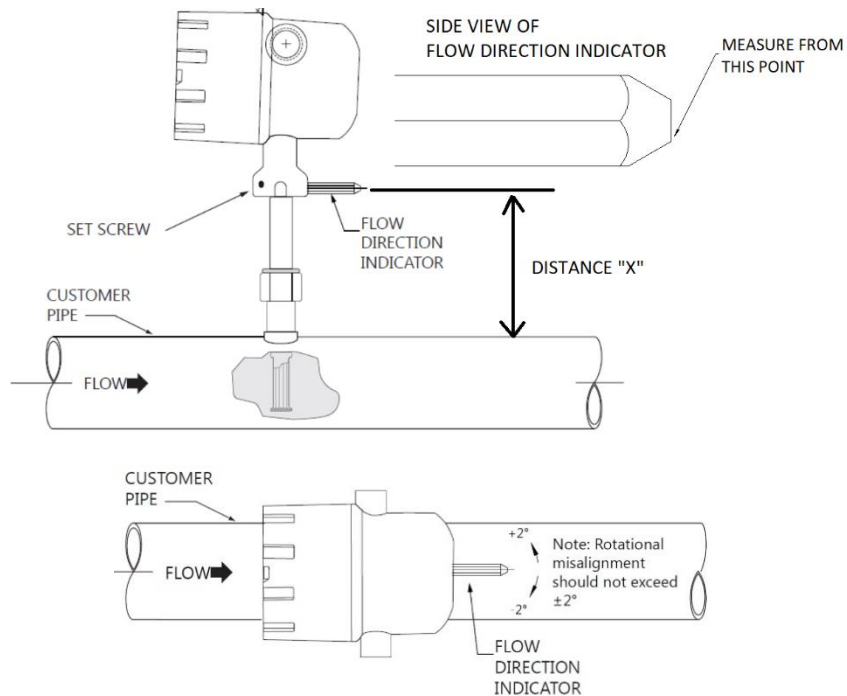


Figure 6: Meter Inserted into Pipe

Table 1: Meter Insertion Distance

Pipe Size (Schedule 40 & 80)	Distance "X" for FMP109... (9" Probe)	Distance "X" for FMP112... (12" Probe)
1-1/2"	8.65"	N/A
2"	8.41"	N/A
2-1/2"	8.16"	N/A
3"	7.85"	10.85"
4"	7.35"	10.35"
5"	6.72"	9.72"
6"	6.29"	9.29"
8"	N/A	8.29"

Installation Procedure (continued)

Note: Once the “nut” end of the tube fitting is tightened, the stainless steel ferrules will swage or bite into the meter’s probe. This swaging is permanent - ferrules are extremely difficult to remove from probe after swaging. Make absolutely sure that distance “X” shown in Figure 6 above is set correctly before the tube nut is tightened.

Note: The PTFE (Teflon) ferrules can be used instead of the stainless steel ferrules. These will not swage or bite into the meter’s probe. These can be used for temporary installation with pressures not exceeding 60 PSIG [4.1 bar]. Stainless steel ferrules are highly recommended for permanent installations.

7. For insertion type meters - after the meter is inserted to the correct depth with the pointer in the direction of flow (+/- 2 degrees), tighten the tube nut with the 1-1/8” open end wrench. To properly swage the stainless steel ferrules, use a back-up wrench (1-1/4” or 1-3/8” open end) and tighten the tube nut 1.25 turns (540 degrees) beyond finger tight. This is shown in Figure 7 below.

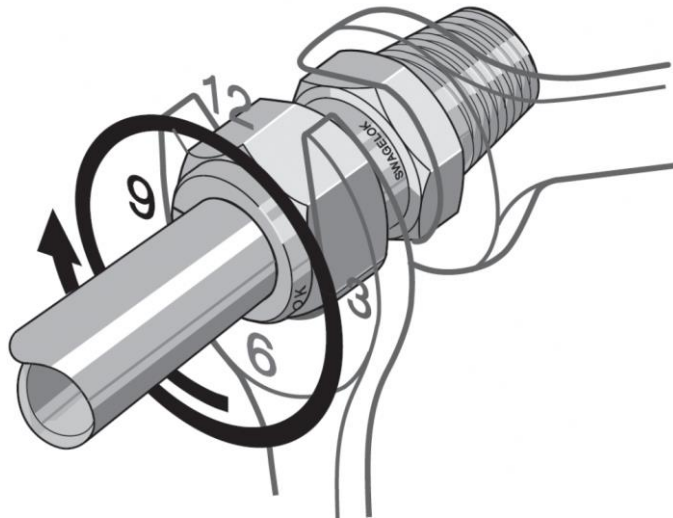


Figure 7: Tightening the Tube Nut to Swage the Stainless Steel Ferrules

Note: To ensure 540 degrees of tightening is achieved, a small index mark can be made on the probe and the tube nut with a pencil / marker when the tube nut is finger tight. Also, the probe will be “pulled in” axially about 0.10” when the tube nut is swaged. This “pull in” with stainless steel ferrules is accounted for in Table 1.

Installation Procedure (continued)

8. The insertion type meter is now properly installed in the piping. Skip to step 13 for details on rotating the meter head relative to the flow direction indicator, if required.
9. Inline type meters are piped in just like a pipe nipple (for NPT threaded models) or like a flanged spool piece (for ANSI #150 flanged models). The spool piece is directional for both the NPT and the ANSI #150 models – the flow straightener end of the spool piece containing the straightening grid must be installed upstream of the flow meter element. This is shown in Figure 8 below.

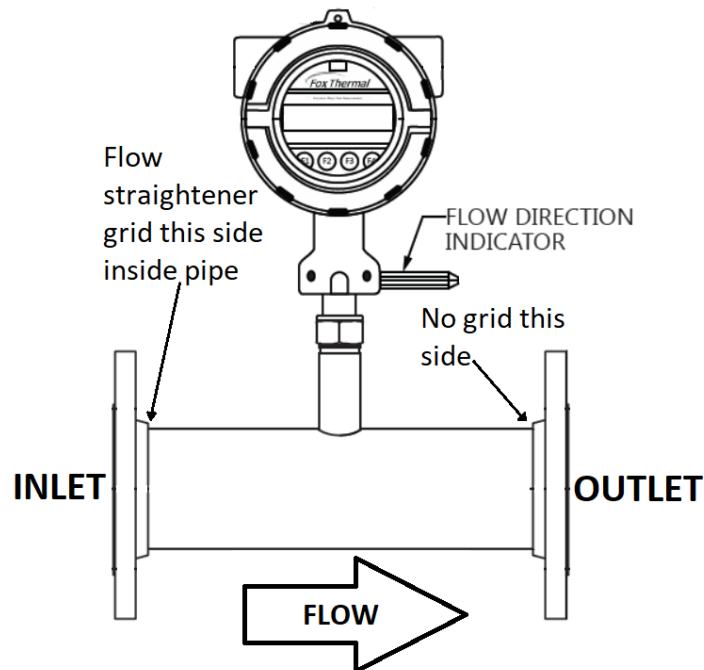


Figure 8: Orientation of Inline Flow Meter – Flanged Version Shown

10. For the NPT threaded inline models, piping unions are recommended on both sides of the flow section to facilitate easy removal should it become necessary. Dimensional drawings of both inline flow meter types can be found in the FMP Flow Meter Technical Instructions (FMP-1000). Spool pieces can be installed in vertical or horizontal piping runs.
11. After the threaded or flanged spool piece is installed into the piping run, install the meter into the spool piece. Double check to make sure that the serial number on the meter matches the serial number on the spool piece.

Installation Procedure (continued)

12. Install the flow meter per Figure 6, ensuring that the flow direction indicator is pointing in the direction of flow +/- 2 degrees. The insertion depth for the meter probe is pre-set for the inline meters. Tighten the tube nut hand tight, and then use the 1-1/8" open end wrench to tighten the tube nut approximately 1/3 to 1/2 a turn (120 to 180 degrees) beyond hand tight. The flow meter is now installed into the spool piece

13. It may be necessary to rotate the housing of the flow meter relative to the flow direction indicator. To do this loosen both of the 2.5mm set screws and unscrew (remove) the flow direction indicator. These pieces are detailed in Figure 6. Rotate the housing +/- 90 degrees or 180 degrees. Do not spin the housing around completely (360 degrees repeatedly) due to wires connecting the probe to the housing. Re-install the flow indicator and then tighten set screws.

14. After the mechanical installation of the flow meter is complete, the next step is to install the electrical conduit and wire the meter. Wiring is shown below for the following applications:
 - LMV52 using the pulse output – Figure 9
 - LMV3x using the pulse output – Figure 10
 - Combustion control panel using the 4-20mA output – Figure 11
 - Master Panel using the 4-20mA output – Figure 12

Installation Procedure (continued)

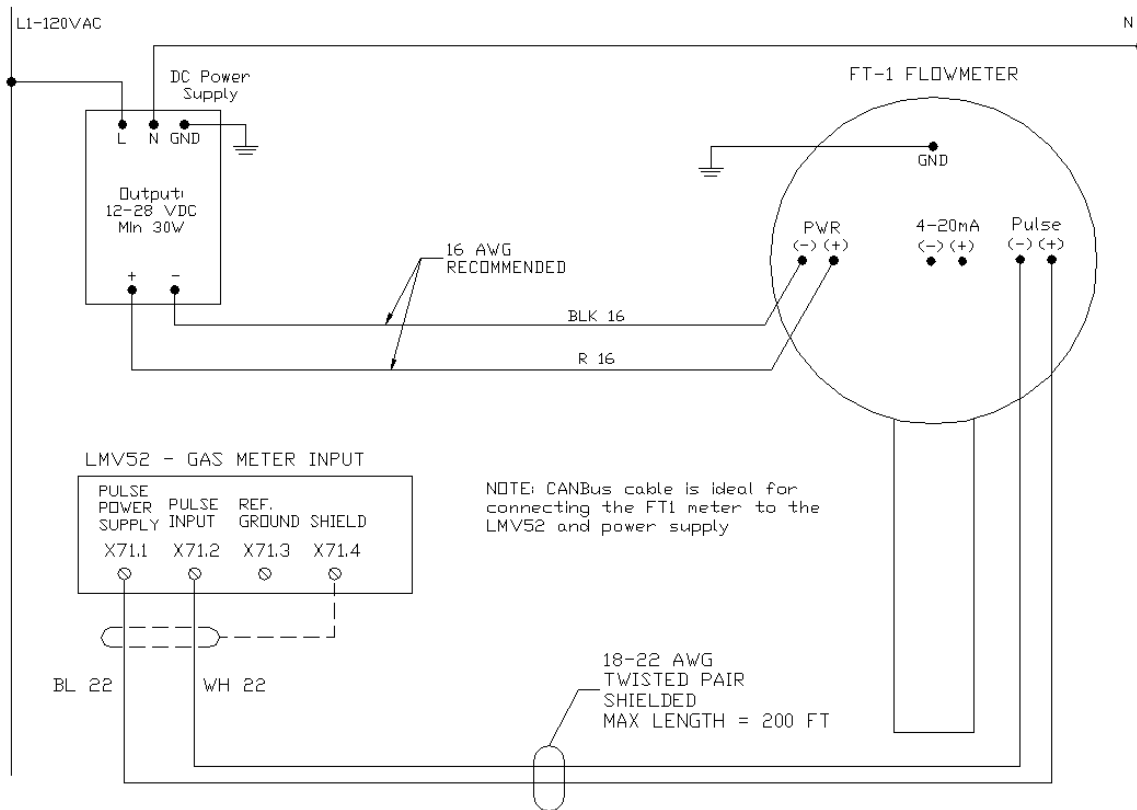


Figure 9: Electrical Connections between an FMP... Flow Meter and an LMV52 Burner Control

Note: The maximum flow that can be read by the LMV52 is 65,534 units (SCFH). If higher flow is required, the flow meter can be scaled for SCFM.

Installation Procedure (continued)

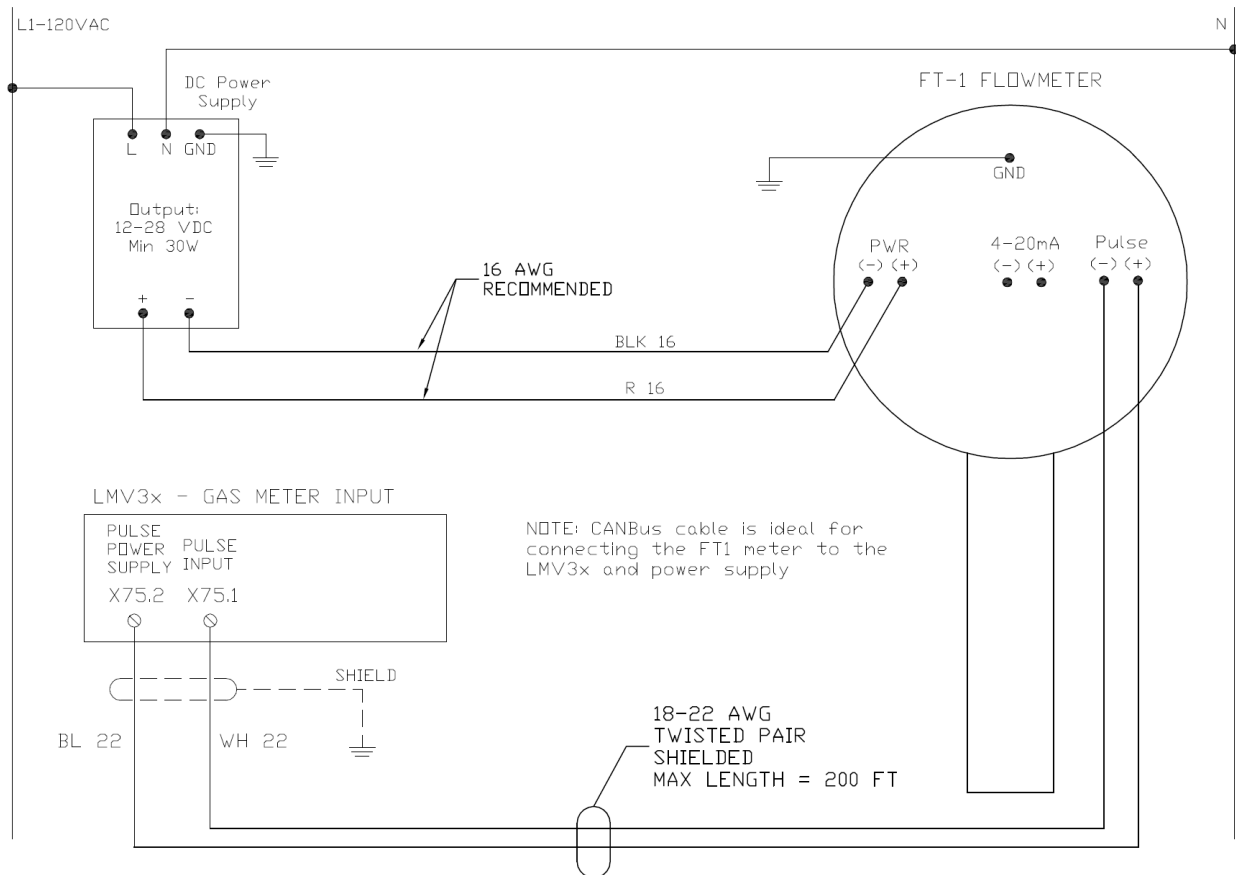


Figure 10: Electrical Connections between an FMP... Flow Meter and an LMV3x Burner Control

Note: The maximum flow that can be read by the LMV3x is 6,554 units (SCFH). If higher flow is required, the flow meter can be scaled for SCFM.

Installation Procedure (continued)

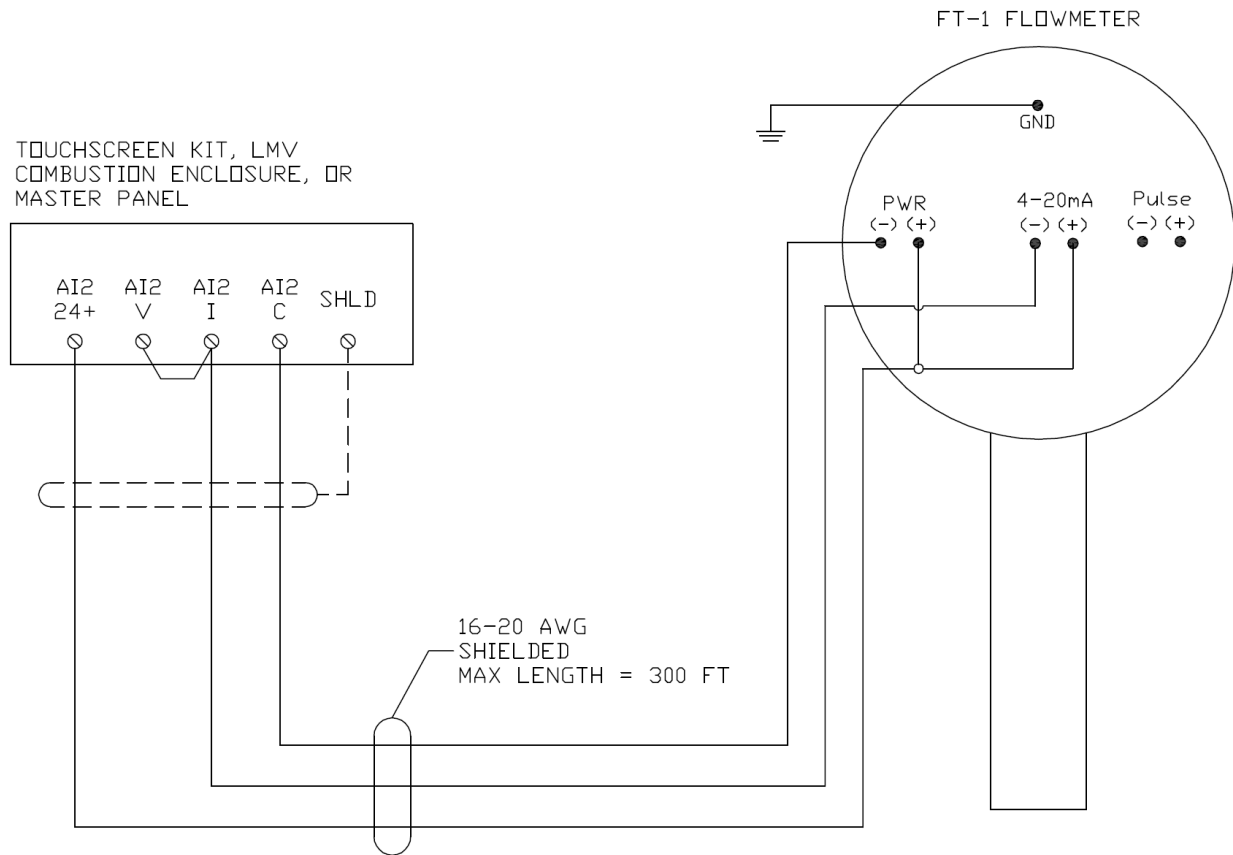


Figure 11: Electrical Connections between an FMP... Flow Meter and a TS... Touchscreen Kit, Combustion Enclosure, or Master Panel

Note: Not all TS... series products have analog inputs available to connect an FMP... flow meter. For TS-KT... touchscreen kits and TS-CE... combustion enclosures, annunciation option B, F, G, or H must be selected to get four analog inputs with totalization. For TS-MS... master panels, four analog inputs come standard for systems with steam boilers. For systems with hot water boilers, four analog inputs can be added by choosing option A for the Analog Measurement for Hot Water Boilers selection.

Note: In the wiring example above, the flow meter is connected to analog input 2 in the enclosure. There are four analog inputs available (AI1, AI2, AI3, and AI4). The flow meter can be connected to any of these four inputs.

Installation Procedure (continued)

15. After the wiring of the flow meter is complete, the next step is to program (scale) the device that is reading the flow meter signal. The next steps outline how to program the various devices.
16. For the LMV52 gas meter pulse input, log into the LMV52 at the service or OEM password level. Access parameter "PulseValueGas" by using the following menu path:

Params & Display > VSD Module > Configuration > Fuel Meter > PulseValueGas

Set the units for "1ft³" and set the pulse / unit according to Table 2.

17. For the LMV3x gas meter pulse input, log into the LMV3x at the service or OEM password level. Access parameter 128 (fuel 0) or parameter 129 (fuel 1). Set the pulse per unit according to Table 2. Note that in the LMV3x only carries two decimal points for the pulse per unit setting, so accuracy will be limited.
18. For any TS... touchscreen product, log into the touchscreen at the SETUP level. On a TS-MS... master panel, go to System Setup and then Input/Output Config. On a TS-KT... touchscreen kit or TS-CE... combustion enclosure, go to System Settings and then Expanded Annunciator Options. Select the analog input that corresponds with the input that the flow meter was connected to. Enter a name for the input, units (typically SCFH), and set the type to 4-20 mA. The input then needs to be scaled. Set the minimum value to 0 and the maximum value for the maximum flow according to Table 2. Finally, set up totalization (if desired) by selecting if the 4-20 mA signal from the meter indicates units per minute (SCFM) or units per hour (SCFH).

The current flow rate and totalized flow can be read by going back to the main menu on the touchscreen and navigating to the Analog Inputs screen.

Installation Procedure (continued)

Table 2: Flow Meter Scaling for Schedule 40 Pipe

Pipe Size (in)	Max. Standard Velocity (SFPM)	Min. Flow ¹ (SCFH)	Max. Flow ² (SCFH)	Pulse / Unit (30 Hz Max.) (Pulse / SCFH)	SCH 40 Pipe I.D. (in)	Max. Boiler Output (BHP) ³		
						Natural Gas	Propane	Biogas
1	25000	20	9003	11.996488	1.049	229	571	126
1-1/4		35	15580	6.931815	1.380	396	989	218
1-1/2		48	21207	5.092762	1.610	538	1346	296
2		79	34954	3.089756	2.067	888	2219	488
2-1/2		113	49872	2.165524	2.469	1266	3166	697
3		174	77007	1.402473	3.068	1955	4888	1075
4		300	132607	0.814437	4.026	3367	8418	1852
6		681	300940	0.358875	6.065	7641	19104	4203
8		1179	520984	0.207300	7.981	13229	33072	7276

Notes:

1. Minimum flow is also known as the “Cutoff Flow” – eliminates noise at the bottom of the range but does not influence the scaling. A 4 mA signal equates to 0 SCFH and does not depend on this setting. This also applies to the pulse signal.
2. Maximum flow is the highest possible flow based on the maximum standard velocity. This also equates to 20 mA when scaling an LMV Combustion Control Panel or Master Panel. Flow meter is programmed for the maximum flow for a given pipe size. When used with an LMV52 pulse input, maximum flow is 65,534 SCFH. When used with an LMV3x pulse input, maximum flow is 6,554 SCFH.
3. Boiler Horsepower numbers assume the following:
 - a. Natural gas heating value of 1000 BTU / SCF
 - b. Propane heating value of 2500 BTU / SCF
 - c. Biogas heating value of 550 BTU / SCF
 - d. Boiler efficiency of 85%

Calibration Validation Procedure

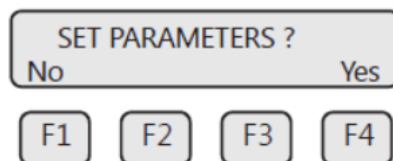
The Fox Thermal FT1 has the ability to validate its own calibration, thus significantly reducing the number of re-calibrations over the life of the meter. This calibration validation is referred to as Zero CAL-CHECK®, and the procedure to do this is outlined below.

1. Visually inspect the meter's probe for damage and / or significant dirt build up. The probe should look like Figure 13.



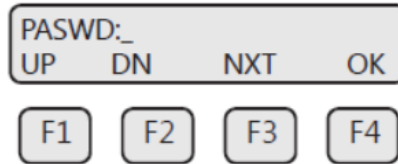
Figure 13: Clean Undamaged Probe

2. The gas flow meter probe must be in an area of zero gas velocity for the calibration validation. It is recommended to remove the meter from the pipe and put the meter probe in a container or a tube to ensure that no air flows across the probe.
3. The meter cover must be unscrewed, and buttons F1 thru F4 must be used to navigate down through the menus to reach the Zero CAL-CHECK®.
4. With the screen in normal running mode, press the F1 key and the following screen should appear:

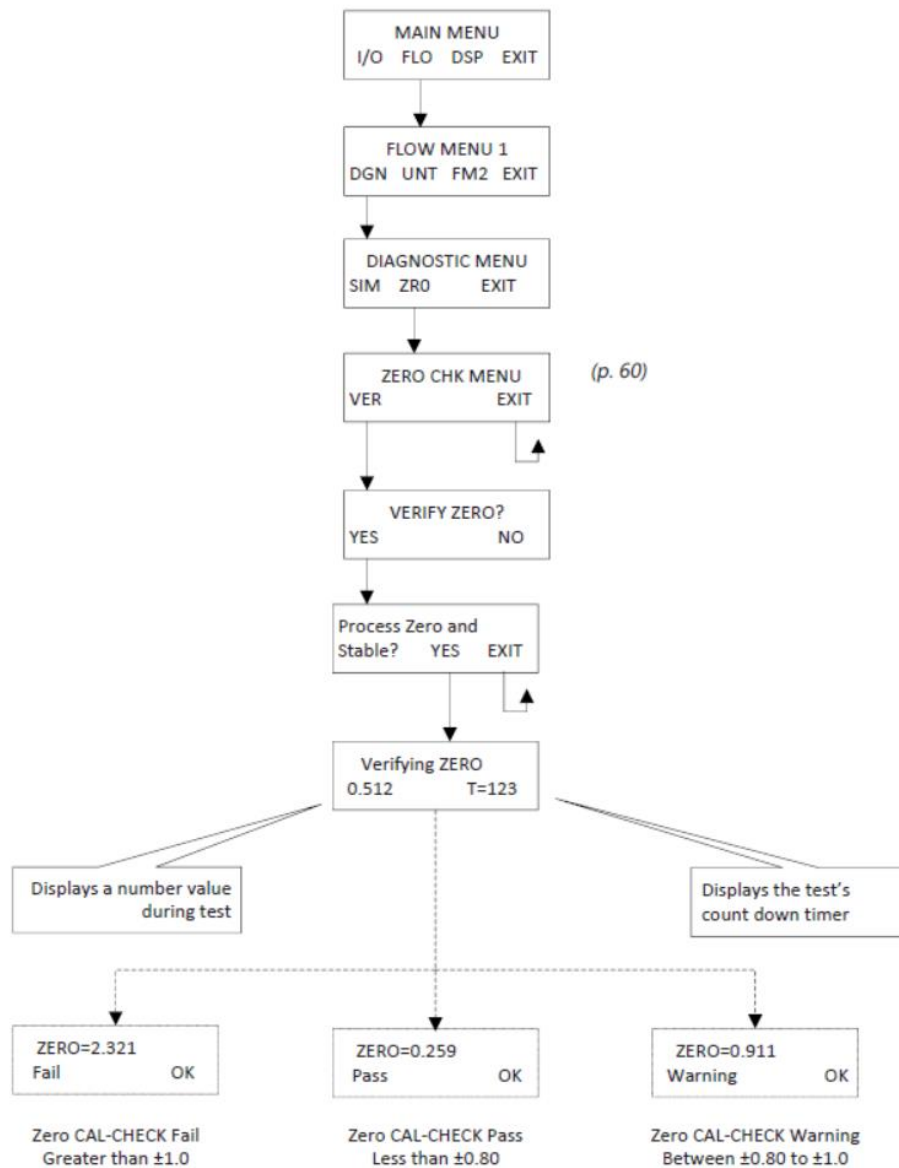


Calibration Validation Procedure (continued)

- Press Yes (F4) and the next screen will prompt the user to enter a password. The default password is "1234". Press OK (F4) after the password is entered



- After this, follow the menu path below to execute the Zero CAL-CHECK®:



Calibration Validation Procedure (continued)

7. If the result of “Warning” or “Fail” is displayed, clean the sensor with a soft bristle (non-metallic) brush with water or denatured alcohol. Let the sensor dry thoroughly (at least 10 minutes), re-install the probe cover, and run the calibration validation again.
8. If the calibration still fails, contact your salesperson. The meter will need to be sent back for repair.

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