Base Load Power Hub (BLPH)

ULTRASONIC FLOWMETER

INSTALLATION, OPERATING AND MAINTENANCE MANUAL - ULTRASONIC FLOWMETER

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3	Revision / Change Log / Hold List	X	X						
5	INSTALLATION, OPERATING AND MAINTENANCE MANUAL - ULTRASONIC FLOWM	X	X						

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Panametrics
a Baker Hughes business

T5/T5MAX Flare Gas Transducer

(Standard and Extended Velocity Range)

Installation Guide



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(Standard and Extended Velocity Range)

Installation Guide

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Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: Training, Product Repairs, Service Agreements and more.

Please visit https://www.bakerhughes.com/panametrics/panametrics-services for more details.

Typographical Conventions

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: These paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.

CAUTION! **This symbol indicates a risk of potential minor personal injury and/or severe damage to the equipment, unless these instructions are followed carefully.**

WARNING! **This symbol indicates a risk of potential serious personal injury, unless these instructions are followed carefully.**

Safety Issues

WARNING! **It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.**

Attention European Customers!To meet CE Mark requirements for all units intended for use in the EU, all electrical cables must be installed as described in this manual.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area

WARNING! **Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.**

WARNING! **Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on this equipment.**

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

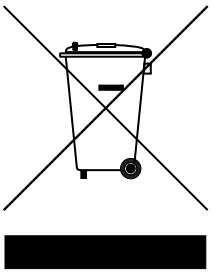
Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

Panametrics is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2012/19/EU.



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end of life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Please visit www.bakerhughesds.com/health-safety-and-environment-hse for take-back instructions and more information about this initiative.

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Chapter 1. Installing Pipe Nozzles

1.1 Introduction

Before the T5 transducers can be installed into the pipe, you will need to install pipe nozzles. Nozzles may be installed as part of a fabricated spoolpiece or by using the hot or cold tap process with a Panametrics *Nozzle Installation Kit.*

IMPORTANT: This procedure only applies if you are using a Nozzle Installation Kit. If you are tapping the pipe without using a Nozzle Installation Kit, refer to the supplied drawings in your shipment. This procedure is written and illustrated for installations on horizontal pipes. However, the procedure is the same for vertical pipe installations.



WARNING! Please follow all applicable site, local, and regional safety measures when conducting tapping of nozzles to pipe. Great care should be taken to ensure activity is not being conducted in a flammable environment without proper mitigation strategies.



WARNING! Any deviation from this prescribed procedure can result in accidental release of process gas that may be dangerous or hazardous due to its pressure, flammability, or composition. Safe work practices should be followed and periodic review of this procedure is highly recommended before conducting this work.

This section describes how to install nozzles in the following configurations:

1. Bias 90° Installation
   - Standard transducer spacings of 10” and 9”, with both transducers facing straight at each other, are for applications with gas velocities up to 100 m/s (328 ft/s). This is the standard velocity range.
   - A shorter transducer spacing of 6.4”, with only the downstream transducer rotated 6° into the flow is for applications with gas velocities up to 120 m/s (394 ft/s). This is the extended velocity range.
2. Tilted 45° Installation
   - Standard transducer face to face spacings, with both transducer body axes concentric and parallel to each other are for applications with gas velocities up to 100 m/s (328 ft/s). This is the standard velocity range.
   - A shorter transducer face to face spacing of approximately 7.85”, with only the downstream transducer tilted 6° into the flow, is for applications with gas velocities up to 120 m/s (394 ft/s). This is the extended velocity range.

Bias 90° Installation

This procedure includes the following steps:

- Identifying and checking the nozzle installation kit components
- Selecting and marking the pipe for nozzle locations
- Installing the first welding boss
- Installing the first nozzle
- Installing the second welding boss
- Installing the second nozzle
- Tapping the pipe

1.1.1 Identifying and Checking the Nozzle Installation Kit Components

The *Nozzle Installation Kit* contains the materials listed below. Use *Figure 1* below to help identify each component.

- 2 Nozzles (if purchased)
- 2 Welding bosses
- 1 Jig
- 1 Alignment plate (9", 10" or 6.4" spacing)
- 1 Spacer flange
- 1 Threaded rod (1" diameter), with washer and nut

IMPORTANT: You will need eight 5/8" studs with two nuts each, or 3/4" studs with two nuts each. The 5/8" studs are needed for 2"-150#, 2"-300# and 3"-150# flanges. The 3/4" studs are needed for 3"-300# flanges.

After you are familiar with each component, verify that the welding bosses and alignment plate shipped are for the required transducer spacing and the pipe size described in the following steps.

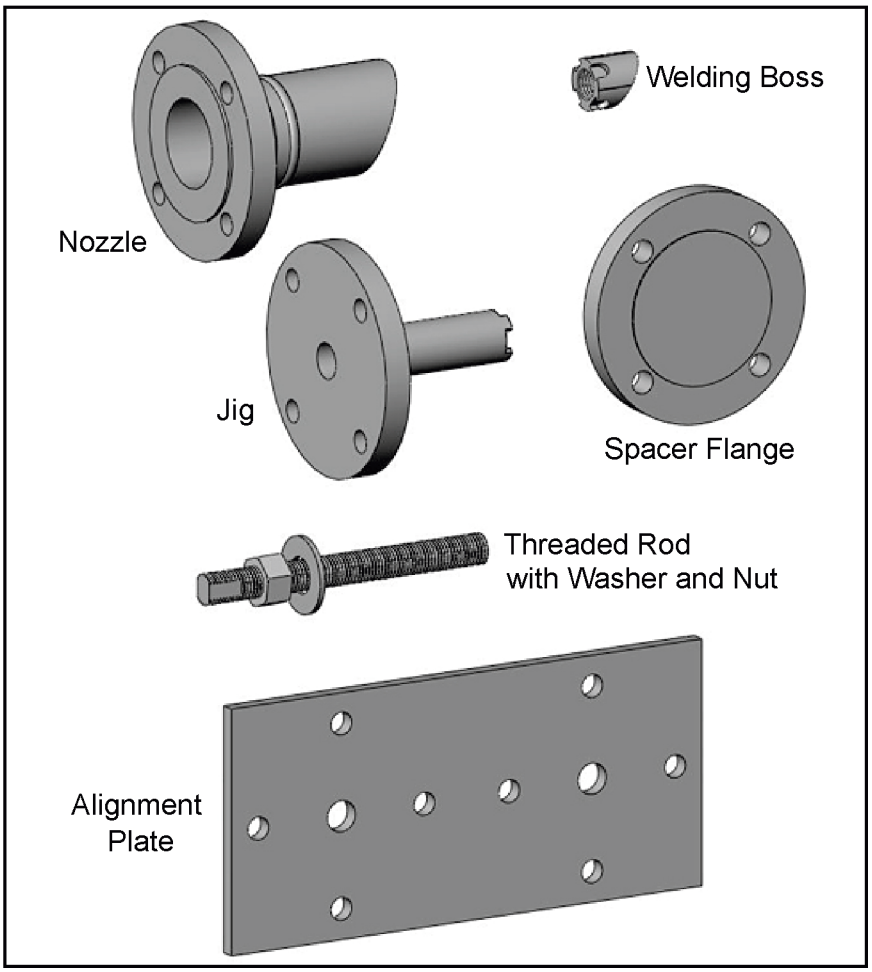
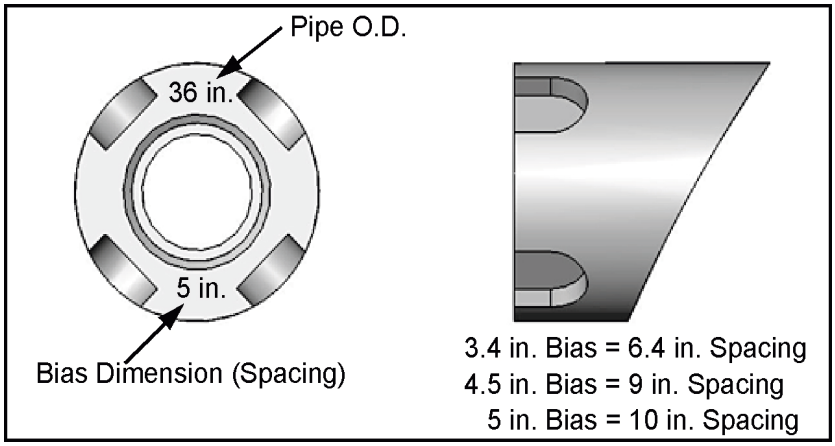


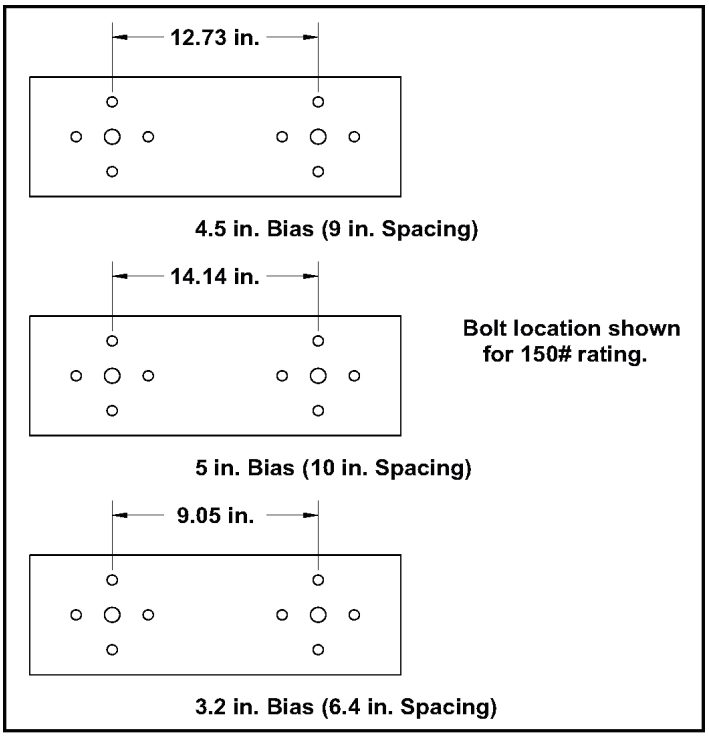
Figure 1: Components for Nozzle Installation Kit

1. Check the marking on the end of the welding boss. The pipe O.D. and the *bias dimension* (i.e., the *transducer spacing*) are engraved on the boss as shown below. Typically,
   - For flow velocities up to 100 m/s (328 ft/s), the 10 in. spacing is used on pipes 18 in. (450 mm) in diameter or larger, while the 9 in. spacing is used on pipes 16 in. (400 mm) in diameter or on larger pipes when attenuating gases are present.
   - For flow velocities up to 120 m/s (394 ft/s), the 6.4 in. spacing is used on pipes 14 in. (356 mm) in diameter or larger.

Note: *Bias dimension refers to the distance between the centerof the nozzle location and the center line of the pipe.*



2. Check the spacing between the holes on the alignment plate, as shown below. The dimensions should correspond to the bias/spacing dimension on the welding boss.

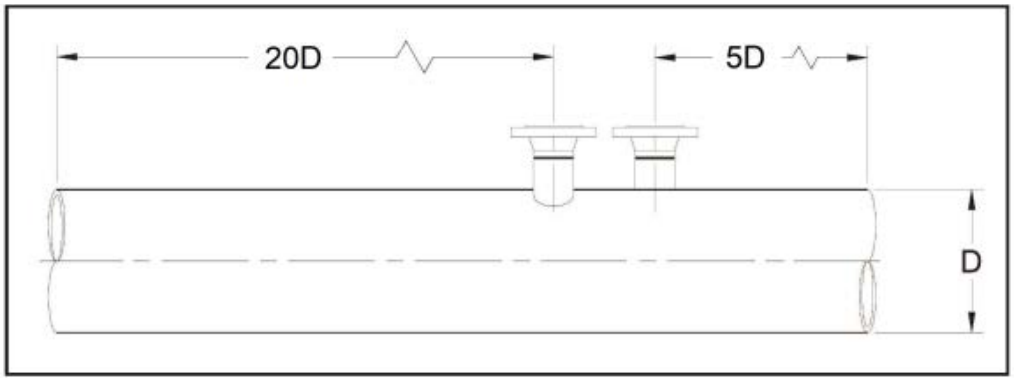


1.1.2 Selecting and Marking the Pipe for Nozzle Locations

CAUTION! **Correct nozzle alignment is critical to the successful operation of the flowmeter. Therefore, all marking, positioning and welding operations must be carried out with the utmost attention to accuracy. Unless otherwise stated, dimensional positioning of the nozzles must be held to a tolerance of ±1/16 in. (±1.6 mm) relative to each other and with respect to the pipe centerline. The angular tolerance must be held to ±1°. All hole cutting in process piping must be performed using hot tapping equipment.**

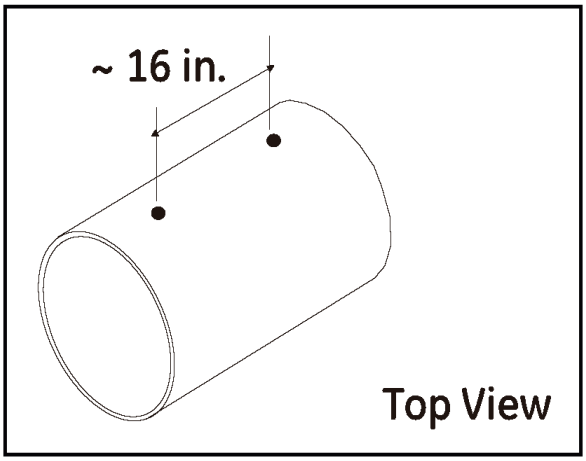
WARNING! **Be sure to adhere to all applicable safety regulations.**

1. For optimum performance, you should select a location that has at least 20 pipe diameters of straight, undisturbed flow upstream and 5 pipe diameters of straight, undisturbed flow downstream from the point of measurement. Undisturbed flow means avoiding sources of turbulence such as flanges, elbows and tees; avoiding swirl; and avoiding disturbed flow profiles. Never install the flowmeter downstream of control valves, especially butterfly valves. If you cannot find a proper location, please consult with Panametrics Flow Application engineering.

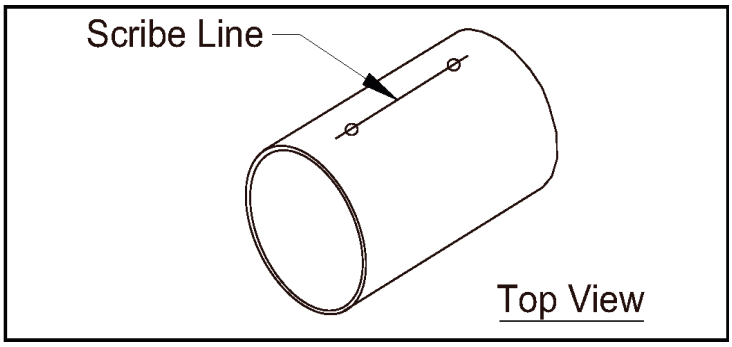


2. Use a center finder device to locate the center of the pipe. **"EYEBALLING" IS NOT ADEQUATE FOR ACCURATE FLOW MEASUREMENT!**

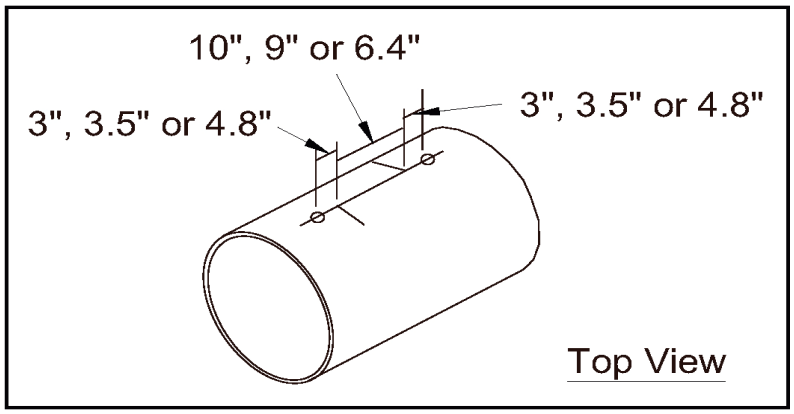
3. Lightly punch two marks approximately 16 in. apart on the top of the pipe, running along the center line. The two nozzle locations will be located between these two center punch marks.



4. Spray the area between the two punch marks on the top of the pipe with a marking dye product. Using a metal straight edge, scribe a line between the two punch marks.



5. Along the new scribe line, mark off a length equal to your transducer spacing (10 in., 9 in. or 6.4 in.) and scribe two lines at least 10 in. in length and perpendicular to the scribe line on different sides of the scribe line.



6. Along each of the perpendicular scribe lines, lightly punch a mark at a distance equal to half of your transducer spacing (5 in., 4.5 in. or 3.2 in.) from the center line, depending on the bias distance for your transducers. Keep in mind that the distance along the arc of the pipe (L) from the pipe centerline is slightly greater than the point-to-point distance through the pipe. These marks pinpoint the centers for the nozzles. Refer to Table 1 on page 7 for arc distances for the most commonly used pipe sizes. If your pipe size is not shown in Table 1, use the equation in the figure on page 6 to calculate the arc distance.

IMPORTANT: For a 3.2 in.bias distance, the downstream port must be located on the right side of the long scribe line when viewed from the downstream end of the pipe (see the figure below). This convention is mandatory for the 6.4 in. transducer spacing and is optional (not required) for a 10 in. or 9 in. spacing.

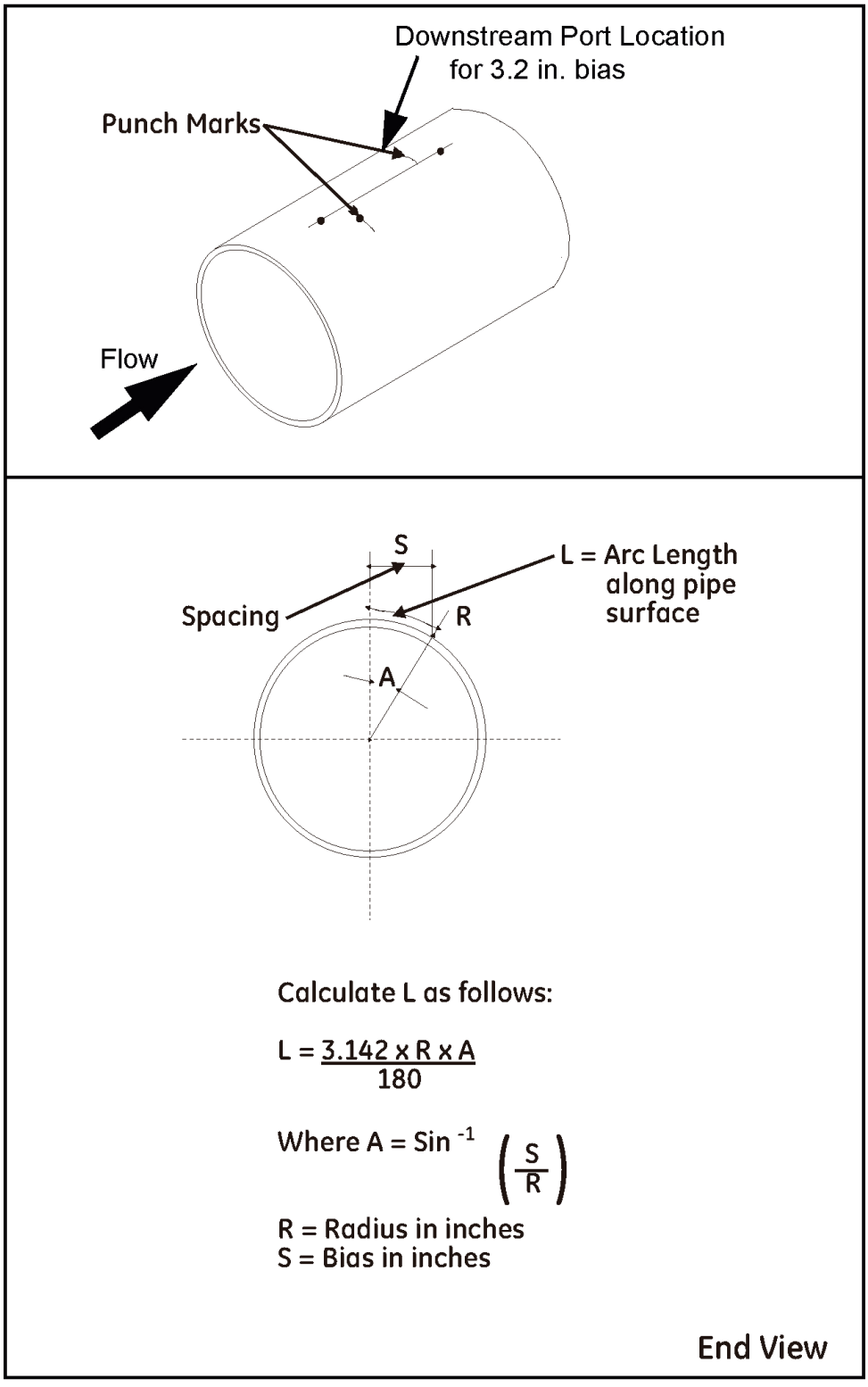
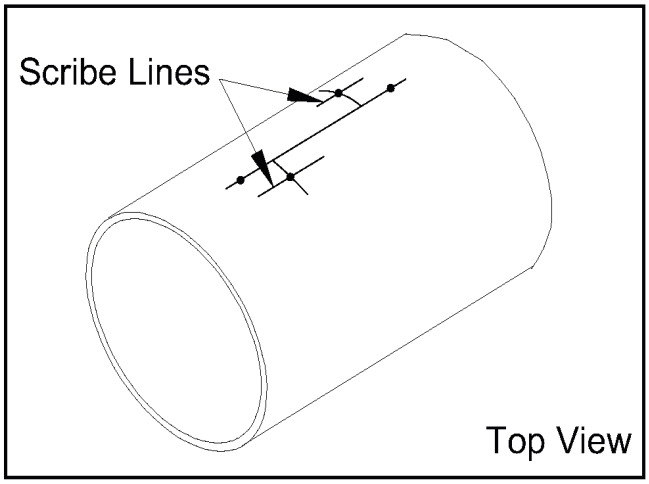


Table 1: Calculated Arc Distances for Common Pipe Sizes

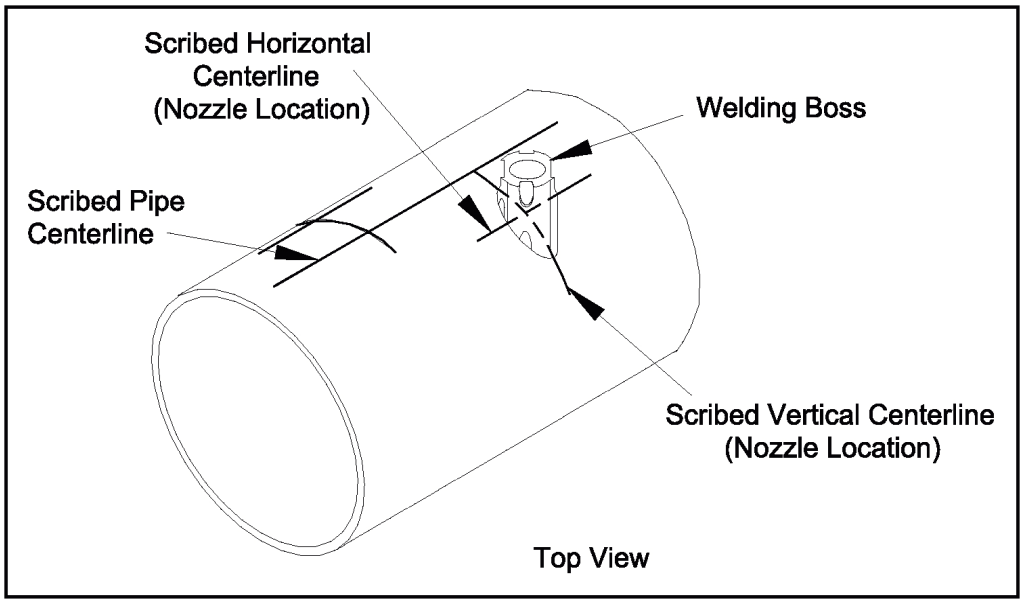
Pipe O.D.	Arc Distance
5 in. Bias	
18 in. (450 mm)	5.301 in. (134.6 mm)
24 in. (600 mm)	5.157 in. (131.0 mm)
30 in. (750 mm)	5.098 in. (129.5 mm)
36 in. (900 mm)	5.067 in. (128.7 mm)
42 in. (1050 mm)	5.048 in. (128.2 mm)
4.5 in. Bias	
16 in. (400 mm)	4.779 in. (121.4 mm)
18 in. (450 mm)	4.713 in. (119.7 mm)
24 in. (600 mm)	4.613 in. (117.2 mm)
30 in. (750 mm)	4.571 in. (116.1 mm)
36 in. (900 mm)	4.549 in. (115.5 mm)
42 in. (1050 mm)	4.536 in. (115.2 mm)
3.2 in. Bias	
14 in. (350 mm)	3.323 in. (84.4 mm)
16 in. (400 mm)	3.292 in. (83.6 mm)
18 in. (450 mm)	3.272 in. (83.1 mm)
24 in. (600 mm)	3.239 in. (82.3 mm)
30 in. (750 mm)	3.225 in. (81.9 mm)
36 in. (900 mm)	3.217 in. (81.7 mm)
42 in. (1050 mm)	3.213 in. (81.6 mm)

7. Scribe a 6 in. long horizontal centerline through each nozzle center location point and parallel to the original centerline.



1.1.3 Installing the First Welding Boss

1. Each welding boss has four scribe marks indicating the center of the bias.Take one welding boss and line up its scribe marks with the horizontal and perpendicular scribe marks on the pipe as shown below. Make sure you position the boss on the pipe so that the contoured end of the boss matches the pipe arc. That is, the shorter side of the boss should be closer to the original scribed pipe centerline.

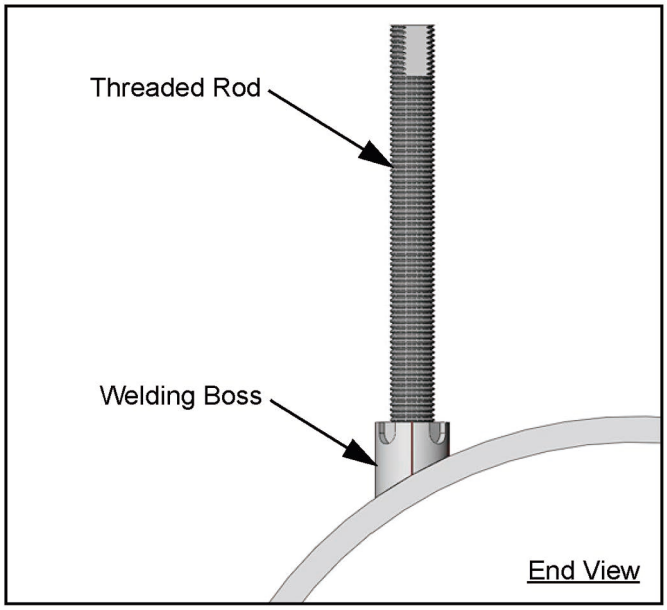


2. Clamp the boss in place, using a pipe strap or equivalent, so that it cannot move during tack welding.
3. Check the boss alignment again, and then tack weld the boss in each of the four grooves between the boss scribe marks. Make sure you keep the boss contour flush with the pipe contour during the entire tack welding operation. The boss is constructed of carbon steel.
4. Check the alignment again. If the boss is misaligned by 0.02 in. (0.5 mm) or more, remove the boss, grind off the welds and reinstall the boss.

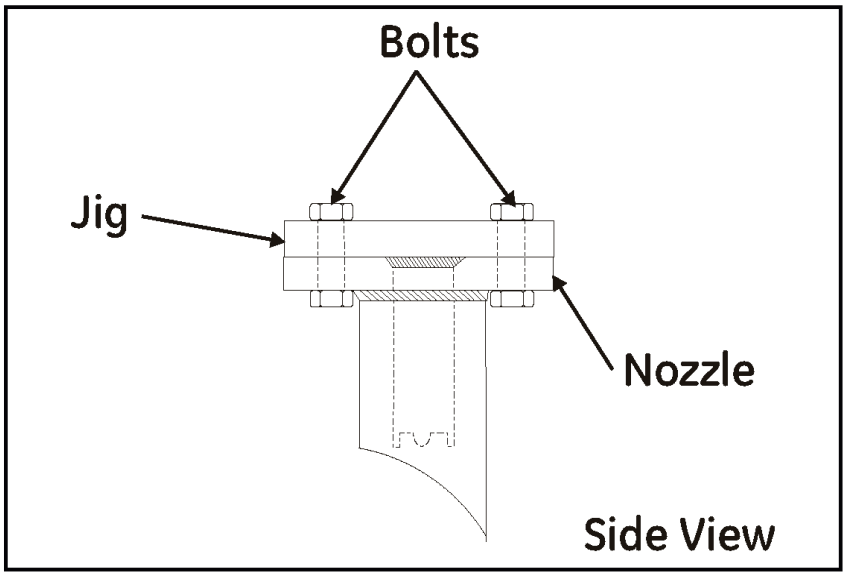
1.1.4 Installing the First Nozzle

CAUTION! **It is essential that the nozzles are set up and fixed in position using the jig and alignment plate provided, prior to welding the nozzle.**

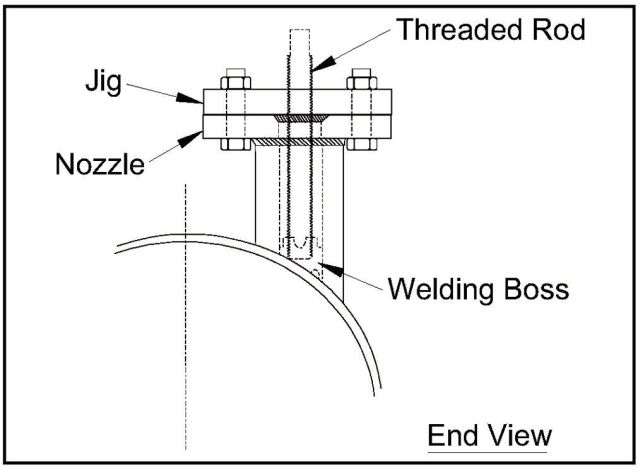
1. Screw the threaded rod into the boss that is welded onto the pipe. If necessary, remove the washer and nut from the threaded rod.



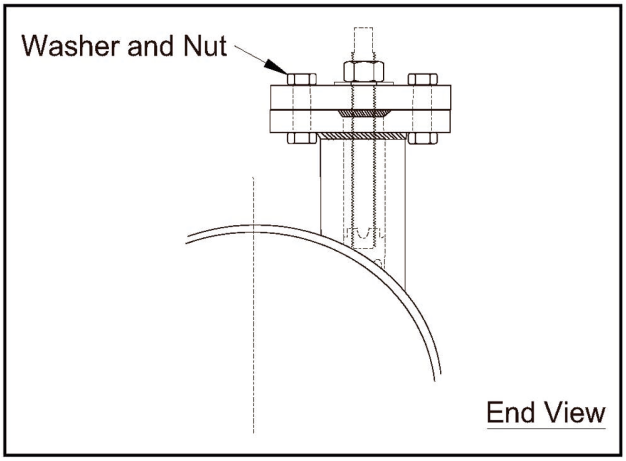
2. Insert the pipe section of the jig (the key cut section) into the pipe section of the nozzle, and fasten the assembly together using four nuts and bolts.



3. Slide the jig/nozzle assembly over the threaded rod, fitting the jig into the key cut end of the welding boss while aligning the contoured end of the nozzle to the pipe arc.



4. Align the nozzle scribe marks with the pipe scribe marks and tighten the assembly in place using the 1-in. washer and nut provided. If slight misalignment occurs between the nozzle scribe marks and pipe scribe marks, loosen the four bolts holding the jig and nozzle assembly, and rotate the nozzle for the best alignment. After the nozzle has been accurately aligned, retighten the four bolts.



5. The jig, boss, and nozzle assembly is designed to provide a 0.094 in. (2.4 mm) root gap between the beveled edge of the nozzle and the outside diameter of the pipe. If this gap is not present all the way around the nozzle, the nozzle must be removed and ground appropriately to provide the required clearance. If the root gap is larger than the 0.094 in. (2.4 mm) dimension evenly all the way around the nozzle, then suitably sized washers may be inserted between the jig and the nozzle to reduce the root gap dimension.

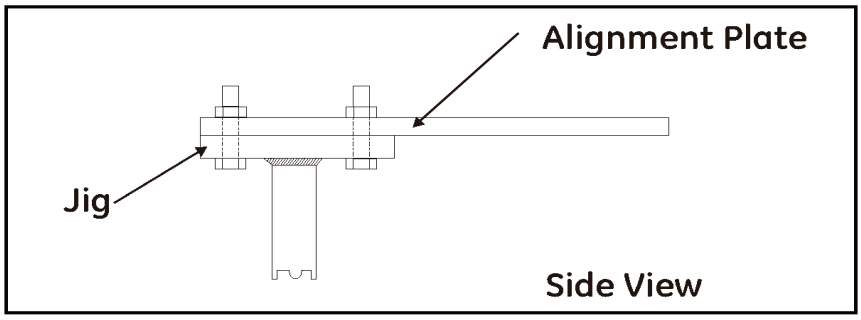


WARNING! **Only qualified personnel should weld bosses and nozzles, using a suitable ASME IX qualified welding procedure. All applicable safety codes should be observed.**

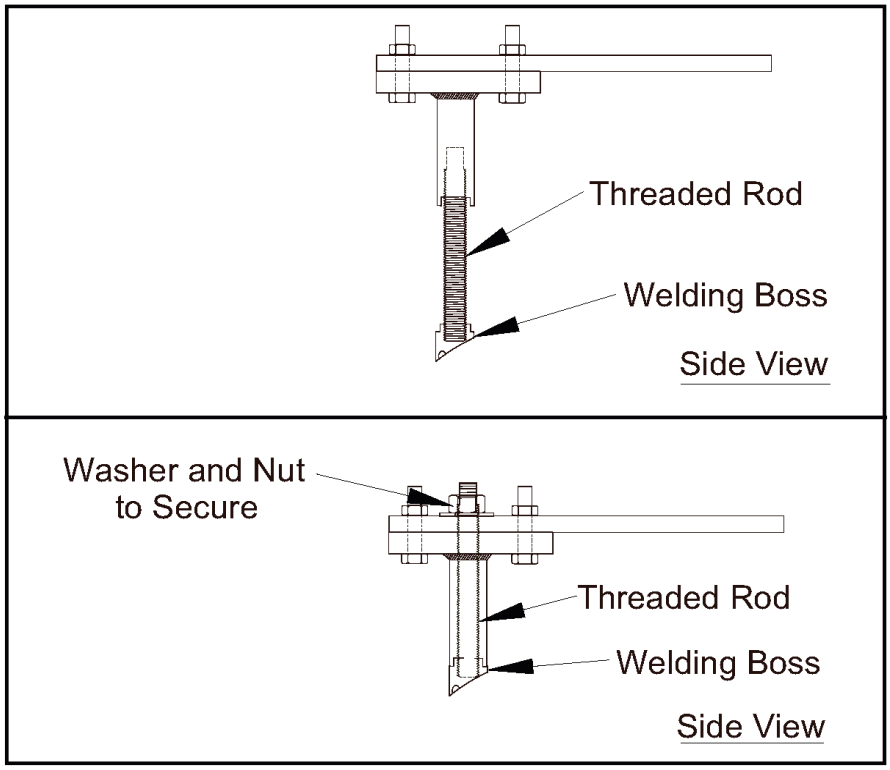
6. Tack weld the nozzle to the pipe at four diametrically opposed points, each tack being approximately 0.2 in. (5 mm) in length. Allow the weld to cool for 30 seconds between tacks.
7. Complete the root pass and subsequent filler passes as required.
8. Allow the weld to cool, and then remove the nut, washer, jig and threaded rod.

1.1.5 Installing the Second Welding Boss

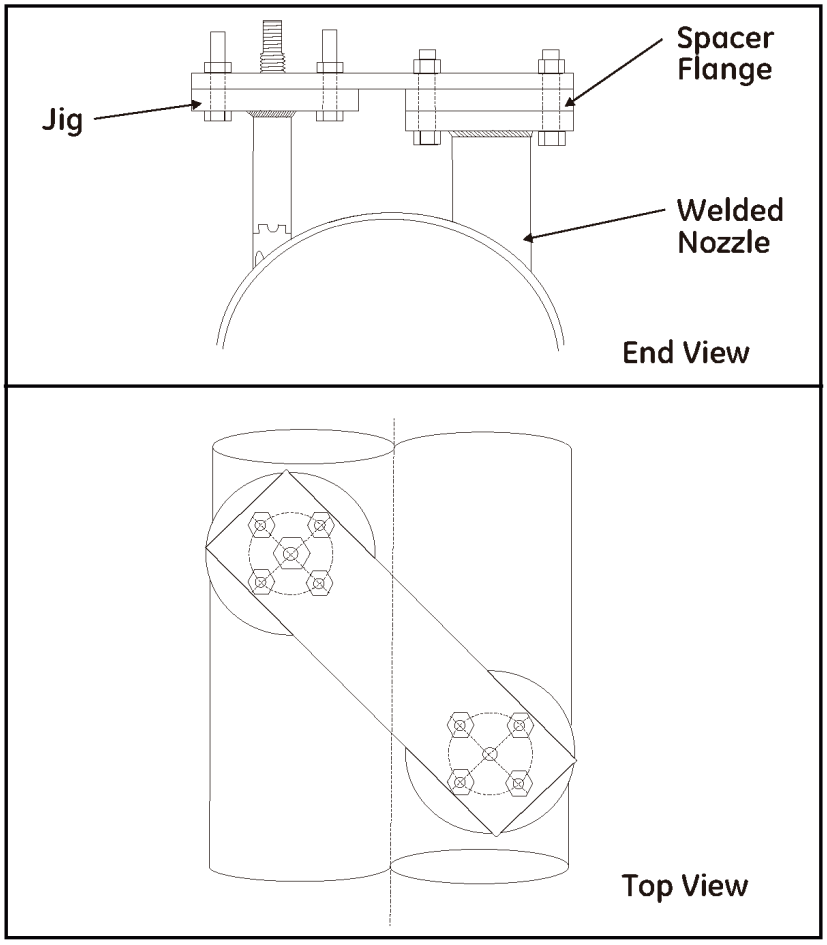
1. Bolt the jig to one end of the alignment plate using four bolts.



2. Screw the threaded rod into the second boss. Then, insert the bolt/boss assembly into the jig key cut grooves and secure it with a washer and nut on top.



3. Remember to orient the boss in the jig to maintain the proper contour location to the pipe for installation.
4. Place the spacer flange on top of the welded nozzle and then mount the second end of the alignment plate on top of the spacer flange. Bolt the alignment plate into position with the remaining bolts.

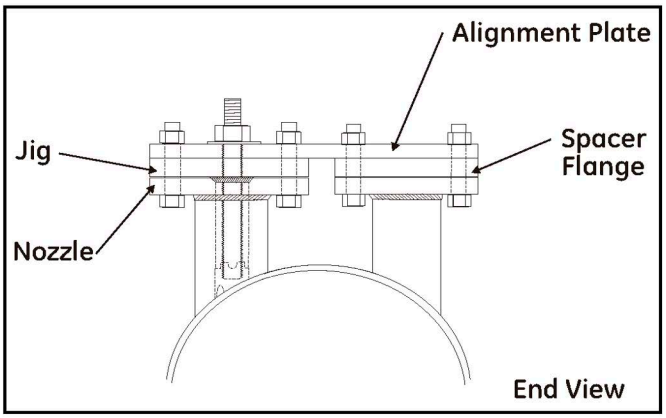


5. The second welding boss should now be positioned over the second nozzle location scribe marks. Align the boss scribe marks with the pipe scribe marks, and then tighten all of the nuts securely.
6. Check the boss alignment again, then tack weld the boss in each of the four grooves between the boss scribe marks.
7. After tacking, check the boss alignment once more. If the boss is misaligned by 0.02 in. (0.5 mm) or more, remove the boss by grinding off the welds, and then reinstall the boss.
8. Remove the threaded rod and the jig. Leave the alignment plate bolted to the first nozzle, with the spacer flange sandwiched between them.

1.1.6 Installing the Second Nozzle

To install the second nozzle, complete the following steps:

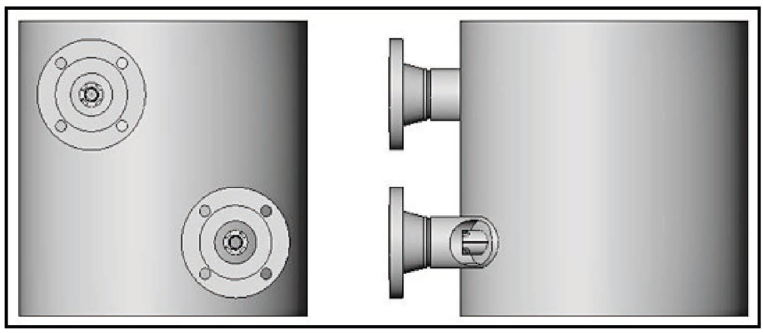
1. Insert the jig into the second nozzle and position this assembly over the boss and under the alignment plate. Then, insert the threaded rod.



2. The jig, boss, and nozzle assembly is designed to provide a 0.094 in. (2.4 mm) root gap between the beveled edge of the nozzle and the outside diameter of the pipe. If this gap is not present all the way around the nozzle, the nozzle must be removed and ground appropriately to provide the required clearance. If the root gap is larger than the 0.094 in. (2.4 mm) dimension evenly all the way around the nozzle, then suitably sized washers may be inserted between the jig and the nozzle to reduce the root gap dimension.
3. Secure the alignment plate by installing the two sets of four bolts on the alignment plate. Also, install the washer and nut on the threaded rod.
4. Line up the nozzle scribe marks with the pipe scribe marks and tighten all the nuts.
5. Make sure the nozzle is still in alignment..

WARNING! **Only qualified personnel should weld bosses and nozzles, using a suitable ASME IX qualified welding procedure. All applicable safety codes should be observed.**

6. Tack weld the nozzle to the pipe at four diametrically opposed points, each tack being approximately 0.2 in. (5 mm) in length. Allow the weld to cool for 30 seconds between tacks.
7. Complete the root pass and subsequent filler passes as required.
8. Allow the weld to cool, and then remove all nuts and bolts, the alignment plate, the jig, the spacer flange and the threaded rod. The completed installation should appear as shown below.



1.1.7 Hot Tapping the Pipe



WARNING! **Hot tapping should only be performed by qualified personnel. Follow all applicable code and safety practices during these procedures.**

1.1.7.1 Hot Tapping For 3" Flanges

To hot tap the pipe for 3" flanges, complete the following steps:

1. Obtain two suitable 3 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 8 in. or 300# RF flanges and a face-to-face length of 11.125 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with either 5/8 in. studs and nuts for 150# flanges or 3/4 in. studs and nuts for 300# flanges.
3. Orient the isolation valve handles to minimize interference during operation of the valves.
4. Hot tap holes in the pipe using a hot tap machine equipped with a 3/4 in. (19.05 mm) drill bit.
5. Then use a coupon retaining hole saw to cut a hole with a diameter of 2.36 in. (60 mm) minimum to 2.875 in. (73 mm) maximum.

1.1.7.2 Hot Tapping For 2" Flanges

To hot tap the pipe for 2" flanges, complete the following steps:

1. Obtain two suitable 2 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 7 in. or 300# RF flanges and a face-to-face length of 8.50 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with 5/8 in. studs and nuts.
3. Orient the isolation valve handles to minimize interference during operation of the valves.
4. Hot tap holes in the pipe using a hot tap machine equipped with a 3/4 in. (19.05 mm) drill bit.
5. Then use a coupon retaining hole saw to cut a hole with a diameter of 1.81 in. (46 mm) minimum to 1.89 in. (48 mm) maximum.

1.1.8 Cold Tapping the Pipe



WARNING! **Cold tapping should only be performed by qualified personnel. Follow all applicable code and safety practices during these procedures**

The procedure for cold tapping a pipe is the same as the hot tapping procedure described above. However, isolation valves are not necessary during the tapping process. The hot tap machine is used directly on the nozzles. The isolation valves are added after the tapping process has been completed.

1.2 Tilted 45° Installation

This procedure includes the following steps:

- Identifying and checking the nozzle installation kit components
- Selecting and marking the pipe for nozzle locations
- Installing the first welding boss
- Installing the first nozzle
- Installing the second welding boss
- Installing the second nozzle
- Tapping the pipe

1.2.1 Identifying and Checking the Nozzle Installation Kit Components

The *Nozzle Installation Kit* contains the materials listed below. Use Figure 2 below to help identify each component.

- 2 Nozzles (if purchased)
- 2 Welding bosses
- 1 Jig
- 1 Threaded rod (1" diameter), with washer and nut

IMPORTANT: You will need eight 5/8" studs with two nuts each, or 3/4" studs with two nuts each. The 5/8" studs are needed for 2"-150#, 2"-300# and 3"-150# flanges. The 3/4" studs are needed for 3"-300# flanges.

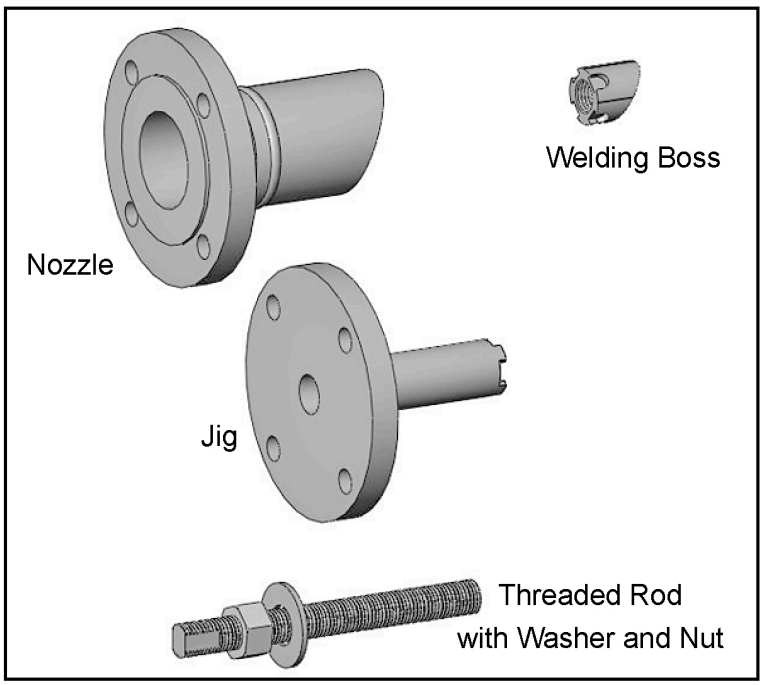
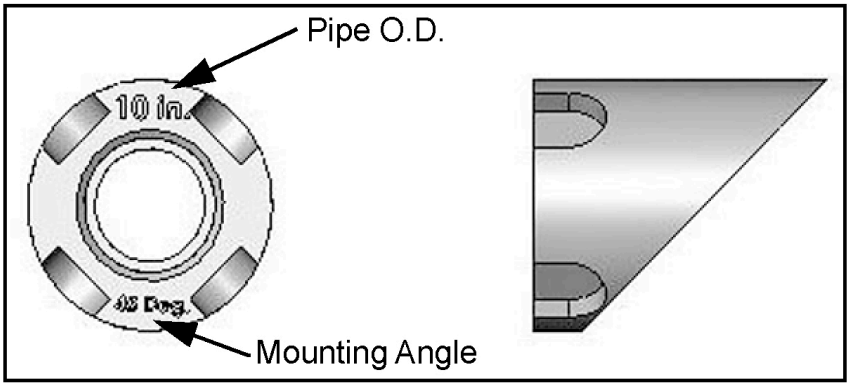


Figure 2: Components for Nozzle Installation Kit

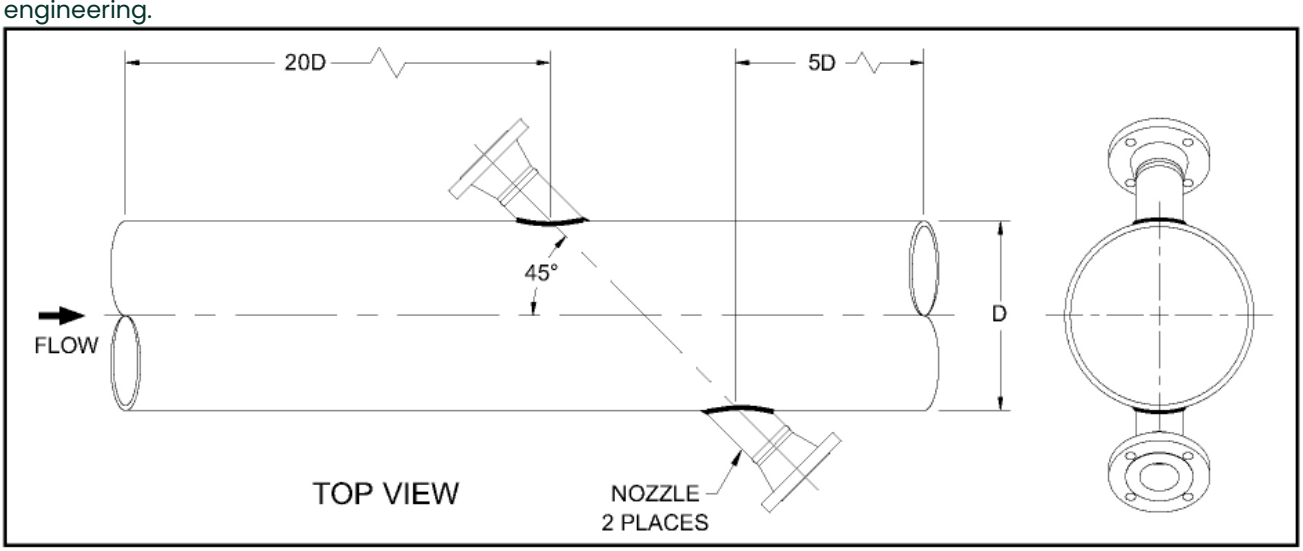
Check the markings on the end of the welding boss. The pipe OD and the mounting angle are engraved on the boss, as shown below.



1.2.2 Selecting and Marking the First Nozzle Location

CAUTION! **Correct nozzle alignment is critical to the successful operation of the flowmeter. Therefore, all marking, positioning and welding operations must be carried out with the utmost attention to accuracy. Unless otherwise stated, dimensional positioning of the nozzles must be held to a tolerance of ±1/16 in. (±1.6 mm) relative to each other and with respect to the pipe centerline. The angular tolerance must be held to ±1°. All hole cutting in process piping must be performed using hot tapping equipment.**

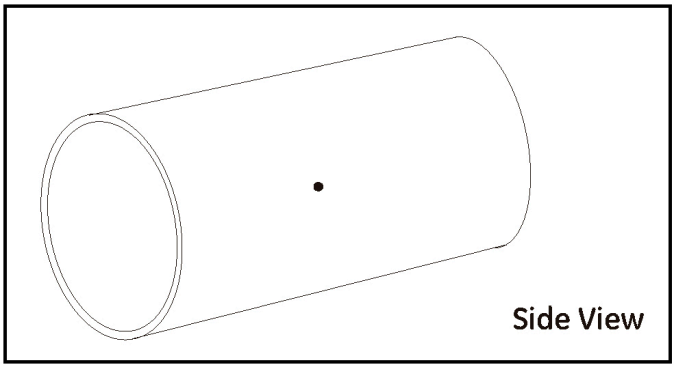
1. For optimum performance, you should select a location that has at least 20 pipe diameters of straight, undisturbed flow upstream and 5 pipe diameters of straight, undisturbed flow downstream from the point of measurement. Undisturbed flow means avoiding sources of turbulence such as flanges, elbows and tees; avoiding swirl; and avoiding disturbed flow profiles. Never install the flowmeter downstream of control valves, especially butterfly valves. If you cannot find a proper location, please consult with Panametrics Flow Application engineering.



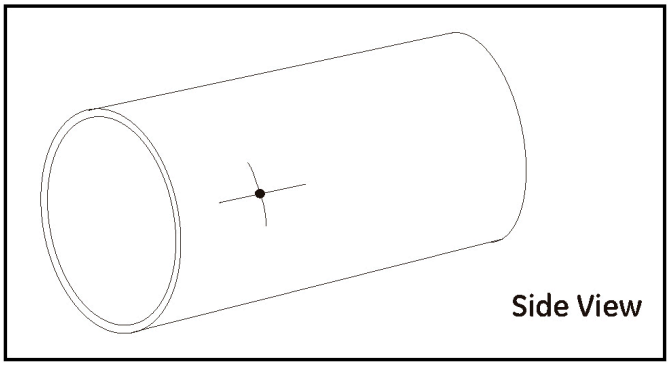
2. Install the pipe nozzles on a pipe diameter as near as possible to the horizontal plane. This would be at the 3 o'clock and 9 o'clock positions for a horizontal pipe.

Note: *If you cannot find a proper location, please consult with Panametrics Flow Application engineering.*

3. At the 3 o'clock position, center punch the pipe to mark the position for the center of the first nozzle.



4. Spray this area with a marking dye product. Using a metal straight edge, scribe 6 in. long vertical and horizontal lines that intersect at the center punch mark.

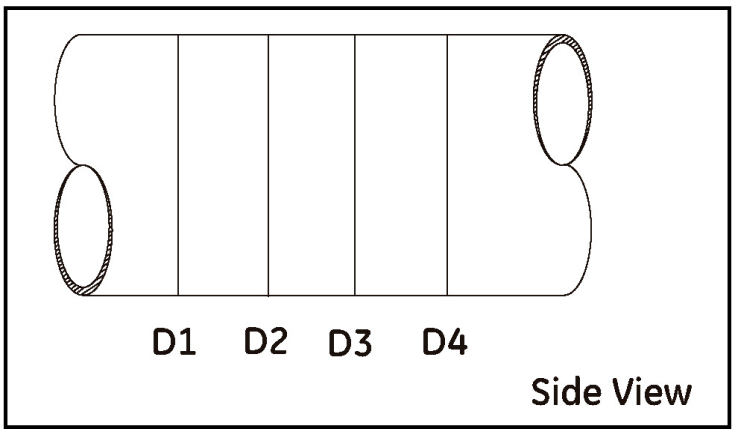


1.2.3 Determining and Marking the Second Nozzle Location

1. The second nozzle is located a distance equal to one pipe O.D. along the pipe centerline and on the opposite side of the pipe (180° around the circumference). Spray this area with a marking dye product.

Note: *For installation angles other than 45°, the distance along the pipe centerline is equal to the pipe O.D. times the tangent of the installation angle.*

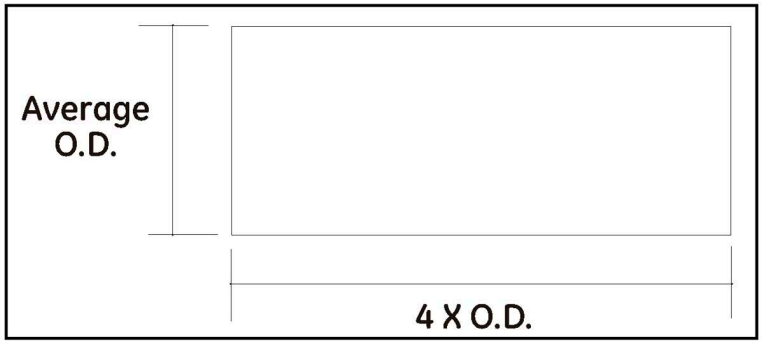
2. To account for possible variations in the O.D. of the pipe, measure the pipe O.D. at four location between the nozzle centers. Calculate the average outside diameter based on these measurements.



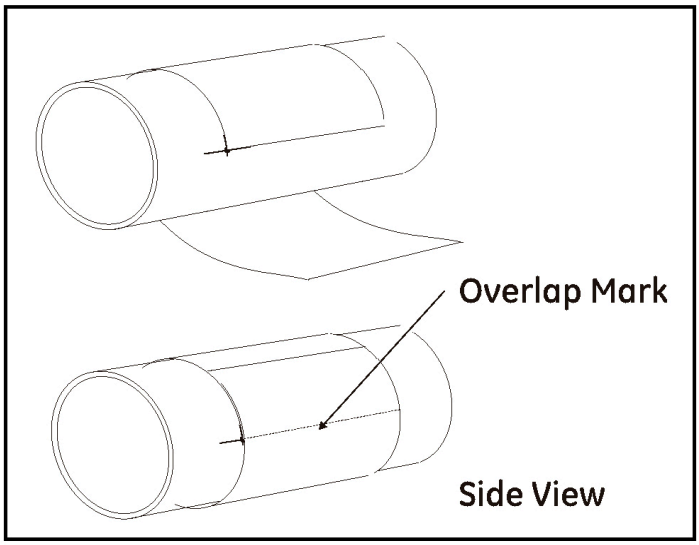
3. Using a roll of polyester film (or equivalent), cut a strip of film to the following width and length:

IMPORTANT: Ensure that the sides of the film are cut parallel to each other.

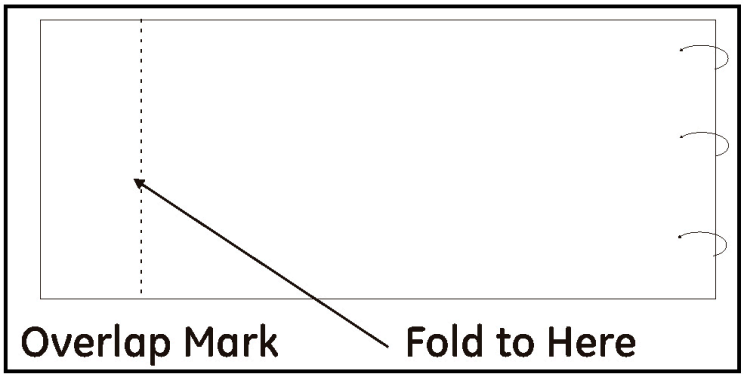
- **Width** - equal to the average pipe O.D., as calculated in Step 1 above.
- **Length** - equal to 4 times the average pipe O.D., as calculated in Step 1 above.



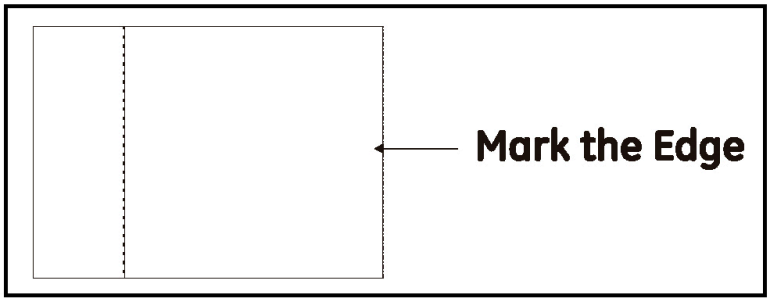
4. Wrap the strip of film around the pipe with one edge running along the vertical scribe line at the first nozzle location. Make sure the strip overlaps squarely all the way around the pipe, and mark the overlap location of the strip. This equals the circumference of the pipe.



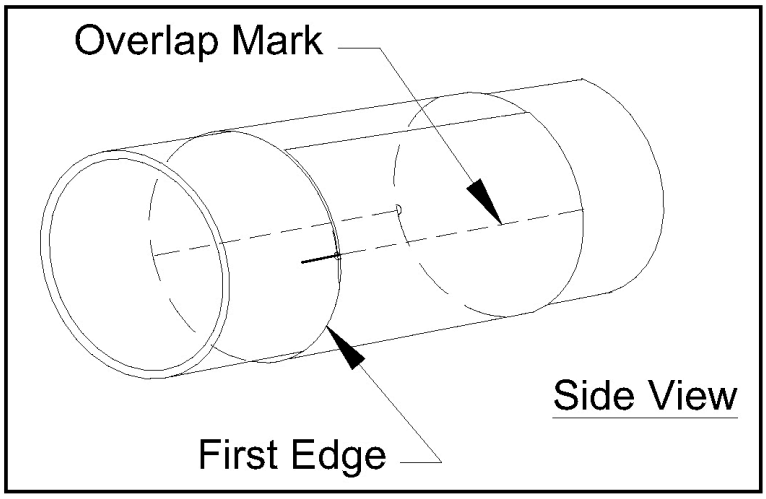
5. Remove the strip of film and fold it as shown below to determine the position which is diametrically opposite the overlap position when the film is reapplied to the pipe.



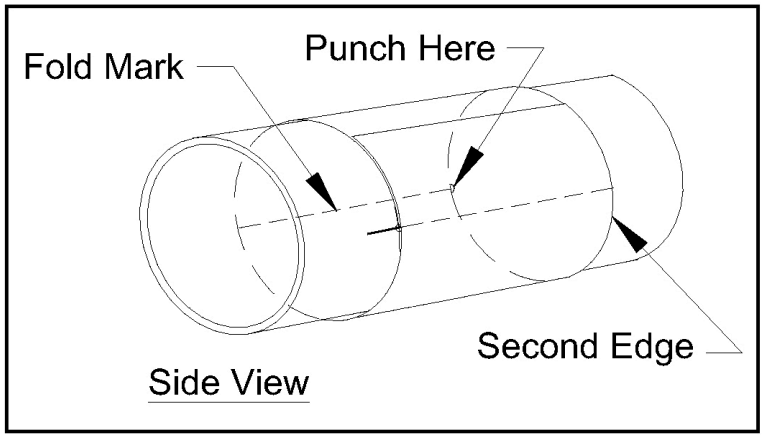
6. Mark the outside of the fold for reference.



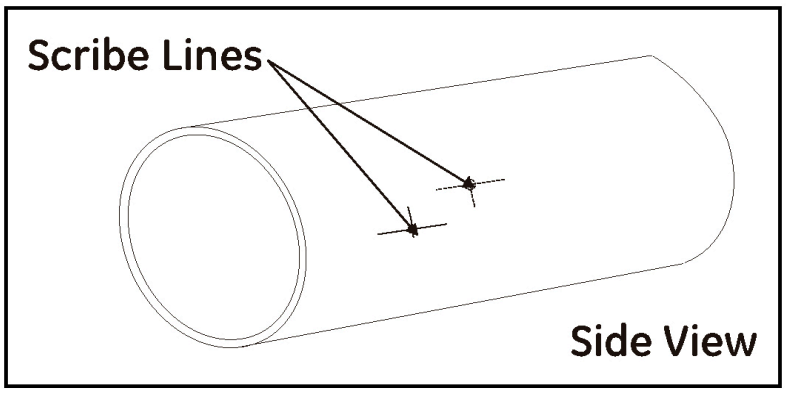
7. Wrap the strip of film around the pipe again. This time, line up the overlap mark with the horizontal and vertical scribe lines. Again, make sure you wrap the strip of film squarely all the way around the pipe.



8. The new location of the center of the second nozzle is now identified as the intersection of the fold line and the second edge of the strip of film. Center punch this location prior to removing the strip of film.



9. Remove the strip of film from the pipe.
10. Scribe 6 in. long vertical and horizontal lines which intersect at the new center-punch mark.



1.2.4 Installing the First Welding Boss

1. Before welding the first boss, you must add another scribe line known as the oblique center line. The oblique center line compensates for the slope or oblique of the boss. The oblique center line is offset from the true center (vertical) scribe line marked earlier by a distance of X, which is dependent on the pipe outside diameter as follows:

$$X = D/2 - \frac{d/2}{\tan[\sin^{-1}(d/D)]}$$

where, D = pipe outside diameter

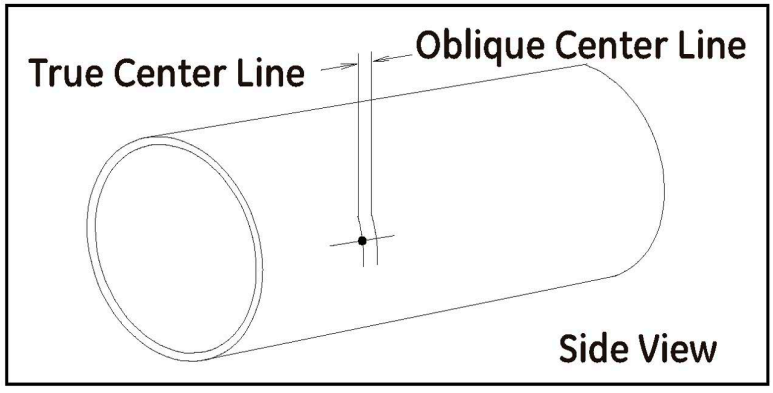
d = welding boss outside diameter (1.660 in.)

Table 2 below shows values of X for various pipe sizes.

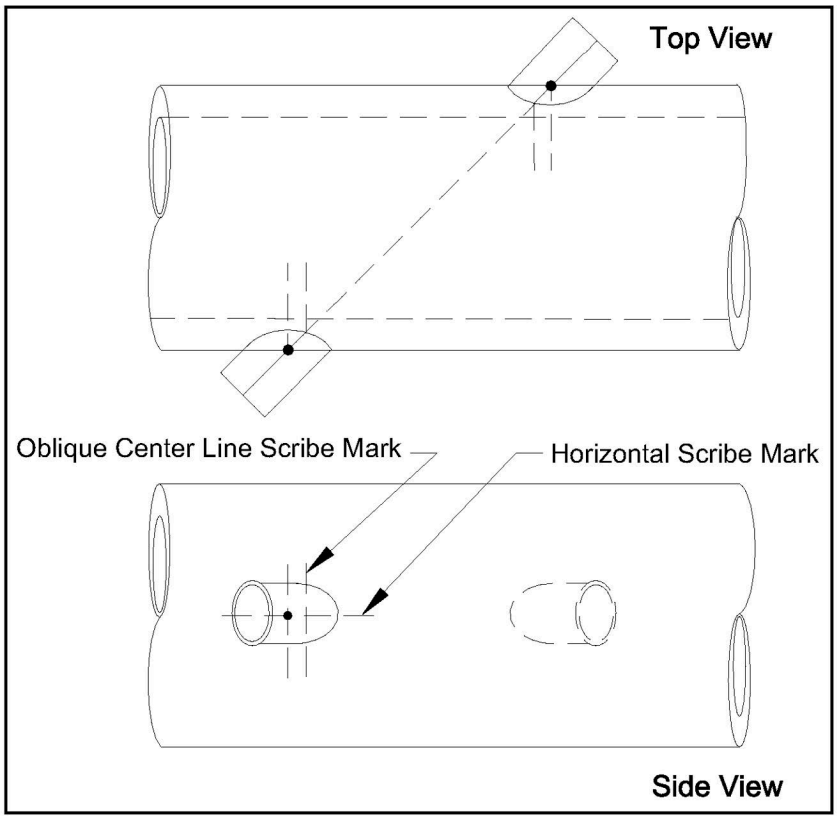
Table 2: Values for Various Pipe Sizes

Pipe Size		
NPS (DN)	O.D.	X Dimensions
6 in. (150 mm)	6.625 in. (168 mm)	0.106 in. (2.69 mm)
8 in. (200 mm)	8.625 in. (219 mm)	0.081 in. (2.06 mm)
10 in. (250 mm)	10.750 in. (273 mm)	0.064 in. (1.62 mm)
12 in. (300 mm)	12.750 in. (324 mm)	0.054 in. (1.37 mm)
14 in. (350 mm)	14.000 in. (356 mm)	0.049 in. (1.24 mm)

2. Scribe the oblique center line on the pipe at the calculated distance from the true center line. The oblique center line should be marked on the side of the true center line that is closer to the second nozzle location.



3. Position the welding boss such that the four scribe lines on the welding boss are lined up with the horizontal scribe mark and the oblique center line on the pipe. Make sure you orient the boss as shown below.

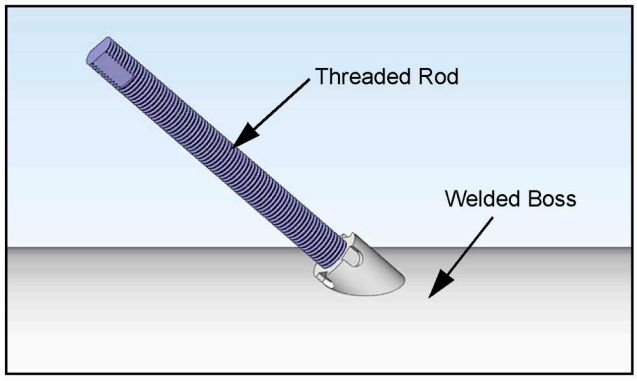


4. Clamp the boss in place using a pipe strap or equivalent so that it cannot move during tack welding.
5. Check the boss alignment, then tack weld the carbon steel boss to the pipe in each of the four grooves between the boss scribe marks.
6. Remove the clamp and check the alignment again. If the boss is misaligned by 0.02 in. (0.5 mm) or more, remove the boss, grind off the welds and reinstall the boss.

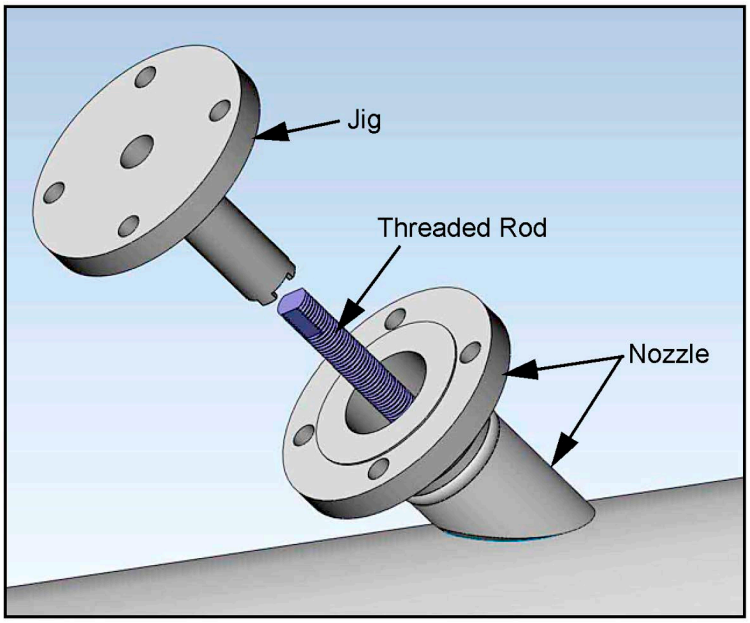
1.2.5 Installing the First Nozzle

IMPORTANT: Prior to welding the nozzle, it is essential that the nozzle is set up and fixed in position using the jig and the 1-in. threaded rod provided in the kit.

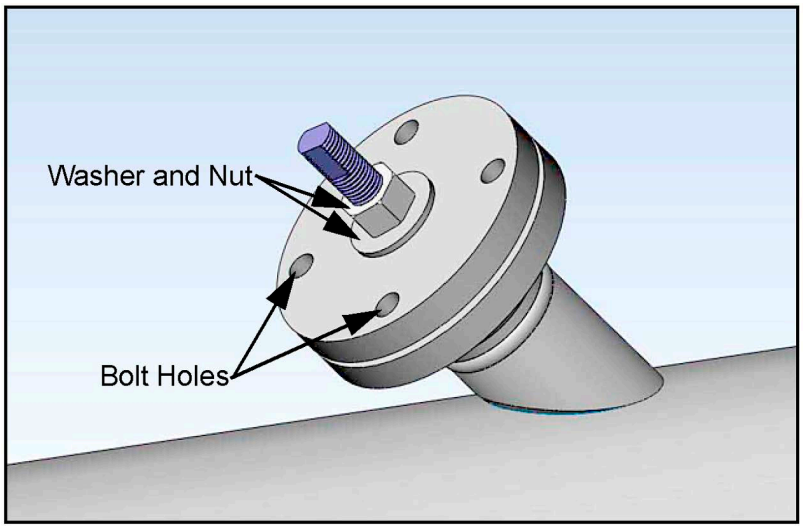
1. Screw the threaded rod into boss that is welded onto the pipe. If necessary, remove the washer and nut from the threaded rod.



2. Slide the nozzle over the threaded rod, and align the contoured end of the nozzle so that it matches the pipe arc. Then slide the jig over the threaded rod and fit the jig into the welding boss.



3. Align the jig bolt holes with the nozzle bolt holes. Then, tighten the assembly together, using the washer and nut on the threaded rod.



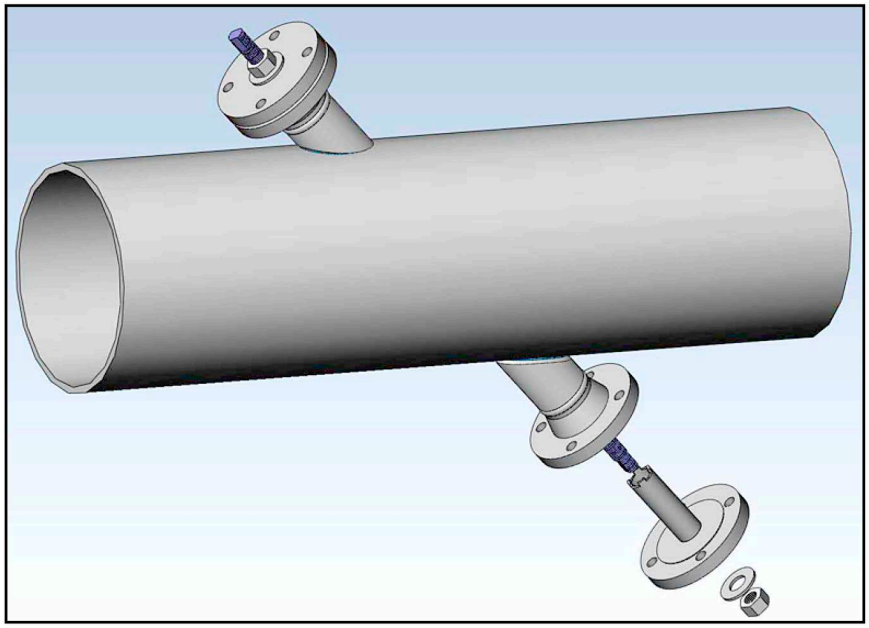
4. The jig, boss, and nozzle assembly is designed to provide a 0.094 in. (2.4 mm) root gap between the beveled edge of the nozzle and the outside diameter of the pipe. If this gap is not present all the way around the nozzle, the nozzle must be removed and ground appropriately to provide the required clearance. If the root gap is larger than the 0.094 in. (2.4 mm) dimension evenly all the way around the nozzle, then suitably sized washers may be inserted between the jig and the nozzle to reduce the root gap dimension..

WARNING! **Only qualified personnel should weld bosses and nozzles, using a suitable ASME IX qualified welding procedure. All applicable safety codes should be observed.**

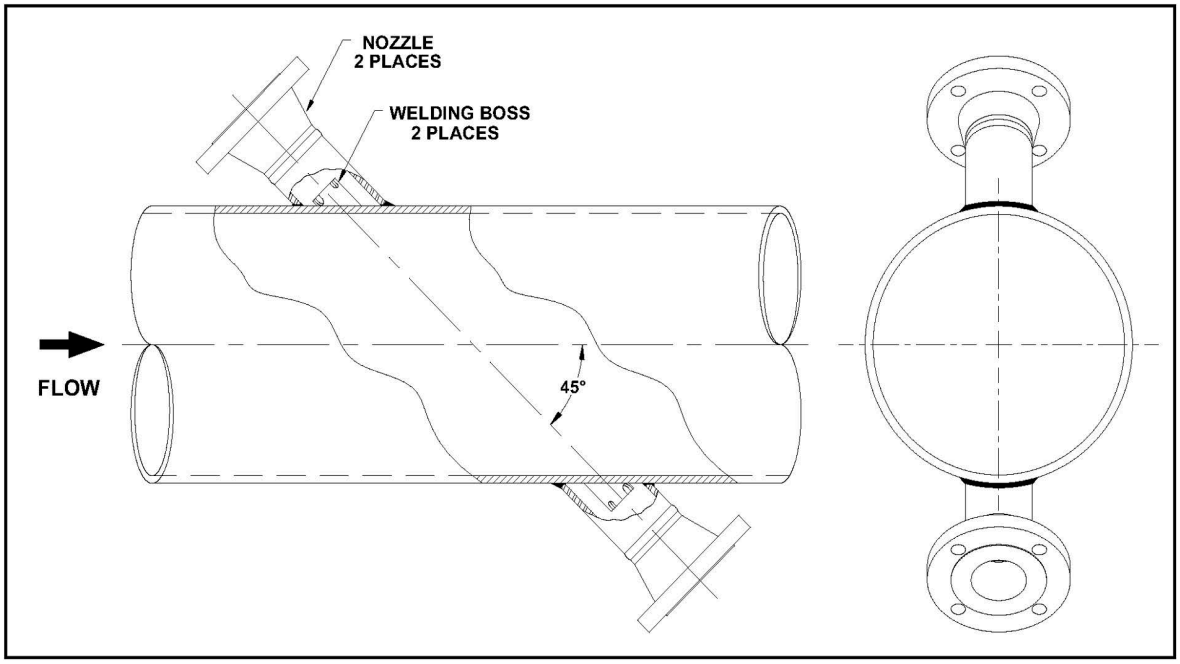
5. Tack weld the nozzle to the pipe at four diametrically opposed points, each tack being approximately 0.6 in. (15 mm) in length. Allow the weld to cool for 30 seconds between tacks.
6. Complete the root pass and subsequent filler passes as required.
7. Allow the weld to cool, and then remove the nut, washer, jig and threaded rod.

1.2.6 Installing the Second Welding Boss and Nozzle

Using the same procedures used for installing the first welding boss and nozzle, install the second welding boss and nozzle at the marked position on the pipe.



The completed installation should appear as shown below.



1.2.7 Hot Tapping the Pipe

Note: *Hot tapping a tilted 45° installation is possible only for the standard velocity range (100 m/s, 328 ft/s). For the extended velocity range (120 m/s, 394 ft/s), only the 4" pipe size can be hot topped.*



WARNING! **Hot tapping should only be performed by qualified personnel. Follow all applicable code and safety practices during these procedures.**

1.2.7.1 Hot Tapping For 3" Flanges

To hot tap the pipe for 3" flanges, complete the following steps:

1. Obtain two suitable 3 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 8 in. or 300# RF flanges and a face-to-face length of 11.125 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with either 5/8 in. studs and nuts for 150# flanges or 3/4 in. studs and nuts for 300# flanges.
3. Orient the isolation valve handles to minimize interference during operation of the valves.
4. Hot tap holes in the pipe using a hot tap machine equipped with a 3/4 in. (19.05 mm) drill bit.
5. Then use a coupon retaining hole saw to cut a hole with a diameter of 2.36 in. (60 mm) minimum to 2.875 in. (73 mm) maximum.

1.2.7.2 Hot Tapping For 2" Flanges

To hot tap the pipe for 2" flanges, complete the following steps:

1. Obtain two suitable 2 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 7 in. or 300# RF flanges and a face-to-face length of 8.50 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with 5/8 in. studs and nuts.
3. Orient the isolation valve handles to minimize interference during operation of the valves.
4. Hot tap holes in the pipe using a hot tap machine equipped with a 3/4 in. (19.05 mm) drill bit.
5. Then use a coupon retaining hole saw to cut a hole with a diameter of 1.81 in. (46 mm) minimum to 1.89 in. (48 mm) maximum.

1.2.8 Cold Tapping the Pipe



WARNING! **Cold tapping should only be performed by qualified personnel. Follow all applicable code and safety practices during these procedures.**

The cold tapping procedure is the same as the hot tapping procedure described above for a standard velocity range (100 m/s, 328 ft/s) installation. Except for the 4 in. pipe size, cold tapping can be performed only before the isolation valve is installed. The hot tap machine is used directly on the nozzles, and the isolation valves are added after the tapping process has been completed.

Chapter 2. Installing the Isolation Valves

This chapter provides instructions for installing an isolation valve onto a nozzle for applications using the flare gas insertion mechanism.

Note: *Installation of the isolation valves may have been done already during the hot tapping operation.*

2.1 Bias 90° Installation (Standard or Extended Velocity Range)

2.1.1 For 3 inch Flanges

1. Obtain two suitable 3 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 8 in. or 300# RF flanges and a face-to-face length of 11.125 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with either 5/8 in. studs and nuts for 150# flanges or 3/4 in. studs and nuts for 300# flanges.
3. Orient the isolation valve handles to minimize interference during operation of the valves.

2.1.2 For 2 inch Flanges

1. Obtain two suitable 2 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 7 in. or 300# RF flanges and a face-to-face length of 8.50 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with 5/8 in. studs and nuts.
3. Orient the isolation valve handles to minimize interference during operation of the valves.

2.2 Tilted 45° Installation (Standard Velocity Range)

2.2.1 For 3 inch Flanges

1. Obtain two suitable 3 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 8 in. or 300# RF flanges and a face-to-face length of 11.125 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with either 5/8 in. studs and nuts for 150# flanges or 3/4 in. studs and nuts for 300# flanges.
3. Orient the isolation valve handles to minimize interference during operation of the valves.

2.2.2 For 2 inch Flanges

1. Obtain two suitable 2 in. ANSI flanged isolation valves. The valves should be a full bore type with either 150# RF flanges and a face-to-face length of 7 in. or 300# RF flanges and a face-to-face length of 8.50 in.
2. Install one of the isolation valves, including a suitable gasket, on each of the nozzles. Secure the valves with 5/8 in. studs and nuts.
3. Orient the isolation valve handles to minimize interference during operation of the valves.

2.3 Tilted 45° Installation (Extended Velocity Range)

Note: *The upstream valve and transducer are installed without wedges, as described in the previous section.*

To install the downstream isolation valve, the items shown in Figure 3 below are required.

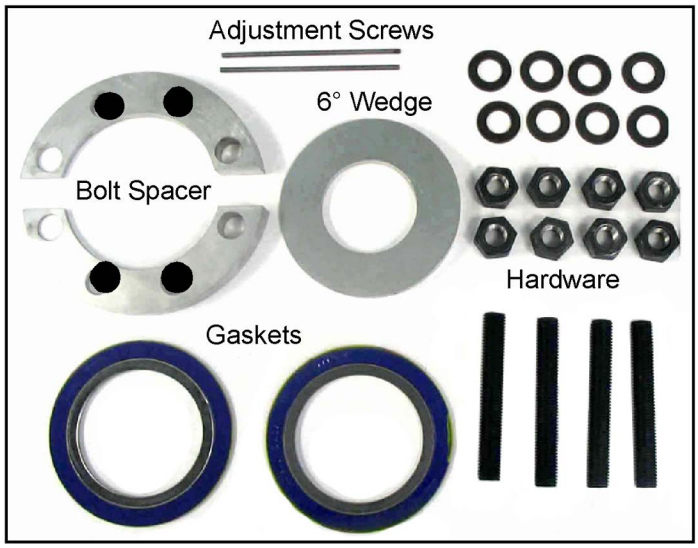


Figure 3: Parts for 150# RF Flange Isolation Valve Installation

1. Insert the four bolts into the nozzle flange holes.
2. With the Nut Side marking facing the pipe, place the split bolt spacer halves over the bolts behind the flange, with the thin ends corresponding to what will be the thickest side of the other wedge (see Figure 4 below).

Note: *The wedge positions are based on the need to tilt the transducer 6° against the flow.*

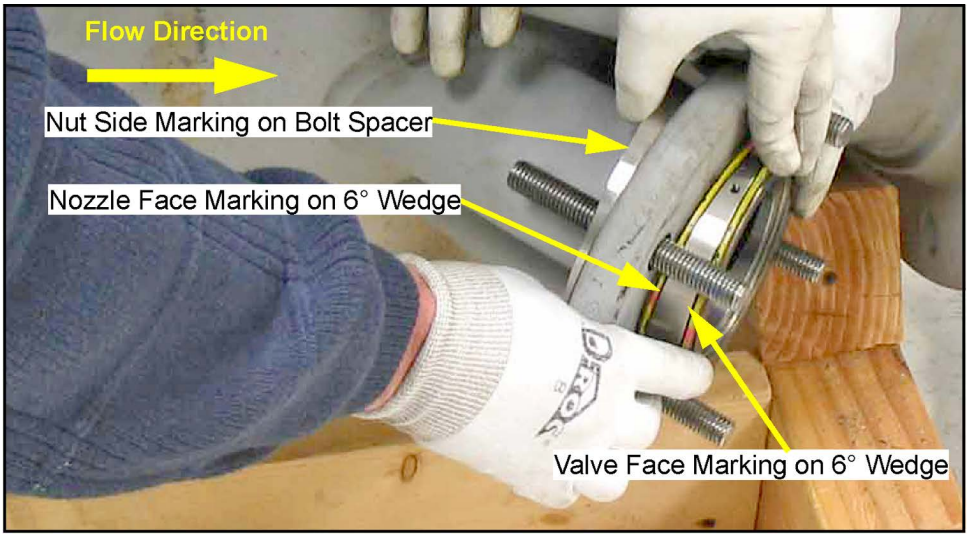


Figure 4: Mounting Bolts, Bolt Spacers, Wedge and Gaskets Positions

3. With the Nozzle Face marking facing the pipe and the Valve Face marking facing outward, hold the gasket/wedge/gasket combination in line with the insertion hole and oriented as shown in Figure 4 on page 28.
4. While one person holds the gaskets and wedges in place, another person should line up the isolation valve mounting holes with the bolts in the nozzle flange, push the isolation valve against the gasket/wedge/gasket combination, and install the washers and nuts to secure the isolation valve to the nozzle flange (see Figure 5 below).

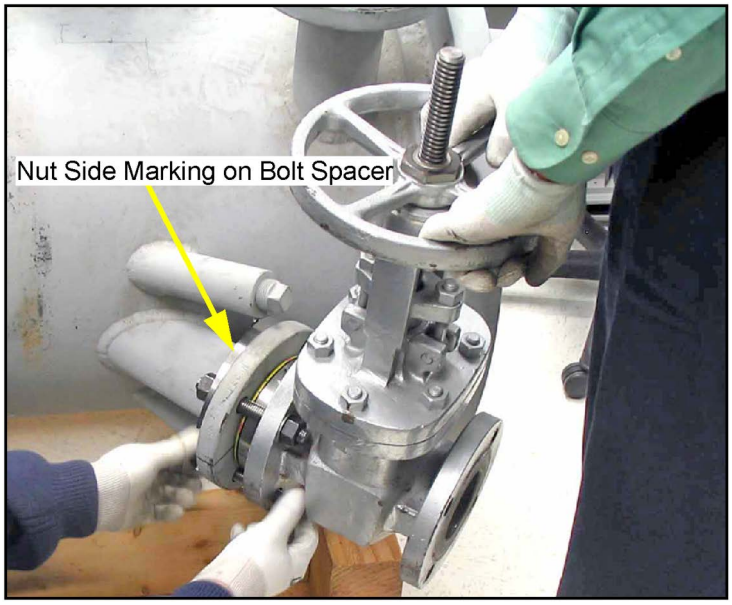


Figure 5: Mounting the Isolation Valve

5. Insert the two adjustment screws into the threaded holes on the 6° wedge (see Figure 6 below) and use them to rotate the wedge until the scribe line is centered between the two bolts.

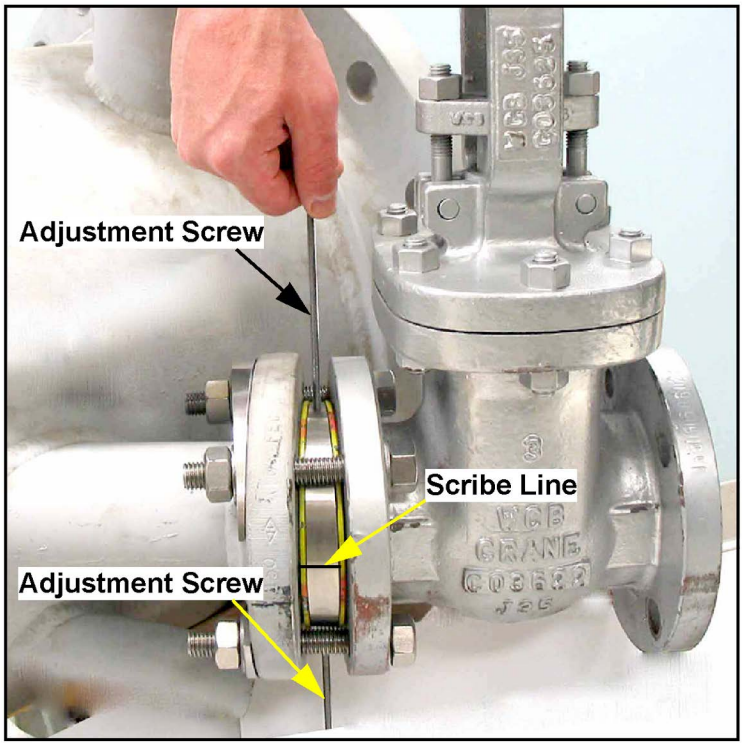


Figure 6: Adjusting the Wedge Position

6. After the wedge is positioned correctly, use two wrenches to tighten the hardware and secure the isolation valve to the nozzle. Then remove the adjustment screws from the wedge.

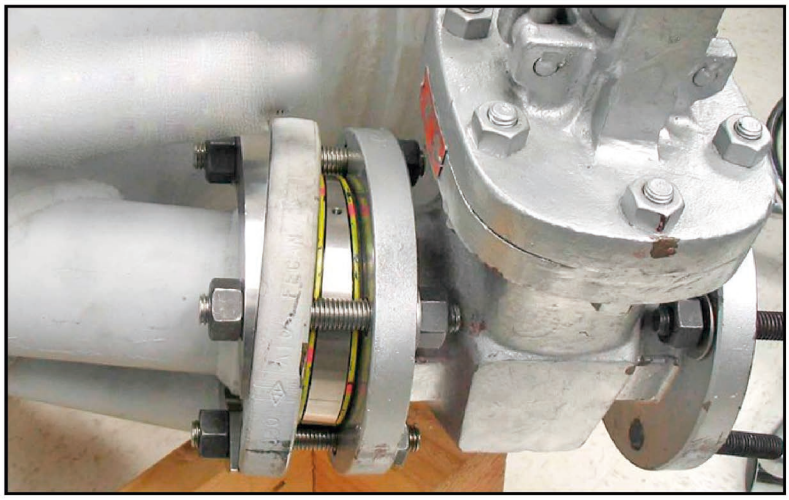


Figure 7: Completed Isolation Valve Installation

Note: *The upstream valve and transducer are installed without wedges, as described in the previous section.*

Chapter 3. Installing the Transducer Assemblies

3.1 Introduction

Transducers and their holder assemblies are installed into a meter body, which is a section of pipe that contains the ports for mounting the transducer assemblies. The meter body may be prefabricated or created by installing ports on an existing pipe. The transducers can be inserted into the meter body using the following holder methods:

- Low-pressure insertion mechanism
- Barrel holder
- Flanged holder

Note: *As an example, this chapter describes the use of the low-pressure insertion mechanism type only.*

3.2 Using the Low-Pressure Insertion Mechanism

Note: *The Low-Pressure Insertion Mechanism is designed for manual (non-assisted) transducer insertion into operating pipes at low pressure. The mechanism uses an isolation valve and a packing gland for sealing.*

Inserting the transducers into the pipe requires the following steps:

- Preparing for installation
- Mounting the insertion mechanism
- Inserting the transducer into the pipe
- Aligning the transducers



WARNING! **The manual insertion mechanism is used for low-pressure applications (80 psig/6.5 bar absolute or less). Use the appropriate safety precautions when inserting or withdrawing the insertion mechanism.**

3.2.1 Preparing for Installation

Before you begin, find a work area where you can stand the insertion mechanism upright without placing any weight on the transducer (e.g., a bench with a cutout large enough for the transducer to slide through).

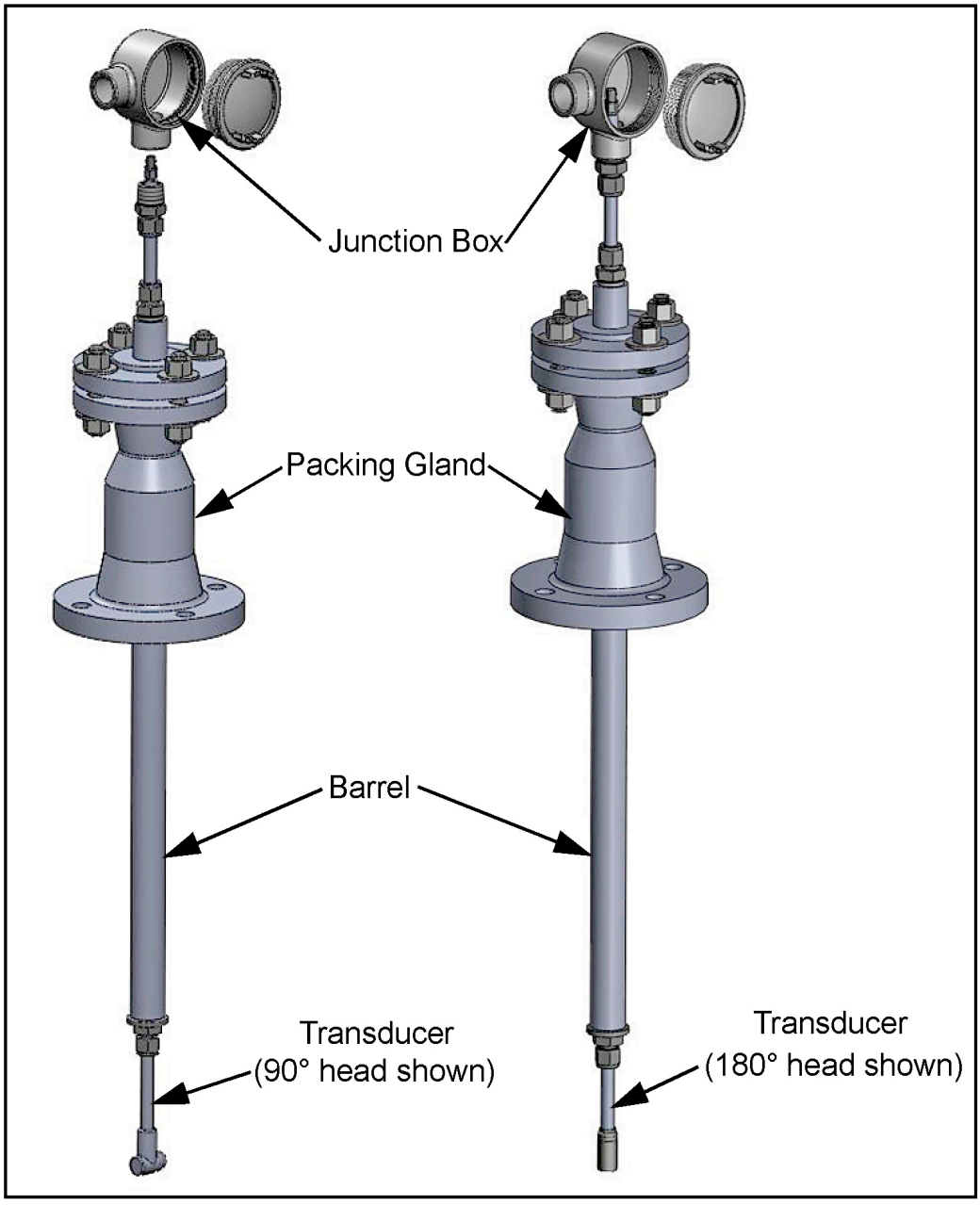
You will need the following items for installation:

- A packing tool (may be shipped with the flowmeter)
- A gasket for the isolation valve
- A straight edge ruler
- A tag to place on the isolation valve
- Bolts

3.2.2 Mounting the Insertion Mechanism

1. Before mounting the insertion mechanism on the isolation valve you should familiarize yourself with its components (see the figure below):
   - Junction box
   - Barrel
   - Packing gland
   - Transducer

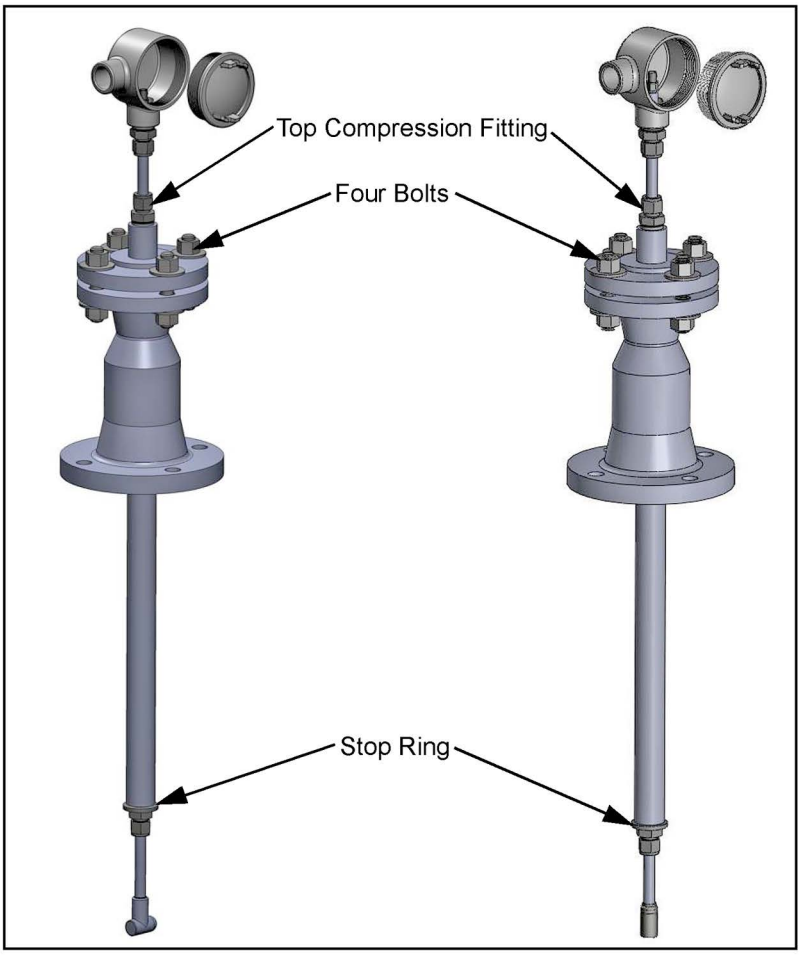
Note: *Explosion-proof junction boxes are not pre-mounted on the end of the transducer when shipped.*


Junction Box
Packing Gland
Barrel
Transducer
(90° head shown)
Transducer
(180° head shown)

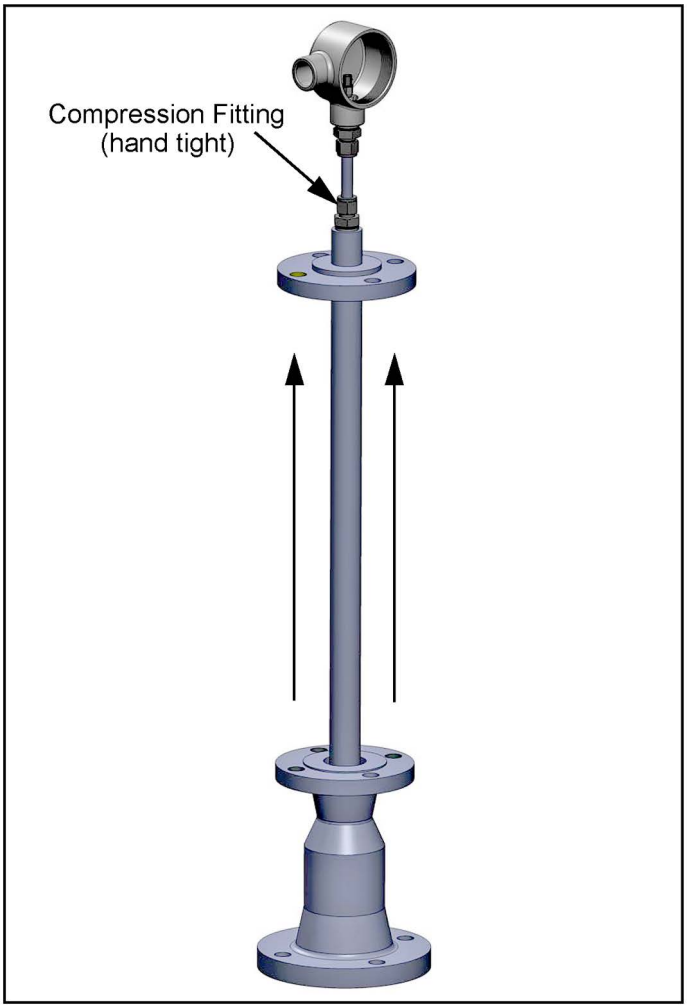
2. Visually inspect the transducer, and make sure the top compression fitting is not loose.

IMPORTANT: The stop ring at the end of the barrel should be loose. DO NOT tighten the compression fitting or you could change the transducer alignment.

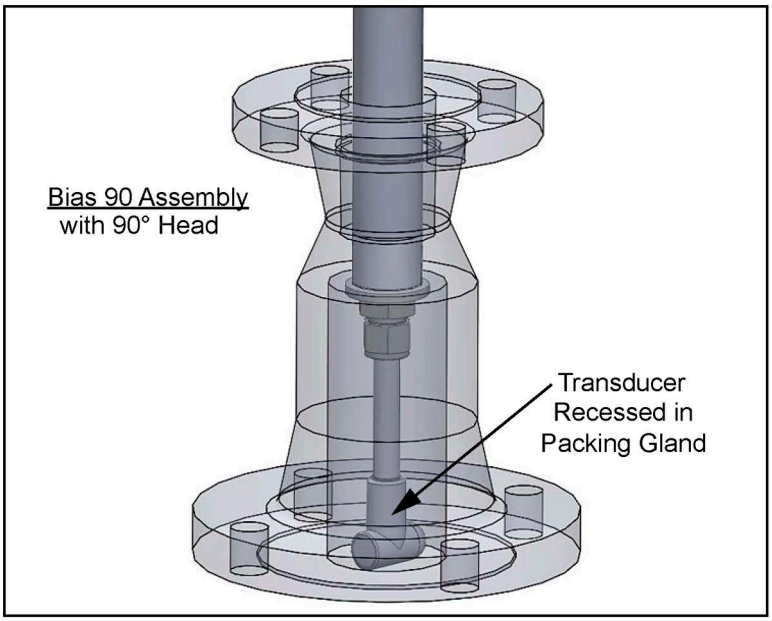
3. Remove the four bolts that fasten the barrel to the packing gland.

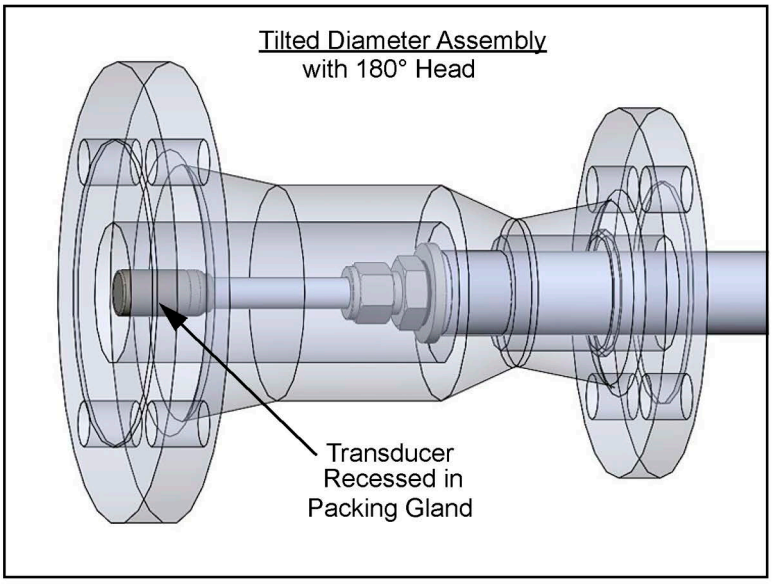


4. Retract the barrel from the packing gland so that the transducer head is recessed in the packing gland. You will hear the stop ring click into place when the transducer is fully recessed.



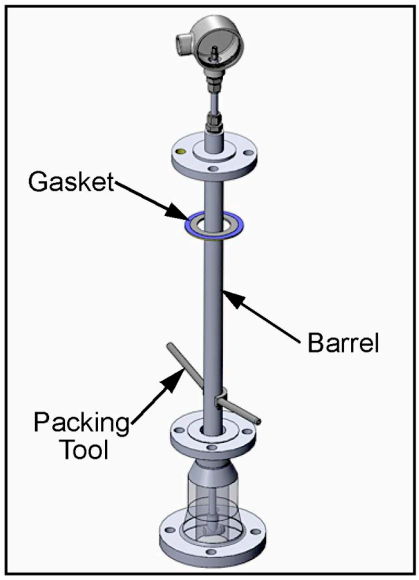
5. Visually inspect the mechanism. Make sure the transducer is recessed in the packing gland. Again, make sure the top compression fitting is secure and hand tight.



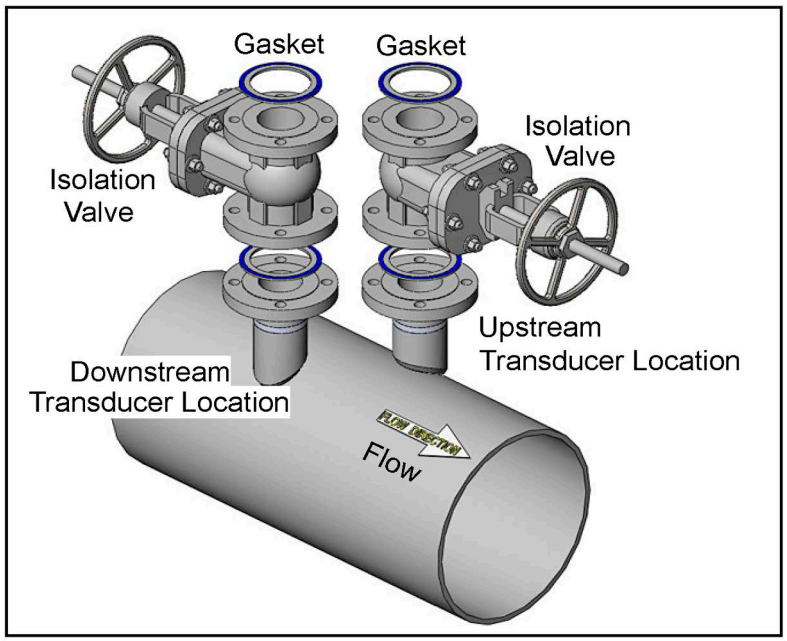


3.3 Mounting the Bias 90 Insertion Mechanism/Transducer Assembly

1. Lift the gasket and insert the packing tool into the packing nut. By turning the packing tool clockwise, tighten the packing material so that the barrel stays up without support.



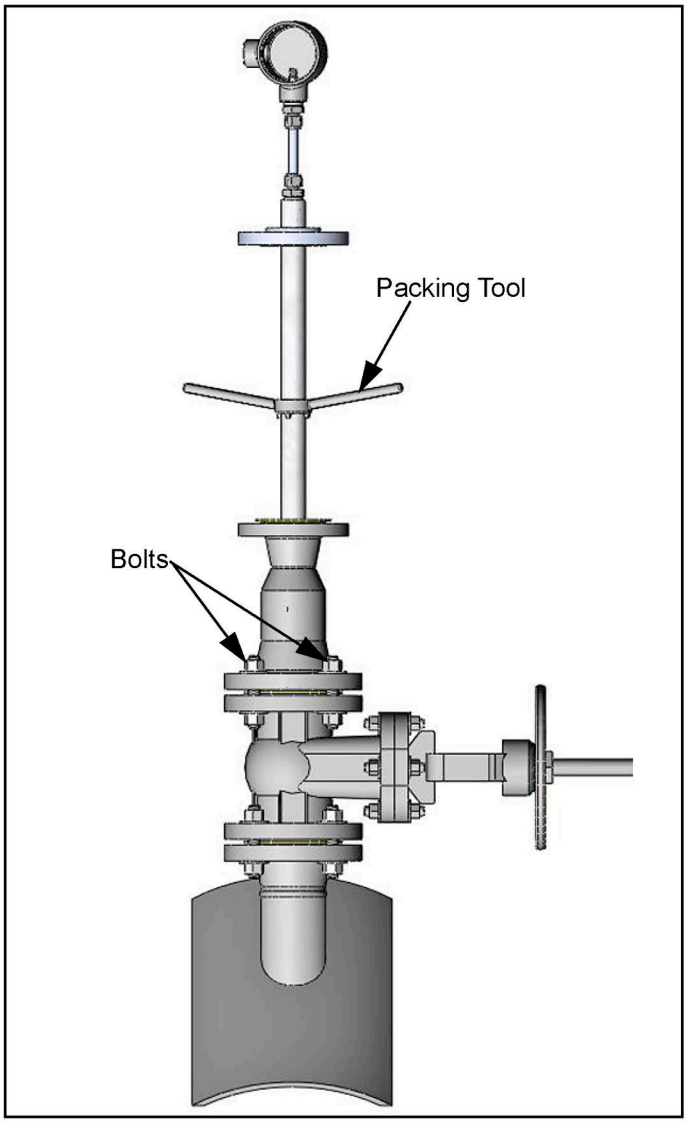
2. Verify that the isolation valves are securely installed with gaskets and hardware. Then, place a gasket on the face of each isolation valve.



3. Identify the upstream and downstream nozzles as follows:
   - For a Standard Velocity Range application, the upstream and downstream nozzles are interchangeable, because the system is bi-directional.
   - For an Extended Velocity Range application, the system is not bi-directional. Note which nozzle is designated as upstream and which is designated as downstream on the pipe. Then, identify the upstream and downstream insertion mechanism assemblies. The downstream assembly is labeled with a ring marked Downstream at the end of the assembly near the junction box (see the figure below).
4. Proceed with either the upstream or downstream assembly.
5. Lift the insertion mechanism by the barrel and place the insertion mechanism on the isolation valve.



6. Line up the flange holes and bolt the packing gland to the isolation valve.

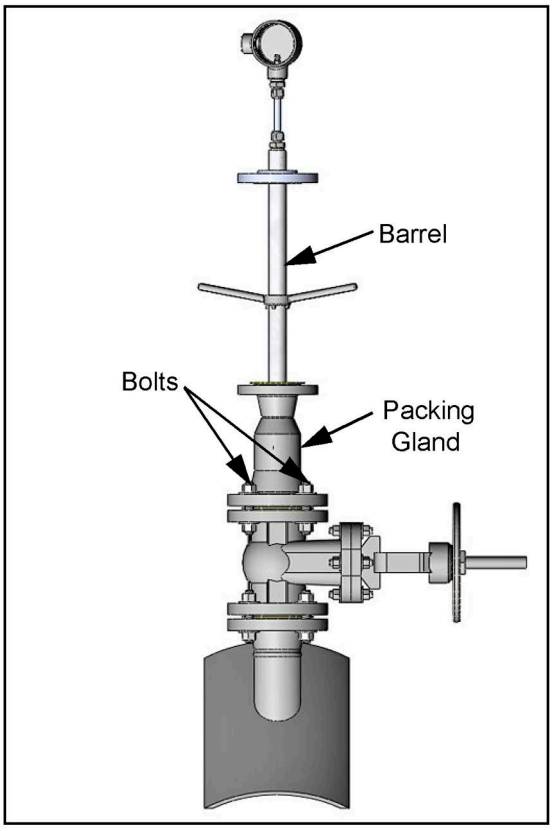


7. Using the packing tool, tighten the packing nut again so the nut is recessed.

WARNING! **The packing material must be securely packed before the isolation valve is opened.**

3.4 Inserting the Bias 90 Transducer into the Pipe

1. Before you open the isolation valve, carefully verify the following:
   - The barrel is pulled up as far as it can go
   - All bolts are secure
   - The transducer head is recessed in the packing gland

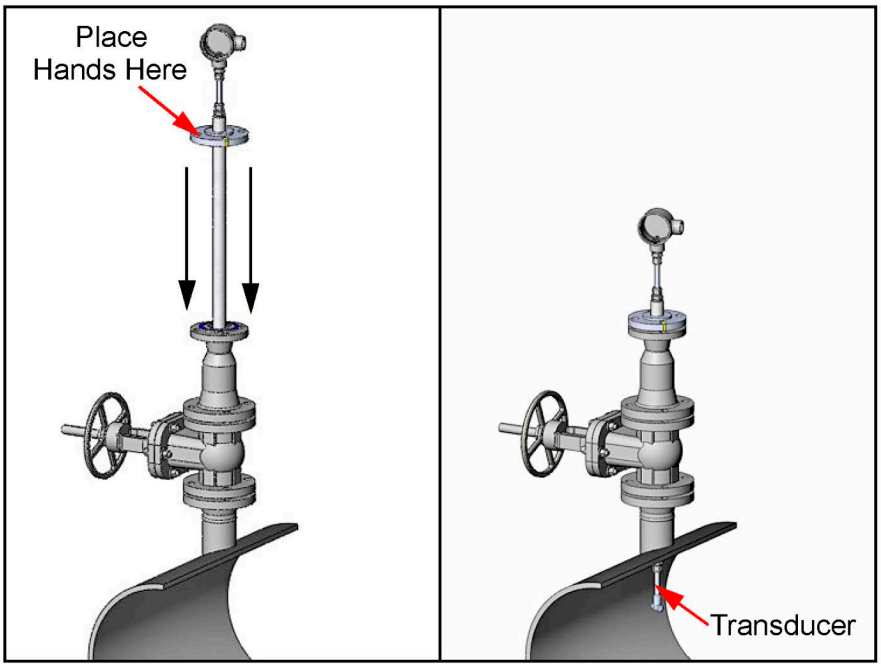




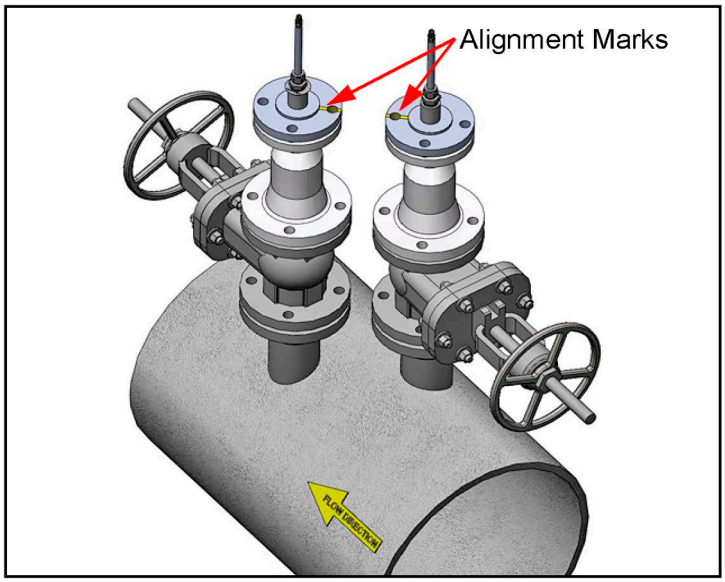
WARNING! **Follow all applicable safety codes and practices before opening the isolation valve.**

2. Open the isolation valve.

3. Placing your hands on top of the barrel, push the barrel/transducer down into the pipe so that the barrel flange and the packing gland flange meet. You may have to twist the barrel to get it moving.

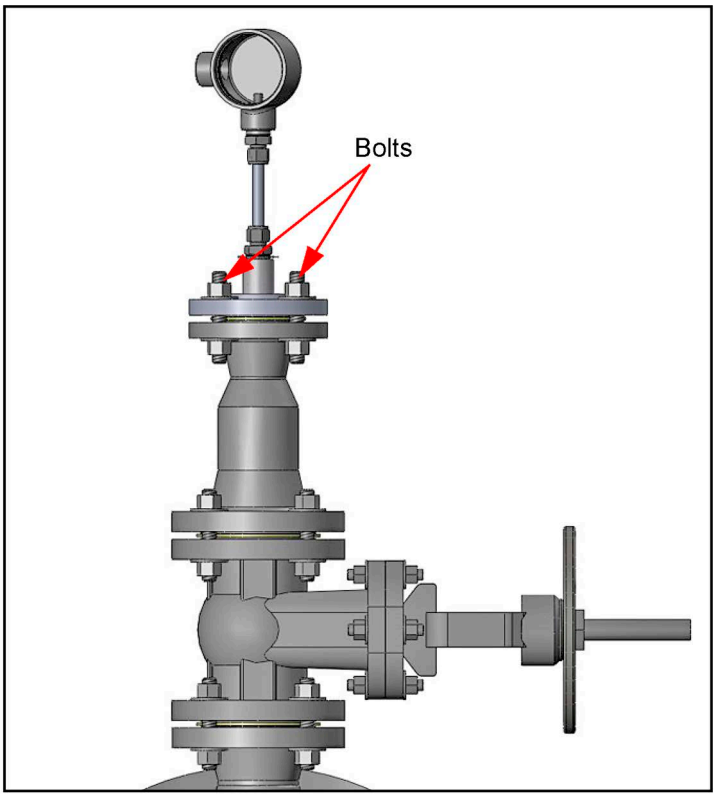


4. For this Bias 90 configuration, orient the alignment marks on each barrel flange so that they are facing each other. The alignment mark, which is marked with yellow paint, is scribed on the top and outside of the flange.



5. Place two bolts into the flange in holes opposite each other, but not in the hole with the scribe mark. Then, hand tighten the nuts.

Note: **DO NOT** insert the remaining bolts until instructed to do so in the following section.



6. Install the second insertion mechanism by repeating the steps in the two previous sections. After the second insertion mechanism is installed, proceed to one of the following sections:
   - “Aligning the Transducers (Standard Velocity Range)” on page 42
   - “Aligning the Transducers (Extended Velocity Range)” on page 42

3.5 Aligning the Transducers (Standard Velocity Range)

For applications with gas flow velocities up to 100 m/s, align the transducers as follows:

Note: *These instructions apply to both the upstream and downstream transducer assemblies.e*

1. Use a straight edge to line up the alignment marks on the two barrel flanges.
2. Place the remaining bolts into the flanges and tighten them securely.
3. Place a tag on each isolation valve stating the following:

DO NOT OPERATE (CLOSE) WHEN
TRANSDUCER IS INSERTED INTO PIPE.

4. Refer to your flowmeter Startup Guide to make the transducer electrical connections.

3.6 Aligning the Transducers (Extended Velocity Range)

For applications with gas flow velocities up to 120 m/s, align the transducers as follows:

Note: *The downstream transducer is pre-installed at the factory in the barrel of the downstream insertion mechanism, to shift the signal direction 6° away from the upstream transducer signal.*

1. Verify that the downstream transducer is located on the right to a person looking from the downstream end of the pipe (see Figure 8 below). Contact Panametrics if the port locations do not follow this convention.

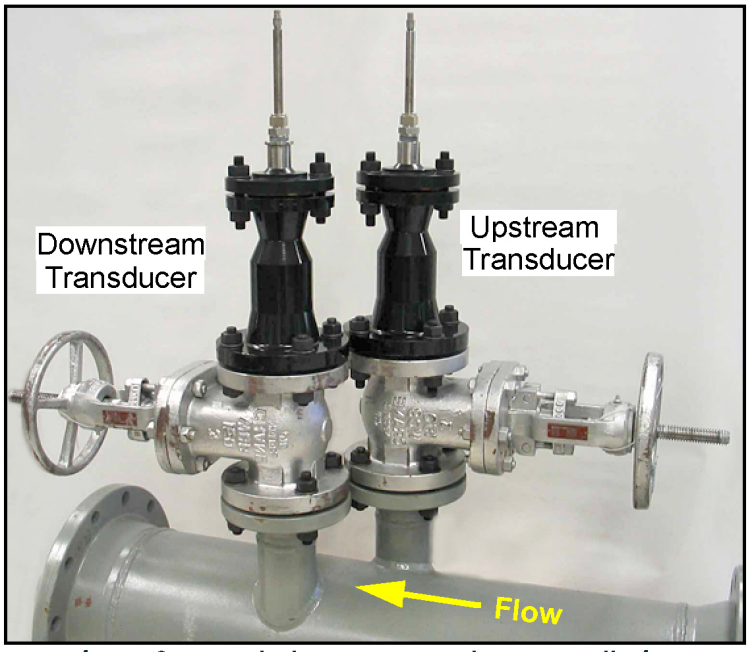


Figure 8: Extended Range Transducer Installation

2. Slide the end slot of the guide plate around the upstream transducer, and rotate the plate until the side slot is around the downstream transducer (see Figure 9 below). Then, align the mark on the upstream transducer barrel with the guide plate mark. Slightly tighten the upstream barrel flange bolts to maintain the alignment.

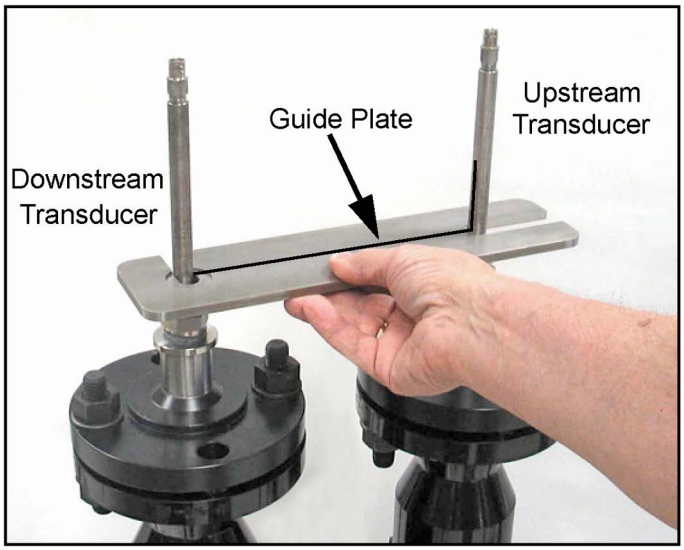


Figure 9: Installing the Guide Plate

3. Place the cover plate on top of the guide plate and slide it as far as possible until it is positioned around the upstream transducer, as shown in Figure 10 below. Then, tighten the screws to secure it.

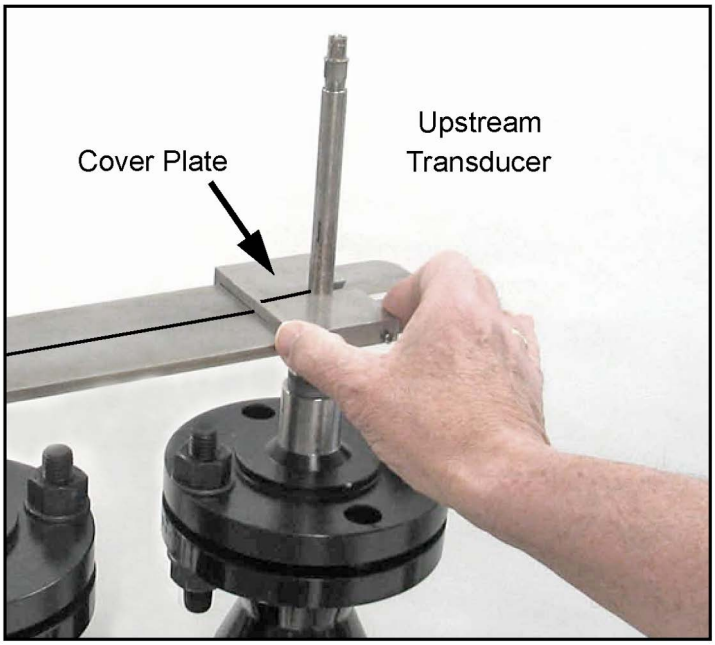


Figure 10: Installing the Cover Plate

4. Slide the locking collar over the downstream transducer to the cavity on top of the guide plate. Align the 6° mark on the top of the collar with the line on the transducer (see Figure 11 below). Then, tighten the collar set screws until the collar is secured to the transducer.

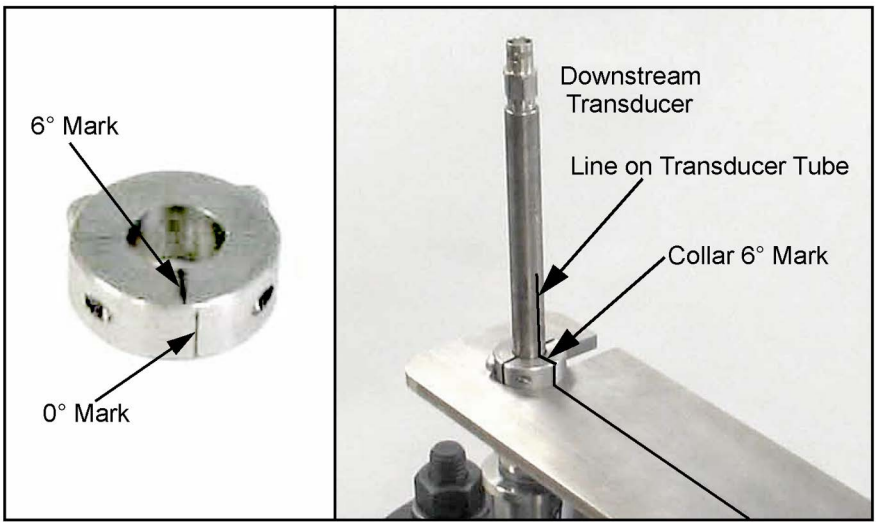


Figure 11: Installing the Locking Collar

5. Check to see if the 0° mark on the side of the locking collar is aligned with the line on the guide plate. If they are not aligned, then loosen the nuts on top of the barrel flange and rotate the transducer assembly until the two lines are aligned (see Figure 12 below). Then, re-tighten the nuts.

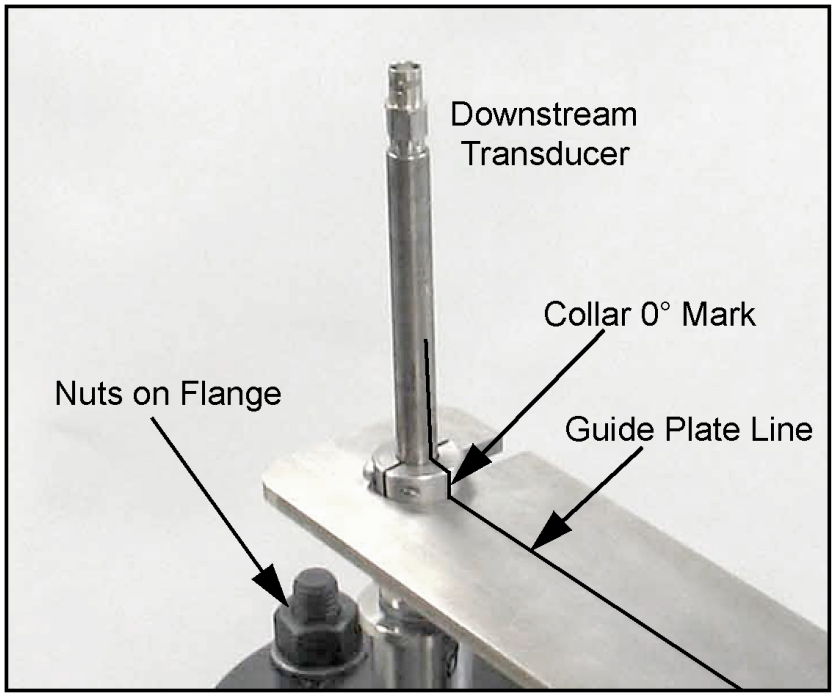


Figure 12: Locking Collar 0° Mark Aligned with Guide Plate Line

6. Check to see if the line on the upstream transducer tube is aligned with the line on the cover plate. If they are not aligned, loosen the nuts on top of the barrel flange and rotate the transducer assembly until the two lines are aligned (see Figure 13 below). Then, re-tighten the nuts.

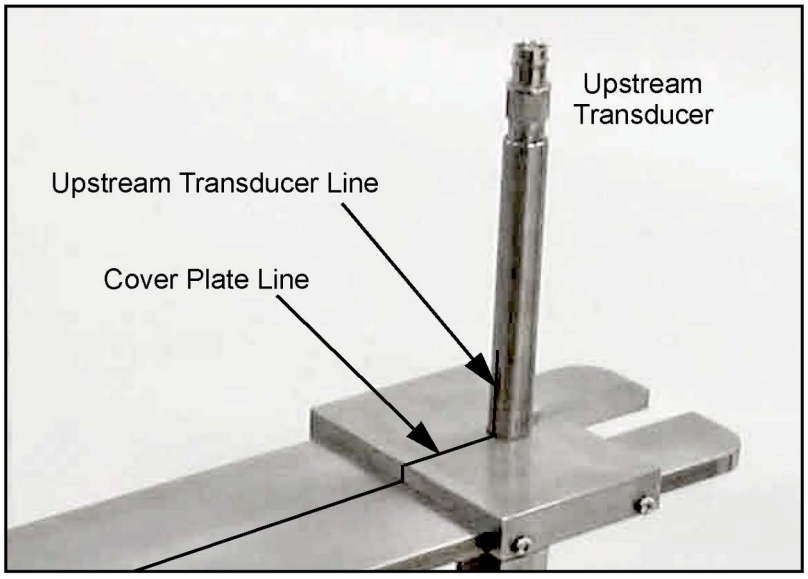


Figure 13: Upstream Transducer Mark Aligned with Cover Plate Linea

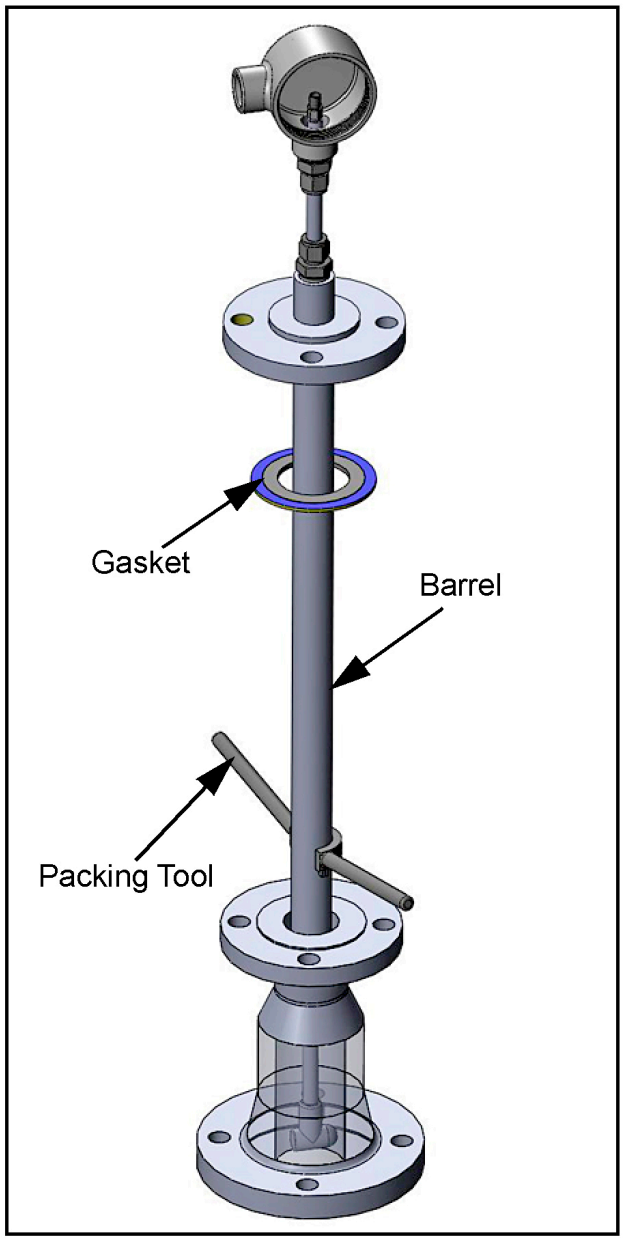
7. Upon completion of the above steps, remove the cover plate, locking collar and guide plate from the transducer assemblies.
8. Place the remaining bolts into the flanges and tighten them securely.
9. Place a tag on each isolation valve stating the following:

DO NOT OPERATE (CLOSE) WHEN
TRANSDUCER IS INSERTED INTO PIPE.

10. Refer to your flowmeter Startup Guide to make the transducer electrical connections.

3.7 Mounting the Tilted 45 Insertion Mechanism/Transducer Assembly

1. Lift the gasket and insert the packing tool into the packing nut. Turning the packing tool clockwise, tighten the packing material so that the barrel will stay up without support.



2. Check and make sure the isolation valves are securely installed with gaskets and hardware. Then, place a gasket on the face of each isolation valve (see either Figure 14 below or Figure 15 on page 48).

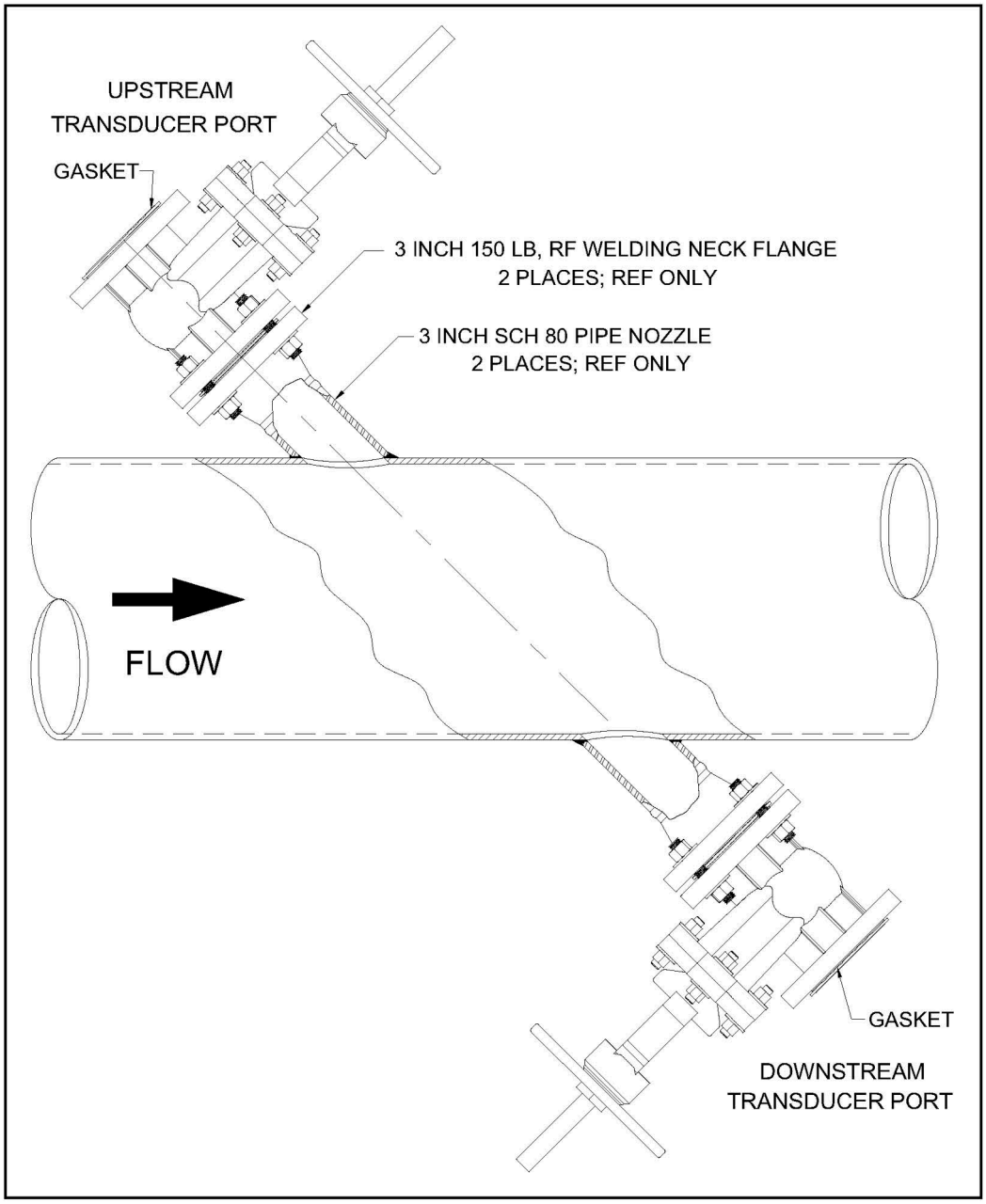


Figure 14: Standard Velocity Range Assembly

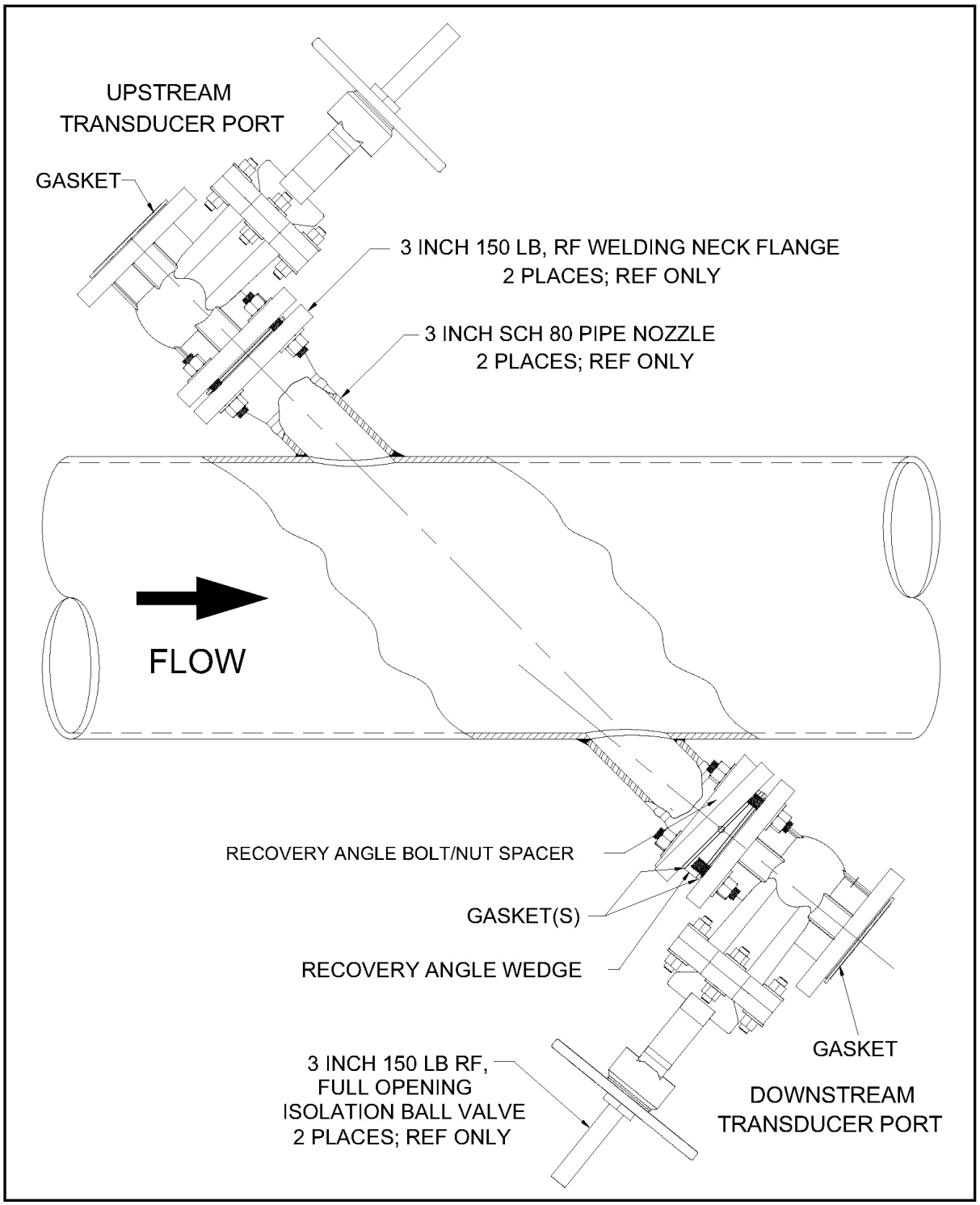
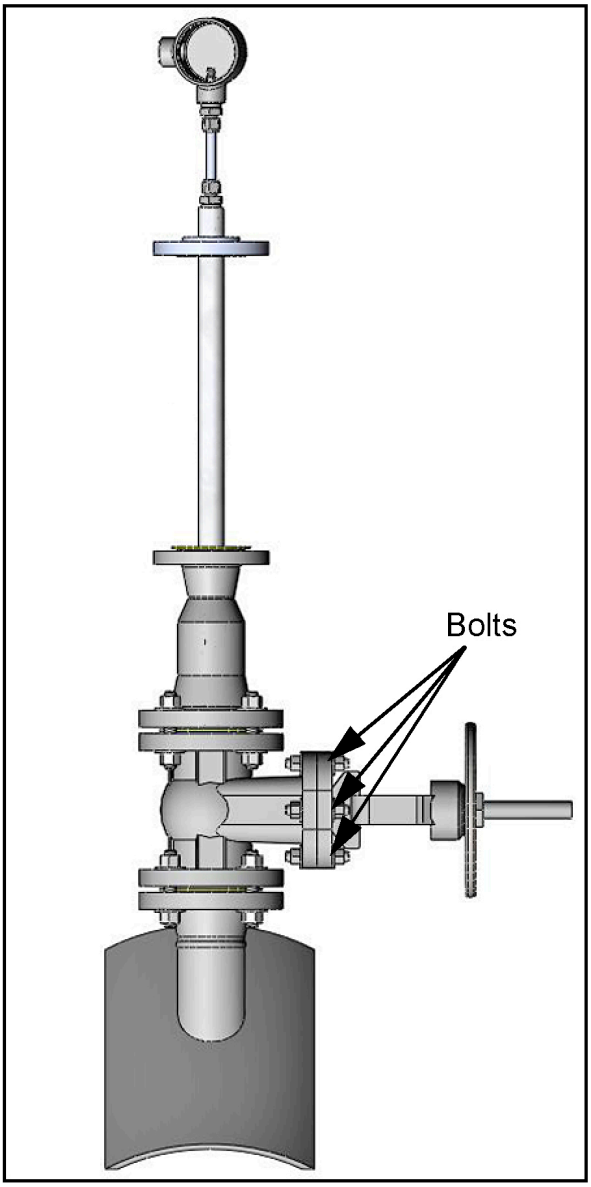


Figure 15: Extended Velocity Range Assembly

3. Identify the upstream and downstream nozzles as follows:
   - For a Standard Velocity Range application, the upstream and downstream nozzles are interchangeable, because the system is bi-directional.
   - For an Extended Velocity Range application, the system is not bi-directional. Note which nozzle is designated as upstream and which is designated as downstream on the pipe. Then, identify the upstream and downstream insertion mechanism assemblies. The downstream assembly is labeled with a ring marked Downstream at the end of the assembly near the junction box (see the figure below).
4. Proceed with either the upstream or downstream assembly.
5. Lift the insertion mechanism by the barrel and place the insertion mechanism on the isolation valve.

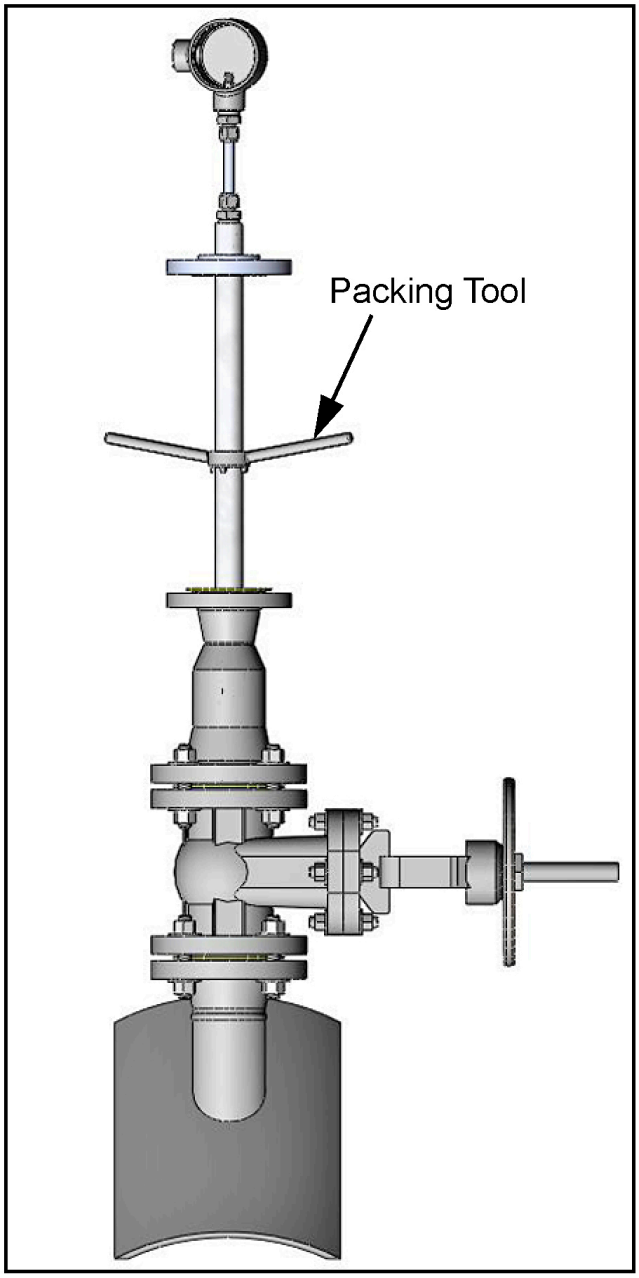


6. Line up the flange holes and bolt the packing gland to the isolation valve.



7. Using the packing tool, tighten the packing nut again until the nut is recessed.

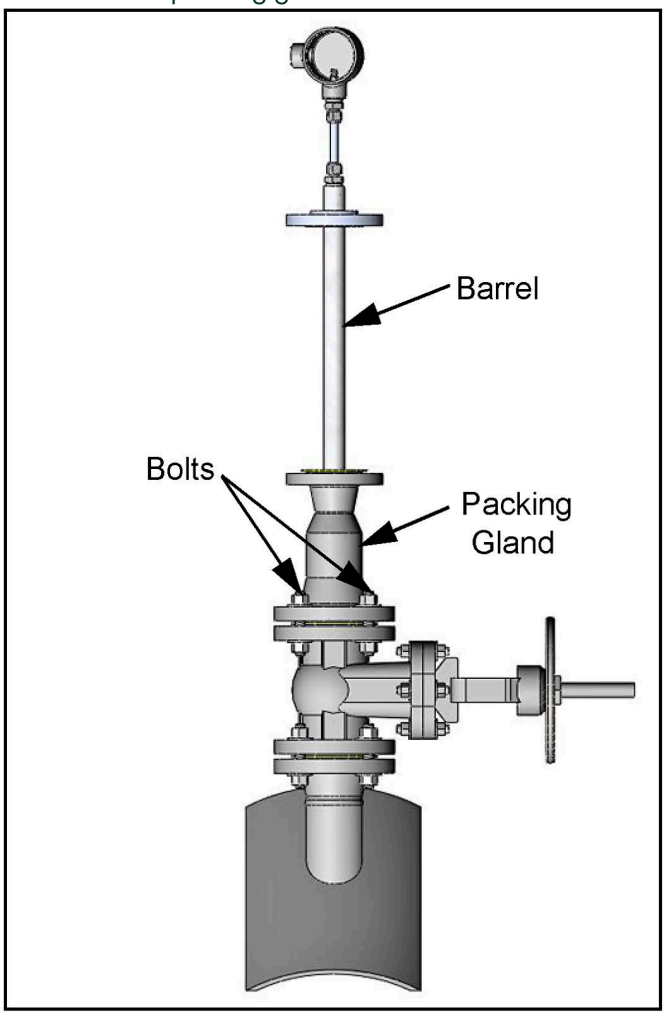
WARNING! **The packing material must be securely packed before the isolation valve is opened.**



3.8 Inserting the Tilted 45 Transducer into the Pipe

1. Before you open the isolation valve, carefully verify the following:

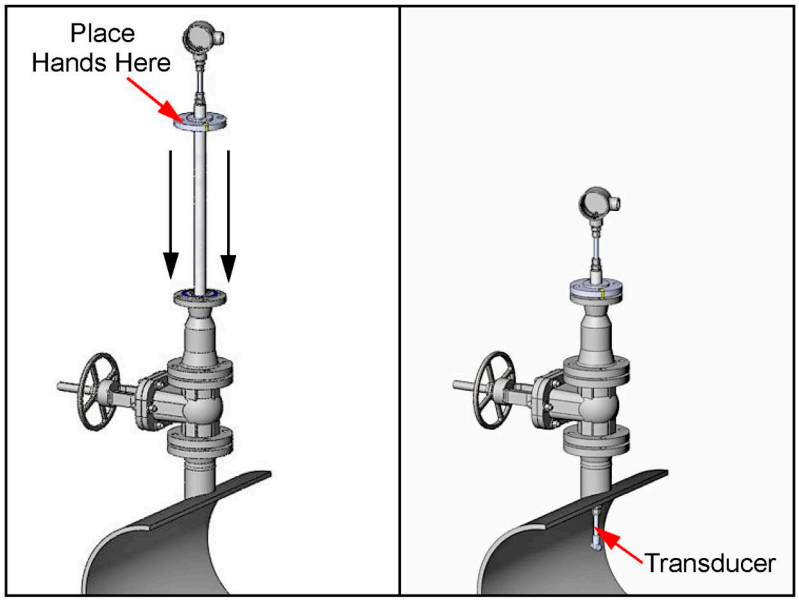
- The barrel is pulled up as far as it can go
- All bolts are secure
- The transducer head is recessed in the packing gland.



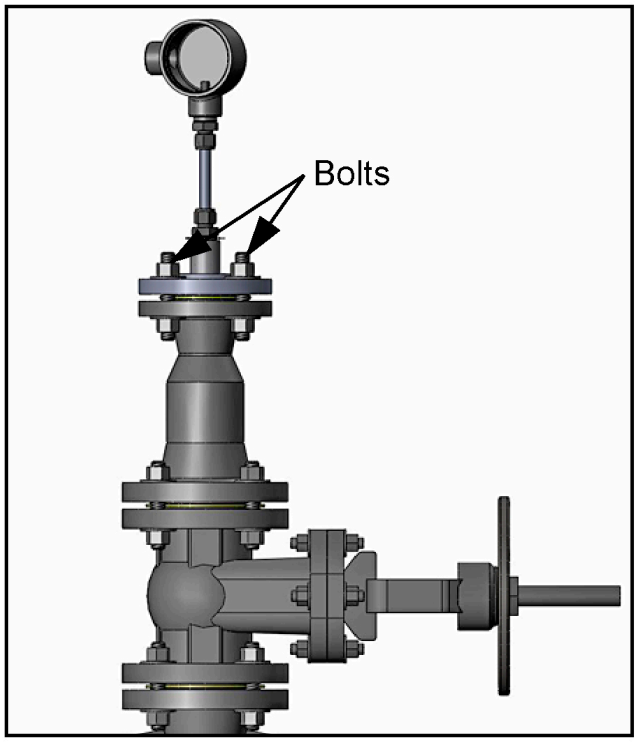
WARNING! **Follow all applicable safety codes and practices before opening the isolation valve.**

2. Open the isolation valve.

3. Placing your hands on top of the barrel, push the barrel/transducer down into the pipe so that the barrel flange and the packing gland flange meet. You may have to twist the barrel to get it moving.



4. Place the bolts into the flange joining the barrel flange to the packing gland flange.
5. 5. Tighten the bolts securely.



6. Install the second insertion mechanism by repeating the steps in the previous sections. Confirm that the downstream transducer assembly is in the downstream port and the upstream transducer assembly is in the upstream port.

Note: *The following steps apply to both the upstream and downstream assemblies equally.*

7. Place a tag on each isolation valve stating the following:

DO NOT OPERATE (CLOSE) WHEN
TRANSDUCER IS INSERTED INTO PIPE

8. Refer to your flowmeter Startup Guide to make the transducer electrical connections.

3.9 Connecting an XAMP

This section explains how to correctly install and assemble an XAMP into a transducer junction box. It applies to all three possible junction box options, but only one of the junction box options is used as an example in the steps below.

1. Place a 3/4" NPT compression fitting on the stem of the transducer closest to the BNC connector.
2. Torque the fitting into one of the 3/4" NPT ports of the junction box with at least 5 threads engaged. After the fitting is torqued into place, ensure that the BNC head of the transducer extends slightly past the ground screw bosses, as shown in Figure 16 below::

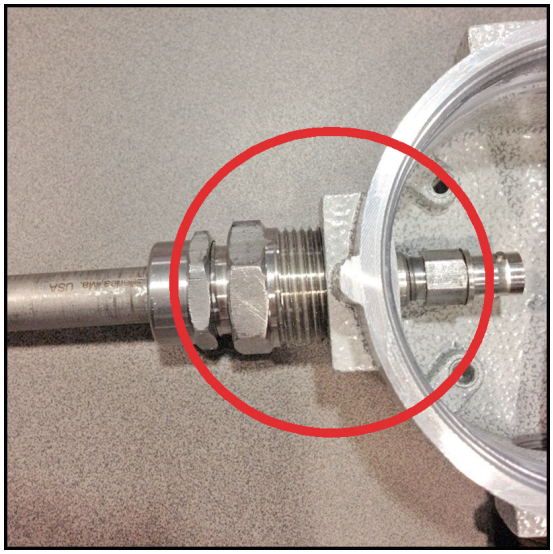


Figure 16: Torquing the NPT Reducer

3. If the BNC head extends too far into the junction box, it will make the assembly more difficult to install by reducing the amount of area needed to properly store the excess cable. If the BNC head is not positioned approximately where it is pictured in Figure 16 above, loosen the compression fitting and adjust the transducer. Then, re-tighten the compression fitting.

4. Torque the cable gland coming from the flowmeter electronics main housing into the other 3/4" NPT port in the junction box until there are at least 5 threads of engagement (see Figure 17 below).

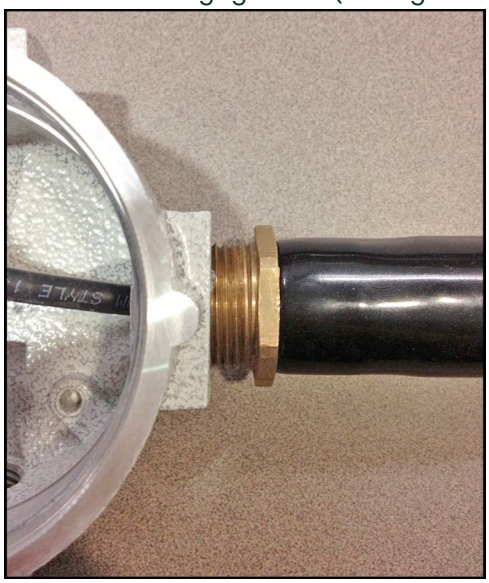


Figure 17: Torquing the Cable Gland

5. Verify that, with the transducer and the cable gland assembled, the junction box looks like Figure 18 below:

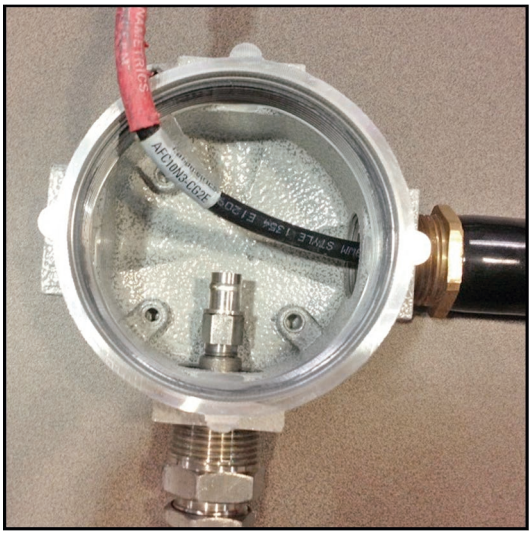


Figure 18: Assembled Transducer and Cable Gland

6. Connect the right angle male BNC plug to the exposed BNC cable from the cable gland assembly, as shown in Figure 19 below.

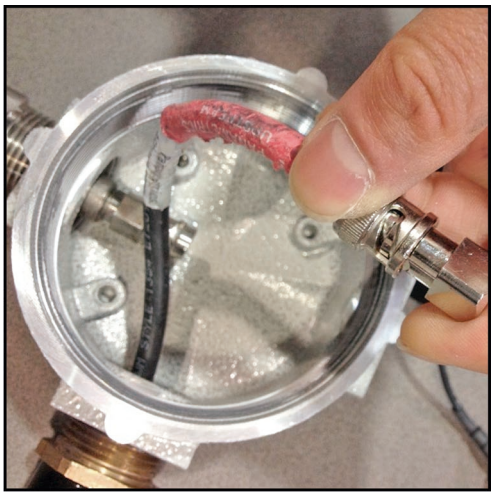


Figure 19: Connecting BNC Plug to the Cable

7. Connect the female BNC plug of the XAMP to the male BNC transducer head as shown in Figure 20 below:



Figure 20: Female Plug to Male BNC Head

8. Wrap the extra length of cable around the inside of the junction box such that the BNC heads do not rest on other cables or on each other. The assembly should now look like Figure 21 below.

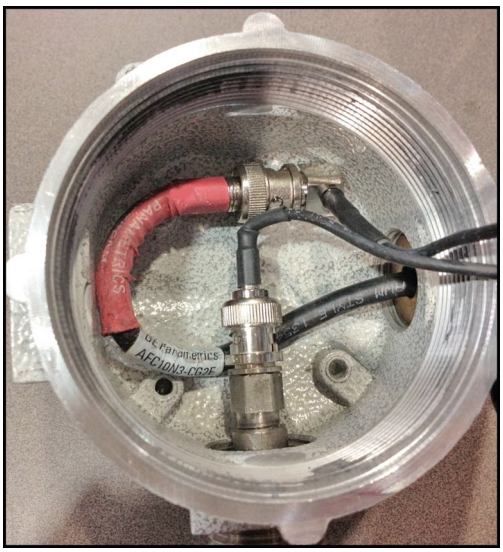


Figure 21: BNC Heads

9. Place the XAMP body into the junction box, resting the puck gently on the cables below it. To reduce stress and strain on the joint. ensure that the cables of the XAMP rest naturally according to the slant at which they exit the epoxy. The XAMP should remain still, and the cap of the junction box should rotate freely around the XAMP.



Figure 22: Junction Box Cap

10. Place the cap of the junction box over the XAMP and tighten the cap until the junction box is firmly closed. Engage the set screw (see Figure 23 below) to secure the cap in place.

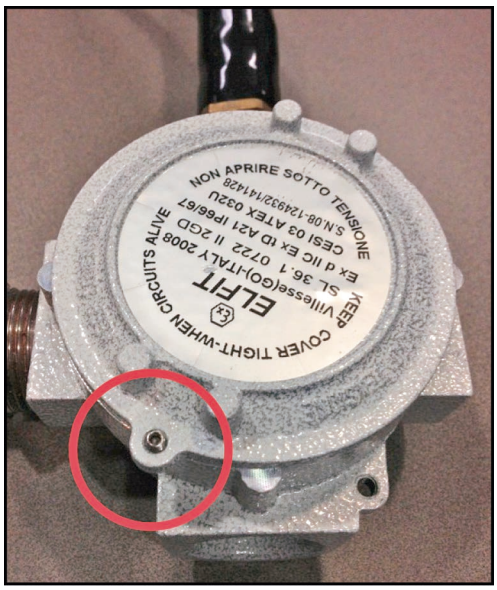


Figure 23: Junction Box Set Screw

Note: *To disconnect or uninstall the XAMP from the assembly, perform the above steps in reverse order.*

Chapter 4. Specifications

4.1 T5/T5 MAX Transducer Physical Specifications

Applications:	Hazardous Area, Flare Gas, Hydrocarbon Gases, Saturated Steam
Installation Type:	Wetted
Material:	Standard: Titanium *Optional: 316 Stainless Steel, Monel® or Hastelloy®*
Field Mounting:	Flowcell, Hot or Cold Tap
Process Connection:	Flanged, 1.5 in. to 3 in. (40 mm to 80 mm)
Holder Type:	Insertion Mechanism
Holder Ratings:	150#, 300#, 600#
Operating Frequency:	Standard: 100 kHz Optional: 50 kHz and 200 kHz
Pressure Range:	0 to 2700 psig Standard, 0 to 1500 psig for USA/Canada Certified Products
Electrical Rating:	200 V peak-to-peak, 5 mA
Ambient Temperature Range:	–40° to +140°F (–40° to +60°C)
Process Temperature Range:	–364° to +572°F (–220° to +300°C) -55°C to 150°C for T5 Max Only

4.2 T5/T5MAX Transducer Certifications

North American - Explosion proof:	Class I, Division 1, Group B, C, D
European/International Flameproof:	II 2 G Ex db IIC T6...XX Gb (T code dependent on Process Temperature) Tamb –40° to +140°F (–40° to +60°C) SIRA 20ATEX10001X, IECEx SIR 20.0006X
North American - Weatherproof:	IP66, TYPE 4X 200Vpp, 5mA
European/International - Weatherproof:	IP 66

4.3 Specific conditions of use

Consult the manufacturer if dimensional information on the flameproof joints is necessary.

It is end-user's responsibility to ensure that the ambient around the T5 and T5MAX assembly does not exceed the permitted ambient of -40°C to +60°C, regardless of process temperature.

The T5 and T5MAX transducers made of titanium (where ff = Ti) are potential ignitions sources when subjected to impact or friction, which shall be taken into consideration during installation.

The T5 and T5MAX have non-conducting coating which may generate an ignition-capable level of electrostatic charge under certain extreme conditions. The user shall take the necessary precautions to minimise the risk from electrostatic discharge. For example, controlling the environmental humidity where installed in order to minimize generation of static electricity, with the equipment protected from direct airflow which could cause a transfer of charge to the surface of the equipment. Cleaning should be done only with a damp cloth.

The temperature classification rating of the T5 and T5MAX assemblies is dependent upon the maximum process temperature (see table below).

Table 3: Temperature Classification Rating of the T5 and T5MAX

Model (where aa = T5, T5MAX)	Process temperature	T-Class
aa-bb-cc-dd-LT-ff-gg-hh-ii-jj-zz	-220°C to +85°C	T6
	+85°C to +100°C	T5
aa-bb-cc-dd-NT-ff-gg-hh-ii-jj-zz	-55°C to +85°C	T6
	+86°C to +100°C	T5
	+101°C to +135°C	T4
	+136°C to +150°C	T3
aa-bb-cc-dd-HT-ff-gg-hh-ii-jj-zz	-50°C to 85°C	T6
	+86°C to +100°C	T5
	+101°C to +135°C	T4
	+136°C to +200°C	T3
	+201°C to +250°C	T2
aa-bb-cc-dd-XT-ff-gg-hh-ii-jj-zz	-180°C to 85°C	T6
	+86°C to +100°C	T5
	+101°C to +135°C	T4
	+136°C to +200°C	T3
	+201°C to +300°C	T2

Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- One year from delivery for electronic or mechanical failures.
- One year from delivery for sensor shelf life.

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a RETURN MATERIAL AUTHORIZATION (RMA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

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Customer Support Centers

U.S.A.
The Boston Center
1100 Technology Park Drive
Billerica, MA 01821
U.S.A.
Tel: 800 833 9438 (toll-free)
978 437 1000
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Shannon, County Clare
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Scan here for Panametrics support and service information

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DigitalFlow™ XGF868i

Flare Gas Mass Flow Ultrasonic Transmitter

Startup Guide



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DigitalFlow™ XGF868i

Flare Gas Mass Flow Ultrasonic Transmitter

Startup Guide

BH060C41 EN E
April 2024

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Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: Training, Product Repairs, Service Agreements and more.

Please visit https://www.bakerhughes.com/panametrics/panametrics-services for more details.

Typographical Convention

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: These paragraphs provide information emphasizing instructions which are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.



WARNING! Indicates a potentially hazardous situation which can result in serious personal injury or death, if it is not avoided.



CAUTION! Indicates a potentially hazardous situation which can result in minor or moderate injury to personnel or damage to the equipment, if it is not avoided.



HIGH VOLTAGE! This symbol indicates the presence of high voltage. It calls your attention to situations or operations that could be dangerous to you and other persons operating the equipment. Read these messages and follow the instructions carefully.

Safety Issues



WARNING! It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area



WARNING! **Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.**



WARNING! **Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on the equipment.**

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

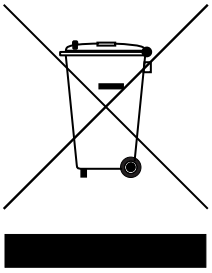
Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

Panametrics is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2012/19/EU.



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

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Chapter 1. Installation

1.1 Introduction

To ensure safe and reliable operation of the *XGF868i Ultrasonic Flow Transmitter*, the system must be installed in accordance with the guidelines established by Panametrics engineers. Those guidelines, which are explained in detail in this chapter, include the following specific topics:

- Unpacking the XGF868i system
- Selecting suitable sites for the electronics enclosure, the flowcell and the transducers
- Installing the flowcell and the transducers

Note: *See the appropriate* Transducer Installation Guide *for detailed instructions on transducer installation.*

- Installing optional temperature and pressure transmitters
- Installing the electronics enclosure
- Wiring the electronics enclosure



WARNING! **The XGF868i flow transmitter can measure the flow rate of many gases, some of which are potentially hazardous. In such cases, observing the proper safety practices is critical. Be sure to follow all applicable local safety codes and regulations for installing electrical equipment and for working with hazardous gases or flow conditions. Consult company safety personnel or local safety authorities to verify the safety of any procedure or practice.**



Attention European Customers!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.

1.2 Unpacking

Carefully remove the electronics enclosure, the transducers, and the cables from the shipping containers. Before discarding any of the packing materials, account for all components and documentation listed on the packing slip. The discarding of an important item along with the packing materials is all too common. If anything is missing or damaged, contact the factory immediately for assistance.

1.3 Site Considerations

Because the relative location of the flowcell and the electronics enclosure is important, use the guidelines in this section to plan the XGF868i installation.



WARNING! **Before beginning installation, please refer to *"Installing Panametrics Measurement & Control Ultrasonic Flow Transmitters in a Potentially Hazardous Area"* near the back of this manual.**

1.3.1 Electronics Enclosure Location

The standard XGF868i electronics enclosure is a powder-coated, cast-aluminum, Type-7/4X explosion-proof enclosure. An optional stainless steel enclosure is available. Typically, the enclosure is mounted as close as possible to the transducers. When choosing a site, make sure the location permits easy access to the electronics enclosure for programming, maintenance and service.

IMPORTANT: For compliance with the EU Low Voltage Directive (2006/95/EC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

1.3.2 Flowcell Location

The pipeline flowcell consists of the flow rate transducers and any pressure and/or temperature transducers employed as part of the flow measurement system. Ideally, choose a section of pipe with unlimited access to the flowcell, such as a long stretch of pipe that is above ground. However, if the flowcell is to be mounted on an underground pipe, dig a pit around the pipe to facilitate installation of the transducers.

1.3.3 Transducer Location

For a given fluid and pipe, the accuracy of the XGF868i depends primarily on the location and alignment of the transducers. In addition to accessibility, when planning for transducer location, adhere to the following guidelines:

1. Locate the transducers so that there are at least 20 pipe diameters of straight, undisturbed flow upstream and 5 pipe diameters of straight, undisturbed flow downstream from the measurement point. To ensure undisturbed flow, avoid sources of turbulence in the fluid such as valves, flanges, expansions, elbows and dips or low spots in which condensed liquid may collect.
2. Because condensate or sediment at the bottom of the pipe may cause attenuation of the ultrasonic signal, locate the transducers on the side of a horizontal pipe, when possible. If limited pipe access necessitates top-mounted transducers and the sound beam path includes a reflection, shift the transducers to at least 10° off top dead center. This will minimize the influence of any sediment on the reflected ultrasonic signals.

1.3.4 Cable Lengths

Locate the electronics enclosure as close as possible to the flowcell and transducers, preferably directly on the flowcell. However, Panametrics can supply transducer cables up to 1000 ft (300 m) in length for remote location of the electronics enclosure. If longer cables are required, contact Panametrics for assistance.

1.3.5 Temperature and Pressure Transmitters

When installing temperature and/or pressure transmitters in the flowcell, locate them downstream of the transducers. These transmitters should be positioned no closer to the XGF868i transducers than 2 pipe diameters and no further away from the transducers than 20 pipe diameters.

1.3.6 Transducer Cables

When installing the transducer cables, always observe established standard practices for the installation of electrical cables. Specifically, do not route transducer cables alongside high-amperage AC power lines or any other cables that could cause electrical interference. Also, protect the transducer cables and connections from the weather and from corrosive atmospheres.

IMPORTANT: When using non-Panametrics cables to connect the flow transducers to the XGF868i electronics enclosure, the cables must have electrical characteristics identical to the Panametrics cables. Type RG62A/U coaxial cable should be used, and each cable must be the same length (within ±4 in.).

All interconnecting cables must comply with IEC/EN 60079-14.

1.4 Installing a Flowcell

A flowcell is the section of pipe upon which the transducers are mounted. It can be created either by mounting the transducers on the existing pipeline or by mounting them on a spoolpiece. A spoolpiece is a separately manufactured pipe section, matched to the existing pipe, which contains ports for mounting the transducers. This approach allows the transducers to be aligned and calibrated before inserting the spoolpiece into the pipeline.

Figure 6 on page 18 shows a typical right-angle mounting bracket for installing the XGF868i electronics enclosure. For detailed instructions on installing the transducers and the spoolpiece, refer to any supplied drawings and to the appropriate *Transducer Installation Guide*.

1.5 Installing Temperature and Pressure Transmitters

Optional temperature and pressure transmitters may be installed near the ultrasonic transducer ports as part of the flowcell. Be sure to observe the siting requirements given earlier in this chapter. These transmitters should send a 0/4-20 mA signal to the XGF868i. In turn, the XGF868i must be fitted with a suitable option card to process the signals and to provide the required 24 VDC power to the transmitters. Any desired transmitters or sensors may be used, but they must have an accuracy equal to ±0.5% of the reading or better.

Note: *Resistive Thermal Devices (RTDs) are a good choice for measuring the temperature.*

Typically, a 1/2" NPT or 3/4" NPT female threaded port is used to mount the transmitters on the flowcell. If the pipeline is insulated, the coupling may need to be extended to provide convenient access. Of course, other types of mounting ports, including flanged ports, may be used for the transmitters.

Figure 1 below shows a typical mounting arrangement for the pressure and temperature transmitters. The temperature sensor should extend into the pipe by 1/4 to 1/2 of the pipe inside diameter.

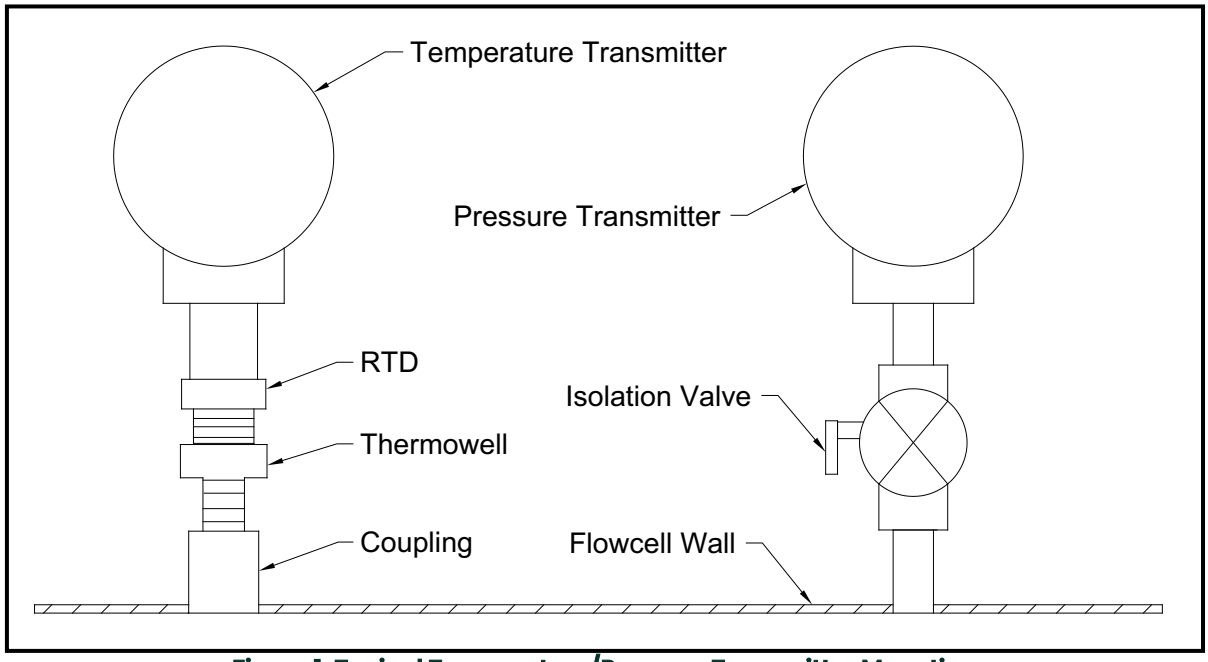


Figure 1: Typical Temperature/Pressure Transmitter Mounting

1.6 Mounting the XGF868i Electronics Enclosure

The standard XGF868i electronics package is housed in a Type-4X weather-resistant enclosure suitable for indoor or outdoor use. Refer to *Figure 5 on page 17* for the mounting dimensions and the weight of this enclosure.

The XGF868i electronics enclosure is fitted with a mounting boss that has a single 3/4" NPT-F threaded hole at its center and four 1/4-20 tapped holes at its corners. By using this mounting boss, the electronics enclosure may be mounted by any of the typical techniques shown in *Figure 6 on page 18*.



WARNING! Proper grounding of the XGF868i chassis is required to prevent possible electric shock. See *Detail A in Figure 6 on page 18* for the location of the chassis grounding screw.

1.7 Making the Electrical Connections

This section contains instructions for making all the necessary electrical connections to the XGF868i flow transmitter. Refer to *Figure 7 on page 19* for a complete wiring diagram.



WARNING! Refer to *Installing Panametrics Ultrasonic Flow Transmitters in a Potentially Hazardous Area* near the rear of this manual for additional installation instructions.

Except for the power connector, all electrical connectors are stored on their terminal blocks during shipment and may be removed from the enclosure for more convenient wiring. Simply, feed the cables through the conduit holes on the side of the enclosure, attach the wires to the appropriate connectors and plug the connectors back onto their terminal blocks.



WARNING! To ensure safe and reliable operation of the XGF868i, be sure to install and tighten all cable glands in accordance with the gland manufacturer's instructions.



WARNING! To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.



WARNING! Always disconnect the line power from the XGF868i before removing either the front cover or the rear cover. This is especially important in a hazardous environment.

Refer to *Figure 2* below and prepare the XGF868i for wiring by completing the following steps:

1. Disconnect any existing power line from its source.
2. Loosen the set screw on the rear cover.

3. Place a rod or long screwdriver across the cover in the slots provided, and rotate the cover counterclockwise until it comes free from the enclosure.
4. Install any required cable clamps in the appropriate conduit holes around the side of the enclosure.
5. Note the labels inside the rear cover to assist in wiring the power and option card connections. Also, *Figure 8 on page 20* shows the rear cover option card labels for every available option card configuration.

Proceed to the appropriate section of this chapter to make the desired wiring connections.

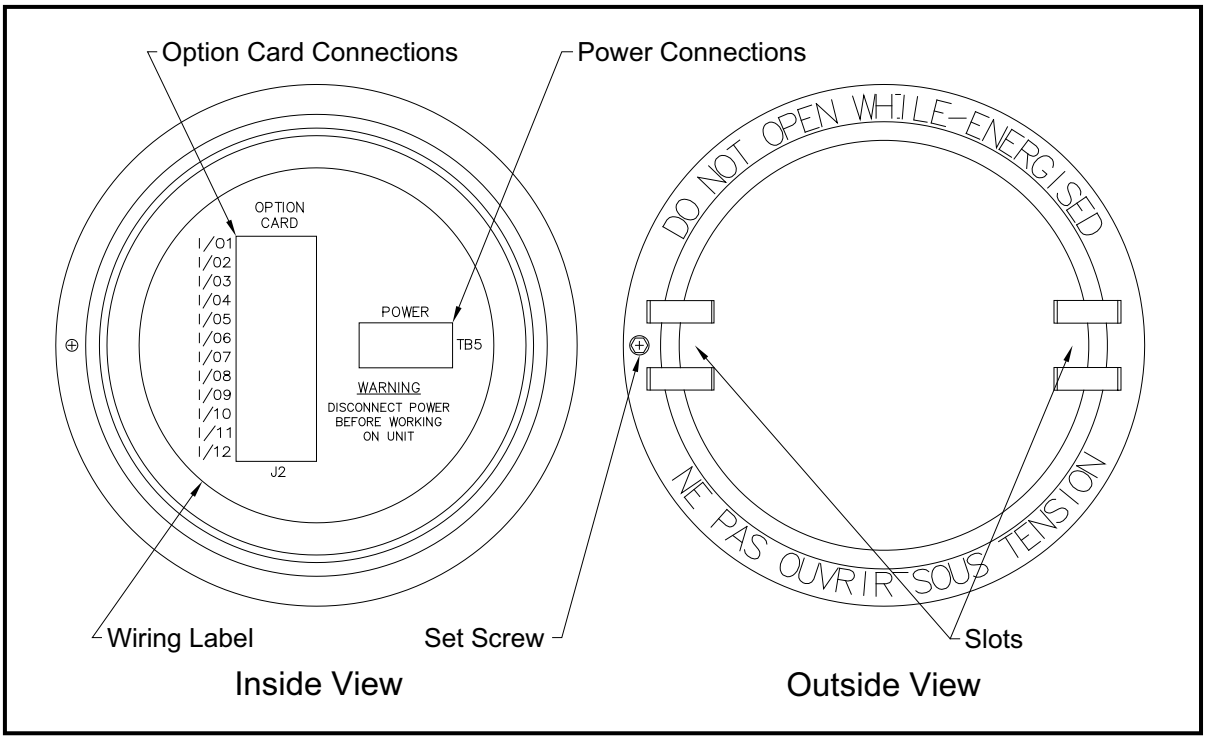


Figure 2: Rear Cover with Connection Labels

1.7.1 Wiring the Line Power

The XGF868i may be ordered for operation with power inputs of 100-120 VAC, 220-240 VAC, or 12-28 VDC. The label on the side of the electronics enclosure lists the required line voltage and the power rating for the unit. Be sure to connect the meter only to the specified line voltage. The fuse size is listed in *Table 1* below.

Table 1: Line Voltages and Fuse Ratings

Line Voltage	Fuse Rating
85-250 VAC	Not field-replaceable (contact Panametrics)
12-28 VDC	2.0 A, Slow-Blow

IMPORTANT: For compliance with the EU Low Voltage Directive (2006/95/EC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

Note: *Only use Class 2 Rated Power supply for line power connection to DC instrument.*

Refer to *Figure 7 on page 19* to locate terminal block TB5 and connect the line power as follows:



HIGH VOLTAGE! **Improper connection of the line power leads or connecting the meter to the incorrect line voltage may damage the unit. It may also result in hazardous voltages at the flowcell and associated piping as well as within the electronics enclosure.**

1. Prepare the line power leads by trimming the line and neutral AC power leads (or the positive and negative DC power leads) to a length 0.5 in. (1 cm) shorter than the ground lead. This ensures that the ground lead is the last to detach if the power cable is forcibly disconnected from the meter.
2. Install a suitable cable clamp in the conduit hole indicated in *Figure 7 on page 19*. If possible, avoid using the other conduit holes for this purpose, to minimize any interference in the circuitry from the AC power line.



WARNING! **To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.**

3. Strip 1/4 in. of insulation from the end of each of the three power line leads.
4. Route the cable through the conduit hole and connect the line power leads to terminal block TB5, using the pin number assignments shown in *Figure 7 on page 19*.
5. Leaving a bit of slack, secure the power line with the cable clamp.



WARNING! **Make sure that both covers with the o-ring seals are installed and the set screws are tightened before applying power to the unit in a hazardous environment.**



CAUTION! **The transducers must be properly wired before applying power to the meter.**

1.7.2 Wiring the Transducers and Preamplifiers

Before wiring the XGF868i transducers and preamplifiers, complete the following steps:

- Disconnect the main power from the electronics enclosure
- Remove the rear cover and install all required cable clamps

The *electronics enclosure* may be located either directly on the flowcell (*local*) or some distance away from the flowcell (*remote*). The *preamplifiers* may be located either in the transducer junction boxes (*local*) or some distance away from the transducers in their own separate enclosures (*remote*). Based on the specific configuration of your system, proceed to one of the following sections for detailed instructions:

- Local or Remote electronics enclosure with **Local preamplifiers** (see *Section 1.7.2.1 on page 8*)
- Local or Remote electronics enclosure with **Remote preamplifiers** (see *Section 1.7.2.2 on page 9*)

1.7.2.1 Local or Remote Electronics Enclosure with Local Preamplifiers



WARNING! **Before connecting the transducers, take them to a safe area and discharge any static buildup by shorting the center conductor of the transducer cables to the metal shield on the cable connector.**

IMPORTANT: The cable lengths for a given pair of transducers, including the preamplifier-to-electronics enclosure cables, must be equal to within ±4 in. (10 cm) of each other.

For an XGF868i system configured with either a local or remote electronics enclosure and local preamplifiers, wire the transducers and preamplifiers as follows:

1. The local preamplifier must be installed in the junction box on the end of the transducer. Connect the BNC cable with the mating connector from the preamplifier to the transducer BNC connector.
2. Locate the two CH1 preamplifier-to-electronics enclosure cables and connect one to each of the two CH1 preamplifiers in the junction boxes, using the remaining preamplifier connections. Then, feed the free ends of the cables through the selected conduit holes in the electronics enclosure.
3. See *Figure 7 on page 19* for the location (**J3**) of the connections for the Channel 1 transducers in the electronics enclosure. Then, refer to *Figure 10* to wire the transducer to preamplifier and preamplifier to electronics enclosure connections.

Note: *The* RED *cable leads are the SIG(+) leads and the* BLACK *cable leads are the RTN(-) leads.*



Attention European Customers!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.

4. For a 2-Channel XGF868i, repeat steps 1-3 to connect the CH2 transducers to terminal block **J4** in the electronics enclosure. Note that it is not required that both channels of a 2-channel unit be connected.
5. If wiring of the system has been completed, reinstall the rear cover and o-ring on the electronics enclosure and tighten the set screw.

Note: *A channel must be activated in the* Channel Menu *before it can begin taking measurements. See* Chapter 2, Initial Setup*, for instructions.*

1.7.2.2 Local or Remote Electronics Enclosure with Remote Preamplifiers



WARNING! **Before connecting the transducers, take them to a safe area and discharge any static buildup by shorting the center conductor of the transducer cables to the metal shield on the cable connector.**

IMPORTANT: The cable lengths for a given pair of transducers, including the preamplifier-to-electronics enclosure cables, must be equal to within ±4 in. (10 cm) of each other.

Note: *A dual preamplifier is typically used in these installations, and you must note the labeled upstream and downstream connections on the preamplifier. Be sure to connect the upstream transducer to the upstream connection on the preamplifier and in the XGF868i electronics enclosure. Follow the same procedure for the downstream connections.*

The remote preamplifier (PRE868) uses a transformer (p/n 705-603) which connected to the **"XDCR"** *BNC connector on the preamplifier (see* Figure 9 on page 21*).*

For an XGF868i system configured with either a local or remote electronics enclosure and a *dual remote preamplifier*, wire the transducers and preamplifier as follows:

1. Refer to *Figure 9 on page 21* and use the pair of coaxial cables with BNC to BNC connectors supplied by Panametrics (or equivalent cables) to connect both **CH1** transducers to the dual preamplifier, using the connections on the transformer.



CAUTION! **As part of maintaining the FM/CSA environmental rating (TYPE 4) on the remote preamplifier, thread sealant is required on all conduit entries.**

2. If an optional lightning protector is installed, connect it between the preamplifier and the electronics enclosure. Locate the device near the electronics enclosure and install it according to the supplied wiring documentation for the device.
3. See *Figure 7 on page 19* for the location (**J3**) of the connections for the Channel 1 transducers in the electronics enclosure. Using the supplied coaxial cables with BNC to flying lead connectors (or equivalent cables), route the cables through one of the conduit holes in the electronics enclosure and connect the preamplifier to terminal block **J3**. Secure the cables with the cable clamp.

Note: *The* RED *cable leads are the SIG(+) leads and the* BLACK *cable leads are the RTN(-) leads..*



Attention European Customers!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.

4. For a 2-Channel XGF868i, repeat steps 1-3 to connect the CH2 transducers to terminal block **J4** in the electronics enclosure. Note that it is not required that both channels of a 2-channel unit be connected.
5. If wiring of the system has been completed, reinstall the rear cover and o-ring on the electronics enclosure and tighten the set screw.

Note: *A channel must be activated in the* Channel Menu *before it can begin taking measurements. See* Chapter 2, Initial Setup*, for instructions.*

1.7.3 Wiring Std 0/4-20 mA Analog Outputs

The standard configuration of the XGF868i flow transmitter includes two isolated 0/4-20 mA analog outputs (designated as outputs 1 and 2). Connections to these outputs may be made with standard twisted-pair wiring, but the current loop impedance for these circuits must not exceed 600 ohms.

To wire the analog outputs, complete the following steps:

1. Disconnect the main power and remove the rear cover.
2. Install the required cable clamp in the chosen conduit hole on the side of the electronics enclosure.
3. Refer to *Figure 7 on page 19* for the location of terminal block **J1** and wire the analog outputs as shown. Secure the cable clamp.

Note: *Analog outputs 1 and 2 in the wiring diagram correspond to analog outputs A and B in Slot 0 in the XGF868i software.*



WARNING! **To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.**

4. If wiring of the unit has been completed, reinstall the rear cover on the enclosure and tighten the set screw.



WARNING! **Make sure that both covers with the o-ring seals are installed and the set screws are tightened before applying power to the unit in a hazardous environment.**

Note: *Prior to use, the analog outputs must be set up and calibrated. See Chapter 1,* Calibration*, of the* Service Manual *for detailed instructions.*

1.7.4 Wiring the Serial Port

The XGF868i flowmeter is equipped with an RS232 serial interface. The serial port is used to transmit stored data and displayed readings to a personal computer by connecting the meter's serial interface to the serial port of the PC. In addition, the XGF868i can receive and execute remote commands, using the *Instrument Data Manager* or *PanaView* software via this link.

For more information on serial communications refer to your *EIA-RS Serial Communications* manual (916-054). Proceed to the appropriate sub-section for wiring instructions.



WARNING! **To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.**

1.7.4.1 Wiring the RS232 Interface

Use the serial port to connect the XGF868i flow transmitter to a printer, an ANSI terminal or a personal computer. The RS232 interface is wired as Data Terminal Equipment (DTE). *Table 2* below lists the standard cables available from the factory for this purpose.

Table 2: Panametrics Serial Cables

Part Number	PC Connector	XGF868i Connector
704-659	DB-25 Male	Flying Leads (5)
704-660	DB-9 Male	Flying Leads (5)
704-661	DB-25 Female	Flying Leads (5)
704-662	DB-9 Female	Flying Leads (5)

Each of the cables listed in the table above is available in several standard lengths. However, a user-supplied cable may be used, if preferred. In either case, wire the XGF868i end of the serial cable in accordance with the pin designations listed in *Table 3*.

Refer to *Figure 7 on page 19* to complete the following steps:



HIGH VOLTAGE! Dangerous voltages exist within the electronics enclosure. Do not attempt to wire the unit until the main power has been disconnected.

1. Disconnect the main power and remove the rear cover.



WARNING! The XGF868i must be moved to a safe environment before removing either cover

2. Install the required cable clamp in the chosen conduit hole on the side of the electronics enclosure.
3. Use the information in *Table 3* below to construct a suitable cable for connecting the XGF868i to the external device. If desired, an appropriate cable may be purchased from Panametrics.

Table 3: RS232 Connection to DCE or DTE Device

J1 Pin #	Signal Description	DCE DB25 Pin #	DCE DB9 Pin #	DTE DB25 Pin #	DTE DB9 Pin #
5	DTR (Data Terminal Ready)	20	4	20	4
6	CTS (Clear to Send)	4	7	5	8
7	COM (Ground)	7	5	7	5
8	RX (Receive)	2	3	3	2
9	TX (Transmit)	3	2	2	3

4. Feed the cable's flying leads through the conduit hole and wire it to terminal block J1. Connect the other end of the cable to the external serial device and secure the cable clamp.

After the wiring has been completed, consult the *User's Manual* for the external device to configure it for use with the XGF868i.

1.7.5 Wiring the Option Cards

The XGF868i can accommodate one option card in **Slot 1** and one option card in **Slot 2**. The following option card functions are available only in the combinations listed in *Table 13*:

- Analog Inputs (Slot 1)
- Totalizer/Frequency Outputs (Slot 1)
- RTD Inputs (Slot 1)
- Analog Outputs (Slot 1)
- MODBUS Communications (Slot 2)
- MODBUS/TCP Communications (Slot 2)
- Ethernet (Slot 2)
- Foundation Fieldbus (Slot 2)
- Data Logging (Slot 2) - *no wiring required*

Wiring any option card installed in Slot 1 requires completion of the following general steps:

1.7.5.1 Preparing for Wiring

1. Disconnect the main power and remove the rear cover.
2. Install a cable clamp in the chosen conduit hole on the side of the electronics enclosure and feed a standard twisted-pair cable through this conduit hole.
3. Locate the 12-pin terminal block (**J2**) in *Figure 7 on page 19* and wire the option card as indicated on the label inside the rear cover (see *Figure 2 on page 6* and *Figure 8 on page 20*). Secure the cable clamp.

IMPORTANT: Because of the attached wiring label, all rear covers must remain with their original meters.



WARNING! **To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.**

4. If wiring of the unit has been completed, reinstall the rear cover on the enclosure and tighten the set screw.

Note: *Prior to use, the option card must be set up and calibrated. See Chapter 1,* Programming Site Data*, in the* Programming Manual *and Chapter 1,* Calibration*, in the* Service Manual *for detailed instructions.*

For more specific instructions on particular option cards, proceed to the appropriate section(s) that follow.

1.7.5.2 Wiring a 0/4-20 mA Analog Inputs Option Card

To calculate the standard flow rates, the XGF868i requires accurate *temperature* and *pressure data* from the measurement site. Transmitters installed in the flowcell can provide this information via an optional 0/4-20 mA analog inputs option card. This option card includes two or four isolated 0/4-20 mA analog inputs (designated as A, B, C and D), each of which includes a 24 VDC power supply for loop-powered transmitters. Either input may be used to process the temperature signal, while the other input is used to process the pressure signal.

Note: *To properly enter programming data into the meter, it is necessary to know which input is assigned to which process parameter. This information should be entered in Appendix B,* Data Records*.*

The analog inputs, which have an impedance of 118 ohms, should be connected with standard twisted-pair wiring. Power to the transmitters may be supplied either by the integral 24 VDC power supply on the analog input option card or by an external power supply. *Figure 3* below shows typical wiring diagrams, with and without an external power supply, for one of the analog inputs.

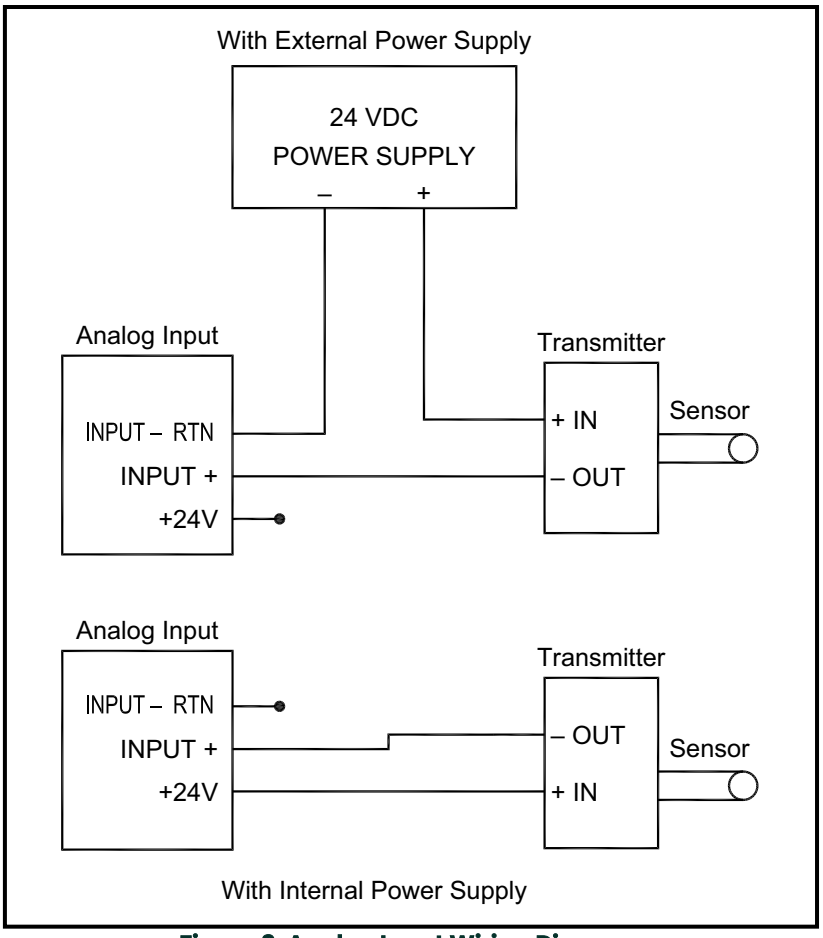


Figure 3: Analog Input Wiring Diagram

Before making any connections, complete the steps in *Preparing for Wiring* on *page 12*. Wire the analog inputs as shown on the label in the rear cover (see *Figure 8 on page 20*).

Note: *The analog inputs option card can be calibrated with the XGF868i built-in analog outputs. However, be certain that the analog outputs have been calibrated first. See Chapter 1,* Calibration*, in the* Service Manual *for the appropriate procedures.*

1.7.5.3 Wiring a Totalizer/Frequency Outputs Option Card

Each totalizer/frequency outputs option card provides two or four outputs (designated as A, B, C, and D) that can be used as either totalizer or frequency outputs.

Before making any connections, complete the steps in *Preparing for Wiring* on *page 12*. Then, wire this option card in accordance with the connections shown on the label in the rear cover (see *Figure 2 on page 6* and *Figure 8 on page 20*). *Figure 4* below shows sample wiring diagrams of a totalizer output circuit and a frequency output circuit. Refer to *See "Optional Inputs and Outputs" on page 44.* for load and voltage requirements.

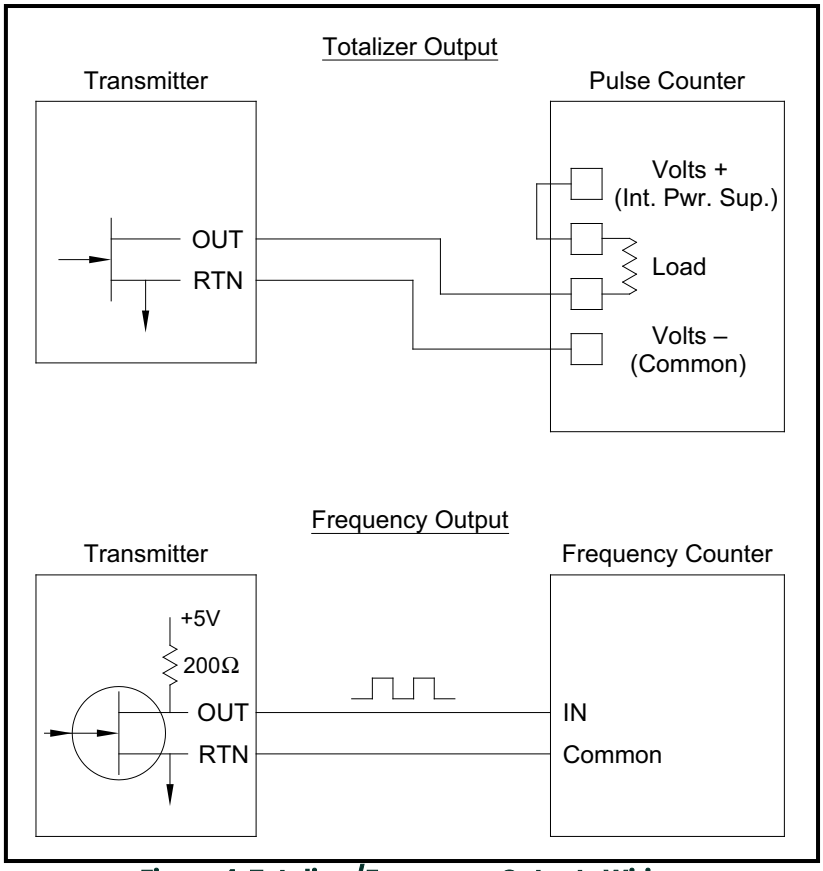


Figure 4: Totalizer/Frequency Outputs Wiring

1.7.5.4 Wiring an RTD Inputs Option Card

The XGF868i RTD (Resistance Temperature Device) inputs option card provides two or four direct RTD inputs (designated as A, B, C and D). Each RTD input requires three wires, and should be connected as shown on the label in the rear cover (see *Figure 2 on page 6* and *Figure 8 on page 20*).

Note: *Before making any connections, complete the steps in* Preparing for Wiring *on* page 12*.*

1.7.5.5 Wiring a 0/4-20 mA Analog Outputs Option Card

The analog outputs option card includes two isolated 0/4-20 mA outputs (designated as A and B). Connections to these outputs may be made with standard twisted-pair wiring, but the total current loop impedance for these circuits must not exceed 1000 ohms.

Before making any connections, complete the steps in *Preparing for Wiring* on *page 12*. Then, wire this option card with the connections shown on the label in the rear cover (see *Figure 2 on page 6* and *Figure 8 on page 20*).

1.7.5.6 A Specific Example

To illustrate the procedures described in the previous sections for wiring the option cards, a specific example may prove helpful. Assume that an XGF868i is equipped with an option card numbered *703-1223-08*. *Table 13* in Appendix C, *Data Records*, indicates that this option card includes two analog current inputs and two standard alarm relays.

1.7.5.7 Wiring the MODBUS/TCP Interface

Customers can also use a modified XGF868i that provides a MODBUS/TCP interface to communicate to an internal network. An optional MODBUS/TCP card with a unique MAC (IP) address (installed only in slot 2) includes an RJ45 connector. To connect the MODBUS/TCP-enabled XGF868i to the network, insert the jack of an RJ45 cable into the RJ45 connector, route the cable through one of the conduit holes using an appropriate cable clamp, and wire the other end of the cable to the Ethernet network according to the manufacturer's instructions (see Figure 11).

Note: *The MAC address for a specific XGF868i is included with customer documentation. For more information on setting up the MAC address, refer to Chapter 6 of the* Programming Manual.

1.7.5.8 Wiring the Ethernet Interface

A modified XGF868i can use the Ethernet interface to communicate to a local area network. An optional Ethernet card with a unique MAC (IP) address (installed only in slot 2) includes an RJ45 connector. To connect the Ethernet-enabled XGF868i to the network, insert the jack of an RJ45 cable into the RJ45 connector, route the cable through one of the conduit holes using an appropriate cable clamp, and wire the other end of the cable to the Ethernet network according to the manufacturer's instructions. An external connection is required between the Ethernet option card and the XGF868i RS232 connector, as shown in *Table 4* below and *Figure 11*.

Note: *The MAC address for a specific XGF868i is included with the customer documentation. For more information on setting up the MAC address, refer to Appendix C of the* Programming Manual.

Table 4: RS232 to Ethernet Interconnections

RS232 Terminal Block on Rear Board	TB1 Terminal Block on Ethernet Card
TX	Pin 1
RX	Pin 2
COM	Pin 3

1.7.5.9 Wiring the Foundation Fieldbus Interface

To connect the Foundation Fieldbus interface to the XGF868i, make the network connections at J8, pins 1 and 2, as shown in drawing Y of *Figure 11*. As an option, you can connect a shield to J8 pin 3, depending on the network wiring.

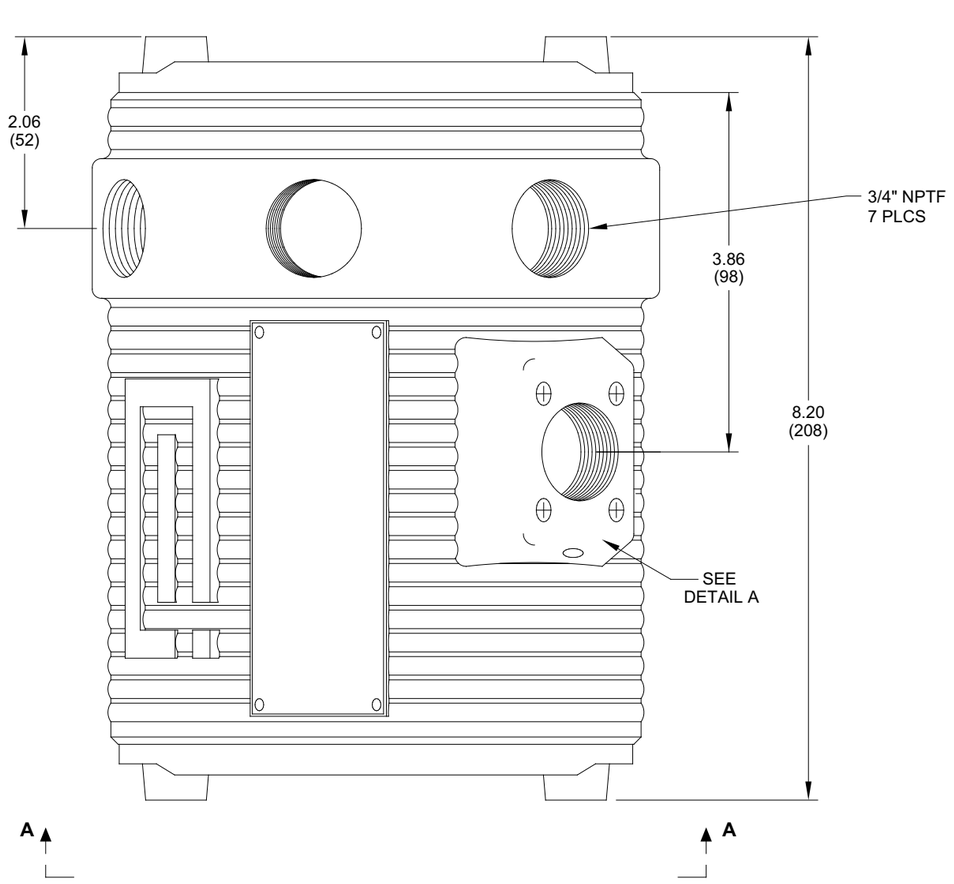
No connections are made to J9 under normal operation. If you need to reset the network board to factory defaults:

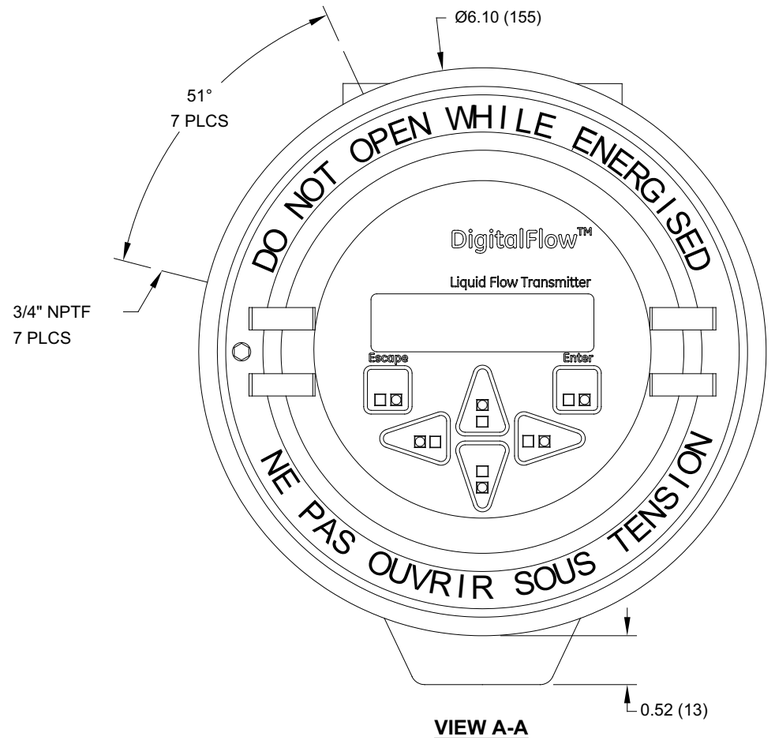
1. Connect a jumper between J9 pin 2 and J9 pin 3.
2. Power cycle (i.e., turn off and on) the XGF868i.
3. Ten seconds after the power has been restored to the XGF868i, remove the jumper to return the network board to normal operation.



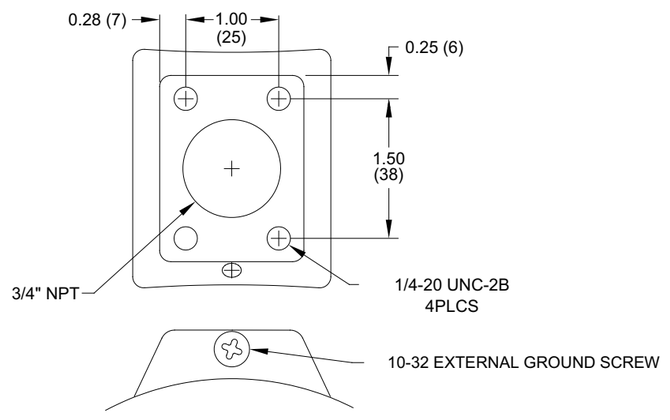
WARNING! Make sure that both covers with the o-ring seals are installed and the set screws are tightened before applying power to the unit in a hazardous environment.

[no content intended for this page]





VIEW A-A



DETAIL A

NOTES:

1. ALL DIMENSIONS ARE REFERENCE.

2. WEIGHT: 10 LB (4.5 KG) AL
   25 LB (11.5 KG) SS

3. DIMENSIONS ARE IN INCHES (MILLIMETERS).

Figure 5: Outline and Installation – Electronics Enclosure (ref. dwg #712-1318)

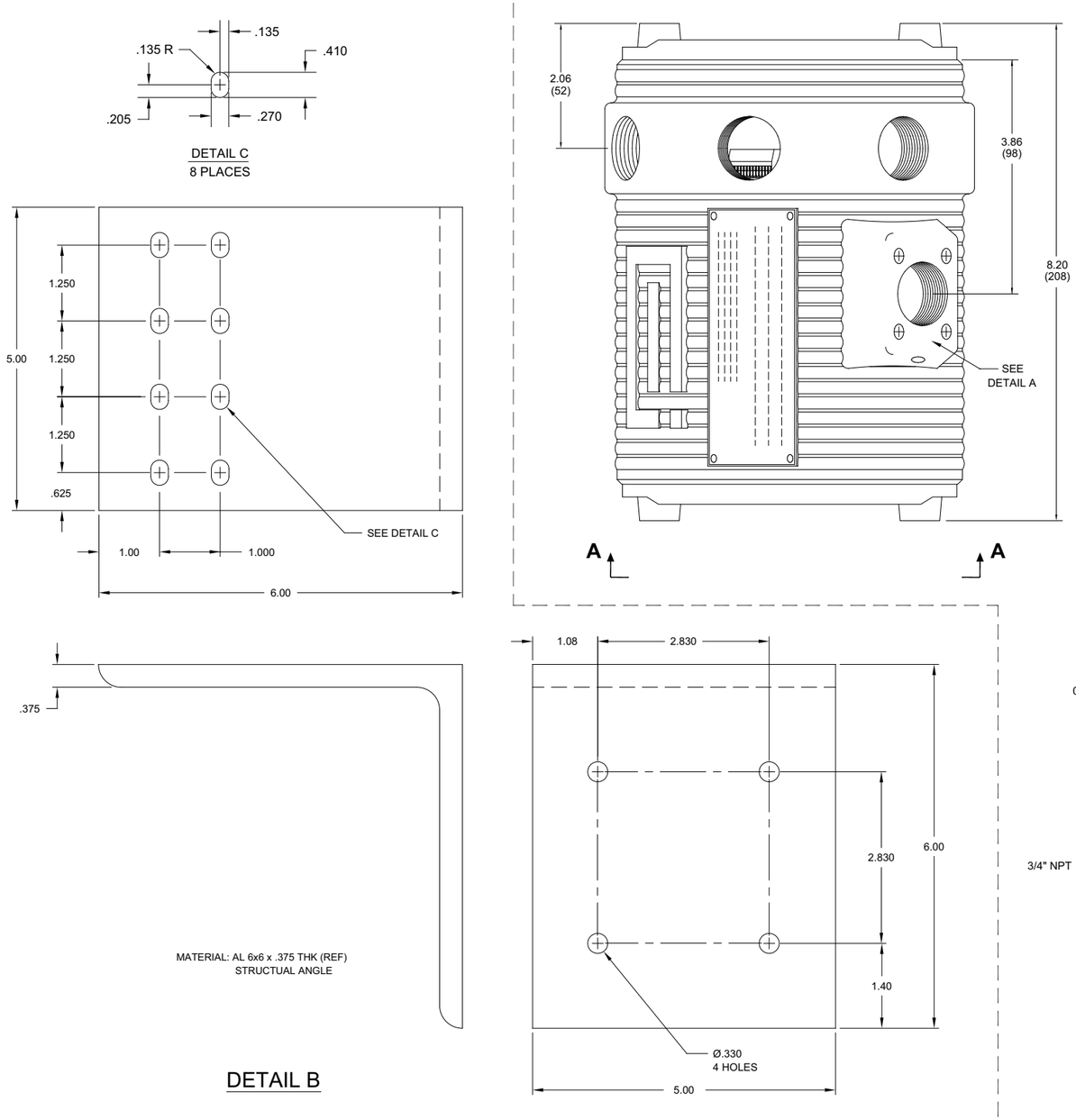


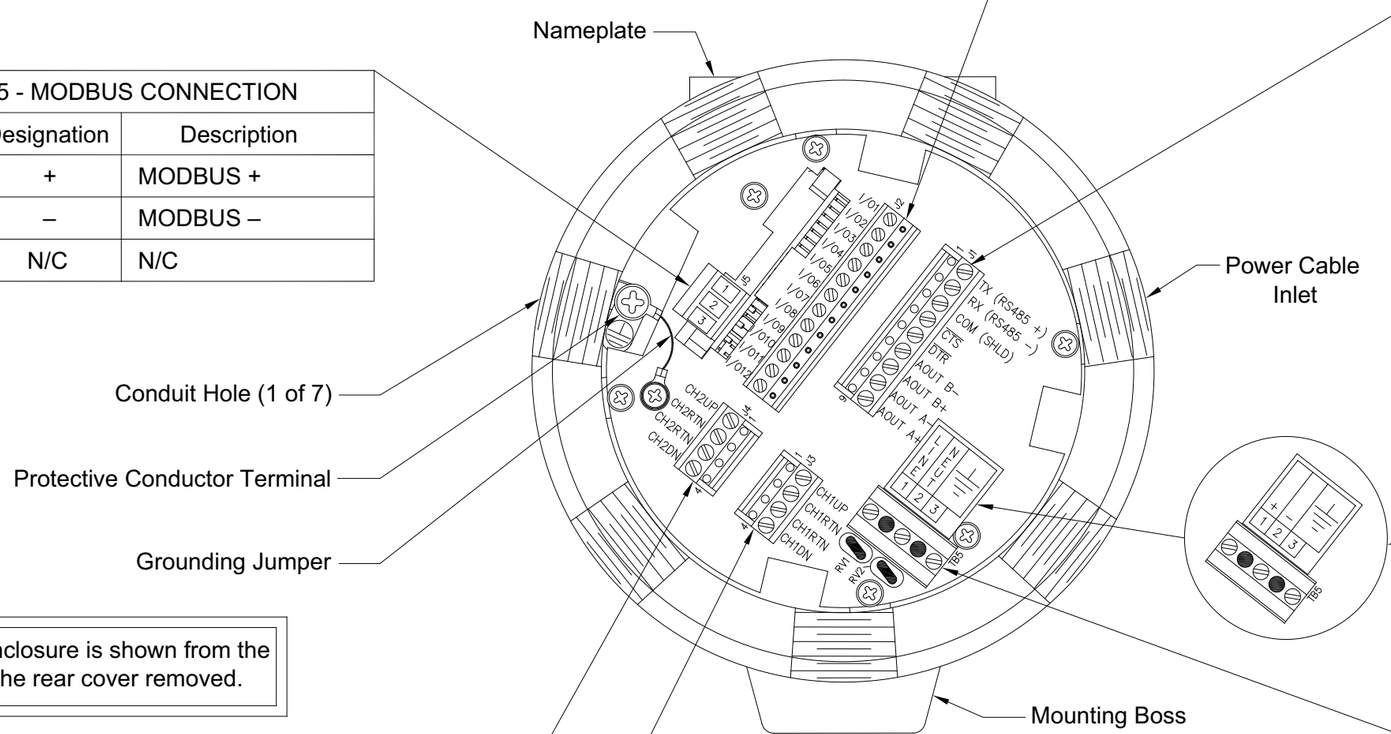
Figure 6: Right Angle Mounting Bracket – Electronics Enclosure (ref. dwg #712-1317)

NOTE: *For compliance with the EU Low Voltage Directive, this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible and located within 1.8 m (6 ft) of the unit.*

J2 - INPUT/OUTPUT CONNECTIONS*												
Pin #	1	2	3	4	5	6	7	8	9	10	11	12
Designation	I/O1	I/O2	I/O3	I/O4	I/O5	I/O6	I/O7	I/O8	I/O9	I/O10	I/O11	I/O12
Description	*See the wiring label inside the rear cover and Figure 9.											

J1 - RS232/ 4-20 OUTPUT		
Pin #	Designation	Description
1	TX	Transmit / +
2	RX	Receive / –
3	COM (SHLD)	Ground
4	$\overline{CTS}$	Clear To Send
5	$\overline{DTR}$	Data Terminal Ready
6	AOUT B–	4-20 Output 2 RTN
7	AOUT B+	4-20 Output 2 SIG
8	AOUT A–	4-20 Output 1 RTN
9	AOUT A+	4-20 Output 1 SIG

J5 - MODBUS CONNECTION		
Pin #	Designation	Description
1	+	MODBUS +
2	–	MODBUS –
3	N/C	N/C



NOTE: Enclosure is shown from the rear with the rear cover removed.

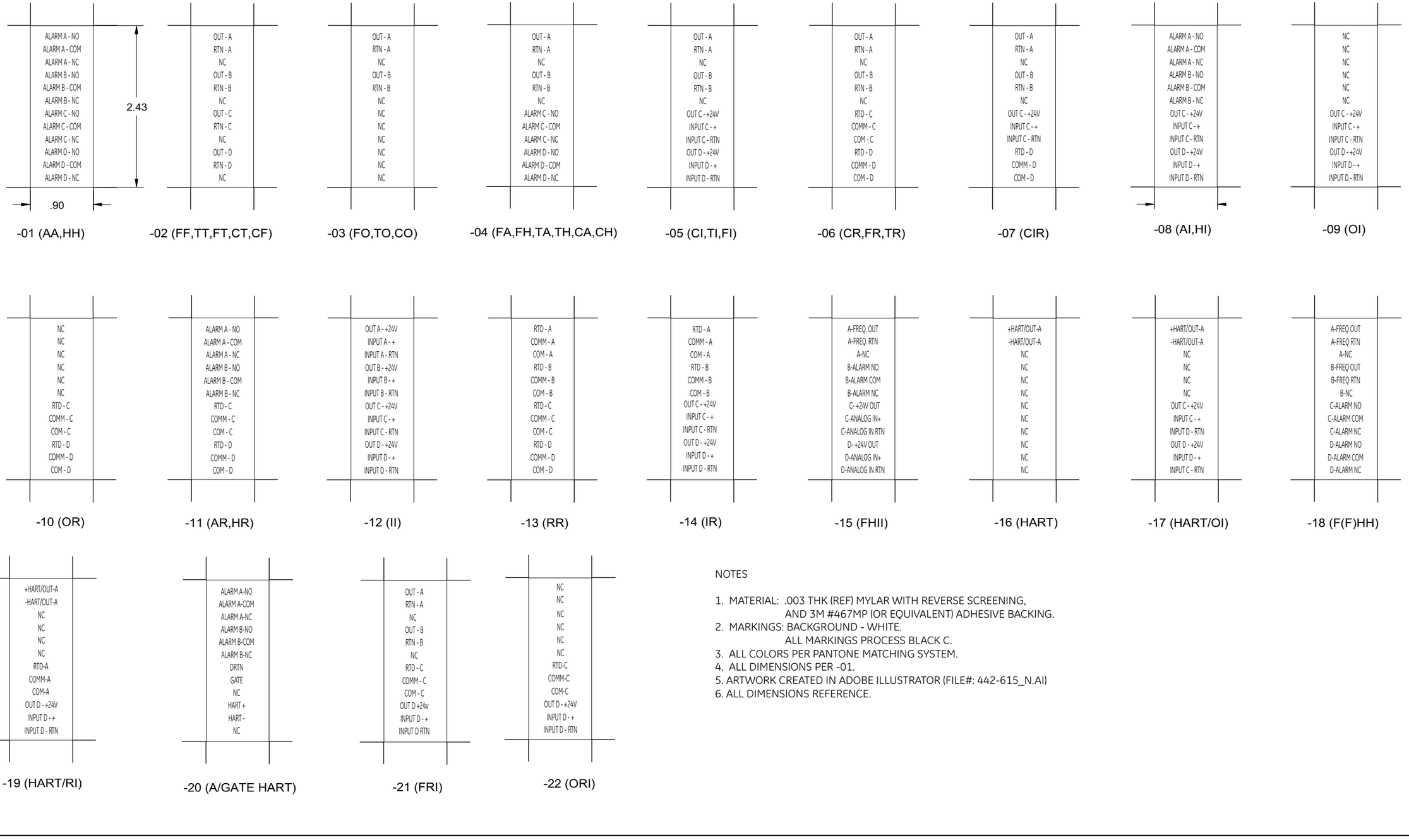
DC POWER INPUT	
Pin #	Description
1	Line Positive
2	Line Negative
3	No Connection

AC POWER INPUT	
Pin #	Description
1	Line Power
2	Line Neutral
3	Earth Ground

J4 - CH2 TRANSDUCER CONNECTION (optional)		
Pin #	Designation	Description
1	CH2UP	Upstream Transducer SIG(+)
2	CH2RTN	Upstream Transducer Analog RTN(-)
3	CH2RTN	Downstream Transducer Analog RTN(-)
4	CH2DN	Downstream Transducer SIG(+)

J3 - CH1 TRANSDUCER CONNECTION		
Pin #	Designation	Description
1	CH1UP	Upstream Transducer SIG(+)
2	CH1RTN	Upstream Transducer Analog RTN(–)
3	CH1RTN	Downstream Transducer Analog RTN(-)
4	CH1DN	Downstream Transducer SIG(+)

Figure 7: Wiring Diagram – Electronics Enclosure



NOTES

1. MATERIAL: .003 THK (REF) MYLAR WITH REVERSE SCREENING, AND 3M #467MP (OR EQUIVALENT) ADHESIVE BACKING.
2. MARKINGS: BACKGROUND - WHITE. ALL MARKINGS PROCESS BLACK C.
3. ALL COLORS PER PANTONE MATCHING SYSTEM.
4. ALL DIMENSIONS PER -01.
5. ARTWORK CREATED IN ADOBE ILLUSTRATOR (FILE#: 442-615_N.AI)
6. ALL DIMENSIONS REFERENCE.

Figure 8: Option Card Connection Labels (ref. dwg #703-1473)

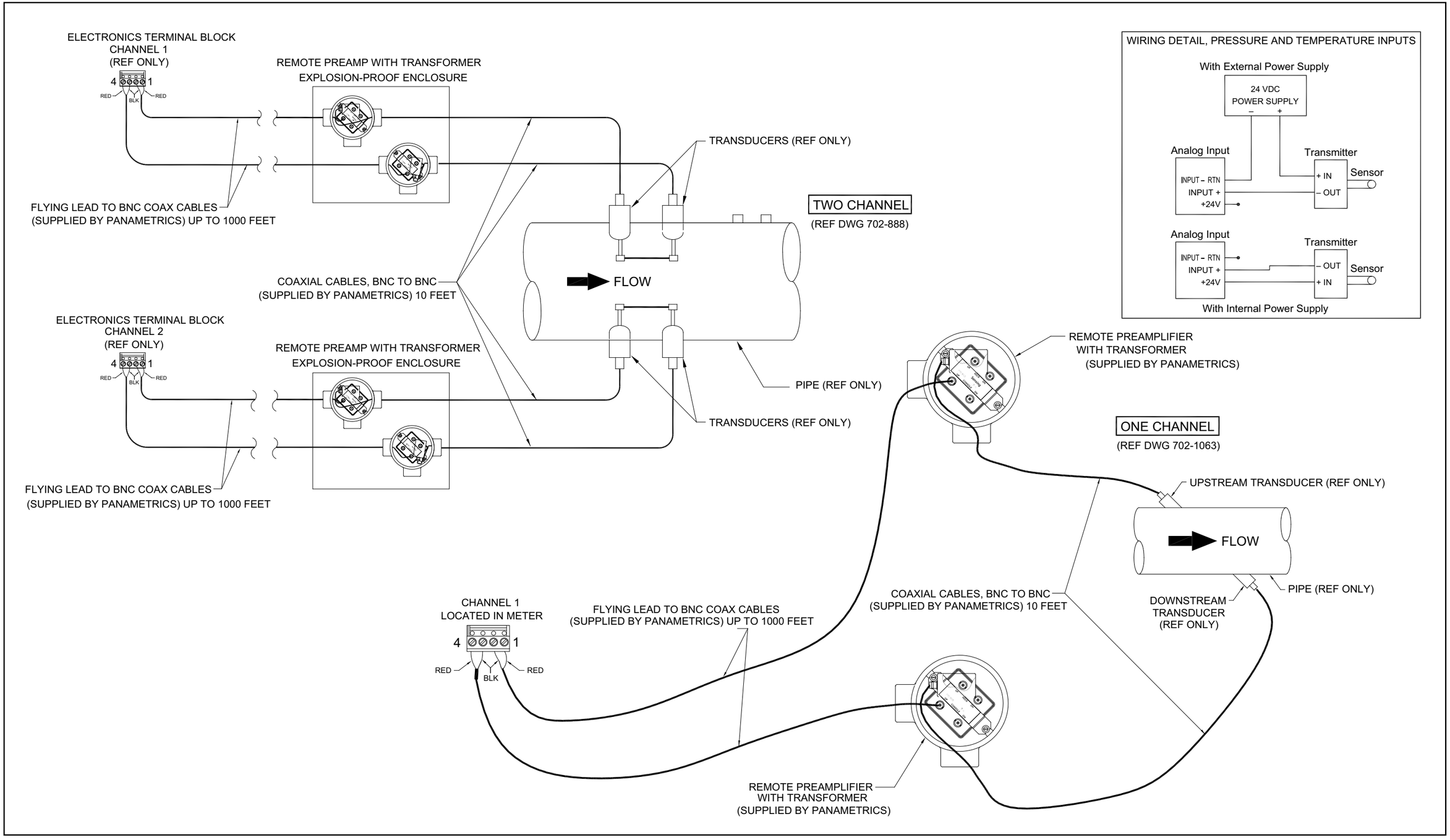


Figure 9: Wiring Diagram – Transducers with Remote Preamplifier (PRE868) and Transformer

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Chapter 2. Initial Setup

2.1 Introduction

This chapter provides instructions for programming the minimum amount of data required to place the XGF868i flowmeter into operation. Before the XGF868i can begin taking measurements and displaying valid data, the current system and pipe parameters must be entered. In addition, a 2-Channel meter requires that each channel be activated prior to use. Additional programming options provide access to the more advanced features of the XGF868i, but this information is not required to begin taking measurements.

Refer to the *Programming Manual* for information on programming all other features. Be sure to record all programming data in Appendix B, *Data Records*.

As a guide in following the programming instructions in this chapter, the relevant portions of the XGF868i menu map have been reproduced in *Figure 11 on page 31*.

2.2 Programming Methods

Note: *See the* Programming Manual *for information on those* User Program *features not covered in this chapter.*

You can program the XGF868i via either the keypad on the lower part of the glass enclosure, or **PanaView™,** a Panametrics PC-based, non-resident software program that communicates with the XGF868i via its RS232 serial port. PanaView supplements basic XGF868i functions with several additional capabilities. With PanaView, you can:

- Load and save site file data
- Create and save graph and log files
- Display text output and graphs of live measurement data
- Create custom templates for displaying text, graph and log data
- Interface with multiple Panametrics instruments.

This chapter focuses on programming via the keypad. For information on programming the XGF868i via PanaView, refer to Appendix C of the *Programming Manual*.

2.3 The XGF868i Keypad

Keypad Program

Along with the 2-line, 16-character LCD, the XGF868i includes a 6-key magnetic keypad. The decal cutout for each key contains a hall effect sensor, pushbutton switch and visible red LED. The magnetic wand used to activate a magnetic key is found attached to the meter chassis below the front panel. An operator activates the key by pressing the magnetic wand up to the glass lid over the desired key. The LED will light indicating a successful key press.

Note: *The pushbutton switch will also act as a key press but is done with the glass lid open. Do not use the pushbutton switch in a hazardous area where the lid needs to be installed.*

Use the magnetic keypad to navigate through the user program. The menu map may be followed in sequence, or the four arrow keys may be used to scroll through the prompt screens. Figure 10 shows the front of the XGF868i, with magnetic keypad and magnetic wand.

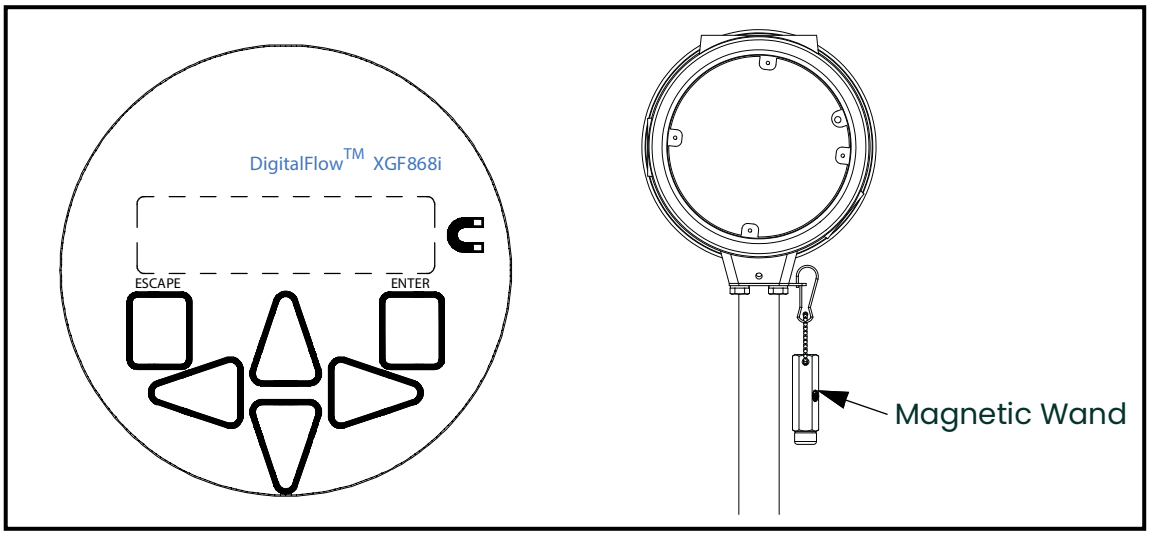


Figure 10: XGF868i Magnetic Keypad and Wand

IMPORTANT: The XGF868i keypad enables programming of the instrument through the glass faceplate without removing the cover. Thus, all programming procedures may be performed while the unit is installed in a hazardous area.

Six keys on the keypad enable users to program the XGF868i:

- [Enter] - confirms choice of a specific option and data entry within the option
- [Escape] - allows users to exit from a specific option without entering unconfirmed data
- [△] and [▽] - enable users to view a specific measurement in the Key display setting or to scroll through a list of options (letters and numbers 0-9 as well as the negative sign and decimal point) in a menu
- [◁] and [▷] - enable users to scroll to a specific option, among choices in an option, or to a character in a text entry.

When you power up the XGF868i, the display first shows the model and software version:

Panametrics
XGF868i Y4DF.STD

The meter then starts to display measured parameters.



To enter the *Keypad Program*, press the [Escape] key, followed by the [Enter] key, and the [Escape] key again. Each successive key must be entered within 10 seconds of the prior key.

As a guide in following the programming instructions in this chapter, the relevant portions of the Model XGF868i menu map have been reproduced in *Figure 11 on page 31.* Proceed to the following sections to enter data in the Channel or GLOBL menus.

IMPORTANT: If the keypad has not been pressed for 10 minutes, the XGF868i exits the Keypad Program and returns to displaying measurements. The meter retains any configuration changes that were confirmed with the [Enter] key, and restarts as if the operator had completed the programming cycle.

2.4 Entering Data in the GLOBL Menu

To begin programming your meter, you must select the system units from the **GLOBL** menu as discussed below. Refer to *Figure 11 on page 31* and remember to record all programming data in Appendix B, *Data Records*.

Note: *Refer to the* Programming Manual *for information on the other submenus in the GLOBL menu.*

2.4.1 Entering Global System Data

The GLOBL-SYSTM submenu is used to enter several general system parameters (e.g., English or metric units). For units with 2 channels, this menu is also used to compute parameters such as the sum, difference or average of the channel 1 and channel 2 signals. When calculating the **SUM**, **DIF** or **AVE** readouts, data from the **GLOBL-SYSTM** submenu is used. Any conflicting data entered in the **CHANNEL-SYSTM** submenu is overridden.

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to SYSTM and press [Enter].
4. Scroll to the desired *System Units* selection (either metric or English) and press [Enter]. The XGF868i will display all parameters and measurements in the designated units.
5. Scroll to the desired *Pressure Units* selection (absolute or gauge) and press [Enter].
6. Do one of the following:
   - If PSIa (absolute) was selected, proceed to Step 7.
   - If PSIg (gauge) was selected, enter the desired atmospheric pressure, press [Enter] and proceed to Step 7.
7. Do one of the following:
   - For a single-channel XGF868i, the program returns to the Global PROGRAM menu.
   - For a 2-channel meter, proceed to the next page.

2.4.1.1 Selecting Volumetric Units

1. Scroll to the desired *Volumetric Units* for the flow rate display and press [Enter]. *Table 5* below lists the available volumetric units.

Table 5: Available Volumetric/Totalizer Units

English	Metric
ACF = Actual Cubic Feet	ACM = Actual Cubic Meters
KACF = Thousands of ACF	KACM = Thousands of ACM
MMACF = Millions of ACF	MMACM = Millions of ACM
SCF = Standard Cubic Feet	SCM = Standard Cubic Meters
KSCF = Thousands of SCF	KSCM = Thousands of SCM
MMSCF = Millions of SCF	MMSCM = Millions of SCM

2. Scroll to the desired unit of *Volumetric Time* (from seconds to days), and press [Enter].
3. Scroll to the desired number of *Vol Decimal Digits* (digits to the right of the decimal point) in the volumetric flow display, and press [Enter].

2.4.1.2 Selecting Totalizer Units

4. Scroll to the desired *Totalizer Units* for the flow rate display and press [Enter]. Available units are listed in *Table 5* above.
5. Scroll to the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display) and press [Enter].
6. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting Mass Flow Units* on *page 26*.
   - If MASS FLOW is OFF, the meter returns to the Global PROGRAM window. Press [Escape] twice and proceed to Chapter 3, *Operation*, or the *Programming Manual*.

Note: *To activate mass flow, see* Activating Mass Flow *in Chapter 1 of the* Programming Manual. *The following prompts appear only if mass flow is activated for both channels.*

2.4.1.3 Selecting Mass Flow Units

1. Scroll to the desired *Mass Flow* units for the flow rate display and press [Enter]. The available units for this prompt, which are determined by the selection made at the *System Units* screen, are shown in *Table 6* below.

Table 6: Available Mass Flow Units

English	Metric
LB = Pounds	Kilograms
KLB = Thousands of LB	Metric Tons (1000 KG)
MMLB = Millions of LB	
Tons (2000 LB)	

2. Scroll to the desired *Mass Flow Time* units for the mass flow rate display (from seconds to days) and press [Enter].
3. Scroll to the desired number of *Mdot Dec. Digits* (digits to the right of the decimal point in the mass flow rate display) and press [Enter].
4. Scroll to the desired *Mass (Totalizer)* units for the totalized mass flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt.
5. Scroll to the desired number of *Mass Dec. Digits* (digits to the right of the decimal point in the totalized mass flow rate display) and press [Enter].
6. Enter the *Molecular Weight (Mw)* and press [Enter].
7. After completing the above steps, the XGF868i returns to the Global PROGRAM window. Press [Escape] and scroll to CH1 or CH2 to continue setup programming.

2.5 Activating a Channel

The **ChannelX-ACTIV** submenu permits selection of the desired measurement method. In addition, it is used to activate/deactivate one or both of the channels in a 2-Channel XGF868i.

To access the ChannelX-ACTIV submenu:

1. From the *Keypad Program,* scroll to CH1 or CH2 and press [Enter].
2. In the Channel PROGRAM menu, scroll to ACTIV and press [Enter].
3. Scroll to *Burst* to activate the channel/path, and press [Enter].
4. Scroll to one of the measurement methods described below and press [Enter].
   - *Skan Only* is the preferred technique for locating the acoustic signal and for high velocity measurements. It is more robust in a noisy environment than the Measure technique.
   - *Skan/Measure* is the preferred technique to use for low velocity measurements.

If *Skan Only* is selected at the above prompt, the meter uses this technique exclusively. However, if *Skan/Measure* is selected, the meter uses *Skan Only* to find the acoustic signal and then tries to use the *Skan/Measure* technique for the actual measurement.

After completing the above step, the meter returns to the Channel PROGRAM window. Proceed to the next section to continue programming your meter.

2.6 Entering System Data for the Channel

The ChannelX-System submenu is used to enter system parameters for the channel.

2.6.1 Accessing the ChannelX-System Submenu

1. From the Channel PROGRAM menu, scroll to SYSTM and press [Enter].
2. The first prompt asks for the *Channel Label.*Use the four scrolling keys to enter the desired label (in any numeric or text combination up to five characters), and press [Enter].
3. The next prompt asks for the *Channel (Site) Message*. Enter the desired text in the same manner as the channel label with up to 15 characters, and press [Enter].

2.6.2 Selecting Volumetric Units

1. Scroll to the desired *Volumetric Units* for the flow rate display and press [Enter]. The available units are listed in *Table 7* below.
2. Scroll to the desired *Volumetric Time* units for the flow rate display (from seconds to days) and press [Enter].
3. Scroll to the desired number of *Vol Decimal Digits* (digits to the right of the decimal point in the volumetric flow rate display) and press [Enter].

Table 7: Available Volumetric/Totalizer Units

English	Metric
ACF = Actual Cubic Feet	ACM = Actual Cubic Meters
KACF = Thousands of ACF	KACM = Thousands of ACM
MMACF = Millions of ACF	MMACM = Millions of ACM
SCF = Standard Cubic Feet	SCM = Standard Cubic Meters
KSCF = Thousands of SCF	KSCM = Thousands of SCM
MMSCF = Millions of SCF	MMSCM = Millions of SCM

2.6.3 Selecting Totalizer Units

1. Scroll to the desired *Totalizer Units* for the totalized flow rate display and press [Enter]. Available units are listed in *Table 7* above.
2. Scroll to the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display) and press [Enter].

3. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting Mass Flow Units* on *page 28*.
   - If MASS FLOW is OFF, the meter returns to the **Channel PROGRAM** window. Proceed to *Entering Transducer and Pipe Parameters on page 28*.

Note: *To activate mass flow, see* Activating Mass Flow *in Chapter 1 of the* Programming Manual.

2.6.4 Selecting Mass Flow Units

1. Scroll to the desired *Mass Flow* units for the flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt. See *Table 8* below.

Table 8: Available Mass Flow Units

English	Metric
LB = Pounds	Kilograms
KLB = Thousands of LB	Metric Tons (1000 KG)
MMLB = Millions of LB	
Tons (2000 LB)	

2. Scroll to the desired *Mass Flow Time* units for the mass flow rate display and press [Enter].
3. Scroll to the desired number of *Mdot Decimal Digits* (digits to the right of the decimal point in the mass flow rate display) and press [Enter].
4. Scroll to the desired *Mass (Totalizer)* units for the totalized mass flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt.
5. Scroll to the desired number of *Mass Dec. Digits* (digits to the right of the decimal point in the totalized mass flow rate display) and press [Enter].

After completing the above steps, the XGF868i returns to the Channel PROGRAM window. Proceed to the next section to program transducer and pipe parameters.

2.7 Entering Transducer and Pipe Parameters

Enter the transducer and pipe parameters via the **PIPE** submenu.

1. From the Channel PROGRAM menu, scroll to the PIPE option and press [Enter].
2. The first prompt asks for the *Transducer Number.*
   - For a standard transducer, use the arrow keys to enter the number engraved on the transducer head, and press [Enter].
   - If there is no number engraved on the transducer head, press the right arrow key to scroll to the *STD* option, and use the up and down arrow keys to change to *SPEC*. Then use the arrow keys to enter an assigned number (from 91 to 99), and press [Enter].

IMPORTANT: Special transducers, which have no engraved number on the head, are rarely used. Examine the transducer head carefully for a number.

- If you entered the number for a standard transducer, proceed to the *Pipe OD* prompt in step 5.
- If you entered the number for a special transducer, proceed to step 3 on the next page.

2.7.1 Special Transducers

3. Scroll to the transducer *Frequency* (supplied by the factory) and press [Enter].

Note: *The frequency is required to transmit an excitation voltage at the transducer's natural frequency.*

4. Enter the special transducer *Tw* (time delay) value (supplied by the factory) and press [Enter].

   Tw is the time required for the transducer signal to travel through the transducer and its cable. This time delay must be subtracted from the transit times of the upstream and downstream transducers to ensure an accurate measurement.

2.7.2 Pipe Data

If either a standard or a special transducer is being used, the programming sequence should be rejoined at this point.

5. To select the appropriate *Pipe OD Unit* type from the list shown in *Table 9* below, scroll to the right side of the screen, and use the up and down arrow keys to step through the list. Press [Enter]. Then use the arrow keys to enter the known pipe outside diameter or circumference on the left side and press [Enter].

Obtain the required information by measuring either the pipe outside diameter (OD) or circumference at the transducer installation site. The data may also be obtained from standard pipe size tables found in *Sound Speeds and Pipe Size Data* (914-004).

Table 9: Available Pipe OD Units

English	Metric
inch	mm = millimeters
feet	m = meters
in/PI = pipe circumference in inches	mm/PI = pipe circumference in millimeters
ft/P I= pipe circumference in feet	m/PI = pipe circumference in meters

6. Use the arrow keys to enter the known *Pipe Wall Thickness* (in inches or mm) and press [Enter]. If the pipe wall thickness is not available, look up the value in a table of standard pipe size data which can be found in the *Sound Speeds and Pipe Size Data* manual (914-004).

2.7.3 Path and Axial Lengths

7. To enter the *Path Length*:

a. Use the [▷] arrow key to highlight the path length unit type at the right of the screen.Then use the [△] and [▽] arrow keys to scroll to the desired unit type.

b. Use the [◁] arrow key to return to the numeric entry on the left, and enter the path length of the ultrasonic signal. Press [Enter].

Note: *If a spoolpiece was ordered with the meter, the transducer signal path length* **(P)** *and the transducer signal axial length* **(L)** *are engraved on the flowcell and/or are included in the documentation supplied with the meter. For on-site transducer installations, refer to Appendix C,* Measuring P and L Dimensions.

8. In the same manner, enter the appropriate *Axial Length L* unit type and axial length of the ultrasonic signal, and press [Enter].

9. Scroll to the desired *Fluid Type* and press [Enter]. Then do one of the following:

- If **OTHER** was selected - proceed to Step 10.
- If **AIR** was selected - proceed to Step 11.

10. Use the arrow keys to enter the *Fluid Soundspeed* (in feet per second) in the gas to be measured and press [Enter].

11. Scroll to the appropriate choice to indicate whether you want *Reynolds Correction*, and press [Enter].

- If *Off* is selected, go to Step 12.
- If *On* is selected, the program asks for the *Kinematic Viscosity*. Use the arrow keys to enter the desired value, and press [Enter].

12. Use the arrow keys to enter a value for the flow *Calibration Factor* and press [Enter]. The default value is 1.00, but values between 0.50 and 2.0 may be entered.

2.7.3.1 Procedure Options

After completing the above steps, the XGF868i returns to the Channel PROGRAM window. Press [Escape] twice to return to the meter display. Then proceed to Chapter 3, *Operation*, for instructions on taking measurements, or refer to the *Programming Manual* for instructions on programming the XGF868i advanced features.

[no content intended for this page]

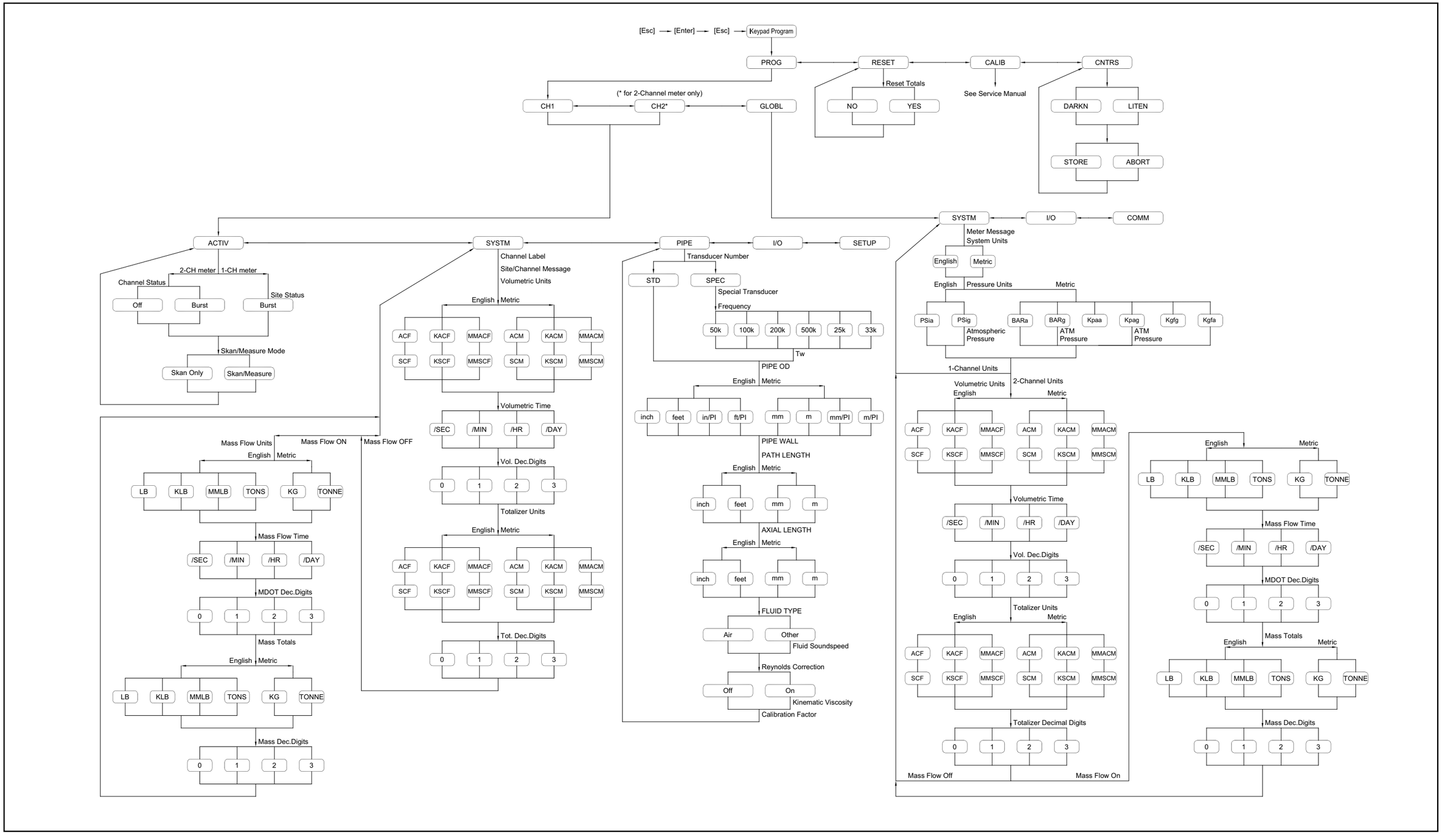


Figure 11: Model XGF868i Initial Setup Menu Map

[no content intended for this page]

Chapter 3. Operation

3.1 Introduction

See Chapter 1, *Installation*, and Chapter 2, *Initial Setup*, to prepare the XGF868i system for operation. When the meter is ready to take measurements, proceed with this chapter. The following specific topics are discussed:

- Powering Up
- Using the Display
- Taking Measurements
- Recording Diagnostics

Note: *All inputs and outputs of the XGF868i are calibrated at the factory, prior to shipment. If it becomes necessary to recalibrate any of the inputs and/or outputs, see Chapter 1,* Calibration*, of the* Service Manual *for instructions.*



WARNING! **To ensure the safe operation of the XGF868i, it must be installed and operated as described in this manual. In addition, be sure to follow all applicable local safety codes and regulations for the installation of electrical equipment.**

3.2 Powering Up

Because the XGF868i does **not** have an ON/OFF switch, it will power up as soon as the connected power source is energized.

IMPORTANT: For compliance with the EU Low Voltage Directive (2006/95/EC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

There are three methods for obtaining readings from the XGF868i:

- Built-in LCD display
- PanaView software on a computer
- Device to read the XGF868i analog output

At least one of the above display options must be installed in order to obtain flow rate readings from the meter.

Immediately upon power up the software version display appears. Then, the meter performs a series of internal checks, which take about 45 seconds, prior to displaying the flow rate data.

Note: *If the XGF868i fails any of the internal checks (see Chapter 2,* Error Codes*, in the* Service Manual*), try disconnecting the power and then repowering the unit. If the meter continues to fail any of the internal checks, contact Panametrics for assistance.*

After successfully performing the internal checks, the XGF868i begins taking measurements and the software version display is replaced by a measurement mode display. Proceed to the appropriate section for instructions on using the LCD display and the PanaView display option.

Note: *As a minimum, the system and pipe parameters (for each installed channel of a 2-channel meter) must be entered before the XGF868i can display valid data. Refer to Chapter 2,* Initial Setup*, for instructions.*

3.3 The LCD Display

The components of the LCD display are shown in *Figure 12* below, along with a typical mass flow rate readout.

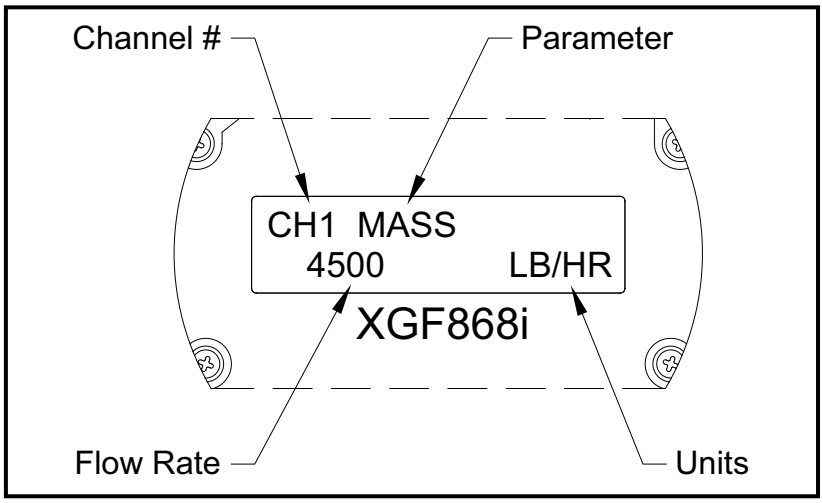


Figure 12: A Typical LCD Flow Rate Display

As shown in *Figure 12* above, the display screen includes the following information:

- Channel Number
- Flow Parameter
- Units of Measure
- Flow Rate Value

The example in *Figure 12* above uses the default display settings. However, the first three items in the list above may be reprogrammed to display a variety of alternative choices. See the *Programming Manual* for detailed instructions on programming these parameters.

Note: *The LCD backlight flashes to signal errors. If the backlight is off when an error is detected, the display is illuminated briefly; if the backlight is already on, the light is interrupted briefly. Error code messages may appear in the upper right corner of the LCD display. For information about these error codes and how to respond to them, refer to Chapter 2,* Error Codes*, in the* Service Manual.

Proceed to the *Taking Measurements* section to use the XGF868i.

3.4 The Optional PanaView Display

The components of the PanaView text display appear in *Figure 13* below, along with a typical flow rate readout.

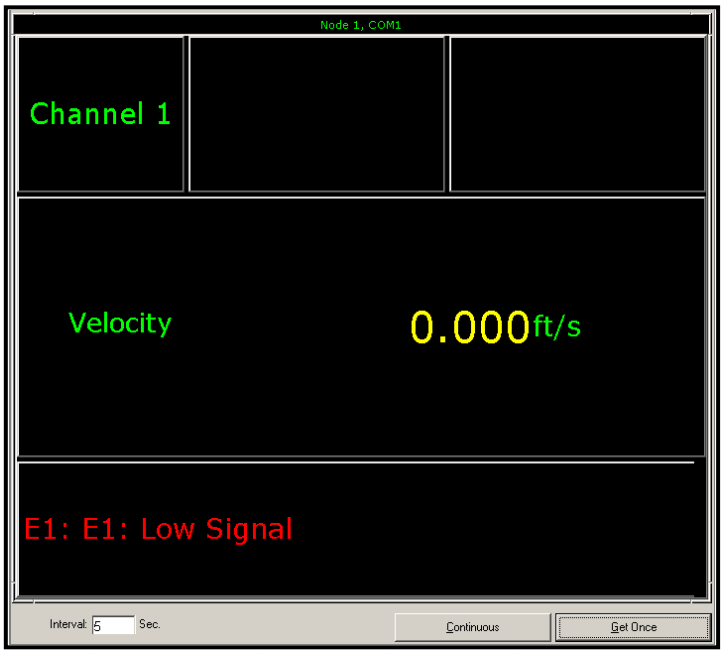


Figure 13: A Typical PanaView Text Display Pane

As shown in *Figure 13* above, the text pane includes the following information:

- Channel Number
- Flow Parameter
- Units of Measure
- Flow Rate Value

The example in *Figure 13* above is typical, but the first three items in the list above may be reprogrammed to display a variety of alternative choices. See the next section for detailed instructions on programming these parameters.

Note: *Error code messages may appear in the lower left corner of the PanaView text display window. For information about these error codes and how to respond to them, refer to Chapter 2,* Error Codes*, in the* Service Manual.

Proceed to the *Taking Measurements* section to use the XGF868i.

3.5 Taking Measurements

The XGF868i is capable of displaying several different variables in a variety of formats. However, this manual discusses only the basic measurement displays using the LCD display or the PanaView display. Refer to Chapter 2, *Displaying Data*, in the *Programming Manual* for instructions on setting up alternate choices. Also, refer to the *Programming Manual* and the *PanaView User's Manual* to use PanaView or the analog outputs to obtain the flow rate data.

3.5.1 Programming the LCD

Note: *When you first initialize the XGF868i, the number of LCD parameters is set to OFF. You must program the LCD to display any measured parameters.*

Through the *Keypad Program*, you can program the LCD display to display up to four variables in sequence. Complete the following steps to program the LCD display:

1. Power up the XGF868i and wait until it has initialized.
2. Press [Escape], [Enter], [Escape].
3. In the *Keypad Program* window, scroll to PROG and press [Enter].
4. In the PROG menu, scroll to GLOBL and press [Enter].
5. Scroll to I/O and press [Enter].
6. Scroll to LCD and press [Enter].
7. The window now asks for the *# of LCD Parameters*. Scroll to the desired number (from OFF through 1-4 and KEY) and press [Enter].

The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program.* If you select KEY:

- To view a parameter other than the one currently displayed, press the [△] or [▽] keys to scroll through the various parameters.
- To scroll through the channel options on a two-channel XGF868i, press the [◁] and [▷] keys until you have reached the desired option.

8. Scroll to the desired *Channel option*, as listed in *Table 10* below.

Table 10: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

9. For each channel, select the desired *Measurement Parameter*, as shown in *Table 11* below.

Table 11: Available Measurement Parameters

Option Bar	Description	Good	Bad
VEL	Displays the flow velocity.	N.A.	N.A.
VOLUM	Displays the volumetric flow.	N.A.	N.A.
+TOTL	Displays the forward totalized volume flow.	N.A.	N.A.
-TOTL	Displays the reverse totalized volume flow.	N.A.	N.A.
TIME	Displays the total flow measurement time.	N.A.	N.A.
MDOT	Displays the mass flow.	N.A.	N.A.
+MASS	Displays the forward totalized mass flow.	N.A.	N.A.

Table 11: Available Measurement Parameters

Option Bar	Description	Good	Bad
-MASS	Displays the reverse totalized mass flow.	N.A.	N.A.
SS up	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
SS do	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
SNDSP	Displays the measured speed of sound in the gas.	N.A.	N.A.
Tup	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
Tdown	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
DELTA	Displays the transit time difference between the upstream and downstream signals.	N.A.	N.A.
Tot K	Displays the total K factor.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default).	N.A.	N.A.
Qup	Displays the signal quality for the upstream transducer.	≥1200	–400 to +400
Qdown	Displays the signal quality for the downstream transducer.	≥1200	–400 to +400
AMPup	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29
AMPdn	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29
CNTup	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
CNTdn	Displays the AGC DAC count for downstream gain setting.	N.A.	N.A.
P#up	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
TEMP	Displays the gas temperature (from 0/4-20 mA input).	N.A.	N.A.
PRESR	Displays the gas pressure (from 0/4-20 mA input).	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
z	Displays the compressibility.	N.A.	N.A.
AcVOL	Displays actual volumetric flow.	N.A.	N.A.
StVOL	Displays standard volumetric flow.	N.A.	N.A.
Tu S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Td S[1]	Displays Skan transit time downstream.	N.A.	N.A.
DT S[1]	Displays Skan Delta T.	N.A.	N.A.
Tu M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Td M[1]	Displays Measure transit time downstream.	N.A.	N.A.
DT M[1]	Displays Measure Delta T.	N.A.	N.A.
Vinst	Displays the instantaneous velocity.	N.A.	N.A.

[1]available only if Burst Mode = S/M

Note: *The measurement units that appear in these prompts are those selected in the* **GLOBL-SYSTM** *menu earlier in this section. Also, when differences in one channel's programming invalidate an output previously chosen for the other, the measurement defaults to the nearest selectable item in the parameter list.*

The previous two prompts repeat until all of the specified **# of LCD Parameters** have been set up. When all of the display parameters have been set up, the meter returns to the **Global I/O** window. To leave the *Keypad Program*, press the **[Escape]** key three times.

After leaving the *Keypad Program*, the XGF868i will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

3.5.2 Using the LCD Display

To use the programmed LCD display for obtaining flow rate data, simply power on the XGF868i as described earlier in this chapter. Then, read the flow rate directly from the display, as shown in *Figure 12 on page 34*.

Note: *See Chapter 2,* Displaying Data*, in the* Programming Manual *to customize the contents of the LCD display.*

3.5.3 PanaView Display

Power up PanaView, establish communications with the XGF868i and enter the **required startup parameters**, as described in Chapter 2, *Initial Setup*. Then, proceed as follows:

Note: *See Chapter 2,* Initial Setup*, in this manual and/or Chapter 1,* Programming Site Data*, in the* Programming Manual *for complete instructions on entering startup data via PanaView.*

1. In PanaView, pull down the *Output* menu, as shown in Figure 14 below, and click on the *Text Display* option.

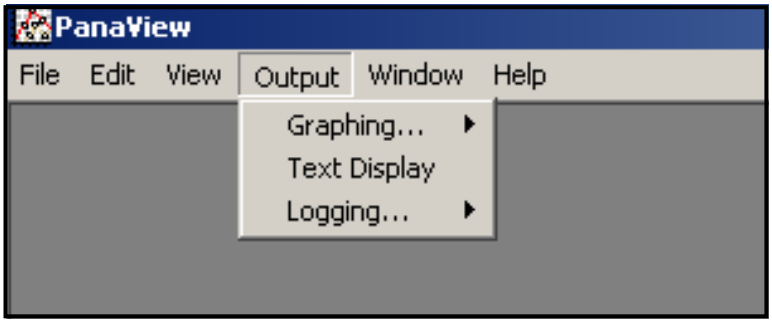


Figure 14: The Output Menu

Note: *The* Text Display *window that appears after Step 1 is actually stacked on top of any previously opened windows (such as the* Meter Browser *window).*

2. Using the *Window* menu, as described in the *PanaView User's Manual,* arrange the open windows in the desired format. For this discussion, *Figure 15* below shows the *Text Display* window in its maximized (full-screen) size.

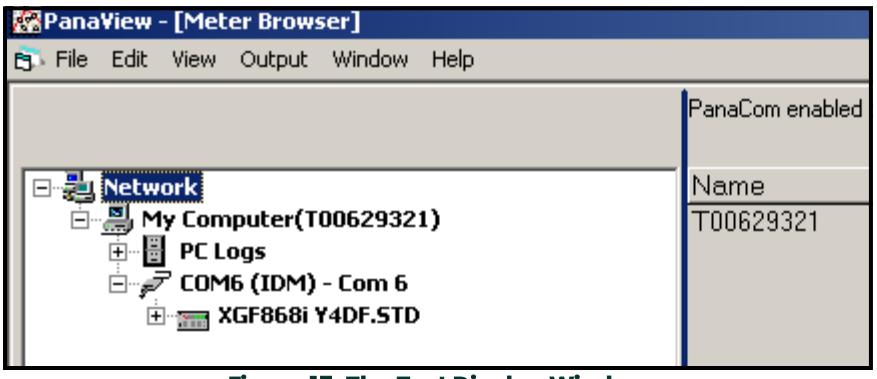


Figure 15: The Text Display Window

3. The left pane of the *Text Display* window contains the standard PanaView network tree. Expand the XGM branch, and double-click on the desired channel. (On 2-channel units, you can also display the SUM, DIFF or AVG parameters.)

4. From the expanded tree, double-click on the desired flow parameter to display it in the right pane of the window.
5. Before actual data values can be displayed in the text pane, activate one of the following data collection modes (see *Figure 15 on page 38*):
   - Click on the **[Get Once]** option button at the bottom of the right pane in the *Text Display* window. The current value of the selected process parameter, as specified in the PanaView network tree, is displayed in the right pane of the *Text Display* window.

or

   - Enter an *"interval"* in the text box at the bottom of the right pane in the *Text Display* window, or check the *"Max. Comm Rate"* box to collect readings as fast as the system allows (1 sec). Then, click on the **[Continuous]** option button to begin collecting data for display in the right pane of the *Text Display* window.

Note: *Any value entered in the* "Interval" *text box is overridden if the* "Max. Comm Rate" *box is checked.*

The right pane now appears similar to *Figure 13 on page 35*.

6. If the **[Continuous]** option was selected in Step 5, click on the **[Stop]** option button, which has replaced the original **[Continuous]** option button, to terminate data collection.

The *Text Display* window may be left open while other tasks are performed, or it may be closed by clicking on the lower **[X]** control button at the far right of the menu bar.

IMPORTANT: If you click on the upper **[X]** control button at the far right of the PanaView title bar, you will exit PanaView completely.

3.5.3.1 Displaying Multiple Process Parameters

The procedure for displaying a single process parameter in a text screen may be repeated to simultaneously display multiple process parameters. To do so, proceed as follows:

1. Display the first process parameter in a text screen, as described in the previous section.
2. Repeat Step 1 for any desired additional process parameters, by double clicking on them in the PanaView network tree. PanaView automatically tiles the multiple text screens in the right pane of the *Text Display* window, as shown in *Figure 16* below.

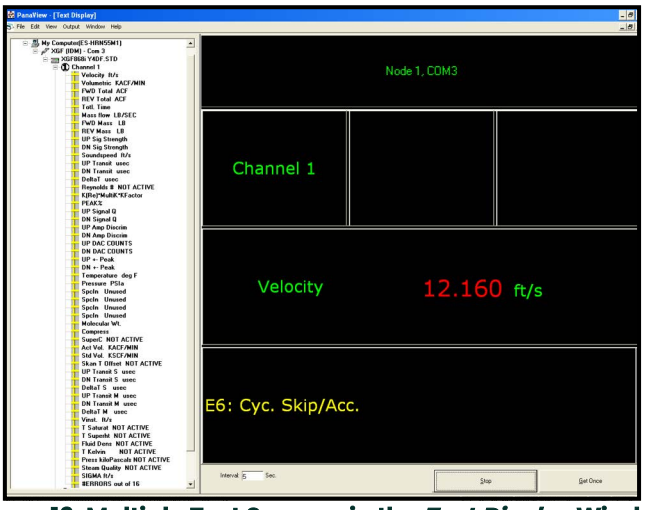


Figure 16: Multiple Text Screens in the *Text Display* Window

3. As in any standard Windows application, the multiple text screens may be resized by dragging their borders. Also, the individual panes within a parameter's text screen may be resized by dragging the borders within that text screen.
4. To close an open text screen, right click anywhere within that screen (except in the title bar or the error section) and click on the **[Remove]** option that pops up in the context menu.

Note: *After resizing or removing any of the multiple text screens, the default tiled layout may be restored by opening the* Window *menu (see the* PanaView User's Manual*) and clicking on the* Tile Output Displays *option.*

3.5.3.2 Displaying Multiple Text Windows

The procedures for displaying one or more process parameters in a single *Text Display* window may be repeated to open multiple *Text Display* windows. To do so, proceed as follows:

1. To open another *Text Display* window and display the desired process parameter(s) in the new window, repeat the steps in *PanaView Display*.
2. Arrange the multiple *Text Display* windows as desired via the *Window* menu (see the *PanaView User's Manual*).

3.5.4 Pausing Measurements

On occasion, it might become necessary for the XGF868i to stop taking measurements. Through PanaView, you can direct the XGF868i to pause measurements without cutting off the power from the meter.

1. From the meter tree in the *New Meter Browser*, click on the XGF868i entry.
2. Expand the *Edit Functions* option, and double-click on the *Pause Measurement* entry. A window opens similar to *Figure 17* below.

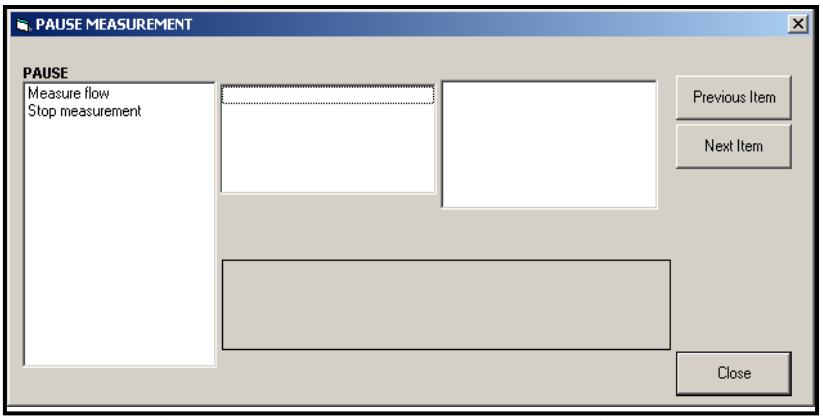


Figure 17: The *Pause Measurement* Window

3. To pause current measurements, double-click on the *Stop measurement* option. The window closes, and the XGF868i stops taking measurements.
4. To restart measurement, double-click on the *Pause Measurement* entry, and then on the *Measure flow* option. The XGF868i resumes flow measurement.

3.5.4.1 Procedure Options

The *Startup Guide* is intended to provide only those instructions necessary to get the XGF868i installed and operating. By following the instructions in this chapter, the XGF868i can be set up to display the desired channel option and the desired measurement parameter, using either the LCD display or PanaView. To utilize the more advanced capabilities of the XGF868i, refer to the *Programming Manual* and/or the *Service Manual* for the instrument. Also, refer to the *PanaView User's Manual* for instructions on using the PanaView software with the XGF868i.

[no content intended for this page]

Chapter 4. Specifications

4.1 Operation and Performance

4.1.1 Fluid Types

Flare and vent gases

4.1.2 Pipe Materials

All metals, fiberglass (Consult Panametrics for other materials)

4.1.3 Pipe Sizes

14 to 120 in. NB ANSI (350 to 3000 mm)

4.1.4 Flow Accuracy (Velocity)

4.1.4.1 High Flow Range: ±1.0 ft/s to ±394 ft/s (±0.3 to ±120 m/s)

One-Path: ±2.0%
Two-Path: ±1.5%
Note: For 4 to 12 in. NB pipe sizes, accuracy ranges from 1.5 to 4% (consult Panametrics for details). Accuracy to ±0.5% may be achieved with calibration.

4.1.4.2 Low Flow Range: ±0.1 ft/s to ±1.0 ft/s (±0.03 to ±0.3 m/s)

One-Path: ±0.008 f/s (±0.002 m/s)
Two-Path: ±0.0057 f/s (±0.0017 m/s)

Note: *Accuracies listed assume a fully developed flow profile. A minimum straight pipe run of 20 pipe diameters upstream and 5 pipe diameters downstream from the measurement point are recommended. Also, consult Panametrics for the accuracy of non-standard flow transducer types.*

4.1.5 Molecular Weight Accuracy

±1.8% of reading for hydrocarbon mixtures with molecular weights of 2 to 120 gr/gr mole

4.1.6 Mass Flow Accuracy

One-Path: ±2.7%
Two-Path: ±1.9%
Note: Dependent on the accuracy of the temperature and pressure inputs.

4.1.7 Repeatability

4.1.7.1 High Flow Range: ±1.0 ft/s to ±394 ft/s (±0.3 to ±120 m/s)

One-Path: ±0.5 to 1.0%
Two-Path: ±0.35 to 0.75%

4.1.7.2 Low Flow Range: ±0.1 ft/s to ±1.0 ft/s (±0.03 to ±0.3 m/s)

One-Path: ±5 to 6%
Two-Path: ±3.5 to 4.0

4.1.8 Rangeability (Overall)

4000:1

4.2 Electronics

4.2.1 Flow Measurement

Patented *Correlation Transit-Time* mode

4.2.2 Enclosures

Standard: Epoxy-coasted aluminum, Hazardous area ratings:
Explosion-proof: Class I, Division 1, Groups B, C, D
Flameproof:ISSeP 07ATEX015
II 2 G Ex d IIC T5 IP66
IECEx:FM G 0011x
II 2 G Ex IIC T6 Gb IP66

Optional: Stainless steel

4.2.3 Dimensions (l x d)

8.2 in. x 6.6 in. (208 mm x 168 mm)

4.2.4 Weight

Aluminum: 10 lb (4.5 kg)
Stainless steel: 30 lb (13.6 kg)

4.2.5 Channels

Standard: Two channels (for two-path averaging)

4.2.6 Display

2 line x 12 character backlit LCD display,
configurable to display up to four measurement parameters in sequence

4.2.7 Keypad

Built-in magnetic six-button keypad for full functionality operation

4.2.8 Power Supplies

Standard: 100 to 240 VAC, 50/60 Hz, ± 10%.
Optional: 12 to 28 VDC, ±5%.

4.2.9 Power Consumption

20 W maximum

4.2.10 Operating Temperature

–40°F to 140°F (–40°C to 60°C)

4.2.11 Storage Temperature

–67°F to 167°F (–55°C to 75°C)

4.2.12 Standard Inputs and Outputs

Two 0/4 to 20 mA isolated analog outputs, 600 Ω maximum load, and
Two 4 to 20 mA isolated analog inputs, 24 VDC loop power
or
One 4 to 20 mA isolated analog inputs, 24 VDC loop power, and
One direct three-wire RTD (temperature) input, -148°F to 662°F (-100°C to 350°C), 100 Ω platinum

4.2.13 Optional Inputs and Outputs

Two optically isolated frequency outputs, 3 A maximum, 100 VDC maximum,
1 W maximum, from DC to 10 kHz maximum

4.2.14 Digital Interfaces

Standard:RS232 (PanaView (PC software)

HART® protocol on 4-20 mA output

Optional:Modbus® TCP/IP
Ethernet
OPC Server

Foundation Fieldbus®

4.2.15 European Compliance

System: Directives EMC 2004/108/EC, LVD 2006/95/EC (Installation Category II, Pollution Degree 2)
Transducers: PED Directive 97/23/EC for DN<25
[See the *CE Declaration of Conformity* at the back of this manual.]

4.3 Wetted Ultrasonic Flow Transducers

4.3.1 Temperature Range

Overall: -364ºF to 536ºF (-220ºC to 280ºC)
Note: Transducer type selection is based on specific application review.

4.3.2 Pressure Range

Standard: 2 psig to 1500 psig (87.6 kPa to 10300 kPa)

4.3.3 Materials

Standard: Titanium

Optional: Monel® or Hastelloy® alloys

4.3.4 Process Connections

Flanged and compression fittings

4.3.5 Area Classifications

Standard: Epoxy-coasted aluminum, Hazardous area ratings:
Explosion-proof: Class I, Division 1, Groups C, D
Flameproof:II 2 G Ex d IIC T4, T3 or T2 Gb
IECEx: Ex d IIC T4, T3 or T2 Gb

Optional: Class I, Division 1, Group B

4.4 Insertion Mechanism

4.4.1 Standard Range

3 in. (76 mm) flange-mounted packing gland and valve with equal mounting angles upstream and downstream

4.4.2 Extended Velocity Range

3 in. (76 mm) flange-mounted packing gland and valve with *Recovery Angle* in downstream assembly

4.5 Preamplifier

4.5.1 Physical

In-line, powered preamplifier with transformer and BNC connections. One preamplifier with transformer is required per transducer per channel.

4.5.2 Gain

Standard: 20
Optional: 2, 10, 40 (factory selected)

4.5.3 Temperature Range

–40°F to 60°F (–40°C to 140°C)

4.5.4 Enclosure

Explosion-proof: Class I, Division 1, Groups C, D (*Optional*: Group B upon request)
ATEX Flameproof: II 2 G Ex d IIC T4, T3 or T2 Gb
IECEx Flameproof: Ex d IIC T4, T3 or T2 Gb

4.6 Transducer Cables

4.6.1 Standard (per Transducer pair)

- One pair of coaxial cables for transducer to preamplifier connections (if required), type RG62A/U, length 3m (10 ft)
- One pair of coaxial cables for preamplifier to XGF868i electronics, type RG62A/U, length 10 ft (3 m) to 1000 ft (330 m) maximum

4.6.2 Optional

flame retardant, armored cable; cable glands

4.7 Options

4.7.1 PanaView™ PC-Resident Interface Software

Using the *PanaView* software, the *DigitalFlow™ XGF868i* flow transmitter communicates with a PC running a *Windows*® operating system through a serial interface. Features include *site files*, *logs* and other operations.

4.7.2 Installation Flowcells

Flanged or plain-end spoolpiece, with hot tap or cold tap transducer connections
Note: Consult with Panametrics for the availability of transducers and flowcells for specific applications.

4.7.3 Pressure and Temperature Transducers

Available upon request.

Appendix A. CE Mark Compliance

A.1 Introduction

For CE Mark compliance, the XGF868i flow transmitter must be wired in accordance with the instructions in this appendix.

IMPORTANT: *CE Mark compliance is required for all units intended for use in EU countries.*

A.2 Wiring

The XGF868i must be wired with the recommended cable, and all connections must be properly shielded and grounded. Refer to *Table 12* below for the specific requirements. All interconnecting cables shall comply with IEC/EN 60079-14.

Table 12: Wiring Requirements

Connection	Cable Type	Ground Termination
Transducer	Armored RG62 a/U	Grounded via cable gland.
Input/Output	Armored 22 AWG shielded (e.g. Baystate #78-1197) with armored material added to outside of jacket	Grounded via cable gland.
Power	Armored 14 AWG 3 conductor	Grounded via cable gland.



WARNING! To ensure safe and reliable operation of the XGF868i, be sure to install and tighten all cable glands in accordance with the gland manufacturer's instructions.

Note: *If the XGF868i is wired as described in this appendix, the unit will comply with the EMC Directive 2004/108/EC.*

[no content intended for this page]

Appendix B. Certification and Safety Statements

B.1 Certification & Safety Statements for Panametrics Ultrasonic Flow Transmitters

When installing this apparatus, the following requirements must be met:

- Field wiring shall be rated at least 10°C above 70°C.
- Connecting cables shall be mounted securely and protected from mechanical damage, pulling and twisting.
- Cable entries are ¾" NPT.
- Cable glands of an approved flameproof design are required. These must be installed according to the manufacturer's instructions. Where the cable glands are provided by Panametrics, the manufacturer's instructions, as supplied, to Panametrics, will be included in the documentation.
- Unused cable entries must be sealed using a certified threaded plug.
- Modifications to the flameproof enclosure are not permitted.
- The apparatus should be de-energized before opening.
- Installation should comply with IEC/EN 60079-14.
- Equipment is of type flameproof "d" design and complies with: EN 60079-0:2009, EN 60079-1:2007, EN 60529:1991 +A1:2000, IEC 60079-0:2011, IEC 60079-1:2007, IEC 60529:2001.
- The product contains no exposed parts which produce surface temperature infrared, electromagnetic ionizing, or
non-electrical dangers.
- The product must not be subjected to mechanical or thermal stresses in excess of those permitted in the certification documentation and the instruction manual.
- The product cannot be repaired by the user; it must be replaced by an equivalent certified product. Repairs should only be carried out by the manufacturer or by an approved repairer.
- Only trained, competent personnel may install, operate and maintain the equipment
- The product is an electrical apparatus and must be installed in the hazardous area in accordance with the requirements of the EC Type Examination Certificate. The installation must be carried out in accordance with all the appropriate international, national and local standard codes and practices and site regulations for flameproof apparatus and in accordance with the instructions contained in the manual. Access to the circuitry must not be made during operation.

Special Conditions for Safe Use: Consult the manufacturer if dimensional information on the flameproof joints is necessary.

Markings: Markings shall appear on the product as shown below:

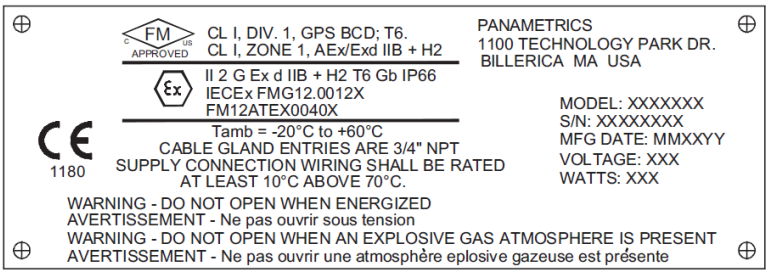
When installing this apparatus, the following requirements must be met:

- Field wiring shall be rated at least 10°C above 70°C.
- Connecting cables shall be mounted securely and protected from mechanical damage, pulling and twisting.
- Cable entries are ¾" NPT.
- Cable glands of an approved flameproof design are required. These must be installed according to the manufacturer's instructions. Where the cable glands are provided by Panametrics, the manufacturer's instructions, as supplied, to Panametrics, will be included in the documentation.
- Unused cable entries must be sealed using a certified threaded plug.
- Modifications to the flameproof enclosure are not permitted.
- The apparatus should be de-energized before opening.
- Installation should comply with IEC/EN 60079-14.
- Equipment is of type flameproof "d" design and complies with: EN 60079-0:2009, EN 60079-1:2007, EN 60529:1991 +A1:2000, IEC 60079-0:2011, IEC 60079-1:2007, IEC 60529:2001.

- The product contains no exposed parts which produce surface temperature infrared, electromagnetic ionizing, or
non-electrical dangers.
- The product must not be subjected to mechanical or thermal stresses in excess of those permitted in the certification documentation and the instruction manual.
- The product cannot be repaired by the user; it must be replaced by an equivalent certified product. Repairs should only be carried out by the manufacturer or by an approved repairer.
- Only trained, competent personnel may install, operate and maintain the equipment
- The product is an electrical apparatus and must be installed in the hazardous area in accordance with the requirements of the EC Type Examination Certificate. The installation must be carried out in accordance with all the appropriate international, national and local standard codes and practices and site regulations for flameproof apparatus and in accordance with the instructions contained in the manual. Access to the circuitry must not be made during operation.

Special Conditions for Safe Use: Consult the manufacturer if dimensional information on the flameproof joints is necessary.

Markings: Markings shall appear on the product as shown below:



ATEX/IECEx

Specific Conditions of Use:

- The 868i and 878 series transmitter shall only be mounted in such an orientation that the mounting base is pointed downwards with the cylindrical enclosure in a horizontal position. (See clause 26.5.1.1 of IEC 60079-0).
- Contact the manufacturer if dimensional information of flameproof joints is needed. (See clause 5.1 of IEC 60079-1).
- Field connections to the 868i and 878 series transmitter (e.g. ultrasonic transducers, accessories or similar peripherals) shall be appropriately certified for the location and installed in accordance with wiring method requirements of the local electrical code as applicable

US/Canada:

Specific Conditions of Use:

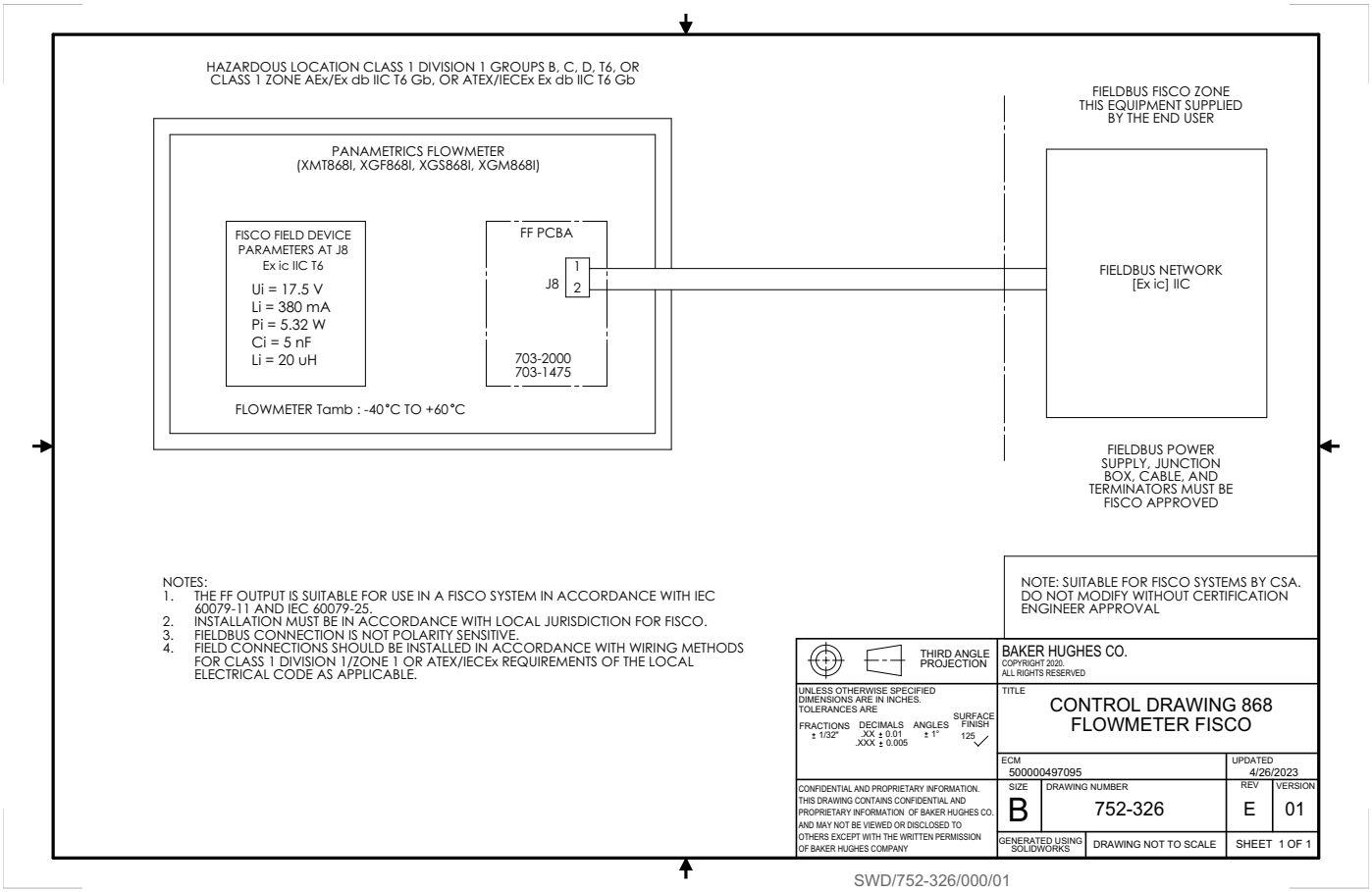
- The 868i and 878 series model designation may include additional suffixes denoting dimensions and details for construction. (See drawing 752-111)
- The above models are permanently (conduit) connected, intended for continuous operation in extended environmental conditions as specified. Equipment Class I, Overvoltage Category II, Pollution Degree 2.
- The DC version is intended to be supplied by Class 2, SELV or equivalent power source.
- The 868i and 878 series Transmitter shall only be mounted in such an orientation that the mounting base is pointed downwards with the cylindrical enclosure in a horizontal position.
- Contact the manufacturer if dimensional information of flameproof joints is necessary.
- Field connections to the 868i and 878 series Transmitter (e.g. ultrasonic transducers, accessories or similar peripherals) shall be appropriately certified for the location and installed in accordance with wiring method requirements of the local electrical code as applicable.

- The 868i and 878 series Transmitter have non-conducting coating which may generate an ignition-capable level of electrostatic charge under certain extreme conditions. The user shall take the necessary precautions to minimize the risk from electrostatic discharge. For example, controlling the environmental humidity where installed in order to minimize generation of static electricity, with the equipment protected from direct airflow which could cause a transfer of charge to the surface of the equipment. Cleaning should be done only with a damp cloth.

USA/Can/ATEX/IECEx FISCO:

Specific Conditions of Use:

- The 868i and 878 series model code variables shown as an asterisk (*) above may be replaced by alpha numeric characters without affecting certification status.
- The 868i and 878 series model designation may include additional suffixes denoting dimensions and details for construction. (See drawing 752-111)
- The above models are permanently (conduit) connected, intended for continuous operation in extended environmental conditions as specified, supplied by Class 2, SELV or equivalent power source. Equipment Class III, Overvoltage Category I, Pollution Degree 2.
- Field connections to the 868i and 878 series Transmitter (e.g. ultrasonic transducers, accessories or similar peripherals) shall be appropriately certified for the location and installed in accordance with wiring method requirements of the local electrical code as applicable.



SWD/752-326/000/01

B.2 Installing Panametrics Ultrasonic Flow Transmitters in a Potentially Hazardous Area

When installing this apparatus in a potentially hazardous area, the following requirements must be met:

- The installation shall comply with IEC 60079-14.
- Apparatus Markings:
  Ex d IIC T6 Gb
- Supply connection wiring shall be rated at least 10°C above rated ambient temperature of 60°C. Cable entries are 3/4" NPT.
- Certificate Number: IECExFMG12.0011X
  Complies with IEC 60079-0: 2011 and IEC 60079-1: 2007
  Manufacturer: Panametrics, Billerica, MA.
- The certification covers the following Panametrics product types — XMT868, XMT868i, XGF868, XGF868i, XGN868, XGN868i, XGS868, XGS868i, XGM868, XGM868i, IGM878 &: IGM878i.
- This apparatus is equipment category 2 and may be employed in Zones 1 and 2. It may not be employed in a Zone 0 area. This apparatus is certified for gas hazards only.
- Enclosure Material: Si=95, Mg=0.35%, Mn=0.5%, Al = remainder.
- This apparatus must be securely mounted using the mounting fixtures provided on the enclosure.
- All covers are fitted with a locking device. This device must be tightened after the cover is replaced so as to preserve the protection offered by the enclosure.
- Modifications to the flameproof enclosure are not permitted.
- Cable glands of an approved flameproof design are required. These must be installed according to the manufacturer's instructions. Where the cable glands are provided by Panametrics, the manufacturer's instructions, as supplied to Panametrics, will be included in the documentation.
- Connecting cable shall be mounted securely and protected from mechanical damage, pulling and twisting.
- Unused entries must be sealed using a certified threaded plug.
- The apparatus should be de-energized before opening.
- If live working is necessary, the apparatus may only be opened when the surrounding atmosphere is known to be safe. Measures must be taken to ensure that it remains safe while the unit is open, such as a system of hot work permits.
- The apparatus uses standard printed circuit assemblies. Always quote the apparatus serial number when ordering spares.
- This flameproof apparatus is only designed to be installed in a potentially hazardous area. This apparatus has not been designed for use in a safe area, where it would be subject to CD 2006/95/EC (LVD). For a safe area installation, an external mains disconnect must be provided close to this apparatus. If in doubt, consult Panametrics.

Appendix C. Data Records

C.1 Available Option Cards

The XGF868i can hold one option card in Slot 1 and one in Slot 2. The available configurations are listed in *Table 13* below.

Table 13: Option Card Configurations

Card #	Slot #	Configuration
1473-02	1	OI - 2 Current Inputs
1473-14		OR - 1 RTD Input/1 Current Input
1473-06		FI - 2 Current Inputs/2 Frequency Outputs
1473-15		FR - FRI- 2 Frequency Outputs/1 RTD Input/1 Current Input
1345-04	2	Modbus Communications Protocol
1658		HART Communication
1477-03		MODBUS/TCP/IP
1477-01		Ethernet
1475-01		Foundation Fieldbus

[no content intended for this page]

Appendix D. Measuring P and L Dimensions

D.1 Introduction

When programming the PIPE menu in the XGF868i *User Program*, the *path length* (P) and the *axial dimension* (L) must be entered. These parameters are determined by measurements on the actual transducer installation, with P equal to the face-to-face distance between the transducers and L equal to the axial distance between the centers of the transducer faces.

The accuracy of the programmed P and L values is critical to precise flow rate measurements. If Panametrics supplies the flowcell for the system, the correct values will be included in the documentation supplied with the system. For transducers installed on an existing pipe (see Figure 18 on page 56), P and L must be measured at the site. This appendix provides instructions for properly determining these dimensions.

D.2 Measuring P and L

Whenever possible, physically measure the face-to-face distance (P) and the axial distance (L) between the centers of the flat faces of the transducers. Refer to *Figure 18 on page 56* for an illustration of the proper distances to measure, in a typical installation.

In some situations only one of the required distances can be directly measured. When this happens, a knowledge of the installation angle (θ) of the transducers, permits the second distance to be calculated from *Equation C-1* below.

$$\cos\theta = \frac{L}{P}$$

As an example, assume that the transducer installation angle is known to be 45° and the L distance is measured to be 10.00 inches. Then, the P distance is calculated to be P = 10.00/0.707 = 14.14 inches.

With a Bias 90° transducer installation, it sometimes happens that the only known parameters are the transducer angle (θ) and the centerline distance between the transducer bodies (CL). In these cases, it is still possible to calculate P and L by combining *Equation C-1* above with the additional *Equation C-2* below (see *Figure 18 on page 56*):

$$P = CL - 1.2$$

Standard Panametrics 90° transducers have the face offset from the centerline of the body by 0.6 inches. Thus, a pair of transducers has a total offset of 1.2 inches, as indicated in Equation C-2. For example, suppose that the transducer installation angle is 30° and CL is measured to be 12.00 inches. Then, P = 12.00 – 1.2 = 10.80 inches and L = 10.80 x 0.866 = 9.35 inches.

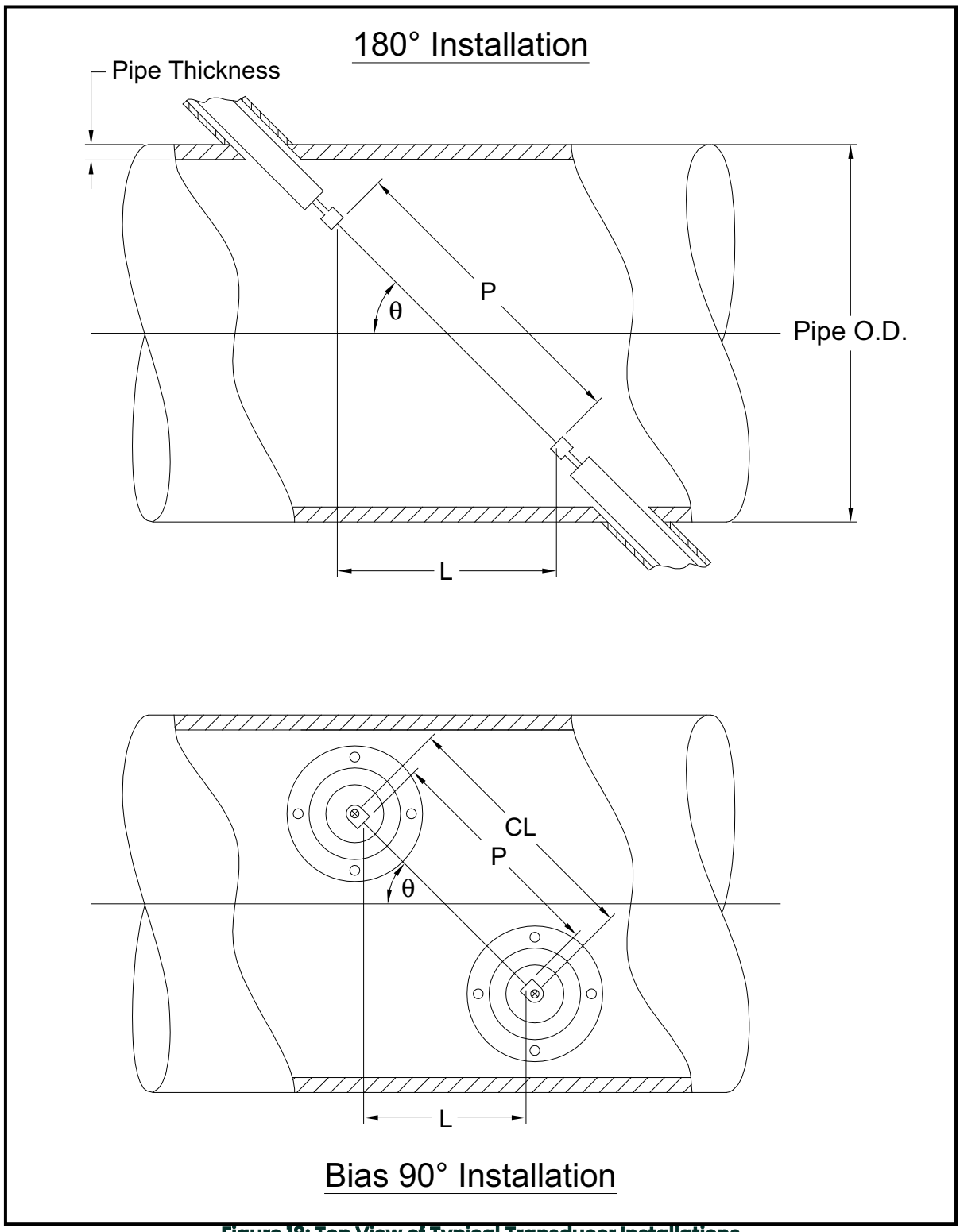


Figure 18: Top View of Typical Transducer Installations

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[no content intended for this page]

Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- One year from delivery for electronic or mechanical failures
- One year from delivery for sensor shelf life

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a RETURN MATERIAL AUTHORIZATION (RMA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

[no content intended for this page]

Customer Support Centers

U.S.A.
The Boston Center
1100 Technology Park Drive
Billerica, MA 01821
U.S.A.
Tel: 800 833 9438 (toll-free)
978 437 1000
E-mail: panametricstechsupport@bakerhughes.com

Ireland
Sensing House
Shannon Free Zone East
Shannon, County Clare
Ireland
Tel: +353 (0)61 470200
E-mail: panametricstechsupport@bakerhughes.com

Scan here for Panametrics support and service information

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BH060C41 EN E (04/2024)

Baker Hughes

Panametrics

DigitalFlow™ XGF868i

Panametrics Flare Gas Flow Transmitter

Programming Manual



Panametrics

DigitalFlow™ XGF868i

Panametrics Flare Gas Flow Transmitter

Programming Manual

BH060C31 EN D
April 2024

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Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: Training, Product Repairs, Service Agreements and more.

Please visit https://www.bakerhughes.com/panametrics/panametrics-services for more details.

Typographical Convention

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: These paragraphs provide information emphasizing instructions which are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.



WARNING! **Indicates a potentially hazardous situation which can result in serious personal injury or death, if it is not avoided.**



CAUTION! **Indicates a potentially hazardous situation which can result in minor or moderate injury to personnel or damage to the equipment, if it is not avoided.**



HIGH VOLTAGE! **This symbol indicates the presence of high voltage. It calls your attention to situations or operations that could be dangerous to you and other persons operating the equipment. Read these messages and follow the instructions carefully.**

Safety Issues



WARNING! **It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.**

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area



WARNING! **Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.**



WARNING! **Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on the equipment.**

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

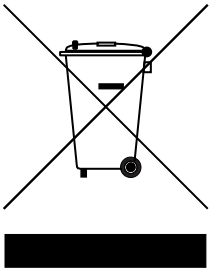
Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

Panametrics is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2012/19/EU.



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

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Chapter 1. Programming Site Data

1.1 Introduction

The XGF868i flow transmitter must be properly installed and programmed, as described in the *Startup Guide*, before it can provide accurate flow rate measurements. After completing the installation and initial setup, use this chapter to program the advanced features of the XGF868i *Keypad Program*.

Step-by-step programming instructions are presented in this chapter. Also, as a programming aid, a complete set of menu maps for the **XGF868i** are included in Appendix A, *Menu Maps*. The specific figure numbers will be referenced throughout this chapter, as required.

Refer to the appropriate section for a discussion of the following *Keypad Program* features:

- **ChannelX-ACTIV** - activate one or both channels and Scroll to the desired measurement method.
- **ChannelX-SYSTM** - enter the individual channel parameters.
- **ChannelX-PIPE -** enter the pipe geometry and other parameters.
- **ChannelX-I/O** - set up the inputs and outputs.
- **ChannelX-SETUP** - set the signal limits, response times and mass flow status.
- **Global-SYSTM** - scroll to system units (English or metric).
- **Global-I/O** - set up error handling, option cards and the display.
- **Global-COMM** - set the serial port parameters.

Note: *The "x" in CHx represents the channel number.*

To get the XGF868i up and running as quickly as possible you must, as a minimum, activate the channel(s), enter the channel and global system data and the pipe parameters. The *Procedure Options* section at the end of each menu will help you in programming the required (quick startup) and optional data.

Note: *In this manual, only the programming of Channel 1 will be described. To program Channel 2 of a 2-channel meter, simply repeat the same procedure presented for Channel 1.*

1.2 Programming Methods

You can program the XGF868i via either the keypad on the lower part of the glass window, or **PanaView™,** a PC-based, non-resident software program that communicates with the XGF868i via its RS232 serial port. PanaView supplements basic XGF868i functions with several additional capabilities. With PanaView, you can:

- Load and save site file data
- Create and save graph and log files
- Display text output and graphs of live measurement data
- Create custom templates for displaying text, graph and log data
- Interface with multiple Panametrics instruments.

Although the actual displays differ somewhat, the general procedures are the same for all three programming methods. This chapter provides detailed programming instructions for use with the magnetic keypad. If you are using PanaView™, see Appendix C, *Programming the XGF868i via PanaView™,* and/or the *PanaView™ User's Manual* (910-211) for detailed instructions.

IMPORTANT: This manual is for instruments using software version Y4AM or later.

1.3 The XGF868i Keypad

Keypad Program

Along with the 2-line, 16-character LCD, the XGF868i includes a 6-key magnetic keypad. The decal cutout for each key contains a hall effect sensor, pushbutton switch and visible red LED. The magnetic wand used to activate a magnetic key is found attached to the meter chassis below the front panel. An operator activates the key by pressing the magnetic wand up to the glass lid over the desired key. The LED will light indicating a successful key press.

Note: *The pushbutton switch will also act as a key press but is done with the glass lid open. Do not use the pushbutton switch in a hazardous area where the lid needs to be installed.*

Use the magnetic keypad to navigate through the user program. The menu map may be followed in sequence, or the four arrow keys may be used to scroll through the prompt screens. Figure 1 shows the front of the XGF868i, with magnetic keypad and magnetic wand.

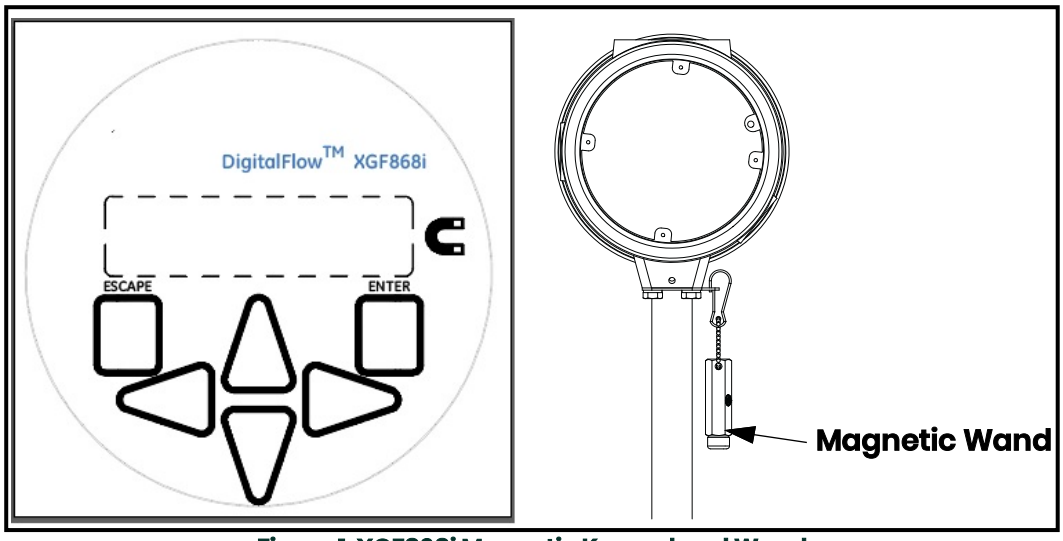


Figure 1: XGF868i Magnetic Keypad and Wand

IMPORTANT: The XGF868i keypad enables programming of the instrument through the glass faceplate without removing the cover. Thus, all programming procedures may be performed while the unit is installed in a hazardous area.

Six keys on the keypad enable users to program the XGF868i:

- [Enter] - confirms choice of a specific option and data entry within the option
- [Escape] - allows users to exit from a specific option without entering unconfirmed data
- [△] and [▽] - enable users to highlight a specific window in the display option or to scroll through a list of options (parameters, letters, and numbers 0-9 as well as the negative sign and decimal point) in a menu
- [◁] and [▷] - enable users to scroll to a specific option, among choices in an option, or to a character in a text entry.

When you power up the XGF868i, the display first shows the model and software version:

Panametrics
XGF868i Y4DF.STD

The meter then starts to display measured parameters.



To enter the *Keypad Program*, press the [Escape] key, followed by the [Enter] key, and the [Escape] key again. Each successive key must be entered within 10 seconds of the prior key.

As a guide in following the programming instructions in this chapter, the relevant portions of the XGF868i menu map have been reproduced in *Figure 28 on page 61* and *Figure 29 on page 62*. Proceed to the following sections to enter data in the Channel or GLOBL menus.

IMPORTANT: If the keypad has not been pressed for 10 minutes, the XGF868i exits the Keypad Program and returns to displaying measurements. The meter retains any configuration changes that were confirmed with the [Enter] key, and restarts as if the operator had completed the programming cycle.

1.4 Activating a Channel

The **ChannelX-ACTIV** submenu permits selection of the desired measurement method. In addition, it is used to activate/deactivate one or both of the channels in a 2-Channel XGF868i.

While following the programming instructions, refer to *Figure 28 on page 61*. To access the ChannelX-ACTIV submenu:

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to ACTIV and press [Enter].
4. Scroll to *Burst* to activate the channel/path, and press [Enter].
5. Scroll to one of the measurement methods described below and press [Enter].
   - Skan Only is the preferred technique for locating the acoustic signal and for high velocity measurements. It is more robust in a noisy environment than the Measure technique.
   - Skan/Measure is the preferred technique to use for low velocity measurements.

If Skan Only is selected at the above prompt, the meter uses this technique exclusively. However, if Skan/Measure is selected, the meter uses Skan Only to find the acoustic signal and then tries to use the Skan/Measure technique for the actual measurement.

Note: *To change the Skan Only and Skan/Measure parameters, see the* **Signal** *submenu section on* page 12 *of this chapter.*

Procedure Options

After completing the above step, the XGF868i returns to the Channel PROGRAM window. Do one of the following:

- To continue entering “quick startup” data, proceed to Step 3 in the following section.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] twice.

1.5 Entering System Data for the Channel

The Channelx-System submenu is used to enter system parameters for the channel. While following the programming instructions, refer to *Figure 28 on page 61*.

1.5.1 Accessing the Channelx-System Submenu

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to SYSTM and press [Enter].
4. Use the arrow keys to enter the desired *Channel Label* (up to 5 characters) and press [Enter].
5. Use the arrow keys to enter the desired *Site/Channel Message* (up to 21 characters) and press [Enter].

1.5.2 Selecting Volumetric Units

1. Scroll to the desired *Volumetric Units* for the flow rate display and press [Enter]. Table 1 lists available units.
2. Scroll to the desired *Volumetric Time* units for the flow rate display and press [Enter].
3. Scroll to the desired number of *Vol. Decimal Digits* (digits to the right of the decimal point in the volumetric flow rate display) and press [Enter].

Table 1: Available Volumetric/Totalizer Units

English	Metric
ACF = Actual Cubic Feet	ACM = Actual Cubic Meters
KACF = Thousands of ACF	KACM = Thousands of ACM
MMACF = Millions of ACF	MMACM = Millions of ACM
SCF = Standard Cubic Feet	SCM = Standard Cubic Meters
KSCF = Thousands of SCF	KSCM = Thousands of SCM
MMSCF = Millions of SCF	MMSCM = Millions of SCM

1.5.3 Selecting Totalizer Units

1. Scroll to the desired *Totalizer Units* for a totalized flow rate display and press [Enter]. *Table 1* above lists available units.
2. Scroll to the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display) and press [Enter].
3. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting the Mass Flow Units* on the following page.
   - If MASS FLOW is OFF, the meter returns to the Channel PROGRAM. Go to *Procedure Options* on the next page.

Note: *To activate mass flow, refer to* page 17.

1.5.4 Selecting Mass Flow Units

1. Scroll to the desired *Mass Flow* units for the flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at System Units (see *Table 2* below).

Table 2: Available Mass Flow Units

English	Metric
Pounds	Kilograms
Thousands of LB	Metric Tons (1,000 KG)
Millions of LB	
Tons (2,000 LB)	

2. Scroll to the desired *Mass Flow Time* units for the mass flow rate display and press [Enter].
3. Scroll to the desired number of *Mdot Decimal Digits* (digits to the right of the decimal point in the mass flow rate display) and press [Enter].
4. Scroll to the desired *Mass (Totalizer)* units for the totalized mass flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt.
5. Scroll to the desired number of *Mass Decimal Digits* (digits to the right of the decimal point in the totalized mass flow rate display) and press [Enter].

Procedure Options

After completing the steps on the previous page, the XGF868i returns to the Channel PROGRAM window. Do one of the following:

- To continue entering “quick startup” data, continue to Step 1 in *Entering Transducer and Pipe Parameters* on the next page.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] twice.

1.6 Entering Transducer and Pipe Parameters

Enter the transducer and pipe parameters via the **PIPE** submenu. While following the programming instructions, refer to *Figure 28 on page 61*.

1. From the Channel PROGRAM menu, scroll to the PIPE option and press [Enter].
2. The first prompt asks for the *Transducer Number.*
   - For a standard transducer, use the arrow keys to enter the number engraved on the transducer head, and press [Enter].
   - If there is no number engraved on the transducer head, press the right arrow key to scroll to the *STD* option, and use the up and down arrow keys to change to *SPEC*. Then use the arrow keys to enter an assigned number (from 91 to 99), and press [Enter].

IMPORTANT: Special transducers have no engraved number on the head and are rarely used. Examine the transducer head carefully for a number.

- If you entered the number for a standard transducer, proceed to the *Pipe OD* prompt in step 5.
- If you entered the number for a special transducer, proceed to step 3 below.

1.6.1 Special Transducers

Note: *For special transducers, Panametrics supplies a transducer data sheet with programming information.*

3. Scroll to the transducer *Frequency* (supplied by the factory) and press [Enter].

Note: *The frequency is required to transmit an excitation voltage at the transducer's natural frequency.*

4. Enter the special transducer *Tw* (time delay) value (supplied by the factory) and press [Enter].

   Tw is the time required for the transducer signal to travel through the transducer and its cable. This time delay must be subtracted from the transit times of the upstream and downstream transducers to ensure an accurate flow rate measurement.

1.6.2 Pipe Data

If either a standard or a special transducer is being used, the programming sequence should be rejoined at this point.

1. To select the appropriate *Pipe OD Unit* type from the list shown in Table 3, scroll to the right side of the screen, and use the up and down arrow keys to step through the list. Press [Enter]. Then use the arrow keys to enter the known pipe outside diameter or circumference on the left side and press [Enter].

   Obtain the required information by measuring either the pipe outside diameter (OD) or circumference at the transducer installation site. The data may also be obtained from standard pipe size tables found in *Sound Speeds and Pipe Size Data* (914-004).

Table 3: Available Pipe Size Units

English	Metric
inches	mm = millimeters
feet	m = meters
in/PI = pipe circumference in inches	mm/PI = pipe circumference in millimeters
ft/PI= pipe circumference in feet	m/PI = pipe circumference in meters

2. Use the arrow keys to enter the known *Pipe Wall Thickness* (in inches or mm) and press [Enter]. If the pipe wall thickness is not available, look up the value in a table of standard pipe size data which can be found in the *Sound Speeds and Pipe Size Data* manual (914-004)

IMPORTANT: Because the units cannot be independently chosen for this parameter, the value must be entered in the same units used for the pipe OD/Circumference.

1.6.2.1 Path and Axial Lengths

1. To enter the *Path Length:*

a. Use the [▷] arrow key to highlight the path length unit type at the right of the screen.Then use the [△] and [▽] arrow keys to scroll to the desired unit type.

b. Use the [◁] arrow key to return to the numeric entry on the left, and enter the path length of the ultrasonic signal. Press [Enter].

Note: *If a spoolpiece was ordered with the meter, the transducer signal path length* **(P)** *and the transducer signal axial length* **(L)** *are engraved on the flowcell and/or are included in the documentation supplied with the meter. For on-site transducer installations, refer to Appendix C,* Measuring P and L Dimensions*, in the* Startup Guide.

2. In the same manner, enter the appropriate *Axial Length L* unit type and axial length of the ultrasonic signal, and press [Enter].
3. Scroll to the desired *Fluid Type* and press [Enter]. Then do one of the following:
   - If **OTHER** was selected - proceed to Step 10.
   - If **AIR** was selected - proceed to Step 11.
4. Use the arrow keys to enter the *Fluid Soundspeed* (in feet per second) in the gas to be measured and press [Enter].
5. Scroll to the appropriate choice to indicate whether you want *Reynolds Correction*, and press [Enter].
   - If *Off* is selected, go to Step 12.
   - If *On* is selected, the program asks for the *Kinematic Viscosity*. Use the arrow keys to enter the desired value, and press [Enter].
6. Use the arrow keys to enter a value for the flow *Calibration Factor* and press [Enter]. The default value is 1.00, but values between 0.50 and 2.0 may be entered.

Procedure Options

After entering the **Calibration Factor**, the XGF868i returns to the **Channel PROGRAM**. Do one of the following:

- To continue entering "*quick startup*" data, press [**Escape] once and proceed to Step 1 in Entering Global System Data** on *page 18*.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press the **[Escape]** key twice.

1.7 Entering Zero Cutoff and Setting Up Inputs

Enter the zero cutoff value and set up the temperature and pressure inputs via the **I/O** submenu. While programming these parameters, refer to *Figure 28 on page 61*.

IMPORTANT: If an option card in **Slot 1** fails to appear in this menu, it may be turned **Off**. See the **Global-I/O-Options** section on page 21 for setup instructions.

1.7.1 Zero Cutoff Value

Near a zero flow rate, the XGF868i's readings may fluctuate due to small offsets caused by thermal drift or similar factors. To force a zero display reading when there is minimal flow, enter a *zero cutoff value* as described below.

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to I/O and press [Enter].
4. Enter a value from 0 to 1 ft/sec (0 to 0.30 m/sec) for the *Zero Cutoff* and press [Enter]. The recommended setting is 0.0200 ft/sec (0.0009 m/sec).

1.7.2 Temperature Input

The XGF868i can use either a fixed temperature value or a live temperature input to calculate the density for the mass flow rate display.

1. Scroll to a *Fixed* temperature value or to set up the option card in *Slot 1* that will supply the live temperature input and press [Enter].

Note: *If Slot 1 contains an activated option card with an analog input assigned to* **Temperature** *or an* **RTD** *input, Slot 1 appears as an option at the above prompt. If the process temperature is stable, a fixed value may be used, but most applications require a live temperature input. If there is no active option card for temperature, the meter assumes you are using a fixed temperature.*

2. Proceed to one of the following sections:
   - If you selected *Fixed* - proceed to Step 3.
   - If you selected *Slot 1* - proceed to Step 4.
3. Enter the known *Fixed Temp.* (process temperature) and press [Enter]. The meter will accept values from –328° to 1832°F (–200° to 1000°C). Proceed to *Base Temperature* on the next page.
4. Scroll to *Input A* or *Input B* and press [Enter]. The inputs were labeled during setup.

Note: *The set up of Input A is used as an example. Identical procedures would be used to set up Input B.*

1.7.3 Base Temperature

1. Use the arrow keys to enter the *Base Temperature* and press [Enter]. The ratio of this value to the actual temperature is used to calculate the standard mass flow rate.
2. Do one of the following:
   - If you selected Pressure as the Input Type, proceed to *Pressure Input* below.
   - If you selected Temperature as the Input Type, proceed to *Base Pressure* below.

1.7.4 Pressure Input

1. Scroll to a *Fixed* pressure value or to set up the option card in *Slot 1* that will supply the live pressure input and press [Enter].

Note: *If Slot 1 contains an activated option card with an input assigned to* **Pressure, Slot 1** *appears as an option at the above prompt. If the process pressure is stable, a fixed value may be used, but most applications require a live pressure input. If there is no active option card for pressure, the meter assumes you are using a fixed pressure.*

2. Proceed to one of the following steps:
   - If you selected Fixed - proceed to Step 3.
   - If you selected Slot 1 - proceed to Step 4.
3. Enter the known *Fixed* process *Pressure* and press [Enter]. The meter will only accept values from 0 to 5,000 psia. Proceed to *Base Pressure* below.
4. Scroll to *Input A* or *Input B* and press [Enter]. The inputs were labeled during setup.

Note: *The set up of Input A is used as an example. Identical procedures would be used to set up Input B.*

1.7.5 Base Pressure

1. Enter the *Base Pressure* and press [Enter]. The ratio of this value to the actual pressure is used to calculate the standard mass flow rate.

1.7.6 Low Pressure Switch

1. Scroll to *Yes* or *No* to activate or deactivate the *Low Pressure Switch* software function and press [Enter].
2. Proceed to one of the following steps:
   - If you selected Yes - proceed to Step 3.
   - If you selected No - go to *Procedure Options* below.
3. Enter the *Pressure Limit*, the low pressure switch set point, and press [Enter]. The acceptable range is 0 to 5000 psia. The meter will stop taking readings if the pressure drops below this value.

Procedure Options

After completing the above steps, the XGF868i returns to the Channel PROGRAM window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.8 Entering Setup Data

The signal limits, response times, mass flow and multiple K factors for the XGF868i are specified via the **Setup** submenu. The following four submenus are included in this section:

- **Signal** - set the parameters related to the transducer signal (see below).
- **Default Setup** - reset all parameters to default values (*page 15*).
- **V averaging** - specify the response of the meter to step changes (*page 15*).
- **Advanced Features** - enable mass flow and enter K factors (*page 16*).

While following the programming instructions, refer to *Figure 29 on page 62*. Record all programmed data in Appendix B, *Data Records*.

1.8.1 Setting Transducer Signal Parameters

Use this option to set the limits for the incoming signal and other parameters affecting the transducer signal. For example, the programmed signal strength low limit may be used to determine the trigger point for an alarm.



CAUTION! **The Signal default settings are suitable for most applications. Consult with Panametrics before changing any of these parameters.**

Only after consulting the factory, complete the following steps to program the signal parameters:

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to SIGNL and press [Enter].
5. Use *Table 4 on page 13* to choose the desired values. Use the arrow keys to enter a value (or scroll to a value for a parameter with menu options) and press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the Channel SET UP window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

Table 4: Transducer Signal Settings

Transducer Signal Parameters	Range	Default Value	Description
Signal Low Limit	-20 to 100	20	The E1:LOW SIGNAL error message appears when the signal strength falls below the programmed SIGNAL LOW LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Correlation Peak Limit	0 to 500	100	The **E4: SIGNAL QUALITY** error message appears when the signal quality falls below the programmed **COR. PEAK LIMIT** value. See Chapter 2 in the Service Manual for a discussion of error codes
Soundspeed+ - Limit	1 to 50%	20%	The E2:SOUNDSPEED error message appears when the calculated fluid sound speed differs from the fluid sound speed entered in the Channelx-System menu by more than the programmed SOUNDSPEED +– LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Velocity Low Limit	-500 to 500 ft/sec (-150 to 150 m/sec)	-150 ft/sec (-46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity is less than the programmed VELOCITY LOW LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Velocity High Limit	-500 to 500 ft/sec (-150 to 150 m/sec)	150 ft/sec (46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity exceeds the programmed VELOCITY HIGH LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Acceleration Limit	0 to 250 ft/s (0 to 76 m/s)	15 ft/s (5 m/s)	The **E6: CYCLE SKIP** error message appears when the calculated fluid velocity changes by more than the programmed **ACCELERATION LIMIT** value from one reading to the next. See Chapter 2 in the Service Manual for a discussion of error codes.
Amplitude Discriminator Low	0 to 100	14	The amplitude discriminator measures the transducer signal received by the Model XGF868i. The default value for the above parameter is 14, and values from 0 to 100 are acceptable. The **E5: AMPLITUDE** error message appears when the amplitude discriminator falls below the programmed **AMP. DISCRIM LOW** value. See Chapter 2 in the Service Manual for a discussion of error codes.
Amplitude Discriminator High	0 to 100	34	The amplitude discriminator measures the transducer signal received by the Model XGF868i. The default value for the above parameter is 34, and values from 0 to 100 are acceptable. The **E5: AMPLITUDE** error message appears when the amplitude discriminator exceeds the programmed **AMP. DISCRIM HIGH** value. See Chapter 2 in the Service Manual for a discussion of error codes.
Delta T Offset	-1000 to 1000 µsec	0 µsec	An offset between the upstream and downstream transit times is specified at this prompt.
Skan T Offset	–500 to 500 µsec	58 µsec	At this prompt, specify a time measurement offset that compensates for any shift resulting from cross-correlation. Set to 0 for active Skan T Offset.
% of Peak	1 to 100%	50%	The percentage of peak used to calculate the transit times and Delta T is specified at this prompt.

Table 4: Transducer Signal Settings (cont.)

Transducer Signal Parameters	Range	Default Value	Description
M>S Switch	0 to 250 µsec	50 µsec	If the burst mode is set to Skan/Measure (S/M), the meter switches from Skan to Measure Mode when Delta T is less than the **M>S_Switch** value. **DO NOT** change this value unless advised to do so by the factory.
# Shifts	0 to 10	3	The number of shifts corresponds to the actual number of transmits per cycle (number of signals added together in one direction to produce an averaged signal for one interrogation of the fluid) and need only be changed if the environment is very noisy or the acoustic signal is weak.
A Divisor	0.1 to 10	2.5	**A Divisor** is used to calculate the Measure Mode integrated threshold level and is not normally changed.
# Transmit Pulses	1 to 16	4	**# Transmit Pulses** specifies the number of pulses in a burst. For difficult conditions (i.e. long paths, high velocity or high temperature), settings as high as 16 may be necessary.
T Window (cycles)	0 to 1000	0	The XGF868i calculates the size of the transmit window based on pipe size and fluid sound speed. However, for diagnostic purposes, the window size may be reset.
R Window (cycles)	10 to 128	10	The XGF868i calculates the size of the receive window based on pipe size and fluid soundspeed. However, for diagnostic purposes, the window size may be reset.

1.8.2 Initializing Setup Parameters - Default Setup

Use this option to initialize (reset) all of the parameters within the **Setup** menu to their default values. Complete the following steps to reset all of the parameters:

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to INIT. Press [Enter].
5. Scroll to Yes to initialize default parameters or No to abort this command. Press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the Channel Set up window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] four times.

1.8.3 Setting Response Time - V Averaging

Use this option to specify the number of readings that occur before the meter will respond to a step change in flow rate. In general, the smaller the number of readings, the less steady the display will appear. Complete the following steps to set the response time:

IMPORTANT: Do not change this number unless instructed to do so by Panametrics personnel.

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to AVRG and press [Enter].
5. Scroll to the *Response Time* (in number of readings) from the pull-down menu and press [Enter]. For best results, select a value of 30 to ensure the most stable signal.

Procedure Options

After completing the above steps, the XGF868i returns to the Channel SET UP window. Do one of the following:

- To continue programming, refer to Appendix A, M*enu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] four times.

1.8.4 Using Advanced Features

This option enables you to access the more advanced features of the meter. In this option you can do the following:

- *Enter a table of K factors* - to compensate for non-linear flow rates (see below).
- *Enable mass flow* - calculated for static fluid density (see the next page).

1.8.4.1 Entering K Factors

Use this option to enter a table of K factors. K factors are used to create a curve for the flow range (based on velocity) that compensates for non-linear flow rates. The meter accepts from 2 to 20 data pairs. Complete the following steps to enter multiple K factors for velocity values:

Note: *The K factors are supplied by the factory. Without them the K factor table cannot be edited.*

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to ADVAN. Press [Enter].
5. Scroll to MULTK, and press [Enter].
6. Scroll to *Yes* to activate, or to *No* to deactivate multiple K factors, and press [Enter].

Note: *If you selected No, go to* Procedure Options *below.*

7. Scroll to the *Custom Type* of K factor desired: CstV (velocity) or CstR (Reynolds). Press [Enter].
8. Scroll to *Yes* to *Edit Table,* or to *No* to retain the current values, and press [Enter].

Note: *If you scroll to No, go to* Procedure Options *on the next page.*

1.8.4.2 Editing K Factors

1. Use the arrow keys to enter the number of K factors (2 to 20) in the table and press [Enter].
2. Enter the velocity (or Reynolds) value for K factor number "X" and press [Enter].

Note: *When editing the K factor table, the velocities must be entered in increasing order.*

3. Enter the K factor corresponding to velocity number "X" (0.333 to 3.0) and press [Enter].
4. Repeat Steps 2 and 3 for each pair of values.

Procedure Options

After completing the previous steps, the XGF868i returns to the Advanced Features window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] five times.

1.8.4.3 Activating Mass Flow

Use this option to calculate mass flow from a static fluid density. Complete the following steps to enter the static density of the fluid:

IMPORTANT: The XGF868i can use a static density from either a single value of density (Rho), or from the live or fixed temperature and pressure inputs, as programmed in the I/O menu, along with a single entered value of Molecular Weight (MW). This is done by setting the Mass flow calculation prompt to Yes **and following the prompts below to calculate mass flow.**

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to CH1 or CH2 and press [Enter].
3. In the Channel PROGRAM menu, scroll to Setup and press [Enter].
4. Scroll to ADVAN. Press [Enter].
5. Scroll to MASS, and press [Enter].
6. Scroll to *Yes* to activate, or to *No* to deactivate *Static Density*, and press [Enter].

Note: *If you scroll to No, go to* Procedure Options *below.*

7. Scroll to the *Density Type* (molecular weight (Mw)) and press [Enter].
8. Do one of the following:
   - If you selected Rho - proceed to Step 9.
   - If you selected Mw - proceed to Step 11.
9. Scroll to the type of volumetric units (standard - StVOL or actual- AcVOL) for the measurement data display and press [Enter].
10. Enter the *Fluid Density* (0.00001 to 0.100 lb/ft^3 or 0.00001 to 123.18 kg/m^3) and press [Enter]. Go to *Procedure Options* below.
11. Enter the *Molecular Weight* and press [Enter].

Procedure Options

After completing the steps on the previous page, the XGF868i returns to the Advanced Features window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] five times.

1.9 Entering Global Data

The **Global** menu is used to enter information that is not specific to either of the individual channels. Information programmed via this menu is used to compute parameters such as the sum, difference or average of the channel 1 and channel 2 signals (for a 2-Channel meter). In addition, several general system parameters may be entered in the **Global** menu.

IMPORTANT: When calculating the **sum**, **difference** or **average** readouts, data from the **Global-System** submenu is used. Any conflicting data entered in the **ChannelX-System** submenu is overridden.

The following submenus are included in the **Global** menu:

- **SYSTM** - use to specify the units of measure used in calculations (see the next page).
- **I/O** - used to set up error handling and to configure analog inputs and outputs (see page 20).
- **COMM**- used to set up the serial communications port (see page 26).

Based on the selection made above, proceed to the appropriate section of this chapter for instructions. While following the programming instructions, refer to *Figure 30 on page 63*. Remember to record all programmed data in Appendix B, *Data Records*.

1.9.1 Entering Global System Data

This menu enables you to select the system units that the XGF868i will use when channel data is added, subtracted or averaged together.

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to SYSTM and press [Enter].
4. At the *System Units* prompt, scroll to *Eng* to display measurements in English units or to *Metrc* for metric units and press [Enter].
5. Scroll to the desired *Pressure Units* (absolute or gauge) and press [Enter].
6. Do one of the following:
   - If absolute was selected, proceed immediately to Step 7.
   - If gauge was selected, enter the desired *Atmospheric Pressure*, press [Enter] and proceed to the next step.

1.9.1.1 Selecting Volumetric Units

1. Scroll to the desired *Volumetric Units* for the flow rate display and press [Enter]. Available units are listed in *Table 5* below.

Table 5: Available Volumetric/Totalizer Units

English	Metric
ACF = Actual Cubic Feet	ACM = Actual Cubic Meters
KACF = Thousands of ACF	KACM = Thousands of ACM
MMACF = Millions of ACF	MMACM = Millions of ACM
SCF = Standard Cubic Feet	SCM = Standard Cubic Meters
KSCF = Thousands of SCF	KSCM = Thousands of SCM
MMSCF = Millions of SCF	MMSCM = Millions of SCM

2. Scroll to the desired *Time* units for the flow rate display and press [Enter].
3. Scroll to the desired number of *Vol Decimal Digits* (digits to the right of the decimal point in the volumetric flow rate display) and press [Enter].

1.9.1.2 Selecting Totalizer Units

1. Scroll to the desired *Totalizer Units* for the totalized flow rate display and press [Enter]. Available units are listed in *Table 5*.
2. Scroll to the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display) and press [Enter].
3. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting the Mass Flow Units* below.
   - If MASS FLOW is OFF, the meter returns to the Channel PROGRAM window. Go to *Procedure Options* on the following page.

Note: *To activate mass flow, refer to* page 17. *The following prompts will only appear if mass flow is activated for both channels.*

1.9.1.3 Selecting Mass Flow Units

1. Scroll to the desired *Mass Flow* units for the flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at System Units (see *Table 6* below).

Table 6: Available Mass Flow Units

English	Metric
LB = Pounds	KG = Kilograms
KLB = Thousands of LB	Tonne = Metric Tons (1,000 KG)
MMLB = Millions of LB	
Tons (2,000 LB)	

2. Scroll to the desired *Mass Flow Time* units for the mass flow rate display and press [Enter].
3. Scroll to the desired number of *Mdot Decimal Digits* (digits to the right of the decimal point in the mass flow rate display) and press [Enter].
4. Scroll to the desired *Mass (Totalizer)* units for the totalized mass flow rate display and press [Enter]. The available units for this prompt are determined by the selection made at the *System Units* prompt.
5. Scroll to the desired number of *Mass Decimal Digits* (digits to the right of the decimal point in the totalized mass flow rate display) and press [Enter].

Procedure Options

After completing the previous steps, the XGF868i returns to the Global PROGRAM window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] twice.

1.9.2 Setting Up Inputs and Outputs

Set up the XGF868i inputs and outputs via the **I/O** submenu. While following the programming instructions, refer to *Figure 30 on page 63* and *Figure 31 on page 64*. The following three submenus are included in this section:

- **ERROR** - program the meter's response during an error condition (see below)
- **OPTN** - set up any option cards and the **Slot 0** analog outputs (*page 21*)
- **LCD** - set up the LCD display. Refer to Chapter 2, *Displaying Data.*

Note: *In this section,* **Slot 1** *appears as an option only if a suitable option card is installed in Slot 1.*

Proceed to the appropriate section to program the option selection made at the above prompt. Remember to record all programmed data in Appendix B, *Data Records*.

1.9.2.1 Selecting Error Handling

This menu option permits programming of the manner in which the XGF868i outputs respond during an error condition. See Chapter 2, *Error Codes*, in the *Service Manual* for a discussion of the built-in error codes. To access this submenu:

Note: *The 2-Channel meters have an additional option for error handling.*

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to ERROR and press [Enter].
5. Scroll to the desired option for error handling and press [Enter]. If you select Error Level in mA, proceed to Step 6 on the next page. (See *Table 7 on page 20* for a description of error handling options available and how the totalizers and analog outputs respond to them.)

Note: *The error responses listed in* Table 7 below *apply only to the* **Channelx** *measurement mode and to the* **Sum/Difference** *measurement modes, if either or both channels are in error. Error handling in the* **Average** *measurement mode is set in Step 7 on* page 20.

Table 7: Error Response Options

Option	Output Response	Totalizer Response
HOLD	Holds the last "good" reading.	Continues to totalize, based on last "good" flow reading.
LOW	Forces outputs to the low set point.	Stops totalizing.
HIGH	Forces outputs to the high set point.	Stops totalizing.
HHIGH	Forces outputs ≈10% above the high set point.	Stops totalizing.
OTHER	Forces outputs to the entered mA level.	Stops totalizing during critical errors.

6. Use the arrow keys to enter a specific current that will signify meter errors and press [Enter].
7. Scroll to *Yes* or *No* to enable or disable 2-path error handling. Specific responses of the display and the totalizer are listed in *Table 8* below. The **2-path error handling** option is intended for applications where two sets of transducers are installed in the same location in the same pipe to improve accuracy and the meter is operated in **AVE** mode. With this function enabled, the Model XGF868i performs error handling only if both channels are in error. If this function is disabled, error handling occurs when either channel goes into error.

Table 8: 2-Path Error Response Options

Option	Display Response	Totalizer Response
No	Displays the average of **Channel 1** and **Channel 2**, regardless of the error state of either channel.	Outputs the average of Channel 1 and Channel 2 totals, regardless of the error state of either channel.
Yes	1. If one channel is in error, the other channel's value is displayed as the average. 2. If both channels are in error, the last average reading is held.	1. If one channel is in error, totalizing continues. 2. If both channels are in error, totalizing stops.

Procedure Options

After completing the above steps, the XGF868i returns to the **Global I/O** window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] four times.

1.9.2.2 Setting Up Slot 0 and Slot 1 Inputs/Outputs

The XGF868i has two built-in analog outputs, which are assigned to **Slot 0**. Also, a variety of input/output option cards may be installed in **Slot 1**. See Chapter 1, *Installation*, of the *Startup Guide* for a complete description of the available option cards.

To set up option cards, refer to one of the following sections:

- Analog Outputs - see *Section 1.9.2.3* below.
- Analog Inputs - see *Section 1.9.2.4 on page 23*
- RTD - see *Section 1.9.2.5 on page 24*
- Frequency Outputs - see *Section 1.9.2.6 on page 25*

1.9.2.3 Analog Outputs

While following the programming instructions, refer to *Figure 31 on page 64*.

Accessing the Output

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to OPTN and press [Enter].
5. Scroll to Slot 0 or Slot 1, depending on which output you want to set up.
6. Scroll to the desired *Output* and press [Enter].

Note: *Output letters (A, B, etc.) correspond to the output wiring terminal numbers from top to bottom. For example, Output A corresponds to pins 1,2 and 3; Output B corresponds to pins 4, 5 and 6; etc.*

Setting Up the Output Scale

1. Scroll to the desired output scale and press [Enter].
2. If you selected *Off*, the XGF868i returns to the I/O window. Go to *Procedure Options* on *page 23*.
3. Scroll to the desired *Channel* option (CH1, CH2, SUM, DIF or AVE) and press [Enter].
4. Scroll to the desired *Measurement Parameter* and press [Enter]. See Table 9 below for a description of the available options.
5. At Zero, enter a value for the low end of the analog output range and press [Enter].
6. At Full, enter a value for the high end of the analog output range and press [Enter].

Table 9: Available Measurement Parameters

Option Bar	Description	Good	Bad
VEL	Displays the flow velocity.	N.A.	N.A.
VOLUM	Displays the volumetric flow.	N.A.	N.A.
+TOTL	Displays the forward totalized volume flow.	N.A.	N.A.
-TOTL	Displays the reverse totalized volume flow.	N.A.	N.A.
TIME	Displays the total flow measurement time.	N.A.	N.A.
MDOT	Displays the mass flow.	N.A.	N.A.
+MASS	Displays the forward totalized mass flow.	N.A.	N.A.
-MASS	Displays the reverse totalized mass flow.	N.A.	N.A.
SS up	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
SS do	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
SNDSP	Displays the measured speed of sound in the gas.	N.A.	N.A.
Tup	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
Tdown	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
DELTA	Displays the transit time difference between the upstream and downstream signals.	N.A.	N.A.
Tot K	K factor, based on the Reynolds number.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default).	N.A.	N.A.
Qup	Displays the signal quality for the upstream transducer.	≥1200	–400 to +400
Qdown	Displays the signal quality for the downstream transducer.	≥1200	–400 to +400
AMPup	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29
AMPdn	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29

Table 9: Available Measurement Parameters

Option Bar	Description	Good	Bad
CNTup	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
CNTdn	Displays the AGC DAC count for the downstream gain setting.	N.A.	N.A.
P#up	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
TEMP	Displays the gas temperature (from 0/4-20 mA input).	N.A.	N.A.
PRESR	Displays the gas pressure (from 0/4-20 mA input).	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
z	Displays the compressibility.	N.A.	N.A.
AcVOL	Displays actual volumetric flow.	N.A.	N.A.
StVOL	Displays standard volumetric flow.	N.A.	N.A.
Tu S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Td S[1]	Displays Skan transit time downstream.	N.A.	N.A.
DT S[1]	Displays Skan Delta T.	N.A.	N.A.
Tu M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Td M[1]	Displays Measure transit time downstream.	N.A.	N.A.
DT M[1]	Displays Measure Delta T.	N.A.	N.A.
Vinst	Displays the instantaneous velocity.	N.A.	N.A.
[1]available only if Burst Mode = S/M			

Note: *The measurement units that appear in these prompts are those selected in the* **Global-System** *window earlier in this section.*

Procedure Options

After completing the above steps, the XGF868i returns to the I/O window. Do one of the following:

- To continue programming, refer to Appendix A, M*enu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.9.2.4 Analog Inputs

Refer to *Figure 31 on page 64*, and complete the following steps to set up the analog inputs of an option card installed in **Slot 1**:

Accessing the Input

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to OPTN and press [Enter].
5. Scroll to Slot 1 and press [Enter].
6. Scroll to the desired *Input* and press [Enter].

Note: *Input letters (A, B, etc.) correspond to input wiring terminal numbers from top to bottom (e.g. Input A corresponds to pins 1,2 and 3; Input B corresponds to pins 4, 5 and 6; etc.).*

Setting Up the Input

1. Enter a *Label* of up to eight characters for input and press [Enter].
2. Scroll to the desired input *Measurement* and press [Enter]. Do one of the following:
   - If **Off** was selected, go to *Procedure Options* below.
   - If **Pressure** or **Temperature** was selected, proceed to Step 5.
   - If **Special** was selected to set up the input as a live special input, proceed to the next step.
3. Use the arrow keys to enter a *Name* for the input and press [Enter].
4. Use the arrow keys to enter a *Unit* of measurement for the input and press [Enter].
5. Use the arrow keys to enter a value (a temperature value for special inputs) for the low end of the analog input range and press [Enter].
6. Use the arrow keys to enter a value (a temperature value for special inputs) for the high end of the analog input range and press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the I/O window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.9.2.5 RTD Inputs

Option cards with RTD inputs have a temperature range of –148 to 662°F (–100 to 350°C). While following the programming instructions, refer to Figure 31 on page 64, and complete the following steps to set up the RTD inputs of an option card installed in Slot 1.

Accessing the Input

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to OPTN and press [Enter].
5. Scroll to Slot 1 and press [Enter].
6. Scroll to the desired *Input* and press [Enter].

Note: *Input letters (A, B, etc.) correspond to input wiring terminal numbers from top to bottom (e.g. Input A corresponds to pins 1,2 and 3; Input B corresponds to pins 4, 5 and 6; etc.).*

Setting Up the RTD Input

1. Enter a *Label* for the RTD input and press [Enter].
2. Scroll to the desired input type and press [Enter]. Do one of the following:
   - If **Off** was selected, go to *Procedure Options* below.
   - If **Temperature** was selected, proceed to the next step.
3. Enter a temperature value for the *Low* end of the analog input range and press [Enter].
4. Enter a temperature value for the *High* end of the analog input range and press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the I/O window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] four times.

1.9.2.6 Frequency Outputs

The frequency output issues a continuous signal with a frequency proportional to the selected measurement. Refer to *Figure 31 on page 64*, and complete the following steps to set up the totalizer outputs of an option card installed in **SLOT 1**:

Accessing the Frequency Output

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to I/O and press [Enter].
4. Scroll to OPTN and press [Enter].
5. Scroll to Slot 1 and press [Enter].
6. Scroll to the desired *Output* and press [Enter].
7. If you selected *Off*, the XGF868i returns to the Input/Output window. Go to *Procedure Options* on the following page.

Note: *Output letters (A, B, etc.) correspond to the output wiring terminal numbers from top to bottom (e.g. Output A corresponds to pins 1,2 and 3; Output B corresponds to pins 4, 5 and 6; etc.).*

Setting Up the Frequency

1. Scroll to the desired *Channel* option and press [Enter].
2. Scroll to the desired *Measurement* parameter and press [Enter]. See *Table 9* for a description of the available options. Refer to the *Service Manual* for a description of diagnostic parameters.

Note: *The measurement units that appear in these prompts are those selected in the* **Global-System** *window earlier in this section.*

3. Use the arrow keys to enter a value for the *Low* end of the frequency output range and press [Enter].

Note: *A complete pulse consists of equal amounts of* ON *and* OFF *times. Choose a value that is compatible with the frequency counter to be used.*

4. Use the arrow keys to enter a value for the *High* end of the frequency output range and press [Enter].
5. Use the arrow keys to enter a value between 1 and 10,000 for the *Frequency* at full scale and press [Enter].

Procedure Options

After completing the above steps, the XGF868i returns to the I/O window. Do one of the following:

- To continue programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.9.3 Configuring the Communications Port

The XGF868i flowmeter is equipped with an RS232 serial interface. The meter can be configured with a MODBUS option card for MODBUS communications, a Foundation Fieldbus option card for Foundation Fieldbus communications, an Ethernet option card for Ethernet communications, or with a MODBUS/TCP option card for MODBUS communication over the Ethernet, if desired.

Note: *To set Fieldbus communications parameters, see Appendix E,* Foundation Fieldbus Communications.

The serial port is used to transmit stored data and displayed readings to a personal computer by connecting the meter's serial interface to the serial port of the PC. In addition, the XGF868i can receive and execute remote commands, using *PanaView* software via this link.

Use the **COMM** submenu to set the communications port and MODBUS parameters. While programming the meter, refer to *Figure 30 on page 63*.

1.9.3.1 Setting Up the Serial Port

Use the steps below to configure the communications port:

1. In the *Keypad Program*, scroll to PROG and press [Enter].
2. In the PROG menu, scroll to GLOBL and press [Enter].
3. In the Global PROGRAM menu, scroll to COMM and press [Enter].
4. Enter a *Meter Address* (between 1 and 127) and press [Enter]. (The default address is 1.)

A meter address is necessary for communication with the Panametrics *PanaView* software. See Appendix C, *Programming the XGF868i with PanaView™*, or the *PanaView™ User's Manual* (910-211) for more information.

IMPORTANT: If the meter address or baud rate is changed, communication with PanaView must be re-established with the new parameters.

5. Scroll to the desired *Baud Rate* and press [Enter]. (Available baud rates extend from 300 to 19200.)
6. If you have the standard RS232 serial interface, go to *Procedure Options* on the next page.

1.9.3.2 Setting Up MODBUS Communications

When equipped with an optional MODBUS output card, the XGF868i can transmit flow data serially to a flow computer, or SCADA, using a Gould-type RTU protocol. Thus only the MODBUS function command, 3 (read multiple registers), 6 (write multiple registers) is valid. The XGF868i uses the following format for the data exchange:

- The *Send* command (initiated by the host flow computer or controller) comes in the form:
  [time delimiter]<Addr><3><First Register MSB>
  <First Register LSB> <Register Count MSB>
  <Register Count LSB><CRC Low><CRC High>[time delimiter]
- The *Response* (initiated by the host flow computer or controller) comes in the form:
  [time delimiter]<Addr><3><Byte count><Data.....>
  <CRC Low><CRC High>[time delimiter]

The format for the returned data types is:

- Integer (16 bit Integer) <MSB><LSB>
  1 Register - 16 bit integer
- Integer (32 bit IntegerI) <MSB><LSB><LSB><LSB>
  2 Register - 32 bit integer
- Floating Point (FP)<EXP><MAN><MAN><MAN>
  2 Registers - 32 bit IEEE floating point number

Use the steps below to configure MODBUS communications:

IMPORTANT: The XGF868i MODBUS communications settings chosen in the next four steps must match those of the MODBUS control system.

1. Scroll to the desired *MODBUS Baud Rate* and press [Enter].
2. Scroll to the *MODBUS Parity* and press [Enter].
3. Scroll to the *MODBUS Stop Bits* and press [Enter].
4. Enter a MODBUS *Meter Address* (between 1 and 254) and press [Enter]. (The default address is 1.)

IMPORTANT: You must reboot the XGF868i to load the new settings.

Procedure Options

After completing the above steps, the XGF868i returns to the Global PROGRAM window. Do one of the following:

- Refer to the section *Requesting Parameters Using MODBUS* on the following page to retrieve data from the XGF868i using MODBUS.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *Keypad Program*, press [Escape] three times.

1.9.4 Requesting Parameters Using MODBUS

To request specific parameters from the XGF868i via the MODBUS, the control system must enter the appropriate register number. Only registers 1 through 90 are available for MODBUS communications, while registers 508 through 512 are used by the XGF868i to store the MODBUS parameters. For details, see *Table 10* below.

Table 10: MODBUS Registers for a 2-Channel XGF868i

MODBUS Reg #	DPR Hex Addr	Description	Scaling (decimal places)	Size in Bytes
1	0	1"Clear Ch1 Totalizers"	--	2 (16 bit signed)
2	2	1"Clear Ch2 Totalizers"	--	2 (16 bit signed)
3	4	Ch1 Velocity	2	4 (2 16-bit int)
5	8	Ch1 Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)
7	C	Ch1 Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)
9	10	Ch1 Fwd Totals	#T DIGITS	4 (2 16 bit int)
11	14	Ch1 Rev Totals	#T DIGITS	4 (2 16 bit int)
13	18	Ch1 #Tot Digits	0	2
14	1A	Ch1 Mass Flow	#M DIGITS	4 (IEEE 32 bit)
16	1E	Ch1 Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)
18	22	Ch1 Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)
20	26	Ch1 #Mass Tot Digits	0	2
21	28	Ch1 Timer	2	4 (2 16-bit int)
23	2C	Ch1 Error Code	0	2
24	2E	Ch1 Sound Speed	3	4 (2 16-bit int)
26	32	Ch1 Molecular Weight	4	4 (2 16-bit int)
28	36	Ch1 Sig Strength Upstream	1	4 (2 16-bit int)
30	3A	Ch1 Sig Strength Downstream	1	4 (2 16-bit int)
32	3E	Ch1 Temperature	2	4 (2 16-bit int)
34	42	Ch1 Pressure	3	4 (2 16-bit int)
36	46	Ch2 Velocity	2	4 (2 16-bit int)
38	4A	Ch2 Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)
40	4E	Ch2 Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)
42	52	Ch2 Fwd Totals	#T DIGITS	4 (2 16 bit int)
44	56	Ch2 Rev Totals	#T DIGITS	4 (2 16 bit int)
46	5A	Ch2 #Tot Digits	0	2
47	5C	Ch2 Mass Flow	#M DIGITS	4 (IEEE 32 bit)
49	60	Ch2 Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)
51	64	Ch2 Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)
53	68	Ch2 #Mass Tot Digits	0	2
MODBUS Reg #	DPR Hex Addr	Description	Scaling (decimal places)	Size in Bytes
54	6A	Ch2 Timer	2	4 (2 16-bit int)
56	6E	Ch2 Error Code	0	2
57	70	Ch2 Sound Speed	3	4 (2 16-bit int)
59	74	Ch2 Molecular Weight	4	4 (2 16-bit int)

Table 10: MODBUS Registers for a 2-Channel XGF868i

61	78	Ch2 Sig Strength Upstream	1	4 (2 16-bit int)
63	7C	Ch2 Sig Strength Downstream	1	4 (2 16-bit int)
65	80	Ch2 Temperature	2	4 (2 16-bit int)
67	84	Ch2 Pressure	3	4 (2 16-bit int)
69	88	Avg Velocity	2	4 (2 16-bit int)
71	8C	Avg Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)
73	90	Avg Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)
75	94	Avg Fwd Totals	#T DIGITS	4 (2 16 bit int)
77	98	Avg Rev Totals	#T DIGITS	4 (2 16 bit int)
79	9C	Avg #Tot Digits	0	2
80	9E	Avg Mass Flow	#M DIGITS	4 (IEEE 32 bit)
82	A2	Avg Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)
84	A6	Avg Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)
86	AA	Avg #Mass Tot Digits	0	2
87	AC	Avg Timer	2	4 (2 16-bit int)
89	B0	[5]Avg Error Code	0	2
90	B2	Avg Sound Speed	3	4 (2 16-bit int)
508	3F6	[2]MODBUS baud rate	0	2
509	3F8	[3]MODBUS parity	0	2
510	3FA	[4]MODBUS stop bits	0	2
511	3FC	MODBUS meter addr	0	2
512	3FE	RESERVED	---	---

1. **Clear Totalizers:**
   Flag from the 8051 to clear either the Channel 1 or Channel 2 totalizers.
2. **MODBUS baud rate:**
   5 = 2400, 6 = 4800, 7 = 9600
3. **MODBUS parity:**
   0 = none, 1 = odd, 2 = even
4. **MODBUS stop bits:**
   1 = 1 stop bit, 2 = 2 stop bits
5. **AVG Error Code:**
   0=Both Ch1 and Ch2 are in error.
   1=Ch1 only is in error
   2=Ch2 only is in error
   3=Both channels are error free.

1.9.5 Activating Security

In order to prevent unauthorized tampering with the flowmeter's programming, the XGF868i is equipped with a security feature that locks all the keys except [PROG] (which, when pressed, requires the password).

When the system is locked, access to the menus will be denied unless the correct password is entered. The XGF868i is shipped with a default password (2719 and three spaces). For increased security, the default password should be changed.

IMPORTANT: Once the system has been locked, it can only be unlocked by entering the password, because access to the SECUR submenu is restricted.

While following the programming instructions, refer to the menu map in Figure 30 on page 63.

IMPORTANT: It is recommended that all program parameters be recorded before changing the password. (This information should be recorded in Appendix B, Data Records, as a matter of routine.) If the password is lost, the site data is not retrievable and will have to be re-entered.

1. In the *Keypad Program*, scroll to **PROG** and press **[Enter]**.
2. From the **PROGRAM** menu, scroll to **GLOBL** and press **[Enter]**.
3. Scroll to **SECUR** and press **[Enter]**.
4. At the Lock Out prompt, scroll to **UNlck** to unlock the system and return to the initial **PROGRAM** menu, or scroll to **LOCK** to lock the system.

Note: *If the system was unlocked at the above prompt, the following steps do not appear.*

5. Enter the current or default Password and press **[Enter]**.
6. At the Edit Password prompt, scroll to **NO** and press **[Enter]** to leave the password unchanged, or scroll to **YES** to enter a new password.

IMPORTANT: Since the default password is printed in this manual, a new password should be entered. If the password is ever lost, contact the factory for assistance.

7. Enter the New Password and press **[Enter]**. Any combination of letters and numbers up to a total of 7 characters may be used as a password.
8. Verify the New Password by entering it again and press **[Enter]**. Be sure to record the new password in a safe place.

1.10 Exiting the User Program

After completing the **COMM** option, the XGF868i returns to the **Global PROGRAM** prompt. Press **[Escape]** twice to return to the *Keypad Program,* and a third time to return to the meter display. Then proceed to Chapter 3, *Operation*, of the *Startup Guide* for instructions on taking measurements, or refer to the appropriate chapters of this manual for detailed instructions on using the other features of the XGF868i flow transmitter.

Chapter 2. Displaying Data

2.1 Introduction

This chapter explains how to display measurement data using either of the available methods:

- **LCD Display** - show data on the built-in display
- **PanaView** - display data on a computer terminal using the optional PanaView software

2.2 Displaying Data with the LCD

When equipped with the Liquid Crystal Display (LCD), the XGF868i may be programmed to display up to four variables in sequence. In addition, the contrast of the LCD may be adjusted for optimum viewing. Proceed to the appropriate section for instructions, and refer to *Figure 30 on page 63* of Appendix A, *Menu Maps.*

2.2.1 Adjusting LCD Contrast

The LCD contrast may be adjusted through the *Keypad Program* to suit individual needs.

1. Press [Escape]. [Enter], [Escape].
2. In the *Keypad Program* window, scroll to CNTRS and press [Enter].
3. Scroll to *DARKN* or *LITEN* and press [Enter] until the screen shows the desired contrast.
4. When you have achieved the desired contrast, scroll to *STORE* to retain the setting, or to *ABORT* to leave the menu without changing the setting. In either case, the XGF868i returns to the *Keypad Program.*
5. Then press [Escape] to return to the display screen.

2.2.2 Programming the LCD

Note: *When you first initialize the XGF868i, the number of LCD parameters is set to OFF. You must program the LCD to display any measured parameters.*

Through the *Keypad Program*, you can program the LCD display to display up to four variables in sequence. Complete the following steps to program the LCD display:

1. Power up the XGF868i and wait until it has initialized.
2. Press [Escape], [Enter], [Escape].
3. In the *Keypad Program* window, scroll to PROG and press [Enter].
4. In the PROG menu, scroll to GLOBL and press [Enter].
5. Scroll to I/O and press [Enter].
6. Scroll to LCD and press [Enter].
7. The window now asks for the *# of LCD Parameters*. Scroll to the desired number (from OFF through 1-4 and KEY) and press [Enter].

The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program*. If you select KEY:

- To view a different parameter, press the [v] or [w] keys to scroll through the various parameters.
- To scroll through the channel options on a two-channel XGF868i, press the [r] or [s] keys until you have reached the desired option.

2.2.2 Programming the LCD (cont.)

8. Scroll to the desired *Channel option*, as listed in *Table 11* below.

Table 11: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

9. For each channel, select the desired *Measurement Parameter*, as shown in Table 9.

Note: *The measurement units that appear in these prompts are those selected in the* **GLOBL-SYSTM** *menu earlier in this manual. Also, when differences in one channel's programming invalidate an output previously chosen for the other, the measurement defaults to the nearest selectable item in the parameter list.*

The previous two prompts repeat until all of the specified **# of LCD Parameters** have been set up. When all of the display parameters have been set up, the meter returns to the **Global I/O** window. To leave the *Keypad Program*, press the **[Escape]** key three times.

After leaving the *Keypad Program*, the XGF868i will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

2.3 Displaying Data on a Computer Terminal

The flow rate data collected by the XGF868i may be displayed in various formats on a remote computer terminal via the meter's RS232 serial port. This requires the use of the optional PanaView software. Refer to the instructions below to display data via PanaView.

2.3.1 Preparing for PanaView Programming

Before you attempt to communicate with the XGF868i, be sure you have linked your PC to the XGF868i via an RS232 interface. For details on wiring the interface, refer to *Wiring the Serial Port* in the *Startup Guide*, and to the document *EIA-RS Serial Communications* (916-054). You must also install PanaView, as discussed in the *PanaView User's Manual* (910-211), and in Appendix C, *Programming the XGF868i via PanaView™*.

1. Power up the XGF868i and wait until it has initialized.
2. Launch PanaView and wait until it initializes the XGF868i and displays the basic PanaView window.
3. As described in Appendix C, open the *Meter Browser* window and highlight the meter to be used.

At this time, any of PanaView's comprehensive data handling capabilities may be used. These include:

- Collecting and displaying live data in text format
- Collecting and displaying live data in graphical format
- Collecting and logging live data
- Displaying a log file in text format
- Displaying a log file in graphical format

To access PanaView's data handling options, pull down the *Output* menu, as shown in *Figure 2* below.

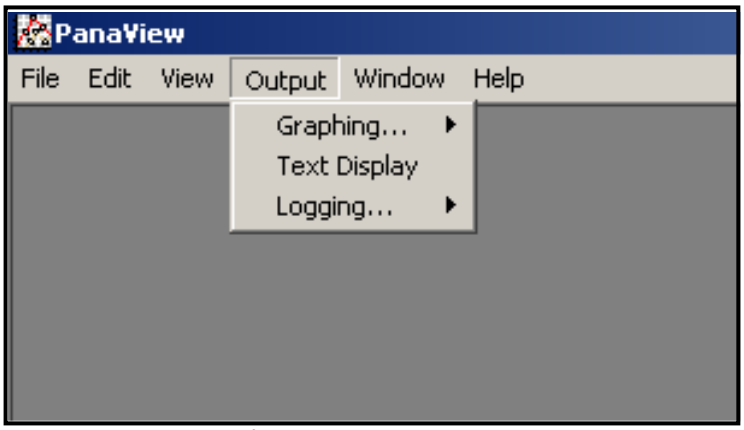


Figure 2: Output Menu

Proceed directly to the appropriate section for instructions on either of the following output options:

- *Text Display* output, discussed below
- *Graphing* output on *page 37*

Note: *For information on the* Logging *output, see Chapter 3,* Logging Data.

2.3.2 The Text Display Output

To collect data from the instrument and display it on a text screen, complete the following steps:

1. Complete Steps 1-3 on the previous page.
2. Pull down the *Output* menu and click on the *Text Display* option (see *Figure 2 on page 34*).

Note: *The* Text Display *window that appears after Step 2 is actually stacked on top of any previously opened windows (such as the* Meter Browser *window).*

3. Using the *Window* menu, arrange the open windows in the desired format. For this discussion, *Figure 3* below shows the *Text Display* window in its maximized (full-screen) size.

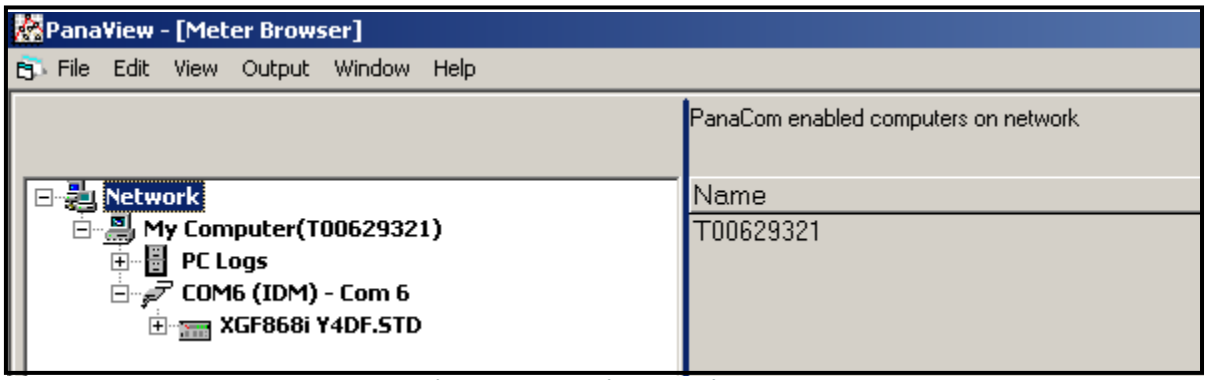


Figure 3: Text Display Window

Note: Figure 3 *above has been compressed both vertically and horizontally for improved clarity.*

4. The left pane of the *Text Display* window contains the standard PanaView network tree. Expand this tree as far as necessary, and double click on the desired process parameter to display it in the right pane of the window.
5. Before actual data values can be displayed in the text pane, activate one of the following data collection modes (refer to *Figure 3 on page 35*):
   - Click on the **[Get Once]** option button at the bottom of the right pane in the *Text Display* window. The current value of the selected process parameter, as specified in the PanaView network tree, is displayed in the right pane of the *Text Display* window.

or

   - Enter an *interval* in the text box at the bottom of the right pane in the *Text Display* window, or check the *Max. Comm Rate* box to collect readings as fast as the system allows (1 sec). Then, click on the **[Continuous]** option button to begin collecting data for display in the right pane of the *Text Display* window.

Note: *Any value entered in the* Interval *text box is overridden if the* Max. Comm Rate *box is checked.*

6. If the **[Continuous]** option was selected in Step 5 above, click on the **[Stop]** option button, which has replaced the original **[Continuous]** option button, to terminate data collection.

The *Text Display* window may be left open while other tasks are performed, or it may be closed by clicking on the lower **[X]** control button at the far right of the menu bar.

IMPORTANT: If you click on the upper **[X]** control button at the far right of the PanaView title bar, you will exit PanaView completely.

2.3.2.1 Displaying Multiple Process Parameters

The procedure for displaying a single process parameter in a text screen may be repeated to simultaneously display multiple process parameters. To do so, proceed as follows:

1. Display the first process parameter in a text screen, as described in the previous section.
2. Repeat Step 1 for any desired additional process parameters, by double clicking on them in the PanaView network tree. PanaView automatically tiles the multiple text screens in the right pane of the *Text Display* window.
3. As in any standard Windows application, the multiple text screens may be resized by dragging their borders. Also, the individual panes within a parameter's text screen may be resized by dragging the borders within that text screen.
4. To close an open text screen, right click anywhere within that screen (except in the title bar or the error section) and click on the **[Remove]** option that pops up in the context menu.

Note: *After resizing or removing any of the multiple text screens, the default tiled layout may be restored by opening the* "Window" *menu (see the* PanaView User's Manual*) and clicking on the* "Tile Output Displays" *option.*

2.3.2.2 Displaying Multiple Text Windows

The procedures for displaying one or more process parameters in a single *Text Display* window may be repeated to open multiple *Text Display* windows. To do so, proceed as follows:

1. To open another *Text Display* window, repeat the steps on *page 35* and *page 36*.
2. To display the desired process parameter(s) in the new window, repeat Steps 1-4 on *page 36*.
3. Arrange the multiple *Text Display* windows as desired via the *Window* menu.

2.3.3 Graphing the Output

To collect data from the instrument and display it graphically in a new format, complete the following steps:

2.3.3.1 Setting Up a Graph

1. Perform Steps 1-3 on *page 32*.
2. Pull down the *Output* menu and click on the *Graphing - New* option (see *Figure 2 on page 34*).

Note: *The* Graph *window is stacked on top of any previously opened windows (such as the* Meter Browser *window).*

3. Using the *Window* menu, arrange the open windows in the desired format. For this discussion, *Figure 4* below shows the *Graph* window in its maximized (full-screen) size.

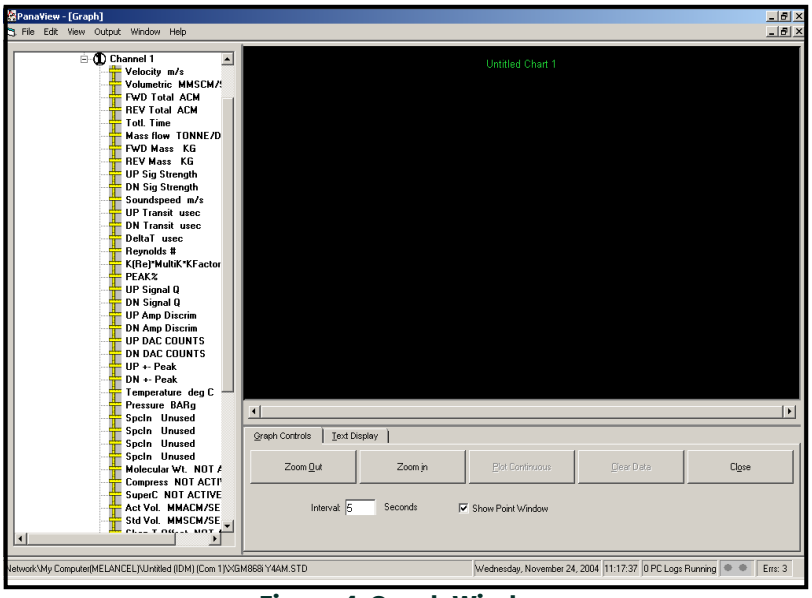


Figure 4: Graph Window

The *Graph* window shown above consists of three panes:

- *left pane* - PanaView network tree
- *top right pane* - graph with default chart style
- *bottom right pane* - graph controls or text display

Note: *The three panes of the* Graph *window may be resized by simply dragging their borders.*

2.3.3.2 Graphing Data

The PanaView network tree has already been described, and the display pane shows only a graph in the default style with no data points. The bottom right pane enables you to set up the graph. To begin graphing your data, proceed as follows:

1. Expand the network tree as far as necessary and double click on the process parameter to be graphed. The grid for the selected graph appears in the display pane, with *Time* as the x-axis and the parameter *Value* as the y-axis. In addition, a *legend* appears above the graph, which indicates the name, data point shape and line color for that parameter.
2. If desired, a second parameter may be added to the graph by repeating Step 1. In this case, the parameter "*Value*" is shown as a *right* y-axis (Y2).

Note: *Although only two parameters may be graphed for any one meter channel, the same two parameters may also be graphed for any other active meter channels.*

3. To begin plotting data for the selected parameter(s), enter a time *Interval* for data sampling in the text box provided (the default value is 5 seconds).
4. Click on the **[Plot Continuous]** control button to begin graphing the selected process parameter(s) as a function of time, at the interval specified in Step 3.
5. While PanaView is graphing the data, the following actions may be taken from the control pane:
   - change the sampling interval by entering a new value
   - click on the **[Zoom Out]** control button to increase the size of the intervals shown on the x-axis
   - click on the **[Zoom In]** control button to decrease the size of the intervals shown on the x-axis

Note: *The zoom buttons may be clicked multiple times to enhance the effect.*

   - click on the *Text Display* tab to view the data being graphed in the text format described in the previous section

When you have finished graphing your data, click on the **[Stop]** control button, which has replaced the original **[Plot Continuous]** control button.

For further information on setting up graph properties, refer to Chapter 5, *Displaying Data,* of the *PanaView User's Manual*.

2.3.4 Displaying Transducer Signals

Along with flow rate data, PanaView enables XGF868i users to read and plot transducer signals from the XGF868i.

1. From the *New Meter Browser*, highlight the XGF868i.
2. Right-click on the highlighted XGF868i and click on the *Properties* option, as shown in *Figure 5* below.

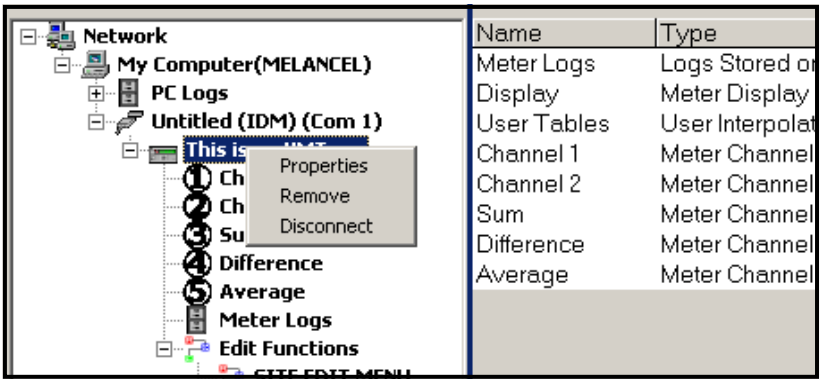


Figure 5: *Properties* Option in the *New Meter Browser*

The *Properties* window opens, as shown in *Figure 6* below.

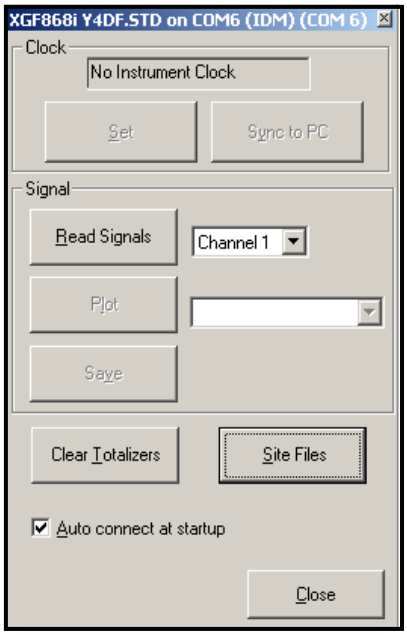


Figure 6: *Properties* Window

2.3.4.1 Reading Transducer Signals

3. To read a signal from the meter, click on the [Read Signals] button. (If the meter is a multi-channel instrument, open the Channel drop-down menu and click on the desired channel.) After a moment, the *Properties* window appears similar to *Figure 7* below.

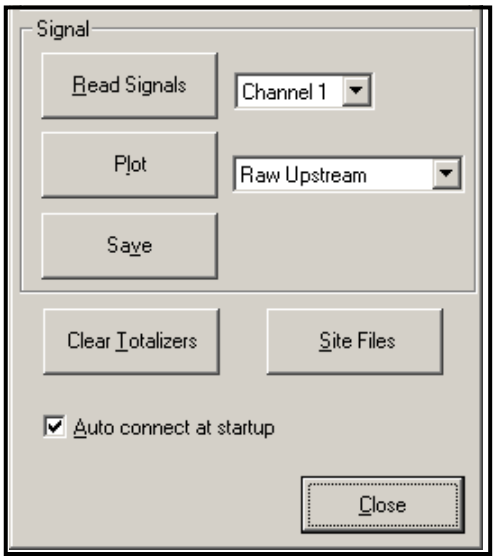


Figure 7: Active Signal Options

4. To select a different signal type, open the signal menu at the right (shown here with *Raw Upstream* highlighted) and click on the desired signal.

2.3.4.2 Plotting Transducer Signals

To plot the selected signal, click on [Plot]. A graphical window opens, as shown in *Figure 8* below.

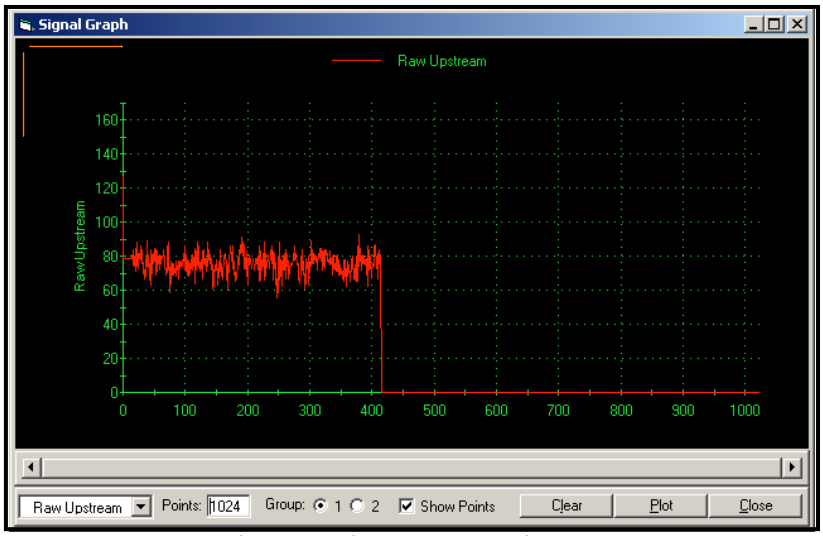


Figure 8: *Signal Graph* Window

2.3.4.3 Saving Transducer Signals

To save the raw signal, click on [Save]. A window opens similar to *Figure 9* below. Enter the desired name, and click on [Save] to save the signal as a text file.

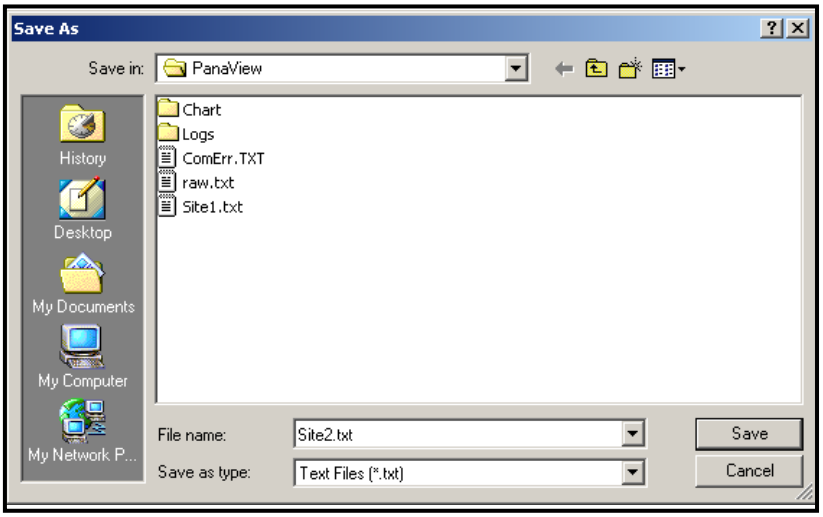


Figure 9: *Save As* Window

[no content intended for this page]

Chapter 3. Logging Data

3.1 Introduction

PanaView can create *PC log files* for the XGF868i for storage on the PC's hard drive.

This chapter explains how to use the XGF868i data logging capability with PanaView.

3.2 Logging with PanaView

PanaView is capable of creating and viewing log files of the following types:

- **meter logs** - log files stored in the XGF868i memory, as discussed above
- **PC logs** - log files stored on your PC's hard drive (see *page 46*)

To create or view logs of the above types, proceed to the appropriate section of this chapter.

3.3 Creating Meter Logs

To create a new meter log, complete the following steps:

1. From the *New Meter Browser* in PanaView, expand the network tree and open the *Edit Functions* option (described in Appendix C, *Programming the XGF868i via PanaView*). The menu will appear similar to *Figure 10* Below.

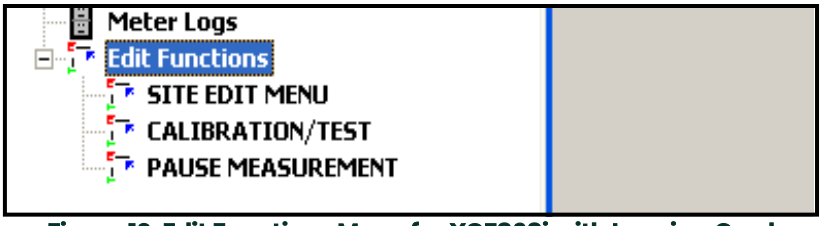


Figure 10: Edit Functions Menu for XGF868i with Logging Card

2. Double-click on the *Log Edit Menu*, as shown in *Figure 10* above. The window appears similar to *Figure 11* below.

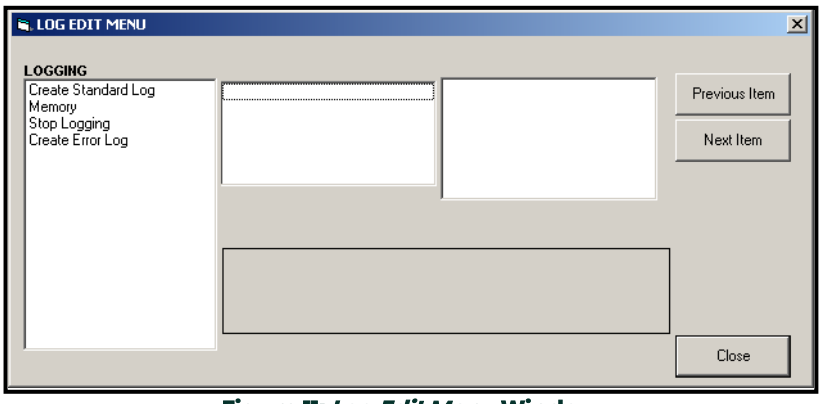


Figure 11: *Log Edit Menu* Window

3.3.1 Creating a Standard Meter Log

3. To create a standard meter log, complete the following steps:

a. Double-click on the *Create Standard Log* option.The window now appears similar to *Figure 12* below.

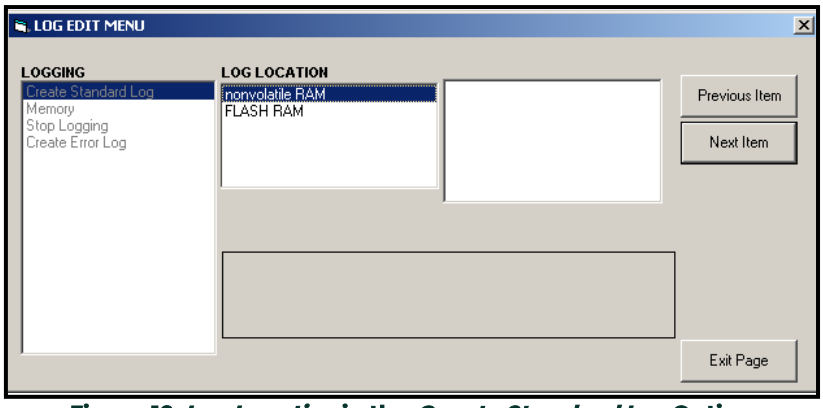


Figure 12: *Log Location* in the *Create Standard Log* Option

b. PanaView first asks for the *Log Location,* either flash or non-volatile RAM. Double-click on the desired location.

c. Now type the desired *Log Name* in the right window, and click **[Next Item]**.

d. Type the desired *Log Message* in the right window, and click **[Next Item]**.

e. PanaView now asks for the *Number of Variables* you wish to log. Type in the desired number (from 1 to 6), and click **[Next Item]**.

f. Double-click on the desired *Channel* for the first variable.

g. Scroll to and double-click on the desired *Measurement* to be logged.

h. Repeat steps f and g for the specified number of variables.

Note: *If you select a forward or reverse total, PanaView asks if you want to Reset Totals to 0? Double-click on Yes or No.*

i. PanaView indicates a given *StartTime*. Double-click on OK to agree to the given time, on *Now* to start the log immediately, or on *Edit* to change the starting time.

j. If you select *Edit,* PanaView asks first for the desired *Hour*, then for the *Minute*, and finally for the *Second*. For each parameter, type the desired number in the right window, and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

k. PanaView indicates a given *StartDate*. Double-click on *OK* to agree to the given day, on *Today* to start the log that day, or on *Edit* to change the starting date.

- If you select *Edit,* PanaView asks first for the desired *Year*, then for the *Month,* and finally for the *Day*. For each parameter, type the desired number in the right window, (or scroll to and click on the desired month) and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

l. PanaView indicates a given *End Time*. Double-click on OK to agree to the given time, on *Now* to start the log immediately, or on *Timed* to indicate a specific duration.

- If you select *Edit,* PanaView asks first for the desired *Hour*, then for the *Minute*, and finally for the *Second*. For each parameter, type the desired number in the right window, and click **[Next Item]** (or simply click **[Next Item] to step through the parameters).**
- If you select *Timed*, PanaView asks for the *Log Time* (duration). Scroll to and double-click on the desired length of time (from 10 minutes to 24 hours.) Then go to step m.

m. PanaView indicates a given *End Date*. Double-click on *OK* to agree to the given day, on *Today* to start the log that day, or on *Edit* to change the starting date.

- If you select *Edit,* PanaView asks first for the desired *Year*, then for the *Month,* and finally for the *Day*. For each parameter, type the desired number in the right window, (or scroll to and click on the desired month) and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

n. Scroll to and double-click on the desired *Time Increment* (from 5 seconds to 24 hours). PanaView indicates that the log has been created, and returns to the *Log Edit Menu.*

If an erroneous value has been entered, PanaView displays a *Log Creation Error* message. Otherwise, the program indicates that the log has been created, and returns to the *Log Edit Menu.*

3.3.2 Creating an Error Log

To create an error meter log, complete the following steps:

1. Double-click on the *Create Error Log* option.

a. PanaView first asks for the *Log Location,* either flash or non-volatile RAM. Double-click on the desired location.

b. Now type the desired *Log Name* in the right window, and click **[Next Item]**.

c. Type the desired *Log Message* in the right window, and click **[Next Item]**.

d. PanaView now asks for the *Number of Variables* you wish to log. Type in the desired number (from 1 to 6), and click **[Next Item]**.

e. Double-click on the desired *Channel* for the first variable.

f. Scroll to and double-click on the desired *Measurement*.

g. Repeat steps e and f for the specified number of variables.

- If you select a forward or reverse total, PanaView asks if you want to *Reset Totals to 0*? Double-click on *Yes* or *No*.

h. PanaView asks, *Is Log Circular?* Double-click on *Yes* or *No.*

i. PanaView indicates a given *StartTime*. Double-click on OK to agree to the given time, on *Now* to start the log immediately, or on *Edit* to change the starting time.

- If you select *Edit,* PanaView asks first for the desired *Hour*, then for the *Minute*, and finally for the *Second*. For each parameter, type the desired number in the right window, and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

j. PanaView indicates a given *StartDate*. Double-click on *OK* to agree to the given day, on *Today* to start the log that day, or on *Edit* to change the starting date.

- If you select *Edit,* PanaView asks first for the desired *Year*, then for the *Month,* and finally for the *Day*. For each parameter, type the desired number in the right window, (or scroll to and click on the desired month) and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

Note: *If you have selected a circular log, PanaView now indicates that the log has been created, and returns to the* Log Edit Menu.

k. PanaView indicates a given *End Time*. Double-click on OK to agree to the given time, on *Now* to start the log immediately, or on *Timed* to indicate a specific duration.

- If you select *Edit,* PanaView asks first for the desired *Hour*, then for the *Minute*, and finally for the *Second*. For each parameter, type the desired number in the right window, and click **[Next Item]** (or simply click **[Next Item] to step through the parameters).**
- If you select *Timed*, PanaView asks for the *Log Time* (duration). Scroll to and double-click on the desired length of time (from 10 minutes to 24 hours.) Then go to step m.

l. PanaView indicates a given *End Date*. Double-click on *OK* to agree to the given day, on *Today* to start the log that day, or on *Edit* to change the starting date.

- If you select *Edit,* PanaView asks first for the desired *Year*, then for the *Month,* and finally for the *Day*. For each parameter, type the desired number in the right window, (or scroll to and click on the desired month) and click **[Next Item]** (or simply click **[Next Item] to step through the parameters)**.

m. Scroll to and double-click on the desired *Time Increment* (from 5 seconds to 24 hours). PanaView indicates that the log has been created, and returns to the *Log Edit Menu.*

If an erroneous value has been entered, PanaView displays a *Log Creation Error* message. Otherwise, the program indicates that the log has been created, and returns to the *Log Edit Menu.*

3.3.2.1 Checking Log Memory

To check on the amount of log memory available, double-click on the *Memory* option in the *Log Edit Menu.* The right window indicates the number of bytes available in both NVR and Flash memory.

3.3.2.2 Stop Logging

To manually terminate logging, double-click on the *Stop Logging* option in the *Log Edit Menu.* PanaView displays the name of the currently active logs. Double-click on your choice, and then click on *Yes* when the program asks if you wish to stop logging.

3.4 Creating PC Logs

PC logs are created in a different menu from the meter logs described in the last section. To create a new PC log:

1. Open the *Output* menu (see *Figure 13* below), and click on the *Logging* option.

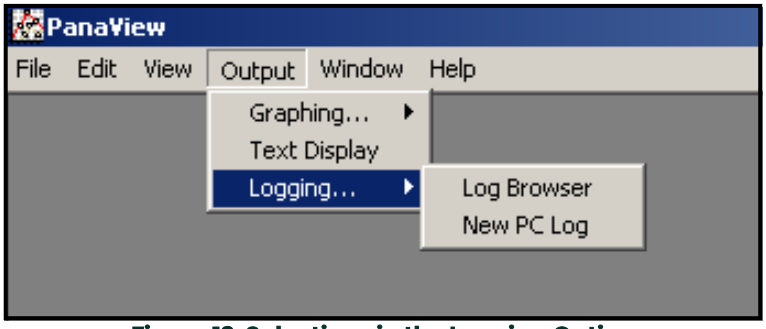


Figure 13: Selections in the Logging Option

You have two choices:

- Click on the *New PC Log* option and proceed to step 5, or
- Click on the *Log Browser* option. The dialog box shown in *Figure 14* below appears.

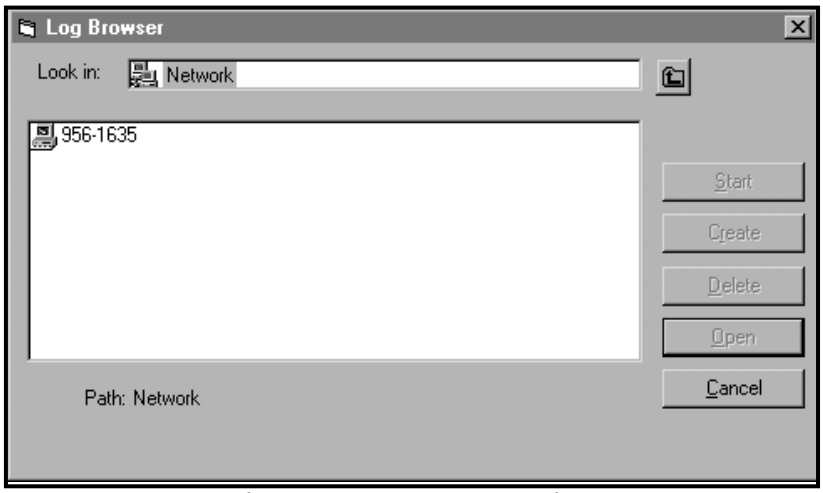


Figure 14: Computer Selection

Note: *If no log files have yet been created or if a log file has not yet been selected from the list, all of the option buttons (except for* **[Cancel]***) in the* Log Browser *dialog box are unavailable.*

2. Double click on the *computer name* to advance to the dialog box shown in *Figure 15* below.

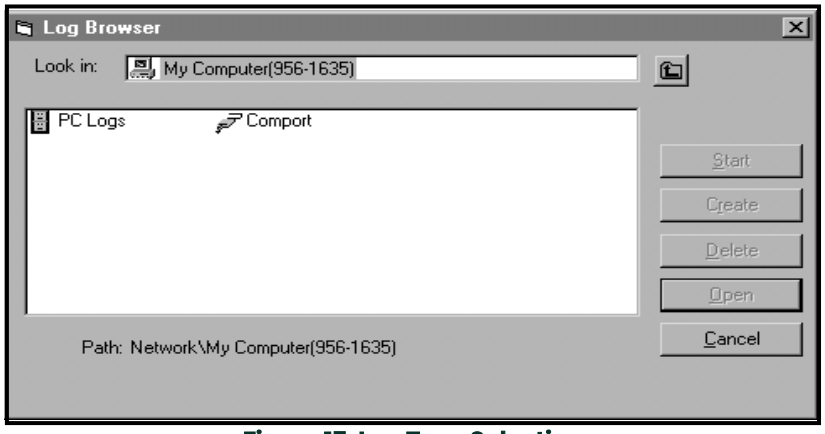


Figure 15: Log Type Selection

3. Double click on *PC Logs* to advance to the dialog box shown in *Figure 16*. below

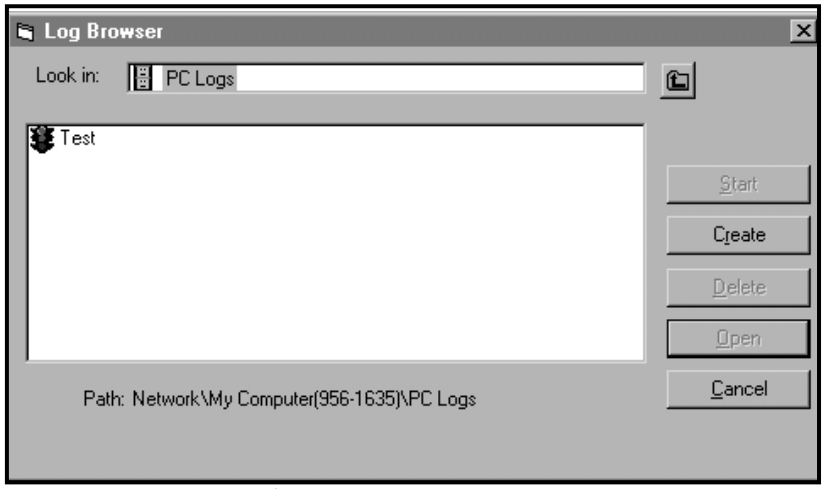


Figure 16: Create a PC Log

4. At the dialog box shown in *Figure 16* above, click on the **[Create]** option button to create a new meter log.
5. Enter a log *file name* (“*Sample*” in this case) in the dialog box shown in *Figure 17* below. Click on the **[OK]** option button.

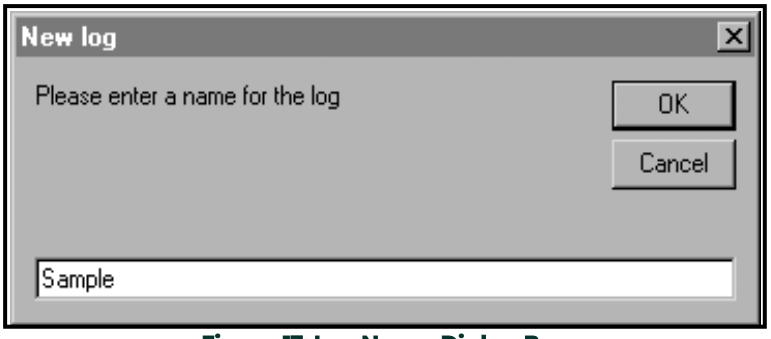


Figure 17: Log Name Dialog Box

6. At the resulting *PC Log* window shown in *Figure 18* below, place a check mark in the text box to create a *circular log*, or leave this box empty to create a linear log.

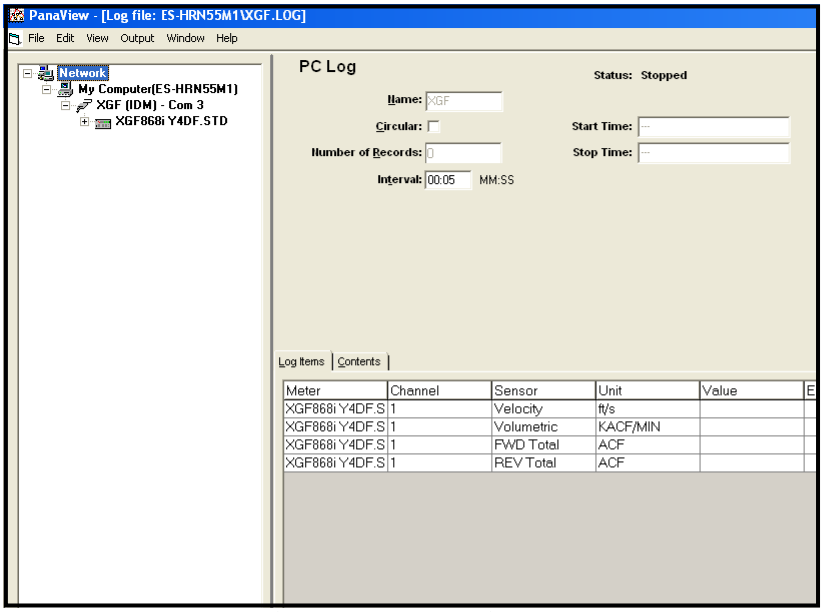


Figure 18: PC Log Window

7. Enter a sampling *interval* in the text box shown in *Figure 18* above.

Note: Start Time *and* Stop Time *cannot be specified for PC logs. These options are inactive in the* PC Log *window.*

8. Expand the network tree as far as necessary and double click on the process parameter(s) to be logged. As they are selected, the parameters are listed in the lower right pane of the *PC Log* window (make sure that the *Log Items* tab in this pane is selected).

Note: *To add all the channel parameters to a given log, right-click on the desired channel. A pop-up button, "Add Group to Log," appears. Click on the button to add the entire set of channel parameters to the log.*

9. Click on the **[Apply]** option button to record the log setup information, and then click on the **[Start]** option button to begin logging data immediately. (The *Start Time* automatically appears in the *PC Log* window.)

3.5 Viewing Meter Log Files

After one or more meter log files have been created, the logs may be viewed by using the *New Meter Browser*:

1. From the *New Meter Browser* in PanaView, expand the network tree and click on the *Meter Logs* option. If you have created one or more logs, the tree will appear similar to *Figure 19* below.

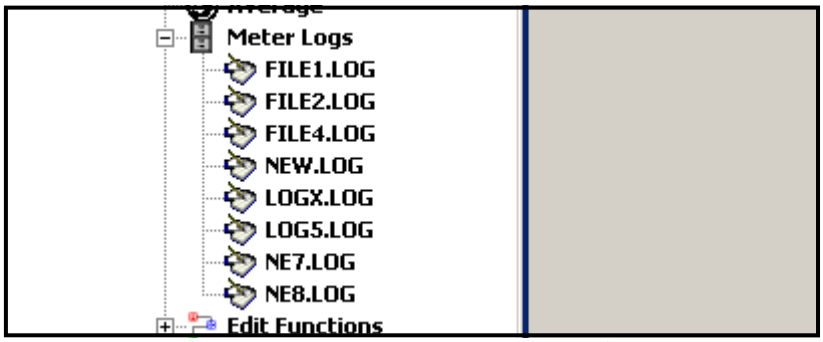


Figure 19: Expanded Meter Logs Option

2. Double-click on the desired log. A window opens for the individual log, as shown in *Figure 20* below.

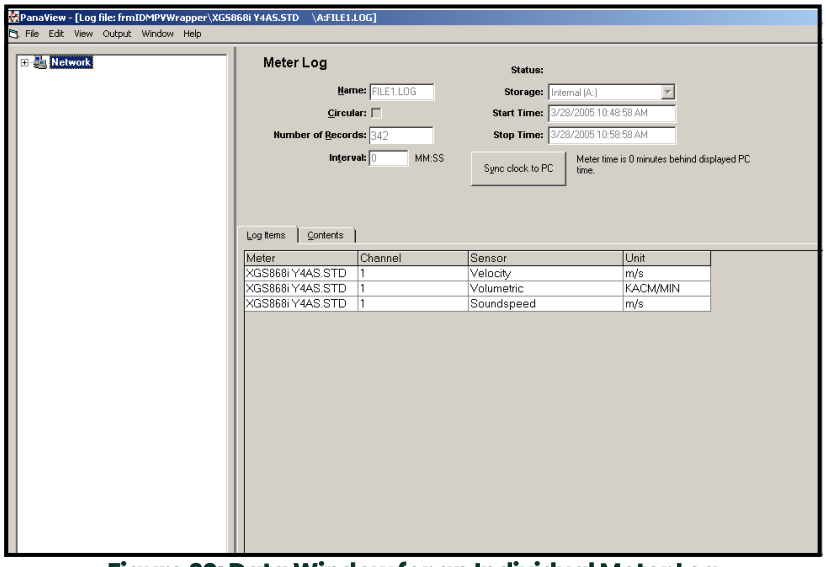


Figure 20: Data Window for an Individual Meter Log

- Click on the *Log Items* tab (see *Figure 20* above) for a list of the parameters specified for logging.
- Click on the *Contents* tab (see *Figure 21 on page 49*) for a list of all the data points logged to date for the parameter currently highlighted on the *Log Items* tab.
- Click on the **[Graph]** option button to display a graphical representation of the data logged to date.

Note: *The graph is displayed in its own window, which is opened on top of the* Meter Log *window. For instructions on using the* Graph Log *window, refer to the* Graphing Output *section in Chapter 2 of the PanaView User's Manual.*

Remember that only two parameters per channel may be graphed, and that the same two parameters must be graphed for each channel of a multi-channel graph display. When you have finished viewing the graph, click on the **[Close]** option button to close the Graph window and leave the log running.To review log details, click on the *Contents* tab. The window now appears similar to *Figure 21* below.

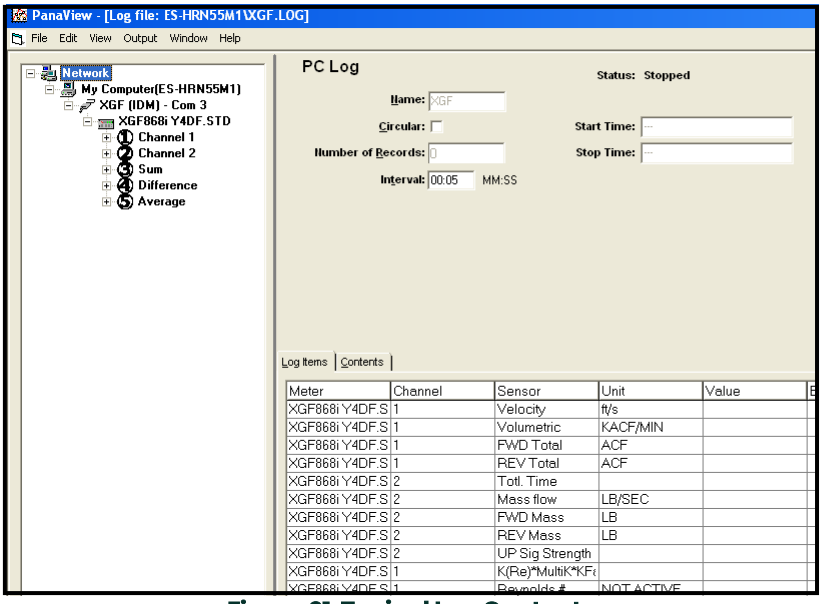


Figure 21: Typical Log Contents

3.6 Viewing PC Log Files

After one or more PC log files have been created, the logs may be viewed by using PanaView as follows:

1. You can access PC logs in two ways:
   - From the *New Meter Browser* in PanaView, expand the network tree and click on the *PC Logs* option. If you have created one or more logs, the tree will appear similar to Figure 22 below. Double-click on the log name to open the log, or
   - Pull down the *Output* menu (see *Figure 13 on page 46*), and click on the *Log Browser* option. Advance to the *PC Logs* dialog box as described in previous sections. A screen similar to that shown in Figure 23 appears.

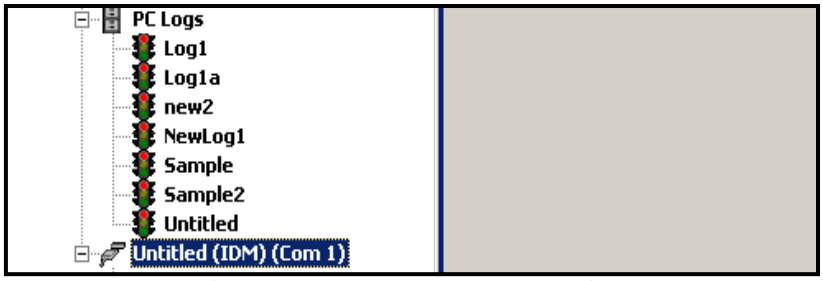


Figure 22: Expanded PC Logs Option

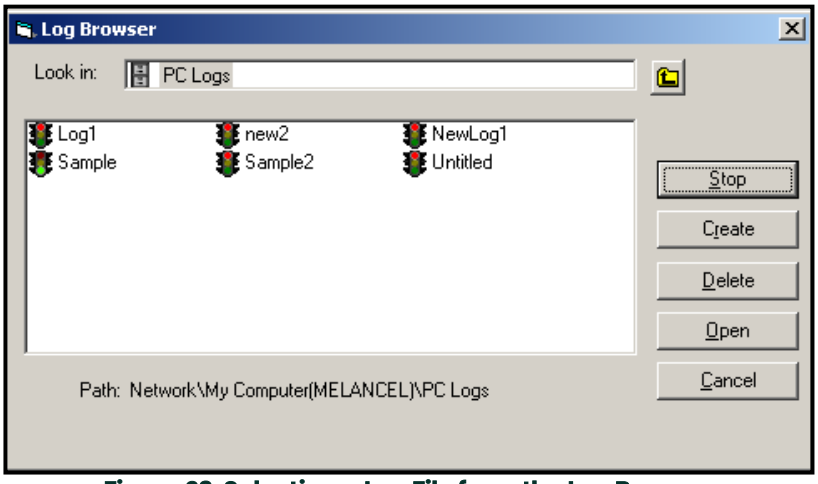


Figure 23: Selecting a Log File from the Log Browser

Notice that each of the log files in *Figure 22* and *Figure 23* has a traffic light icon next to its name. These icons indicate the current status of the log as follows:

- *Red light* - log has not run to its specified stop time but has been manually stopped
- *Green light* - log is currently running but is not yet complete

2. In the *Log Browser*, after you highlight the name of the desired log file, the following option buttons become available:
   - **[Start]** - resumes logging if the log is currently stopped, or

     [Stop] - stops logging, if the log is currently running
   - **[Delete]** - permanently deletes the log file
   - **[Open]** - opens the log in the *PC Log* window
3. Click on one of the option buttons listed in Step 2 above.

You can monitor the progress of an ongoing log in several ways:

- Click on the *Log Items* tab (see *Figure 21 on page 49*) for a list of the parameters specified for logging.
- Click on the *Contents* tab (see *Figure 21 on page 49*) for a list of all the data points logged to date for the parameter currently highlighted on the *Log Items* tab.
- Click on the **[Graph]** option button to display a graphical representation of the data logged to date.

Note: *The graph is displayed in its own window, which is opened on top of the* PC Log *window. For instructions on using the* Graph Log *window, refer to the* Graphing Output *section in Chapter 2 of the PanaView User's Manual.*

- Click on the **[Refresh]** option button to update the information shown on the *Contents* tab and in the *Graph Log* window. Any data logged since the last use of the **[Refresh]** option button is added to the list and to the graph.

Remember that only two parameters per channel may be graphed, and that the same two parameters must be graphed for each channel of a multi-channel graph display. When you have finished viewing the graph, click on the **[Close]** option button to close the *Graph* window and leave the log running.

4. To terminate the logging process, simply click on the **[Stop]** option button, which has replaced the original **[Start]** option button. (The *Stop Time* automatically appears in the *PC Log* window.)

Because a PC log has no specific *"Stop Time,"* the log will continue to run until it is manually stopped (unless the PC is turned off or you run out of hard drive space).

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Chapter 4. Printing Data

4.1 Data Types for Printing

The XGF868i flowmeter has no ability to print any of its data directly. However, any of the data stored in its memory may be printed via the built-in RS232 communications port, using a computer terminal. In order to use the capability, the XGF868i must be linked to the computer terminal with the optional *PanaView* software.

Note: *See Chapter 1,* Installation, *of the* Startup Guide *for instructions on wiring the RS232 serial port. For additional information, refer to the* EIA-RS Serial Communications *Manual (916-054).*

After making the hardware connections and installing PanaView software, the following data may be output to a printer connected to the personal computer:

- Live data in numeric or graphical format
- Log file in numeric or graphical format
- Site file in tabular format
- Transducer signal array data in tabular format

For detailed instructions on printing any of the data types listed above, consult the *PanaView User's Manual.*

[no content intended for this page]

Chapter 5. Clearing Data

5.1 Introduction

This chapter explains how to purge totalized measurements, site data and/or log files from the XGF868i memory.

Note: *For detailed information on creating a log file, see Chapter 3,* Logging Data. *For detailed information on programming site data, see Chapter 1,* Programming Site Data.

IMPORTANT: None of the clearing procedures described in this chapter can be undone. Be very sure that the exact consequences of a selected option are thoroughly understood before proceeding.

5.2 Clearing the XGF868i Memory

If the XGF868i available memory becomes nearly full, it may be necessary to purge some or all of the existing data from memory, before any additional data can be stored. In order to accomplish this task, proceed to the appropriate section for step-by-step instructions.

Note: *Depending on the current configuration of the XGF868i, it may be possible to add additional memory by installing an option card in* **Slot 2**. *See Chapter 4,* Parts Replacement, *of the* Service Manual *for details.*

5.2.1 Clearing Site Data

This feature has not yet been implemented, because the XGF868i currently has no capability to store site files in its own memory.

5.2.2 Clearing Log Files

To clear log files from the XGF868i or from the PC's memory, complete the following steps:

1. From PanaView, click on the *Logging* option in the *Output* menu. Then click on the *Log Browser* option, as shown in *Figure 24* below.

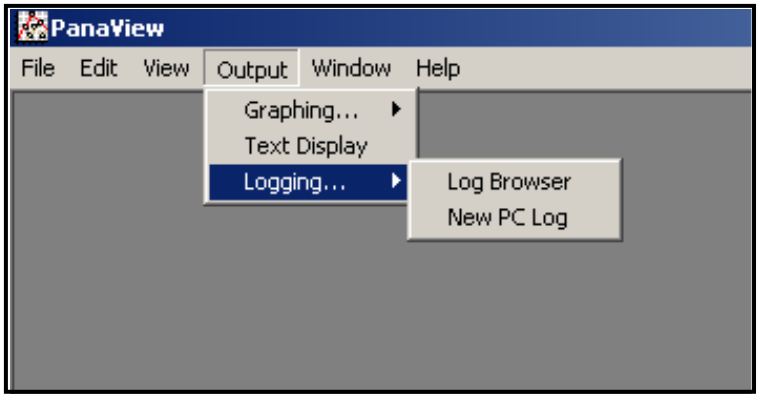


Figure 24: *Log Browser* in the *Logging* Option

2. Double-click on the *computer name* to move to the network level.
3. Double-click on *PC Logs* to access the stored PC logs, or on the *communication port* name and the *meter* name to access the stored meter logs. In either case, the *Log Browser* appears similar to *Figure 25* below.

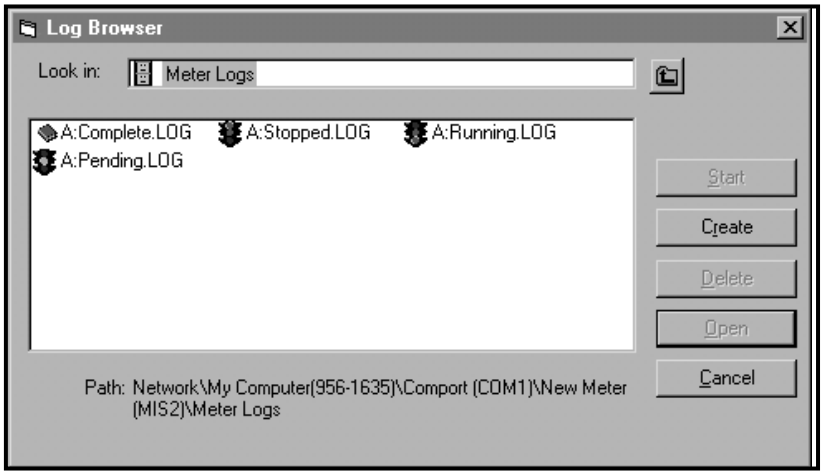


Figure 25: Log Browser Window

4. Highlight the log you wish to delete, and click on the [Delete] option button.

5.2.3 Clearing the Totalizers

You can clear the XGF868i totalizers (i.e., reset specified totalized flow rates to zero) from either the LCD display or from PanaView. (Refer to *Figures A-1, A-2, A-3 or A-4* in Appendix A.) To reset totals from the display, complete the following steps:

1. Press [Escape], [Enter], [Escape].
2. In the *Keypad Program*, scroll to RESET and press [Enter].
3. The XGF868i asks *Reset Totals?* Scroll to *NO* or *YES* (2) and press [Enter] at the desired choice.

The XGF868i totalizers are reset to 0, and the meter returns to the *Keypad Program*. Press [Escape] to return to the data display.

To reset the totals from PanaView:

1. From the *New Meter Browser* in PanaView, highlight the XGF868i.
2. Open the *Edit* menu and select the *Properties* option, as shown in *Figure 26* below.

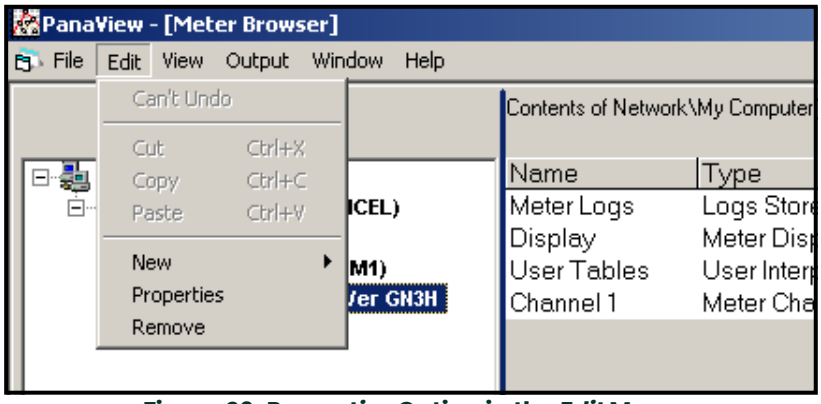


Figure 26: *Properties* Option in the *Edit* Menu

3. The *Properties* window appears similar to *Figure 27* below. To clear the XGF868i totalizers, click on the [Clear Totalizers] button. The XGF868i totalizers are reset to 0.

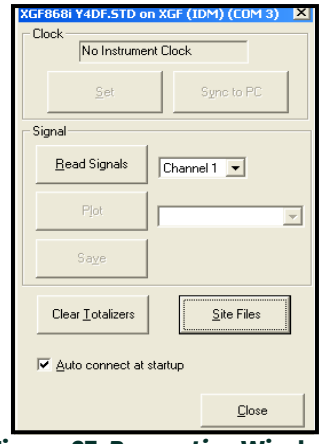


Figure 27: *Properties* Window

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Appendix A. Menu Maps

The following *Menu Maps* are included in this appendix:

- Figure 28, “PROG > CHx > ACTIV, SYSTM, PIPE & I/O Menus,” on page 61
- Figure 29, “PROG > CHx > SETUP Menu,” on page 62
- Figure 30, “PROG > GLOBL > SYSTM, I/O & COMM Menus,” on page 63

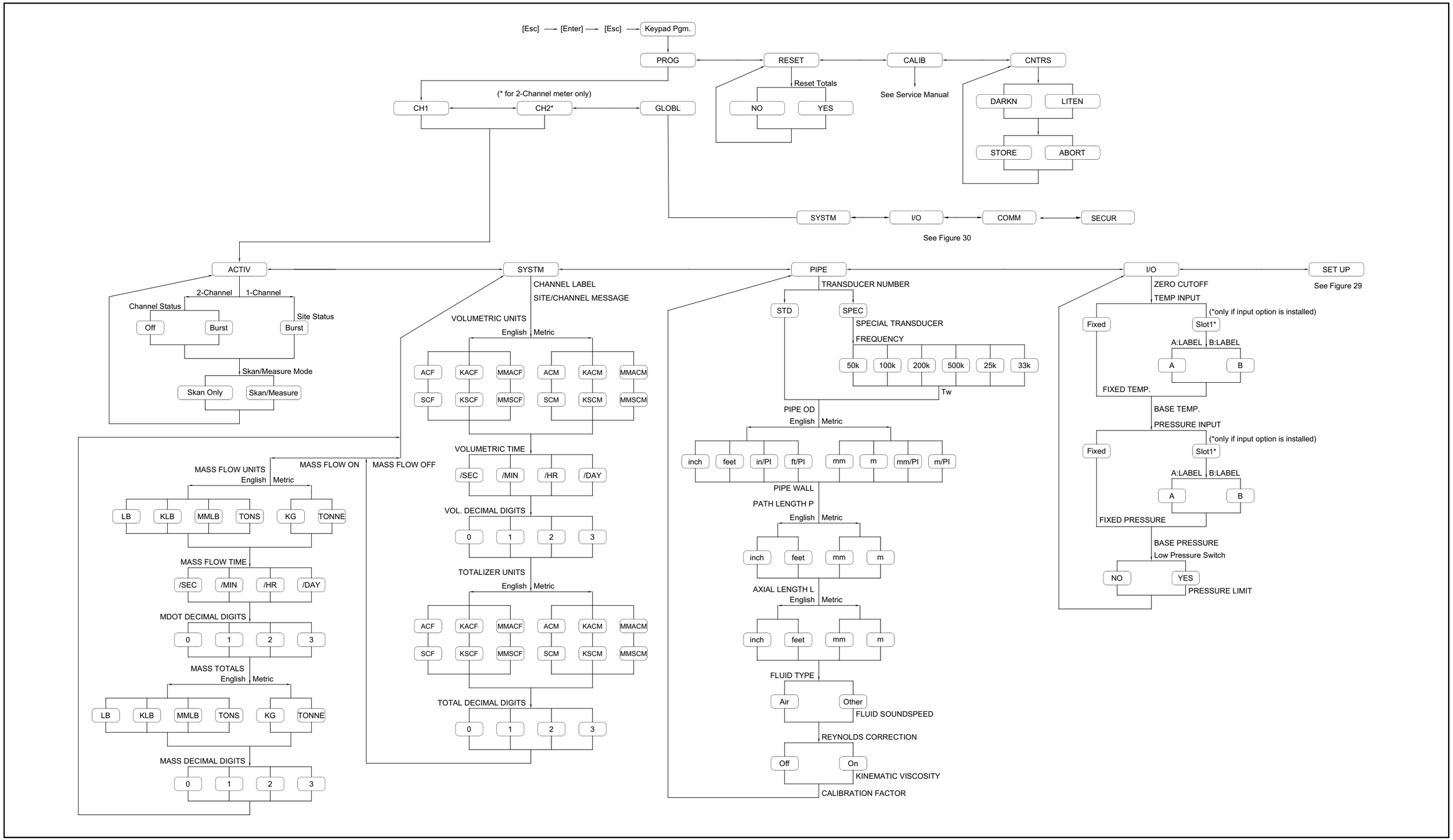


Figure 28: PROG > CHx > ACTIV, SYSTM, PIPE & I/O Menus

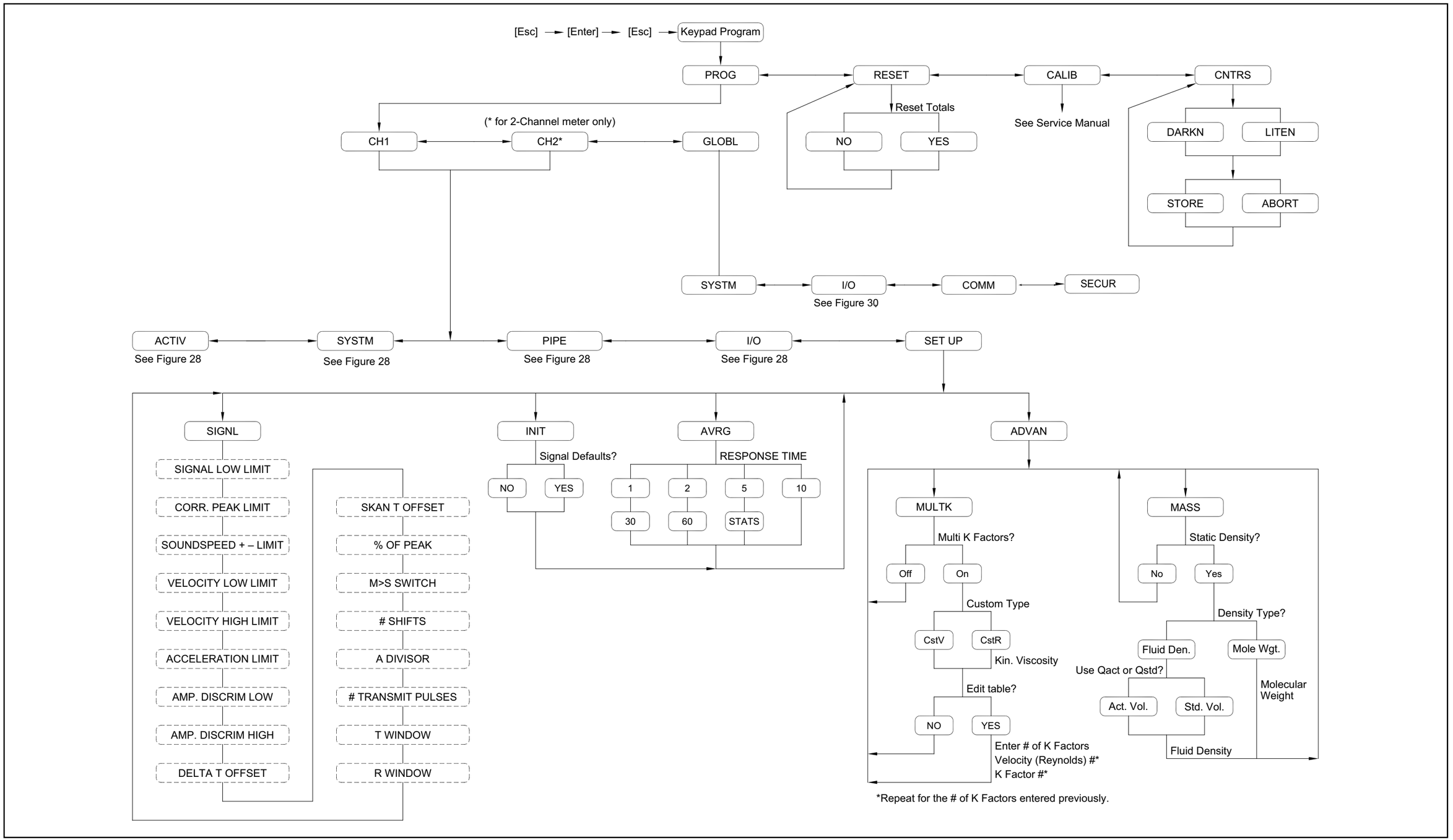


Figure 29: PROG > CHx > SETUP Menu

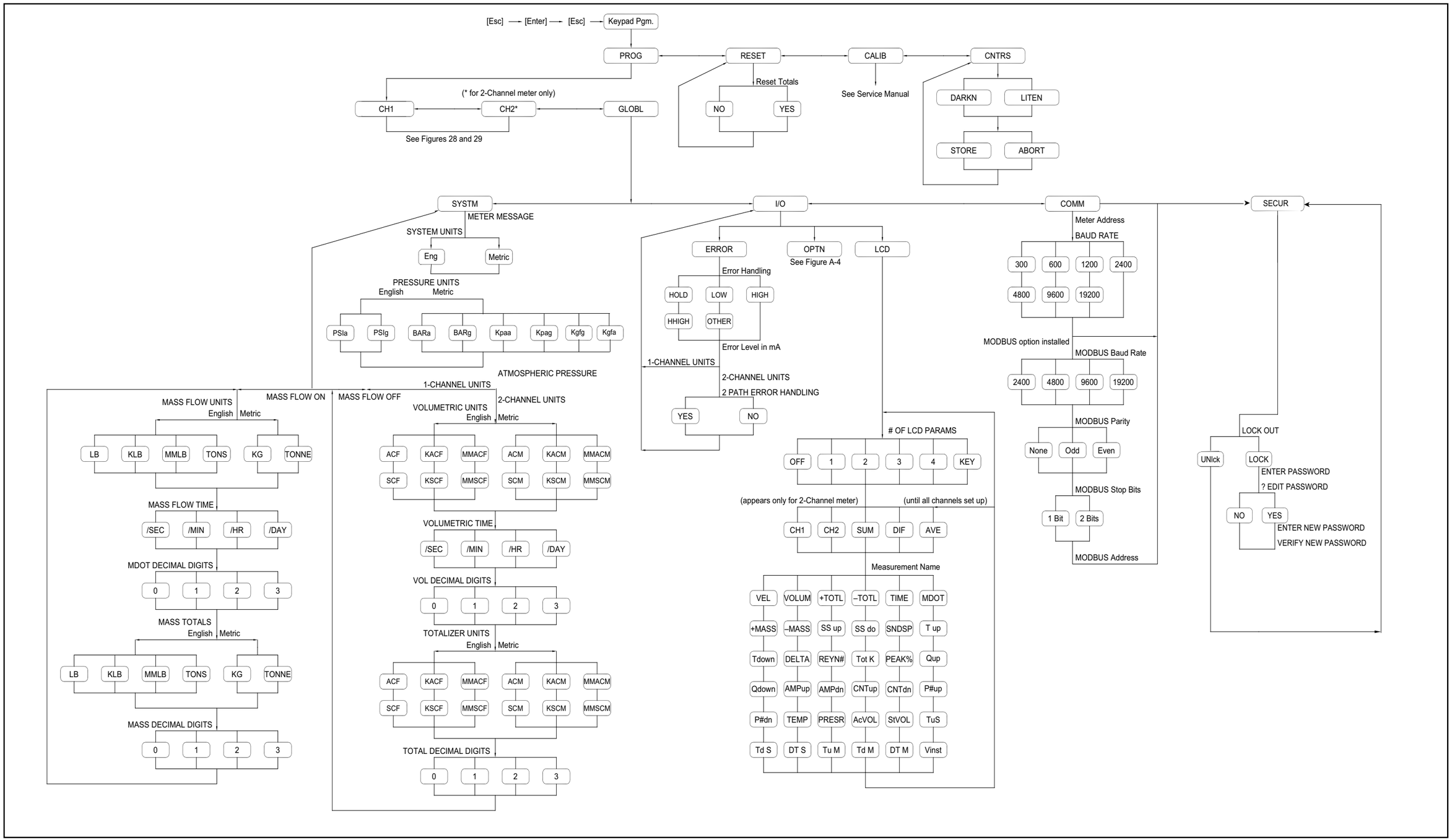


Figure 30: PROG > GLOBL > SYSTM, I/O & COMM Menus

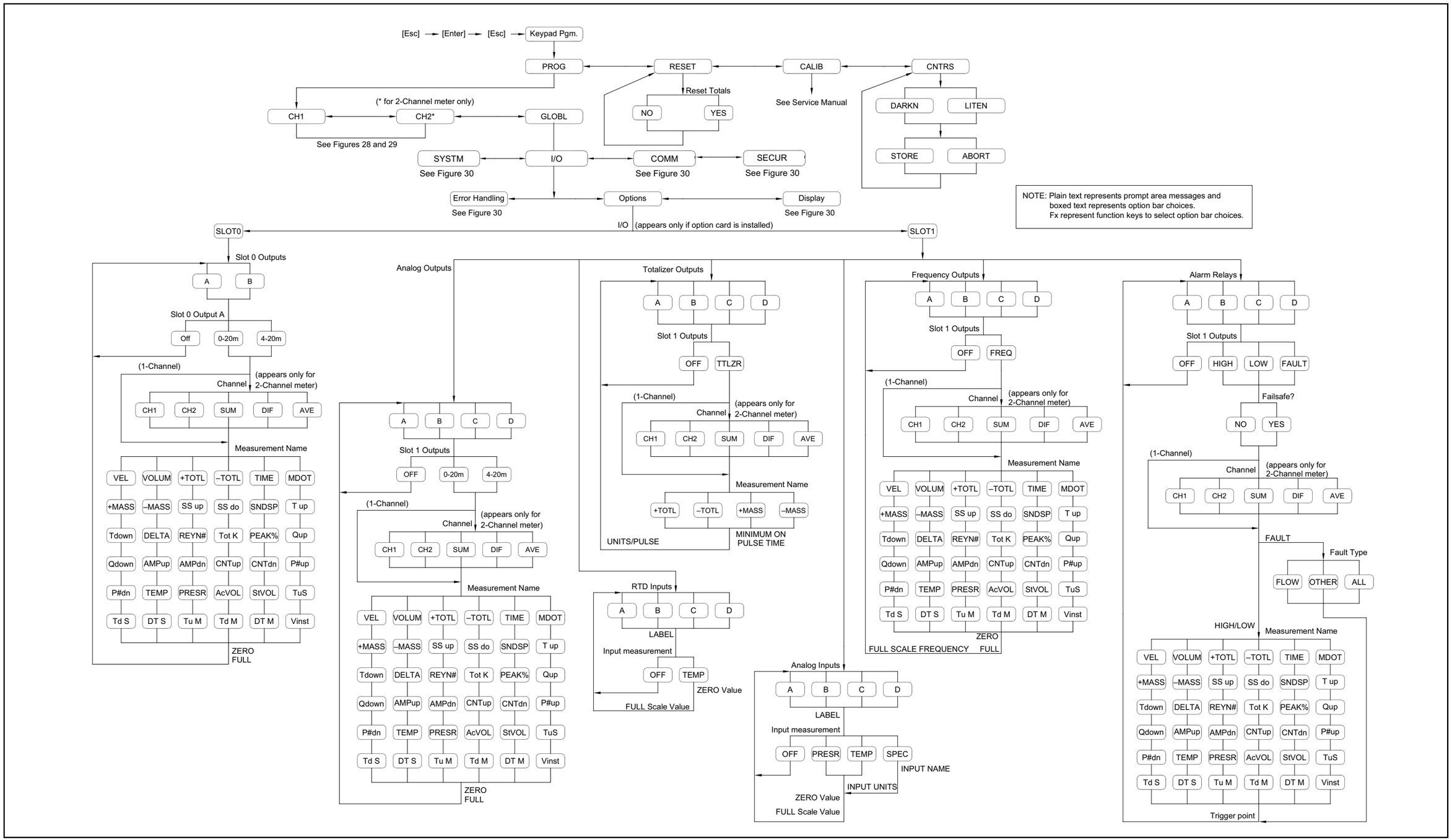


Figure 31: PROG > GLOBL > I/O > OPTIONS Menu

Appendix B. Data Records

B.1 Available Option Cards

The XGF868i can hold one option card in Slot 1 and one in Slot 2. The available configurations are listed in *Table 12* below.

Table 12: Option Cards Configuration

Card #	Slot #	Configuration
1473-02	1	OI - 2 Current Inputs
1473-14		ORI - 1 RTD Input/1 Current Input
1473-06		FI - 2 Current Inputs/2 Frequency Outputs
1473-15		FRI - 2 Frequency Outputs/1 RTD Input/1 Current Input
1345-04		Modbus Communications Protocol
1385		HART Communication
1477-03	2	MODBUS/TCP/IP
1477-01		Ethernet
1475-01		Foundation Fieldbus

B.2 Option Cards Installed

Whenever an option card is installed or changed in the XGF868i flow transmitter, record the type of card and any additional setup information in the appropriate row of *Table 13* below.

Table 13: Option Cards Installed

Slot #	Type of Option Card	Additional Setup Information
0	Analog Outputs (A, B)	
1		
2		

B.3 Setup Data

After the XGF868i flow transmitter has been installed, setup data must be entered via the *User Program* prior to operation. Record that information in *Table 14* below.

Table 14: Setup Data

General Information						
Model #				Serial #		
Software Version				Setup Date		
Channel - Status						
Channel 1				Channel 2		
Channel Status	Off	Burst		Channel Status	Off	Burst
Measure Mode	Skan	S/M		Measure Mode	Skan	S/M
Channel - System						
Channel Label				Channel Label		
Site/Channel Msg.				Channel Message		
Vol. Units				Vol. Units		
Vol. Time Units				Vol. Time Units		
Vol. Dec. Digits				Vol. Dec. Digits		
Totalizer Units				Totalizer Units		
Tot. Dec. Digits				Tot. Dec. Digits		
Mass Flow				Mass Flow		
Mass Flow Time				Mass Flow Time		
MDOT Dec. Digits				MDOT Dec. Digits		
Mass Totalizer				Mass Totalizer		
Mass Dec. Digits				Mass Dec. Digits		
Molecular Weight				Molecular Weight		

Table 14: Setup Data

Channel - Pipe Parameters						
Channel 1				Channel 2		
Transducer Type	STD	SPEC		Transducer Type	STD	SPEC
Transducer #				Transducer #		
Spec. Trans. Freq.				Spec. Trans. Freq.		
Spec. Trans. Tw				Spec. Trans. Tw		
Pipe O.D.				Pipe O.D.		
Pipe Wall				Pipe Wall		
Path Length (P)				Path Length (P)		
Axial Length (L)				Axial Length (L)		
Fluid Type	Air	Other		Fluid Type	Air	Other
Other/Sndspd				Other/Sndspd		
Calibration Factor				Calibration Factor		
Channel - Input/Output						
Zero Cutoff				Zero Cutoff		
Temp. Input				Temp. Input		
Base Temp.				Base Temp.		
Pressure Input				Pressure Input		
Base Pressure				Base Pressure		
Low Press. Switch	No	Yes		Low Press. Switch	No	Yes
Pressure Limit				Pressure Limit		
Channel - SETUP - V Averaging						
Response Time				Response Time		
Channel - SETUP - Advanced Features - Multi K Factors						
K-Factor #	Velocity	K-Factor		K Factor #	Velocity	K-Factor
1				1		
2				2		
3				3		
4				4		
5				5		
6				6		
7				7		
8				8		
9				9		
10				10		

Table 14: Setup Data

Channel - SETUP - Advanced Features - Multi K Factors (cont.)						
K-Factor #	Velocity	K-Factor		K Factor #	Velocity	K-Factor
11				11		
12				12		
13				13		
14				14		
15				15		
16				16		
17				17		
18				18		
19				19		
20				20		
Channel - SETUP - Advanced Features - Mass Flow Calculation						
Mass Flow	Yes	No		Mass Flow	Yes	No
Density Type	Fluid Dens.	Mol. Wt.		Density Type	Fluid Dens.	Mol. Wt.
Q_{act} or Q_{std}?	Actual	Standard		Q_{act} or Q_{std}?	Actual	Standard
Fluid Density				Fluid Density		
Mole. Weight				Mole. Weight		
Global - System						
Meter Message				Totalizer Units		
System Units	English	Metric		Tot. Dec. Digits		
Pressure Units				Mass Flow		
Atmos. Pressure				Mass Flow Time		
Vol. Units				MDOT Dec. Digit		
Vol. Time Units				Mass Totals		
Vol. Dec. Digits				Mass Dec. Digits		
Global - Input/Output - Error Handling						
Error Handling				2-Path Error	No	Yes
Global - Communications Port						
Meter Address				MOD. Parity		
Baud Rate				MOD. Stop Bits		
MOD. Baud Rate				MOD. Address		

[no content intended for this page]

Appendix C. Programming the XGF868i With PanaView™

C.1 Introduction

The XGF868i flow transmitter must be properly installed and programmed, as described in the *Startup Guide*, before it can provide accurate flow rate measurements. After completing the installation and initial setup, use this chapter to program the advanced features of the Model XGF868i's via the PanaView™ software program. Refer to the appropriate section for a discussion of the following menu features:

- Channel-Status - activate one or both channels and select the desired measurement method
- Channel-System - enter the individual channel parameters
- Channel-Pipe - enter the pipe parameters
- Channel-I/O - set up the inputs and outputs
- Channel-Setup - set the signal limits, response times and activating mass flow.
- Global-System - enter the system units
- Global-I/O - set up error handling, option cards and display
- Global-Comm - set the serial port and MODBUS parameters

As a programming aid, a complete set of menu maps for the PROG menu is included in Appendix D, *PanaView Menu Maps*. The specific figure numbers will be referenced throughout this chapter, as required.

C.2 Programming With PanaView™

You can program the XGF868i with PanaView™, a Panametrics PC-based, non-resident software program that communicates with the XGF868i via its RS232 serial port.

C.2.1 Preparing for PanaView Programming

Before you attempt to communicate with the XGF868i, be sure you have linked your PC to the XGF868i via an RS232 interface. For details on wiring the interface, refer to *Wiring the Serial Port* in the *Startup Guide,* and to the document *EIA-RS Serial Communications* (916-054). You must also install PanaView, as described in the *PanaView User's Manual* (910-211).

C.2.2 Setting Up the Communications Port

Use the steps below to establish PanaView communications with the XGF868i.

1. Launch PanaView, as discussed in Chapter 3, *Initial Setup*, of the *PanaView User's Manual*.
2. Open the *New Meter Browser* window in the *File* menu and expand the network tree. Then, highlight the *My Computer (Name)* branch by clicking on it.
3. Pull down the *Edit* menu by clicking on it in the menu bar.
4. Click on the *New* menu option to select it, and a submenu opens with two choices on it (see *Figure 32* below).

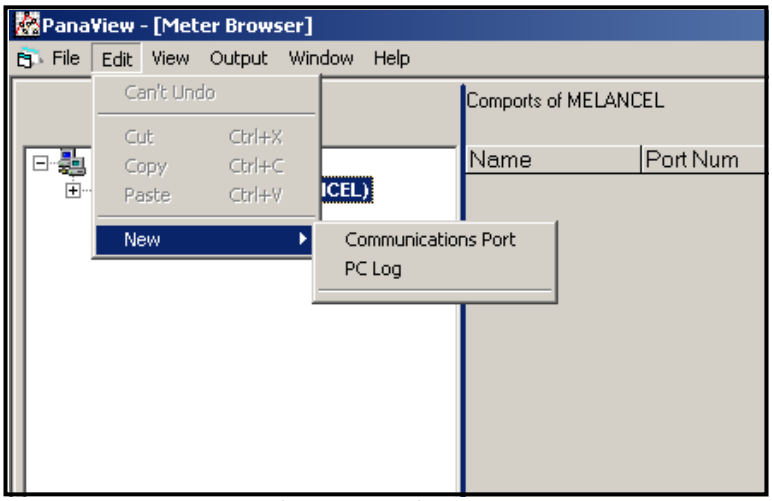


Figure 32: Edit Menu

5. Click on the *Communications Port* option to select it. The *Setup Communications* screen appears similar to *Figure 33* below.

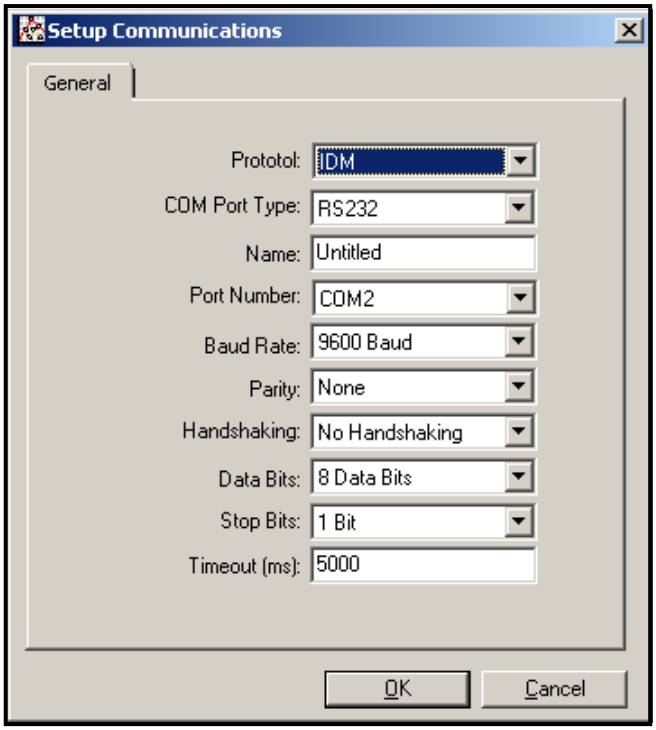


Figure 33: *Setup Communications* Screen

6. Open the Protocol menu (the first of the drop-down menus) and click on *IDM*.

7. Open the COM Port Type menu and click on the desired type (or on *TCP/IP*, if the XGF868i is using an Ethernet connection).

Note: *If you select TCP/IP, the menu changes. Proceed to the next page.*

8. Select any suitable available baud rate. A baud rate of 19200 is appropriate for almost all applications. However, if you experience periodic communication reliability problems, you may wish to consider lowering the baud rate on your instrument and in PanaView.

IMPORTANT: *Be sure all the communications port settings match those made in setting up the meter's serial port.*

9. Click on [OK] to complete data entry.

C.2.3 Setting up Ethernet Communications

If you have selected TCP/IP in step 6 on the previous page, the Setup Communications window appears similar to *Figure 34* below.

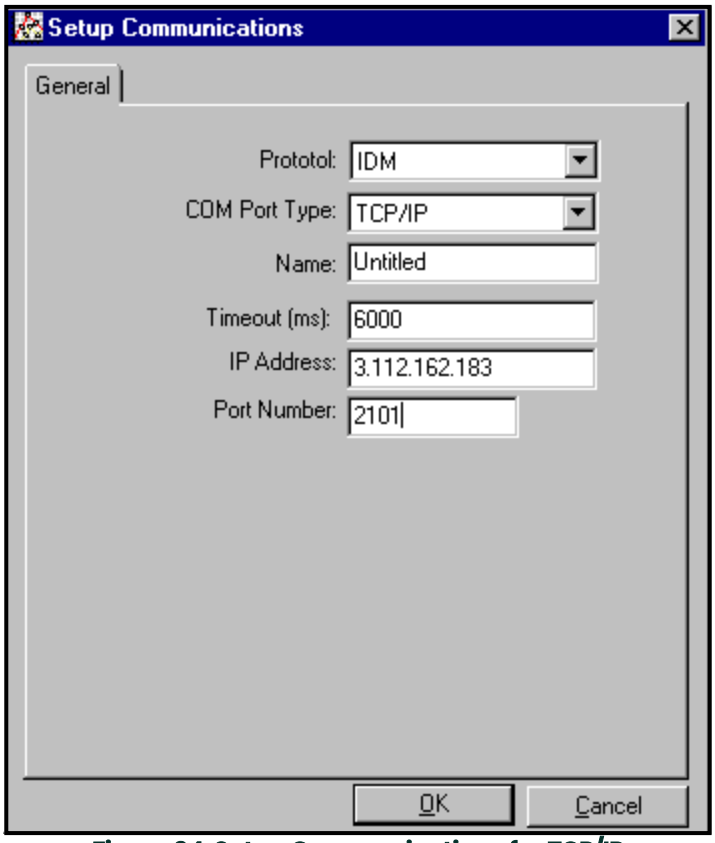


Figure 34: Setup Communications for TCP/IP

1. Type in the desired *Name* and *Timeout* (in milliseconds).
2. In the *IP Address* text box, enter the IP address. If the IP address is unknown, run the Device Discovery software utility. All units found will be identified by their MAC address and the assigned IP address. In the *Port Number* box, enter 2101 (the default value).
3. Click [OK] to complete data entry.

IMPORTANT: *If you are using Ethernet communications, be sure the XGF868i is set up with the default communications parameters: 9600 baud, no parity, no handshaking, 8 data bits and 1 stop bit. The port number must match the "Enable Raw TCP access using TCP Port" assignment shown under the* Device Discovery *"TCP Server Settings" menu* (Configuration>Serial Ports>Port).

C.2.4 Modifying Ethernet Parameters

To establish Ethernet communications with the XGF868i or to modify its IP parameters, you will need to install the Ethernet Device Discovery software utility (available with your XGF868i) on a PC connected to the LAN. Once installed and running, the software displays all Ethernet devices currently connected to the subnet. You can identify the XGF868i by its MAC address, supplied as part of customer documentation. The default IP Port is 2101.

The default IP addressing for the XGF868i is DHCP (dynamic). If you need to assign a static IP address to the XGF868i, complete the following steps:

IMPORTANT: *To assign a static IP address, the XGF868i must be connected to an Ethernet network with a dynamic address assignment mechanism (DHCP) first.*

1. Run Ethernet Device Discovery software, and identify the XGF868i's current IP address.
2. Open your Internet browser (Internet Explorer, Netscape, or other) and type the XGF868i IP address in the Address box.
3. The Connect ME Configuration and Management window opens. Two text boxes ask for the user name and password.
   a. In the Username text box, type root.
   b. In the Password text box, type dbps.
4. At the left of the window, click on Network.
5. The IP Settings window opens. In the text boxes for IP Address, Subnet Mask, and Default Gateway, type in the new information.
   4. Click Apply. The software applies the new address.

C.3 Adding the XGF868i

To add the XGF868i on the IDM-configured communications port, complete the following steps:

1. Highlight the communication port to which the meter will be added by clicking on it, and then open the *Edit* menu on the menu bar (if the communication port is not highlighted first, the *New Meter* option is not active in the *Edit* menu).
2. Click on the *New* option in the *Edit* menu (see *Figure 35* below).

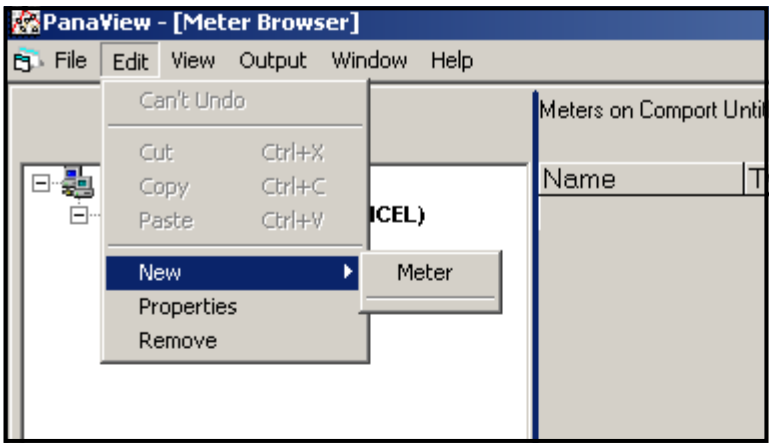


Figure 35: *New* Option in the *Edit* Menu

3. After clicking on the *New* option, the *Meter* menu option appears. Click on this option to select it.
4. The *New IDM Meter* screen (see *Figure 36* below) opens. Enter the Network ID number for the meter, and click [OK].

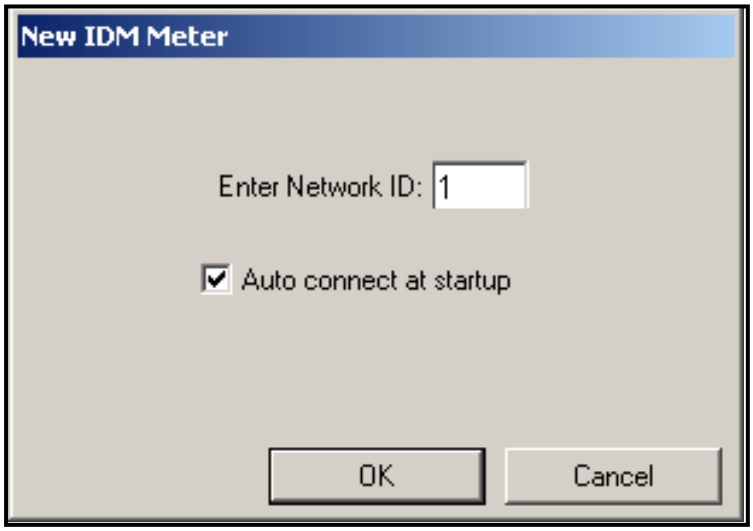


Figure 36: New IDM Meter Screen

IMPORTANT: *The Network ID number must match the Network ID programmed in the meter's Communications menu.*

If the initialization is successful, the *Meter Browser* shows a listing similar to *Figure 37* below.

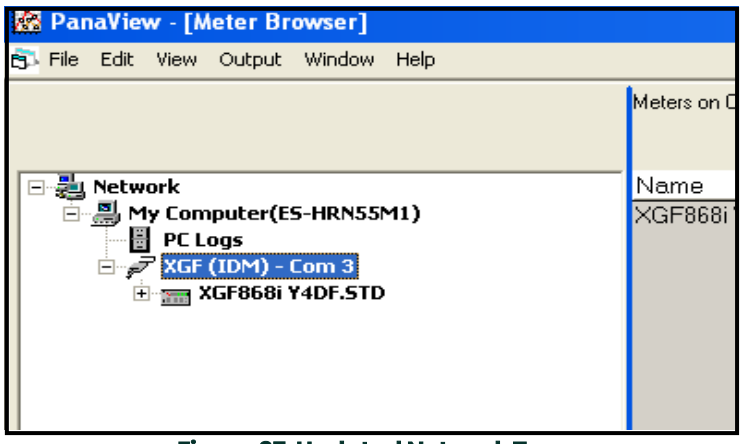


Figure 37: Updated Network Tree

However, if the settings do not match, or there is some other difficulty, a screen appears similar to *Figure 38* below.

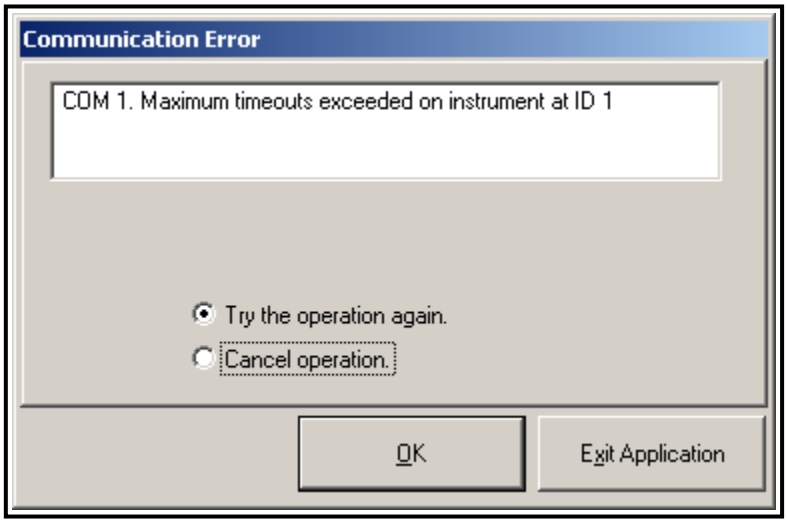


Figure 38: Communication Error Screen

The screen offers the options of trying again or of canceling the operation. Click on the desired choice, and then on [OK] to confirm the choice or on [Exit Application] to close PanaView.

C.4 Entering the User Program Using PanaView

Note: *Be sure to record all the programming data entered in this chapter in Appendix B,* Data Records.

Programming of the Status, System, and Pipe submenus of the Channel menu and the Global-System menu are required for basic operation of the XGF868i. Failure to accurately enter all of the necessary information will result in unreliable flow rate data. Therefore, be sure to complete at least the sections of this chapter pertaining to those three submenus. Except for those three submenus, it is not necessary to program the XGF868i flowmeter in any particular order. Therefore, the sections of this chapter need not be completed in sequence. Enter the user program as described below and proceed immediately to any section of interest.

To begin entering data into the XGF868i via PanaView:

1. From the meter tree in the *New Meter Browser* (see *Figure 37 on page 75*), click on the XGF entry. The screen now appears similar to *Figure 39* below.

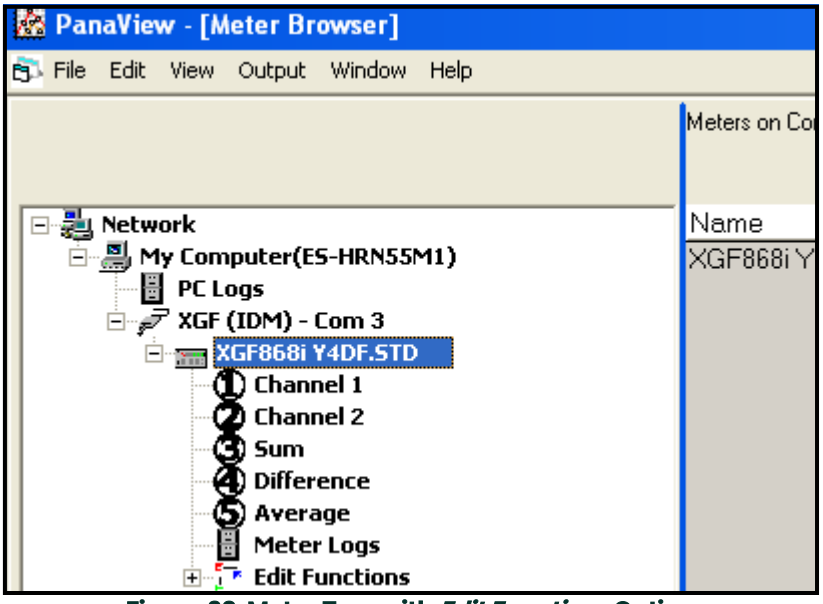


Figure 39: Meter Tree with *Edit Functions* Option

2. Expand the *Edit Functions* option. The window now appears similar to that shown in *Figure 40 on page 78*.

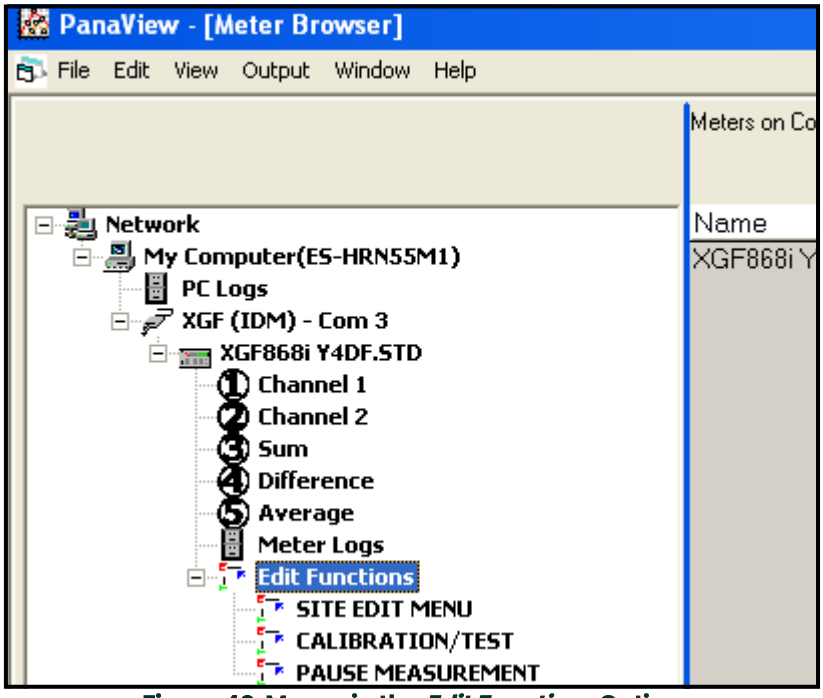


Figure 40: Menus in the *Edit Functions* Option

3. To enter data into the user program, double-click on the *Site Edit Menu*. The window appears similar to *Figure 41* below.

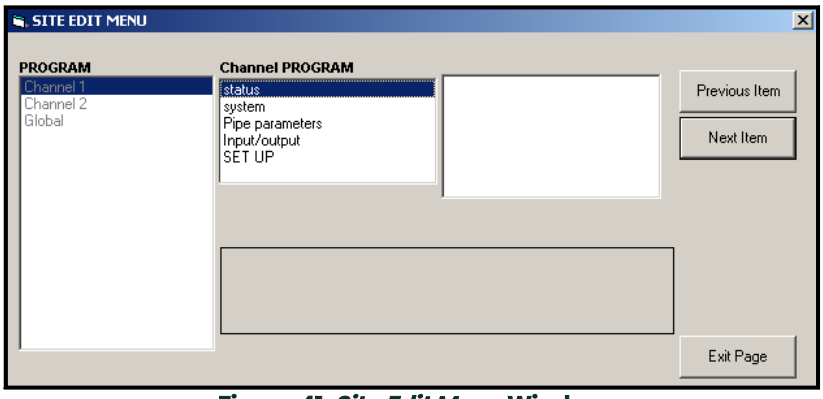


Figure 41: *Site Edit Menu* Window

4. To enter the Channel 1, Channel 2, or Global menu, highlight and double-click on the desired menu in the left pane. For example, clicking on Channel 1 in *Figure 41* above opens the list of options shown in the center pane.
5. To enter a particular option:
   a. Highlight and double-click on the desired option in the center pane. *Figure 42 on page 79* shows the first entry (Transducer Number) in the *Pipe Parameters* option. The title above the center pane lists the current entry, while the center pane displays the available selections for that entry.

   b. Click on the desired choice. If the entry requires a numeric or text value, change the value displayed in the right pane.

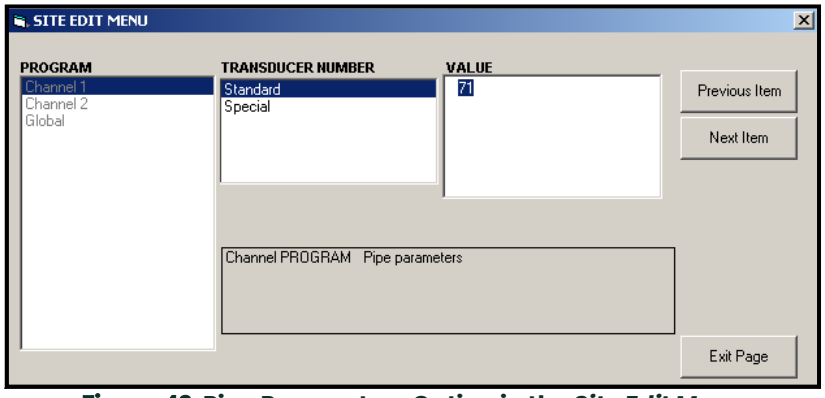


Figure 42: Pipe Parameters Option in the *Site Edit Menu*

c. Do one of the following:

Click on [Next Item] to proceed to the next menu item,
or
Click on [Previous Item] to return back through the menu to a previous item.

Note: *If you click on either [Next Item] or [Previous Item] without changing the settings, the current settings remain unchanged.*

As you step through the menu, the bottom panel lists the current settings you have modified or left unchanged, as shown in *Figure 43* below. If you modify or step through more than five items, a scroll bar at the right of the panel lets you review the earlier settings.

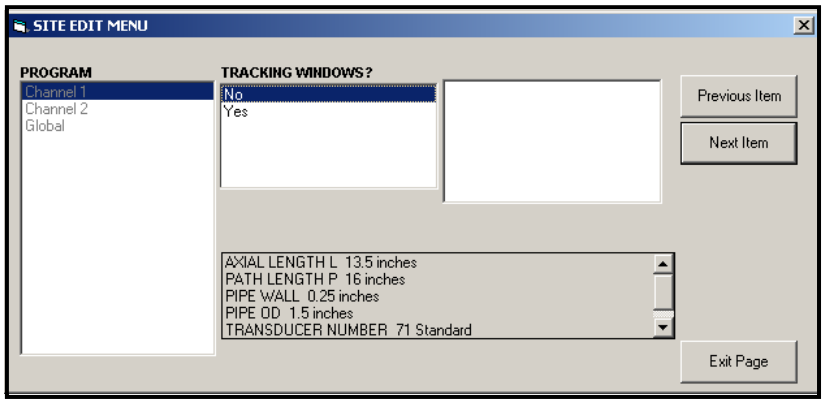


Figure 43: *Site Edit Menu* with Current Settings

6. When you have completed entering parameters in a given option, click [Exit Page] to close the option. You can then double-click on another option, or click [Close] to close the window.

You can double-click on another menu to modify its settings, or return to the *New Meter Browser*. Proceed to the following sections to enter data in the Channel or Global menus.

C.5 Entering Data in the Channel Menu

The Channel menu is used to enter data specific to each channel. Refer to Figures D-1 through D-3 in Appendix D, *PanaView Menu Maps*, and remember to record all programming data in Appendix B, *Data Records*.

Note: *In this manual, only the programming of Channel 1 is described. To program Channel 2 of a 2-Channel meter, simply repeat the same procedures presented for Channel 1.*

C.5.1 Selecting the Channel Measurement Method

The Status submenu permits selection of the desired measurement method.

1. In the *Site Data Menu*, double-click on the desired channel.
2. Highlight and double-click on the Status option in the center pane. The window now appears similar to *Figure 44* below.

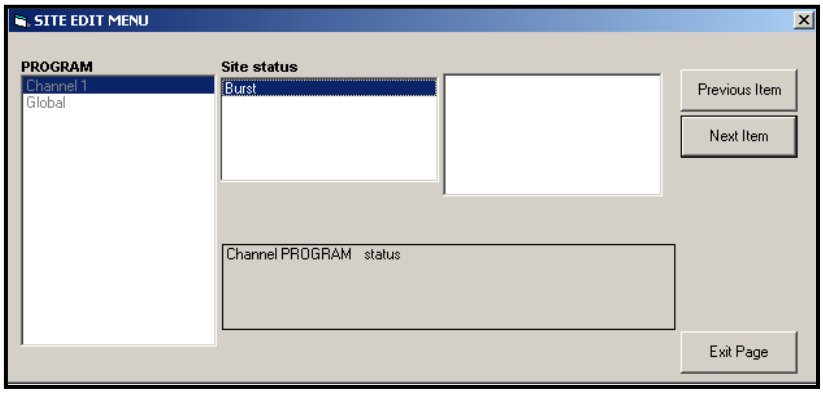


Figure 44: *Status* Option in the Channel Menu

3. Double-click on *Burst* to activate the channel/path.
4. Double-click on one of the measurement methods described below.
   - Skan Only is the preferred technique for locating the acoustic signal and for high velocity measurements. It is more robust in a noisy environment than the Measure technique.
   - Skan/Measure is the preferred technique to use for low velocity measurements.

If Skan Only is selected at the above prompt, the meter uses this technique exclusively. However, if Skan/Measure is selected, the meter uses Skan Only to find the acoustic signal and then tries to use the Skan/Measure technique for the actual measurement.

Note: *To change the Skan Only and Skan/Measure parameters, see the* Signal *submenu section on* page 12.

PanaView returns to the Channel PROGRAM menu (see *Figure 41 on page 78*). Proceed to the System option.

C.5.2 Entering Data in the Channel System Option

1. From the Channel PROGRAM menu, highlight and double-click on the System option in the center pane.
2. The first prompt asks for the *Channel Label*. Enter the desired label (in any numeric or text combination up to five characters) in the right pane, and click [Next Item].
3. Enter the desired *Channel Message*, and click [Next Item].
4. Double-click on the desired V*olumetric Units* (from the list shown in *Table 15* below).

Note: *Refer to the System option of the* Global *menu to choose between English or metric measurements.*

Table 15: Available Volumetric/Totalizer Units

English	Metric
Actual Cubic Feet	Actual Cubic Meters
Thousands of ACF	Thousands of ACM
Millions of ACF	Millions of ACM
Standard Cubic Feet	Standard Cubic Meters
Thousands of SCF	Thousands of SCM
Millions of SCF	Millions of SCM

5. Double-click on the desired unit of *Volumetric Time* (from seconds to days) in the volumetric flow display.
6. Double-click on the desired number of *Decimal Digits* (digits to the right of the decimal point) in the volumetric flow display.
7. Double-click on the desired *Totalizer Units* for the totalized flow rate display (listed in *Table 15* above).
8. Double-click on the desired number of *Decimal Digits* (digits to the right of the decimal point) in the totalized flow rate display.

The program now varies, depending on whether you have activated MASS FLOW (see *Chapter 1* for details).

- If you have activated MASS FLOW, continue to step 1 on the next page.
- If you are not using MASS FLOW, PanaView returns to the Channel PROGRAM window shown in *Figure 41 on page 78*. Proceed to the Pipe option.

C.5.2.1 Programming the Mass Flow Option

1. Double-click on the desired *Mass Flow* units for flow rate display (listed in *Table 16* below).

Table 16: Available Mass Flow Units

English	Metric
Pounds	Kilograms
KiloPounds = Thousands of Pounds	Tonnes = Metric Tons (1000 KG)
MillionPounds	
TONS (2000 LB)	

2. Double-click on the desired *Mass Flow Time* units.
3. Double-click on the desired number of *MDOT Decimal Digits* (digits to the right of the decimal point) in the mass flow rate display.
4. Double-click on the desired *Mass Totalizer* units for the totalized mass flow rate display (listed in *Table 16* above).
5. Double-click on the desired number of *Mass Decimal Digits* (digits to the right of the decimal point) in the totalized mass flow rate display.

PanaView returns to the Channel PROGRAM window shown in *Figure 41 on page 78*. Proceed to the Pipe option on the next page.

C.5.3 Entering Pipe Parameters

Enter the transducer and pipe parameters via the Pipe submenu. While following the programming instructions, see *Figure 55 on page 109* of Appendix D, *PanaView Menu Maps.*

1. From the Channel PROGRAM menu, highlight and double-click on the Pipe Parameters option in the center pane.
2. The first prompt asks for the *Transducer Number.*
   - For a standard transducer, double-click on the *Standard* option in the center pane. Then enter the number engraved on the transducer head in the right pane, and click [Next Item].
   - If there is no number engraved on the transducer head, double-click on the *Special* option, enter an assigned number (from 91 to 99), and click [Next Item].

IMPORTANT: *Special transducers, which have no engraved number on the head, are rarely used. Examine the transducer head carefully for a number.*

The menu now varies, depending on your selection in step 2.

- If you entered the number for a standard transducer, proceed to the *Pipe OD* prompt in step 4.
- If you entered the number for a special transducer, proceed to step 3 below.

C.5.3.1 Special Transducers

1. For special transducers:

Note: *Panametrics supplies the information required for steps a and b with the transducers.*

   a. Double-click on the appropriate *Frequency* (from 25 kHz to 500 kHz).The frequency is required to transmit an excitation voltage at the transducer's natural frequency.

   b. Enter the *Time Delay (Tw)* value supplied by Panametrics and click [Next Item].

Tw is the time required for the transducer signal to travel through the transducer and its cable. This time delay must be subtracted from the transit times of the upstream and downstream transducers to ensure an accurate measurement.

C.5.3.2 Pipe OD

1. Click on the appropriate *Pipe OD Unit* type in the center pane from the list shown in *Table 17* below. Then enter the known pipe outside diameter or circumference in the right pane and click [Next Item].

Obtain the required information by measuring either the pipe outside diameter (OD) or circumference at the transducer installation site. The data may also be obtained from standard pipe size tables found in *Sound Speeds and Pipe Size Data* (914-004).

Table 17: Available Pipe OD Units

English	Metric
inch	mm
feet	meters
circum.in = pipe circumference in inches	circum.mm = pipe circumference in millimeters
circum.ft = pipe circumference in feet	circum.m = pipe circumference in meters

2. Enter the known *Pipe Wall Thickness* (in inches or mm) in the right pane and click [Next Item].

C.5.3.3 Path and Axial Lengths

1. Click on the appropriate *Path Length* unit type in the center pane. Then enter the path length of the ultrasonic signal in the right pane and click [Next Item].

Note: *If a spoolpiece was ordered with the meter, the transducer signal path length* (P) *and the transducer signal axial length* (L) *are engraved on the flowcell and/or are included in the documentation supplied with the meter. For on-site transducer installations, refer to Appendix C,* Measuring P and L Dimensions, *in the* Startup Guide *for instructions.*

2. Click on the appropriate *Axial Length* unit type in the center pane. Then enter the axial length of the ultrasonic signal in the right pane and click [Next Item].

C.5.3.4 Fluid Type

3. Double-click on the appropriate *Fluid Type*, either *Air* or *Other*.
   - If you select *Other*, PanaView asks for the *Fluid Soundspeed*. Enter the appropriate soundspeed (in ft/sec) and click [Next Item].

C.5.3.5 Reynolds Correction

1. Double-click on the appropriate choice to indicate whether you want *Reynolds Correction*.
   - If *Off* is selected, enter the *Calibration Factor* and click on [Next Item].
   - If *On* is selected, enter the *Kinematic Viscosity* and click [Next Item]. Then enter the *Calibration Factor* and click [Next Item].

PanaView returns to the Channel PROGRAM menu. You have completed entering pipe parameters.

C.5.4 Entering Input/Output Parameters

Enter the zero cutoff value and set up the temperature, pressure and quality inputs via the Input/Output submenu. While programming these parameters, refer to *Figure 55 on page 109* of Appendix D, *PanaView Menu Maps*.

IMPORTANT: *If an option card in* Slot 1 *fails to appear in this menu, it may be turned* OFF. *See the* Global-I/O-Options *section on* page 91 *for setup instructions.*

C.5.4.1 Zero Cutoff Value

Near a zero flow rate, the XGF868i readings may fluctuate due to small offsets caused by thermal drift or similar factors. To force a zero display reading when there is minimal flow, enter a *zero cutoff value* as described in the following steps:

1. From the Channel menu, highlight and double-click on the Input/Output option in the center pane.
2. The program asks for the *Zero Cutoff*. Enter a value from 0 to 1 ft/sec (0 to 0.30 m/sec) for the zero cutoff and click [Next Item]. The recommended setting is 0.1 ft/sec (0.03 m/sec).

C.5.4.2 Temperature Input

The XGF868i can use either a fixed temperature value or a live temperature input to calculate the density for the mass flow rate display.

1. Double-click on a *Fixed* temperature value or to set up the option card in *Slot 1* that will supply the live temperature input and press [Next Item].

Note: *If Slot 1 contains an activated option card with an analog input assigned to* Temperature *or an* RTD *input, Slot 1 appears as an option at the above prompt. If the process temperature is stable, a fixed value may be used, but most applications require a live temperature input. If there is no active option card for temperature, the meter assumes you are using a fixed temperature.*

2. Proceed to one of the following sections:
   - If you selected *Fixed* - proceed to Step 3.
   - If you selected *Slot 1* - proceed to Step 4.
3. Enter the known *Fixed Temp.* (process temperature) and click [Next Item]. The meter will accept values from −328 to 1832°F (−200 to 1000°C). Proceed to *Base Temperature* on the next page.
4. Select *Input A* or *Input B* and click [Next Item]. The inputs were labeled during setup.

Note: *The set up of Input A is used as an example. Identical procedures would be used to set up Input B.*

C.5.4.3 Base Temperature

1. Enter the *Base Temperature* and click [Next Item]. The ratio of this value to the actual temperature is used to calculate the standard mass flow rate.
2. Do one of the following:
   - If you selected Pressure as the Input Type, proceed to *Pressure Input* below.
   - If you selected Temperature as the Input Type, proceed to *Base Pressure* below.

C.5.4.4 Pressure Input

1. Double-click on a *Fixed* pressure value or to set up the option card in *Slot 1* that will supply the live pressure input.

Note: *If Slot 1 contains an activated option card with an input assigned to* Pressure, Slot 1 *appears as an option at the above prompt. If the process pressure is stable, a fixed value may be used, but most applications require a live pressure input. If there is no active option card for pressure, the meter assumes you are using a fixed pressure.*

2. Proceed to one of the following steps:
   - If you selected Fixed - proceed to Step 3.
   - If you selected Slot 1 - proceed to Step 4.
3. Enter the known *Fixed* process *Pressure* and click [Next Item]. The meter will only accept values from 0 to 5000 psia. Proceed to *Base Pressure* below.
4. Double-click on *Input A* or *Input B*. The inputs were labeled during setup.

Note: *The set up of Input A is used as an example. Identical procedures would be used to set up Input B.*

C.5.4.5 Base Pressure

1. Enter the *Base Pressure* and click [Next Item]. The ratio of this value to the actual pressure is used to calculate the standard mass flow rate.

C.5.4.6 Low Pressure Switch

1. Click on *Yes* or *No* to activate or deactivate the *Low Pressure Switch* software function and click [Next Item].
   - If you selected Yes, enter the *Pressure Limit*, the low pressure switch set point, and click [Next Item]. The acceptable range is 0 to 5000 psia. The meter will stop taking readings if the pressure drops below this value.

PanaView returns to the Channel PROGRAM menu. You have completed entering input/output parameters.

C.5.5 Entering Setup Parameters

The signal limits and response times for the XGF868i are specified via the SETUP submenu. While following the programming instructions, refer to *Figure 57 on page 111* of Appendix D, *PanaView Menu Maps*. This submenu includes four options:

- Signal - set the parameters related to the transducer signal
- V Averaging - specify the response of the meter to step changes
- Default Setup - initialize all parameters to default values
- *Advanced Features* - enable mass flow or activate K factors.

To enter the Set Up submenu, highlight and double-click on the *Set Up* option in the center pane of the Channel menu. Remember to record all programmed data in Appendix B, *Data Records*.

C.5.5.1 The Signal Option

Use this option to set the limits for the incoming signal and other parameters affecting the transducer signal. For example, the programmed signal strength low limit may be used to determine the trigger point for an alarm.

IMPORTANT: *The Signal default settings are suitable for most applications. Consult with Panametrics before changing any of these parameters.*

1. From the Set Up option menu, highlight and double-click on *Signal* in the center pane.
2. For each parameter, click [Next Item] to accept the current value or enter a new value and click [Next Item]. *Table 18 below* lists ranges and default parameters for each parameter.

Table 18: Transducer Signal Settings

Transducer Signal Parameters	Range	Default Value	Description
Signal Low Limit	-20 to 100	20	The E1:LOW SIGNAL error message appears when the signal strength falls below the programmed SIGNAL LOW LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Correlation Peak Limit	0 to 500	100	The E4: SIGNAL QUALITY error message appears when the signal quality falls below the programmed COR. PEAK LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes
Soundspeed+ - Limit	1 to 50%	20%	The E2:SOUNDSPEED error message appears when the calculated fluid sound speed differs from the fluid sound speed entered in the Channelx- System menu by more than the programmed SOUNDSPEED +– LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Velocity Low Limit	-500 to 500 ft/sec (-150 to 150 m/sec)	-150 ft/sec (-46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity is less than the programmed VELOCITY LOW LIMIT value.See Chapter 2 in the Service Manual for a discussion of error codes.

Table 18: Transducer Signal Settings (cont.)

Transducer Signal Parameters	Range	Default Value	Description
Velocity High Limit	-500 to 500 ft/sec (-150 to 150 m/sec)	150 ft/sec (46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity exceeds the programmed VELOCITY HIGH LIMIT value. See Chapter 2 in the Service Manual for a discussion of error codes.
Acceleration Limit	0 to 250 ft/s (0 to 76 m/s)	15 ft/s (5 m/s)	The E6: CYCLE SKIP error message appears when the calculated fluid velocity changes by more than the programmed ACCELERATION LIMIT value from one reading to the next. See Chapter 2 in the Service Manual for a discussion of error codes.
Amplitude Discriminator Low	0 to 100	14	The amplitude discriminator measures the transducer signal received by the Model XGF868i. The default value for the above parameter is 14, and values from 0 to 100 are acceptable. The E5: AMPLITUDE error message appears when the amplitude discriminator falls below the programmed AMP. DISCRIM LOW value. See Chapter 2 in the Service Manual for a discussion of error codes.
Amplitude Discriminator High	0 to 100	34	The amplitude discriminator measures the transducer signal received by the Model XGF868i. The default value for the above parameter is 34, and values from 0 to 100 are acceptable. The E5: AMPLITUDE error message appears when the amplitude discriminator exceeds the programmed AMP. DISCRIM HIGH value. See Service Manual, Chapter 2 for a discussion of error codes.
Delta T Offset	-1000 to 1000 µsec	0 µsec	An offset between the upstream and downstream transit times is specified at this prompt.
Skan T Offset	–500 to 500 µsec	58 µsec	At this prompt, specify a time measurement offset that compensates for any shift resulting from cross-correlation. Set to 0 for active Skan T Offset.
% of Peak	1 to 100%	50%	The percentage of peak used to calculate the transit times and Delta T is specified at this prompt.
M>S Switch	0 to 250 µsec	50 µsec	If the burst mode is set to Skan/Measure (S/M), the meter switches from Skan to Measure Mode when Delta T is less than the M>S_Switch value. **DO NOT** change this value unless advised to do so by the factory.
# Shifts	0 to 10	3	The number of shifts corresponds to the actual number of transmits per cycle (number of signals added together in one direction to produce an averaged signal for one interrogation of the fluid) and need only be changed if the environment is very noisy or the acoustic signal is weak.
A Divisor	0.1 to 10	2.5	A Divisor is used to calculate the Measure Mode integrated threshold level and is not normally changed.
# Transmit Pulses	1 to 16	4	# Transmit Pulses specifies the number of pulses in a burst. For difficult conditions (i.e. long paths, high velocity or high temperature), settings as high as 16 may be necessary.
T Window (cycles)	0 to 1000	0	The XGF868i calculates the size of the transmit window based on pipe size and fluid sound speed. However, for diagnostic purposes, the window size may be reset.
R Window (cycles)	10 to 128	10	The XGF868i calculates the size of the receive window based on pipe size and fluid soundspeed. However, for diagnostic purposes, the window size may be reset.

After responding to the above prompt, the meter returns to the SET UP option window.

C.5.5.2 The Default Setup Option

Use this option to initialize (reset) all of the parameters within the Set Up Signal menu back to their default values. Complete the following steps to reset all of the parameters:

1. From the Set Up option menu, highlight and double-click on *Default Setup* in the center pane.
2. Double-click on *No* to keep the current values or on *Yes* to reset all values to their default settings.

After responding to the above prompt, the meter returns to the Set Up option window.

C.5.5.3 The V Averaging Option

Use this option to specify the number of readings that occur before the meter will respond to a step change in flow rate. In general, the smaller the number of readings, the less steady the display will appear. Complete the following steps to set the response time:

1. From the Set Up option menu, highlight and double-click on *V Averaging* in the center pane.
2. Double-click on the desired *Response Time* (from 1 to 60 sec).

For best results, select the STATS (statistics) option, as this increases the response time under steady flow conditions while still allowing a rapid response to changes in flow rate.

After responding to the above prompt, the meter returns to the Set Up option window.

C.5.5.4 The Advanced Features Option

This option enables you to enable the more advanced features of the meter. In this option you can do the following:

- enter a table of K-factors (based on velocity or reynolds number) that compensates for non-linear flow rates
- enable mass flow (calculated for static fluid density)

The Multiple K Factors Option

Use this option to enter a table of K-factors. K-factors are used to create a curve for the flow range (based on velocity or reynolds number) that compensates for non-linear flow rates. The meter accepts from 2 to 20 pairs. Complete the following steps to enter multiple K factors for velocity or reynolds values:

1. From the *Advanced Features* option menu, highlight and double-click on *Multiple K Factors* in the center pane.
2. Double-click on *Yes* to *Activate Multi K Factors* or on *No* to disable this option.

   If NO was selected, the meter returns to the *Advanced Features* window. If YES was selected, proceed to Step 3.
3. Double-click on the desired *Custom Type* (velocity or reynolds).
4. Double-click on *Yes* to *Edit* the K-factor *Table* or on *No* to retain the current K-factor table (and return to the *Advanced Features* window).

   If NO was selected, the meter returns to the *Advanced Features* window. If YES was selected, proceed to Step 5.

Note: *If the necessary velocity/reynolds vs. K-factor data was not provided with the XGF868i's documentation, the K-factor table cannot be edited.*

5. Enter the *Number Of K-factors* (from 2 to 20) to be entered into the table, and click [Next Item].

Note: *When editing the K-factor table, the velocities must be entered in increasing order.*

6. Enter the *Velocity/Reynolds Value* for K-factor number "X" and click [Next Item].
7. Enter the *K-factor* corresponding to velocity/reynolds number "X" (0.333 to 3.0) and click [Next Item].

The *Velocity #* and *K Factor #* prompts repeat for each pair. After entering all the pairs, the meter returns to the *Advanced Features* window.

The Mass Flow Option

Use this option to calculate mass flow from a static fluid density. Complete the following steps to enter the static density of the fluid:

1. From the *Advanced Features* option menu, highlight and double-click on *Mass flow calculation* in the center pane.
2. Double-click on *Yes* to activate *Static Density* or on *No* to disable this option. (If you select No, PanaView returns to the *Advanced Features* window.)
3. Double-click the *Density Type* (fluid density (Rho) or molecular weight (Mw)) and click [Next Item].
4. Do one of the following:
   - If you selected Rho - proceed to Step 5.
   - If you selected Mw - proceed to Step 7.
5. Double-click the type of volumetric units (standard - StVOL or actual-AcVOL) for the measurement data display and click [Next Item].
6. Enter the *Fluid Density* (0.00001 to 0.100 lb/ft^3 or 0.00001 to 123.18 kg/m^3) and click [Next Item]. PanaView returns to the *Advanced Features* window.
7. Enter the *Molecular Weight* and click [Next Item].

After responding to the above prompt, the meter returns to the *Advanced Features* window. Click [Exit Page] three times to return to the *Site Edit Menu.*

C.6 Entering Data in the Global Menu

The Global menu is used to enter information that is not specific to any of the individual channels. Information programmed via this menu is used to enter several general system parameters (e.g., English or metric units). For meters with 2 channels, this menu is also used to compute parameters such as the sum, difference or average of the channel 1 and channel 2 signals. When calculating the SUM, DIF or AVE readouts, data from the Global-System submenu is used. Any conflicting data entered in the Channel-System submenu is overridden.

The following submenus are included in the Global menu:

- System - use to specify the units of measure used in calculations
- Input/Output - used to set up error handling and to configure analog inputs and outputs
- Comm port - used to set up the serial communications port and MODBUS parameters

To enter the Global menu, double-click on the Global entry in the left pane of the *Site Edit Menu* window. Then proceed to the appropriate section of this chapter for instructions. See *Figure 58 on page 112* in Appendix D, *PanaView Menu Maps,* and remember to record all programming data in Appendix B, *Data Records*.

C.6.1 Entering Global-System Data

While completing these instructions, refer to *Figure 58 on page 112* in Appendix D, *PanaView Menu Maps*.

1. In the *Site Data Menu*, double-click on the Global entry.
2. Highlight and double-click on the *System* option in the center pane. The window now appears similar to *Figure 45* below.

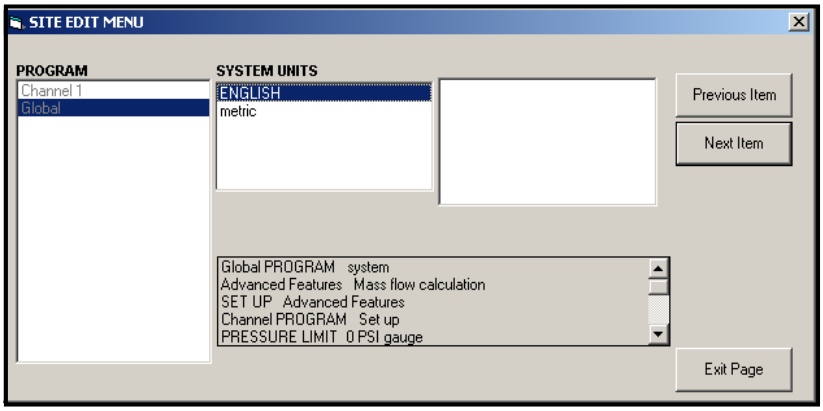


Figure 45: System Option in the Global Menu

3. Double-click on the desired *System Units* selection (either metric or English). The XGF868i will display all parameters and measurements in the designated units.
4. Double-click on the desired *Pressure Units* (absolute or gauge) and click [Next Item].
   a. If gauge was selected, enter the desired *Atmospheric Pressure*, and click [Next Item].

- Proceed to step 1 on the next page.

C.6.1.1 Volumetric Units

1. Double-click on the desired *Volumetric Units* for the flow rate display. *Table 19* below lists the available units.

Table 19: Available Volumetric/Totalizer Units

English	Metric
Actual Cubic Feet	Actual Cubic Meters
Thousands of ACF	Thousands of ACM
Millions of ACF	Millions of ACM
Standard Cubic Feet	Standard Cubic Meters
Thousands of SCF	Thousands of SCM
Millions of SCF	Millions of SCM

2. Double-click on the desired *Time* units for the flow rate display.
3. Double-click on the desired number of *Vol Decimal Digits* (digits to the right of the decimal point in the volumetric flow rate display).

C.6.1.2 Selecting Totalizer Units

1. Double-click on the desired *Totalizer Units* for the totalized flow rate display. Available units are listed in *Table 19* above.
2. Double-click on the desired number of *Tot Decimal Digits* (digits to the right of the decimal point in the totalized flow rate display).
3. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting the Mass Flow Units* on the next page.
   - If MASS FLOW is OFF, the meter returns to the Global PROGRAM window. Click [Exit Page] to return to the *Site Edit Menu*.

Note: *To activate mass flow, refer to* page 89. *The following prompts will appear only if mass flow is activated for both channels.*

C.6.1.3 Programming Mass Flow Data

1. Double-click on the desired *Mass Flow* units for flow rate display. The options are listed in *Table 20* below.

Table 20: Available Mass Flow Units

English	Metric
Pounds	Kilograms
KiloPounds (Thousands of Pounds)	Tonne = Metric Tons (1000 KG)
MillionPounds	
TONS (2000 LB)	

2. Double-click on the desired *Mass Flow Time* units (from seconds to days).
3. Double-click on the desired number of *MDOT Dec.Digits* (digits to the right of the decimal point) in the mass flow rate display.
4. Double-click on the desired *Mass Totalizer Units* The available units for the totalized mass flow rate display are listed in *Table 20*.
5. Double-click on the desired number of *Mass Decimal Digits* (digits to the right of the decimal point) in the totalized mass flow rate display.

The XGF868i returns to the Global PROGRAM window. Click [Exit Page] to return to the *Site Edit Menu*.

You have completed entering selections in this option.The program returns to the Global PROGRAM menu.

C.6.2 Setting Up Inputs and Outputs

Set up the XGF868i inputs and outputs via the I/O submenu. While following the programming instructions, see *Figure 58 on page 112* in Appendix D, *PanaView Menu Maps*. Remember to record all programmed data in Appendix B, *Data Records*.The I/O submenu consists of the following options:

- Error Handling - program the meter's response during an error condition
- Options - set up any option cards and the Slot 0 analog outputs
- Display - set up the LCD display.

To enter the I/O submenu:

1. In the *Site Data Menu*, double-click on the Global entry.
2. Highlight and double-click on the *Input/Output* option in the center pane.

Note: *In this section,* Slot 1 *appears as an option only if a suitable option card is installed in Slot 1.*

C.6.2.1 Setting Up Error Handling

This menu option lets you set how the XGF868i will handle the outputs for measurements and average (two-path) measurements during an error condition. See Chapter 2, *Error Codes*, in the *Service Manual* for a discussion of the built-in error codes.

1. From the Input/Output option, highlight and double-click on the *Error Handling* option in the center pane.
2. Double-click on the desired *Error Handling* selection (as shown in *Table 21* and *Table 22* below).
   a. If you selected *Error Level in mA*, enter the *4-20 mA Error Level* (the number of milliamps the analog output will put out during a fault condition). Enter a whole number between 0 and 22, and click [Next Item].

See *Table 21* and *Table 22* below for a description of the error handling options available and how the totalizers and display respond to them for a single and two-channel meter.

Table 21: Error Options and Responses for a One-Channel Meter

Option	Output Response	Totalizer Response
Hold Last Value	Holds the last "good" reading	Holds the last "good" reading and continues to totalize, based on that reading
Force Low	Forces the outputs to the low set point	Stops totalizing
Force High	Forces the outputs to the high set point	Stops totalizing
Force High High	Forces the outputs ≈10% above the high set point	Stops totalizing
Error Level in mA	Allows user to enter 4-20 mA error level in mA.	Sends analog outputs to entered mA level when a fault occurs.

Table 22: Error Options and Responses for a Two-Channel Meter

When Measuring	Display Response	Totalizer Response When Error Handling is	
		HOLD	LOW, HIGH, HHIGH
CH1 or CH2 (vel, vol, etc.)	Holds last "good" reading.	Holds last "good" reading and continues to totalize based on that "good" reading.	Stops totalizing.
SUM	Adds two channels using the last "good" reading.	Holds last "good" reading and continues to totalize based on two channels.	Stops totalizing if either or both channels go into error.
DIF	Subtracts two channels using last "good" reading.	Holds last "good" reading and continues to totalize based on two channels.	Stops totalizing if either or both channels go into error.
AVE	See *Error Handling for Average Measurements* below.		

C.6.2.2 The Error Option

Note: *The* 2PATH ERROR HANDLING *option is intended for applications where two sets of transducers are installed in the same location in the same pipe to improve accuracy and the meter is operated in* AVE *mode. With this function enabled, the XGF868i performs error handling only if both channels are in error. If this function is disabled, error handling occurs when either channel goes into error.*

For a one-channel meter, after responding to the previous prompt, the meter returns to the Global I/O prompt shown on the previous page. For a two-channel meter, proceed to step 3 below.

3. Double-click *Yes* to enable *Two-path Error Handling,* or on *No* to disable this function.

Specific responses of the display and the totalizer to the two-path error handling option available at the above prompt are listed in *Table 23* below.

Table 23: 2-Path Error Response Options

Option	Display Response	Totalizer Response
NO	Displays the average of CH1 and CH2, regardless of the error state of either channel.	Outputs the average of CH1 and CH2 totals, regardless of the error state of either channel.
YES	1. If one channel is in error, the other channel's value is displayed as the average. 2. If both channels are in error, the last average reading is held.	1. If one channel is in error, totalizing continues. 2. If both channels are in error, totalizing stops.

After responding to the above prompt, the meter returns to the Input/Output option menu.

C.6.2.3 Setting Up Option Cards

The XGF868i has two built-in analog outputs, which are assigned to Slot 0. Also, a variety of input/output option cards may be installed in Slot 1. See Chapter 1, *Installation*, of the *Startup Guide* for a complete description of the available option cards.

To access this submenu, double-click on the *Options* entry in the Input/Output submenu. This menu option is used to set up and/or scale the inputs and outputs. To accomplish this, complete the following steps:

- Double-click on the desired *I/O Slot* to program the I/O functions in that slot.

Note: *If an option card is not installed in Slot 1, the* Slot1 *option does not appear at the above prompt.*

Proceed to the appropriate section for programming instructions specific to the type of input or output selected above.

Analog Outputs

Complete the following steps to set up the analog outputs for any slot (refer to *Figure 58 on page 112*):

1. Double-click on the desired *Output* (A or B).

Note: *The set up of output A is used here as an example. Identical procedures would be used to set up output B.*

2. Double-click on *Off* to disable Output A and return to step 1, or on *0-20 mA* or *4-20 mA* to specify the desired range for output A.
3. Double-click on the desired *Channel* option. See *Table 24* below for a description of the channel options available.

Table 24: Channel Options

Option	Description
Channel 1	Channel 1
Channel 2	Channel 2
Add Channels	CH1+CH2

Table 24: Channel Options

Option	Description
Subtract Channels	CH1-CH2
Average Channels	(CH1+CH2)/2

4. Double-click on the desired *Measurement Name*. (Table 25 on next page) provides a description of the available parameters.)

Note: *All the options shown below will appear only if Mass Flow is activated.*

Table 25: Available Measurement Parameters

Option Bar	Description	Good	Bad
Velocity	Displays the flow velocity.	N.A.	N.A.
Volumetric	Displays the volumetric flow.	N.A.	N.A.
FWD Total	Displays the forward totalized volume flow.	N.A.	N.A.
REV Total	Displays the reverse totalized volume flow.	N.A.	N.A.
Time	Displays the total flow measurement time.	N.A.	N.A.
Mass Flow	Displays the mass flow.	N.A.	N.A.
FWD Mass	Displays the forward totalized mass flow.	N.A.	N.A.
REV Mass	Displays the reverse totalized mass flow.	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
UP Sig Strength	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
DN Sig Strength	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
Soundspeed	Displays the measured speed of sound in the gas.	N.A.	N.A.
UP Transit	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
DN Transit	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
Delta T	Displays the transit time difference between the upstream and downstream signals.	N.A.	N.A.
K(Re)*Multi K*K Factor	K factor, based on the Reynolds number.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default).	N.A.	N.A.
UP Signal Q	Displays the signal quality for the upstream transducer.	≥1200	–400 to +400
DN Signal Q	Displays the signal quality for the downstream transducer.	≥1200	–400 to +400
UP Amp Discrim	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29
DN Amp Discrim	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29
UP DAC COUNTS	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
DN DAC COUNTS	Displays the AGC DAC count for the downstream gain setting.	N.A.	N.A.
UP +–Peak	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
DN +– Peak	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
Temperature	Displays the gas temperature (from 0/4-20 mA input).	N.A.	N.A.
Pressure	Displays the gas pressure (from 0/4-20 mA input).	N.A.	N.A.
Act Vol.	Displays actual volumetric flow.	N.A.	N.A.
Std Vol.	Displays standard volumetric flow.	N.A.	N.A.

Table 25: Available Measurement Parameters

Option Bar	Description	Good	Bad
Up Transit S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Dn Transit S[1]	Displays Skan transit time downstream.	N.A.	N.A.
Delta T S[1]	Displays Skan Delta T.	N.A.	N.A.
Up Transit M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Dn Transit M[1]	Displays Measure transit time downstream.	N.A.	N.A.
Delta T M[1]	Displays Measure Delta T.	N.A.	N.A.
Vinst	Displays the instantaneous velocity.	N.A.	N.A.
[1]available only if Burst Mode = S/M			

Note: *The measurement units that appear in these prompts are those selected in the* Global-System *menu earlier in this section.*

5. Enter a flow rate value for the *Zero* (low) end of the analog output range and click [Next Item].
6. Enter a flow rate value for the *Full* (high) end of the analog output range and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page] to proceed to another menu or option.

Option Card Analog Inputs

Complete the following steps to set up the analog inputs of an option card installed in Slot 1 (refer to *Figure 58 on page 112*):

1. Double-click on the desired *Input* (A, B, C or D).

Note: *The setup of input A is used as an example. Identical procedures would be used to set up the remaining inputs.*

2. Enter a *Label* of up to eight characters for input A and click on [Next Item].
3. Double-click on *Off* to disable Input A and return to step 1, or on *Temp* or *Spec* to designate it as a temperature or special input.

- OFF

If OFF was selected to disable input A, the meter returns to the *Input* prompt in step 1. Double-click on another input, or click [Exit Page] to move to another menu.

- TEMP or PRESR

If TEMP or PRESR was selected to set up input A as a live temperature or pressure input, complete steps 4 and 5 below:

4. Enter a value for the *Base* (low) end of the analog input range and click [Next Item].
5. Enter a value for the *Full Scale* (high) end of the analog input range and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page] to proceed to another menu or option.

- SPEC

If SPEC was selected to set up input A as a live special input, complete steps 6 through 9 below:

6. Enter a *Name* for input A and click [Next Item].
7. Enter the *Units* of measurement for input A and click [Next Item].
8. Enter a temperature value for the *Base* (low) end of the analog input range and click [Next Item].
9. Enter a temperature value for the *Full Scale* (high) end of the analog input range and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page] to proceed to another menu or option.

Option Card RTD Inputs

Option cards with RTD inputs have a temperature range of -148° to 660°F (–100° to 350°C). Complete the following steps to set up the RTD inputs of an option card installed in Slot 1 (refer to *Figure 58 on page 112*):

1. Double-click on the desired *Input* (A, B, C or D).

Note: *The setup of RTD input A is used here as an example. Identical procedures would be used to set up the remaining RTD inputs.*

2. Enter a *Label* of up to eight characters for input A and click [Next Item].
3. Double-click on *Off* to disable Input A and return to step 1, or on *Temp* to enable input A as a live temperature input.
4. Enter a temperature value for the *Zero* (low) end of the analog input range and click [Next Item].
5. Enter a temperature value for the *Full Scale* (high) end of the analog input range and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page] to proceed to another menu or option.

Option Card Frequency Outputs

This type of output produces a frequency pulse that is proportional to the output measurement. Complete the following steps to set up the frequency outputs of an option card installed in Slot 1 (see *Figure 58 on page 112*):

1. Double-click on the desired *Output* (A, B, C or D).

Note: *The set up of output A is used as an example. Identical procedures would be used to set up the other outputs.*

2. Double-click on *Off* to disable Output A and return to step 1, or on *Frequency* to set up output A as a frequency output.
3. Double-click on the desired *Channel* option.See *Table 26* for a description of the channel options available at the above prompt.
4. Double-click on the desired *Measurement Name*. (*Table 25* provides a description of the available parameters.)

Note: *The measurement units that appear in these prompts are those selected in the* Global-System *menu earlier in this section.*

5. Enter a flow rate value for the *Zero* (low) end of the frequency output range and click [Next Item].
6. Enter a flow rate value for the *Full* (high) end of the frequency output range and click [Next Item].
7. Enter a value between 1 and 10,000 for the *Full Scale Frequency* and click [Next Item].

After responding to the above prompt, the meter returns to step 1. Click [Exit Page]:

- once to return to the Global I/O option:
- twice to return to the Global PROGRAM option:
- three times to return to the *Site Edit Menu*:
- four times to exit the *Site Edit Menu*.

C.6.2.4 Programming the LCD

Through PanaView, you can program the LCD display to display up to four variables in sequence. Complete the following steps to program the LCD display:

Note: *When you first initialize the XGF868i, the number of LCD parameters is set to OFF. You must program the LCD to display any measured parameters.*

1. From the Input/Output option, highlight and double-click on the *Display* option in the center pane.
2. The first prompt asks for the *# of LCD Parameters*. Double-click on the desired number (from OFF through 1-4 and KEY).
   The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program*. If you select KEY:
   - To view a parameter other than the one currently displayed, press the [△] or [▽] keys to scroll through the various parameters.
   - To scroll through the channel options on a two-channel XGF868i, press the [◁] and [▷] keys until you have reached the desired option.
3. Scroll to the desired *Channel option*, as listed in *Table 26* below.

Table 26: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

4. For each channel, select the desired *Measurement Parameter*, as shown in *Table 25*.
5. Repeat steps 3 and 4 for each parameter. PanaView returns to the Global I/O menu.

C.6.3 Entering Communications Data

The XGF868i flowmeter is equipped with an RS232 serial interface. The serial port is used to transmit stored data and displayed readings to a personal computer by connecting the meter's serial interface to the serial port of the PC. In addition, the XGF868i can receive and execute remote commands, using *PanaView* software, via this link.

Use the Comm port submenu to set the communications port and MODBUS parameters. While following the programming instructions, refer to *Figure 57 on page 111* of Appendix D, *PanaView Menu Maps*.

C.6.3.1 Setting Up the Serial Port

1. To enter this submenu from the Global menu, highlight and double-click on the *Comm port* option in the center pane.
2. Enter a *Meter Address* number between 1 and 254 and click [Next Item]. The default number is 1.
   A meter address is only necessary for communication with the Panametrics *PanaView* software. See the *PanaView User's Manual* for more information.

IMPORTANT: *If the meter address or baud rate is changed, communication with PanaView must be re-established with the new address number.*

3. Double-click on the desired *Baud Rate* (from 300 to 19200).

If you have the MODBUS option, proceed to step 4 below. If you have the standard RS232 serial interface, the meter exits the Comm port submenu and returns to the Global PROGRAM prompt.

Note: *The XGF868i MODBUS communication settings chosen in the next four steps must match those of the MODBUS control system.*

4. Double-click on the desired *MODBUS Baud Rate* (from 2400 to 9600).
5. Double-click on the desired *MODBUS Parity* (None, Odd or Even).

6. Double-click on the desired *MODBUS Stop Bits* (1 or 2).
7. Enter the desired *MODBUS Address*.

The meter exits the Comm port submenu and returns to the Global window. Click [Exit Page] once to return to the *Site Edit Menu*, and [Close] to exit the *Site Edit Menu*.

IMPORTANT: *You must reboot the XGF868i to load the new settings.*

Refer to the section *Requesting Parameters Using MODBUS* on the following page to retrieve data from the XGF868i using MODBUS.

C.6.3.2 Requesting Parameters Using MODBUS

To request specific parameters from the XGF868i via the MODBUS, the control system must access the appropriate register number, as shown in *Table 27* below. Only registers 1–84 are available with the XGF868i for MODBUS communications. Registers 508–512 are used by the XGF868i to store the MODBUS parameters.

Table 27: MODBUS Registers

MODBUS Reg #	DPR Hex Addr	Description	Scaling (decimal places)	Size in Bytes	MODBUS Reg #
1	0	1"Clear Ch1 Totalizers"	--	2 (16 bit signed)	1
2	2	1"Clear Ch2 Totalizers"	--	2 (16 bit signed)	2
3	4	Ch1 Velocity	2	4 (2 16-bit int)	3
5	8	Ch1 Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)	5
7	C	Ch1 Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)	7
9	10	Ch1 Fwd Totals	#T DIGITS	4 (2 16 bit int)	9
11	14	Ch1 Rev Totals	#T DIGITS	4 (2 16 bit int)	11
13	18	Ch1 #Tot Digits	0	2	13
14	1A	Ch1 Mass Flow	#M DIGITS	4 (IEEE 32 bit)	14
16	1E	Ch1 Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)	16
18	22	Ch1 Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)	18
20	26	Ch1 #Mass Tot Digits	0	2	20
21	28	Ch1 Timer	2	4 (2 16-bit int)	21
23	2C	Ch1 Error Code	0	2	23
24	2E	Ch1 Sound Speed	3	4 (2 16-bit int)	24
26	32	Ch1 Molecular Weight	4	4 (2 16-bit int)	26
28	36	Ch1 Sig Strength Upstream	1	4 (2 16-bit int)	28
30	3A	Ch1 Sig Strength Downstream	1	4 (2 16-bit int)	30
32	3E	Ch1 Temperature	2	4 (2 16-bit int)	32
34	42	Ch1 Pressure	3	4 (2 16-bit int)	34
36	46	Ch2 Velocity	2	4 (2 16-bit int)	36
38	4A	Ch2 Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)	38
40	4E	Ch2 Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)	40
42	52	Ch2 Fwd Totals	#T DIGITS	4 (2 16 bit int)	42
44	56	Ch2 Rev Totals	#T DIGITS	4 (2 16 bit int)	44
46	5A	Ch2 #Tot Digits	0	2	46
47	5C	Ch2 Mass Flow	#M DIGITS	4 (IEEE 32 bit)	47
49	60	Ch2 Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)	49
51	64	Ch2 Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)	51

Table 27: MODBUS Registers

MODBUS Reg #	DPR Hex Addr	Description	Scaling (decimal places)	Size in Bytes	MODBUS Reg #
53	68	Ch2 #Mass Tot Digits	0	2	53
54	6A	Ch2 Timer	2	4 (2 16-bit int)	54
56	6E	Ch2 Error Code	0	2	56
57	70	Ch2 Sound Speed	3	4 (2 16-bit int)	57
59	74	Ch2 Molecular Weight	4	4 (2 16-bit int)	59
61	78	Ch2 Sig Strength Upstream	1	4 (2 16-bit int)	61
63	7C	Ch2 Sig Strength Downstream	1	4 (2 16-bit int)	63
65	80	Ch2 Temperature	2	4 (2 16-bit int)	65
67	84	Ch2 Pressure	3	4 (2 16-bit int)	67
69	88	Avg Velocity	2	4 (2 16-bit int)	69
71	8C	Avg Act Volumetric	#Q DIGITS	4 (IEEE 32 bit)	71
73	90	Avg Std Volumetric	#Q DIGITS	4 (IEEE 32 bit)	73
75	94	Avg Fwd Totals	#T DIGITS	4 (2 16 bit int)	75
77	98	Avg Rev Totals	#T DIGITS	4 (2 16 bit int)	77
79	9C	Avg #Tot Digits	0	2	79
80	9E	Avg Mass Flow	#M DIGITS	4 (IEEE 32 bit)	80
82	A2	Avg Fwd Mass Totals	#MT DIGITS	4 (2 16-bit int)	82
84	A6	Avg Rev Mass Totals	#MT DIGITS	4 (2 16-bit int)	84
86	AA	Avg #Mass Tot Digits	0	2	86
87	AC	Avg Timer	2	4 (2 16-bit int)	87
89	B0	[5]Avg Error Code	0	2	89
90	B2	Avg Sound Speed	3	4 (2 16-bit int)	90
508	3F6	[2]MODBUS baud rate	0	2	508

Notes:

1. **Clear Totalizers:** flag from the 8051 to clear totalizers in the 68332 memory.
2. **Error Value:** see table in XGF868i manual for error codes
3. **Average:**
   average of channel 1 and channel 2 if both channels out of error,
   channel 1 value if channel 2 is in error,
   channel 2 value if channel 1 is in error,
   zero if both channels in error.
4. **Average Error Status:**
   0 = both in error
   1 = chan 2 in error,
   2 = chan 1 in error,
   3 = both ok
5. **MODBUS baud rate:**
   5 = 2400, 6 = 4800, 7 = 9600
6. **MODBUS parity:**
   0 = none, 1 = odd, 2 = even
7. **MODBUS stop bits:**
   1 = 1 stop bit, 2 = 2 stop bits

8. General:
   Registers are written if corresponding functions are actuated by the user. Registers for unactuated functions are initialized to zero at startup.

C.7 Exiting the Site Edit Menu

After leaving the Global submenu, PanaView returns to the *Site Edit Menu*. Click [Close] to exit the *Site Edit Menu.* Then proceed to Chapter 3, *Operation*, of the *Startup Guide* for instructions on taking measurements, or refer to the appropriate chapters of this manual for detailed instructions on using the other features of the XGF868i flow transmitter.

C.7.0.1 Activating Security in the Global Menu

In order to prevent unauthorized tampering with the flowmeter's programming, the XGF868i is equipped with a security feature that locks all the keys except [PROG] (which, when pressed, requires the password).

When the system is locked, access to the menus will be denied unless the correct password is entered. The XGF868i is shipped with a default password (2719 and three spaces). For increased security, the default password should be changed.

Note: *Once the system has been locked, it can only be unlocked by entering the password, because access to the SECUR submenu is restricted.*

While completing these instructions, refer to the menu map in Figure 57 on page 111.

1. In the *Site Data Menu*, double-click on the Global entry. If the system is unlocked, the window appears similar to Figure 46 below. Highlight and double-click on the Security option in the center pane.

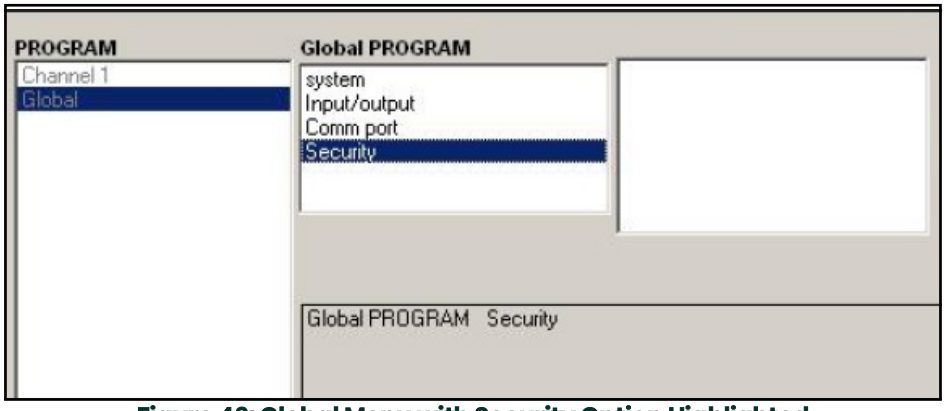


Figure 46: Global Menu with Security Option Highlighted

2. If the system is locked, the window is similar to Figure 47 below.

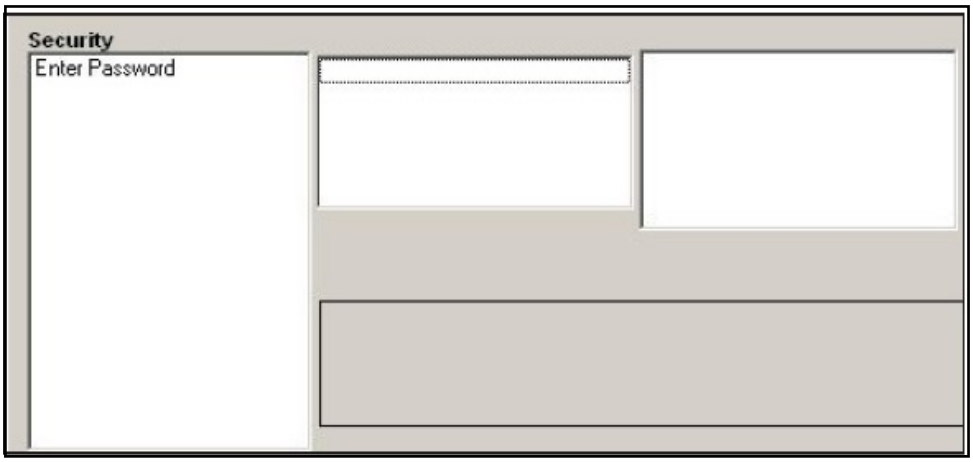


Figure 47: Password Window

3. Enter the current or default Password and click [Next Item].

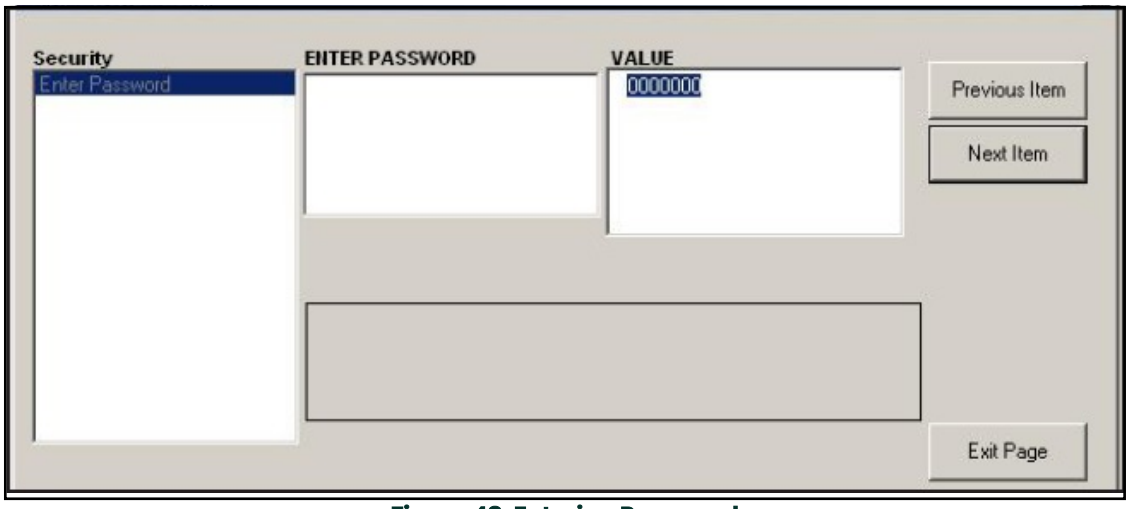


Figure 48: Entering Password

4. At the Lock Out prompt, click UNlck to unlock the system and return to the initial PROGRAM menu, or click LOCK to lock the system.
5. At the Edit Password prompt, click No to leave the password unchanged, or click YES to enter a new password.

IMPORTANT: *Since the default password is printed in this manual, a new password should be entered. If the password is ever lost, contact the factory for assistance.*

6. Enter the New Password and click Yes. Any combination of letters and numbers up to a total of 7 characters may be used as a password.
7. Verify the New Password by re-entering it and click Yes. Be sure to record the new password in a safe place.

C.8 Exiting the Site Edit Menu

After leaving the Global submenu, PanaView returns to the *Site Edit Menu*. Click [Close] to exit the *Site Edit Menu.* Then proceed to Chapter 3, *Operation*, of the *Startup Guide* for instructions on taking measurements, or refer to the appropriate chapters of this manual for detailed instructions on using the other features of the XGF868i flow transmitter.

C.9 Saving Site Data

The XGF868i holds setup parameters for a single internal site, called *Working*. Through PanaView, users can store site file data in a PC and reload it into the XGF868i. To save or reload site data via PanaView:

1. In the *New Meter Browser*, highlight the XGF868i.
2. Right-click on the highlighted XGF868i and select the *Properties* option, as shown in *Figure 49* below.

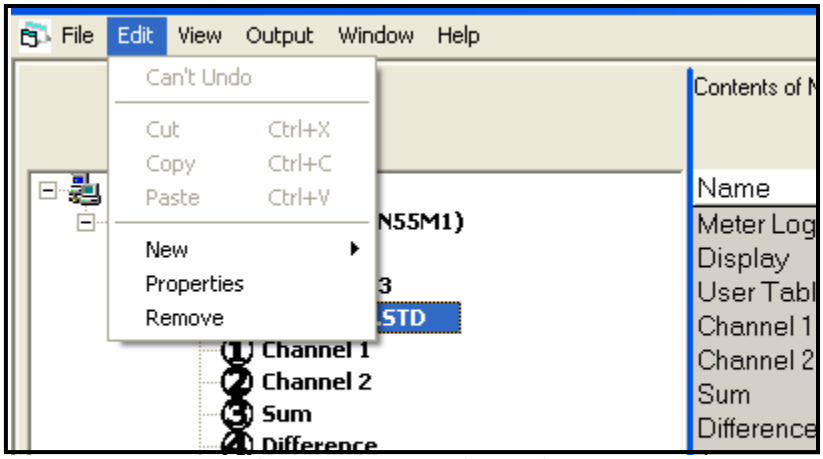


Figure 49: *Properties* Option

The window now appears similar to *Figure 50* below.

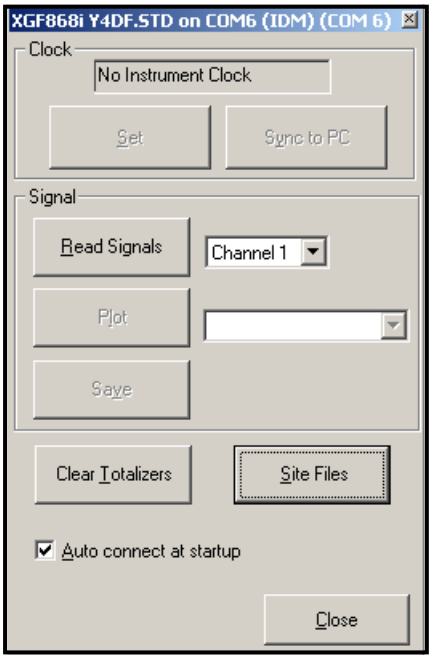


Figure 50: Properties Window

3. Click on the [Site Files] button. The *Site File Operations* window, as shown in *Figure 51* below, opens.

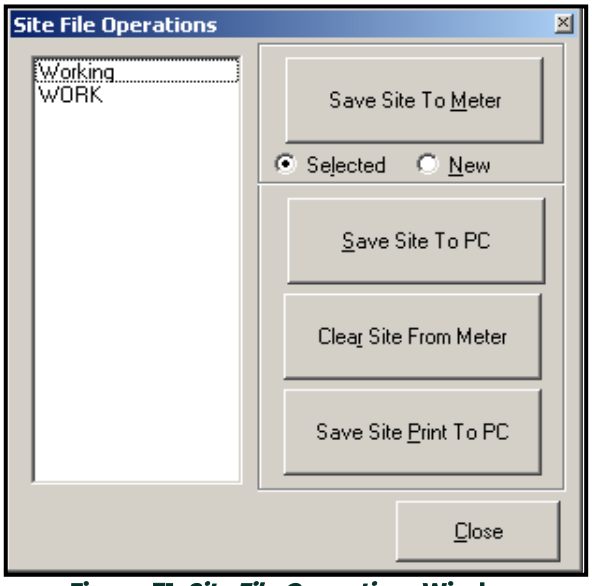


Figure 51: *Site File Operations* Window

C.9.1 Saving Current Site Data to the Meter

To save existing site data to the meter:

1. Select the radio button for *Selected* and highlight an existing site in the left pane.
2. Then click on the [Save Site to Meter] button. A screen similar to *Figure 52* below opens.

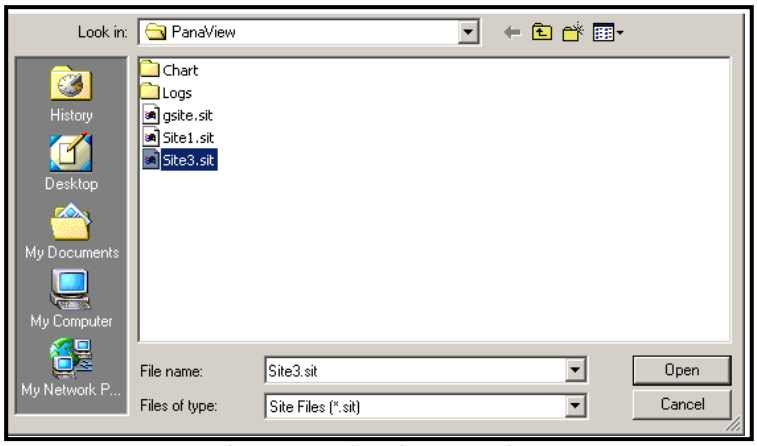


Figure 52: Site File Selection

3. Highlight the desired site and click [Open]. PanaView sends the site to the meter.

C.9.2 Saving New Site Data to the XGF868i

To save new site data to the meter:

1. Select the radio button for *New* and click on the [Save Site to Meter] button.
2. A window similar to *Figure 53* below opens. Enter the desired name, and click [OK].

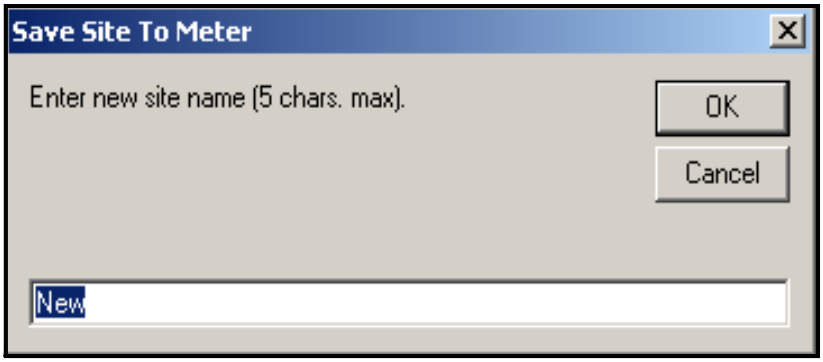


Figure 53: Site Name Entry Window

5. The *Site File Selection* window (*Figure 52 on page 103*) opens. Highlight a site file with the desired settings, and click [Open]. The site file becomes the *Working* site in the meter with the desired settings.

C.9.3 Saving a Site to the PC

To save a site to the PC:

1. Highlight the desired site in the left pane. (See *Figure 51 on page 103.*)
2. Click [Save Site to PC]. A window similar to *Figure 52 on page 103* opens.
3. Enter the desired site name and click [Save]. PanaView saves the site in the PanaView folder unless otherwise specified.

Note: *If you have created a site on the meter after opening the* Site File Operations *window, you must close and reopen the window to click on the new site.*

C.9.4 Clearing a Site from the Meter

As the XGF868i has only one site loaded (*Working)* at any time, it is not possible to remove this site. To change site parameters, first save a site to the PC (as discussed in *Saving a Site to the PC* on the previous page), and then save the site to the XGF868i (as discussed in *Saving New Site Data to the XGF868i* on the previous page).

C.9.5 Saving Site Data in Text Form

To store the data from a site file as a text file for display or printout:

1. Highlight the site in the left pane. (see *Figure 52 on page 103.*)
2. Click on [Save Site Print to PC].
3. The *Site File Selection* window (shown in *Figure 52 on page 103*) opens. Enter the desired site name (now with a .prt suffix) and click on [Save]. PanaView displays a text version of the site, as shown in *Figure 54* below.

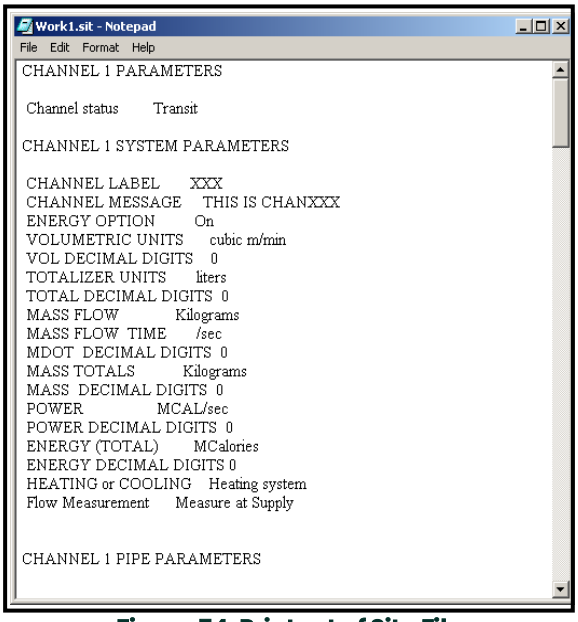


Figure 54: Printout of Site File

4. Click [Close] once to close the *Site File Operations* window, and a second time to close the *Properties* window and return to the *Meter Browser*.

[no content intended for this page]

Appendix D. PanaView Menu Maps for the XGF868i

The following *PanaView Menu Maps* are included in this appendix:

- Figure 55, “PanaView PROG > CHx > ACTIV, SYSTM, PIPE & I/O Menus,” on page 109
- Figure 56, “PanaView PROG > CHx > SETUP Menu,” on page 110
- Figure 57, “PanaView PROG > GLOBL > SYSTM, I/O & COMM Menus,” on page 111

[no content intended for this page]

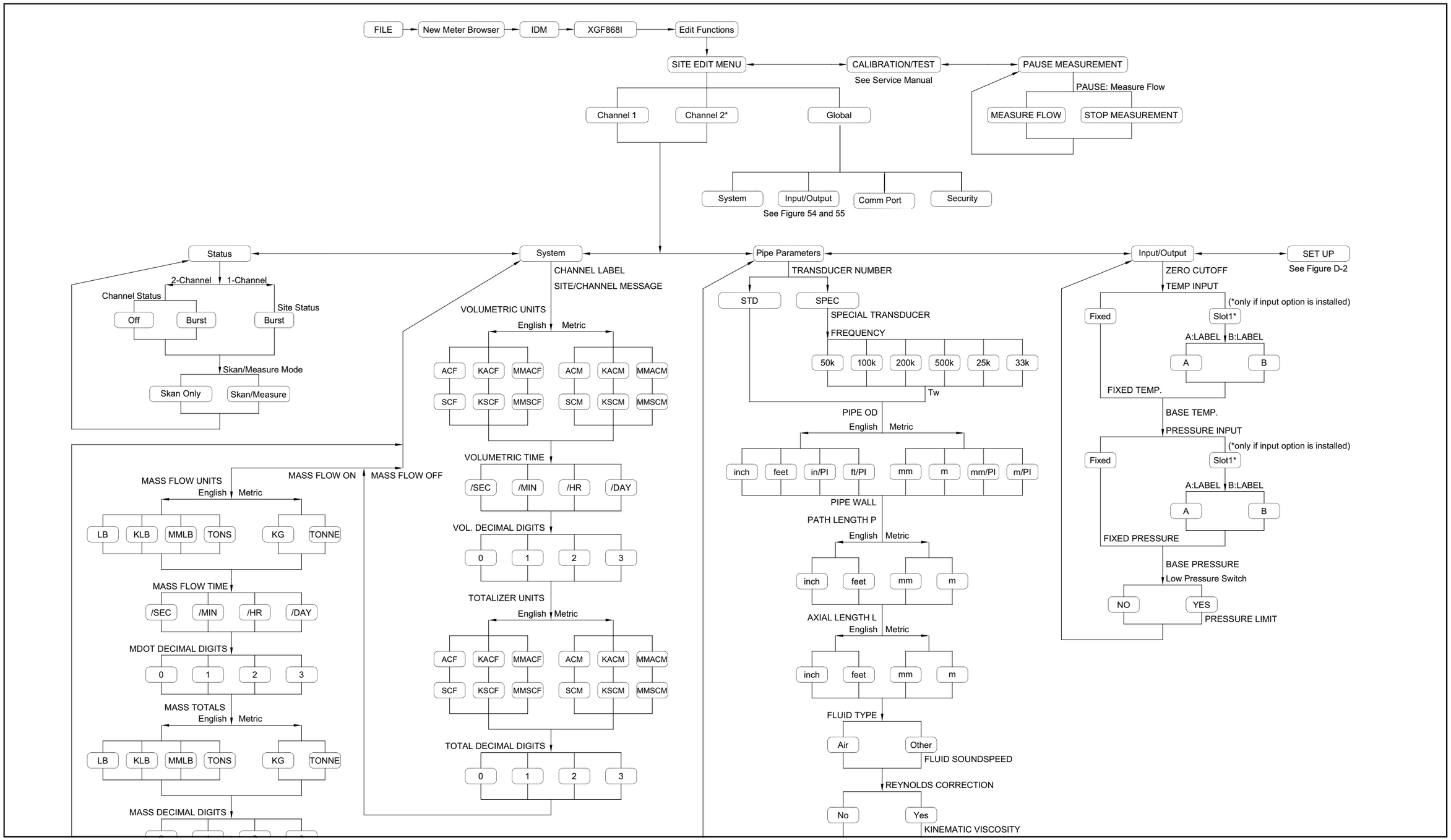


Figure 55: PanaView PROG > CHx> ACTIV, SYSTM, PIPE & I/O Menus

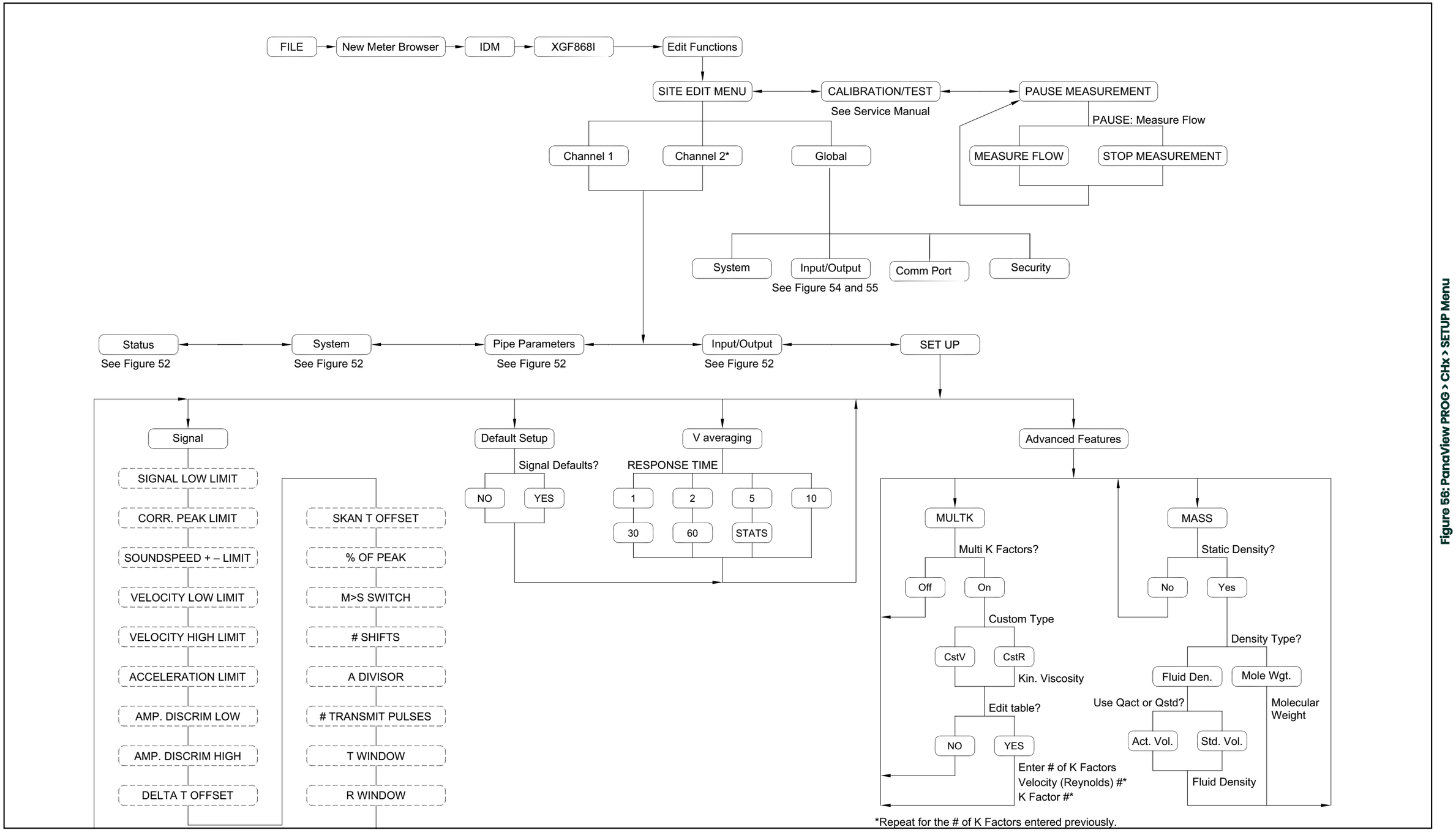


Figure 56: PanaView PROG > CHx > SETUP Menu

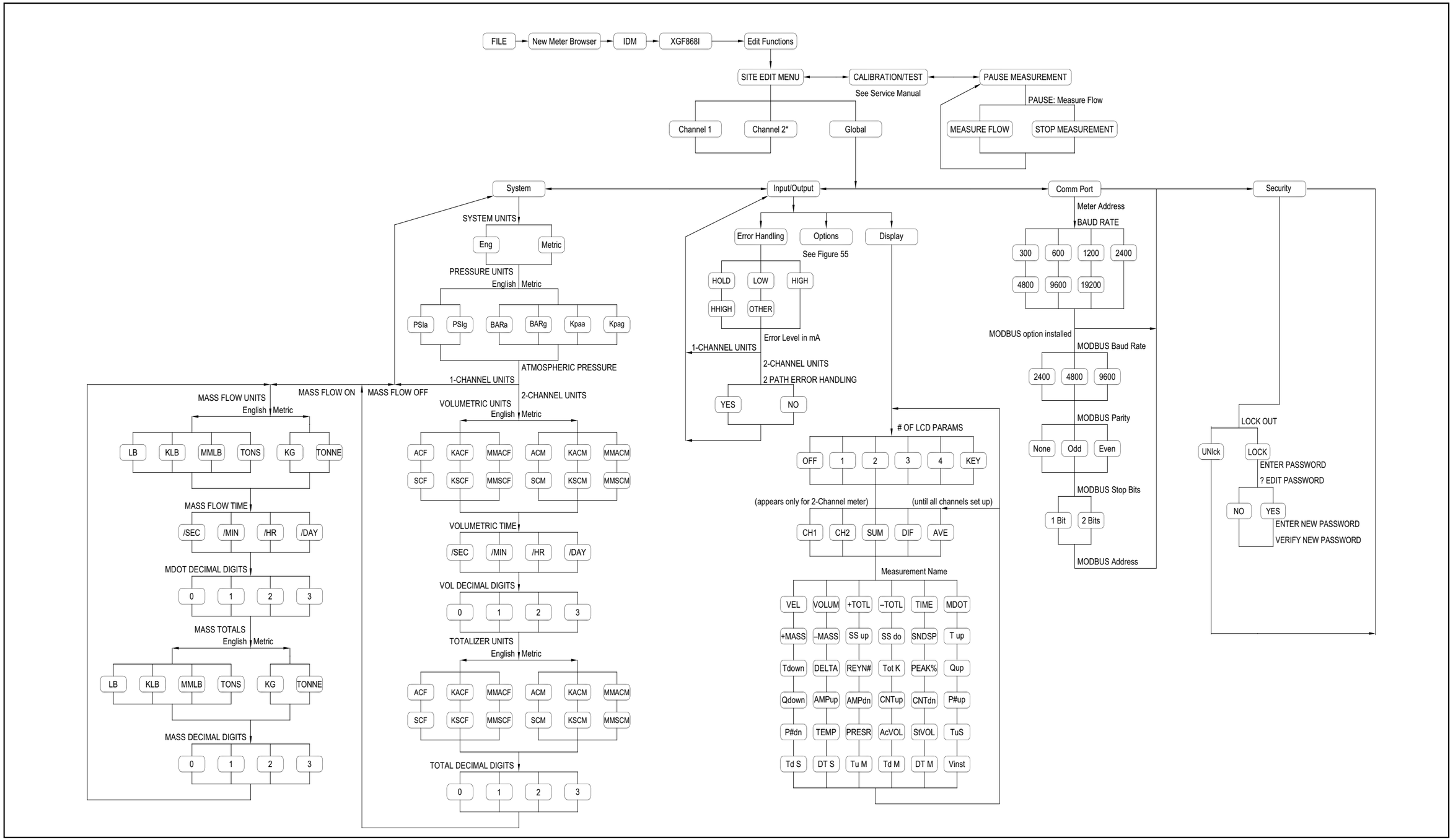
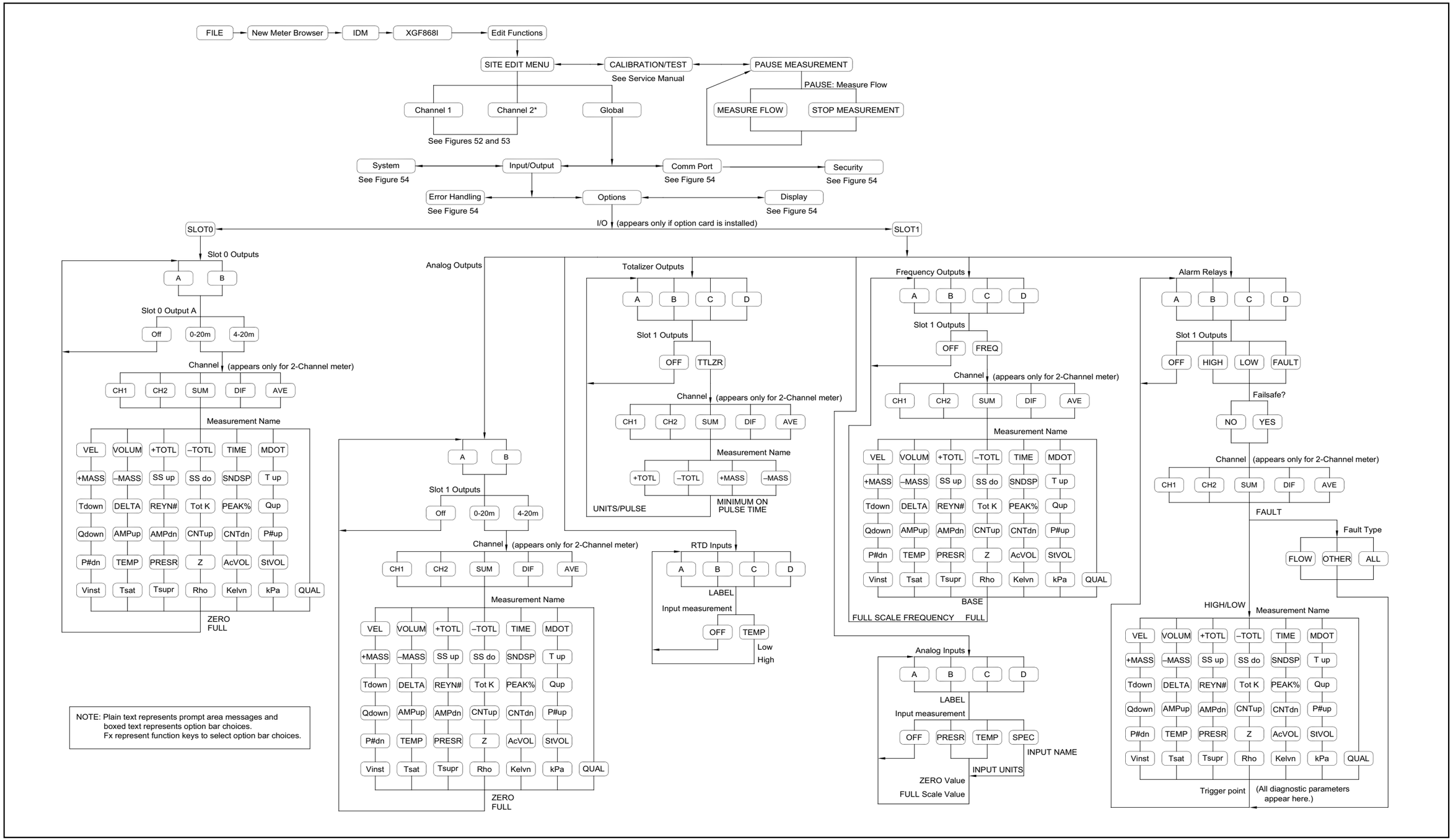


Figure 57: PanaView PROG > GLOBL > SYSTM, I/O & COMM Menus



NOTE: Plain text represents prompt area messages and boxed text represents option bar choices. Fx represent function keys to select option bar choices.

Figure 58: PanaView PROG > GLOBL > I/O > OPTIONS Menu

Appendix E. Foundation Fieldbus Communications

E.1 Introduction

Foundation Fieldbus provides a means of communicating with the flowmeter. The patent numbers which apply are 5,909,363 and 6,424,872. This Foundation Fieldbus device supports six Analog Input (AI) blocks, which can be configured to supply the network measurements shown in *Table 28* below.

Table 28: Available Measurements for the XGF868i

Channel 1	Units	Channel 2	Units	Ave. (CH1+CH2)/2	Units
Ch1 Velocity	ft/s or m/s*	Ch2 Velocity	ft/s or m/s*	Avg Velocity	ft/s or m/s*
Ch1 Act Volumetric	VOL_U	Ch2 Act Volumetric	VOL_U	Avg Act Volumetric	VOL_U
Ch1 Std Volumetric	VOL_U	Ch2 Std Volumetric	VOL_U	Avg Std Volumetric	VOL_U
Ch1 Fwd Totals	TOT_U	Ch2 Fwd Totals	TOT_U	Avg Fwd Totals	TOT_U
Ch1 Rev Totals	TOT_U	Ch2 Rev Totals	TOT_U	Avg Rev Totals	TOT_U
Ch1 #Tot Digits**	none	Ch2 #Tot Digits**	none	Avg #Tot Digits	none
Ch1 Mass Flow	MASS_U	Ch2 Mass Flow	MASS_U	Avg Mass Flow	MASS_U
Ch1 Fwd Mass Totals	MTOT_U	Ch2 Fwd Mass Totals	MTOT_U	Avg Fwd Mass Totals	MTOT_U
Ch1 Rev Mass Totals	MTOT_U	Ch2 Rev Mass Totals	MTOT_U	Avg Rev Mass Totals	MTOT_U
Ch1 #Mass Tot Digits	none	Ch2 #Mass Tot Digits	none	Avg #Mass Tot Digits	none
Ch1 Molecular Weight		Ch2 Molecular Weight		Avg Molecular Weight	
Ch1 Timer	sec	Ch2 Timer	sec	Avg Timer	sec
Ch1 Error Code	none	Ch2 Error Code	none	Avg Error Code	none
Ch1 SSUP	none	Ch2 SSUP	none	Avg SSUP	none
Ch1 SSDN	none	Ch2 SSDN	none	Avg SSDN	none
Ch1 Sound Speed	ft/s or m/s*	Ch2 Sound Speed	ft/s or m/s*	Avg Sound Speed	ft/s or m/s*
Ch1 Density***	see note	Ch2 Density***	see note		
Ch1 Temperature	Deg F or C*	Ch2 Temperature	Deg F or C*		
Ch1 Pressure	PRESS_U	Ch2 Pressure	PRESS_U		

*Metric or English units are determined by the setup of the flowmeter.

**Totalizer digits are available for informational purposes only. Respective totals are automatically scaled by the Tot Digits value selected in the flowmeter setup.

***If the meter is outputting Mole Weight, the unit is “mw”, otherwise it is the programmed pressure unit.

VOL_U, TOT_U, MASS_U, MTOT_U and PRESS_U are determined by the units chosen for these measurements in the flowmeter setup. See the instrument User's Manual for the setup of these parameters.

E.2 Configuration Utility Setup

The following is an *example* setup using National Instruments Configuration Utility v3.1.

Figure 59 below shows the Configuration Utility with a flowmeter on the network (Panametrics Flow-XGF).

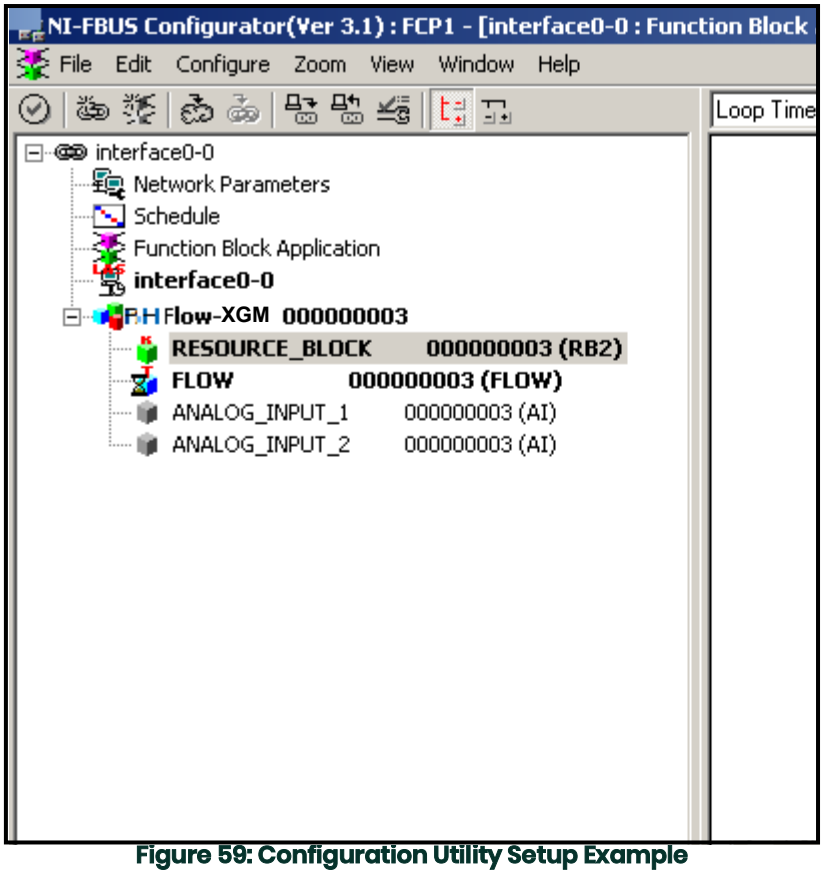


Figure 59: Configuration Utility Setup Example

Note: *The following procedures assume that the device has been placed in the OOS (out-of-service) mode before executing.*

E.3 Selecting the Desired Measurements

To set the measurement unit for each AI:

1. Double click on the FLOW Transducer Block (in the tree under BHFlow-XGF).
2. Select the **Others** tab and open the drop down list for the PRIMARY_SELECTOR and SECONDARY_SELECTOR (refer to *Figure 60 on page 115*).
3. Choose the unit from the list (see *Figure 60 on page 115*).

This unit will correspond to the unit that is available in the AI block for network connection. The PRIMARY_SELECTOR unit will correspond to ANALOG_INPUT_1 and the SECONDARY_SELECTOR will correspond to ANALOG_INPUT_2.

1. After the desired measurements have been selected for the PRIMARY and SECONDARY SELECTOR, choose the unit system (UNIT_SELECTOR above the PRIMARY_SELECTOR) that was programmed in the flowmeter (English or SI), as shown in *Figure 60* below.

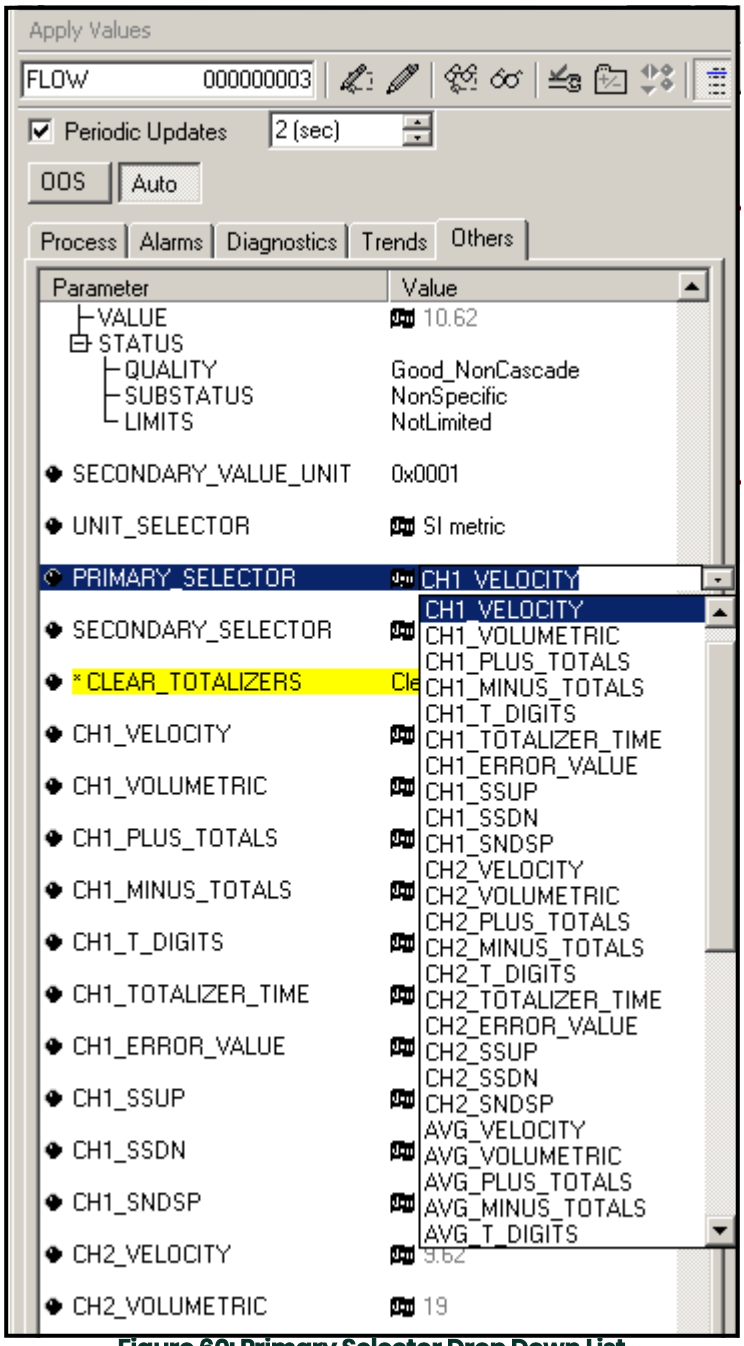


Figure 60: Primary Selector Drop Down List

E.4 Selecting Units for AI Blocks

To select the units for the individual AI blocks:

1. Double click on the AI block for which you wish to set the units (ANALOG_INPUT_1 or ANALOG_INPUT_2 in the tree under GEFlow-XGF; see *Figure 59 on page 114*).
2. Select the **Scaling** tab and set the unit for the measurement based on the flowmeter settings.

For example, if the flowmeter was set to use the metric unit system and the PRIMARY_SELECTOR was set to use VELOCITY you would choose **m/s** for the unit as shown in *Figure 61* below.

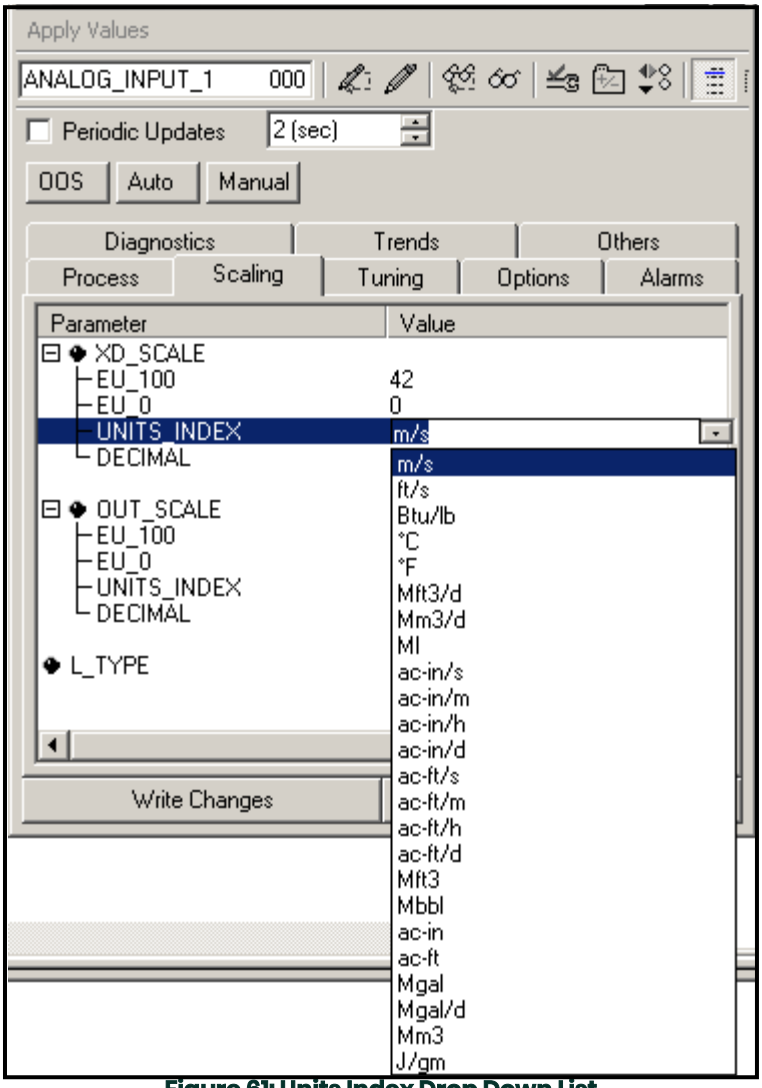


Figure 61: Units Index Drop Down List

E.5 Resetting Instrument Totalizers

To reset the instrument totalizers:

1. Double click on the FLOW transducer block (in the tree under GEFlow-XGF; see *Figure 59 on page 114*).
2. Select the **Others** tab and scroll down to the CLEAR_TOTALIZERS listing.
3. Select **Clear** from the drop down list box (see *Figure 62* below).
4. After the totals have been reset, select **Normal** from the drop down list box to resume total accumulation.

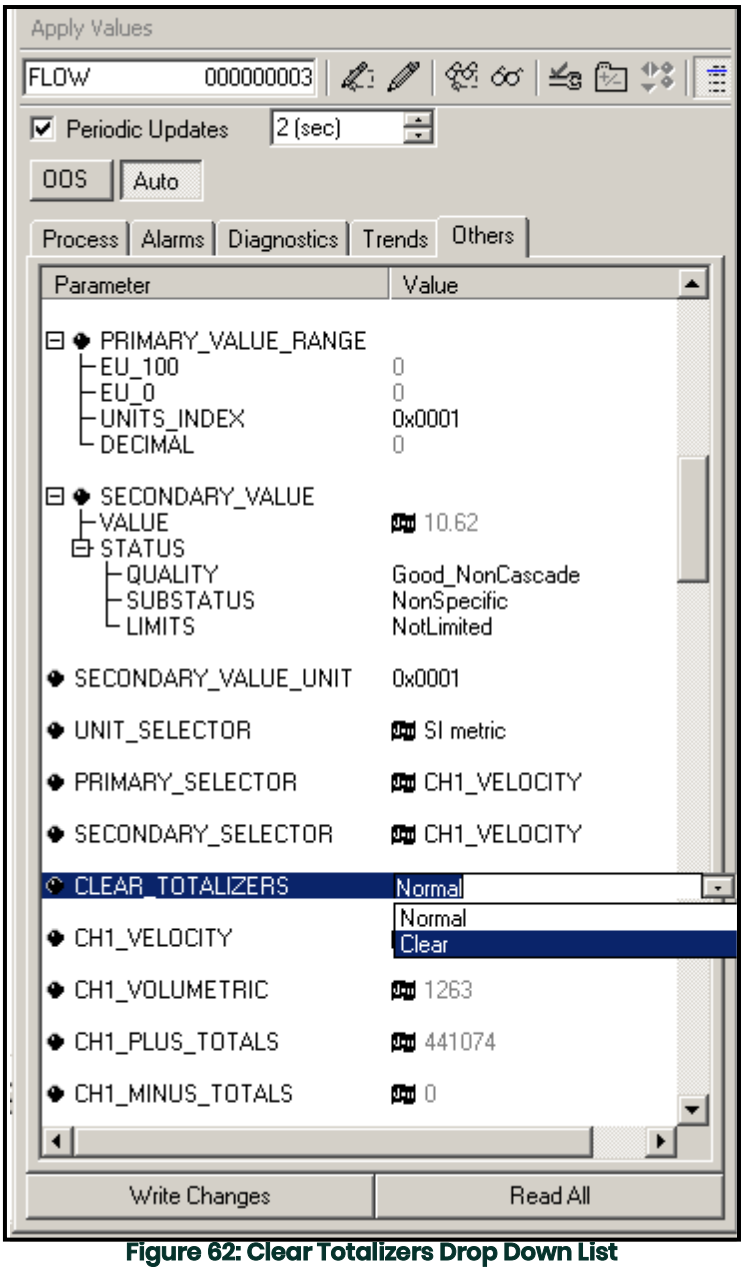


Figure 62: Clear Totalizers Drop Down List

E.6 Function Block Application

Figure 63 below is an example setup using the Function Block Application editor. The flowmeter AI blocks, along with the AO and PID of another device on the network, are displayed. We have connected the AI_1 OUT of the flowmeter to the CAS IN of the AO block. We have also connected the AI_2 OUT of the flowmeter to the CAS IN of the PID block.

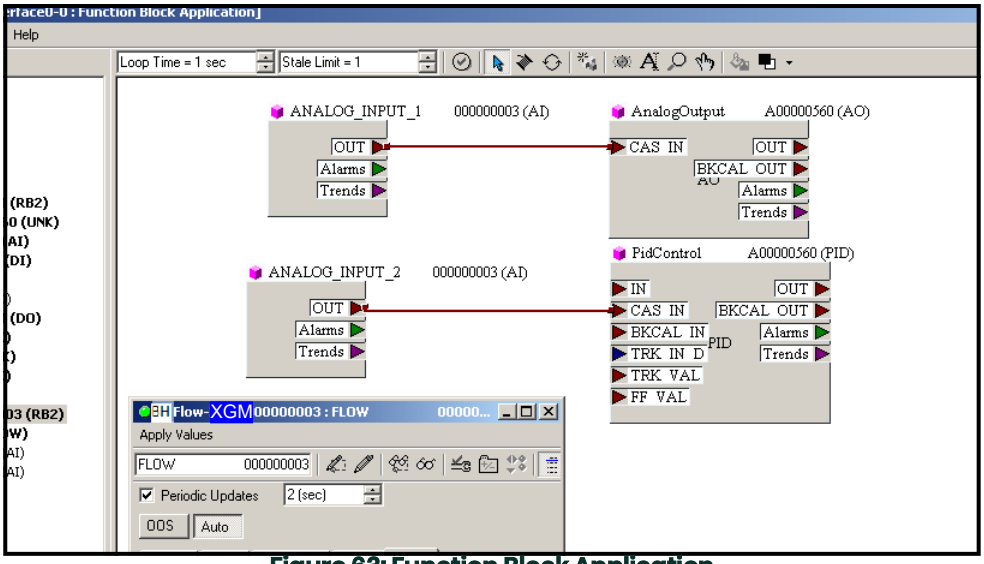


Figure 63: Function Block Application

Symbols

+MASS. 22
+TOTL 22

A

A Divisor 14, 87
Acceleration Limit 13, 87
Act Vol. 95
Activating a Channel 5
AcVOL. 23
Advanced Features 16, 88
  Mass Flow Option. 89
  Multiple K Factors Option 88
AMPdn 22
Amplitude Discriminator
  High 13, 87
  Low. 13, 87
AMPup 22
Analog Inputs
  Option Card. 23
  RTD Inputs 23
  Setting Up 23
Analog Inputs Card
  Setting Up in PanaView 95
Analog Outputs
  Option Card. 21
  Setting Up 21
  Slot 0, Setting Up. 93
Arrow Keys 3
Atmospheric Pressure
  Entering in PanaView 90
Axial Length 9
  in PanaView. 84

B

Backlight
  See Brightness and Contrast
Base Pressure, Entering 11, 86
Base Temperature, Entering 11, 85
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Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- one year from delivery for electronic or mechanical failures
- one year from delivery for sensor shelf life

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a RETURN MATERIAL AUTHORIZATION (RMA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

[no content intended for this page]

Customer Support Centers

U.S.A.
The Boston Center
1100 Technology Park Drive
Billerica, MA 01821
U.S.A.
Tel: 800 833 9438 (toll-free)
978 437 1000
E-mail: mstechsupport@bakerhughes.com

Ireland
Sensing House
Shannon Free Zone East
Shannon, County Clare
Ireland
Tel: +353 (0)61 470200
E-mail: mstechsupport@bakerhughes.com

Scan here for Panametrics support and service information

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Baker Hughes

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DigitalFlow™ XGF868i

Panametrics Flare Gas Flow Transmitter

Service Manual



Panametrics
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DigitalFlow™ XGF868i

Panametrics Flare Gas Flow Transmitter

Service Manual

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Services

Panametrics provides customers with an experienced staff of customer support personnel ready to respond to technical inquiries, as well as other remote and on-site support needs. To complement our broad portfolio of industry-leading solutions, we offer several types of flexible and scalable support services including: Training, Product Repairs, Service Agreements and more.

Please visit https://www.bakerhughes.com/panametrics/panametrics-services for more details.

Typographical Conventions

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: These paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.



CAUTION! **This symbol indicates a risk of potential minor personal injury and/or severe damage to the equipment, unless these instructions are followed carefully.**



WARNING! **This symbol indicates a risk of potential serious personal injury, unless these instructions are followed carefully.**

Safety Issues



WARNING! **It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.**



Attention European Customers!To meet CE Mark requirements for all units intended for use in the EU, all electrical cables must be installed as described in this manual.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area



WARNING! **Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.**



WARNING! **Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on this equipment.**

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

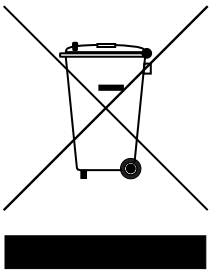
Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

Panametrics is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2012/19/EU.



The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end of life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Please visit www.bakerhughesds.com/health-safety-and-environment-hse for take-back instructions and more information about this initiative.

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Chapter 1. Calibration

1.1 Introduction

Calibrating the XGF868i analog outputs and inputs is explained in this chapter. In addition, testing the optional totalizer, frequency and alarm relay outputs is discussed. The chapter includes the following specific topics:

- Calibrating the **Slot 0** and Slot 1 analog outputs - *page 2*.
- Calibrating option card analog inputs - *page 4*.
- Calibrating option card RTD inputs - *page 6*.
- Testing option card frequency outputs - *page 6*.

Note: *Convention in this manual identifies any expansion slot as* **Slot x**, *where* **x** *is a number from 0-2.* **Slot 2** *is used only for data logging, MODBUS or HART option cards.*

See Chapter 1, *Installation*, and Appendix B, *Data Records*, in the *Startup Guide* for a complete description of the available option cards and the procedures for wiring them.

1.2 Accessing the Calibration Menu

The *Calibration* menu is accessible through the *Keypad Program*, as well as through PanaView™ software. (If you are using PanaView to calibrate the XGF868i, refer to Appendix B.) Use this menu to calibrate and test the **Slot 0** analog outputs, as well as to calibrate and/or test any option cards that are installed in expansion **Slot 1**. Refer to the menu maps in *Figure 3 on page 9* as a guide in following the calibration instructions.

1. Power up the XGF868i and wait until it has initialized.
2. Press the [Escape], [Enter], [Escape] keys. The *Keypad Program* appears on the screen.
3. Press the right arrow key to scroll to the *CALIB* menu. Press [Enter]. The *Cal* window opens.

Proceed to the appropriate sections of this chapter to calibrate and/or test any of the installed inputs and/or outputs.

Note: *The Calibration menu never returns to the* Keypad Program. *Pressing* [Escape] *to exit the menu causes the XGF868i to restart.*

1.3 Calibrating and Testing the Analog Outputs

Every XGF868i flowmeter includes two built-in analog outputs (A and B) at terminal block **J1**, which is designated as **Slot 0**. Additional analog outputs may be added to the Model XGF868i by installing an appropriate option card in **Slot 1**. This option card contains two analog outputs, which are also designated as A and B.

Before beginning calibration, an ammeter must be connected to the desired analog output. Both the zero-point and full-scale values for all of these outputs must be calibrated. After calibrating the outputs, which have a resolution of 5.0 μA (0.03% full scale), their linearity should be tested.

Note: *The zero point of the analog output may be set at either 0 mA or 4 mA. However, the calibration always uses the 4 mA point, as the meter extrapolates this value to obtain the 0 mA point.*

1.3.1 Preparing for Calibration

Prepare for calibration by inserting an ammeter in series with the load on the desired output. Refer to *Figure 1* below and *Figure 4 on page 10* to identify the **OUT(+)** and **RTN(-)** pins for the desired output.

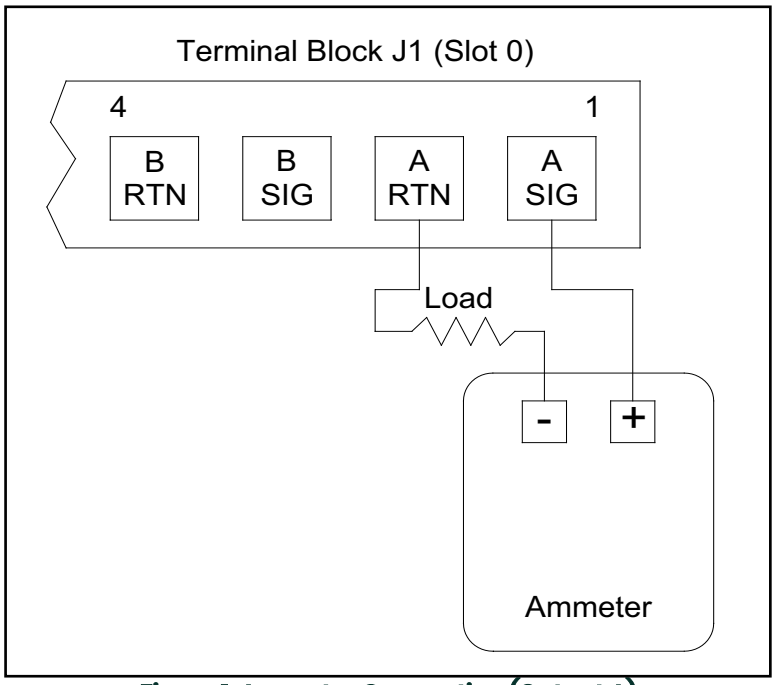


Figure 1: Ammeter Connection (Output A)

1.3.2 Calibrating the Low End of the Output Range

1. From the *Keypad Program*, press the right arrow key to scroll to the *CALIB* menu. Press [Enter].
2. In the *Cal* menu, scroll to the *Slot 0 or Slot 1* option, and press [Enter].

Note: *The* **Slot 1** *option only appears in the menu if an option card has been installed in this slot.*

3. Scroll to either *Output A* or *Output B* to open the *Analog Output* menu. (**Output A** will be used as an example in this manual.) Press [Enter].

IMPORTANT: The procedure for calibrating **Output B** is identical to that for calibrating **Output A**. However, when calibrating **Output B**, be sure to reconnect the ammeter on terminal block **J1**. See Figure 1 on page 2 for the correct pin numbers.

4. Scroll to *4 mA* to calibrate the low end of the output range. Press [Enter].
5. Scroll to *UP* or *DOWN* to adjust the ammeter reading **UP** or **DOWN**, until a 4 mA reading is achieved,
   or
   Scroll to *Numer,* and directly enter the mA reading. In either case, press [Enter] to confirm the entry.
6. Once you have achieved a 4 mA reading, scroll to either *STORE* to store the calibration, or to *ABORT* to exit the menu without storing the calibration. In either case, press [Enter].

Note: *If the ammeter reading cannot be adjusted within 5.0 μA of the 4 or 20 mA setting, contact the factory for assistance.*

1.3.3 Calibrating the High End of the Output Range

7. The XGF868i returns to the *Analog Output* window. Scroll to *20 mA*, and repeat steps 4 and 5 to calibrate the high end of the output range.

Note: *Skip the following prompt, if linearity testing of the output will not be performed at this time.*

1.3.4 Testing Output Linearity

8. Scroll to *TEST* to **test** the linearity of the currently selected analog output. Press [Enter].
9. Check the ammeter reading at *50% Full Scale*. Then, use the arrow keys to enter a different *% Full Scale* (0-100%). Press [Enter] when done.

Table 1 below lists the expected ammeter readings at various *% Full Scale* settings, for both 4-20 mA and 0-20 mA scales. Refer to this table to verify the accuracy of the ammeter readings taken above.

Table 1: Expected Ammeter Readings

% Full Scale	4-20 mA Scale*	0-20 mA Scale*
0	4.000	0.000
10	5.600	2.000
20	7.200	4.000
30	8.800	6.000
40	10.400	8.000
50	12.000	10.000
60	13.600	12.000
70	15.200	14.000
80	16.800	16.000
90	18.400	18.000
100	20.000	20.000
* all ammeter readings should be ±0.005 mA		

If the linearity test readings are not within 5 μA of the values listed in Table 1, check the accuracy and wiring of the ammeter. Then, repeat the low and high end calibrations. If the analog output still does not pass the linearity test, contact the factory for assistance.

10. Scroll to *EXIT* and press [Enter] to return to the *Cal* menu. Then choose another output to calibrate or press [Escape] to leave the *CALIB* menu.

This completes calibration of the **Slot 0** analog outputs. Proceed to the appropriate section to calibrate additional inputs/outputs.

1.4 Calibrating the Analog Inputs

Analog inputs may be added to the XGF868i by installing an appropriate option card in **Slot 1**. This option card contains two or four analog inputs, which are designated as A, B, C and D. Both the zero-point and full-scale values for each input must be calibrated.

Calibration of the analog inputs requires the use of a calibrated current source. If an independent calibrated current source is not available, one of the **Slot 0** analog outputs may be used for the calibration. During the analog input calibration, the **Slot 0** analog output will supply the low reference, high reference, 4 mA and 20 mA signals at the appropriate times.

IMPORTANT: If a **Slot 0** analog output will be used to calibrate the analog inputs, the **Slot 0** analog output calibration procedure must be completed first.

1.4.1 Preparing for Calibration

Prepare for the calibration procedure by connecting a **Slot 0** analog output (or an independent calibrated current source) to the desired input on the option card. See *Figure 4 on page 10* to identify the IN**(+)** and **RTN(–)** pins for the desired input on terminal block J2.

Note: *The zero point of the analog input may be set for either 0 mA or 4 mA. However, the calibration always uses the 4 mA point, as the meter extrapolates this value to obtain the 0 mA point.*

1.4.2 Accessing the Calibration/Test Menu

1. From the *Keypad Program*, press the right arrow key to scroll to the *CALIB* menu. Press [Enter].
2. In the *Cal* window, scroll to *Slot 1*. Press [Enter].
3. Scroll to the desired *Input* to open the *ANALOG INPUT* menu. (**Input A** will be used as an example in this manual.) Press [Enter].

IMPORTANT: Calibrating **Input B, C or D** is identical to calibrating **Input A**. However, be sure to reconnect the current source on terminal block **J2**. Refer to Figure 4 on page 10 for the correct pin numbers.

4. Scroll to the appropriate option to select the reference point to be calibrated. Press [Enter].

IMPORTANT: The procedure for calibrating all the inputs is the same. However, when calibrating a different input, be sure to reconnect the current source at terminal block **J2**. See Figure 4 on page 10 for the correct pin numbers.

5. Do one of the following:
   - Proceed to the *"4 mA Option" on page 5*.
   - Proceed to the *"20 mA Option" on page 5*.

1.4.2.1 4 mA Option

Set the calibrated current source to 4 mA.

- If you selected the *4 mA* option in the *ANALOG INPUT* menu, scroll to *STORE* to accept the current 4 mA value or on *ABORT* to cancel the entry. Press [Enter]. In either case, the XGF868i returns to the **Analog Input** window.

1.4.2.2 20 mA Option

Set the calibrated current source to 20 mA.

- If you selected the *20 mA* option in the *ANALOG INPUT* option, scroll *STORE* to accept the current 20 mA value or to *ABORT* to cancel the entry. Press [Enter]. In either case, the XGF868i returns to the **ANALOG INPUT** window.
- Press [Escape] to return to the *Slot 1* window and calibrate additional inputs/outputs, or press [Escape] again to close the *CALIB* menu.

1.5 Calibrating the RTD Inputs

RTD analog inputs may be added to the XGF868i by installing an appropriate option card in **Slot 1**. The option card contains two or four RTD inputs that are designated as A, B, C and D. Both the set point and slope point values for each input must be specified prior to use.

1.5.1 Preparing for Calibration

Prepare for the calibration procedure by connecting the RTD temperature transmitter to the desired input (A, B, C or D) on the option card. See *Figure 4 on page 10* to identify the **RTD(+)** and **COM(-)** pins for the desired input on terminal block J2.

1.5.2 Accessing the Calibration/Test Menu

1. From the *Keypad Program*, press the right arrow key to scroll to the *CALIB* menu. Press [Enter].
2. In the *Cal* window, scroll to *Slot 1*. Press [Enter].

Note: *The* **Slot 1** *option only appears at the above prompt if an option card is installed in this slot.*

3. Scroll to the desired *Input*. (**Input A** will be used as an example in this manual.) Press [Enter].

IMPORTANT: When calibrating the other inputs, be sure to reconnect the current source at terminal block **J2**. See Figure 4 on page 10 for the correct pins.

1.5.3 Entering the Set Point

1. Before proceeding, place the RTD in a temperature bath and allow it to stabilize at the desired set point temperature.
2. Scroll to *Set* to program the RTD set point. Press [Enter].
3. Use the arrow keys to enter the desired set point temperature and press [Enter].
4. Scroll to *STORE* to accept the new set point value or *ABORT* to cancel the entry. Press [Enter].

1.5.4 Entering the Slope

1. Scroll to *Slope* to program the RTD slope point. Press [Enter].
2. Use the arrow keys to enter the desired slope point temperature and press [Enter].
3. Press *STORE* to accept the new slope point value or *ABORT* to cancel the entry. Press [Enter].

Note: *If an error message appears, verify that the RTD is at the programmed temperature. Also, if you replace the set/slope range with a different range, be sure to recalibrate the set and slope points.*

Procedure Options

This completes calibration of the **Slot 1** RTD input. Do one of the following:

- To calibrate or test another input, press [Escape] and return to Step 3 in *Accessing the Calibration/Test Menu* above.
- To leave the *Keypad Program*, press [Escape] twice.

1.6 Testing the Frequency Outputs

Frequency outputs may be added to the XGF868i by installing an appropriate option card in **Slot 1**. This option card contains two or four frequency outputs, which are designated A, B, C and D.

1.6.1 Preparing for Testing

Prepare for the testing procedure by connecting a frequency counter to the desired output on the option card. See *Figure 2* below for frequency output wiring, and *Figure 4 on page 10* to identify the **OUT(+)** and **RTN(-)** pins for the desired output on terminal block J2.

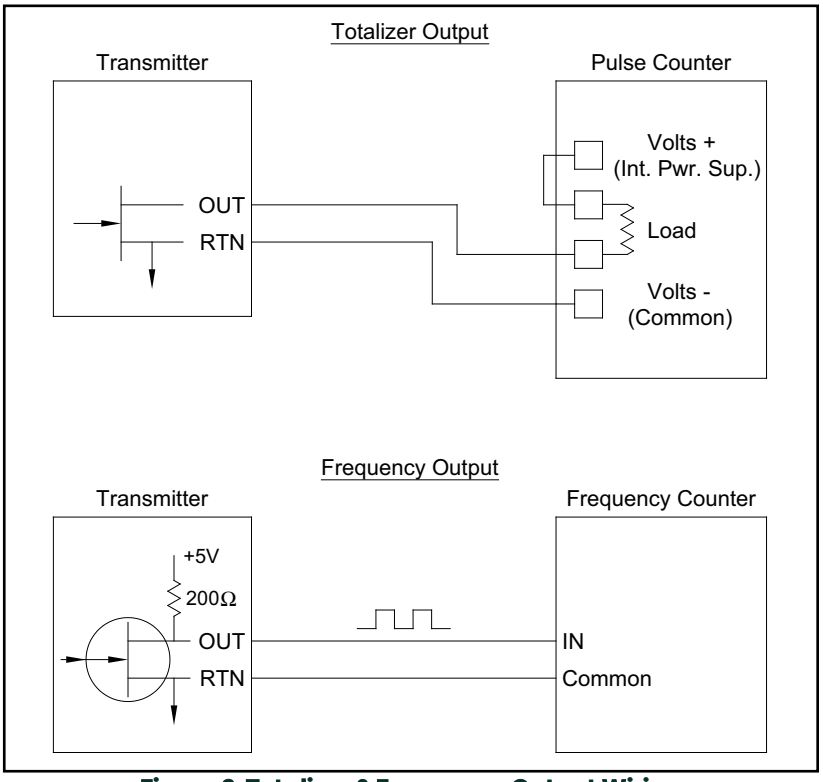


Figure 2: Totalizer & Frequency Output Wiring

1.6.2 Testing the Output

1. From the *Keypad Program*, press the right arrow key to scroll to the *CALIB* menu. Press [Enter].
2. In the *Cal* window, scroll to *Slot 1*. Press [Enter].

Note: *The* **Slot 1** *option only appears at the above prompt if an option card is installed in this slot.*

3. Scroll to the desired *Output*. (**Output A** will be used as an example in this manual.) Press [Enter].

IMPORTANT: The procedure for testing all the outputs is the same. However, when testing another output, be sure to reconnect the frequency counter at terminal block **J2**. See Figure 4 on page 10 for the correct pins.

4. Enter a frequency (between 1 and 10,000 Hz) and press [Enter].
5. Verify that the frequency counter reads the correct value.

Procedure Options

This completes testing of the **Slot 1** frequency outputs. Do one of the following:

- To test another of the available frequency outputs, return to Step 3 in *Testing the Output* above. If any of the frequency outputs fails the test, contact the factory for assistance.
- To calibrate/test additional inputs/outputs, proceed to the appropriate section.
- To leave the *Keypad Program*, press **[Escape]** twice.

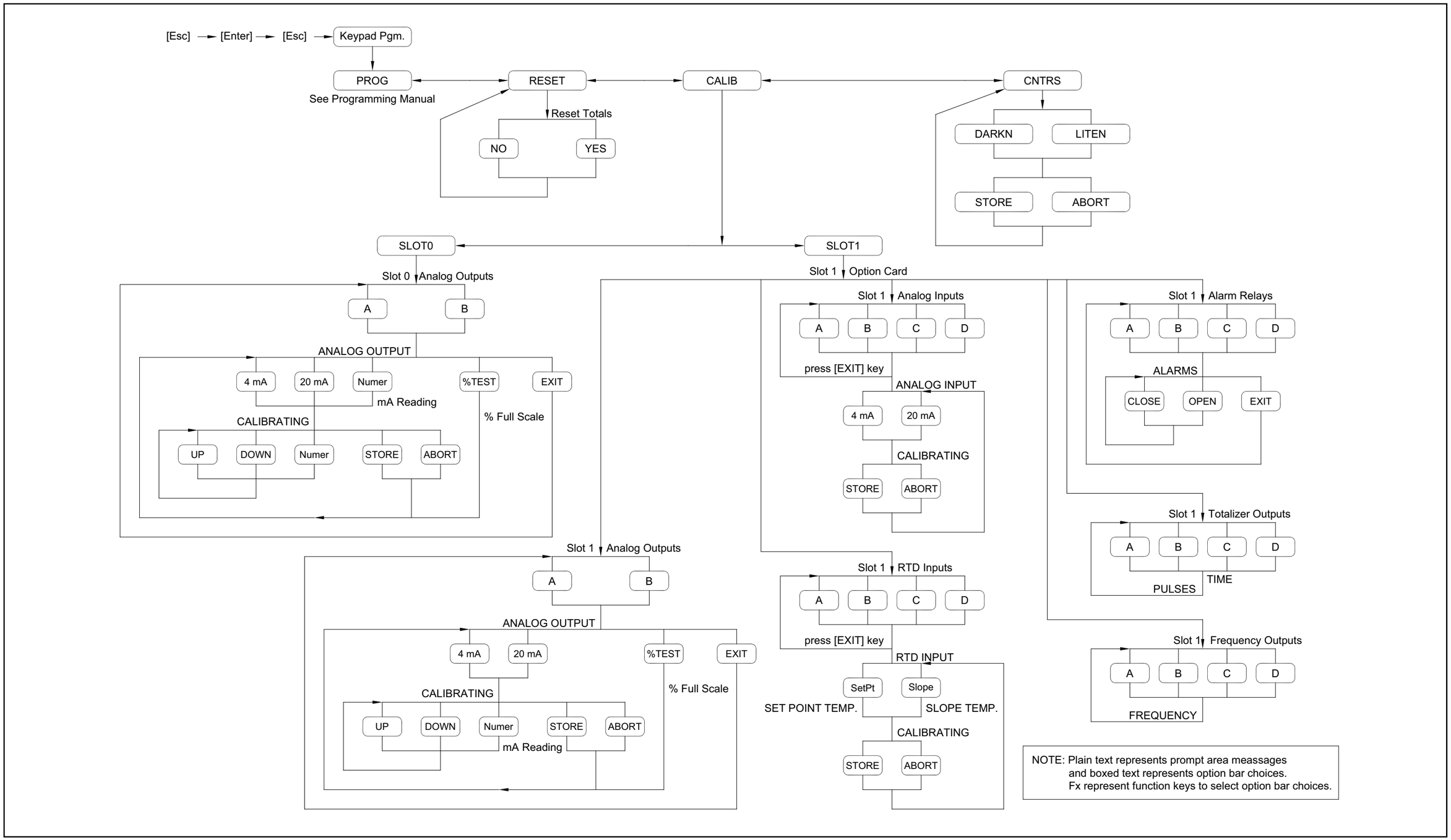
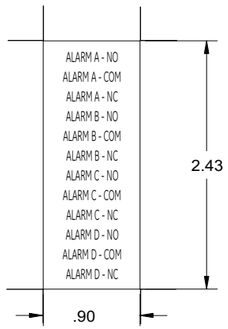
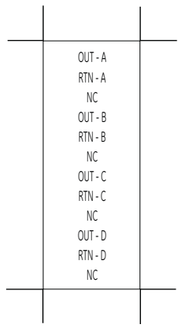


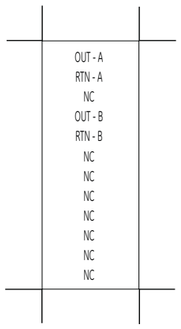
Figure 3: Calibration Menu Map



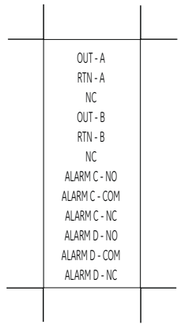
-01 (AA,HH)



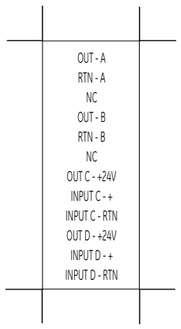
-02 (FF,TT,FT,CT,CF)



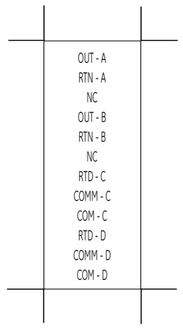
-03 (FO,TO,CO)



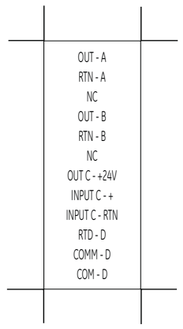
-04 (FA,FH,TA,TH,CA,CH)



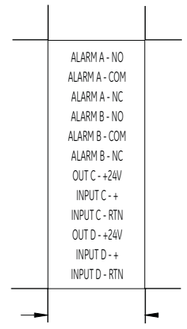
-05 (CI,TI,FI)



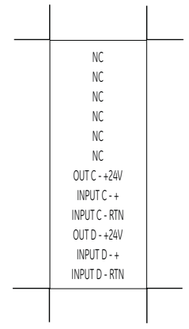
-06 (CR,FR,TR)



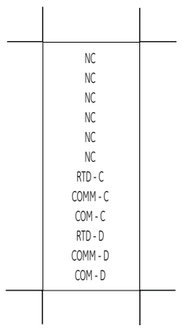
-07 (CIR)



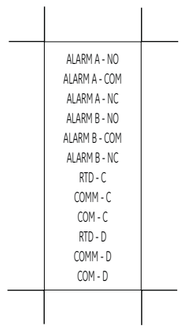
-08 (AI,HI)



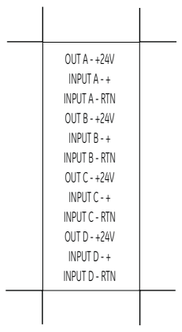
-09 (OI)



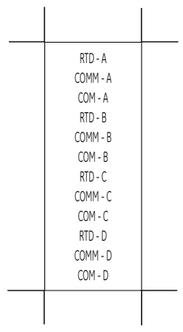
-10 (OR)



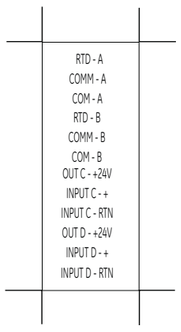
-11 (AR,HR)



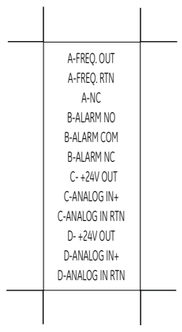
-12 (II)



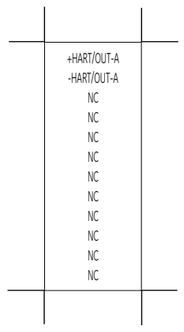
-13 (RR)



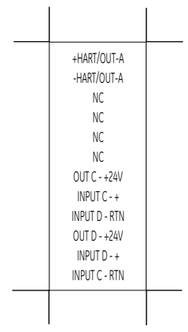
-14 (IR)



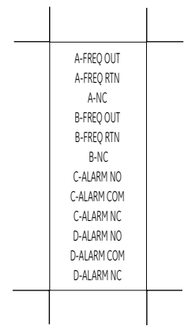
-15 (FHII)



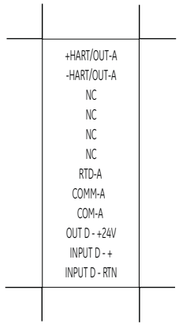
-16 (HART)



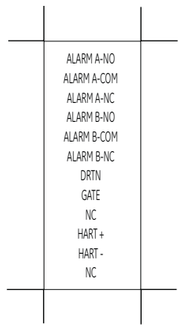
-17 (HART/OI)



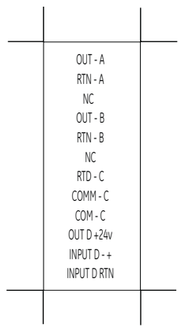
-18 (F(F)HH)



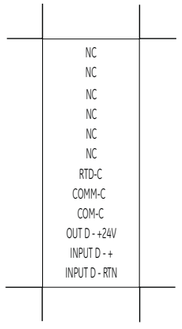
-19 (HART/RI)



-20 (A/GATE HART)



-21 (FRI)



-22 (ORI)

NOTES

1. MATERIAL: .003 THK (REF) MYLAR WITH REVERSE SCREENING, AND 3M #467MP (OR EQUIVALENT) ADHESIVE BACKING.
2. MARKINGS: BACKGROUND - WHITE. ALL MARKINGS PROCESS BLACK C.
3. ALL COLORS PER PANTONE MATCHING SYSTEM.
4. ALL DIMENSIONS PER -01.
5. ARTWORK CREATED IN ADOBE ILLUSTRATOR (FILE#: 442-615_N.AI)
6. ALL DIMENSIONS REFERENCE.

Figure 4: Option Card I/O Connections

Chapter 2. Error Codes

2.1 Introduction

The XGF868i ultrasonic flow transmitter is a reliable, easy to maintain instrument. When properly installed and operated, as described in the *Startup Guide*, the meter provides accurate flow rate measurements with minimal user intervention. However, if a problem should arise with the electronics enclosure, the transducers or the flowcell, a built-in error code message system greatly simplifies the troubleshooting process.

All of the possible XGF868i error code messages are discussed in this chapter, along with the possible causes and the recommended actions. When an error code is generated, it will appear on the LCD as shown in *Figure 5* below.

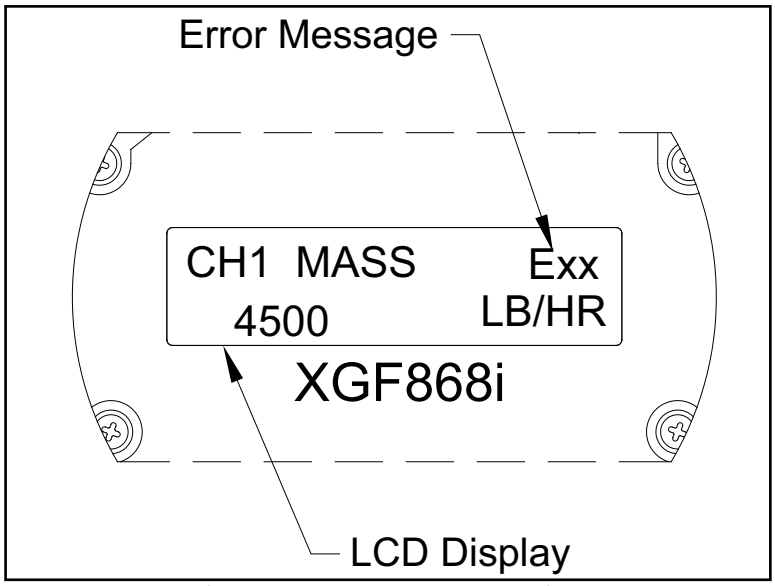


Figure 5: Error Message Location

If an error message appears during normal operation of the Model XGF868i, refer to the appropriate section of this chapter for instructions on how to proceed.

E0: No Error

Problem: No error condition currently exists.

Cause: This message appears briefly to confirm that the response to another error message has corrected the problem.

Action: No action is required.

E1: Low Signal

Problem: Poor ultrasonic signal strength or the signal exceeds the limits entered via the *Keypad Program*.

Cause: Poor signal strength may be caused by a defective cable, a flowcell problem, a defective transducer or a problem in the electronics console. A signal that exceeds the programmed limits is probably caused by the entry of an improper value in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Action: Using the procedures in Chapter 3, *Diagnostics*, check the components listed above. Also, check the limit values entered into the Channelx-**Set up-Signal** submenu, as described in Chapter 1, *Programming Site Data*, of the *Programming Manual*.

E2: Sound Speed Error

Problem: The sound speed exceeds the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: The error may be caused by incorrect programming, poor flow conditions or poor transducer orientation.

Action: Compare the measured sound speed to tabulated nominal values for the gas being used and correct any programming errors. Refer to Chapter 3, *Diagnostics*, to correct any flowcell and/or transducer problems.

E3: Velocity Range

Problem: The velocity exceeds the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: This error may be caused by the entry of improper programming data or by poor flow conditions and/or excessive turbulence.

Action: Make sure the actual flow rate is within ±75 ft/sec (±23 m/sec). See Chapter 1, *Programming Site Data*, in the *Programming Manual* for details. Refer to Chapter 3, *Diagnostics*, to correct any flowcell and/or transducer problems.

E4: Signal Quality

Problem: The signal quality is outside the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: The peak of the upstream or downstream correlation signals has fallen below the correlation peak limit, as set in the Channelx-**Set up-Signal** submenu. This may be caused by a flowcell or electrical problem.

Action: Check for sources of electrical interference and verify the integrity of the electronics console by temporarily substituting a test flowcell that is known to be good. Check the transducers and relocate them, if necessary. See Chapter 3, *Diagnostics*, for further instructions.

E5: Amplitude Error

Problem: The signal amplitude exceeds the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: Excessive levels of an attenuating gas, such as CO_2, may be present in the flowcell. Solid or liquid particulates may be present in the flowcell.

Action: Refer to Chapter 3, *Diagnostics*, to correct any flowcell problems.

E6: Cycle Skip, Accel.

Problem: The acceleration exceeds the limits programmed in the Channelx-**Set up-Signal** submenu of the *Keypad Program*.

Cause: This condition is usually caused by poor flow conditions or improper transducer alignment.

Action: Refer to Chapter 3, *Diagnostics*, to correct any flowcell and/or transducer problems.

E7: Analog Out Error

Problem: The current in the analog output circuit exceeds the limits for the analog output port.

Cause: The output load exceeds the specified limits for the analog output port.

Action: Make sure the output load is <600 ohms for the **Slot 0** analog outputs or is <1,000 ohms for an analog outputs option card in **Slot 1**.

E8: Temperature In

Problem: This message indicates a temperature input error.

Cause: The temperature exceeds the specified limits for the analog/RTD inputs option card or no input device is connected.

Action: Check the temperature transmitter and the connecting cable. Refer to Chapter 1, *Calibration*, and recalibrate the analog/RTD inputs option card.

E9: Pressure In

Problem: This message indicates a pressure input error.

Cause: The pressure exceeds the specified limits for the analog inputs option card or no input device is connected.

Action: Check the pressure transmitter and the connecting cable. Refer to Chapter 1, *Calibration*, and recalibrate the analog inputs option card.

E10: Special Input

Problem: This message indicates a special input error.

Cause: The special input exceeds the specified limits for the analog inputs option card.

Action: Check the special input device and the connecting cable. Refer to Chapter 1, *Calibration*, and recalibrate the analog inputs option card.

E11: Not Used

This error code message is not currently in use.

E12: Low Pressure

Problem: This error code is triggered when the pressure measurement is below the low pressure switch setting.

Cause: The pressure measurement exceeds the specified limits as set in the Channelx-Input/Output submenu.

Cause: Check the limit value (0 to 5,000 psia) entered into the Channelx-**Input/Output** submenu, as described in Chapter 1, *Programming Site Data*, of the *Programming Manual*.

E13: Over Range

Problem: This error code message indicates that the present measurement exceeds the range of the meter.

Cause: A internal mathematical overflow has occurred in either the volumetric or mass flow calculations.

Action: Select larger measurement units or a shorter time interval for the current measurement parameter. For example, choose **KSCF/M** instead of **SCF/M** in the **ChannelX-System** menu. See Chapter 2, *Initial Setup*, of the *Startup Guide* for instructions.

E14: Totals Overflow

Problem: The totalizers are unable to keep up with the total accumulated flow signals.

Cause: The programmed units/pulse value is too small.

Action: Select a larger number of units/pulse value.

E15: Equation Limit

Problem: The meter cannot resolve the molecular weight of the gas based on the measured sound speed, temperature, pressure and N_2 concentration.

Note: *The mw reading will appear as 2.0e3 or 3.0e3 in order to "flag" this condition.*

Cause: One or more of the above measurements must be incorrect.

Cause: Verify the pressure and temperature readings are correct. Verify the programmed (or input) nitrogen concentration is correct. Verify that the acoustic transit time measurements are operating properly, and that the programmed path and axial length dimensions are correct.

[no content intended for this page]

Chapter 3. Diagnostics

3.1 Introduction

This chapter explains how to troubleshoot the XGF868i if problems arise with the electronics enclosure, the flowcell, or the transducers. Indications of a possible problem include:

- Display of an error message on the LCD display screen
- Erratic flow readings
- Readings of doubtful accuracy (i.e., readings that are not consistent with readings from another flow measuring device connected to the same process).

If any of the above conditions occurs, proceed with the instructions presented in this chapter.

3.2 Displaying Diagnostic Parameters

The XGF868i has built-in *Diagnostic Parameters* to aid in the troubleshooting of flowcell, transducer and/or electrical problems. To access these parameters, use the *Keypad Program.* Then, complete the following instructions to display the desired diagnostic parameter:

Note: *To perform this function with PanaView software see Appendix C,* Programming with PanaView *in the* Programming Manual, *and/or the PanaView* User's Manual.

1. Press [Escape], [Enter], [Escape].
2. In the *Keypad Program* window, scroll to PROG and press [Enter].
3. In the PROG menu, scroll to GLOBL and press [Enter].
4. Scroll to I/O and press [Enter].
5. Scroll to LCD and press [Enter].
6. The window now asks for the *# of LCD Parameters*. Scroll to the desired number (from OFF through 1-4 and KEY) and press [Enter].

   The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program.* If you select KEY:

   - To view a parameter other than the one currently displayed, press the [r] or [s] keys to scroll through the various parameters.
   - To scroll through the channel options on an XGF868i, press the [v] or [w] keys until you have reached the desired option.
7. Scroll to the desired *Channel option*, as listed in *Table 2* below.

Table 2: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

8. For each channel, select the desired *Measurement Parameter*, as shown in *Table 3*.

Note: *The measurement units that appear in these prompts are those selected in the* **GLOBL-SYSTM** *menu earlier in this section. Also, when differences in one channel's programming invalidate an output previously chosen for the other, the measurement defaults to the nearest selectable item in the parameter list.*

The previous two prompts repeat until all of the specified **# of LCD Parameters** have been set up. When all of the display parameters have been set up, the meter returns to the **Global I/O** window. To leave the *Keypad Program*, press the **[Escape]** key three times.

After leaving the *Keypad Program*, the XGF868i will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

Table 3: Available Diagnostic Parameters

Option Bar	Description	Good	Bad
VEL	Displays the flow velocity.	N.A.	N.A.
VOLUM	Displays the volumetric flow.	N.A.	N.A.
+TOTL	Displays the forward totalized volume flow.	N.A.	N.A.
-TOTL	Displays the reverse totalized volume flow.	N.A.	N.A.
TIME	Displays the total flow measurement time.	N.A.	N.A.
MDOT	Displays the mass flow.	N.A.	N.A.
+MASS	Displays the forward totalized mass flow.	N.A.	N.A.
-MASS	Displays the reverse totalized mass flow.	N.A.	N.A.
SS up	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
SS do	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
SNDSP	Displays the measured speed of sound in the gas.	N.A.	N.A.
Tup	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
Tdown	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
DELTA	Displays the transit time difference between the upstream and downstream signals.	N.A.	N.A.
Tot K	Displays the total number of K factors.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default).	N.A.	N.A.
Qup	Displays the signal quality for the upstream transducer.	≥1200	–400 to +400
Qdown	Displays the signal quality for the downstream transducer.	≥1200	–400 to +400
AMPup	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29
AMPdn	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29
CNTup	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
CNTdn	Displays the AGC DAC count for the downstream gain setting.	N.A.	N.A.
P#up	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
TEMP	Displays the gas temperature (from 0/4-20 mA input).	N.A.	N.A.
PRESR	Displays the gas pressure (from 0/4-20 mA input).	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
z	Displays the compressibility.	N.A.	N.A.
AcVOL	Displays actual volumetric flow.	N.A.	N.A.
StVOL	Displays standard volumetric flow.	N.A.	N.A.
Tu S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Td S[1]	Displays Skan transit time downstream.	N.A.	N.A.
DT S[1]	Displays Skan Delta T.	N.A.	N.A.
Tu M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Td M[1]	Displays Measure transit time downstream.	N.A.	N.A.
DT M[1]	Displays Measure Delta T.	N.A.	N.A.

Table 3: Available Diagnostic Parameters

Option Bar	Description	Good	Bad
Vinst	Displays the instantaneous velocity.	N.A.	N.A.
[1]available only if Burst Mode = S/M			

3.3 Flowcell Problems

If preliminary troubleshooting with the *Error Code Messages* and/or the *Diagnostic Parameters* indicates a possible flowcell problem, proceed with this section. Flowcell problems fall into two categories:

- Gas problems
- Pipe problems

Read the following sections carefully to determine if the problem is indeed related to the flowcell. If the instructions in this section fail to resolve the problem, contact the factory for assistance.

3.3.1 Gas Problems

Most gas-related problems result from a failure to observe the flowmeter system installation instructions, as described in the *Startup Guide*. Refer to Chapter 1, *Installation*, of the *Startup Guide* to correct any installation problems.

If the physical installation of the system meets the recommended specifications, it is possible that the gas itself may be preventing accurate flow rate measurements. The gas being measured must meet the following requirements:

1. *The gas must be homogeneous, single-phase and relatively clean.*
   Although a low level of entrained particles may have little effect on the operation of the XGF868i, excessive amounts of solid or liquid particles will absorb or disperse the ultrasound signals. This interference with the ultrasound transmissions through the gas will cause inaccurate flow rate measurements. In addition, temperature gradients in the gas flow may result in erratic or inaccurate flow rate readings.
2. *The gas must not excessively attenuate ultrasound signals.*
   Some gases (i.e. high-purity carbon dioxide, hydrogen, nitrogen, etc.) readily absorb ultrasound energy. In such a case, an **E1** error code message will appear on the display screen to indicate that the ultrasonic signal strength is insufficient for reliable measurements.
3. *The gas sound speed must not vary excessively.*
   The XGF868i will tolerate relatively large changes in the gas sound speed, as may be caused by variations in gas composition and/or temperature. However, such changes must occur slowly. Rapid fluctuations in the gas sound speed, to a value that is considerably different from that programmed into the XGF868i, will result in erratic or inaccurate flow rate readings. Refer to Chapter 2, *Initial Setup*, of the *Startup Guide* and make sure that the appropriate sound speed is programmed into the meter.

3.3.2 Pipe Problems

Pipe-related problems may result either from a failure to observe the installation instructions, as described in the *Startup Guide*, or from improper programming of the meter. By far, the most common pipe problems are the following:

1. *The collection of material at the transducer location(s).*
   Accumulated debris at the transducer location(s) will interfere with transmission of the ultrasound signals. As a result, accurate flow rate measurements are not possible. Realignment of the flowcell or transducers often cures such problems, and in some cases, transducers that protrude into the flow stream may be used. Refer to Chapter 1, *Installation*, of the *Startup Guide* for more details on proper installation practices.
2. *Inaccurate pipe measurements.*
   The accuracy of the flow rate measurements is no better than the accuracy of the programmed pipe dimensions. For a flowcell supplied by Panametrics, the correct data will be included in the documentation. For other flowcells, measure the pipe wall thickness and diameter with the same accuracy desired in the flow rate readings. Also, check the pipe for dents, eccentricity, weld deformity, straightness and other factors that may cause inaccurate readings. Refer to Chapter 2, *Initial Setup*, of the *Startup Guide* for instructions on programming the pipe data.

   In addition to the actual pipe dimensions, the path length (P) and the axial dimension (L), based on the actual

transducer mounting locations, must be accurately programmed into the flowmeter. For a Panametrics flowcell, this data will be included with the documentation for the system. If the transducers are mounted onto an existing pipe, these dimensions must be precisely measured. See Appendix C, *Measuring P and L Dimensions*, of the *Startup Guide* for a thorough discussion of this topic.

3. *Signal strength above 75.*
   The XGF868i is supplied with a signal preamplifier. However, this amplifier may not be necessary for high pressure applications. If the meter has a signal strength above 75, bypass the preamp and connect the coax cable directly to the transducers.

3.4 Transducer Problems

Ultrasonic transducers are rugged, reliable devices. However, they are subject to physical damage from mishandling and chemical attack. The most common transducer problems are listed below:

1. **LEAKS:** Leaks may occur around the transducer and/or the flowcell fittings. Repair such leaks immediately. If the leaking gas is corrosive, carefully check the transducer and cables for damage, after the leak has been repaired.
2. **CORROSION DAMAGE:** If the transducer material was not properly chosen for the intended application, the transducers may suffer corrosion damage. The damage usually occurs either at the electrical connector or on the transducer face. If corrosion is suspected, remove the transducer from the flowcell and carefully inspect the electrical connector and the transducer face for roughness and/or pitting. Any transducer damaged in this manner must be replaced. Contact Panametrics for information on transducers in materials suitable for the application.
3. **INTERNAL DAMAGE:** An ultrasonic transducer consists of a ceramic crystal bonded to the transducer case. The bond between the crystal and the case or the crystal itself may be damaged by extreme mechanical shock and/or temperature extremes. Also, the internal wiring can be corroded or shorted if contaminants enter the transducer housing.
4. **PHYSICAL DAMAGE:** Transducers may be physically damaged by dropping them onto a hard surface or striking them against another object. The transducer connector is the most fragile part and is most subject to damage. Minor damage may be repaired by carefully bending the connector back into shape. If the connector can not be repaired, the transducer must be replaced.

IMPORTANT: Transducers must be replaced in pairs. Refer to Chapter 2, Initial Setup, of the Startup Guide to program the new transducer data into the meter.

If the instructions in this section fail to resolve the problem, contact Panametrics for assistance.

Chapter 4. Parts Replacement

4.1 Introduction

The XGF868i has been designed to permit easy on-site upgrades and parts replacement. See *Figure 6 on page 29* for details of the standard XGF868i electronics enclosure assembly. The instructions in this chapter, along with a few common tools, are all that is required to perform the following tasks:

- Removing the circuit board assembly
- Replacing the LCD display/interconnect subassembly
- Replacing the fuse
- Replacing the User Program
- Installing an option card
- Assembling/installing the circuit board assembly



WARNING! **Prior to performing any maintenance procedures, be sure to disconnect the main power from the unit.If the XGF868i is installed in a hazardous environment, the electronics enclosure must be moved to a safe area prior to removing the covers. If the electronics enclosure cannot be moved to a safe area, ensure that the surrounding area is free of ignitable gases.**

IMPORTANT: For compliance with the EU Low Voltage Directive, this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

Use *Figure 6 on page 29*, *Figure 7 on page 30* and *Figure 8 on page 31* to locate the relevant components, while completing the service procedures discussed in this chapter.

IMPORTANT: Keep a detailed record of all parts installations and replacements performed on the XGF868i in Appendix A, Service Record. This service history will be helpful in diagnosing any future problems.

4.2 Removing the Circuit Board Assembly

All parts replacement procedures for the XGF868i require the removal of the *circuit board assembly* from the electronics enclosure. Therefore, complete the instructions in this section before attempting any other service tasks.

The XGF868i circuit board assembly consists of circular front and rear circuit boards with several rectangular circuit boards sandwiched between the circular end boards and oriented perpendicular to them. Specifically, some or all of the following circuit boards may be included in the assembly:

FRONT BOARDS:

- LCD Display/Interconnect Board Subassembly

REAR BOARD:

- Terminal Board

MIDDLE BOARDS:

- Main Board
- Receiver Board
- Power Supply Board
- Slot 1 Input/Output Card (optional)
- Slot 2 Logging/RS485 Card (optional)

To disassemble the circuit board assembly, refer to *Figure 6 on page 29* and complete the following steps:

1. Disconnect the power to the XGF868i and move the electronics enclosure to a safe area.

Note: *If the electronics enclosure cannot be moved to a safe area, be sure the surrounding area is free of ignitable gases before proceeding to step 2.*



WARNING! **The main power to the XGF868i must be disconnected before proceeding.**

2. Refer to *Illustration 1* in *Figure 6 on page 29* and loosen the set screw on the rear cover. Place a rod or long screwdriver across the cover in the slots provided, and rotate the cover counterclockwise until it comes free from the enclosure.
3. Repeat Step 2 to remove the front cover.
4. From the rear of the enclosure, disconnect the power line leads from terminal block TB5. Unplug terminal blocks TB1 to TB6 from connectors J1-J4.
5. Refer to *Illustration 2* in *Figure 6 on page 29*, and remove the *four* terminal board *mounting screws* and the ground screw. This will disconnect one end of the green *grounding jumper wire* and the *label plate* with the ground symbol will come loose from beneath it.

IMPORTANT: Each screw will have a flat washer and a lock washer installed. Be careful not to lose these washers.

6. Refer to *Illustration 3* in *Figure 6 on page 29*and carefully rotate the circuit board assembly counterclockwise about 20°, until the five bosses in the enclosure are visible through the slots along the circumference of the terminal board. Then, slowly push the circuit board assembly through the enclosure and remove it from the front of the enclosure.

Bring the circuit board assembly to a clean, safe work area and proceed to the appropriate section of this chapter to perform the desired service procedure.

4.3 Replacing the LCD Display/Interconnect Board Subassembly

The LCD display normally provides years of dependable service, but it is easily field-replaceable when necessary. To replace the LCD display, see *Figure 7 on page 30* for the component locations, and complete the following steps:

1. Complete the steps in "*Removing the Circuit Board Assembly" on page 22*.
2. Place the circuit board assembly on a flat surface with the LCD display board facing upward. See *Illustration 4* in *Figure 7 on page 30*, and remove the *three mounting screws* (with flat washers and lock washers) indicated.
3. Grasp the LCD display/keypad board/interconnect board subassembly at the top and bottom edges, and carefully pull it straight upward until it comes free from the main board and option boards. Refer to *Illustration 5* in *Figure 7 on page 30*. Remove two screws from the back of the interconnect board. Then hold the edge of the keypad board by one hand, and the edge of the LCD display/interconnect board by the other hand, and pull the two boards apart.

Note: *The two circuit boards are attached by a connector located beneath the top edge of the LCD display board (see Illustration 5 in* Figure 7 on page 30*). The LCD display is attached to the interconnect board as one subassembly.* Do not *disassemble the LCD display from the interconnect board.*

4. Place the keypad board directly over the new LCD display/interconnect board subassembly and align the J1 connector on the rear of the keypad board with the P6 pins on the interconnect board. Firmly, push the two boards together until the interconnect board contacts the two standoffs on the keypad board.
5. Secure the keypad board to the interconnect board with the two screws, flat washers and lock washers previously removed.
6. Firmly insert and seat the complete assembly by aligning the P4 connector on the interconnect board to the J4 connector on the main board and the P1 and P2 connectors to any option card (as applicable). Replace the three screws removed in step 2, while referring back to *Illustration 4* in *Figure 7 on page 30*.

Complete the LCD display/interconnect board subassembly replacement by proceeding to "*Installing the Circuit Board Assembly" on page 28*.

4.4 Replacing the Fuse

IMPORTANT: This procedure applies only to the fuse on the DC power supply. The fuse on the AC power supply is not field-replaceable; please contact Panametrics for replacement.

If the fuse in the XGF868i has been blown, complete the following steps to install a new fuse:

1. Complete the steps in "*Removing the Circuit Board Assembly" on page 22*.
2. Place the circuit board assembly on its side, with the terminal board on the left and the interconnect board on the right. Rotate the assembly until the power supply board is facing upward.
3. Locate the fuse along the left side of the power supply board, just below the terminal board (refer to *Illustration 6* in *Figure 7 on page 30*).
4. Pull the plastic cover off the fuse holder and remove the old fuse.
5. Obtain a new fuse of the same rating and type. Use only a type 3AG (1-1/4" x 1/4") Slo-Blo fuse, having a rating as indicated in *Table 4* below.

Table 4: Line Voltages & Fuse Ratings

Line Voltage	Fuse Rating
12-28 VDC	2.0 A, Slo-Blo
85-250 VAC	Not field replaceable (contact Panamtrics)

6. Press the new fuse into the fuse holder and reinstall the plastic fuse cover.

To complete the fuse replacement, proceed to "*Installing the Circuit Board Assembly" on page 28*.

Note: *Be sure to record the fuse replacement in Appendix A*, Service Record.

4.5 Replacing the User Program

The XGF868i's *User Program* is stored on an erasable programmable read only memory (EPROM) chip. The EPROM, which is designated as component **U6**, is mounted in a socket on the front of the main circuit board. EPROM replacement may be required to replace a defective chip or to upgrade to a newer software version.

To replace the *User Program*, refer to *Figure 7 on page 30* and complete the following steps:

1. Complete the steps in *"Removing the Circuit Board Assembly" on page 22*.
2. Place the circuit board assembly on a flat surface with the terminal board facing upward. See *Illustration 7* in *Figure 7 on page 30*, and remove the *three PCB mounting screws* (with flat washers and lock washers) indicated. This will also remove the green *grounding jumper*.
3. Locate and unscrew a fourth smaller bracket screw close to J2 on the terminal board, capturing the lock washer, flat washer and bracket nut on the back side. Then, carefully pull the *terminal board* away from the main board/power supply board assembly and option board.
4. Remove the two screws, flat washers, lock washers and heat sink in the corners of the power supply board (see *Illustration 8* in *Figure 7 on page 30*).

Note: *An XGF868i with a DC power supply will include two more mounting screws, but no heat sink.*

5. Carefully pull up the power supply board and heat sink assembly, then slide it out.

   The U6 EPROM is located along the upper edge of the main board, on the side that was facing the power supply board (see *Illustration 8* in *Figure 7 on page 30*). It is the only socketed chip on this board and it has a white identification label.
6. Using a chip puller, remove the EPROM from its socket. If a chip puller is unavailable, a straightened paper clip may be used in the notches at the upper right and lower left corners of the socket. Gently pry the EPROM up, a little at a time, at each notch until it comes free.



CAUTION! **The EPROM is easily damaged by static electricity. Before handling the new chip, touch a grounded metal object to discharge any built-up static electricity and avoid touching the leads on the side of the chip.**

7. Make sure that the beveled corner on the new EPROM is aligned with the beveled corner of the socket and place the EPROM into the socket.
8. By applying equal pressure on all four corners, gently press the EPROM into the socket until it is fully seated. Do not strike the EPROM or apply excessive force during this procedure.

Complete the *User Program* replacement by proceeding to *"Assembling the Circuit Board Assembly" on page 26*.

4.6 Installing an Option Card

The XGF868i flowmeter can accommodate up to two option cards. A communication card may be installed in **Slot 2** and a variety of I/O option cards are available for installation in **Slot 1**.

To install an option card, see *Illustrations 9, 10 and 11* in *Figure 8 on page 31* and complete the following steps:

1. Complete the steps in *"Removing the Circuit Board Assembly" on page 22*.
2. Remove the terminal board from the main board/power supply board subassembly by completing Steps 1-3 in *"Replacing the User Program" on page 25*.
3. Remove the screw from the angle bracket on the main board, as shown in *Illustration 11* in *Figure 8 on page 31*.

Note: *Do not lose the* nylon washer *located between the small* angle bracket *on the terminal board and the main board.*

4. If necessary, remove any option card (and optional I/O heat sink) currently in use.
5. There is a 36 pin connector (P2) and a 30 pin connector (P1) on the rear of the interconnect board. The option cards must be plugged into these connectors.
   a. To install a *communication card into Slot 2*, orient the option card so that its 36 pin connector is positioned over connector P2 on the interconnect board. Then, firmly seat the card into its connector. When properly installed, the side of the option card with the 36-pin connector must face the center of the interconnect board, and the edge of the option card must not overhang the edge of the interconnect board.
   b. To install an *I/O option card with optional heat sink into Slot 1*, orient the option card so that its 30 pin connector is positioned over connector P1 on the interconnect board. Then, firmly seat the card into its connector. When properly installed, the side of the option card with the 30-pin connector must face away from the center of the interconnect board, and the edge of the option card must not overhang the edge of the interconnect board. (However, the optional heat sink will extend beyond the edge.)

Note: *To attach an optional heat sink to an I/O option card, see "Attaching an Optional Heat Sink to an I/O Option Card" on page 26. When the XGF868i includes both an I/O board (Slot 1) and an option board (Slot 2), the two boards must be attached to each other with the hardware shown in* Illustration 10 *in* Figure 8 on page 31. *Pre-attach the nylon washer to the screw before inserting the boards into the assembly.*

4.6.1 Attaching an Optional Heat Sink to an I/O Option Card

If you need to attach an optional heat sink to an I/O option card (the TI, TR, FI or FR options in Appendix B of the *Startup Guide)*, refer to *Illustration 9* in *Figure 8 on page 31* and complete the following steps:

1. Orient the thermal heat pad(s) to the heat sink as shown in *Figure 8 on page 31* and apply it to the heat sink.
2. Loosely attach the aluminum backplate to the I/O heat sink with three screws, lock washers and flat washers.

Note: *The following step applies only to the TR and FR option cards. Otherwise, proceed to step 4.*

3. If you have an optional heat sink bridge, attach it to the I/O heat sink with two screws, lock washers, flat washers and nuts.
4. Attach the assembled heat sink by straddling the power supply components on the option card with the aluminum plate to the left (inside) and the heat sink to the right (outside).
5. Tighten the three screws (step 2) to secure the aluminum backplate to the heat sink.

Complete the option card installation by proceeding to *"Assembling the Circuit Board Assembly" on page 26*.

4.7 Assembling/Installing the Circuit Board Assembly

Most of the parts replacement procedures described in this chapter require removal of the circuit board assembly from the electronics enclosure. Furthermore, most of the procedures require varying degrees of disassembly of the circuit board assembly. See *Figure 8 on page 31* and follow the instructions in this section to assemble the circuit board assembly and/or to install it in the electronics enclosure.

4.7.1 Assembling the Circuit Board Assembly

If the circuit board assembly has been disassembled to any degree, complete the steps below. Otherwise proceed directly to *"Installing the Circuit Board Assembly" on page 28*. See *Figure 8 on page 31* and complete the following steps:

1. If necessary, replace the angle bracket on the main board, insert the screw (with flat washer and lock washer), and screw it into the standoff on the main board. See *Illustration 11* in *Figure 8 on page 31*.

IMPORTANT: The small angle bracket on the terminal board must be positioned on the outside of the main board with the previously removed nylon washer between them.

2. Face the *User Program* side of the main board toward the rear of the power supply board. Orient the boards so that the pins along the bottom of the main board align with connectors J2 and J6 on the power supply board, and push the two boards firmly together.

Note: *If the thermal gap filler pad of the power supply board has been damaged, you must remove and replace it before reinserting the power supply board. First, remove and discard the damaged pad. Then remove the blue protective liner from the new pad and apply it with the white face against the power supply board.*

3. Secure the power supply board and heat sink to the main board by reinstalling the screws, flat washers and lock washer previously removed from the corners of the power supply board. See *Illustration 11* in *Figure 8 on page 31*.

4. Refer back to *Illustration 7* in *Figure 7 on page 30*. Carefully align the terminal board onto the main board/power supply assembly and the two option boards (Slot 1 and Slot 2, where applicable), so that the connectors listed in *Table 5* below are facing each other. Then, firmly press the terminal board and the interconnect board toward each other until all of the connectors are completely seated.

Table 5: Mating Connectors for Terminal Board

	Terminal Board	Mating Board
1	J7 Connector (Large Three-Pin Connector Plug)	Power Tab on AC Power Supply Board
2	J6 Connector (Large Three-Pin Connector Plug)	Power Tab on DC Power Supply Board
3	P7 Connector	J7 Connector on Main Board
4	P10 Connector	J9 Connector on Main Board
5	P9 Connector	J10 Connector on Main Board
6	P8 Connector	J8 Connector on Main Board
7	P21 Connector	J1/J3 Connector on I/O Board, Slot 2 Option
8	P22 Connector	P2 Connector on I/O Board, Slot 1

IMPORTANT: With two option cards installed, it may require some patience to get all of the connectors properly aligned. Do not force the assembly together, or some of the pins may not enter the sockets properly.

5. Secure the assembly together by installing the three mounting screws, flat washers and lock washers previously removed from the terminal board. Be sure to install one end of the green grounding jumper wire under the screw indicated in *Illustration 7* in *Figure 7 on page 30*. The smaller screw should be used at the angle bracket location, and secured with a nut, lock washer and flat washer.

Proceed to the next section for instructions on installing the reassembled circuit board assembly in the electronics enclosure.

4.7.2 Installing the Circuit Board Assembly

Be sure that the circuit board assembly is completely assembled, as described in the previous section. Then, refer to *Illustrations 1, 2 and 3* in *Figure 6 on page 29* and install the circuit board assembly into the electronics enclosure as follows:

1. Slide the terminal board end of the circuit board assembly into the front of the electronics enclosure. By aligning the slots around the circumference of the terminal board with the bosses inside the enclosure, guide the circuit board assembly into the enclosure until the terminal board just clears the bosses at the rear of the enclosure (see *Illustration 3*).
2. From the rear of the enclosure, rotate the circuit board assembly about 20° clockwise so that the mounting holes in the terminal board are positioned over the tapped holes in the bosses. Secure the circuit board assembly to the enclosure with four mounting screws, flat washers and lock washers previously removed (see *Illustration 2*).

IMPORTANT: If the circuit board assembly is inserted too far into the enclosure, it cannot be rotated properly.

3. Attach the loose end of the green grounding jumper wire to the enclosure with the mounting screw, flat washer and lock washer previously removed. Be sure to install the metal label plate under this screw (see *Illustration 2*).
4. From the rear of the enclosure, connect the power line leads to terminal block TB5. Plug the connectors back into terminal blocks J1-J4. If necessary, see Chapter 1, *Installation*, of the *Startup Guide* for detailed wiring instruction.
5. Install the front and rear covers on the electronics enclosure and secure them in place with the set screws provided (see *Illustration 1*).

The XGF868i is now ready to be placed back into service. Before taking measurements, refer to Chapter 2, *Initial Setup*, of the *Startup Guide* and Chapter 1, *Calibration*, of this manual for instructions on properly setting up the meter for accurate flow rate measurements.

Note: *Be sure to enter a complete and detailed account of any parts replacement performed on the XGF868i in Appendix A,* Service Record*.*

To purchase the parts mentioned in this chapter or any items not specifically discussed, contact Panametrics for assistance. To make sure the proper components are obtained, be sure to include the *serial number* of your XGF868i when you place your parts order.

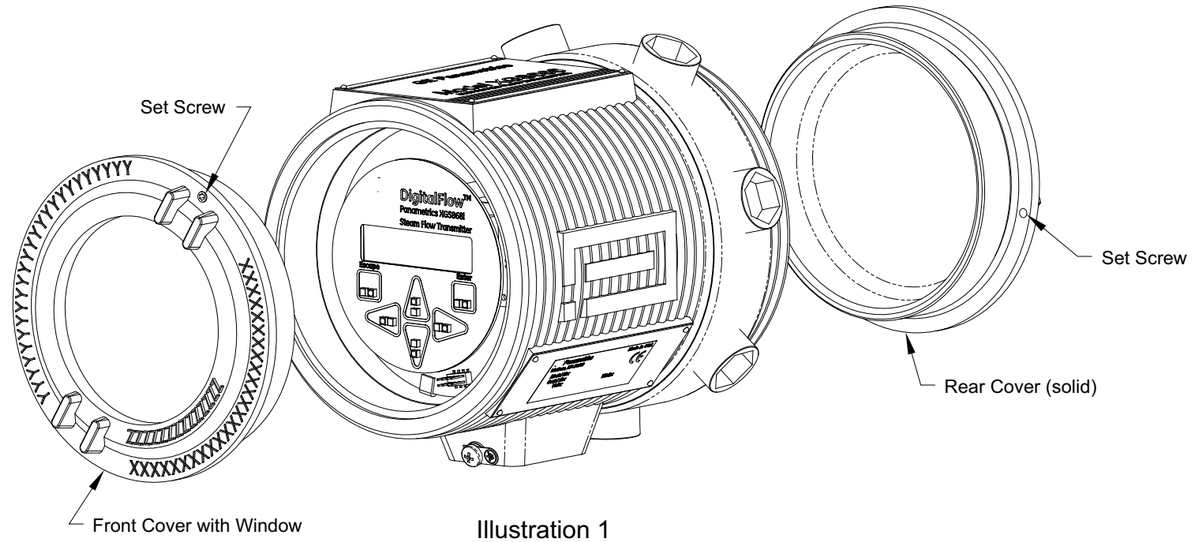


Illustration 1

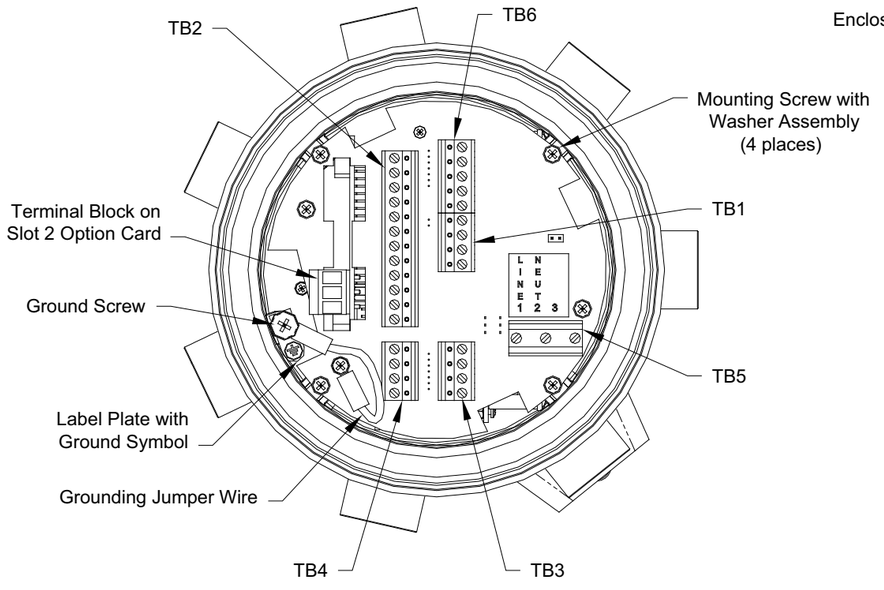


Illustration 2

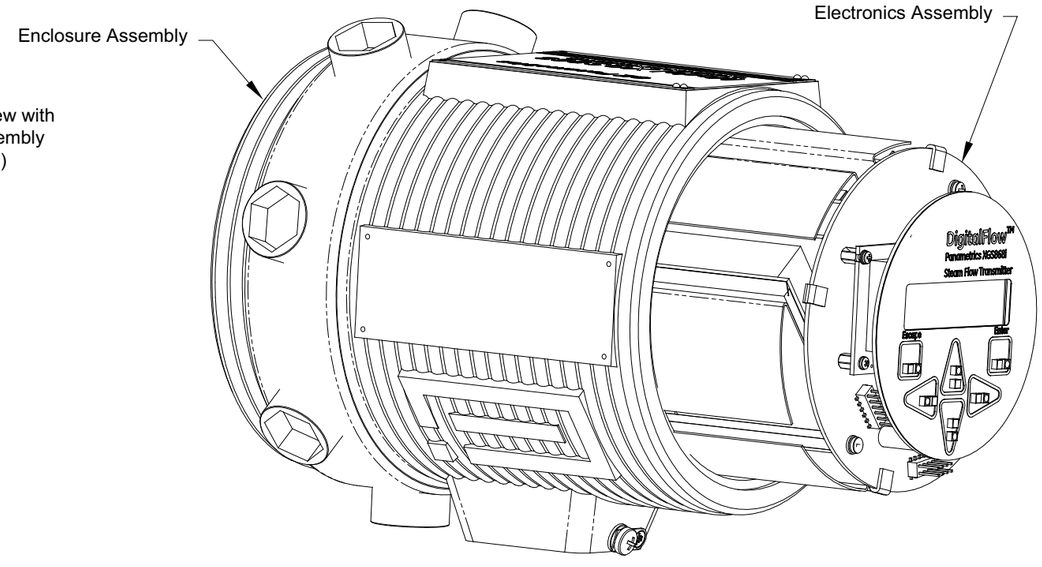


Illustration 3

Figure 6: Model XGF868i Electronics Console Assembly

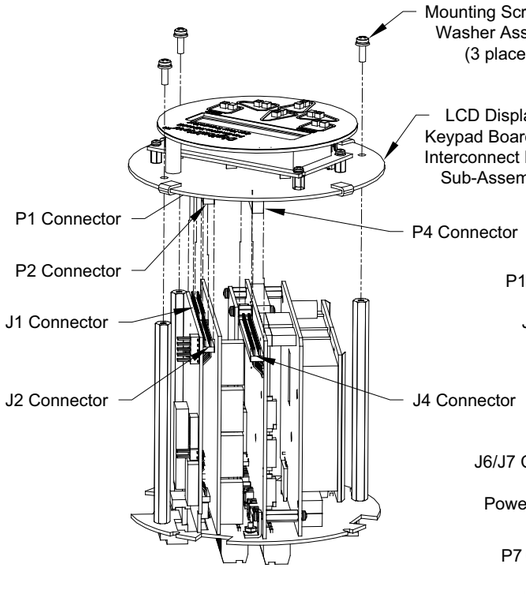


Illustration 4

(shown with heatsinks removed for clarity)

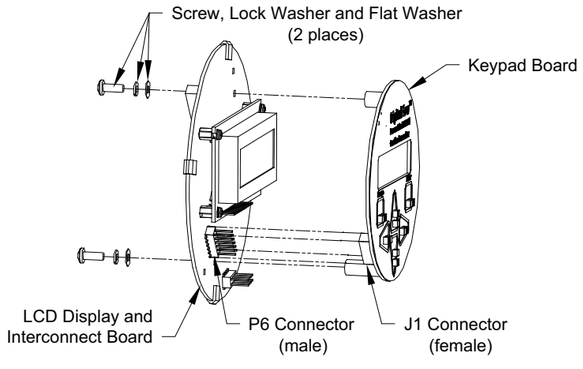


Illustration 5

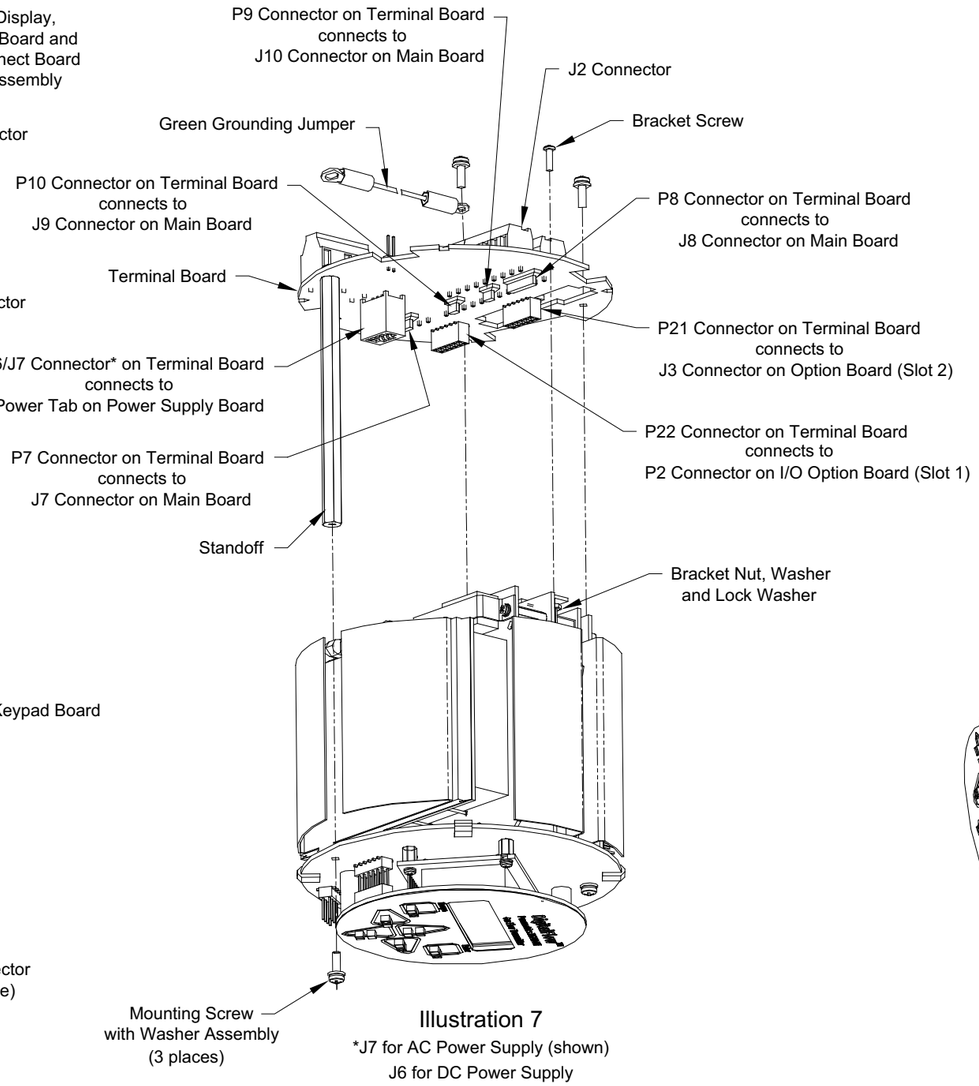


Illustration 7

*J7 for AC Power Supply (shown)

J6 for DC Power Supply

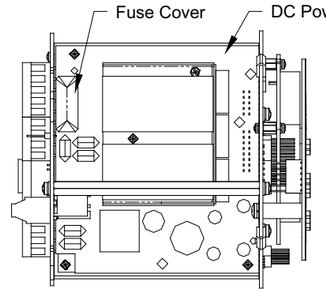


Illustration 6

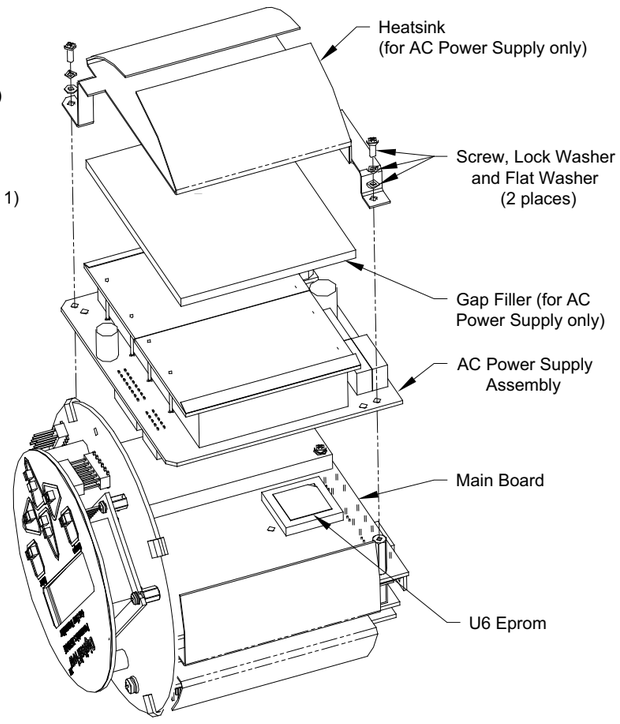


Illustration 8

(shown with AC Power Supply) Note: There are no Heat Sink and Gap Fillers with a DC Power Supply.

Figure 7: Model XGF868i LCD Display/Interconnect Board Subassembly

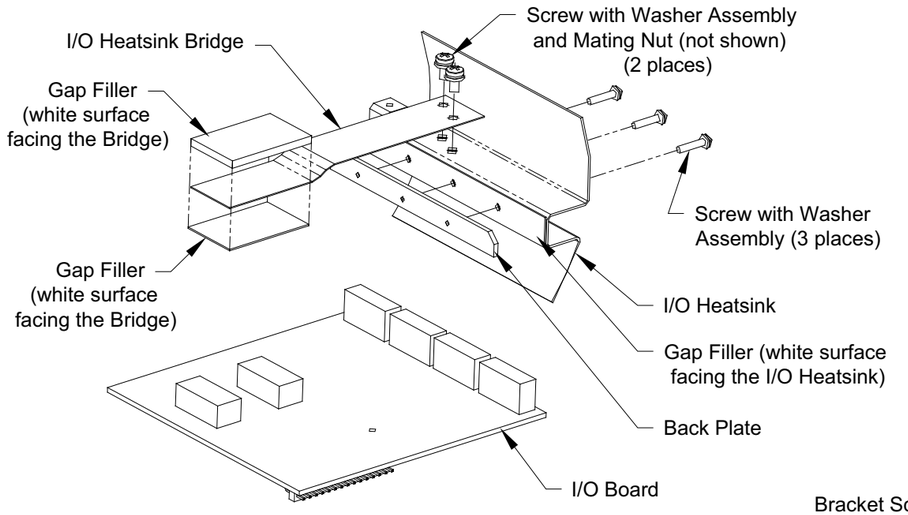


Illustration 9

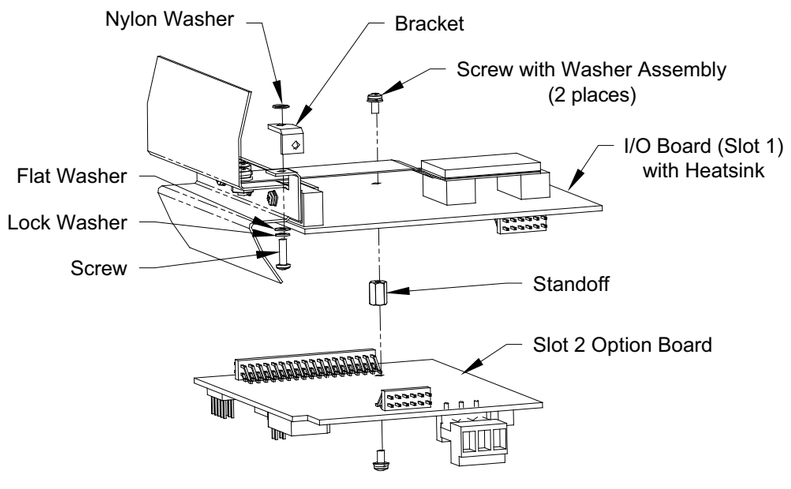


Illustration 10

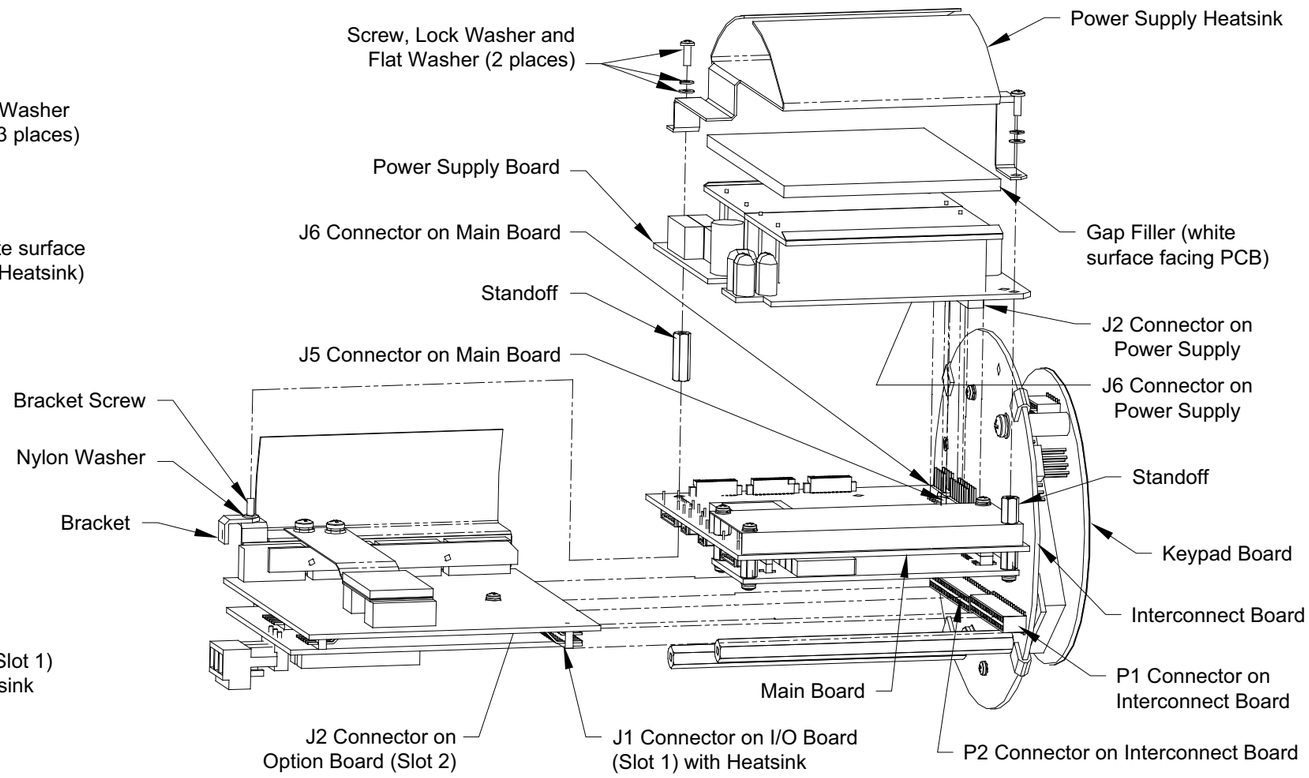


Illustration 11

Figure 8: Model XGF868i I/O Option Card Subassembly

[no content intended for this page]

Appendix A. Service Record

A.1 Introduction

Whenever any service procedure is performed on the XGF868i flow transmitter, the details of the service should be recorded in this appendix. An accurate service history of the meter can prove very helpful in troubleshooting any future problems.

A.2 Data Entry

Record complete and detailed service data for the XGF868i in *Table 6* below. Make additional copies of the table as needed.

Table 6: Data Entry

Date	Description of Service	Performed By

Table 6: Data Entry

Date	Description of Service	Performed By

A.3 Diagnostic Parameters

After a successful initial installation of the XGF868i and whenever any system malfunction is noticed, the values for the diagnostic parameters should be entered in *Table 7* below.

Table 7: Diagnostic Parameters

Parameter	Initial	Current	Parameter	Initial	Current
SS up			CNTdn		
SS do			P#up		
SNDSP			P#dn		
Tup			TEMP		
Tdown			PRESR		
DELTA			AcVOL		
Mw			StVOL		
REYN#			Tu S[1]		
Tot K			Td S[1]		
PEAK%			DT S[1]		
Qup			Tu M[1]		
Qdown			Td M[1]		
AMPup			DT M[1]		
AMPdn			Vinst		
CNTup					

[1]available only if Burst Mode = S/M

[no content intended for this page]

Appendix B. Calibration and Testing with PanaView

B.1 Introduction

This appendix explains how to calibrate the XGF868i analog outputs and inputs using PanaView™ interface software. In addition, testing the optional totalizer, frequency and alarm relay outputs, and XGM868i hardware and software is discussed. The appendix includes the following specific topics:

- Calibrating the Slot 0 analog outputs
- Calibrating option card analog outputs
- Calibrating option card analog inputs and RTD inputs
- Testing option card alarm relays
- Testing option card totalizer and frequency outputs
- Uploading XGF868i signal array data and memory data
- Testing the EPROM, RAM and DAC
- Setting the number of channels
- Resetting the XGF868i to default values

The XGF868i electronics enclosure includes one slot for installation of an input/output option card. This slot is designated as Slot 1, and a variety of option cards are available. In addition, every XGF868i flowmeter includes two built-in analog outputs (A and B) at terminal block J1, which is designated as Slot 0.

Note: *Convention in this manual identifies any expansion slot as* Slot X, *where* X *is a number from 0-2.* Slot 2 *is used only for communication cards.*

See Chapter 1, *Installation*, and Appendix B, *Data Records*, in the *Startup Guide* for a complete description of the available option cards and the procedures for wiring them.

B.2 Accessing the Calibration/Test Menu

The *Calibration/Test* menu is accessed through the *New Meter Browser* menu of PanaView software. Use this menu to calibrate and test the Slot 0 analog outputs, as well as to calibrate and/or test any option cards that are installed in expansion Slot 1. Refer to the menu maps in *Figure 3 on page 9* as a guide in following the calibration instructions.

IMPORTANT: *Before you attempt to communicate with the XGF868i, be sure you have linked your PC to the XGF868i via an RS232 interface. For details on wiring the interface, refer to* Wiring the Serial Port *in the* Startup Guide*, and to the document* EIA-RS Serial Communications *(916-054). You must also install PanaView, as discussed in the* PanaView User's Manual *(910-211).*

1. Power up the XGF868i and wait until it has initialized.
2. Launch PanaView and wait until it initializes the XGF868i and displays the basic PanaView window.
3. As described in the *PanaView User's Manual,* open the *Meter Browser* window and highlight the XGF868i.
4. Expand the *Edit Functions* option. A window now appears similar to that shown in *Figure 9* below.

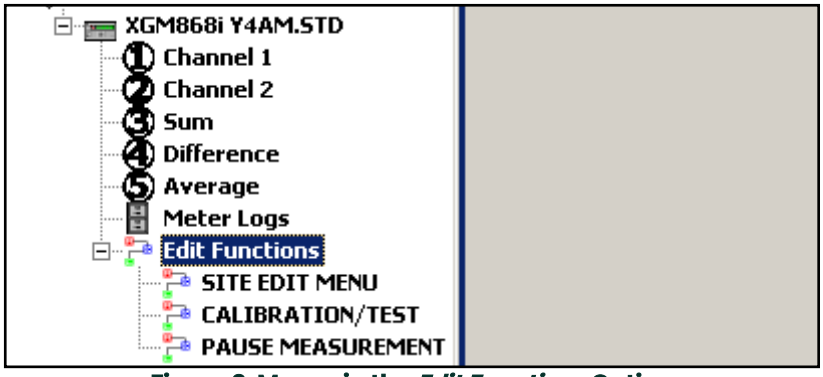


Figure 9: Menus in the *Edit Functions* Option

5. To enter data into the user program, double-click on the *Calibration/Test* menu. The window appears similar to *Figure 10* below.

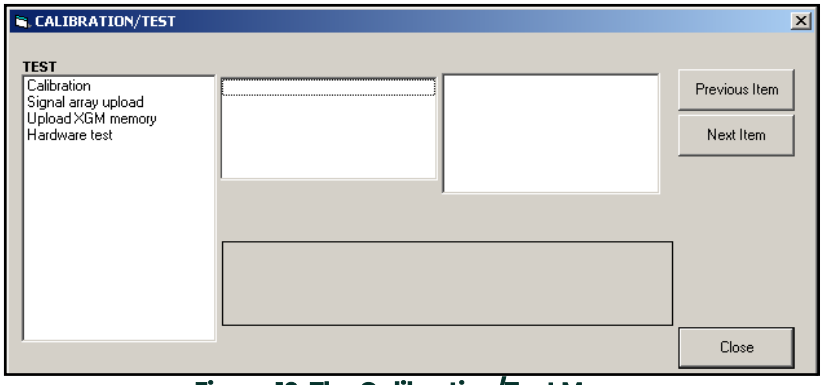


Figure 10: The Calibration/Test Menu

Proceed to the appropriate sections of this appendix to calibrate or test any of the installed inputs or outputs.

B.3 Calibrating Slot 0 Analog Outputs

Every XGF868i flowmeter includes two built-in analog outputs (A and B) at terminal block J1, which is designated as Slot 0. Both the zero-point and full-scale values for each output must be calibrated. After calibrating the outputs, which have a resolution of 5.0 μA (0.03% full scale), their linearity should be tested.

Note: *The zero point of the analog output may be set for either 0 mA or 4 mA. However, the calibration procedure always uses the 4 mA point, as the meter will extrapolate this value to obtain the 0 mA point.*

Prepare for calibration by inserting an ammeter in series with the load on analog output A at terminal block J1, as shown in *Figure 11* below.

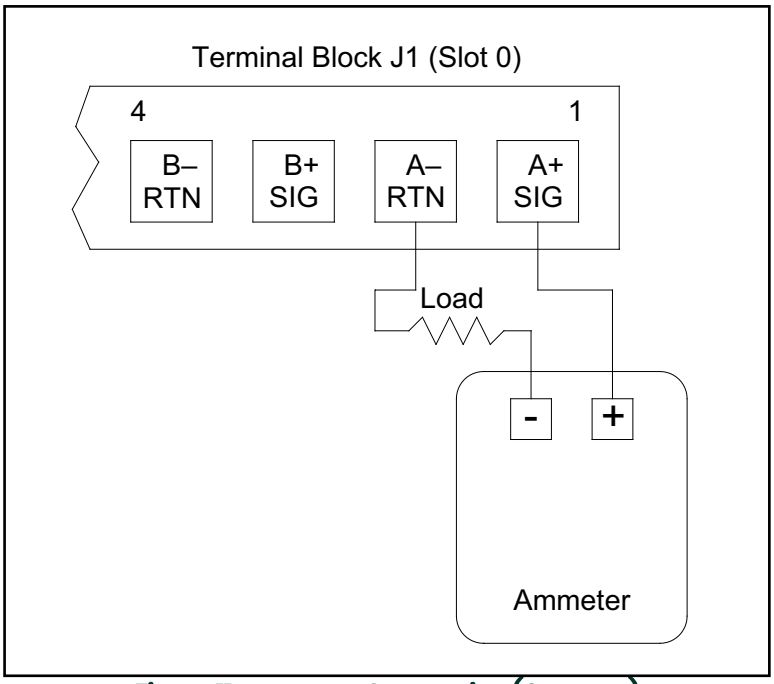


Figure 11: Ammeter Connection (Output A)

1. From the *Calibration/Test* menu (see *Figure 10 on page 38*), double-click on the *Calibration* entry to open the option.
2. In the center pane, double-click on *Slot 0*.

Note: *The* Slot 1 *option only appears in the center pane if an option card has been installed in this slot.*

3. Double-click on either *Output A* or *Output B* to open the *Analog Output* menu. (Output A will be used as an example in this manual.)

IMPORTANT: *The procedure for calibrating* Output B *is identical to that for calibrating* Output A. *However, when calibrating* Output B, *be sure to reconnect the ammeter on terminal block* J1. *See* Figure 11 on page 39 *for the correct pin numbers.*

4. Double-click on *4 milliamps* to calibrate the low end of the output range.
5. Double-click on *4 mA UP* or *4 mA DOWN* to adjust the ammeter reading UP or DOWN, until a 4 mA reading is achieved, or ₀ouble-click on *4 mA Numer,* and directly enter the mA reading in the right pane.
6. Once you have achieved a 4 mA reading, double-click on either *4 mA STORE* to store the calibration, or on *4 mA ABORT* to exit the menu without storing the calibration.

Note: *If the ammeter reading cannot be adjusted within 5.0 μA of the 4 or 20 mA setting, contact the factory for assistance.*

7. PanaView returns to the *Analog Output* window. Double-click on *20 milliamps*, and repeat steps 5 and 6 to calibrate the high end of the output range.

Note: *Skip the following prompt, if linearity testing of the output will not be performed at this time.*

8. Double-click on *% Test* to test the linearity of the currently selected analog output.
9. Check the ammeter reading at *50% output*. Then, enter a different *output* (0-100%) and double-click on *percent*. Check the ammeter reading at this setting and click [Exit Page] when done.

Table 8 on page 40 lists the expected ammeter readings at various *% Full Scale* settings, for both 4-20 mA and 0-20 mA scales. Refer to this table to verify the accuracy of the ammeter readings taken above.

Table 8: Expected Ammeter Readings

% Full Scale	4-20 mA Scale*	0-20 mA Scale*
0	4.000	0.000
10	5.600	2.000
20	7.200	4.000
30	8.800	6.000
40	10.400	8.000
50	12.000	10.000
60	13.600	12.000
70	15.200	14.000
80	16.800	16.000
90	18.400	18.000
100	20.000	20.000
* all ammeter readings should be ±0.005 mA		

If the linearity test readings are not within 5 μA of the values listed in *Table 8* above, check the accuracy and wiring of the ammeter. Then, repeat the low and high end calibrations. If the analog output still does not pass the linearity test, contact the factory for assistance.

10. Double-click on *Exit Function* to return to the *Calibration* menu. Then choose another output to calibrate or click on [Exit Page] to leave the *Calibration/Test* menu.

This completes calibration of the Slot 0 analog outputs. Proceed to the appropriate section to calibrate additional inputs/outputs.

B.4 Calibrating Slot 1 Option Cards

To calibrate any option card installed in Slot 1 of the XGF868i, enter the *Calibration/Test* menu as shown in *Figure 10 on page 38*.

1. In the center pane, double-click on *Slot 1*.

Note: *The* Slot 1 *option only appears in the center pane if an option card has been installed in this slot.*

Notice that all of the available outputs (usually four) appear at the above prompt. The desired type of output may appear as the A and B output pair and/or as the C and D output pair. Simply select the appropriate output for calibration and/or testing. For clarity in this chapter, the desired outputs are always placed in the A and B positions, and the C and D positions are not specifically listed. In addition, Output A is always used as an example. Proceed to the appropriate sub-section for specific instructions, and substitute the correct output letter for the "A" shown in the procedures.

B.4.1 Analog Outputs

Additional analog outputs may be added to the XGF868i by installing an appropriate option card in Slot 1. This option card contains two or four analog outputs, which are designated as A, B, C and D. Both the zero-point and full-scale values for each output must be calibrated. After calibrating the outputs, which have a resolution of 5.0 μA (0.03% full scale), their linearity should be tested.

Note: *The zero point of the analog output may be set for either 0 mA or 4 mA. However, the calibration procedure always uses the 4 mA point, as the meter will extrapolate this value to obtain the 0 mA point.*

Prepare for calibration by inserting an ammeter in series with the load on Output A of the option card. See *Figure 4 on page 10* to identify the OUT(+) and RTN(–) pins for Output A on terminal block J2.

2. Double-click on either *Output A* or *Output B* to open the *Analog Output* menu. (Output A will be used as an example in this manual.)

IMPORTANT: *The procedure for calibrating* Output B *is identical to that for calibrating* Output A. *However, be sure to reconnect the ammeter on terminal block* J2. See Figure 4 on page 10 *for the correct pin numbers.*

3. Double-click on *4 milliamps* to calibrate the low end of the output range.
4. Double-click on *4 mA UP* or *4 mA DOWN* to adjust the ammeter reading UP or DOWN, until a 4 mA reading is achieved, or double-click on *4 mA Numeric Cal,* and directly enter the mA reading in the right pane.
5. Once you have achieved a 4 mA reading, double-click on either *4 mA STORE* to store the calibration, or on *4 mA ABORT* to exit the menu without storing the calibration.

Note: *If the ammeter reading cannot be adjusted within 5.0 μA of the 4 or 20 mA setting, contact the factory for assistance.*

6. PanaView returns to the *Analog Output* window. Double-click on *20 milliamps*, and repeat steps 3 through 5 to calibrate the high end of the output range.

Note: *Skip the following prompt, if linearity testing of the output will not be performed at this time.*

7. Double-click on *% Test* to test the linearity of the currently selected analog output.
8. Check the ammeter reading at *50% output*. Then, enter a different *output* (0–100%) and double-click on *percent*. Check the ammeter reading at this setting and press [Exit Page] when done.

Table 8 on page 40 lists the expected ammeter readings at various *% Full Scale* settings, for both 4-20 mA and 0-20 mA scales. Refer to this table to verify the accuracy of the ammeter readings taken above. If the linearity test readings are not within 5 μA of the values listed in the table, check the accuracy and wiring of the ammeter. Then, repeat the low and high end calibrations. If the analog output still does not pass the linearity test, contact the factory for assistance.

Click [Exit Page] to return to the *Slot 1* window and calibrate additional inputs/outputs, or click [Exit Page] again to close the *Calibration/Test* menu.

B.4.2 Analog Inputs

Analog inputs may be added to the XGF868i by installing an appropriate option card in Slot 1. This option card contains two or four analog inputs, which are designated as A, B, C and D. Both the zero-point and full-scale values for each input must be calibrated.

Calibration of the analog inputs requires the use of a calibrated current source. If an independent calibrated current source is not available, one of the Slot 0 analog outputs may be used for the calibration. During the analog input calibration, the Slot 0 analog output will supply the low reference, high reference, 4 mA and 20 mA signals at the appropriate times.

IMPORTANT: *If a* Slot 0 *analog output will be used to calibrate the analog inputs, the* Slot 0 *analog output calibration procedure must be completed first.*

Prepare for the calibration procedure by connecting a Slot 0 analog output (or independent calibrated current source) to Input A of the option card. See Figure 4 on page 10 to identify the IN(+) and RTN(-) pins for Input A on terminal block J2.

Note: *The zero point of the analog input may be set for either 0 mA or 4 mA. However, the calibration procedure always uses the 4 mA point, as the meter will extrapolate this value to obtain the 0 mA point.*

1. In the center pane of the *Calibration/Test* window, double-click on *Slot 1*.
2. Double-click on the desired input to open the *Analog Input* menu (Input A is used as an example in this manual).

IMPORTANT: *Calibrating* Inputs B, C or D *is identical to calibrating* Input A. *However, be sure to reconnect the current source on terminal block* J2. *Refer to* Figure 4 on page 10 *for the correct pin numbers.*

3. Double-click on the appropriate option to select the reference point to be calibrated.

Proceed to the corresponding sub-section for specific instructions on each of the options available in step 3.

B.4.2.1 4 mA Option

Set the calibrated current source to 4 mA.

- If you selected the *4 mA* option in the *Analog Input* menu, double-click on *Store* to accept the current 4 mA value or on *Abort* to cancel the entry. In either case, the Analog Input prompt reappears.

B.4.2.2 20 mA Option

Set the calibrated current source to 20 mA.

- If you selected the *20 mA* option in the *Analog Input* menu, double-click on *Store* to accept the current 20 mA value or on *Abort* to cancel the entry. In either case, the Analog Input prompt reappears.

Click [Exit Page] to return to the *Slot 1* window and calibrate additional inputs/outputs, or click [Exit Page] again to close the *Calibration/Test* menu.

B.4.3 RTD Inputs

RTD inputs may be added to the XGF868i by installing an appropriate option card in Slot 1. This option card contains two or four RTD inputs, which are designated as A, B, C and D. Both the set and slope temperature values for each input must be calibrated.

Calibration of the RTD inputs requires the use of a calibrated RTD source.

IMPORTANT: *If a* Slot 0 *analog output will be used to calibrate the analog inputs, the* Slot 0 *analog output calibration procedure must be completed first.*

Prepare for the calibration procedure by connecting an independent calibrated RTD source to the desired input of the option card. See *Figure 4 on page 10* to identify the RTD (+) and COM(-) pins for Input A on terminal block J2.

1. In the center pane of the *Calibration/Test* window, double-click on *Slot 1*.
2. Double-click on the desired input to open the *RTD Calibration* menu.

IMPORTANT: *The procedure for calibrating* each input is identical*. However, be sure to reconnect the temperature reference on terminal block* J2. See Figure 4 on page 10 *for the correct pin numbers.*

Proceed to the corresponding sub-section for specific instructions on each of the options shown above.

B.4.4 Entering the Set Point

1. Before proceeding, place the RTD in a temperature bath and allow it to stabilize at the desired set point temperature. If you have connected the RTD to an RTD simulator, set the RTD simulator to the low temperature value.
2. Double-click on *Set t*o program the RTD set point.
3. In the right pane, enter the desired set point temperature and click [Next Item].
4. Double-click on *STORE* to accept the new set point value or *ABORT* to cancel the entry.

B.4.5 Entering the Slope

1. Place the RTD in a temperature bath and allow it to stabilize at the desired slope point temperature. If you have connected the RTD to an RTD simulator, set the RTD simulator to the high temperature value.
2. Double-click on *Slope* to program the RTD slope point.
3. In the right pane, enter the desired slope point temperature and click [Next Item]
4. Double-click on *STORE* to accept the new slope point value or *ABORT* to cancel the entry.

Click [Exit Page] to return to the *Slot 1* window and calibrate additional inputs/outputs, or click [Exit Page] again to close the *Calibration/Test* menu.

B.4.6 Testing Frequency Outputs

Frequency outputs may be added to the XGF868i by installing an appropriate option card in Slot 1. This option card contains two or four frequency outputs, which are designated A, B, C and D.

Prepare for the testing procedure by connecting a frequency counter to Output A of the option card. See *Figure 2 on page 7* for frequency output wiring, and *Figure 4 on page 10* to identify the OUT(+) and RTN(-) pins for Output A on terminal block J2.

1. In the center pane of the *Calibration/Test* window, double-click on *Slot 1*.
2. Double-click on the desired output to open the *Frequency Output* menu. (Output A will be used as an example in this manual.)

IMPORTANT: *The procedure for testing* Outputs B, C or D *is identical to that for testing* Output A. *However, be sure to reconnect the frequency counter on terminal block* J2. *See* Figure 4 on page 10 *for the correct pin numbers.*

3. At the *Frequency* prompt, enter a frequency (between 1 and 10,000 Hz) and click [Next Item]. Verify that the frequency counter reads the correct value.
4. Repeat steps 2 and 3 to test all of the available frequency outputs. If any of the frequency outputs fails the test, contact Panametrics for assistance.

Click [Exit Page] to return to the *Slot 1* window and calibrate additional inputs/outputs, or click [Exit Page] again to close the *Calibration/Test* menu.

B.5 Testing the XGF868i Software and Hardware

In addition to calibration procedures for input and output cards, the *Calibration/Test* menu offers tests for XGF868i hardware and procedures for uploading the signal array data and the XGM868i memory contents into PC files for examination. To test the XGF868i hardware and software:

1. Open the *Meter Browser* window and highlight the XGF868i.
2. Expand the *Edit Functions* option. The window now appears similar to that shown in *Figure 9 on page 38*.
3. Double-click on the *Calibration/Test* menu. The window appears similar to *Figure 10 on page 38*.

Proceed to the appropriate section to upload data and test hardware.

B.5.1 Uploading the Signal Array Data

By uploading XGF868i signal array data for examination, a user can check if the transducer signal is the proper shape, and change setup parameters if necessary.

IMPORTANT: *Consult with Panametrics before using this data to change any parameters.*

1. In the *Calibration/Test* menu, double-click on the *Signal Array Upload* option.
2. Double-click on the desired *Channel*.
3. The next prompt asks for the specific *Array to Load.* Five choices are available:
   - Raw UP (Upstream) Signal
   - Raw DOWN (Downstream) Signal
   - CFUNC UP (Correlation Function Upstream)
   - CFUNC DOWN (Correlation Function Downstream)
   - CCFUNC (Cross-Correlation Function)

Double-click on the desired array.

4. PanaView now offers two options for *Uploading* the array data.
   - If you double-click on *To Display*, the right pane of the window appears similar to *Figure 12* below, and the data is available for immediate evaluation. Click [Exit Page] to close the window and return to the *Calibration/Test* menu.

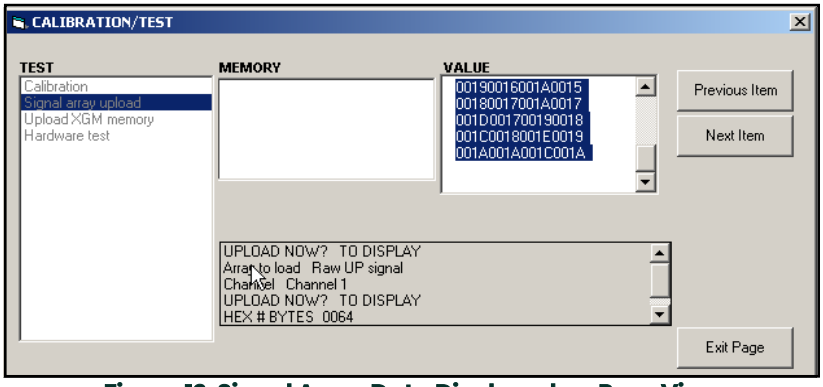


Figure 12: Signal Array Data Displayed on PanaView

   - If you double-click on *To File*, another window opens similar to *Figure 13* below. Enter a file name and click [Save]. PanaView stores the array data in a Windows file, and closes the *Calibration/Test* window.

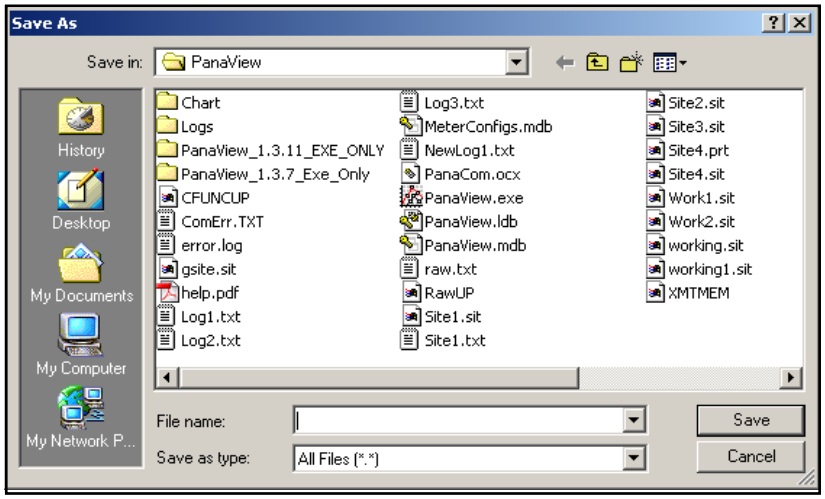


Figure 13: Saving Signal Array Data to File

B.5.2 Uploading the XGF868i Memory

IMPORTANT: *This option is for factory use only.*

The *Upload XGM Memory* option is another diagnostic tool.

IMPORTANT: *Consult with Panametrics before using this data to change any parameters.*

1. In the *Calibration/Test* menu, double-click on the *Upload XGM Memory* option.
2. The first prompt shows the *Hex Start Address*. Click [Next Item].
3. The next prompt displays the value for the *Hex # Bytes*. Click [Next Item].
4. PanaView now offers two options for *Uploading* the XGM memory.
   - If you double-click on *To Display*, the right pane of the window appears similar to *Figure 14* below, and the data is available for immediate evaluation. Click [Exit Page] to close the window and return to the *Calibration/Test* menu.

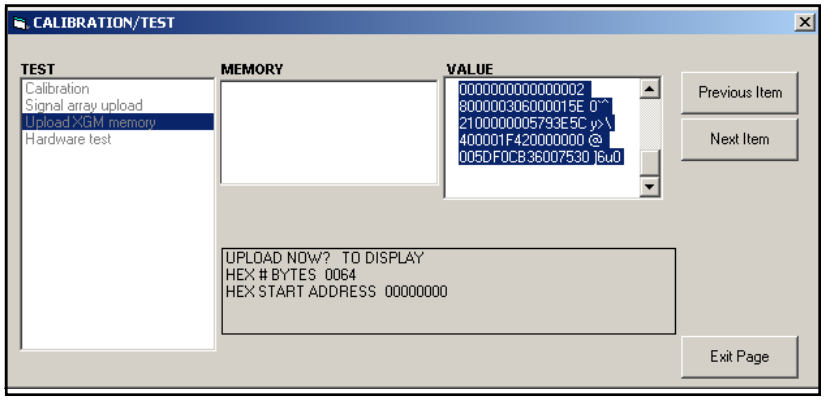


Figure 14: XGF868i Memory Data Displayed on PanaView

   - If you double-click on *To File*, the *Save As* window (similar to *Figure 13 on page 47*) opens. Enter a file name and click [Save]. PanaView stores the array data in a Windows file, and closes the *Calibration/Test* window.

B.5.3 Testing the XGF868i Hardware

Using PanaView, you can check crucial elements of the XGF868i hardware: the EPROM, the NVR, the RAM, FIFO, and the DAC. You can also:

- Program and test optional cards
- Read site checksums and calibration values
- Test and set the contrast for the LCD
- Set the number of channels (either 1 or 2)
- Re-initialize the XGF868i to its default values

IMPORTANT: *Contact Panametrics if the XGF868i fails any of the tests in the following sections.*

B.5.3.1 EPROM Test

To test the EPROM from the *Calibration/Test* menu:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *EPROM TEST*.
3. The right pane displays the *EPROM Sum Value*. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.2 NVR Test

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.

Note: *If you are in the Hardware Test option, skip to step 2.*

2. In the center pane, double-click on *NVR TEST*.
3. A message in the right pane cautions that the test will take several minutes, and that interrupting the test may corrupt the memory. Click [Next Item] to continue the test.
4. If the NVR passes the test, the screen appears similar to *Figure 15* below. Click [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

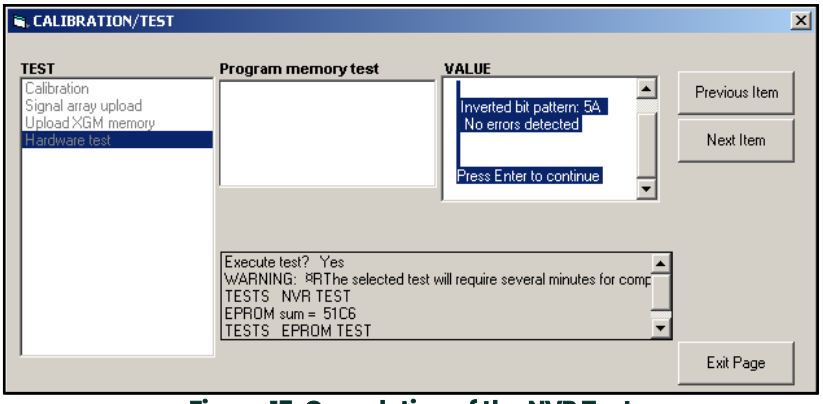


Figure 15: Completion of the NVR Test

B.5.3.3 RAM Test

To check the RAM:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *RAM TEST*.
3. The right pane displays the *RAM Value,* along with an indication as to whether the RAM is functioning. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.4 FIFO Test

To check the FIFO:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *FIFO TEST*.
3. In the right pane, a message lists the desired number of bits, along with the approximate bias and the average sample. Click [Next Item] to perform the test and return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.5 LCD Test

To test the LCD:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *LCD TEST*.
3. The LCD display flashes three times, while a message in the PanaView right pane displays the test values. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.6 LCD Contrast

To change the LCD contrast:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *LCD CONTRAST*.
3. Double-click on *Darken* or *Lighten* to shift the LCD contrast.
4. When you have achieved the desired contrast, double-click on *Store* to save the contrast or on *Abort* to return to the *Hardware Test* menu without changing the contrast.

B.5.3.7 DAC Test

To test the DAC (digital to analog converter):

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test w*indow, double-click on *Hardware Test*.
2. In the center pane, double-click on *DAC TEST*.
3. The center pane indicates whether or not the *Zero Scale* is functioning. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.8 Site Checksums

To display the site checksums:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *SITE CHECKSUMS*.
3. The right pane displays a list of site checksum values. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.9 Calibration Values

To display the calibration values:

Note: *If you are in the Hardware Test option, skip to step 2.*

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *CALIBRATION VALUES*.
3. The right pane displays a list of DAC calibration values. Click [Next Item] or [Exit Page] to return to the *Hardware Test* option, and [Exit Page] again to return to the main *Calibration/Test* menu.

B.5.3.10 Programming an Optional Card EEPROM

To program the EEPROM for an optional card:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *PROG OPCARD EEPROM*.
3. To enable you to *Choose an Opcard*, the center pane displays a list of possible option cards. Scroll to and double-click on the type of card installed.
4. The program asks for the *Board Revision*. Enter the revision letter in the right pane, and click [Next Item].
5. The next prompt asks for the *Group #*. Enter the appropriate value, and click [Next Item].
6. The next prompt asks for the *Special Mod#*. Enter the appropriate value, and click [Next Item].
7. The program now asks for the *Month*. Scroll to and double-click on the desired month.
8. The next prompt asks for the *Day*. Enter the desired value (from 1 to 31), and click [Next Item].
9. The next prompt asks for the *Year*. Enter the appropriate value, (from 2002 to 2089) and click [Next Item].
10. The final prompt asks for the *Serial #*. Enter the appropriate value, and click [Next Item].
11. The right pane now displays the programmed *Header Information*. When you have reviewed the data, click [Next Item] or [Exit Page] to return to the *Hardware Test* option.

B.5.3.11 Reading an Optional Card EEPROM

To read the data of the EEPROM for an optional card:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *READ OPCARD EEPROM*.
3. Double-click on the *Slot* (1 or 2) that holds the optional card.
4. The right pane lists the *Header Information*. When you have reviewed this data, click [Next Item].
5. The right pane now shows *Calibration Values*. When you have reviewed this data, click [Next Item].
6. The right pane now shows *RTD Calibration Values*.When you have reviewed this data, click [Next Item] or [Exit Page] to return to the *Hardware Test* option.

B.5.3.12 Setting the Number of Channels

To set the number of XGF868i channels for display:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *Set #Chans*.
3. In the *Number of Channels* window, double-click on *1* or *2 Channels*. PanaView returns to the *Hardware Test* option. Click [Exit Page] to return to the main *Calibration/Test* menu, and [Close] to exit the *Calibration/Test* menu.

B.5.3.13 Initializing the XGF868i to Default Values

To restore the XGF868i to its original default values:

1. From the left pane of the *Calibration/Test* window, double-click on *Hardware Test*.
2. In the center pane, double-click on *Initialize Meter*.
3. The right pane displays a *Warning* that all application parameters must be reentered after initialization. Click [Next Item] to continue, or [Exit Page] to return to the *Hardware Test* option.
4. In the center pane, double-click on *Yes* to *Reset Meter*, or on *No* to leave the XGF868i in its current state. If you select *Yes*, the XGF868i returns to its default settings, and PanaView exits the *Calibration/Test* menu.

Note: *When you first initialize the XGF868i, the number of LCD parameters is set to OFF. You must program the LCD to display any measured parameters.*

1. In the *Edit Functions* menu, double-click on the *Site Edit Menu.*
2. In the *Site Edit Menu*, double-click on the Global entry, and then on the Input/Output option.
3. From the Input/Output option, highlight and double-click on the *Display* option in the center pane.
4. The first prompt asks for the *# of LCD Parameters*. Double-click on the desired number (from OFF through 1-4 and KEY).

The OFF setting switches the measurement display off, while the KEY setting enables users to change the measurement display via the arrow keys, without accessing the *Keypad Program*. If you select KEY:

- To view a parameter other than the one currently displayed, press the [△] or [▽] keys to scroll through the various parameters.
- To scroll through the channel options on a two-channel XGF868i, press the [◁] or [▷] keys until you have reached the desired option.

5. Scroll to the desired *Channel option*, as listed in *Table 9* below.

Table 9: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

6. For each channel, select the desired *Measurement Parameter*, as shown in *Table 10*.
7. Repeat steps 3 and 4 for each parameter. PanaView returns to the Global I/O menu.

Table 10: Available Measurement Parameters

Option Bar	Description	Good	Bad
VEL	Displays the flow velocity	N.A.	N.A.
VOLUM	Displays the volumetric flow	N.A.	N.A.
+TOTL	Displays the forward totalized volume flow	N.A.	N.A.
-TOTL	Displays the reverse totalized volume flow	N.A.	N.A.
TIME	Displays the total flow measurement time	N.A.	N.A.
MDOT	Displays the mass flow	N.A.	N.A.
+MASS	Displays the forward totalized mass flow	N.A.	N.A.
-MASS	Displays the reverse totalized mass flow	N.A.	N.A.
SS up	Displays the signal strength for the upstream transducer	50–75	<50 or >75
SS do	Displays the signal strength for the downstream transducer	50–75	<50 or >75
SNDSP	Displays the measured speed of sound in the gas	N.A.	N.A.
Tup	Displays the upstream ultrasonic signal transit time	N.A.	N.A.
Tdown	Displays the downstream ultrasonic signal transit time	N.A.	N.A.
DELTA	Displays the transit time difference between the upstream and downstream signals	N.A.	N.A.
Tot K	Displays the total K factor.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default)	N.A.	N.A.
Qup	Displays the signal quality for the upstream transducer	≥1200	–400 to +400
Qdown	Displays the signal quality for the downstream transducer	≥1200	–400 to +400
AMPup	Displays the signal amplitude value of the upstream transducer	24 ± 5	<19 or >29
AMPdn	Displays the signal amplitude value of the downstream transducer	24 ± 5	<19 or >29
CNTup	Displays the AGC DAC count for the upstream gain setting.	N.A.	N.A.
CNTdn	Displays the AGC DAC count for downstream gain setting.	N.A.	N.A.
P#up	Displays signal peaks for the upstream transducer.	100–2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100–2300	<100 or >2300
TEMP	Displays the gas temperature (from 0/4–20 mA input).	N.A.	N.A.
PRESR	Displays the gas pressure (from 0/4–20 mA input).	N.A.	N.A.
Mw	Displays the molecular weight.	N.A.	N.A.
z	Displays the compressibility.	N.A.	N.A.
AcVOL	Displays actual volumetric flow.	N.A.	N.A.
StVOL	Displays standard volumetric flow.	N.A.	N.A.
Tu S[1]	Displays Skan transit time upstream.	N.A.	N.A.
Td S[1]	Displays Skan transit time downstream.	N.A.	N.A.
DT S[1]	Displays Skan Delta T.	N.A.	N.A.
Tu M[1]	Displays Measure transit time upstream.	N.A.	N.A.
Td M[1]	Displays Measure transit time downstream.	N.A.	N.A.
DT M[1]	Displays Measure Delta T.	N.A.	N.A.
Vinst	Displays the instantaneous velocity.	N.A.	N.A.

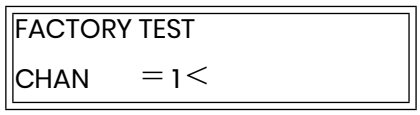
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Appendix C. Factory Tests

C.1 Introduction

For user security, the XGF868i offers two special functions in a separate menu: selection of one-channel or two-channel operation, and the factory-default reset. While the first function enables you to reset the channel configurations set during manufacturing, the reset function, by restoring the meter to its original state, allows you to purge potential errors in program memory.

To enter the *Factory Test* menu, press [Escape], followed in succession by the up arrow key ([△]), the right arrow key ([▷]), the down arrow key ([▽]), the left arrow key ([◁]), the up arrow key again (forming a loop around the keypad), and finally the [Enter] key. The screen displays FACTORY TEST, as shown below.



C.2 Resetting the Number of Channels

To reset the number of channels displayed:

1. In the *Factory Test* menu, scroll to CHAN and press [Enter].
2. Scroll to the desired number of channels (1 or 2) and press [Enter].
3. The XGF868i returns to the *Factory Test* menu. Press [Escape] to return to parameter display.

C.3 Resetting the XGF868i to Factory Defaults

1. In the *Factory Test* menu, scroll to INIT and press [Enter].
2. The screen displays the initial string "ESKE0". Use the left and right arrow keys to move among characters, and the up and down arrow keys to alter each character until the string is "FRIG" plus the number of channels (that is, FRIG1 or FRIG2). Press [Enter].

   The XGF868i re-initializes with factory default settings, and displays the message, *"Review meter settings."* Since the default for the meter display is OFF, you will need to enter the *Keypad Program* to reset the LCD, as described below.
3. Press [Escape], [Enter], [Escape].
4. In the *Keypad Program* window, scroll to PROG and press [Enter].
5. In the PROG menu, scroll to GLOBL and press [Enter].
6. Scroll to I/O and press [Enter].
7. Scroll to LCD and press [Enter].
8. The window now asks for the *# of LCD Parameters*. Scroll to the desired number (from OFF through 1-4 and KEY) and press [Enter].
9. Scroll to the desired *Channel option*, as listed in *Table 11* below.

Table 11: Channel Options

Option	Description
CH1	Channel 1
CH2	Channel 2
SUM	CH1+CH2
DIF	CH1-CH2
AVE	(CH1+CH2)/2

10. For each channel, select the desired *Measurement Parameter*, as shown in the *Programming Manual.*

Note: *The measurement units that appear in these prompts are those selected in the* GLOBL-SYSTM *menu.*

The previous two prompts repeat until all of the specified # of LCD Parameters have been set up. When all of the display parameters have been set up, the meter returns to the Global I/O window. To leave the *Keypad Program*, press the [Escape] key three times.

After leaving the *Keypad Program*, the XGF868i will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

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Warranty

Each instrument manufactured by Panametrics is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of Panametrics. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics determines that the equipment was defective, the warranty period is:

- One year from delivery for electronic or mechanical failures.
- One year from delivery for sensor shelf life.

If Panametrics determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Panametrics, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a Panametrics instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify Panametrics, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, Panametrics will issue a Return Material Authorization (RMA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, Panametrics will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If Panametrics determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

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