Panametrics

DigitalFlow™ GC868

Panametrics Gas Clamp-On Ultrasonic Flowmeter

Startup Guide (1 and 2-Channel)

panametrics.com

910-226UF1
April 2022

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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 for general electronic failures of the instrument
- one year for mechanical failures of the sensor

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 of 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 AUTHORIZATION number (RA), 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]

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Chapter 1. Installation.

1.1 Introduction

To ensure safe and reliable operation of the Model GC868 Clamp-on Gas Flowmeter, the system must be installed in accordance with the guidelines established by Panametrics. Those guidelines, which are explained in detail in this chapter, include the following specific topics:

- Unpacking the Model GC868 system
- Selecting a suitable site for the electronics console and the clamping fixture/transducers
- Installing the clamping fixture, transducers and damping material
- Installing temperature and pressure transmitters
- Installing the electronics console
- Wiring the electronics console.

WARNING! **The Model GC868 flowmeter can measure the flow rate of many gases, some of which are potentially hazardous. The importance of proper safety practices cannot be overemphasized.**

Be sure to follow all applicable local safety codes and regulations for installing electrical equipment and 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! In order to meet CE Mark requirements, all wiring connections must be made in accordance with the instructions in Appendix A, CE Mark Compliance.

1.2 Unpacking

Carefully remove the electronics console, the transducers, the clamping fixture, the preamplifier, 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 physical locations of the clamping fixture and the Model GC868 electronics console are important, use the guidelines given in this section to plan the Model GC868 system installation.

1.3.1 Electronics Console Location

The standard Model GC868 electronics enclosure is a Type-4X weather-resistant, dust-tight, indoor/outdoor type. Typically, the electronics console is mounted in a meter shed. When choosing a mounting site, make sure that the location permits easy access to the console for programming, testing, and servicing.

Note: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), 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 Model GC868.*

1.3.2 Installation Location

The pipe location must accommodate the clamping fixture, the flowmeter transducers and any pressure and/or temperature transducers employed as part of the flowmeter system. Ideally, choose a section of straight run pipe with unlimited access; for example, a long stretch of pipe that is above ground. However, if you are dealing with an underground pipe, dig a pit around the pipe to facilitate installation of the flowmeter equipment.

1.3.3 Transducer Location

The Model GC868's accuracy 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 10 pipe diameters of straight, undisturbed flow downstream from the measurement point. To ensure undisturbed flow, avoid: sources of turbulence in the gas such as valves, flanges, expansion joints, tees and elbows; swirl; 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 either side of a horizontal pipe, where possible. If limited pipe access necessitates top and bottom-mounted transducers, shift the transducers to at least 10° off top center. This will minimize the influence of any sediment or condensate traveling at the lowest point in the pipe.

1.3.4 Cable Lengths

ATTENTION EUROPEAN CUSTOMERS! In order to meet CE Mark requirements, all cables must be installed as described in Appendix A, CE Mark Compliance.

Locate the transducers as close as possible to the electronics console. Panametrics supplies standard 10-ft (3 m) transducer cables to connect between the transducers and the field mounted preamplifier. The connection from the preamplifier to the electronics can be up to 500 ft (153 m) in length. If longer cables are required, consult the factory for assistance.

1.3.5 Temperature and Pressure Transmitters

When installing temperature and/or pressure transmitters, locate them downstream of the flowmeter transducers. These transmitters should be positioned no closer to the flowmeter transducers than 2 pipe diameters and no further away from the flowmeter transducers than 20 pipe diameters. The temperature measurement can be made via contact RTD, but the pressure gauge must be tapped into the process pipe.

Note: *If you are using a 3-wire RTD for temperature measurement, the Model GC868 requires an RTD input board. For monitoring pressure, the GC868 requires a 4-20 mA analog input board. If neither of these options are installed, the GC868 can be programmed for static temperature and pressure values.*

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 corrosive atmospheres.

Note: *When using non-Panametrics cables to connect the flowmeter transducers to the Model GC868 electronics console, the cables must have electrical characteristics identical to the Panametrics cables. Type RG 62 A/U coaxial cable should be used, and each cable must be the same length (within ±4 in. or 100 mm.).*

1.4 Installing Damping Material, Transducers and Fixtures

Since the GC868 is specifically designed for gas measurement with clamp-on transducers, it requires the use of specially designed fixtures and damping material to maintain the highest possible measurement accuracy. Panametrics supplies the CFG series of fixtures:

- The V1 clamping fixture for pipes with diameters between 0.75 and 1.25 in. (20 to 30 mm).
- The V4 clamping fixture for pipes with diameters between 1.25 and 4 in. (30 to 100 mm).
- The V8 clamping fixture for pipes from 4 to 8 in. (100 to 200 mm).
- The V12 clamping fixture for pipes from 8 to 12 in. (200 to 300 mm).
- The PI clamping fixture for pipes from 12 to 24 in. (300 to 600 mm).

Figure 1-1 below illustrates the V series and PI fixture assemblies. Complete the steps in the following sections to position and install the transducers, fixtures and damping material.

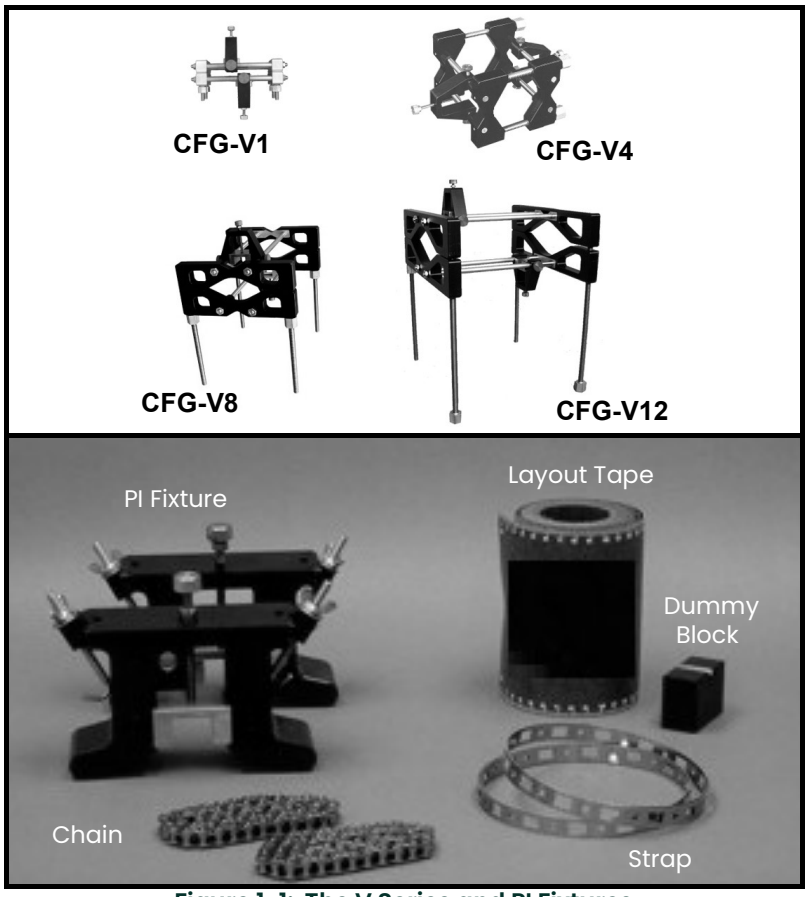

Figure 1-1: The V Series and PI Fixtures

1.4.1 Application Requirements

Before you begin installation, you should ensure that your particular application meets the minimum gas pressure requirements for the GC868 system.

- For air, nitrogen, oxygen or argon, refer to Table 1-1 on page 1-4.
- For natural gas, refer to Table 1-2 on page 1-6.
- For steam, refer to Table 1-3 on page 1-7.

1. Find the pipe size of your application
2. Then find the pipe wall thickness of your application.

3. With the pipe size and pipe wall thickness, determine if your application meets the minimum pressure requirements.
4. Use the same row in the appropriate table to determine the maximum flow velocity capability of the GC868. For reference, the table provides the recommended number of traverses and transducer frequency for your application.

Note: *All provided data is based on metal pipes; plastic pipes must have air at ambient pressure or other gases with a density of 0.074 lbs.ft^3 (0.109 kg/m^3). Consult the factory for applications involving natural gas with sulfur or high carbon dioxide content, or for applications not listed in the tables.*

Table 1-1: GC868 Installation Requirements for Air, Nitrogen, Oxygen or Argon

Pipe Size ANSI (DIN)	Pipe Wall Inches (mm)	Transducer MHz	Min. Pressure psig (bar)	Maximum Velocity, ft/s (m/s)				
				Single Traverse	Dual Traverse	Triple Traverse	Four Traverse	Five Traverse
3/4 (20)	≤0.07 (1.8)	1	60 (5.1)	—	—	90 (27.4)	—	90 (27.4)
1 (25)	≤0.14 (3.6)	1	60 (5.1)	—	—	90 (27.4)	—	90 (27.4)
1 1/2 (40)	≤0.15 (3.8)	1	60 (5.1)	—	—	90 (27.4)	—	57 (17.4)
2 (50)	≤0.16 (4.1)	1	60 (5.1)	90 (27.4)	—	75 (22.9)	—	45 (13.7)
3 (75)	<0.2 (5.1)	1	60 (5.1)	120 (36.6)	96 (29.3)	69 (21.0)	46 (14.0)	—
	≤0.22 (5.6)	0.5						
4 (100)	<0.2 (5.1)	1	60 (5.1)	120 (36.6)	96 (29.3)	53 (16.2)	35 (10.7)	—
	≤0.24 (6.1)	0.5	60 (5.1)					
	≤0.34 (8.6)	0.5	180 (13.4)					
	≤0.68 (17.3)	0.5	300 (21.7)					
6 (150)	<0.2 (5.1)	1	60 (5.1)	90 (27.4)	72 (22.0)	54 (16.5)	—	—
	≤0.28 (7.2)	0.5	60 (5.1)					
		0.2	200 (13.6)	135 (41.5)	108 (32.9)	81 (24.7)		
	≤0.44 (11.2)	0.5	180 (13.4)	90 (27.4)	72 (22.0)	54 (16.5)		
		0.2	600 (40.8)	135 (41.5)	108 (32.9)	81 (24.7)		
	≤0.87 (22.1)	0.5	300 (21.7)	90 (27.4)	72 (22.0)	54 (16.5)		
		0.2	1000 (68)	135 (41.5)	108 (32.9)	81 (24.7)		

Table 1-1: GC868 Installation Requirements for Air, Nitrogen, Oxygen or Argon

Pipe Size ANSI (DIN)	Pipe Wall Inches (mm)	Transducer MHz	Min. Pressure psig (bar)	Maximum Velocity, ft/s (m/s)				
				Single Traverse	Dual Traverse	Triple Traverse	Four Traverse	Five Traverse
8 (200)	≤0.33 (8.4)	0.5	60 (5.1)	80 (24.4)	64 (19.5)	48 (14.6)	—	—
		0.2	200 (13.6)	120 (36.6)	96 (29.3)	72 (21.9)		
	≤0.50 (12.7)	0.5	180 (13.4)	80 (24.4)	64 (19.5)	48 (14.6)		
		0.2	600 (40.8)	120 (36.6)	96 (29.3)	72 (21.9)		
	≤0.88 (22.4)	0.5	300 (21.7)	80 (24.4)	64 (19.5)	48 (14.6)		
		0.2	1000 (68)	120 (36.6)	96 (29.3)	72 (21.9)		
10 (250)	≤0.37 (9.4)	0.5	60 (5.1)	70 (21.3)	56 (17.1)	42 (12.8)	—	—
		0.2	200 (13.6)	105 (32)	84 (25.6)	63 (19.2)		
	≤0.50 (12.7)	0.5	180 (13.4)	70 (21.3)	56 (17.1)	42 (12.8)		
		0.2	600 (40.8)	105 (32)	84 (25.6)	63 (19.2)		
	≤1.00 (25.4)	0.5	300 (21.7)	70 (21.3)	56 (17.1)	42 (12.8)		
		0.2	1000 (68)	105 (32)	84 (25.6)	63 (19.2)		
12 (300)	≤0.38 (9.7)	0.5	60 (5.1)	55 (16.8)	44 (13.4)	33 (10.1)	—	—
		0.2	200 (13.6)	82 (25)	66 (20.1)	49 (14.9)		
	≤0.50 (12.7)	0.5	180 (13.4)	55 (16.8)	44 (13.4)	33 (10.1)		
		0.2	600 (40.8)	82 (25)	66 (20.1)	49 (14.9)		
	≤1.00 (25.4)	0.5	300 (21.7)	55 (16.8)	44 (13.4)	33 (10.1)		
		0.2	1000 (68)	82 (25)	66 (20.1)	49 (14.9)		
14 (350)	≤0.38 (9.7)	0.2	90 (7.2)	87 (26.5)	70 (21.3)	52 (15.9)	—	—
	≤0.50 (12.7)	0.2	270 (19.6)					
16 (400)	≤0.38 (9.7)	0.2	90 (7.2)	76 (23.2)	61 (18.9)	45 (13.7)	—	—
	≤0.50 (12.7)	0.2	270 (19.6)					
18 (450)	≤0.38 (9.7)	0.2	90 (7.2)	67 (20.4)	54 (16.5)	40 (12.2)	—	—
	≤0.50 (12.7)	0.2	270 (19.6)					
20 (500)	≤0.38 (9.7)	0.2	90 (7.2)	60 (18.3)	48 (14.6)	36 (11.0)	—	—
	≤0.50 (12.7)	0.2	270 (19.6)					
24 (600)	≤0.38 (9.7)	0.2	90 (7.2)	49 (14.9)	39 (11.9)	29 (8.8)	—	—
	≤0.50 (12.7)	0.2	270 (19.6)					

Table 1-2: GC868 Installation Requirements for Natural Gas

Pipe Size ANSI (DIN)	Pipe Wall Inches (mm)	Transducer MHz	Min. Pressure psig (bar)	Maximum Velocity, ft/s (m/s)			
				Single Traverse	Dual Traverse	Triple Traverse	Four Traverse
2 (50)	≤0.16 (4.1)	1.0	200 (14.8)	110 (33.5)	88 (26.8)	66 (20.5)	—
3 (75)	≤0.22 (5.6)	0.5	200 (14.8)	120 (36.6)	96 (29.3)	72 (22.0)	48 (14.6)
4 (100)	≤0.24 (6.1)	0.5	150 (11.4)	120 (36.6)	96 (29.3)	72 (22.0)	48 (14.6)
	≤0.34 (8.6)	0.5	400 (28.6)				
	≤0.68 (17.3)	0.5	800 (56.2)				
6 (150)	≤0.28 (7.2)	0.5	150 (11.4)	120 (36.6)	96 (29.3)	72 (22.0)	—
		0.2	250 (17)	180 (54.9)	144 (43.9)	108 (32.9)	—
	≤0.44 (11.2)	0.5	400 (28.6)	120 (36.6)	96 (29.3)	72 (22.0)	—
		0.2	500 (34)	180 (54.9)	144 (43.9)	108 (32.9)	—
	≤0.87 (22.1)	0.5	800 (56.2)	120 (36.6)	96 (29.3)	72 (22.0)	—
		0.2	1000 (68)	180 (54.9)	144 (43.9)	108 (32.9)	—
8 (200)	≤0.33 (8.4)	0.5	175 (13.1)	100 (30.5)	80 (24.4)	60 (18.3)	—
		0.2	250 (17)	150 (45.7)	120 (36.6)	90 (27.4)	—
	≤0.50 (12.7)	0.5	400 (28.6)	100 (30.5)	80 (24.4)	60 (18.3)	—
		0.2	500 (34)	150 (45.7)	120 (36.6)	90 (27.4)	—
	≤0.88 (22.4)	0.5	800 (56.2)	100 (30.5)	80 (24.4)	60 (18.3)	—
		0.2	1000 (68)	150 (45.7)	120 (36.6)	90 (27.4)	—
10 (250)	≤0.37 (9.4)	0.5	200 (14.8)	85 (25.9)	68 (20.7)	51 (15.6)	—
		0.2	300 (20.4)	126 (38.4)	102 (31.1)	75 (22.0)	—
	≤0.50 (12.7)	0.5	500 (35.5)	85 (25.9)	68 (20.7)	51 (15.6)	—
		0.2	600 (40.8)	126 (38.4)	109 (31.1)	75 (22.0)	—
	≤1.00 (25.4)	0.5	800 (56.2)	85 (25.9)	68 (20.7)	51 (15.6)	—
		0.2	1200 (81.6)	126 (38.4)	102 (31.1)	75 (22.0)	—
12 (300)	≤0.38 (9.7)	0.5	200 (14.8)	70 (21.3)	56 (17.1)	42 (12.8)	—
		0.2	300 (20.4)	105 (32)	84 (25.6)	63 (19.2)	—
	≤0.50 (12.7)	0.5	500 (35.5)	70 (21.3)	56 (17.1)	42 (12.8)	—
		0.2	600 (40.8)	105 (32)	84 (25.6)	63 (19.2)	—
	≤1.00 (25.4)	0.5	800 (56.2)	70 (21.3)	56 (17.1)	42 (12.8)	—
		0.2	1200 (81.6)	105 (32)	84 (25.6)	63 (19.2)	—
14 (350)	≤0.38 (9.7)	0.2	300 (21.7)	103 (31.4)	77 (23.5)	62 (18.9)	—
	≤0.50 (12.7)	0.2	800 (56.2)				—
16 (400)	≤0.38 (9.7)	0.2	300 (21.7)	90 (27.4)	67 (20.4)	54 (16.5)	—
	≤0.50 (12.7)	0.2	800 (56.2)				—
18 (450)	≤0.38 (9.7)	0.2	300 (21.7)	78 (23.8)	59 (18.0)	47 (14.3)	—
	≤0.50 (12.7)	0.2	800 (56.2)				—
20 (500)	≤0.38 (9.7)	0.2	300 (21.7)	70 (21.3)	52 (15.9)	42 (12.8)	—
	≤0.50 (12.7)	0.2	800 (56.2)				—

Table 1-2: GC868 Installation Requirements for Natural Gas

Pipe Size ANSI (DIN)	Pipe Wall Inches (mm)	Transducer MHz	Min. Pressure psig (bar)	Maximum Velocity, ft/s (m/s)			
				Single Traverse	Dual Traverse	Triple Traverse	Four Traverse
24 (600)	≤0.38 (9.7)	0.2	300 (21.7)	56 (17.1)	42 (12.8)	34 (10.4)	—
	≤0.50 (12.7)	0.2	800 (56.2)				—

Table 1-3: GC868 Installation Requirements for Steam

Pipe Size in. (mm)	Pipe Wall Inches (mm)	**Transducer (MHz)**	Min. Pressure psig (bar)	Maximum Flow Velocity ft/s (m/s) Single Traverse
3 (80)	≤0.22 (5.6)	0.5	110 (8.6)	120 (36.6)
	≤0.3 (7.6)	0.5	200 (14.8)	
4 (100)	≤0.24 (6.1)	0.5	110 (8.6)	120 (36.6)
	≤0.34 (8.6)	0.5	200 (14.8)	
6 (150)	≤0.28 (7.2)	0.5	110 (8.6)	120 (36.6)
	≤0.44 (11.2)	0.5	200 (14.8)	
8 (200)	≤0.33 (8.4)	0.5	120 (9.3)	100 (30.5)
	≤0.5 (12.7)	0.5	200 (14.8)	
10 (250)	≤0.37 (9.4)	0.5	130 (10.0)	85 (25.9)
	≤0.5 (12.7)	0.5	200 (14.8)	
12 (300)	≤0.38 (9.7)	0.5	140 (10.7)	70 (21.3)
	≤0.5 (12.7)	0.5	200 (14.8)	

1.4.2 Preparing the Pipe

1. Locate a transducer measurement point with 20 diameters of upstream pipe straight run and 10 diameters of downstream pipe straight run. In addition, the point should be at least 10 diameters from any butt welds or flanges. Keep appropriate clearance on either side of the pipe for easy transducer installation:
   - 150 mm (6 in.) if you are not using a junction box, or
   - 225 mm (9 in.) if you are using a junction box.

In general, transducers are installed 180° apart on opposite sides of the pipe and in a horizontal plane (at 3 and 9 o'clock). Figure 1-2 below illustrates the desired acoustic signal projection path for general installation; however, additional pipe surveys may provide data that can lead to modifications for optimal installation.

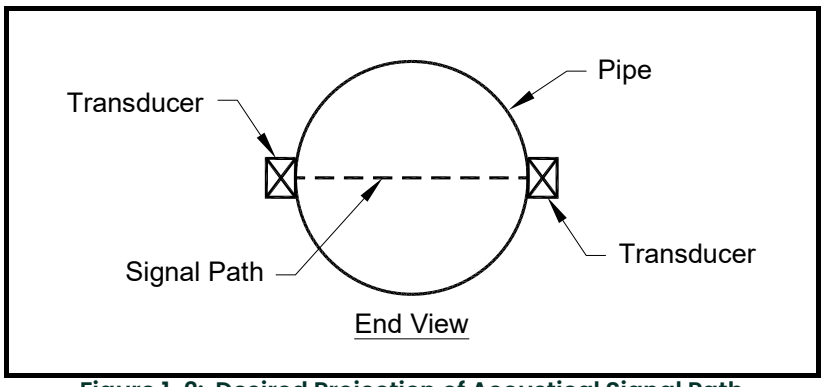

Figure 1-2: Desired Projection of Acoustical Signal Path

Finding a location where the pipe is concentric is important for optimum accuracy and performance. If possible, perform a pipe survey with an ultrasonic thickness gage to find the best location.

2. Clear rust or loose paint and measure the wall thickness at five points along the pipe axis at 25 mm (1-in.) intervals using an ultrasonic thickness gage, as shown in Figure 1-3 below. Check each point three times and record the mean values. If the maximum variation between the five points exceeds 0.25 mm (0.010 in.), find another location.

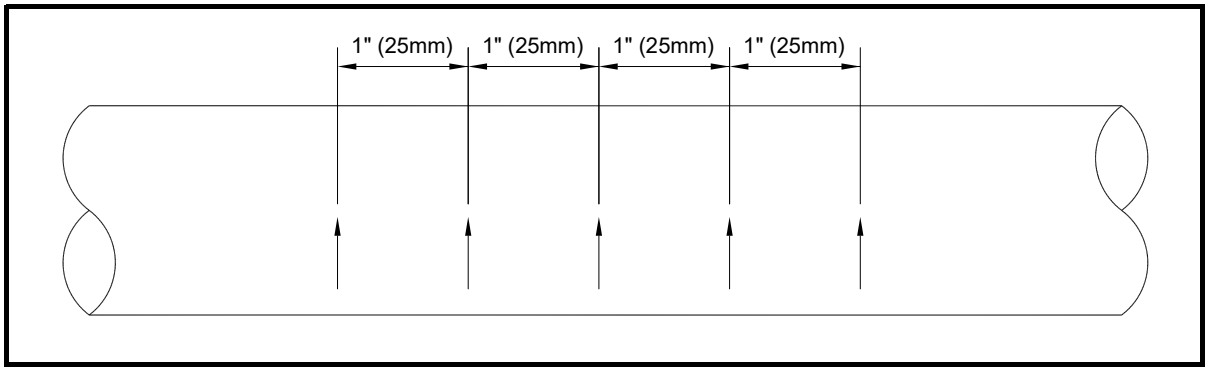

Figure 1-3: Measuring Thickness Along the Pipe Axis

3. Measure the outside diameter (OD) of the pipe using a tape measure or the supplied layout wrap. Using the entire layout wrap, mark two circumferential lines along the edges of the wrap, as shown in Figure 1-4 below.

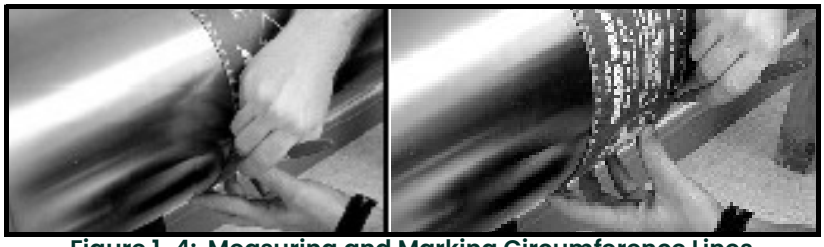

Figure 1-4: Measuring and Marking Circumference Lines

4. Now measure the OD and the wall thickness at eight points along the pipe circumference at 45° intervals (shown in Figure 1-5 below), three times per point, and record the mean values.

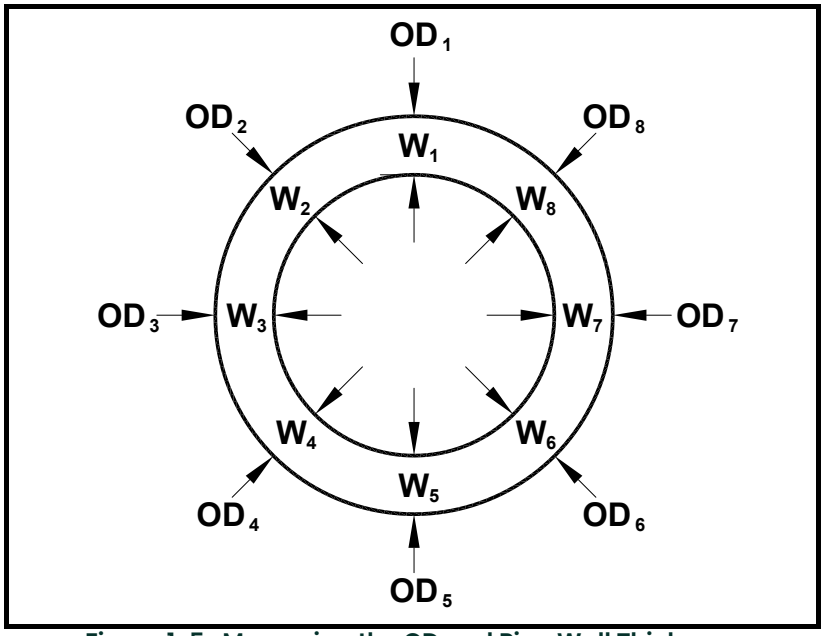

Figure 1-5: Measuring the OD and Pipe Wall Thickness

5. Prepare the pipe for the damping material by removing any rust or loose paint and sanding down any rough spots in an area 14 in. long around the circumference of the pipe. Take care to preserve the original pipe curvature.
6. At the approximate location of each transducer, prepare an area 100 mm (4 in.) long by 50 mm (2 in.) wide for CRV type transducers and 100 mm wide for CRW type transducers. Remove any paint or rust, and polish the cleared area, taking care to preserve the original curvature of the pipe.

Note: *If the paint is in a thin, smooth layer, removal is not necessary.*

1.4.3 Obtaining the Transducer Spacing

1. Using the measured OD and the pipe wall thickness, program the GC868 (discussed in Chapter 2, *Initial Setup*) to determine the required transducer spacing.
2. To determine the GC868 correction factor, calculate the mean inside pipe diameter (ID) and the pipe ID at the transducer locations. Then divide the square of the mean ID by the square of the ID at the transducer location, as shown in the equations below, where OD_X is the outside diameter at a given point, and W_X is the wall thickness at a given point (see Figure 1-5 on page 1-9).

$$\text{mean ID} = ((OD_1 - (W_1 + W_5)) + (OD_2 - (W_2 + W_6)) + (OD_3 - (W_3 + W_7)) + (OD_4 - (W_4 + W_8))) \S 4 \quad (1\text{-}1)$$

$$K_{\text{for non-concentric pipe}} = \frac{(\text{Mean ID}^2)}{(\text{ID at transducer location})^2} \quad (1\text{-}2)$$

3. Program the value into the GC868.

Note: *See Chapter 2,* Initial Setup*, pages 2-11 to 2-15, for more details on programming.*

Based on the pipe OD, proceed to the appropriate section:

- If the pipe < 12" (300 mm), see the section *Installing the V Series Clamping Fixture and Transducers* on the next page.
- If the pipe > 12" (300 mm), go to *Installing the PI Fixture and Transducers* on page 1-12.

1.4.4 Installing the V Series Clamping Fixture and Transducers

Note: *A complete installation involves the clamping fixture, transducers and damping material. Refer to* Installing Damping Material *on page 1-17.*

To install the V Series clamping fixture and transducers, complete the following steps:

1.4.4.1 Installing the Fixture

1. Position the half of the clamping fixture with the threaded rods around the pipe, as shown in Figure 1-6 below. Orient the fixture in the 3 o'clock position on a horizontal pipe.
2. Position the mating half of the fixture over the threaded rods in the 9 o'clock position. Figure 1-6 below shows the two mounted halves.

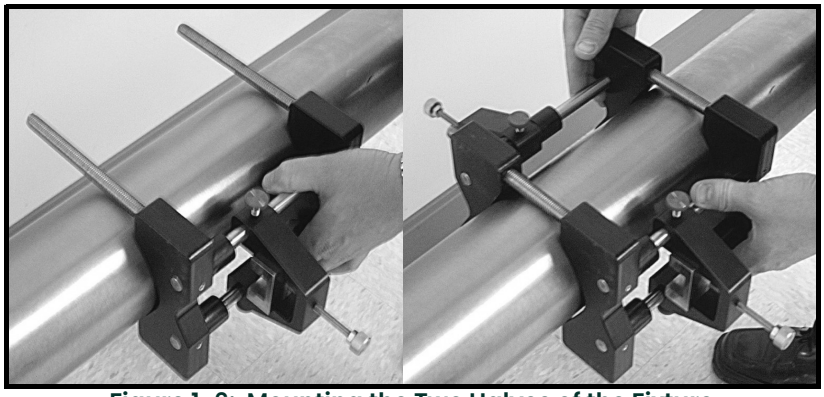

Figure 1-6: Mounting the Two Halves of the Fixture

The two fixture halves have measuring scales; ensure that the scales are on the same side of the fixture, so that both zeros start at the same origin, as shown in Figure 1-7 below.

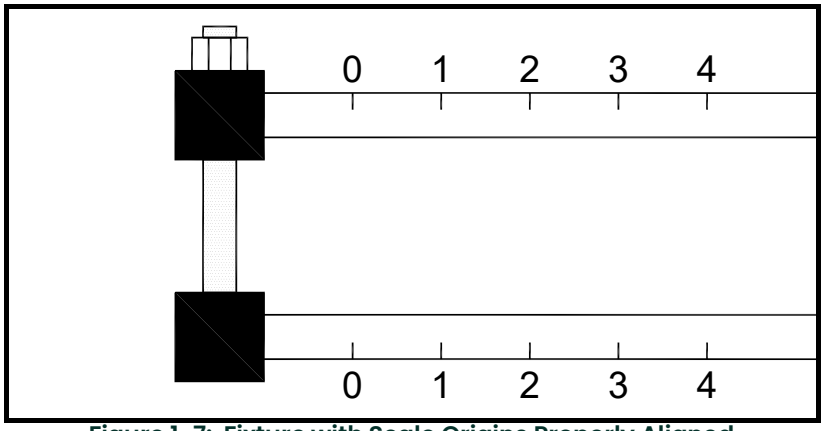

Figure 1-7: Fixture with Scale Origins Properly Aligned

3. Install the four nuts onto the threaded rods with the convex side of the nut facing the fixture. Hand tighten the nuts on each V block evenly, as shown in Figure 1-8 on the next page. Do not use a cross tightening pattern on the four installation nuts.

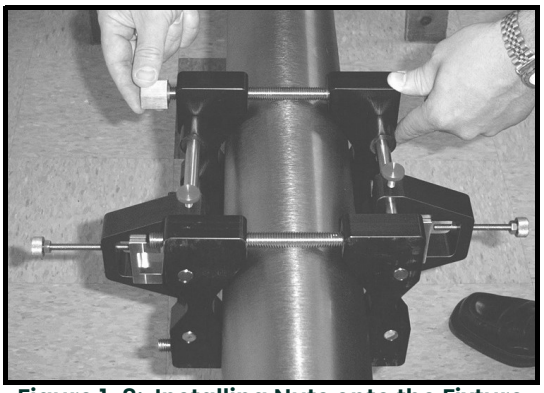

Figure 1-8: Installing Nuts onto the Fixture

1.4.4.2 Installing the Transducers

1. Apply a bead of coupling 6 mm (0.25 in.) wide along the entire length of each transducer face, as shown in Figure 1-9 below.

Figure 1-9: Couplant on Transducer Face

Note: *Do not slide the transducer with couplant along the surface of the pipe when mounting the transducer.*

2. Set the first mounting block (either left edge or right edge) at a convenient number on the scale, such as 2 in. or 5 cm. Install the first transducer with the BNC connector pointing away from the center of the V block fixture. Tighten the transducer mounting thumbscrew onto the slider, which in turn applies pressure to the transducer. Use a handtight grip to set the transducer in contact with the pipe, as shown in Figure 1-10 below. Use a wrench to tighten the backing nut to prevent loosening due to vibration and thermal expansion.

IMPORTANT: Do not use a wrench or pliers on the thumbscrew.

Figure 1-10: Installing the First Transducer

3. Slide the second mounting block to the calculated spacing *plus* the initial scale number selected for the first mounting block. (For example:
   a. Initial convenient number for the first mounting block = 5 cm or 2 in.
   b. Spacing as calculated by the GC868 = 0.5 in. or 12.5 mm
   c. Second mounting block final location = 2 + 0.5 in. = 3.5 in. or 5 cm + 1.25 cm = 6.25 cm

The overall spacing between yokes should be left edge to left edge, or right edge to right edge. Figure 1-11 below shows typical positioning.

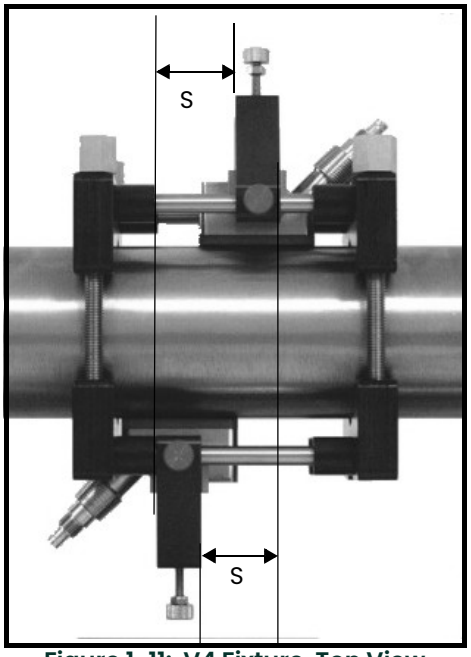

Figure 1-11: V4 Fixture, Top View

4. In a similar manner, install the second transducer as shown in Figure 1-11 above.

1.4.5 Installing the PI Fixture and Transducers

The PI clamping fixture holds transducers on pipes from 12 to 24 in. in diameter. It comes with either a chain or strap, depending on the selection made with the initial order from Panametrics. To install the fixture and transducers, complete the following steps:

1.4.5.1 Surveying the Pipe

1. Measure the pipe circumference to an accuracy of ±2 mm (±1/16 in.)

IMPORTANT: Do not use a calculated value or a nominal value for the circumference.

2. Tightly wrap the layout wrap once around the entire pipe and line up the edges. Using the wrap as a template guide for marks, mark scribe lines around the entire diameter of the pipe, as shown in Figure 1-12 below.

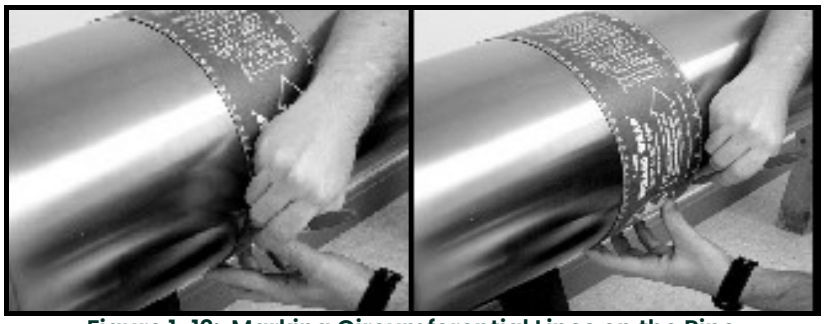

Figure 1-12: Marking Circumferential Lines on the Pipe

3. Line up the zero scale of the layout tape at the desired location of the first transducer. (For a typical installation, this point will be the 3 o'clock position on a horizontal pipe.) Mark each of the two circumferential lines at the zero point. Connect each of these marks using a straight edge (for example, the edge of the layout tape) as shown in Figure 1-13 below.

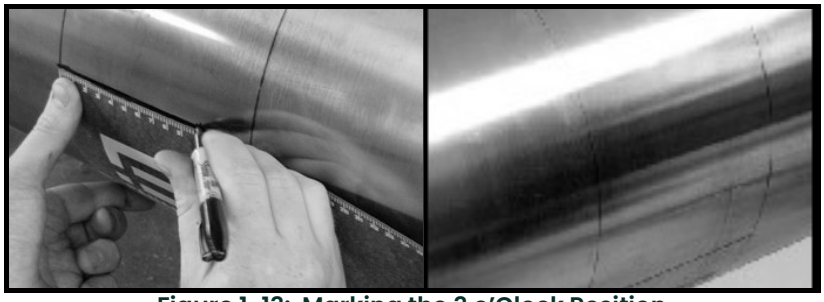

Figure 1-13: Marking the 3 o'Clock Position

4. To find the coinciding point on the opposite side of the pipe (180° away from each other), divide the measured circumference by 2 and measure this distance along the circumferential lines from the zero point, as shown in Figure 1-14 below. Place marks on both sides of the circumferential lines made with the layout wrap and connect the marks.

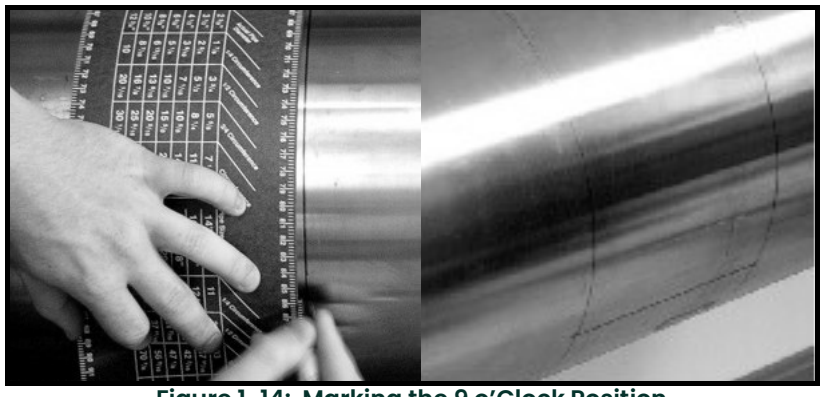

Figure 1-14: Marking the 9 o'Clock Position

Make sure to take the 180° point measurement from both over the top of the pipe and under the bottom of the pipe (on a horizontal pipe) to ensure reciprocity of the installation. Figure 1-15 below shows the appropriate way to measure the 180° point.

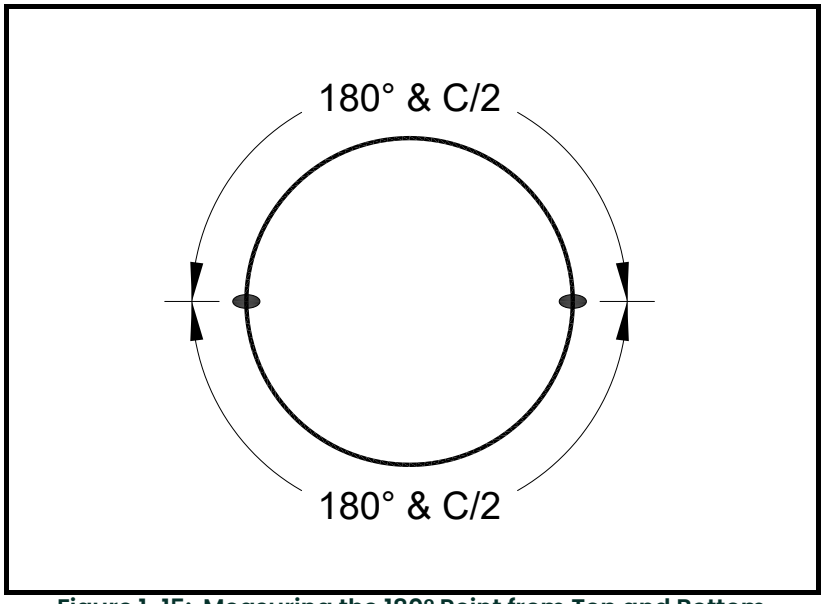

Figure 1-15: Measuring the 180° Point from Top and Bottom

1.4.5.2 Installing the First Bracket with a Chain

The following steps describe how to install the PI fixture with a supplied chain or strap.

1. Carefully wrap the chain or strap around the pipe, taking care not to twist it.
2. Loosen the wing nuts up to the end of the J-hooks. Then hook the chain into the tightest links and loosely hand tighten the wing nuts. If you are using a strap, insert the J-hook into the smaller round hole on the strap.
3. Line up one edge of the CFG-PI holder bracket with the origin scribe line and fully tighten the chain or strap (see Figure 1-16 and Figure 1-17 below).

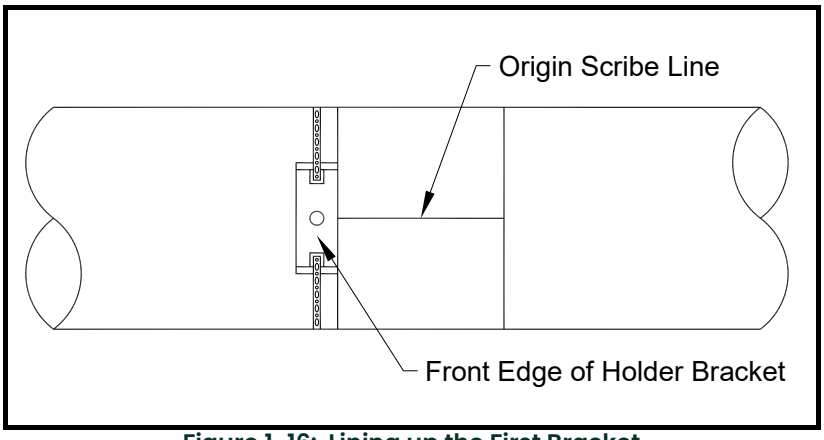

Figure 1-16: Lining up the First Bracket

4. Install the transducer dummy block to verify the circumferential and axial location. Center the indicator line on the block to line up with the scribed mark (see Figure 1-17 below).

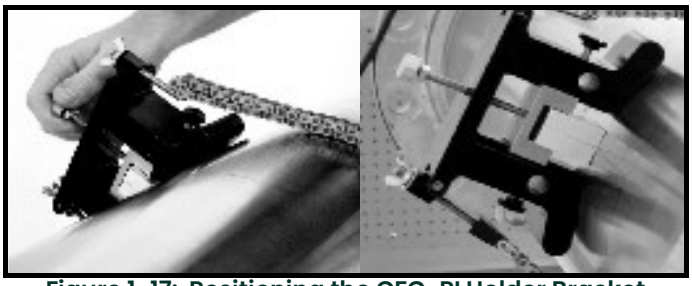

Figure 1-17: Positioning the CFG-PI Holder Bracket

5. Loosen the transducer hold-down screw and tighten the J-hooks on the clamping fixture. Be sure the bracket has not moved from its position.

1.4.5.3 Installing the Second Bracket with a Chain

Note: *The following step requires the transducer spacing discussed on page 1-9.*

1. Measure the spacing from the zero point (the point of circumferential origin). Mark the spacing point with a crosshair on the opposite side of the pipe, 180° from the zero point (as shown in Figure 1-18 below).

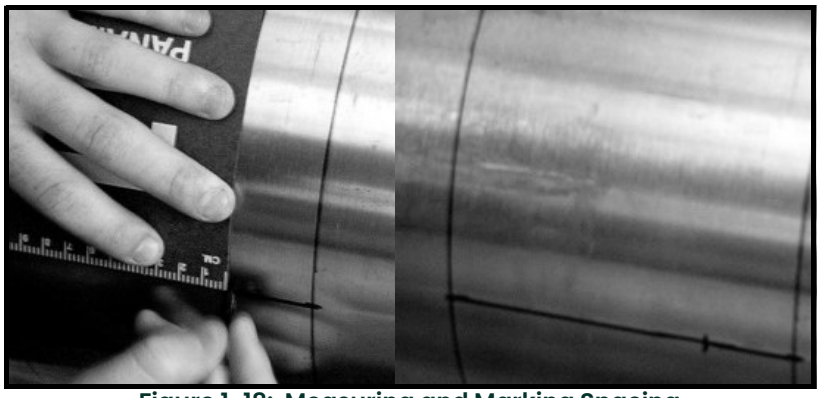

Figure 1-18: Measuring and Marking Spacing

2. Carefully wrap the chain or strap around the pipe, taking care not to twist it.
3. Loosen the wing nuts up to the end of the J-hooks. Then hook the chain into the tightest links and firmly hand tighten the wing nuts.
4. Line up the *other* edge of the CFG-PI holder bracket with the scribe line and tighten the chain or strap, as shown in Figure 1-19 below.

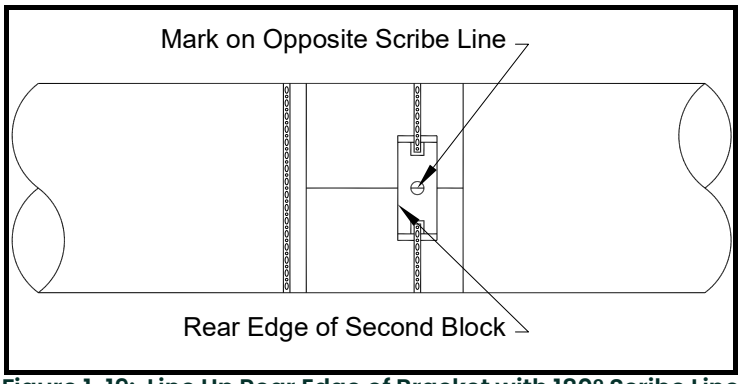

Figure 1-19: Line Up Rear Edge of Bracket with 180° Scribe Line

The spacing should now appear similar to that in Figure 1-20 below.

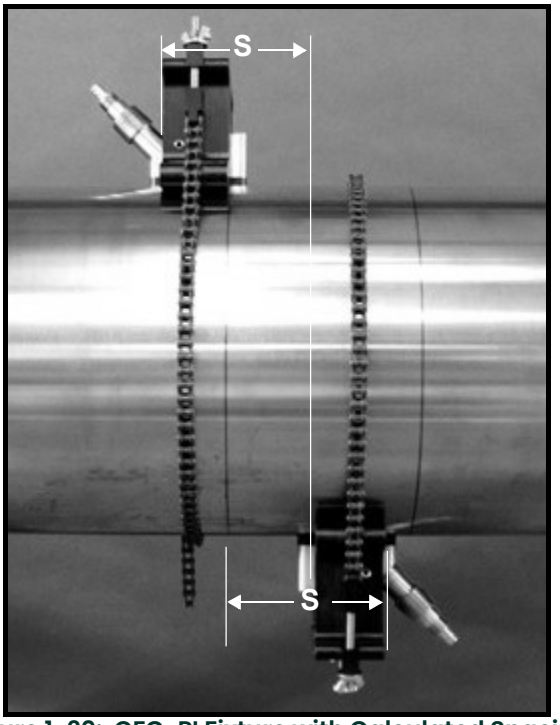

Figure 1-20: CFG-PI Fixture with Calculated Spacing

1.4.5.4 Installing the Transducers

1. Check to be sure the second CFG-PI holder bracket is correctly positioned.
2. Apply a bead of CPL-16 couplant 6 mm (0.25 in.) wide on each transducer face (see Figure 1-21 below).

Figure 1-21: Couplant on Transducer Face

Note: *Do not slide the transducer with couplant along the surface of the pipe when mounting the transducer.*

3. With one hand, mount one transducer into the PI fixture. With the other hand, tighten the thumbscrew, gradually pushing the transducer down to the pipe surface. Use a wrench to tighten the backing nut to prevent loosening due to vibration and thermal expansion.

IMPORTANT: Do not use pliers or a wrench on the thumbscrew.

4. Repeat step 3 for the other transducer.

1.5 Installing Damping Material

Panametrics strongly recommends applying DMP damping material in ALL permanent clamp-on applications to help eliminate signal noise. The material comes in two versions:

- The DMP-1 self-adhesive sheet for applications up to 200°F (93°C). The material comes as two 9.5-in. (24 cm) wide sheets cut in sufficient length for two wraps around a pipe OD. (Length ≈ twice the circumference.) The material can be cut with a utility knife, and comes with a paper backing that is removed before installation.)
- The DMP-3 is a clay-like compound for all temperature applications. If the temperature is over 150°F, the PDJ pipe damping jacket (available from the factory with preapplied DMP-3) must be used with the material.

At a minimum, you should consider applying damping material if you have any of the following conditions:

- The distance from the nearest butt weld or pipe flange is less than 10 ft (3 m);
- The pipe size is under 4 in. (100 mm) diameter and the gas pressure is 200 psig (14 bara) or lower;
- The pipe is deformed,
- The pipe is old, with a history of scaling or rust,
- The pipe experiences condensation on the outside.

Note: *Consult a Panametrics flowmeter applications engineer or sales engineer if you have any questions regarding damping material.*

1.5.1 Installing DMP-1 Damping Material with CFG-V Series Fixtures

1. Be sure the CFG-V clamping fixture is installed on the pipe with the transducers as described in the section *Installing the V Series Clamping Fixture and Transducers* on page 1-10. With a marker, mark scribe lines on the inside edges of the brackets onto the pipe. These lines indicate where to apply the material. (One 9.5-in. roll fits between the brackets.)
2. Remove the fixture and transducers.
3. Use a dry towel or rag and thoroughly dry the pipe.
4. Unroll the DMP-1 material and cut off a length equal to the length of the circumference. Peel the paper backing off the cut portion.

IMPORTANT: The DMP-1 material will only adhere to the pipe correctly if the pipe is completely dry. To adhere properly, the material must also be at a temperature above 50°F (10°C).

5. Before more atmospheric condensation can occur on the outside of the pipe, roll the DMP-1 damping material once around the pipe, following the scribe marks that represent the inside edge of the fixture, as shown in Figure 1-22 below.

Figure 1-22: DMP-1 Damping Material Wrapped Around Pipe

6. Reinstall the fixture, and make sure the spacing is set correctly. Loosely mount the transducers on top of the damping material, using the correct spacing.

7. With a marker, trace around the transducer footprint, as shown in Figure 1-23 below.

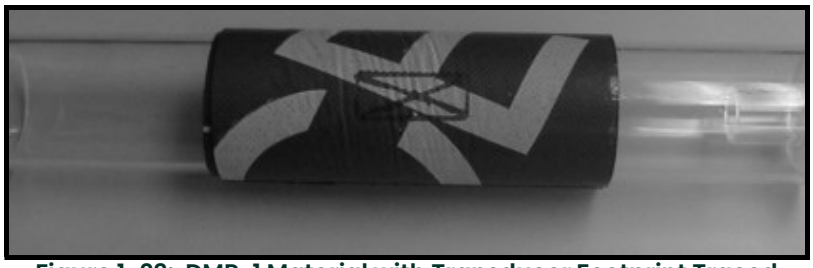

Figure 1-23: DMP-1 Material with Transducer Footprint Traced

8. Remove the fixture and transducer. Then use a utility knife to cut out the area under the transducer footprint, and peel the cut material off the pipe, as shown in Figure 1-24 below.

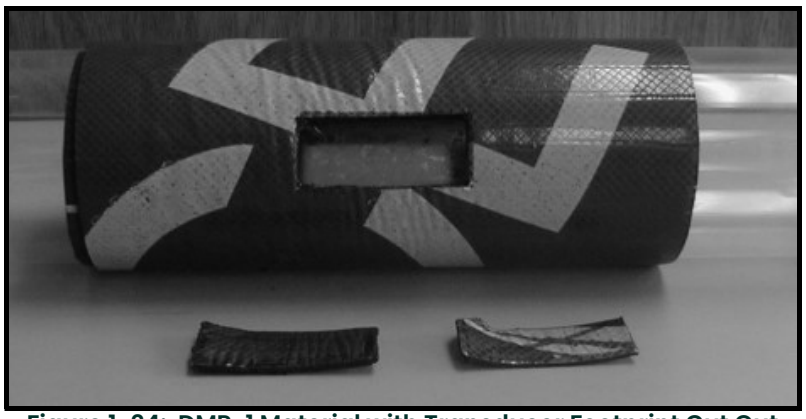

Figure 1-24: DMP-1 Material with Transducer Footprint Cut Out

9. To remove any residual adhesive, clean the cut-out area with a rag or a piece of sandpaper.
10. Reinstall the fixture and transducers on the pipe.
11. Lay the second strip of damping material flat. Then cut the strip into two pieces, each 4.5-in. (12 cm) wide.
12. Wrap each of these strips around the pipe on the outside edge of the clamping fixture, one upstream and one downstream. The completed damping material installation should appear similar to Figure 1-25 below.

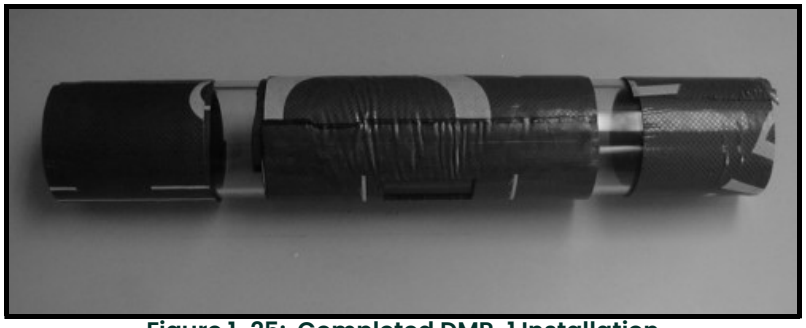

Figure 1-25: Completed DMP-1 Installation

1.5.2 Installing DMP-1 Damping Material with PI Fixture

1. Be sure the PI clamping fixture is installed onto the pipe with the transducers as described in the section *Installing the PI Fixture and Transducers* on page 1-12.
2. Approximate the axial distance from one transducer face to the other transducer face, as shown in Figure 1-26 below.

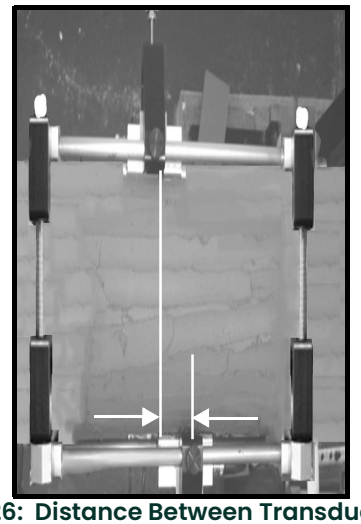

Figure 1-26: Distance Between Transducer Noses

3. Lay the first strip of damping material flat. Cut a strip to a width equal to the distance between transducer faces (the distance illustrated in Figure 1-26 above).
4. Wrap this strip around the pipe in the space between the transducers.
5. Lay the second strip of damping material flat. Then cut the strip into two pieces, each 4.5-in. (12 cm) wide.
6. Wrap each of these strips around the pipe on the outside edge of the clamping fixture, one upstream and one downstream. The completed installation should appear similar to Figure 1-27 below.

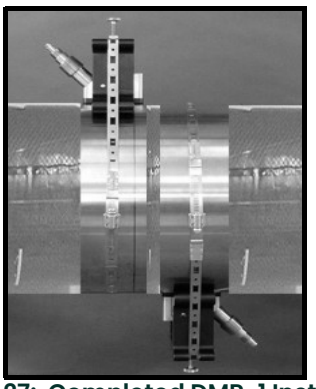

Figure 1-27: Completed DMP-1 Installation

1.5.3 Installing DMP-3 Compound with All Fixtures

1. Be sure the fixture and transducers are installed on the pipe as described in the section *Installing the Damping Material, Transducers and Fixtures* on page 1-3.
2. Remove the fixture and transducers, but be sure to mark the approximate area of installation.
3. Remove any loose paint or rust with a file or emery cloth, as shown in Figure 1-28a below. If the finish is mirror-smooth, roughen the surface.

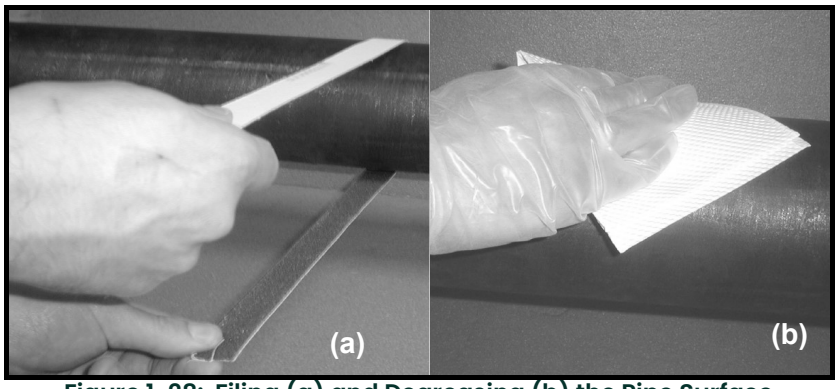

Figure 1-28: Filing (a) and Degreasing (b) the Pipe Surface

4. While wearing appropriate gloves, degrease the surface as shown in Figure 1-28b above.
5. Place a piece of the DMP-3 material on top of the pipe as shown in Figure 1-29a below, and use the palm of the hand to press it onto the pipe (see Figure 1-29b).

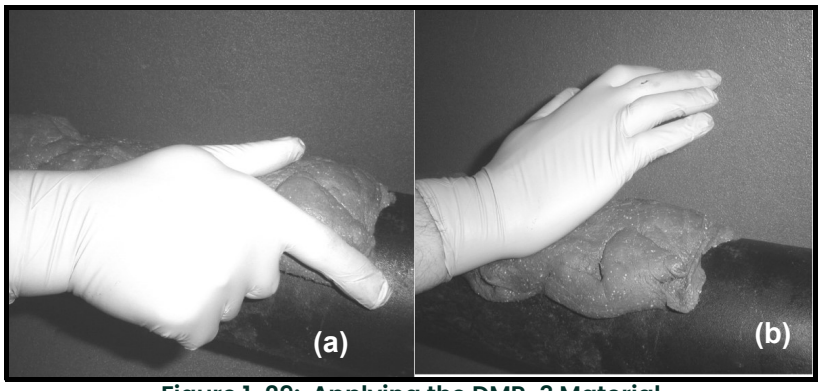

Figure 1-29: Applying the DMP-3 Material

6. Spread the DMP-3 material so that it covers the whole area under the fixture to a thickness of about 0.25 in. (6.4 mm), as shown in Figure 1-30a below.

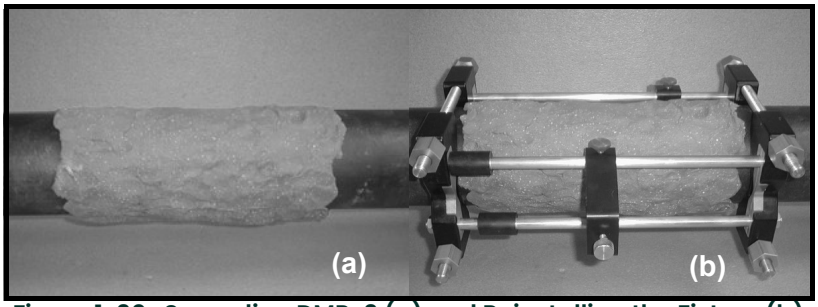

Figure 1-30: Spreading DMP-3 (a) and Reinstalling the Fixture (b)

7. Position the transducer yokes to the correct spacing and reinstall the fixture around, but not on, the DMP-3 material, as shown in Figure 1-30b above.
8. Remove the DMP-3 material from the transducer locations (see Figure 1-31a below).

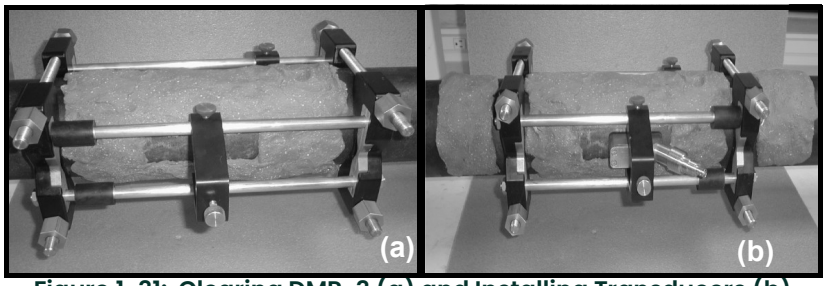

Figure 1-31: Clearing DMP-3 (a) and Installing Transducers (b)

9. Apply the couplant to the transducers, and install the transducers onto the pipe (Figure 1-31b above).

Note: *If the measurement point is near a flange or weld, apply DMP-3 between that structure and the fixture as well.*

1.5.4 Installing the PDJ Damping Jacket

If the pipe temperature is over 150°F, you must use the PDJ pipe damping jacket with preapplied DMP-3. As the damping material dries out over several hours after installation, its effectiveness increases. The jacket is available in standard pipe sizes from 3 to 12 in. (75 to 300 mm).

1. Remove any insulation from the installation area, as well as any loose paint, rust and high spots from the pipe.
2. Remove the backing paper from the inside of the pipe damping jacket (shown in Figure 1-32 below).

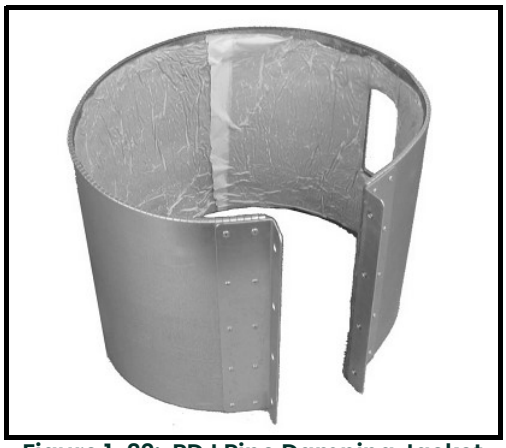

Figure 1-32: PDJ Pipe Damping Jacket

3. Install the jacket on the pipe as shown in Figure 1-33 below. Tighten the clamping screws so that some fluid drips from the bottom of the jacket.

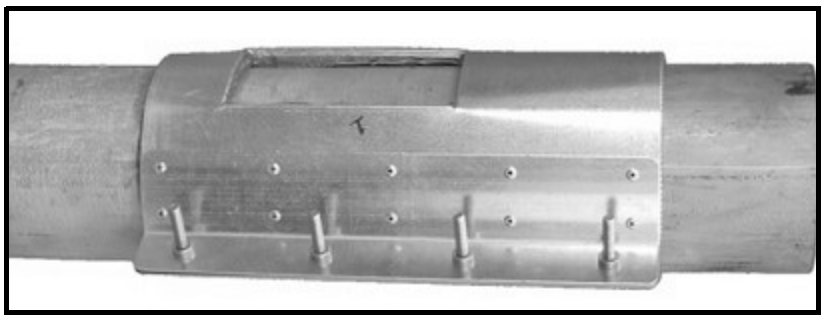

Figure 1-33: PDJ Jacket Installation

WARNING! **The pipe and the dripping fluid will cause severe burns upon contact with bare skin. Also, be sure not to inhale the fumes generated during the DMP-3 curing cycle.**

4. Install the fixture over the jacket, adjusting the spacing to match the prestamped transducer holes and GC868 spacing calculations.
5. Apply a thin bead of CPL-16 couplant. Spread it in a thin layer about 6 mm (0.25 in.) wide on each transducer face.
6. Install the transducers into the yokes, and tighten the hold-down screws until the couplant begins to spread.
7. If you wish, reinstall insulation over the pipe, making sure that the yokes and junction boxes protrude through the pipe.
8. Wait 15 min. for the couplant to cure and finger-tighten the transducer hold-down screws. Do not use pliers or any other tools.
9. Using a wrench, tighten the transducer hold-down screw backing nuts to prevent loosening due to vibration and thermal expansion.

1.6 Installing Temperature and Pressure Transmitters

Optional temperature and pressure transmitters may be installed near the ultrasonic transducer ports as part of the GC868 system. These transmitters can use a 0/4-20 mA or RTD signal to transmit the temperature and pressure values to the Model GC868 electronics console. In turn, the electronics console can provide a 24 VDC signal to power the transmitters, if wired in that configuration. Any desired transmitters or sensors may be used, but they must have an accuracy equal to 0.5% of the reading or better.

Note: *A clamp-on Resistive Thermal Device (RTD) can be used to measure temperature. It can be wired to either a RTD-to-4-20 mA converter (separate from the GC868) or directly into an optional RTD input board in the GC868 (see Figure 1-42 on page 1-43).*

Typically, a 1/2" 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.

IMPORTANT: Under changing temperature and pressure conditions, the Model GC868 can calculate standard volumetric flow accurately only if temperature and pressure transmitters have been installed.

Figure 1-34 below shows a typical mounting arrangement for the pressure and temperature transmitters. The temperature sensor should protrude 1/4 to 1/2 way into the pipe.

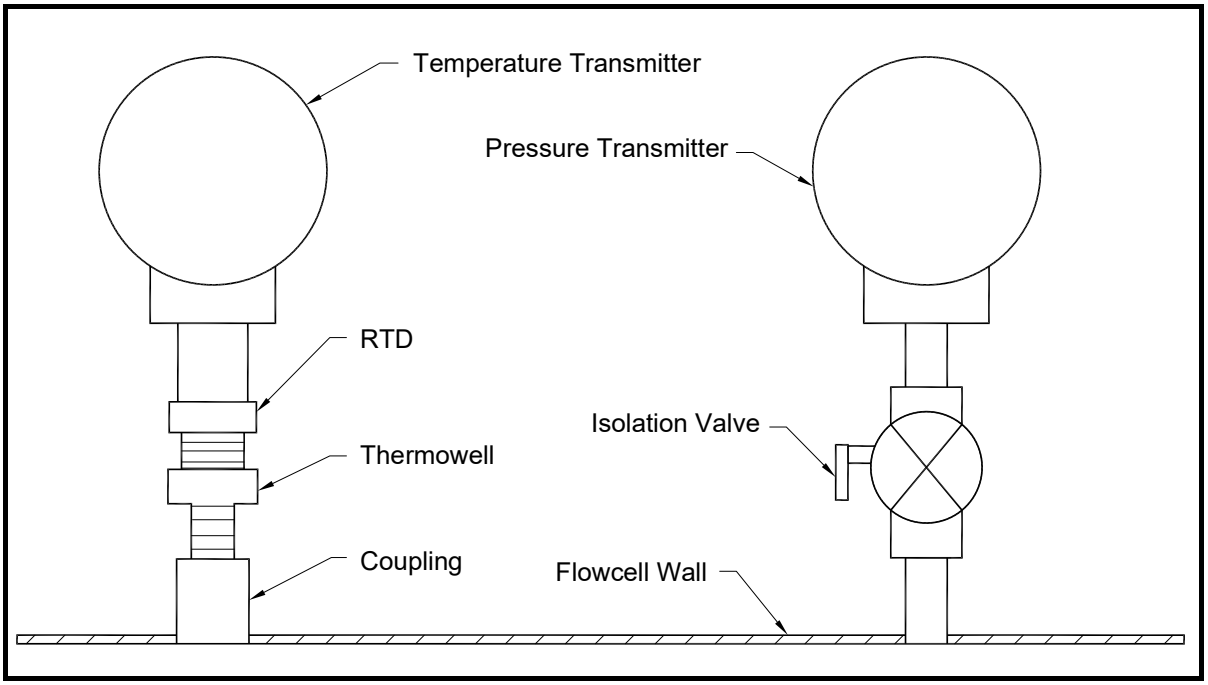

Figure 1-34: Typical Temperature/Pressure Transmitter Mounting

1.7 Mounting the GC868 Electronic Console

The standard Model GC868 electronics package is housed in a Type-4X weather-resistant enclosure. Refer to Figure 1-41 on page 1-42 for the mounting dimensions of this enclosure.

IMPORTANT: For meters supplied in one of the optional enclosure styles, refer to Appendix C, Optional Enclosures, for specific mounting dimensions and instructions.

WARNING! **Proper grounding of the GC868 chassis is required to prevent the possibility of electric shock. See Figure 1-42 on page 1-43 to locate the internal ground connection.**

1.8 Making Electrical Connections

ATTENTION EUROPEAN CUSTOMERS! To meet CE Mark requirements, all cables must be installed as described in Appendix A, CE Mark Compliance.

This section contains instructions for making all the necessary electrical connections to the Model GC868 flowmeter. Refer to Figure 1-42 on page 1-43 for a complete wiring diagram of the unit.

IMPORTANT: For meters supplied in one of the optional enclosure styles, refer to Appendix C, Optional Enclosures, for the appropriate wiring diagram and specific wiring instructions.

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

Note: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), a transparent plastic shroud protects the electrical connections. The shroud must remain in place, except while wiring the unit. Reinstall the shroud after the wiring has been completed.*

Once the Model GC868 is completely wired, proceed to Chapter 2, *Initial Setup*, to configure the unit for operation.

1.8.1 Wiring the Line Power

ATTENTION EUROPEAN CUSTOMERS! To meet CE Mark requirements, all cables must be installed as described in Appendix A, CE Mark Compliance.

The Model GC868 may be ordered for operation with power inputs of 100-120 VAC, 220-240 VAC, or 12-28 VDC. The label on the shroud inside the electronics enclosure, just above the **TB1** line power terminal block, lists the required line voltage and the fuse rating for the unit (the fuse rating is also listed in Chapter 4, *Specifications*). Be sure to connect the meter only to the specified line voltage.

Note: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), 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 Model GC868.*

Refer to Figure 1-35 on page 1-25 or Figure 1-42 on page 1-43 to locate terminal block **TB1** and connect the line power as follows:

WARNING! 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 and within the electronics console.

1. Remove the plastic shroud that covers the terminal blocks. Be sure to reinstall the shroud after all of the wiring has been completed.
2. Strip ¼" of insulation from the end of the power and neutral AC leads (or the positive and negative DC line power leads), and ½" from the end of the ground lead.
3. Connect the ground lead to the internal ground connection located on the side panel of the enclosure (see Figure 1-35 below).

IMPORTANT: The incoming ground lead must be connected to the internal ground connection.

4. Connect the neutral or line lead (or the negative – DC power lead) to TB1-2 and the line power lead (or the positive + DC power lead) to TB1-3 as shown in Figure 1-35 below.

IMPORTANT: Do not remove the existing PC board ground wire or the cover ground wire.

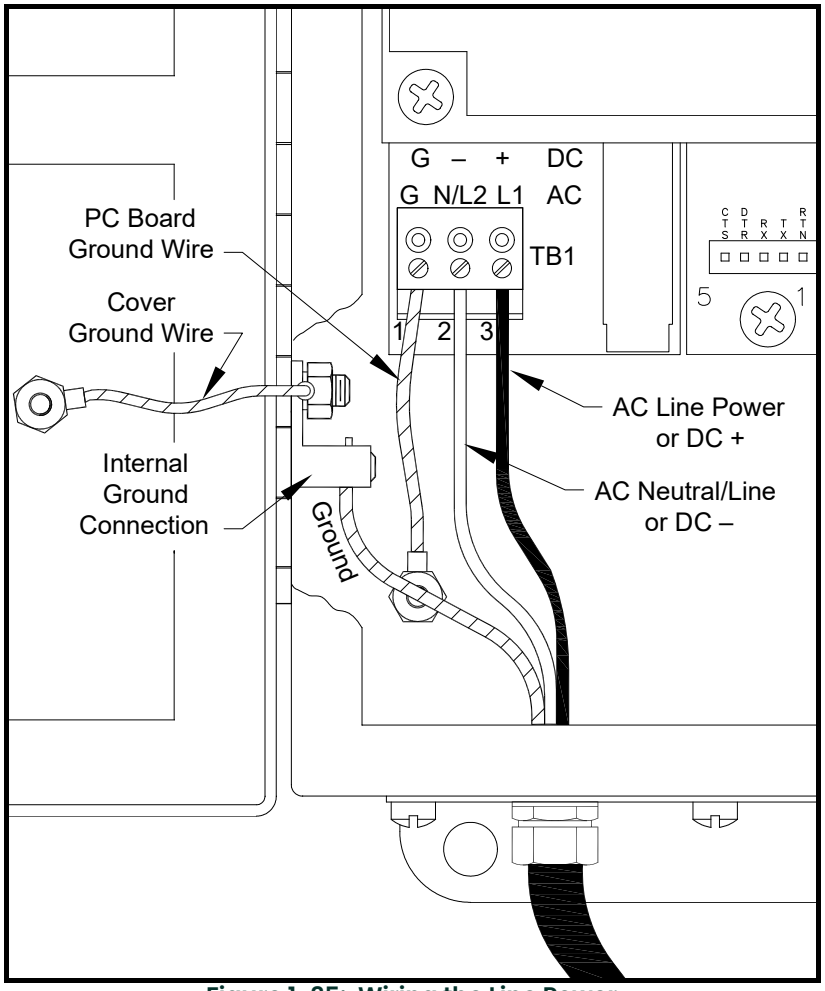

Figure 1-35: Wiring the Line Power

1.8.2 Wiring the Transducers

Wiring a typical Model GC868 ultrasonic gas flowmeter system requires interconnection of the following components:

- a pair of transducers (per channel) mounted on the pipe
- a preamplifier for each channel
- a pair of lightning protectors per channel (optional)
- the electronics console

Refer to the typical transducer/flowcell wiring system in Figure 1-43 on page 1-44, and complete the following steps:

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.**

1. Using the pair of coaxial cables with BNC to BNC connectors supplied by the factory (or equivalent cables), connect both transducers to the preamplifier.

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 being installed, connect it to a high-integrity ground between the preamplifier and the electronics.
3. Using the pair of coaxial cables with BNC to flying lead connectors supplied by Panametrics (or equivalent cables), connect the preamplifier to terminal block **CH1** in the electronics console. Refer to Figure 1-43 on page 1-44 for the location of the terminal block and the terminal block pin assignments.
4. For a 2-channel Model GC868 flowmeter, repeat steps 1-3 to wire the Channel 2 transducer system to terminal block **CH2**.

Note: *It is not required that Channel 2 of a 2-channel Model GC868 be used. This channel may be left inactive for future use.*

After the wiring has been completed, the transducer channel(s) must be activated before measurements can begin. See Chapter 2, *Initial Setup*, for instructions.

1.8.3 Wiring the 0/4-20 mA Analog Outputs

The standard configuration of the Model GC868 flowmeter includes two isolated 0/4-20 mA analog outputs (designated as A and B). Connections to these outputs may be made with standard twisted-pair wiring. The current loop impedance for these circuits must not exceed 550 ohms.

Refer to Figure 1-42 on page 1-43 for the location of terminal block **I/O** and wire the terminal block as shown.

1.8.4 Wiring the Serial Port

The Model GC868 is equipped with a built-in serial communications port. The standard port is an RS232 interface, but an optional RS485 interface is available upon request. Proceed to the appropriate sub-section for wiring instructions. For more information on serial communications, refer to the *EIA-RS Serial Communications* manual (916-054).

1.8.4.1 Wiring the RS232 Interface

The RS232 communications port provides a serial interface for connecting the Model GC868 flowmeter to a personal computer.

The RS232 serial interface is wired as Data Terminal Equipment (DTE), and the signals available at the Model GC868 **RS232** terminal block are shown in Table 1-4 below. See Figure 1-42 on page 1-43 to locate terminal block **RS232** and complete the following steps to wire the terminal:

1. Use the information in Table 1-4 below to construct a suitable cable for connecting the Model GC868 to the external device. If desired, an appropriate cable may be purchased from the factory.

Table 1-4: RS232 Connection to DCE or DTE Device

RS232 Pin #	Signal Description	DCE DB25 Pin #	DTE DB25 Pin #	DTE DB9 Pin #
1	RTN (Return)	7	7	5
2	TX (Transmit)	3	2	2
3	RX (Receive)	2	3	2

Table 1-4: RS232 Connection to DCE or DTE Device

RS232 Pin #	Signal Description	DCE DB25 Pin #	DTE DB25 Pin #	DTE DB9 Pin #
4	DTR (Data Terminal Ready)	20	5	3
5	CTS (Clear to Send)	5	20	8

2. Wire the flying leads end of the cable to terminal block **RS232** and connect the other end of the cable to the personal computer.

After the wiring has been completed, consult the User's Manual for the external device to configure it for use with the Model GC868.

1.8.4.2 Wiring the RS485 Interface

Use the optional RS485 serial port to network multiple GC868 flowmeters to a single computer terminal. Upon request, the standard RS232 port on the GC868 may be configured as a two-wire, half-duplex RS485 interface, through a device such as the INMAC Model 800052 RS232-RS422/RS485 converter.

To wire the RS485 serial port, refer to Figure 1-42 on page 1-43 and complete the following steps:

1. Disconnect the main power to the unit and remove the cover.
2. Install the required cable clamp in the chosen conduit hole on the side of the electronics enclosure.
3. Feed one end of the cable through the conduit hole, wire it to terminal block J1 and secure the cable clamp. Connect the other end of the cable to the converter, as shown in Figure 1-36 below.

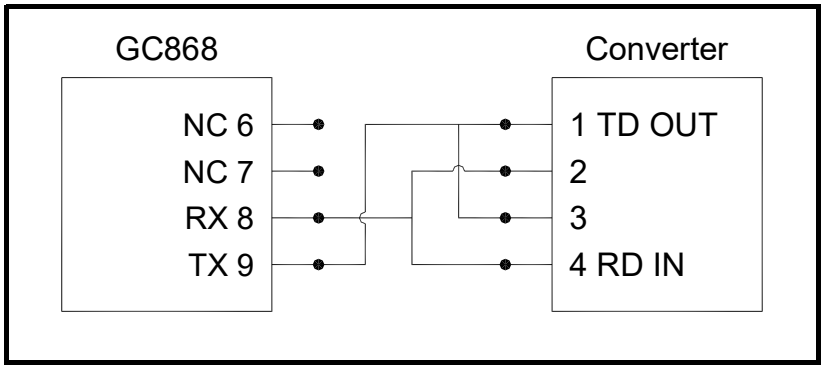

Figure 1-36: Typical RS485 Connections

ATTENTION EUROPEAN CUSTOMERS! 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 plastic shroud, close the cover on the enclosure and tighten the latches.
5. Connect the converter to the control system, as described in its User's Manual.

1.8.4.3 Wiring the Ethernet Interface

A modified GC868 can use the Ethernet interface to communicate to an internal network. An optional Ethernet card with a unique MAC (IP) address (installed only in slots 5 or 6) includes an RJ45 connector. To connect the Ethernet-enabled GC868 to the network, insert the jack of an RJ45 cable into the RJ45 connector, route the cable through the bottom of the GC868, 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 GC868's RS232 connector, as shown in Table 1-5 below.

Note: *The MAC address for a specific GC868 is included with customer documentation. For more information on setting up the MAC address, refer to Chapter 6 of the* Programming Manual.

Table 1-5: RS232 to Ethernet Interconnections

GC868 Type	Terminal Block	Terminal Block
Wall Mount	RS232 on Main Board	TB1 on Ethernet Card
	TX	Pin 1
	RX	Pin 2
	RTN	Pin 3
Rack Mount	RS232 on Main Board	TB2 on Ethernet Card
	TX	Pin 1
	RX	Pin 2
	RTN	Pin 3

1.8.4.4 Wiring the MODBUS/TCP Interface

Customers can also use a modified GC868 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 slots 5 or 6) includes an RJ45 connector. To connect the MODBUS/TCP-enabled GC868 to the network, insert the jack of an RJ45 cable into the RJ45 connector, route the cable through the bottom of the GC868, and wire the other end of the cable to the Ethernet network according to the manufacturer's instructions.

Note: *The MAC address for a specific GC868 is included with customer documentation. For more information on setting up the MAC address, refer to Chapter 6 of the Programming Manual.*

1.8.4.5 Wiring the Foundation Fieldbus Network

Fieldbus network connections are made at J8/J9, pins 1 and 2 (see Figure 1-37 below). Optionally, a shield can be connected to J8/J9 pin 3, depending on the network wiring. Connector J8 or J9 will be installed depending on the option ordered by the customer.

No connections are made to J8/J9, pins 7 and 9, under normal operation. If it is desired to reset the network board to factory defaults:

1. Connect a jumper between J8/J9 pin 7 and pin 9.
2. Power cycle the instrument.
3. Ten seconds after the power has been restored to the unit, remove the jumper to return the network board to normal operation.

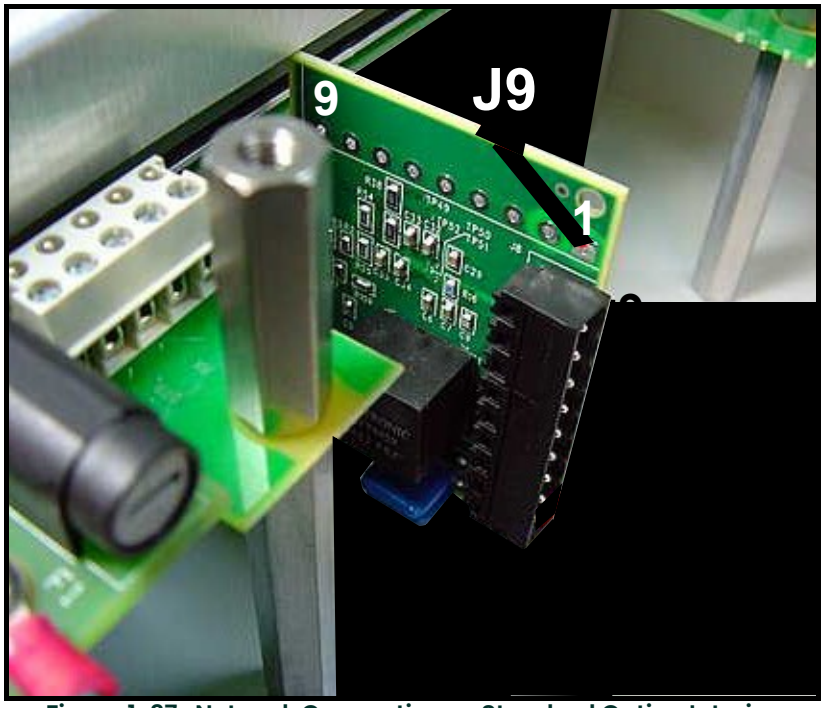

Figure 1-37: Network Connections - Standard Option Interior

1.8.5 Wiring an Alarms Option Card

The Model GC868 flowmeter can accommodate up to 4 alarm option cards. Each alarm option card includes three *Form C relays* (designated as A, B and C).

The alarm relays on the option card are available in two types:

- general purpose
- hermetically sealed for Class I, Division 2 hazardous areas.

The maximum electrical ratings for the relays are listed in Chapter 4, *Specifications*. Each of the three alarm relays can be wired either as *Normally Open* (NO) or *Normally Closed* (NC).

In setting up an alarm relay, it may be wired for either *conventional* or *fail-safe* operation. In fail-safe mode, the alarm relay is constantly energized, except when it is triggered or a power failure or other interruption occurs. See Figure 1-38 below for the operation of an alarm relay in both conventional and fail-safe mode.

Connect the two wires required for each alarm relay in accordance with the pin number assignments shown in Figure 1-42 on page 1-43.

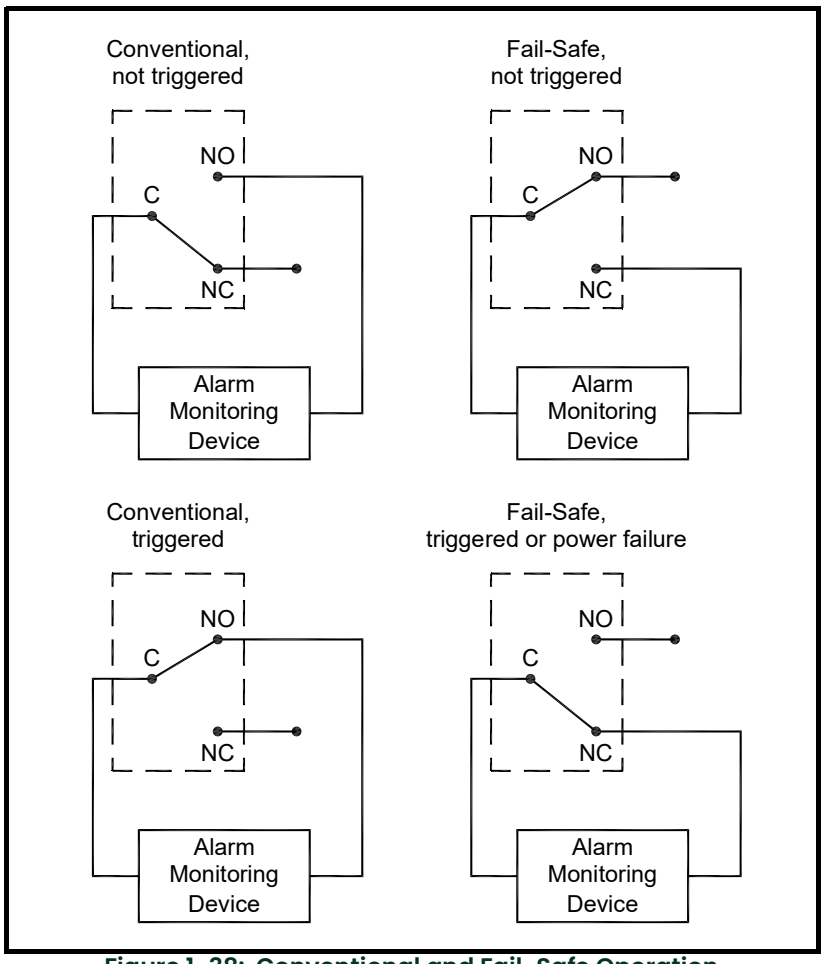

Figure 1-38: Conventional and Fail-Safe Operation

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

To calculate the standard volumetric flow rate of a gas, the Model GC868 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 input card. This option card includes two isolated 0/4-20 mA analog inputs (designated as A and B), 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 enter programming data during operation of the meter, it will be necessary to know which input is assigned to which process parameter. This information should have been 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 card or by an external power supply. Figure 1-39 below shows typical wiring diagrams, with and without an external power supply, for one of the analog inputs.

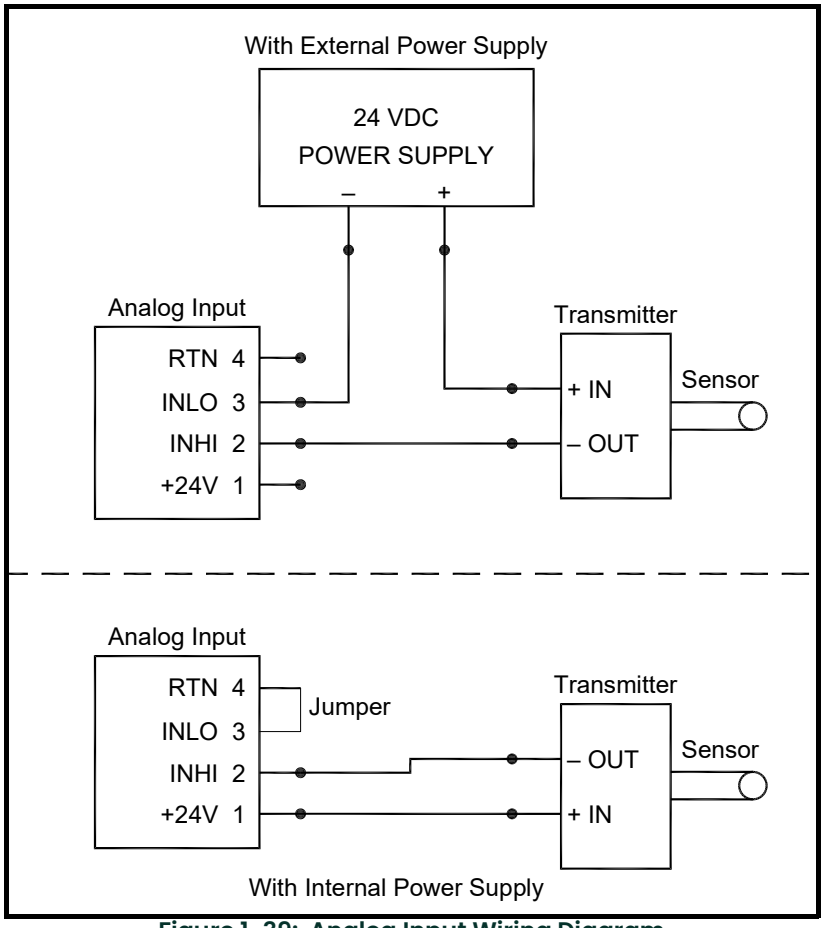

Figure 1-39: Analog Input Wiring Diagram

Wire the analog input terminal block in accordance with the pin number assignments shown in Figure 1-42 on page 1-43.

If the flowmeter system includes additional transmitters, the Model GC868 can accommodate up to three more analog input option cards. These option cards are identical to the temperature/pressure card described above and they should be wired in the same manner (see Figure 1-39 on the previous page).

The analog inputs on the option card(s) can be calibrated with the Model GC868's 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.

1.8.6.1 Wiring a Totalizer/Frequency Outputs Option Card

The Model GC868 can accommodate up to four totalizer/frequency outputs option cards. Each totalizer/frequency output option card provides four outputs (designated as A, B, C, and D) that can be used as either totalizer or frequency outputs.

Each totalizer/frequency output requires two wires. Wire this terminal block in accordance with the pin number assignments shown in Figure 1-42 on page 1-43. Figure 1-40 below shows sample wiring diagrams of a totalizer output circuit and a frequency output circuit.

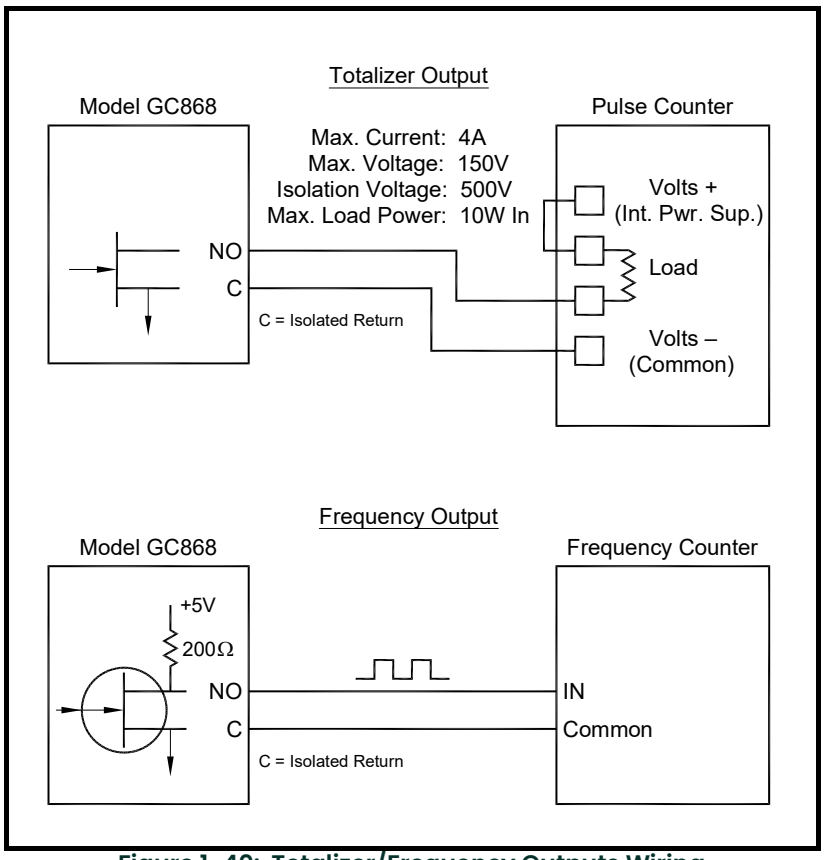

Figure 1-40: Totalizer/Frequency Outputs Wiring

1.8.7 Wiring an RTD Inputs Option Card

The Model GC868 can accommodate up to four RTD (Resistance Temperature Device) input option cards. Each RTD input option card provides two direct RTD inputs (designated as A and B).

Each RTD input requires three wires, which should be fed through one of the conduit holes on the bottom of the electronic console. Wire this terminal block in accordance with the pin number assignments shown in Figure 1-42 on page 1-43.

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

The Model GC868 flowmeter can accommodate up to 4 analog output option cards. Each analog output option card includes four isolated 0/4-20 mA outputs (designated as A, B, C and D).

Connections to these outputs may be made with standard twisted-pair wiring. The total current loop impedance for these circuits must not exceed 1000 ohms. Wire this terminal block in accordance with the pin number assignments shown in Figure 1-42 on page 1-43.

1.8.9 Wiring the MODBUS Option Card

The modified GC868 uses the RS485 standard for MODBUS communications. This standard allows up to 32 nodes (drivers and receivers) on one multidrop network, at distances up to 4,000 ft (1,200 m). To connect the instrument(s) to the control system, Panametrics recommends using a 24-gauge (24 AWG) twisted-pair cable with a characteristic impedance of 120 ohms and a 120-ohm termination at each end of the communications line.

The MODBUS option card must be plugged into either slot 5 or slot 6 of the GC868. On the option card, pin 1 is the **[TMT-]** inverting or negative connection and pin 2 is the **[TMT+]** non-inverting or positive connection. To link the GC868 to the control system, connect the two wires of the twisted-pair cable from these terminals to the corresponding terminals at the control system.

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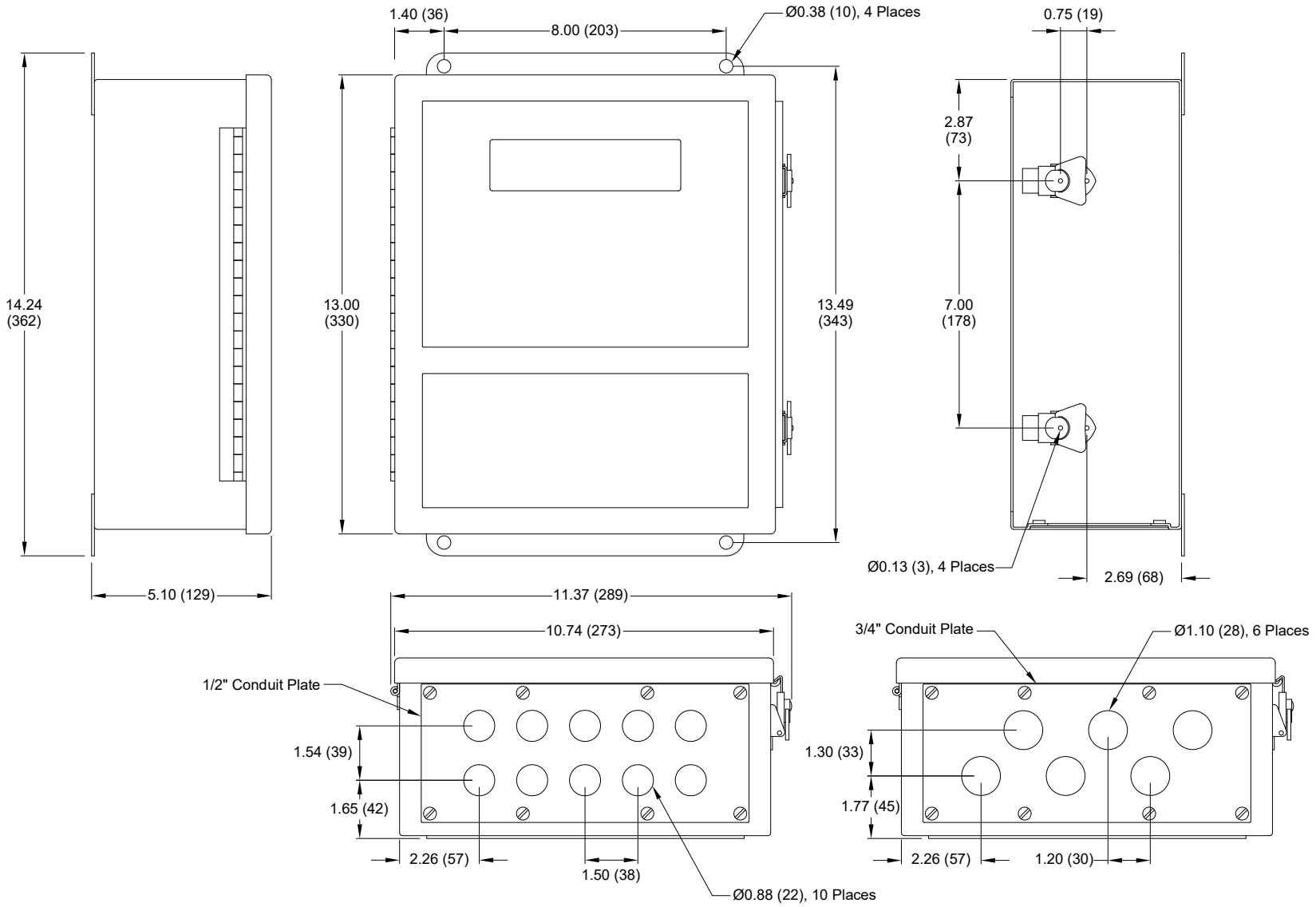


Figure 1-41: Model GC868 Type 4X Enclosure (ref. dwg #425-208)

RS232 SERIAL PORT	
Pin #	Description
1	RTN - Digital Return
2	TX - Transmit
3	RX - Receive
4	DTR - Data Terminal Ready
5	CTS - Clear to Send

RS485 PORT (MODBUS)	
Pin #	Description
1	TMT-
2	TMT+
3	Unused
4	Unused
5	Unused

NOTE: For compliance with the European Union's Low Voltage Directive (73/23/EEC), 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 Model DF868.

TB1 POWER INPUT 12 - 28 VDC	
Pin #	Description
1	G - Earth Ground
2	– Negative
3	+ Positive

OR

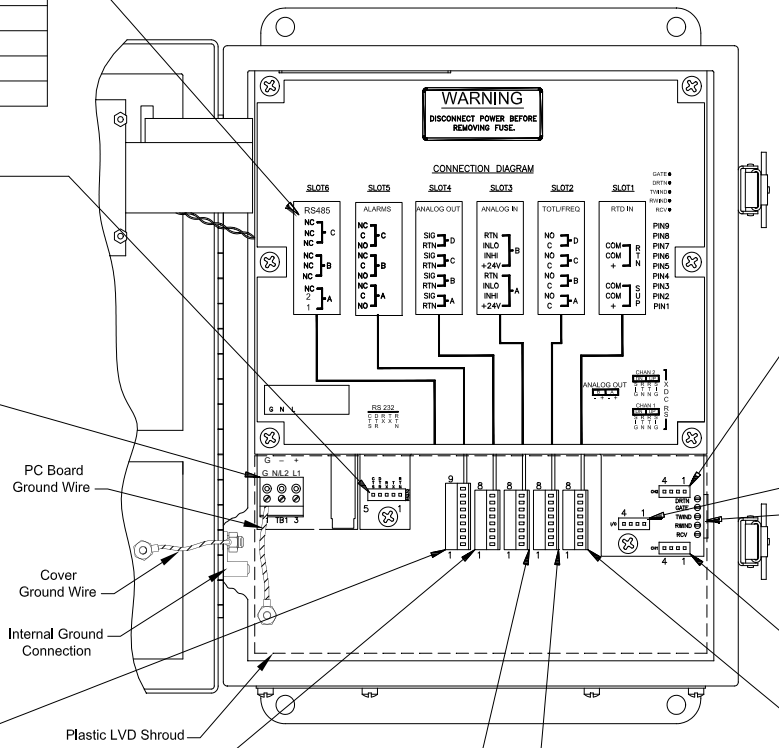
TB1 POWER INPUT 100 or 120 VAC	
Pin #	Description
1	G - Earth Ground
2	N - Line Neutral
3	L1 - Line Power

OR

TB1 POWER INPUT 220 or 240 VAC	
Pin #	Description
1	G - Earth Ground
2	L2 - Line Power
3	L1 - Line Power

NOTE: For compliance with the European Union's Low Voltage Directive (73/23/EEC), a transparent plastic shroud protects the electrical connections. The shroud must remain in place, except while wiring the unit. Reinstall the shroud after the wiring has been completed.

NOTE
One option card of each available type is shown in this diagram. These cards are not always installed in the same slots used for this example.



CH2 TRANSDUCER	
Pin #	Description
1	Upstream SIG(+)
2	Upstream RTN(-)
3	Downstream RTN(-)
4	Downstream SIG(+)

0/4-20 mA ANALOG OUTPUTS	
Pin #	Description
1	Output A - SIG(+)
2	Output A - RTN(-)
3	Output B - SIG(+)
4	Output B - RTN(-)

CH1 TRANSDUCER	
Pin #	Description
1	Upstream SIG(+)
2	Upstream RTN(-)
3	Downstream RTN(-)
4	Downstream SIG(+)

ALARM RELAYS	
Pin #	Description
1	Relay A - Normally Open (NO)
2	Relay A - Common (C)
3	Relay A - Normally Closed (NC)
4	Relay B - Normally Open (NO)
5	Relay B - Common (C)
6	Relay B - Normally Closed (NC)
7	Relay C - Normally Open (NO)
8	Relay C - Common (C)
9	Relay C - Normally Closed (NC)

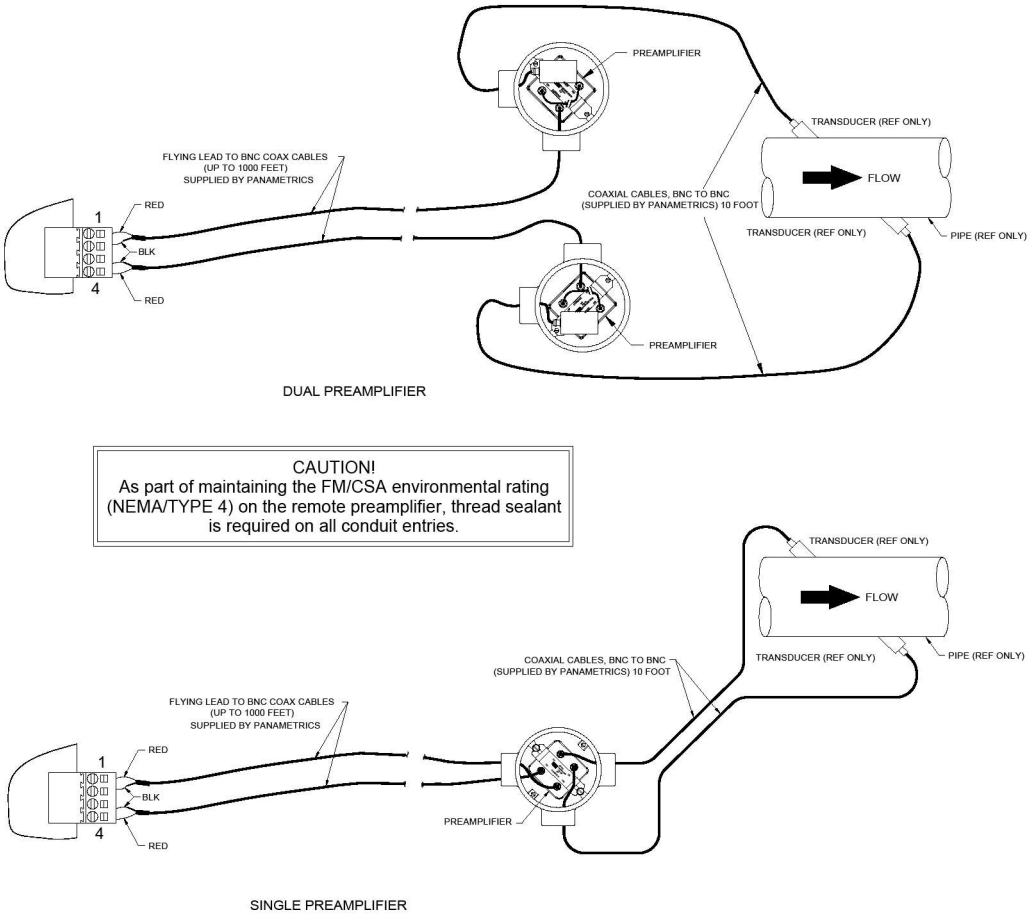
0/4-20 mA ANALOG OUTPUTS	
Pin #	Description
1	Output A - RTN(-)
2	Output A - SIG(+)
3	Output B - RTN(-)
4	Output B - SIG(+)
5	Output C - RTN(-)
6	Output C - SIG(+)
7	Output D - RTN(-)
8	Output D - SIG(+)

0/4-20 mA ANALOG INPUTS	
Pin #	Description
1	Input A - +24V
2	Input A - INHI
3	Input A - INLO
4	Input A - RTN
5	Input B - +24V
6	Input B - INHI
7	Input B - INLO
8	Input B - RTN

TOTALIZER/FREQUENCY OUTPUTS	
Pin #	Description
1	Output A - Common (C)
2	Output A - Normally Open (NO)
3	Output B - Common (C)
4	Output B - Normally Open (NO)
5	Output C - Common (C)
6	Output C - Normally Open (NO)
7	Output D - Common (C)
8	Output D - Normally Open (NO)

RTD INPUTS	
Pin #	Description
1	Input A - SIG(+)
2	Input A - Common (C)
3	Input A - Common (C)
4	Unused
5	Input B - SIG(+)
6	Input B - Common (C)
7	Input B - Common (C)
8	Unused

Figure 1-42: Model GC868 Electronics Console Wiring (ref. dwg #702-213, sht 1 of 2)



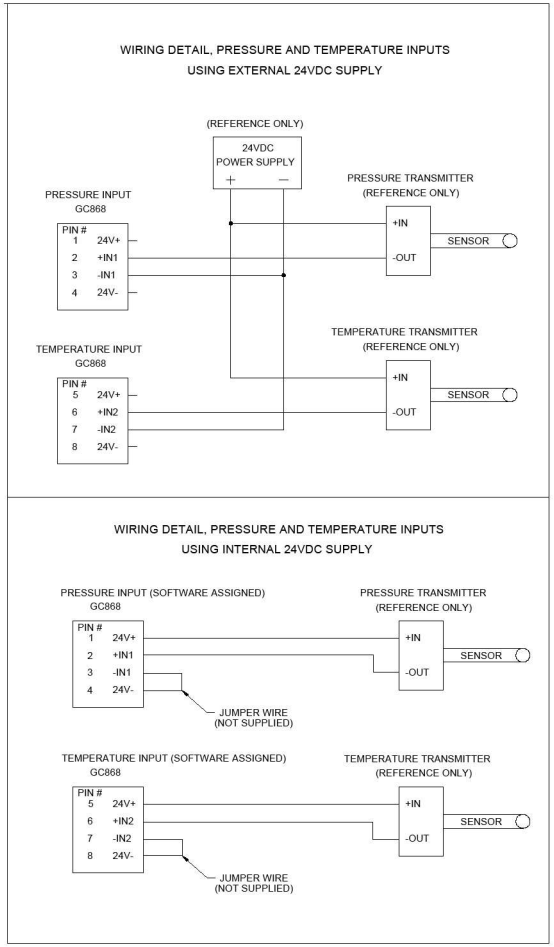


Figure 1-43: Model GC868 Transducer Wiring (ref. dwg #702-213, sht 2 of 2)

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Chapter 2. Initial Setup.

2.1 Introduction

This chapter provides instructions for entering the minimum amount of programming data required to place the Model GC868 flowmeter into operation. Before the GC868 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 Model GC868, but this information is not required to begin taking measurements.

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

2.2 Navigating Through the User Program

In order to begin using the Model GC868, the following submenus within the *User Program* will be accessed:

- **ACTIV** - enables selection of the desired measurement method (for a 2-Channel meter, it is also used to activate a channel)
- **SYSTM** - prompts the user to enter the required system data
- **PIPE** - prompts the user to enter the required pipe parameters

As a guide in following the programming instructions in this chapter, the relevant portions of the Model GC868 menu map have been reproduced in Figure 2-1 on page 2-10.

Note: *There are minor differences at the start of the* **ACTIV** *and* **SYSTM** *submenus for the 1-Channel and 2-Channel models, but the* **PIPE** *submenus are identical.*

The following discussion assumes that the left screen pane is active. If the right screen pane is active, only the function key designations change. That is, replace **[F1]-[F4]** with **[F5]-[F8]**. Be sure to record all programming data in Appendix B, *Data Records*.

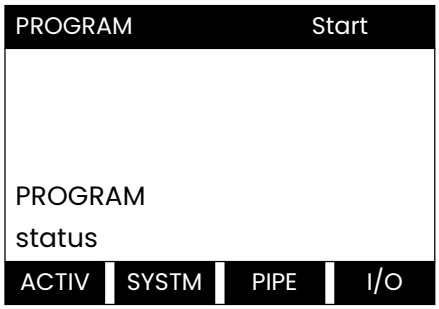
Use the keypad, as described in the *Programming Manual*, to navigate through the *User Program*. The menu map may be followed in sequence, or the [↑] and [↓] keys may be used to scroll through the prompt screens. The [←] key may be used to delete the last alphanumeric character that was entered from the keypad.

2.3 Accessing the User Program

To access the *User Program*, press the **[PROG]** key on the keypad.

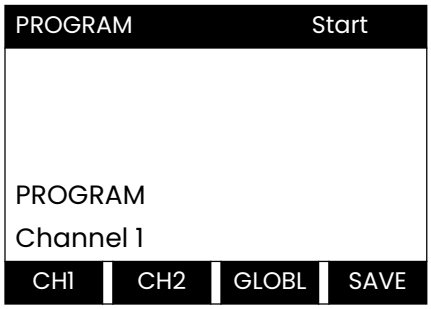
Note: *If the security feature is active, enter the password and press* **[ENT]** *to enter the* User Program*. See the* **SECUR** *submenu section in Chapter 1 of the* Programming Manual *for more information on the security feature.*

For a 1-Channel Model GC868, the measurement mode screen is replaced by the following initial programming mode screen:

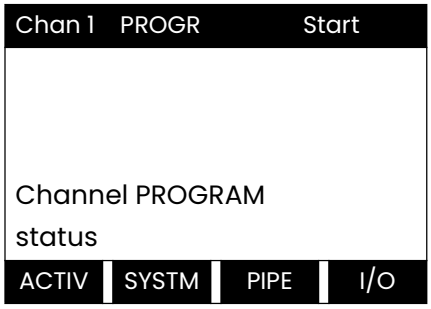


At the *User Program* screen shown, press **[F1]** and proceed to *Activating a Channel* on page 2-3 for instructions.

For a 2-Channel Model GC868, the following two-step sequence is required to reach the initial programming screen:



Press **[F1]** or **[F2]** to select the submenu for Channel 1 or Channel 2, respectively, from the option bar.



At the *User Program* screen shown, press **[F1]** and proceed to *Activating a Channel* on page 2-3 for instructions.

Only the submenus **ACTIV**, **SYSTM** and **PIPE** are discussed in this manual. Refer to the *Programming Manual* for information on the other submenus.

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

2.4 Activating a Channel

The **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 Model GC868.

2.4.1 1-Channel Meter

1. Enter the **ACTIV** submenu by pressing **[F1]** at the **User PROGRAM** prompt.
2. Press **[F1]** to activate the channel in **BURST** mode.

2.4.2 2-Channel Meter

1. Enter the **ACTIV** submenu by pressing **[F1]** at the **Channel PROGRAM** prompt.
2. Press **[F1]** (OFF) to deactivate the channel and return to the **Channel PROGRAM** prompt, or press **[F2]** to activate the channel in **BURST** mode.

2.4.3 1 and 2-Channel Meters

3. Press **[F1]** to select *Skan* mode, **[F2]** to select *Skan/Measure Integrate* mode, **[F3]** to select *Skan/Measure Count* mode, or **[F4]** to select *Skan/Correlation* mode. The meter will exit the **ACTIV** submenu and return to the channel menu screen.
   a. If you select Skan or Skan/Measure Count modes, the GC868 asks if you will *Use 703-1273 DSP?* (the digital signal processing board). Press **[F2]** to apply the board, or **[F1]** to apply the onboard signal processing. (Panametrics recommends using the DSP for improved response time.)

As indicated in the above prompt, the Model GC868 flowmeter can take measurements in four different ways:

Skan is a low resolution technique for locating the acoustic signal and for high velocity measurements. It is more robust in a noisy environment than the Measure technique. A variation, the *Skan/Correlation* mode, is used primarily for liquid detection applications.

Measure is a more precise technique best used for low velocity measurements. You can choose from *Skan/Measure Count* (the default technique) or *Skan/Measure Integrate* (the traditional Skan/Measure mode).

IMPORTANT: Consult with the factory before selecting the Skan/Correlation or Skan/Measure Integrate modes.

If *Skan* is selected at the next prompt, the instrument uses this technique exclusively. However, if one of the *S/M* modes is selected, the meter uses *Skan* to find the acoustic signal and then tries to use the *Measure* technique for a more precise measurement.

Proceed directly to the next section to program the **SYSTM** submenu.

2.5 Entering System Data for a Channel

Begin the programming of the **SYSTM** submenu in either the *1-Channel* or *2-Channel* section below.

2.5.1 A 1-Channel Meter

For the 1-Channel Model GC868, the information entered in the **SYSTM** submenu pertains to the global operation of the flowmeter.

1. At the *User Program* screen, press the **[F2]** function key to program the **SYSTM** submenu.
2. Enter a *Site Label* of up to 9 characters and press **[ENT]**. (While taking measurements, the site label will appear on the locator bar.)
3. Enter a *Site Message* of up to 21 characters. Press **[ENT]**.
4. To select the *System Units*, press **[F1]** to display parameters and measurements in English units, or press **[F2]** to display parameters and measurements in Metric units.
5. Use the **[F1]**-**[F4]** keys to select the type of *Pressure Units* desired.

The abbreviations and definitions of all the available pressure units are shown in Table 2-1 below. The choices shown on the option bar are determined by the selections made at the previous **SYSTEM UNITS prompt**.

Table 2-1: Available Pressure Units

English	Metric
PSIa = Pounds per square inch absolute	BARa = bar absolute
PSIg = Pounds per square inch gauge	BARg = bar gauge
	kPaa = kiloPascals absolute
	kPag - kiloPascals gauge

   a. If you have entered the local *Atmospheric Pressure* (PSIg, BARg or kPag), use the numeric keys to enter the atmospheric pressure value. Press **[ENT].**

6. At the *Stopwatch Totalizer* prompt, press **[F1] to totalize all liquid flow continuously, or [F2]** to measure totals manually with the Stopwatch Timer. (With **MNUAL** (**[F2]**), the console key on the keypad is used to start and stop the totalizer. See the *Programming Manual* for details.)

The remainder of the **SYSTM** submenu is identical for the 1-Channel and 2-Channel versions of the Model GC868. Proceed to the *1- and 2-Channel Meters* section to complete the programming of this submenu.

2.5.2 A 2-Channel Meter

For the 2-Channel Model GC868, the information entered in the **SYSTM** submenu pertains only to the currently selected channel.

1. At the *User Program* screen shown, press the **[F2]** function key to program the **SYSTM** submenu.
2. Enter a *Channel Label* of up to 9 characters. Press **[ENT]**.
3. Enter a *Channel Message* of up to 21 characters. Press **[ENT]**.

Note: *For the 2-Channel Model GC868, the* **System Units, Pressure Units** *and* **Stopwatch Totalizer** *prompts, which are not required to make the unit operational, are located in the* **GLOBL** *submenu. See the* Programming Manual *for details.*

The remainder of the **SYSTM** submenu is identical for the 1-Channel and 2-Channel versions of the Model GC868. Proceed to the *1- and 2-Channel Meters* section below to complete the programming of this submenu.

2.5.3 1- and 2-Channel Meters

1. At the *Equation* prompt, press **[F1]** to display the measurement data in *standard* volumetric units, or press **[F2]** to display the measurement data in *actual* volumetric units. The Model GC868 will use the appropriate gas equation to calculate the flow rate, corresponding to the measured data, in the volumetric units indicated.

   a. If you selected *Standard*, press **[F1]** to have the meter treat the gas as an *ideal gas* or press **[F2]** to have the meter treat the gas as a *supercompressed gas*.

2. Use the **[F1]-[F4]** and [→] keys to select the desired *Volumetric Units* for the flow rate display.

The abbreviations and definitions of all the available volumetric and totalizer units are shown in Table 2-2 on page 2-5. The choices shown on the option bar are determined by the selection made at the previous **SYSTEM UNITS** screen

Table 2-2: Available Volumetric/Totalizer Units

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

3. Use the **[F1]-[F4]** keys to select the *Volumetric Time* (units for the volumetric flow rate display).
4. Use the **[F1]-[F4]** keys to select the *Vol Decimal Digits* (the desired number of digits to the right of the decimal point) in the volumetric flow rate display.
5. Use the **[F1]-[F4] and** [→] keys to select the *Totalizer Units.*

The abbreviations and definitions of all the available volumetric and totalizer units are shown in Table 2-2 above. The choices shown on the option bar in the prompt screen above are determined by the selection made at the previous **SYSTEM UNITS** prompt screen.

6. Use the **[F1]-[F4]** keys to select the *Total Decimal Digits* (the desired number of digits to the right of the decimal point) in the totalized flow display.

2.5.3.1 Mass Flow (static)?

7. If the **Static Density?** prompt in the **ADVAN** submenu (**SETUP** menu) is set to **NO**, the GC868 returns to the initial *User Program* screen. Otherwise, proceed as follows:
   a. Use the **[F1]-[F4]** keys to select the *Mass Flow* units, listed in Table 2-3 below.

Table 2-3: Available Mass Flow Units

English Mass Flow Units	Metric Mass Flow Units
LB- Pounds	KG - Kilograms
KLB - Thousands of Pounds	
MMLB - Millions of Pounds	
TONS - Tons	Tonnes - Metric Tons

   b. Use the **[F1]-[F4]** keys to select the *Mass Flow Time* units.
   c. Use the **[F1]-[F4]** keys to select the *MDOT DECIMAL DIGITS* (the number of digits to the right of the decimal point) for displaying mass flow.
   d. Use the **[F1]-[F4]** keys to select the *Mass (Totalizer)* units, listed in Table 2-3 above.
   e. Use the **[F1]-[F4] to specify the Mass Decimal Digits** (the number of digits to the right of the decimal point) for displaying totalized mass flow. The meter returns to the initial *User* (or *Channel) Program* screen.
8. Proceed directly to the next section to program the **PIPE** submenu.

2.6 Entering Pipe Data

The **PIPE** submenu permits entry of the transducer and pipe specifications. To program this menu, complete the following steps:

1. At the *User* (or *Channel) Program* screen, press **[F3]** to program the **PIPE** submenu.
2. Enter the *Transducer Number* (normally engraved on the head of the transducer). Press **[ENT]**. If there is no engraved number, complete the steps below. Otherwise, proceed to step 3.

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

2.6.1 Special Transducers

a. Assign a number between 91 and 99 to the *Special Transducer* and press **[ENT]**. (The meter will only accept values from 1 to 199.)

b. Press **[F2]** to select Shear wave as the *Transducer Type*.

Note: *While three choices are available (Rayleigh, Shear wave or wetted transducers), the GC868 is designed for use with Shear wave clamp-on transducers. Consult the factory before selecting Rayleigh or wetted transducers.*

c. Use the [→] and **[F1]-[F4] keys to select the Frequency of the special transducer.** The meter can not transmit an excitation voltage at the transducer's natural frequency without this data.

d. Enter the special transducer *Time Delay (Tw)* value supplied by the factory. Press **[ENT]**. (The meter will only accept values from 0 to 1,000 μsec.)

Note: *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.*

e. Press **[F1]-[F4]** to select the *Wedge Material*. The available options include **VHT** (very high temperature), **MT** (medium temperature), **HT** (high temperature) and **OTHER**. Refer to the data sheet supplied with your transducer to determine the appropriate setting.

- If you selected **OTHER,** use the numeric keys to enter the *Wedge Soundspeed* in ft/sec or m/sec and press **[ENT]**. The meter proceeds to step 3.

f. Use the numeric keys to enter the *Wedge Angle* (the angle of the ultrasonic transmission) in degrees and press **[ENT]**.

2.6.2 Wedge Temperature

3. Use the numeric keys to enter the *Wedge Temperature* in deg F and press **[ENT]**. The wedge temperature is an average temperature of the pipe wall temperature and the ambient temperature.

2.6.3 Pipe Material

4. Press **[F1]-[F4]** to select the *Pipe Material*. Press [→] to access additional options, as listed in Table 2-4 below.

Table 2-4: Pipe Materials

Pipe Material Category	Specific Material
Steel	Carbon Steel or Stainless Steel
Iron	Ductile Iron or Cast Iron
Cu - Copper	None
Al - Aluminum	None
Brass	None
CuNi - Copper/Nickel	70% Cu 30% Ni or 90% Cu 10% Ni
Glass	Pyrex, Flint, or Crown

Table 2-4: Pipe Materials

Pipe Material Category	Specific Material
Plastic	Nylon, Polyester, Polypropylene, PVC (CPVC), Acrylic
Other*	Any material

- Depending on the pipe material choice, another prompt may ask you to select the *Specific Material*.
- If you have selected "Other," enter the pipe material *Sound Speed*. Press **[ENT].**

2.6.4 Pipe OD

5. Enter the known *Pipe OD* or circumference and use the **[F1]-[F4]** keys to select the appropriate units. Press **[ENT].** (The meter will only accept values from 1/8 to 648 in.)

The required pipe data may be obtained 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 (see the Panametrics document *Sound Speeds and Pipe Size Data,* #916-004). For a list of the available English and Metric units and their definitions for the **PIPE OD** prompt, refer to Table 2-5 on page 2-7.

Table 2-5: Available Pipe OD Units

English	Metric
inch = pipe OD in inches	mm = pipe OD in millimeters
feet = pipe OD in feet	m = pipe OD in 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

2.6.5 Pipe Wall

6. Enter the known thickness of the *Pipe Wall*, in the same units used for the pipe OD. Press **[ENT]**. (The meter will only accept values from 0 to 4 in., or 0 to 100 mm.)

If the pipe wall thickness is not known and cannot be conveniently measured, look up the value in a table of standard pipe size data or use the Model GC868's on-line *Help Menu*.

2.6.6 Fluid Type

7. Press **[F1]** = natural gas, **[F2]** = air, **[F3]** = steam, or **[F4]** = any other gas to select the *Fluid Type*. If **OTHER** was selected, enter the speed of sound (in feet per second) in the gas to be measured. Press **[ENT]**. (The meter will only accept values from 125 to 9,000 ft/sec, or from 38.1 to 2,743.2 m/s.)

2.6.7 Reynolds Correction

8. The *Reynolds Correction* factor is a number based on the kinematic viscosity and flow rate of the gas. At the prompt, press **[F1] to turn Reynolds Correction off,** or **[F2] to turn it on.**

   a. If you select Reynolds Correction, the GC868 asks for the *Kinematic Viscosity* of the gas (available in the brochure *Sound Speeds and Pipe Size Data*, 914-004). Use the numeric keys to enter the desired value and press **[ENT]**.

2.6.8 Calibration Factor

9. Enter a value for the flow *Calibration Factor* and press **[ENT]**. The default value is 1.00. (The meter will only accept values from 0.5000 to 2.0000.) If you are using wetted transducers, you have completed programming in the **PIPE** menu.

2.6.9 Number of Traverses

10. Press **[F1]-[F4]** to select the desired number of traverses (times the ultrasonic signal traverses the pipe, from 1 to 9).

Note: *Most clamp-on gas applications require a single traverse (1(Z)).*

2.6.10 Transducer Spacing

11. The *Transducer Spacing* prompt displays the spacing of the transducers, as calculated from the information you have entered. Record this number in Appendix B, *Data Records*, and use it to properly space the transducers.

Note: *If necessary, you can overwrite the spacing shown at the previous prompt (using the numeric keys) to match the actual physical spacing of the transducers. Panametrics does not recommend overwriting the spacing. If you must, do not change the spacing by more than ±10% from the value calculated.*

2.6.10.1 Procedure Options

After completing the above steps, the meter returns to the *User (or Channel) Program* prompt. Continue as follows:

- To continue programming the meter, refer to the menu maps in the *Programming Manual* and navigate to the desired menu. Then, proceed to the appropriate section of the manual for instructions.
- To leave the *User Program* and retain the previous settings, press **[EXIT]** once (for a 1-channel GC868) or twice (for a 2-channel GC868) and then press **[F1] = NO** at the *SAVE* prompt. Any programming changes will be discarded and you will be returned to the data display.
- To leave the *User Program* and return to measurement mode, press **[EXIT]** once (for a 1-channel GC868) or twice (for a 2-channel GC868) and then press **[F2] = YES** at the *SAVE* prompt. Your programming changes will be entered into the meter's memory, and you will be returned to the data display.

Note: *See the* Programming Manual *for instructions on using the* **SAVE** *submenu.*

Proceed to Chapter 3, *Operation*, for instructions on taking measurements or refer to the *Programming Manual* for instructions on programming the Model GC868's advanced features.

[no content intended for this page]

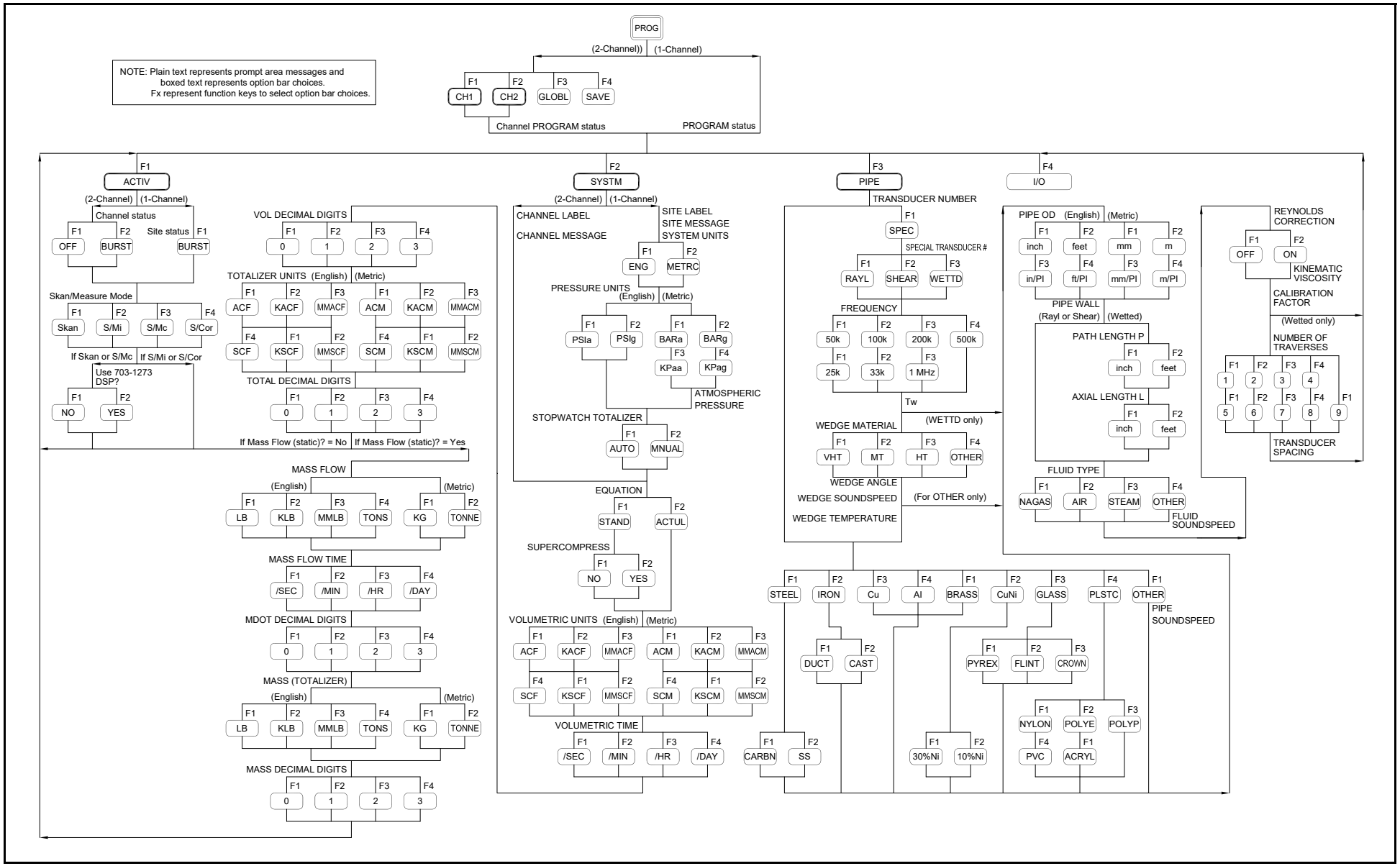


Figure 2-1: Model GC868 Initial Setup Menu Map

[no content intended for this page]

Chapter 3. Operation.

3.1 Introduction

See Chapter 1, *Installation*, and Chapter 2, *Initial Setup*, to prepare the 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

Note: *All inputs and outputs of the Model GC868 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*.*

WARNING! **To ensure the safe operation of the Model GC868, 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 Model GC868 does not have an ON/OFF switch, it will power up as soon as the connected power source is energized.

Note: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), 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 Model GC868.*

Immediately upon power up, the Model GC868 displays the Panametrics logo and the software version in the left pane of the display window. The Model GC868 performs a series of internal checks and display the results in the right pane of the display window.

Note: *If the Model GC868 fails any of the internal checks, try disconnecting the power and then re-powering the unit. If the Model GC868 continues to fail any of the internal checks, contact the factory for assistance.*

After successfully performing the internal checks, the Model GC868 begins taking measurements. The power up display is replaced by a measurement mode display similar to that shown in Figure 3-1 below.

Note: *As a minimum, the system and pipe parameters (for each installed channel of a 2-channel meter) must be entered before the Model GC868 can display valid data. Refer to Chapter 2,* Initial Setup*, for specific instructions.*

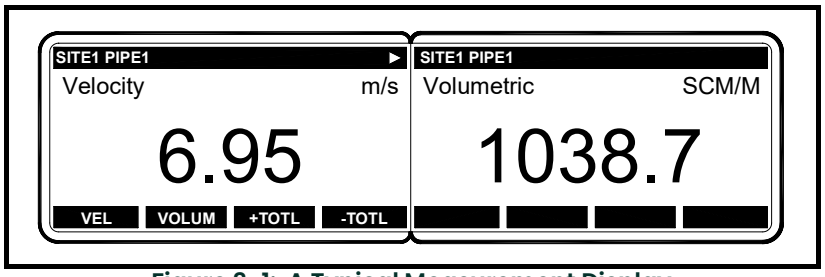


Figure 3-1: A Typical Measurement Display

Proceed to the next section for a description of the components of the Model GC868 display screen.

3.3 Using the Display

The Model GC868 display is divided into a left pane and a right pane. The two screen panes can be set independently to display any of the available measurement or diagnostic parameters. The components of a typical measurement mode screen are shown in Figure 3-2 below.

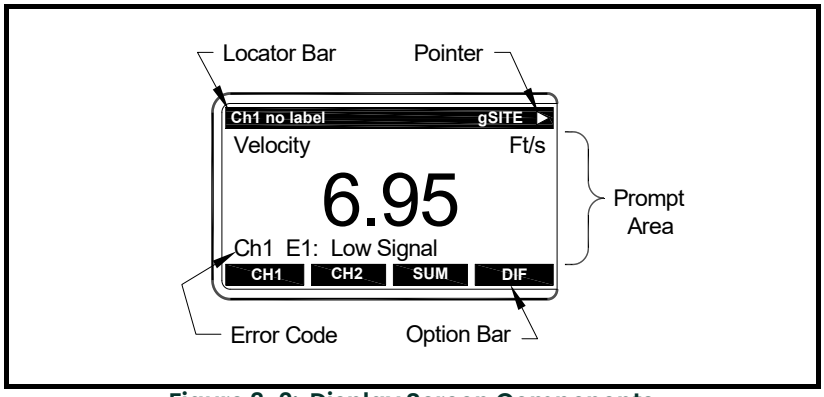


Figure 3-2: Display Screen Components

Both panes of the display screen are continuously updated, but only one pane at a time may be programmed or changed. To select a pane, press the corresponding side of the **[SCREEN]** key on the keypad. The currently selected screen pane will have function names in the option bar, while the other screen pane will have a blank option bar. See the *Programming Manual* for detailed instructions on using the keypad.

As shown in Figure 3-2 above, each pane of the display screen is divided into the following three general areas:

- the locator bar
- the prompt area
- the option bar.

The upper portion of the screen pane is called the *locator bar*. While the meter is taking measurements, the locator bar displays the name of the currently selected site file. In addition, the locator bar identifies the task that is currently being performed and the status of that task. For example, pressing the **[PROG]** key on the keypad will cause the locator bar to display **"PROGRAM"** and **"Start"** to indicate that the meter is ready to be programmed from the start of the *User Program*.

At various times, one or more of the following four symbols may be displayed on the far right of the locator bar:

- ‰: This symbol, which is called the *pointer*, indicates that additional option bar entries are available. These options can be accessed by using the [←] and [→] keys.
- *: A flashing asterisk indicates that the Model GC868 is currently logging information. See the *Programming Manual* for instructions on creating a log file.
- S or S_L: This symbol indicates the status of the red **[SHIFT]** key. "S" indicates that the **[SHIFT]** key is activated for the next keystroke only, while "S_L" indicates that the **[SHIFT]** key is locked. See the next section for instructions on using the keypad.
- T: This symbol indicates that the Model GC868 is currently totalizing data.

The middle portion of the screen pane is the *prompt area*. This area displays data, graphs, and logs in measurement mode and menu prompts in programming mode. In addition, error code messages, which are described in the *Service Manual*, are displayed in the prompt area.

The lower portion of the screen pane is called the *option bar*. The option bar displays the functions assigned to the four keys immediately below the display screen (**[F1]-[F4]** for the left pane and **[F5]-[F8]** for the right pane). Press a function key to select the function listed in the option bar immediately above it. If more than four functions are available, a pointer (‰) appears on the far right of the locator bar. Press the [←] or [→] keys to display the additional functions on the option bar.

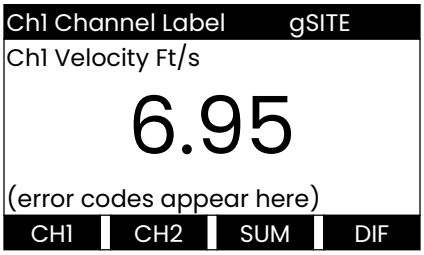
For information about other symbols and text that may appear on the display screen, refer to the *Service Manual*.

3.4 Taking Measurements

The Model GC868 is capable of displaying several different variables in a variety of formats. However, this manual only discusses the basic measurement displays in the default screen format. Refer to the *Programming Manual* for instructions on setting up alternate screen displays and see the *Service Manual* for a discussion of the diagnostic parameters listed under the DIAG option.

Note: *This section assumes that the left pane of the display screen is currently active. However, the same instructions apply equally to the right screen pane, when it is active. Just change the function keys from* [F1]-[F4] *to* [F5]-[F8].

For a 2-channel Model GC868, the following initial screen appears immediately upon completion of the internal checks. As an example, the display shows the measured velocity in ft/sec for Channel 1.

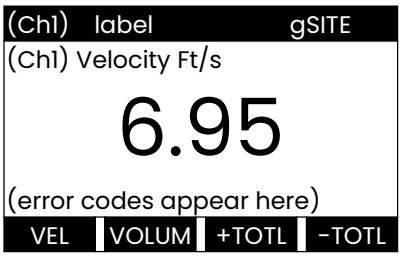


To select a different channel display option, press [F1]-[F4] (or [→] and [F1]). See Table 3-1 below for a complete description of the available options.

Table 3-1: Channel Display Options

Option Bar Choice	Description
[F1] = CH1	Channel 1
[F2] = CH2	Channel 2
[F3] = SUM	(Channel 1) + (Channel 2)
[F4] = DIF	(Channel 1) - (Channel 2)
[→] + [F1] = AVE	[(Channel 1) + (Channel 2)]/2

The following screen appears after selection of the channel mode display option for a 2-channel Model GC868 or immediately after the internal checks for a 1-channel Model GC868.



Use the [F1]-[F4], [←] and [→] keys to select the desired display parameter option. Refer to Table 3-2 on page 3-4 for a complete description of the available options.

Note: *Ch1 (or Ch2), which is shown in parentheses at the previous prompt, appears only with a 2-Channel Model GC868.*

Table 3-2: Measurement Parameter Options

Option Bar Choice	Description
[F1] = **VEL**	Flow Velocity
[F2] = **VOLUM**	Volumetric Flow
[F3] = **+TOTL**	Forward Totalized Volume Flow
[F4] = **-TOTL**	Reverse Totalized Volume Flow
[→] **+ [F1]** = **TIME**	Total Flow Measurement Time
[→] **+ [F2]** = **MDOT***	Mass Flow
[→] **+ [F3]** = **+MASS***	Forward Totalized Mass Flow
[→] **+ [F4]** = **-MASS***	Reverse Totalized Mass Flow
[→] **+** [→] **+ [F1]** = **DIAG**	Diagnostic
* Available only if **Static Density?** = **YES**	

During programming of the **ADVAN option in the SETUP** submenu (see the *Programming Manual*), a **Static Density?** prompt requires a response. If a **YES** response is given, all of the options listed in Table 3-2 above are available. However, if a **NO** response is given, the three options indicated do not appear and the **DIAG** option will appear in the **[F2]** position on the second option bar screen.

By following the instructions in this section, the Model GC868 can be set up to display the desired channel option (for a 2-Channel meter) and the desired measurement parameter. To utilize the more advanced display capabilities of the Model GC868, refer to the *Programming Manual* and/or the *Service Manual* for the instrument.

3.4.1 Foundation Fieldbus Communications

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 two Analog Input (AI) blocks, which can be configured to supply the following measurements on the network (see Table 3-3 on page 3-5).

Table 3-3: Available Measurements Using Foundation Fieldbus

Channel 1	Units	Channel 2	Units	Average	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 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.

Chapter 4. Specifications.

4.1 General

The general specifications for the Model GC868 flowmeter are divided into the following categories:

4.1.1 Hardware Configuration

Package Options:

Epoxy-coated aluminum (standard)
Weatherproof Type 4X IP66
Stainless Steel
Explosion-proof
Flameproof
Fiberglass

Physical (for standard package):

Size: 14.24 × 11.4 × 5.12 in. (362 × 290 × 130 mm)
Weight: 11 lb (5 kg)

4.1.2 Flow Accuracy

±2% to ±5% of reading for pipes under 6 in. (150 mm)

±1% to ±2% of reading for pipes greater than 6 in. (150 mm)

Note: *Specifications assume a fully developed flow profile, with a straight run of pipe 20 diameters upstream and 10 diameters downstream. Accuracy depends on pipe size, number of paths, and other factors.*

4.1.3 Environmental

Ambient Operating Temperature:

-4° to 131°F (–20° to 55°C)

Storage Temperature:

–67° to 167°F (–55° to 75°C)

4.1.4 Range

See Tables 1-1, 1-2 and 1-3 in Chapter 1.

4.1.5 Rangeability (Overall)

150:1

4.1.6 Repeatability

±0.2% to ±0.5% at 1 to 100 ft/s (0.3 to 30 m/s).

4.1.7 Response Time

For a 1–91% Step Change:

3 seconds to within 1% of final value

4.2 Electrical

The electrical specifications for the Model GC868 flowmeter are divided into the following categories:

4.2.1 Power Supply

Input Options:

100 to 130 VAC, 50/60 Hz with 1.0 A Slo-Blo Fuse
200 to 240 VAC, 50/60 Hz with 0.5 A Slo-Blo Fuse
12 to 28 VDC with 3.0 A Slo-Blo Fuse, ±5%

4.2.2 Power Usage

20 W maximum

4.2.3 Operating Mode

Transit-time flow measurement for gas.

4.2.4 European Compliance

This unit complies with EMC Directive 89/336/EEC and 73/23/EEC Low Voltage Directive (Installation Category II, Pollution Degree 2)

4.2.5 Hazardous (Classified) Location Compliance

CENELEC: II 2 G EEx d IIC T6
ISSeP03ATEX 113

North America: Class I, Div 2, Group ABCD
Type 4X
CSA: LR44204
FM: 3013516

4.2.6 Input/Output Specifications

Keypad:
39-key membrane keypad with tactile feedback

Display:
Two independent software-configurable 64 x 128-pixel LCD graphic displays, with backlights.

Printer/Terminal Communications:
One RS232 port for printer, terminal, PC, SCADA, etc.

Analog Output Options:
All meters come with two isolated 0/4–20 mA current outputs (550 Ω maximum load).
Optional selection of up to 3 additional output boards, each with four isolated 0/4–20 mA outputs (1,000 Ω maximum load).

Analog Input Options:
Select up to 3 boards of one of the following types:

1. *Transmitter Input Board* with two isolated 0/4-20 mA inputs and 24-V loop power.
2. *RTD Input Board* with two isolated 3-wire RTD inputs; Span –148° to 662°F (–100° to 350°C).

Totalizer/Frequency Output Options:
Select up to 3 Totalizer/Frequency Output Boards, each with four outputs per board, 10 kHz max.

All boards allow software-selectable functioning in two modes:

Totalizer Mode: one pulse per defined unit of parameter (e.g., 1 pulse/SCF).

Frequency Mode: pulse frequency proportional to magnitude of parameter (e.g., 10 Hz = 1 SCF).

Alarm Options:

Select up to 2 boards of the following types:
Basic Relay Board with three general purpose Form-C relays.
Hermetic Relay Board with three hermetically sealed Form-C relays.

Maximum Relay Ratings:
120 VAC AC Voltage, 28 VDC DV Voltage,
5A AC/DC Current, 60 VA AC Power,
30 W DC Power (General Purpose) or
56 W DC Power (Hermetically Sealed)

4.3 Operational

The operational specifications for the Model GC868 flowmeter are divided into the following categories:

4.3.1 Flow Computer (Built-in)

The flow computer has three operating modes:

1. *RUN (Normal operating mode):*
   Flow velocity equations are solved and statistical data rejection techniques are employed to provide reliable and repeatable results. Volumetric flow is calculated using the American Gas Association report #8 coarse method for compressible gases, with temperature, pressure, $\%N_2$, $\%CO_2$ and specific gravity inputs.
2. *PARAMETER:*
   Allows the operator to program the meter.
3. *DIAGNOSTIC:*
   Allows the operator to calibrate inputs and outputs and to display certain diagnostic information such as checksums, signal strength, calculated gas sound speed, etc.

4.3.2 Data Logging

Keypad-programmable for setting up log units, update interval, start and stop times. Memory capacity for more than 43,000 flow data points in a linear or circular log.

4.3.3 Display Functions

Liquid crystal graphic display shows flow in numeric or graphic format. Also displays logged data and diagnostics.

4.3.4 Printer Signal Output

Supports wide variety of thermal and impact printers. Output data in numeric or graphic ("strip chart") format.

4.4 Transducer

The transducer specifications for the Model GC868 flowmeter are divided into the following categories:

4.4.1 Transducer Type

GC868 works with an array of C-R type clamp-on gas transducers:
C-RW, C-RV and C-RL

4.4.2 Temperature Range

Standard: –40° to 266°F (–40° to 130°C)
Optional: –40° to 446°F (–40° to 230°C)

4.4.3 Frequencies

200 kHz (for pipe sizes 12 to 24 in.)
500 kHz (for pipe sizes 2 to 12 in.)
1 MHz (for pipe sizes 0.75 to 2 in.)

4.4.4 Materials

316 stainless steel and plastic (application dependent)

4.4.5 Couplant

CPL-16

4.4.6 Hazardous (Classified) Location Compliance

CENELEC: II 2 GD EEx md IIC T6 T80°C
KEMA01ATEX2337 X

North America: Class I, Div 1, Group BCD
CSA C US: LR44204

4.4.7 Clamping Fixtures

Anodized aluminum or stainless steel clamping fixture with rigid rails, chain or strap:

0.75 to 1.25 in. (20 to 30 mm) CFG-V1

1.25 to 4 in. (30 to 100 mm) pipe: CFG-V4

4 to 8 in. (100 to 200 mm) pipe: CFG-V8

8 to 12 in. (200 to 30 0 mm) pipe: CFG-V12

12 to 24 in. (300 to 600 mm) pipe: CFG-PI

4.5 Pipe Requirements

The pipe requirements for the Model GC868 flowmeter are divided into the following categories:

4.5.1 Pipe Size

0.75 to 24 inch (19 to 600 mm) and larger (Consult the factory.)

4.5.2 Pressure Requirements

Refer to Tables 1-1, 1-2 and 1-3 in Chapter 1.

4.5.3 Pipe Wall Thickness

Up to Schedule 80. Thicker walls require greater gas density. Consult the factory for other pipe thicknesses.

4.5.4 Fluid Composition

Acoustically conductive gases without entrained particles or condensate, and with a minimum density sufficient to allow reliable measurements.

[no content intended for this page]

Appendix A. CE Mark Compliance.

A.1 Introduction

For CE Mark compliance, the Model GC868 flowmeter must be wired in accordance with the instructions in this appendix.

IMPORTANT: *CE Mark compliance is required only for units intended for use in EEC countries.*

A.2 Wiring

The Model GC868 must be wired with the recommended cable, and all connections must be properly shielded and grounded. Refer to Table A-1 below for the specific requirements.

Table A-1: Wiring Modifications

Connection	Cable Type	Termination Modification
Transducer	RG62 a/u	Add metallic cable clamp from braid to chassis ground.
	Armored RG62 a/u or conduit	None - grounded via cable gland.
Input/Output	22 AWG shielded	Terminate shield to chassis ground.
	Armored conduit	None - grounded via cable gland.
Power	14 AWG, 3 conductor, shielded	An external ground to the chassis is required.
	Armored Conduit	None - grounded via cable gland.
Shielding	For CE compliance, power and I/O cables must be shielded. Cables are to be terminated within the cable gland at the GC868. Shielded cable is not required when installations include metal conduit.	

A.3 External Grounding

For CE Mark compliance, the electronics enclosure and the transducer fixture must each have an external ground wire attached.

Note: *If the Model GC868 is wired as described in this appendix, the unit will comply with the EMC Directive 89/336/EEC.*

Appendix B. Data Records.

B.1 Option Cards Installed

Whenever an option card is installed in one of the Model GC868's expansion slots, record the type of card and any additional setup information in the appropriate row of Table B-1 below.

Table B-1: Option Cards Installed

Slot #	Type of Option Card	Additional Setup Information
0	Analog Outputs (A, B)	
1		
2		
3		
4		
5		
6		

B.2 Initial Setup Data

After the Model GC868 flowmeter has been installed, some initial setup data must be entered via the *User Program*, prior to operation. Record that information in Table B-2 below.

Table B-2: Initial Setup Data

General Information					
Model #			Reference		
Software Vers.			Date		
Serial #					
Measurement Method (1-Channel) - ACTIV					
Site Status	Burst		Measure Mode	Skan S/Mi S/Mc S/Cor	
Measurement Method (2-Channel) - ACTIV					
Channel 1			Channel 2		
Channel Status	Off	Burst	Channel Status	Off	Burst
Measure Mode	Skan S/Mi S/Mc S/Cor		Measure Mode	Skan S/Mi S/Mc S/Cor	
System Parameters - SYSTEM					
1-Channel			2-Channel		
Site Label			Chan.1 Label		
Site Message			Chan. 1 Message		
System Units	English	Metric	Chan. 2 Label		
Pressure Units			Chan. 2 Message		
Stopwatch Total.	Auto	Manual			
1-Channel and 2-Channel					
Channel 1			Channel 2 (if applicable)		
Gas Equation			Gas Equation		
Supercompress?			Supercompress?		
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		
If Static Density? = YES					
Mass Flow			Mass Flow		
Mass Flow Time			Mass Flow Time		
MDOT Dec. Dig.			MDOT Dec. Dig.		
Mass Totalizer			Mass Totalizer		
Mass Dec. Dig.			Mass Dec. Dig.		
Pipe/Transducer Parameters - PIPE					
Channel 1			Channel 2 (if applicable)		
Std. Trans. #			Std. Trans. #		
Spec. Trans. #			Spec. Trans. #		
Spec. Trans. Hz			Spec. Trans. Hz		
Spec. Trans. Tw			Spec. Trans. Tw		
Pipe O.D.			Pipe O.D.		

Table B-2: Initial Setup Data

Pipe Wall			Pipe Wall		
Pipe Material			Pipe Material		
Path Length (P)			Path Length (P)		
Axial Length (L)			Axial Length (L)		
Fluid Type	Nat. Gas Air Steam Other		Fluid Type	Nat. Gas Air Steam Other	
Other/Sndspd			Other/Sndspd		
Cal. Factor			Cal. Factor		
Reynolds Corr?	Yes	No	Reynolds Corr?	Yes	No
Kin. Viscosity			Kin. Viscosity		
# Traverses			# Traverses		
XDCR Spacing			XDCR Spacing		

Appendix C. Optional Enclosures.

C.1 Introduction

Upon request the Model GC868 flowmeter may be supplied in an enclosure other than the standard Type-4X enclosure described in Chapter 1, *Installation*, of this manual. Although the standard installation and wiring instructions still apply in general terms, some of the details may vary for different enclosure types. Refer to the appropriate sections of this appendix for the specific type of enclosure provided.

C.2 Rack Mount Enclosure

The Model GC868 flowmeter is available in a *rack mount* enclosure for installation in a standard 19" electronics rack. Refer to Figure C-1 on page C-3 for the dimensions of this unit. Simply slide the Model GC868 into the rack at the desired height and fasten the unit securely to the rack with four screws in the locations provided at the corners of the front panel.

After the unit has been physically mounted into the rack, proceed to the next section for instructions on wiring the meter.

C.3 Rack Mount Wiring

The rack mount Model GC868 requires exactly the same electrical connections as the standard version. However, the locations and type of connectors used for the various components are different. Refer to Figure C-2 on page C-4 and complete the following steps:

1. Wire the *power input* on the right side of the rear panel as follows:
   a. Make sure a *fuse* (item #4) of the proper size and type is installed.
   b. Connect the female end of the *line cord* provided to the power input receptacle (item #3).
   c. Connect the *earth ground* screw terminal (item #2) to a ground point on the rack.
2. Wire the *transducers* as follows:
   a. Connect the pair of cables supplied with the meter to the *Channel 1* upstream and downstream BNC transducer connectors on the left side of the rear panel.
   b. For a 2-Channel meter, repeat the above step for the *Channel 2* transducer connectors (if the second channel is to be used).
   c. Complete the transducer wiring in accordance with the instructions in Chapter 1, *Installation*, of this manual.
3. Wire the 0/4-20 mA *analog outputs* at the left side of the rear panel in accordance with the instructions in Chapter 1, *Installation*, of this manual.
4. Wire the *RS232 serial port* by completing the following steps:
   a. Purchase or prepare a suitable serial cable. This cable should have a standard female DB9 connector, wired as shown in Figure C-2 on page C-4, for connection to the rear panel of the Model GC868. The other end should be as required for the external device.
   b. Complete the serial port wiring in accordance with the instructions in Chapter 1, *Installation*, of this manual.
5. Wire any installed *option cards* using the same procedures described in Chapter 1, *Installation*, of this manual and the pin # assignments shown in Figure C-2 on page C-4.
6. Place the *power switch* (item #1) in the ON position.

The Model GC868 is now completely wired. Proceed to Chapter 2, *Initial Setup*, of this manual for further instructions.

C.4 Rack Mount Front Panel

The keypad and LCD display for the rack mount Model GC868 are located on the front panel. These items are identical in form and function to those used on the standard Type-4X enclosure, but the layout is somewhat different.

Refer to Figure C-3 on page C-5 for the front panel layout of the rack mount Model GC868 and follow the standard procedures detailed in the main body of this manual.

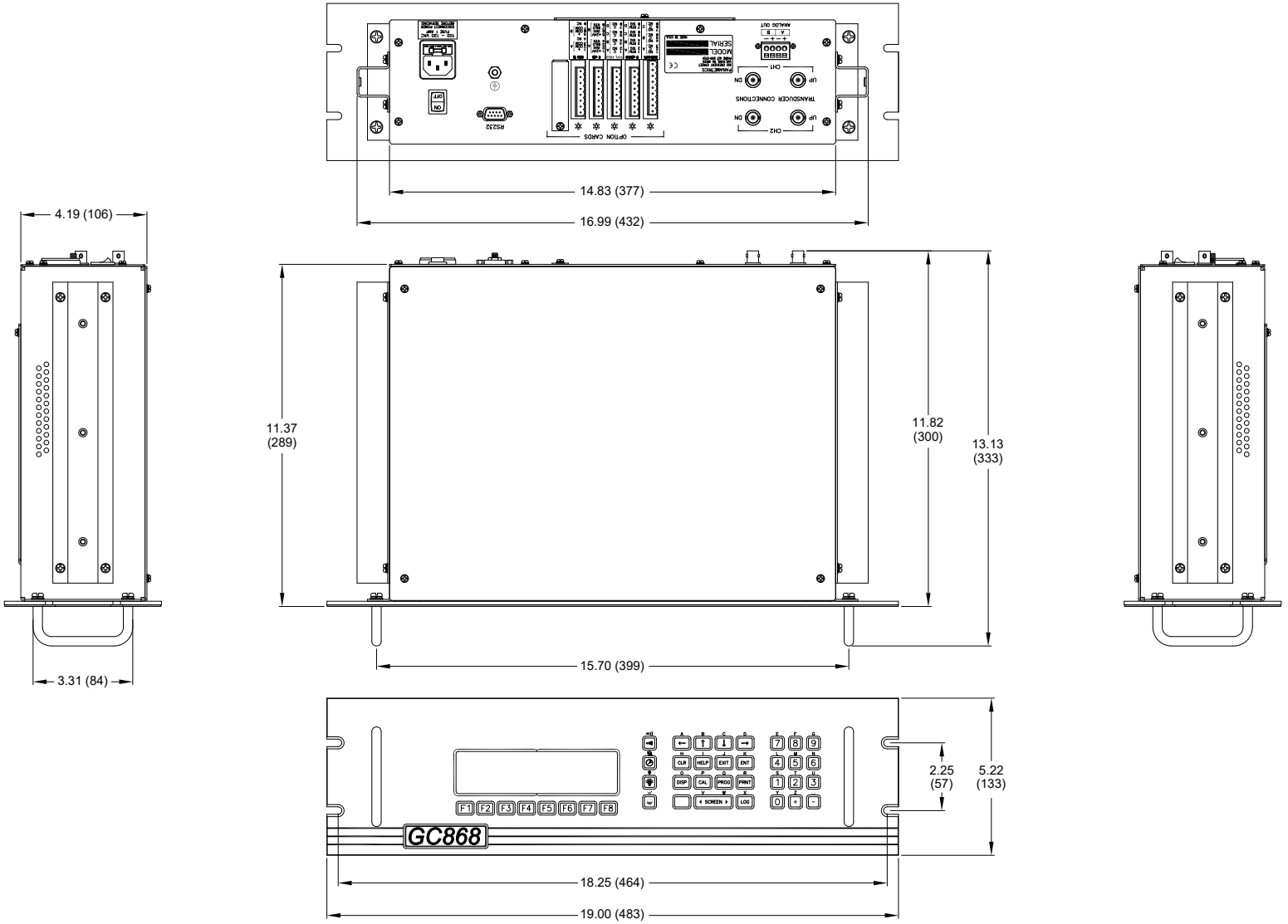


Figure C-1: Model GC868 Rack Mount Enclosure (ref. dwg #712-1078)

CH2 TRANSDUCER	
BNC #	Description
UP	Upstream XDCR
DN	Downstream XDCR

CH1 TRANSDUCER	
BNC #	Description
UP	Upstream XDCR
DN	Downstream XDCR

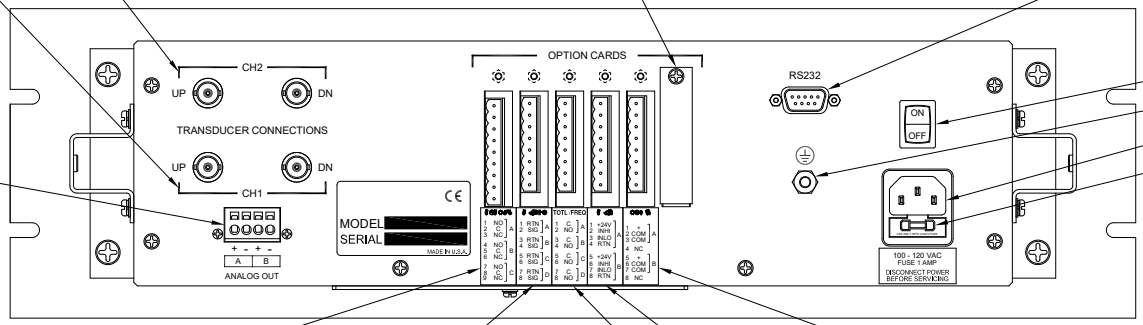
0/4-20 mA ANALOG OUTPUTS	
Pin #	Description
1	Output A - SIG(+)
2	Output A - RTN(-)
3	Output B - SIG(+)
4	Output B - RTN(-)

NOTE
One option card of each available type is shown in this diagram. These cards are not always installed in the same slots used for this example.

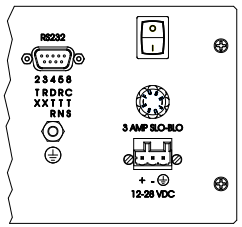
NOTE: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible and located within 1.8 m (6 ft) of the Model GC868.*

RS232 SERIAL PORT (DB9)	
Pin #	Description
1	No Connection
2	TX - Transmit
3	RX - Receive
4	DTR - Data Terminal Ready
5	RTN - Digital Return
6	No Connection
7	No Connection
8	CTS - Clear to Send
9	No Connection

POWER INPUT	
Item #	Description
1	ON/OFF Switch
2	Earth Ground
3	Power Cord
4	Fuse



REAR-VIEW DC OPTION



ALARM RELAYS	
Pin #	Description
1	Relay A - Normally Open (NO)
2	Relay A - Common (C)
3	Relay A - Normally Closed (NC)
4	Relay B - Normally Open (NO)
5	Relay B - Common (C)
6	Relay B - Normally Closed (NC)
7	Relay C - Normally Open (NO)
8	Relay C - Common (C)
9	Relay C - Normally Closed (NC)

0/4-20 mA ANALOG OUTPUTS	
Pin #	Description
1	Output A - RTN(-)
2	Output A - SIG(+)
3	Output B - RTN(-)
4	Output B - SIG(+)
5	Output C - RTN(-)
6	Output C - SIG(+)
7	Output D - RTN(-)
8	Output D - SIG(+)

TOTALIZER/FREQUENCY OUTPUTS	
Pin #	Description
1	Output A - Common (C)
2	Output A - Normally Open (NO)
3	Output B - Common (C)
4	Output B - Normally Open (NO)
5	Output C - Common (C)
6	Output C - Normally Open (NO)
7	Output D - Common (C)
8	Output D - Normally Open (NO)

0/4-20 mA ANALOG INPUTS	
Pin #	Description
1	Input A - +24V
2	Input A - INHI
3	Input A - INLO
4	Input A - RTN
5	Input B - +24V
6	Input B - INHI
7	Input B - INLO
8	Input B - RTN

RTD INPUTS	
Pin #	Description
1	Input A - SIG(+)
2	Input A - Common (C)
3	Input A - Common (C)
4	Unused
5	Input B - SIG(+)
6	Input B - Common (C)
7	Input B - Common (C)
8	Unused

Figure C-2: Model GC868 Rack Mount Enclosure - Wiring Diagram

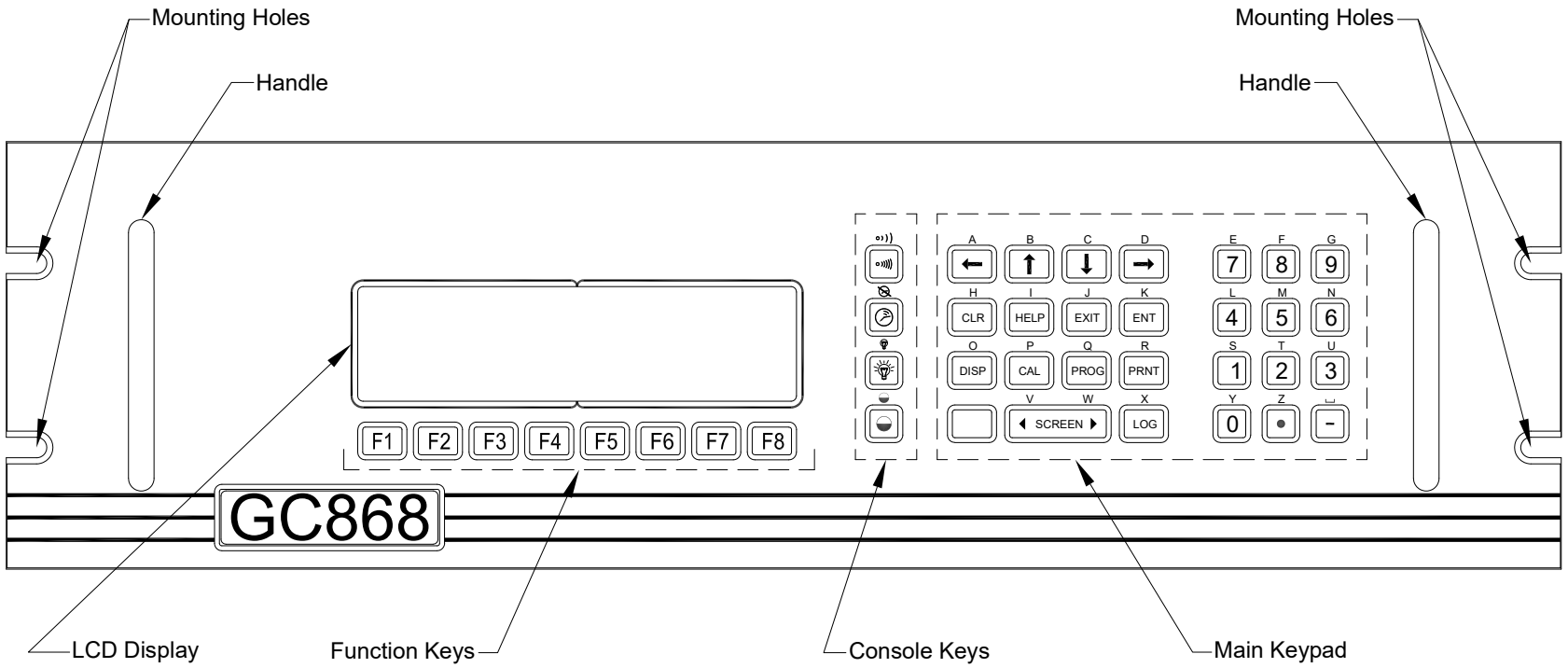


Figure C-3: Model GC868 Rack Mount Enclosure - Front Panel Layout

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Panametrics

DECLARATION OF CONFORMITY

We,

Panametrics Limited
Shannon Industrial Estate
Shannon, County Clare
Ireland

declare under our sole responsibility that the

GC868 Gas Clamp-On Ultrasonic Flowmeter

to which this declaration relates, are in conformity with the following standards:

- EN 61326:1998, Class A, Annex A, Continuous Unmonitored Operation
- EN 61010-1:1993 + A2:1995, Overvoltage Category II, Pollution Degree 2

following the provisions of the 89/336/EEC EMC Directive and the 73/23/EEC Low Voltage Directive.

Shannon - June 1, 2002

Mr. James Gibson
GENERAL MANAGER

CE

NSAI
I.S. EN ISO 9002
Shannon

TÜV
TÜV ESSEN
ISO 9001
U.S.

Panametrics

DECLARATION DE CONFORMITE

Nous,

Panametrics Limited
Shannon Industrial Estate
Shannon, County Clare
Ireland

déclarons sous notre propre responsabilité que les

GC868 Gas Clamp-On Ultrasonic Flowmeter

rélatif á cette déclaration, sont en conformité avec les documents suivants:

- EN 61326:1998, Class A, Annex A, Continuous Unmonitored Operation
- EN 61010-1:1993 + A2:1995, Overvoltage Category II, Pollution Degree 2

suivant les régles de la Directive de Compatibilité Electromagnétique 89/336/EEC et de la Directive Basse Tension 73/23/EEC.

Shannon - June 1, 2002

Mr. James Gibson
DIRECTEUR GÉNÉRAL

CE

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I.S. EN ISO 9002
Shannon

TÜV
TÜV ESSEN
ISO 9001
U.S.

Panametrics

KONFORMITÄTS-ERKLÄRUNG

Wir,

Panametrics Limited
Shannon Industrial Estate
Shannon, County Clare
Ireland

erklären, in alleiniger Verantwortung, daß die Produkte

GC868 Gas Clamp-On Ultrasonic Flowmeter

folgende Normen erfüllen:

- EN 61326:1998, Class A, Annex A, Continuous Unmonitored Operation
- EN 61010-1:1993 + A2:1995, Overvoltage Category II, Pollution Degree 2

gemäß den Europäischen Richtlinien, Niederspannungsrichtlinie Nr.: 73/23/EG und EMV-Richtlinie Nr.: 89/336/EG.

Shannon - June 1, 2002

Mr. James Gibson
GENERALDIREKTOR

CE

I.S. EN ISO 9002
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TÜV
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