Panametrics
a Baker Hughes business

Flow

PanaFlow Z3

User's Manual

910-311 Rev. C
April 2019

Baker Hughes

PanaFlow Z3

Ultrasonic Flow Meter for Liquid Custody Transfer Measurement

User's Manual

910-311 Rev. C
April 2019

[no content intended for this page]

Chapter 1. Introduction

1.1 Overview 1
1.2 Theory of Operation 2
1.2.1 Transit-Time Flow Measurement 2
1.3 System Components 2
1.3.1 Local Transmitter Configuration 2
1.3.2 Remote Transmitter Configuration 3
1.3.3 Marking and Labeling 4
1.3.3.1 Model Tag Plate 4
1.3.3.2 Specification Tag Plate 5
1.3.3.3 Part String and Serial Number Tag Plate 6

Chapter 2. Installation

2.1 Installation Guidelines 7
2.2 Unpacking the PanaFlow Z3 System 8
2.2.1 Inspection 8
2.2.2 Lifting the PanaFlow Z3 System 8
2.3 Site Considerations 10
2.3.1 Installation Location 10
2.3.1.1 Straight Run Requirements 10
2.3.1.2 Transducer Location and Orientation 10
2.3.1.3 Inner Diameter Matching 11
2.3.1.4 Vibration Considerations 11
2.3.2 Guidelines For Installing Pipe Insulation 11
2.3.3 Fluid Comments 11
2.4 Making Electrical Connections 11
2.4.1 Local Mount Configuration Transducer Wiring 12
2.4.2 Remote Mount Configuration Transducer Wiring 12

Chapter 3. Programming

3.1 Introduction 15
3.1.1 HMI Features 15
3.1.2 Indicator Lights 16
3.2 Passcodes 16
3.2.1 Unlock from Keypad Lockout 16
3.3 Measurement View, Log-in and Primary Pages 16
3.3.1 Measurement View 16
3.3.1.1 Changing Display Format 17
3.3.1.2 Selecting a Composite Measurement to Display 17
3.3.1.3 Selecting a Channel Measurement to Display 18
3.3.1.4 Totalizer Display 19
3.3.2 Log-in and Primary Pages 21
3.4 System Settings 21
3.4.1 Selecting Units 22
3.4.1.1 Supported Unit Groups and Units 22
3.4.2 Meter Settings 23
3.5 Inputs and Outputs 24
3.5.1 Modbus Port Settings 24
3.5.2 Standard Analog Output 25
3.5.2.1 Setting up Analog Output 25
3.5.2.2 Understanding the Error Handling Option 25
3.5.2.3 Calibrating Analog Output 27
3.5.3 Standard Digital Output 28
3.5.3.1 Setting up Pulse Output 28
3.5.3.2 Setting up Frequency Output 30
3.5.3.3 Understanding the Error Handling Option 31

3.5.3.4 Setting up Alarm Output 33
3.5.4 Option Comm Slot-1 (optional) 35
3.5.4.1 Option Slot-1 Configured as HART 35
3.5.4.2 Option Slot-1 Configured as FF 35
3.5.5 Option I/O Slot-2 (Optional) 36
3.5.5.1 Option IO (Slot2): Setting up Analog Output 36
3.5.5.2 Option IO (Slot2): Calibrating Analog Output 37
3.5.5.3 Option IO (Slot2): Setting up Analog Input 38
3.5.5.4 Option IO (Slot2): Calibrating Analog Input 39
3.5.5.5 Option IO (Slot2): Calibrating RTD Input 40
3.6 Programming Menu Options 41
3.6.1 Programming the Pipe 41
3.6.2 Programming the Fluid 41
3.6.3 Programming the Path Configuration 43
3.6.4 Programming the Flow and Diagnostic Limits 43
3.6.5 Programming Advanced Settings 44
3.7 Software Upgrade 44
3.0.1 Perform Software Upgrade 45

Chapter 4. Error Codes and Troubleshooting

4.1 Introduction 47
4.2 Error Classification and Error Codes 47
4.3 Flow Errors (E-Errors) 47
4.3.1 General Guidelines for Troubleshooting Flow Errors with Error codes 47
4.3.1.1 Single Channel Error 47
4.3.1.2 Multi-Channel Error 48
4.3.1.3 Viewing Channel Specific Error/Warnings 48
4.3.1.4 Viewing Flow diagnostics 48
4.4 Fluid and Pipe Problems 52
4.4.1 Fluid Problems 52
4.4.2 Pipe Problems 52
4.5 Transducer/Buffer Problems 53
4.5.1 Wetted Transducer Problems 53
4.6 Service Test Points 54
4.7 System Errors (S-Errors) 55
4.8 Communication Errors (C-Errors) 57
4.9 Transmitter Errors 58
4.10 Option I/O Errors 59
4.11 Meter Health with Diagnostics Data 60

Chapter 5. Maintenance and Service

5.1 Hardware Maintenance and Inspection 63
5.1.1 Servicing the Pipe Interface 64
5.1.2 Servicing the Sensor Ports or Transmitter Interface 64
5.1.2.1 Required Equipment 64
5.1.2.2 Instructions to Relieve Pressure in the Sensor Port or Transmitter Interface 64
5.1.2.3 Instructions to Rotate the XMT1000 Transmitter 66
5.1.2.4 Removing the XMT1000 Transmitter 67
5.2 Service 68
5.2.1 Spare Parts 68
5.2.2 Installing Replacement Parts 68

Appendix A. Specifications and Model Configurations

A.1 Operation and Performance 69
A.2 Meter Body/Transducer 70
A.3 Transmitter 71
A.4 Serial Number Information 73
A.5 Pressure Derating Information 76

A.6 O-Ring Chemical Compatibility 78

Appendix B. Data Records

B.1 Electronics 87
B.1.1 Data Entry 87
B.2 Initial Settings 88
B.3 Diagnostic Parameters 91

Appendix C. Modbus Map

C.1 Input Registers Map 93

Appendix D. CE Mark Compliance

D.1 Introduction 95
D.2 Wiring 95

Warranty

Product Registration

Thank you for purchasing a model *PanaFlow Z3* from BakerHughes. Please register your product at https://www.bakerhughes.com/productregistration for product support such as the latest software/firmware upgrades, product information and special promotions.

Services

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

Typographical Conventions

Note: *These paragraphs provide deeper understanding of the situation, but are not essential for proper completion of instructions.*

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

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

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

Safety Issues

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

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

Auxiliary Equipment

Local Safety Standards

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

Working Area

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

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

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment. Please make the factory aware of any customer visits so that any further support to the customer can occur immediately.

Personal Safety Equipment

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

Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment. Security levels need to be set properly at the completion of any customer visit.

Environmental Compliance

RoHS

The PanaFlow Z3 fully complies with RoHS regulations (Directive 2002/95/EC).

Waste Electrical and Electronic Equipment (WEEE) Directive

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

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

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

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

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

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

[no content intended for this page]

Chapter 1. Introduction

1.1 Overview

The PanaFlow Z3 represents the latest generation of Panametrics ultrasonic flow meters. It is a three-path meter designed specifically for dependable, accurate and repeatable flow measurement of process liquids. Utilizing sleek industrial design and ultra-reliable electronics, the meter provides operators with a cost-effective choice when measurement accuracy and reliability are critical. The PanaFlow Z3 consists of the PanaFlow XMT1000 electronics, three pairs of LX transducers, and sensor body. The XMT1000 is our latest ultrasonic flow transmitter with state-of-the-art flow measurement capability in a rugged enclosure certified for use in hazardous areas. The LX transducer system is our latest advancement in ultrasonic transducer technology and provides accurate, drift-free, and obstruction less flow measurement.

The LX transducer system consists of our new integrated LX transducers and our uniquely engineered buffers. The design of this system allows for the safe insertion and removal of the LX transducers at any time without isolating the flow meter or shutting down the process. Together with the XMT1000 electronics and LX transducer, the uniquely designed meter body provides a clean and compact flow meter system.

1.2 Theory of Operation

1.2.1 Transit-Time Flow Measurement

In this method, two transducers serve as both ultrasonic signal generators and receivers. They are in acoustic communication with each other, meaning the second transducer can receive ultrasonic signals transmitted by the first transducer and vice versa.

In operation, each transducer functions as a transmitter, generating a certain number of acoustic pulses, and then as a receiver for an identical number of pulses. The time interval between transmission and reception of the ultrasonic signals is measured in both directions. When the liquid in the pipe is not flowing, the transit time downstream equals the transit time upstream. When the liquid is flowing, the transit time downstream is less than the transit time upstream.

The difference between the downstream and upstream transit times is proportional to the velocity of the flowing liquid, and its sign indicates the direction of flow.

Figure 1: Transducer Paths Across Flow Direction

1.3 System Components

1.3.1 Local Transmitter Configuration

The PanaFlow Z3 consists of the new XMT1000 electronics, a magnetic wand, the LX transducer system, and a meter body as shown in *Figure 2*.

Note: *Actual design varies slightly with size.*

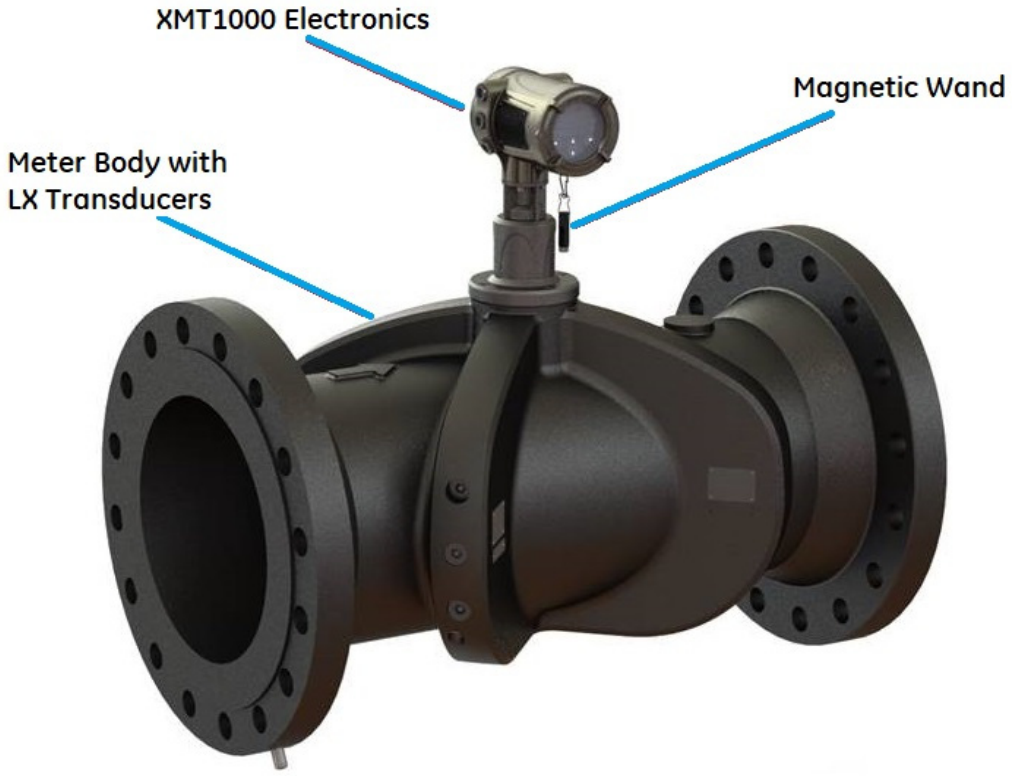


Figure 2: The PanaFlow Z3 Flow Meter

1.3.2 Remote Transmitter Configuration

The PanaFlow Z3 remote mount configuration allows users to place the XMT1000 Transmitter at a separate location from the flowcell. System configurations utilizing this remote mount option are supplied with a 2" pipe mounting bracket for XMT1000 electronics, and require additional electrical connections to be made by the user. *Figure 3* depicts an image of the system utilizing this option in a typical Atex/IECEx installation.

Note: *Actual design varies slightly with size.*

Figure 3: Panaflow Z3 Remote Mount Configuration

1.3.3 Marking and Labeling

There are five tag plates affixed to the PanaFlow Z3 which provide details and information about your system. Three are located on the flowcell and two are located on the transmitter. *Figure 4* highlights the locations of all five tag plates on the device.

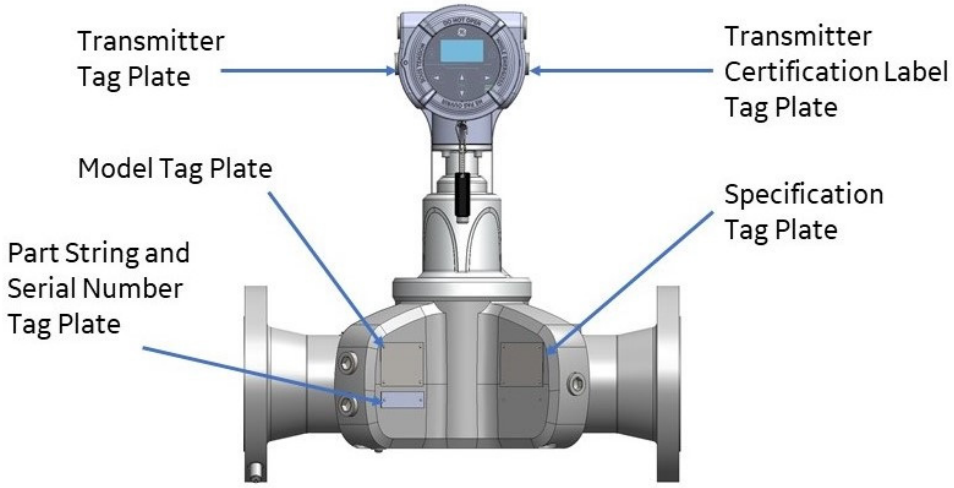


Figure 4: PanaFlow Z3 Tag Plate Locations

1.3.3.1 Model Tag Plate

The model tag plate (Figure 5) contains the model name and certification markings for Hazardous Area usage.

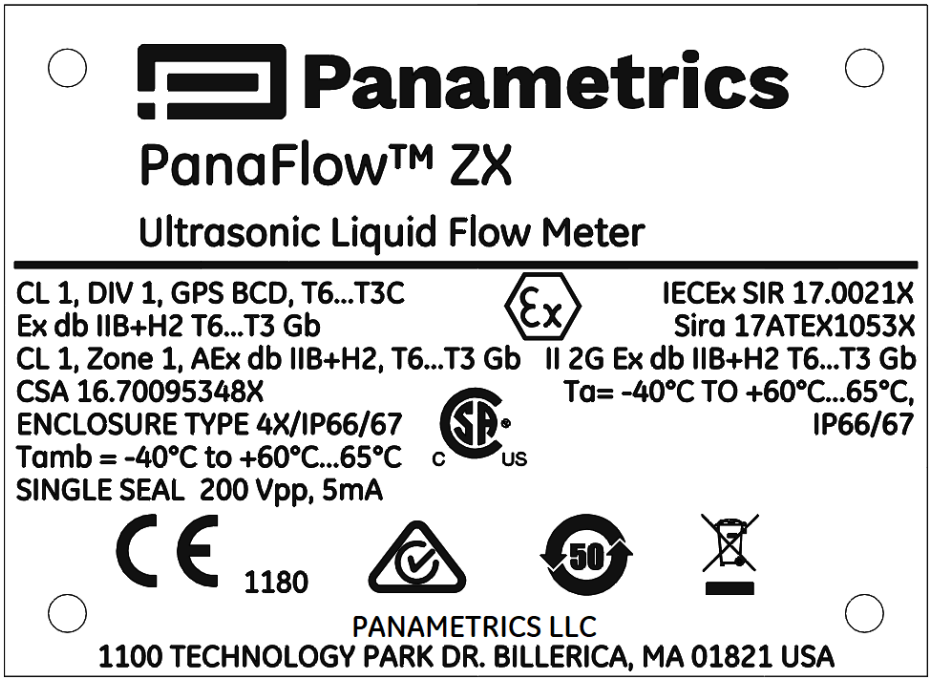


Figure 5: Model Tag Plate (Remote Mount Tag Shown for Example)

1.3.3.2 Specification Tag Plate

The pressure equipment is marked with the CE-mark as follows on the Specification Tag Plate (*Figure 6*). The Specification Tag Plate contains information pertaining to the build and test of the pressure vessel. In addition to the specifics of the following list:

- Vessel nominal size, flange rating, wall thickness, material
- Dry weight (including transmitter)
- Vessel Manufacturer Serial Number
- Ambient and Fluid temperature ranges
- Operating pressures
- Hydro test pressure and date

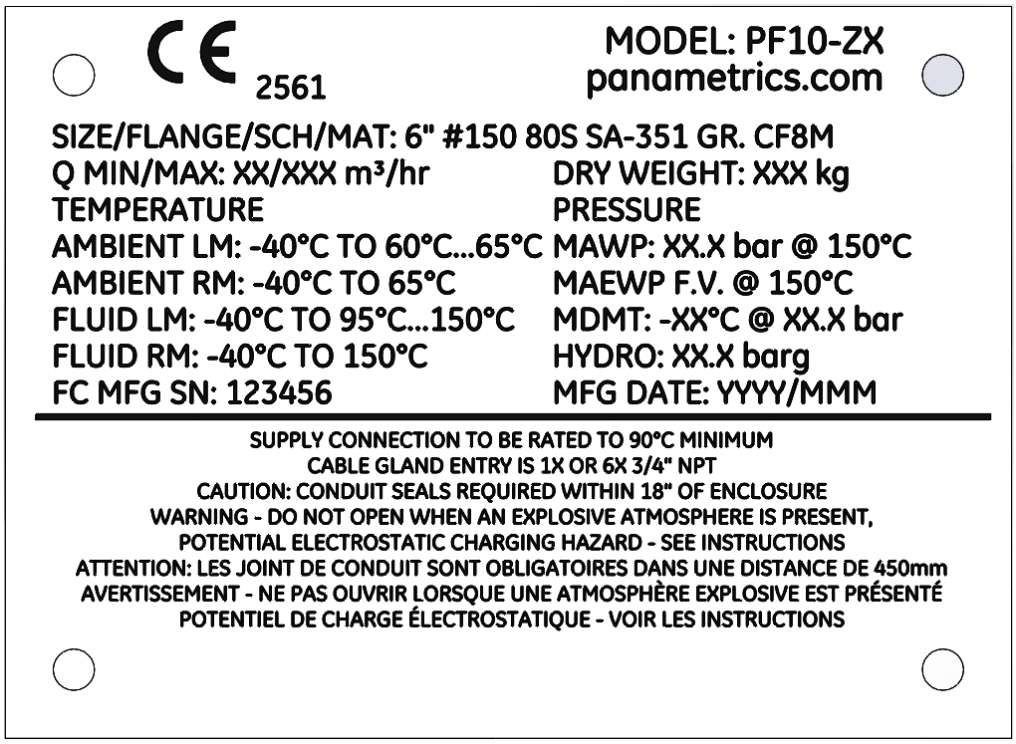


Figure 6: Specification Tag Plate (Remote Mount Tag Shown for Example)

1.3.3.3 Part String and Serial Number Tag Plate

The Part String and Serial Number Tag Plate contains the specific configuration of the pressure vessel as well as final assembly date, BakerHughes serial number and customer tag information. This can be seen in *Figure 7*. For information regarding the serial number, please refer to *Serial Number Information* in Appendix A.

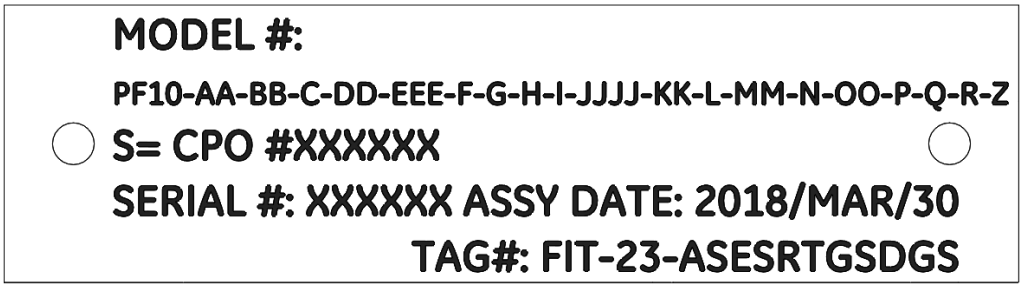


Figure 7: Part String and Serial Number Tag

Chapter 2. Installation

2.1 Installation Guidelines

This section provides general information with respect to the mechanical and electrical installation and should be thoroughly reviewed before the system is installed. To ensure safe and reliable operation of the PanaFlow Z3, the system must be installed in accordance with the established guidelines. Those guidelines, explained in detail in this chapter, include the following topics:

- Unpacking the PanaFlow Z3 System
- Installing the Meter Body
- Site Considerations
- Making Electrical Connections

WARNING! **The PanaFlow Z3 flow meter can measure the flow rate of many fluids, some potentially hazardous. The importance of proper safety practices cannot be overemphasized.**

WARNING! **Be sure to follow all applicable local safety codes and regulations for installing electrical equipment and working with hazardous fluids or flow conditions. Consult company safety personnel or local safety authorities to verify the safety of any procedure or practice.**

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

2.2 Unpacking the PanaFlow Z3 System

The PanaFlow Z3 will typically be packaged in a wooden crate, the size of which will depend on the size of product ordered. The flow meter will be secured by several 2x4 blocks to prevent shifting during transit. Simply remove these 2x4 braces to unpack the system. For local mount systems the transmitter will be installed directly on top of the pressure vessel. For remote mount systems the transmitter and remote cable may ship in a separate parcel.

Before removing the PanaFlow Z3 system from the crate, please inspect the flow meter. Each instrument manufactured by Panametrics is warrantied to be free from defects in material and workmanship. Before discarding any of the packing materials, account for all components and documentation listed on the packing slip. If anything is missing or damaged, contact BakerHughes Customer Care immediately for assistance.

2.2.1 Inspection

Prior to installation, inspect all material to be used in the installation, including:

- Nuts & Bolts - check for debris and damaged threads
- RF Flange Faces - check for damage to serrations that may cause gaskets to not properly seal.

In general, check for anything that may prevent safe operation of the equipment.

2.2.2 Lifting the PanaFlow Z3 System

Figure 8 indicates the only approved method to attach the lifting straps to the PanaFlow Z3. The straps must be wrapped around the meter body, and lifting must be done in the upright position.

Use proper lifting techniques when moving the PanaFlow Z3. No lifting hooks or eyelets are provided. The recommended method for lifting the PanaFlow Z3 is by using lifting straps on each side of the meter body. A stabilizer bar placed between the lifting straps, located above the transmitter head, may also be required. Additional care may be needed to prevent the transmitter from rotating, especially on the smaller systems where the transmitter weight is a larger share of the total system weight.

CAUTION! **Do not use the transmitter to support the weight of the flowcell, the transmitter cannot support the weight of the pressure vessel.**

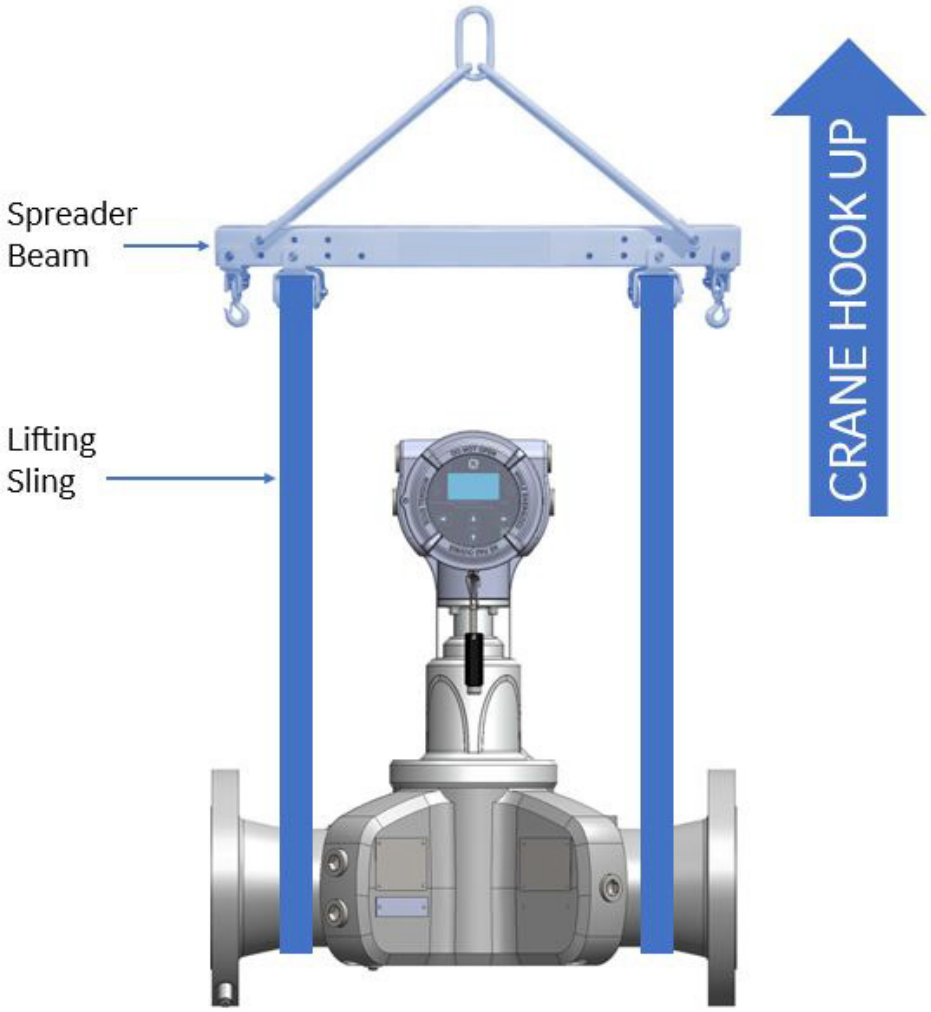


Figure 8: Lifting the PanaFlow Z3 System

2.3 Site Considerations

Proper installation of the PanaFlow Z3 is important to achieve optimum performance from the system. The following installation recommendations provide general guidelines of how this system should be installed. If the following recommendations cannot be met, please consult the factory for a more detailed review of the application to see what performance may be achievable. Following these recommendations may not be the solution for all, since every installation is different.

2.3.1 Installation Location

2.3.1.1 Straight Run Requirements

Ideally, choose a section of pipe with unlimited access; for example, a long stretch of pipe that is above ground. However, if the meter body is to be mounted on an underground pipe, dig a pit around the pipe to facilitate installation or removal of the transducers. Locate the meter body so that there are at least 10 pipe diameters of straight, undisturbed flow upstream and at least 5 pipe diameters of straight, undisturbed flow downstream from the measurement point (see *Figure 9*). Undisturbed flow means avoiding sources of disturbances like valves, reduced bore valves, pipes, flanges, expander/reducer and elbows.

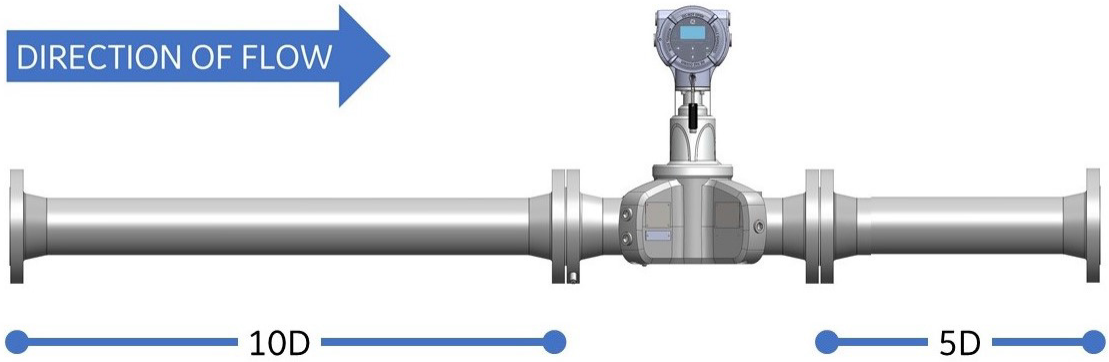


Figure 9: Flow Direction and Pipe Length

2.3.1.2 Transducer Location and Orientation

For a given fluid and pipe, the PanaFlow Z3's accuracy depends on the location and alignment of the transducers. In addition to accessibility, when planning meter location, adhere to the following guidelines.

Locate the transducers on a common axial plane along the pipe (see *Figure 10*). Locate the transducers on the side of the pipe, rather than the top or bottom, since the top of the pipe tends to accumulate gas and the bottom tends to accumulate sediment. Either condition will cause increased attenuation of the ultrasonic signal. There are no similar restrictions with vertical pipes if the flow of the fluid is upward to prevent free falling of the fluid or a partially filled pipe.

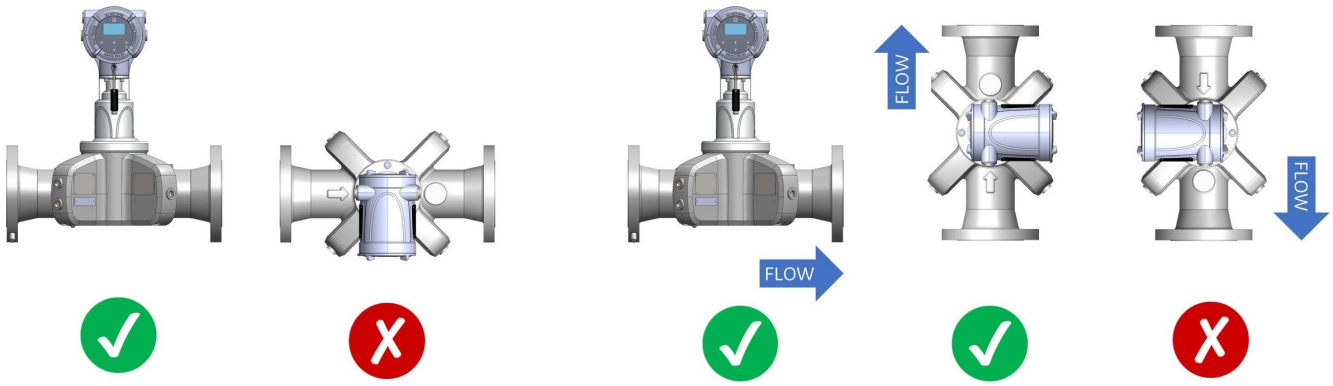


Figure 10: Good and Bad Transducer Orientations

2.3.1.3 Inner Diameter Matching

To maintain optimal product performance, the inner diameter of the upstream sections and flange should be within 1% of the metering section inner diameter at the flange. The downstream matching is not as critical but should be of the same schedule and matched as closely as possible. In addition, gaskets should not protrude past the inner diameter to disrupt the flow profile.

2.3.1.4 Vibration Considerations

The PanaFlow Z3 flow meter should never be exposed to prolonged or intense vibration. Pipeline vibrations at the installation location should be avoided or eliminated whenever possible.

2.3.2 Guidelines For Installing Pipe Insulation

If pipe insulation is required:

- Install all insulation materials and accessories in accordance with the manufacturer's instructions and the recognized industry practices. Adhere to the local code where applicable to ensure that the safe and proper installation will serve its intended purpose.
- Install the insulation material in layers, with smooth and even surfaces. Allow adequate space (Air pocket for convention) around mounting adapter in case of local mount and mounting adapter, junction boxes, conduit fitting and cables in case of remote mount for proper ventilation hence heat dissipation. Allow enough space around transmitter electronics for better heat dissipation and proper functionality.
- Maintain the integrity of any factory-applied vapor barrier jacketing on all pipe insulation, if applicable. Seal all joints and seams, protecting the insulation against puncture, tears or other damage.

2.3.3 Fluid Comments

Gas - To avoid measurement errors suitable measures should be taken to make sure that the line is full and gas in the line is kept below 1% of volume. While the system may still be able to measure with larger amounts, it has the potential to affect accuracy. When gas is present, keep flow rates as high as possible to help push the gas through the metering section.

Particulate - To avoid measurement errors suitable measures should be taken to minimize size of particulate in the line. Ideally, particulates should be less than 1% of volume for accurate measurement.

Water in Oil - Water and oil mixtures under 5% should be measurable and will not affect accuracy if they are well mixed. Keep flow rates high enough to ensure a well-mixed solution.

Fluid Cavitation - Fluids with a high vapor pressure may cavitate near the measurement point. This causes problems resulting from gas bubbles in the fluid. Cavitation can usually be controlled through proper system design.

Please consult the factory for any applications where conditions are outside the recommended ranges for a more comprehensive application review.

2.4 Making Electrical Connections

The PanaFlow Z3 utilizes the XMT1000 Transmitter module. For information regarding electrical connections required for setup of the XMT1000 Transmitter, please refer to the included PanaFlow XMT1000 User's Manual.

WARNING! **Make sure all covers, with their O-ring seals, are installed and the set screws tightened before applying power in a hazardous environment.**

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

2.4.1 Local Mount Configuration Transducer Wiring

The wiring between transmitter and transducers has been completed at the factory. No further work is required on this portion of the wiring. Consult the XMT1000 Transmitter manual for customer connection wiring instructions.

2.4.2 Remote Mount Configuration Transducer Wiring

Wiring the transmitter electronics to the remote flowcell setup is done by attaching the transmitter's cable gland to the six SMB jacks shown in *Figure 11*. A more detailed representation of how this equipment shall be wired is described in *Figure 12*. For Class 1 Division 1 installations, rigid conduit and conduit seals need to be provided and installed by the customer in accordance to local codes, standards, regulations, or laws applicable to safety.

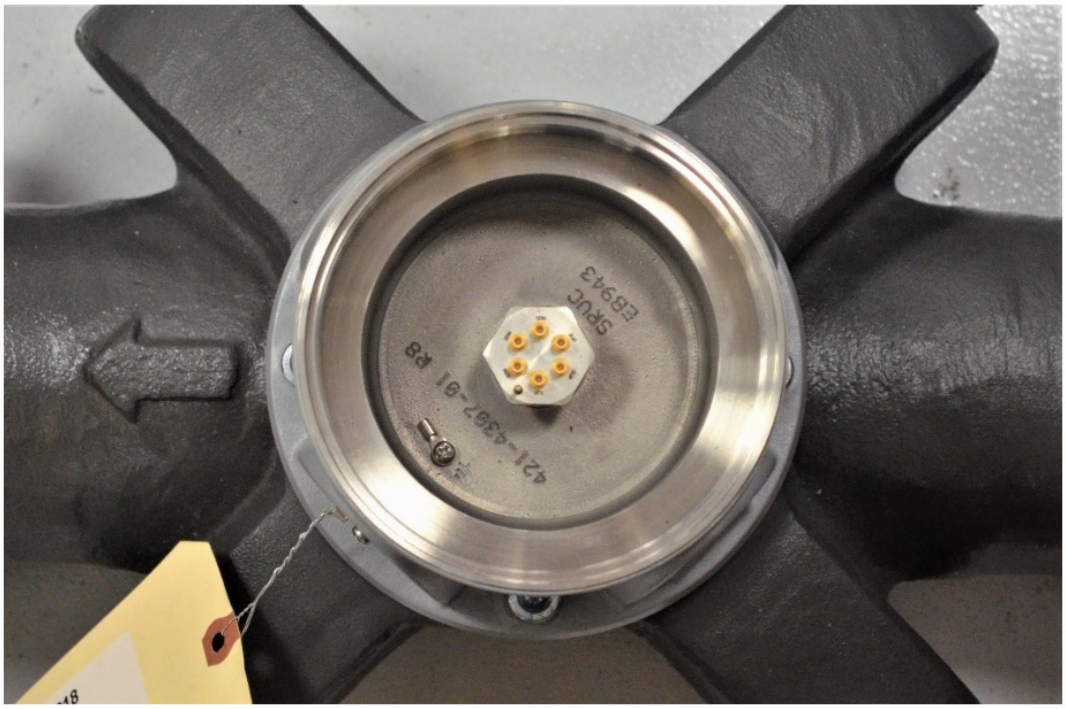


Figure 11: Connection Port at Flowcell

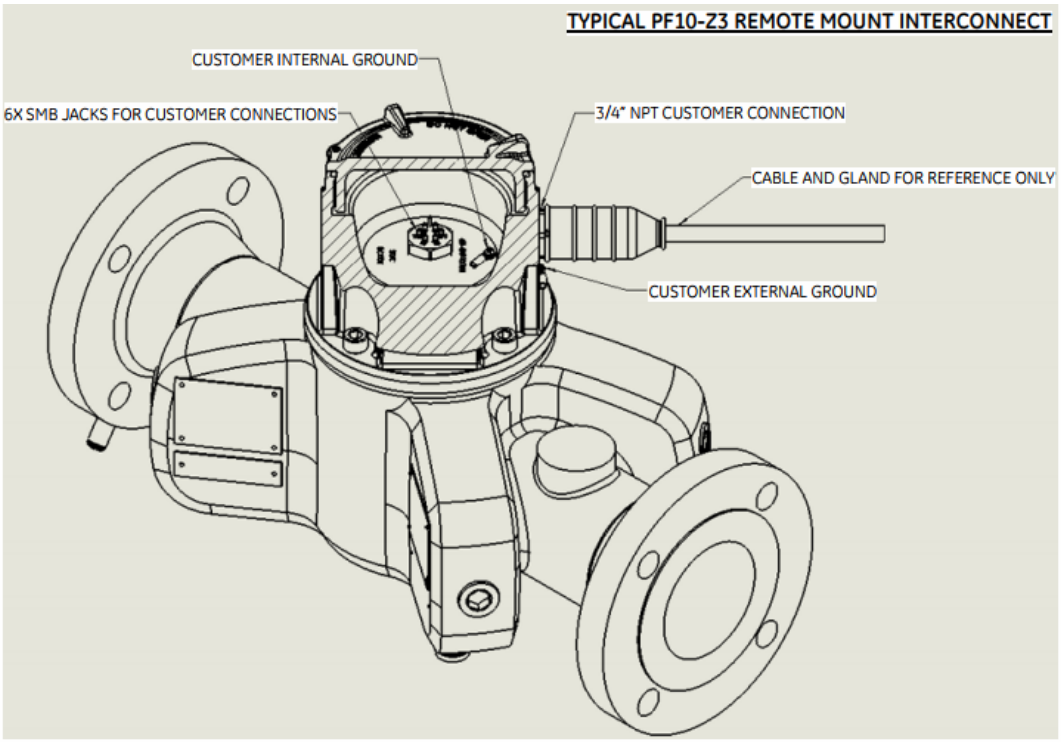


Figure 12: Remote Mount Wiring Diagram

[no content intended for this page]

Chapter 3. Programming

3.1 Introduction

This chapter has instructions for programming various features of the *PanaFlow™ Z3* flow transmitter. In this chapter, we will list all available options. The user can then change the *User Preferences* and *Inputs/Outputs* settings, *Programming* for flow measurements and *Calibration* to meet their needs.

IMPORTANT: *Not all users will have access to all of the menus. Some menus are restricted to only those users with the proper passcodes.*

3.1.1 HMI Features

Figure 13: PanaFlow Z3 HMI

The six keys on the magnetic keypad are used to program the PanaFlow Z3:

Key Symbol	Key Name	Functions
✗	Escape Key	To cancel a numeric entry change, exit a menu or as Back key
✓	Enter Key	To accept a numeric entry or select a menu option
◄	Left Arrow Key	To navigate among menu choices, pages or set cursor position
►	Right Arrow Key	To navigate among menu choices, pages or set cursor position
▲	Up Arrow Key	To navigate among menu choices, pages or increase/decrease numeric entries
▼	Down Arrow Key	To navigate among menu choices, pages or increase/decrease numeric entries

3.1.2 Indicator Lights

- The blue light on the top right above the display is the **Power Indicator** that is normally lit when the instrument is powered.
- The red light on the top left above the display is the **Error Indicator.** The *Error Indicator* light blinks if an instrument error is detected. A short error message will be displayed in the lower left-hand corner of the *Measurement View*. If the instrument is operating without error, red light is turned OFF.

3.2 Passcodes

IMPORTANT: *Not all users will have access to all of the menus. Some menus are restricted to only those users with the proper passcodes.*

The default passcodes for the PanaFlow Z3 flow transmitter are:

- Keypad Lockout Password, default (fixed) = 102719 [this password cannot be changed]
- Operator Password, default (changeable) = 111111
- Software Upgrade Password, System Generated specific for the System Serial Number [this password cannot be changed].

IMPORTANT: *BakerHughes recommends changing all default (changeable) passwords after commissioning the meter.*

3.2.1 Unlock from Keypad Lockout

After power up, if the meter's *Measurement View* (Refer Figure 14) shows a lock icon on the top right of the display, use the following steps to unlock the meter from keypad lockout mode.

- Press C-ENT-ESC [× ✓ ×] followed by either "Operator" password or the "Keypad Lockout" password. The lock icon on the top right of the display will show an open lock indicating the meter keypad is unlocked.

3.3 Measurement View, Log-in and Primary Pages

3.3.1 Measurement View

On power up, the XMT1000 meter shows the following screens:

- Panametrics Logo screen
- Meter Initialization screens
- Power-on self-tests and results
- Finally, the *Measurement View* (Refer Figure 14)

This screen (Refer Figure 14) will be referred to as *"Measurement View"* throughout this chapter. User can choose the measurement to be displayed in this view from a list of options. The Error indicator at the bottom left of the display will be blank if the meter has no error.

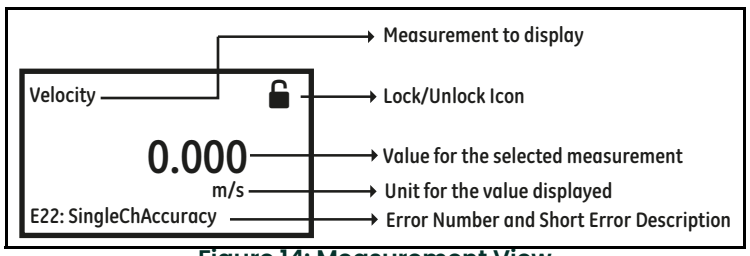


Figure 14: Measurement View

3.3.1.1 Changing Display Format

To change Display Format, do the following steps and refer Figure 15.

1. Press [▶] until the lock icon on the meter's *Measurement View* display is highlighted, and press **[ENTER]**.
2. In the *Main Menu* select **[Display Format]**, then press **[ENTER]**.
3. Select **[One Variable]** or **[Two Variable]** or **[Totalizer]** format to suit your needs.

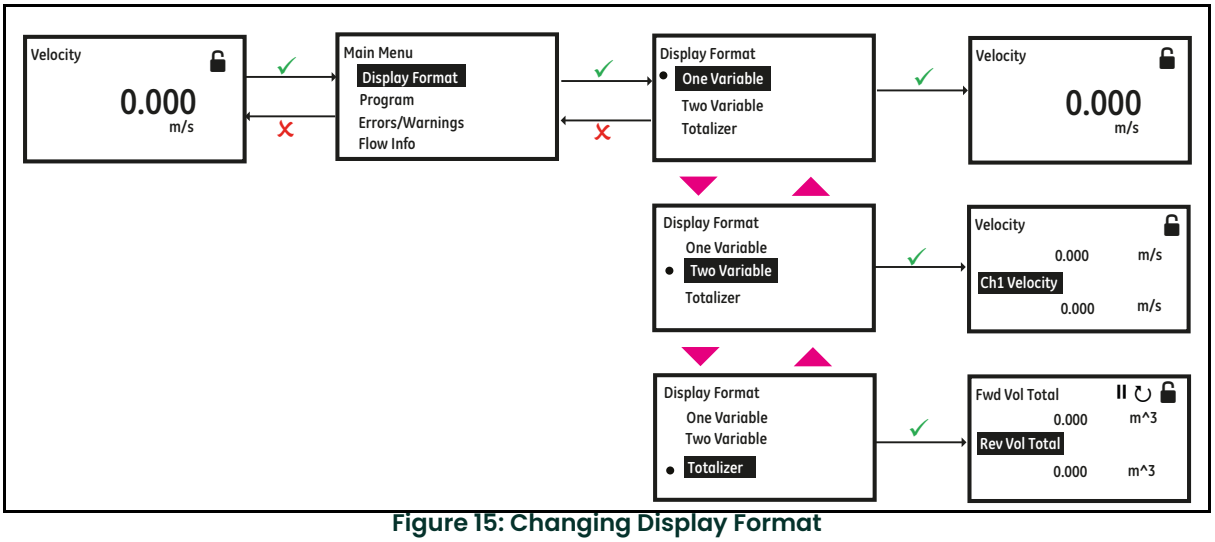


Figure 15: Changing Display Format

3.3.1.2 Selecting a Composite Measurement to Display

To select a composite measurement to display on the *Measurement View*, do the following steps and refer Figure 16:

1. Press [▶] until the Measurement name on the meter's Measurement View display is highlighted, and press **[ENTER]**.
2. In the *Display Measurement* select **[Composite]**, then press **[ENTER]**.
3. Then, select the measurement you would like to see on the *Measurement View* and press **[ENTER]**.

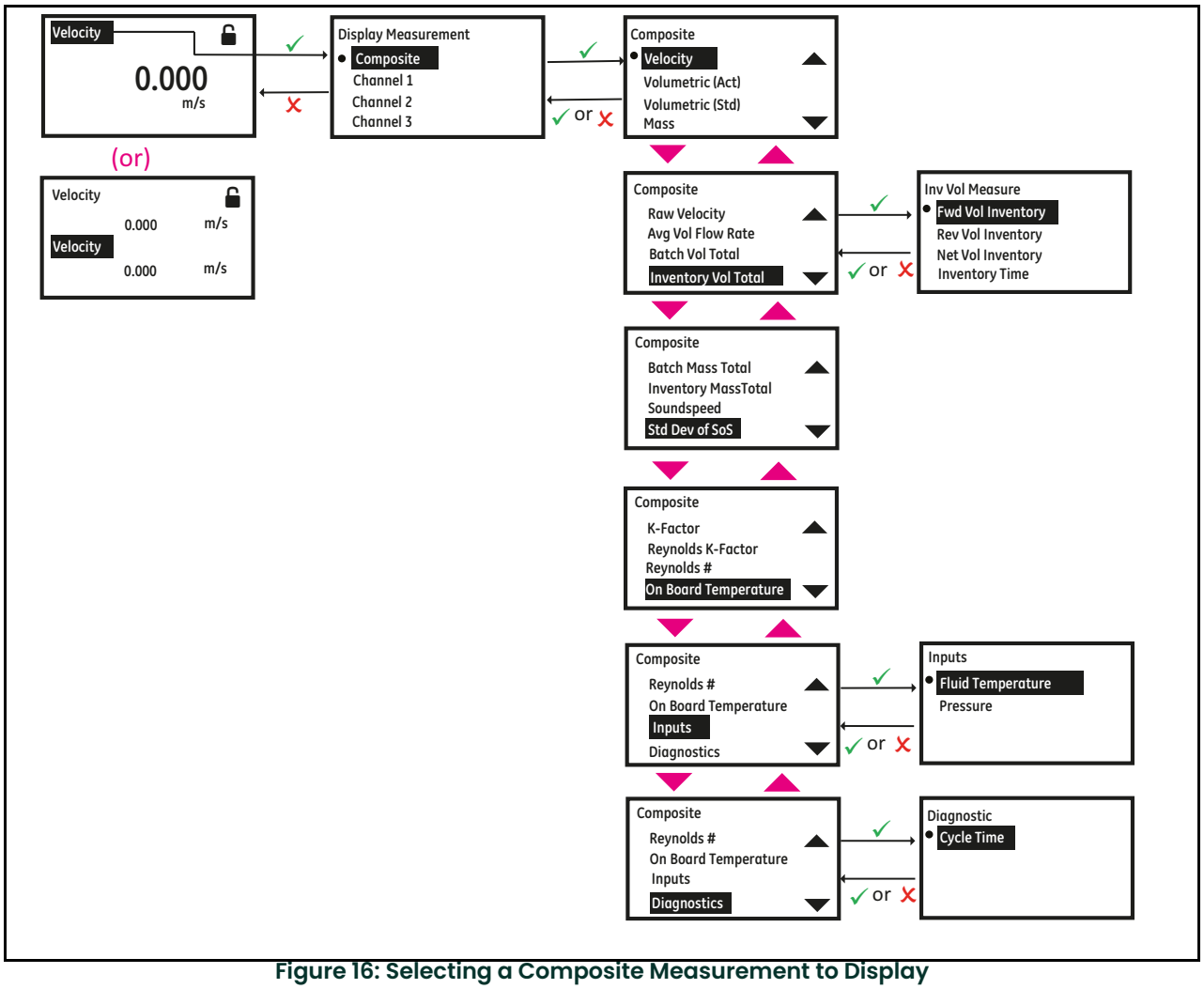


Figure 16: Selecting a Composite Measurement to Display

3.3.1.3 Selecting a Channel Measurement to Display

To select a Channel measurement to display on the *Measurement View*, do the following steps and refer Figure 17.

1. Press [▶] until the Measurement name on the meter's *Measurement View* display is highlighted, then press **[ENTER]**.
2. In the *Display Measurement* select **[Channel x]**, then press **[ENTER]**.
3. Then, select the measurement you would like to see on the *Measurement View* and press **[ENTER]**.

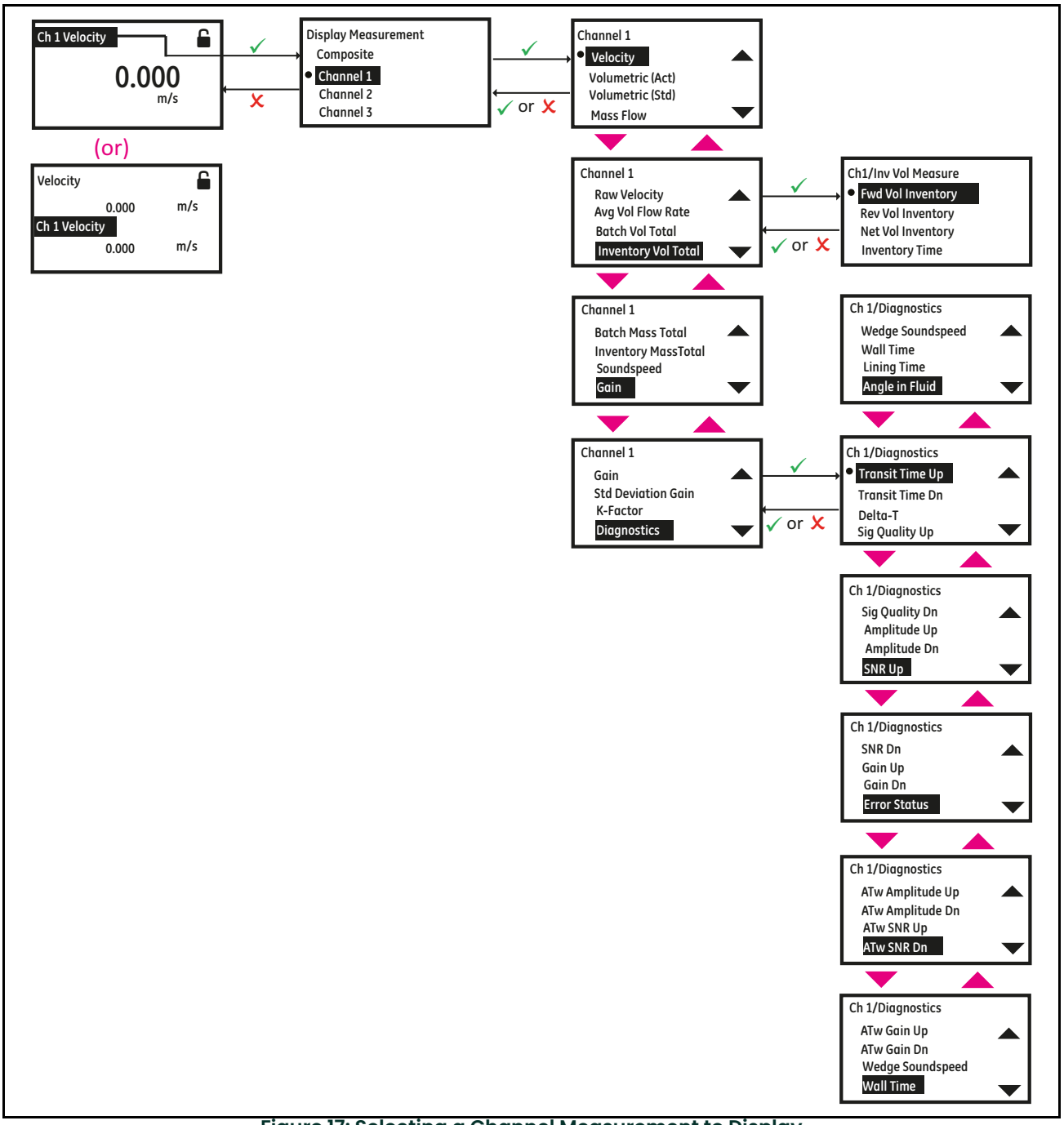


Figure 17: Selecting a Channel Measurement to Display

3.3.1.4 Totalizer Display

The Totalizer display on the *Measurement View* shows the totalized measurements and provides the ability to start, stop and reset totals. Refer to Figure 15 to set Display format to Totalizer. Do the following steps to select the appropriate Totalizer measurements to view on the *Measurement View*. Refer to Figure 18.

1. Press [►] button on the keypad until the Measurement name on the meter's *Measurement View* display is highlighted, and press **[ENTER]**.
2. In the *Display/Totalizer,* select **[Composite]** or **[Channel x]**, then press **[ENTER]**.
3. Then, select the totalizer measurement you would like to see on the *Measurement View* and press **[ENTER]**.

4. Press [►] button on the keypad until the [⏸ or ►] is highlighted to stop or start the totalizing respectively.
5. Press [►] button on the keypad until the [↻] is highlighted to reset/clear the totalized measurements.

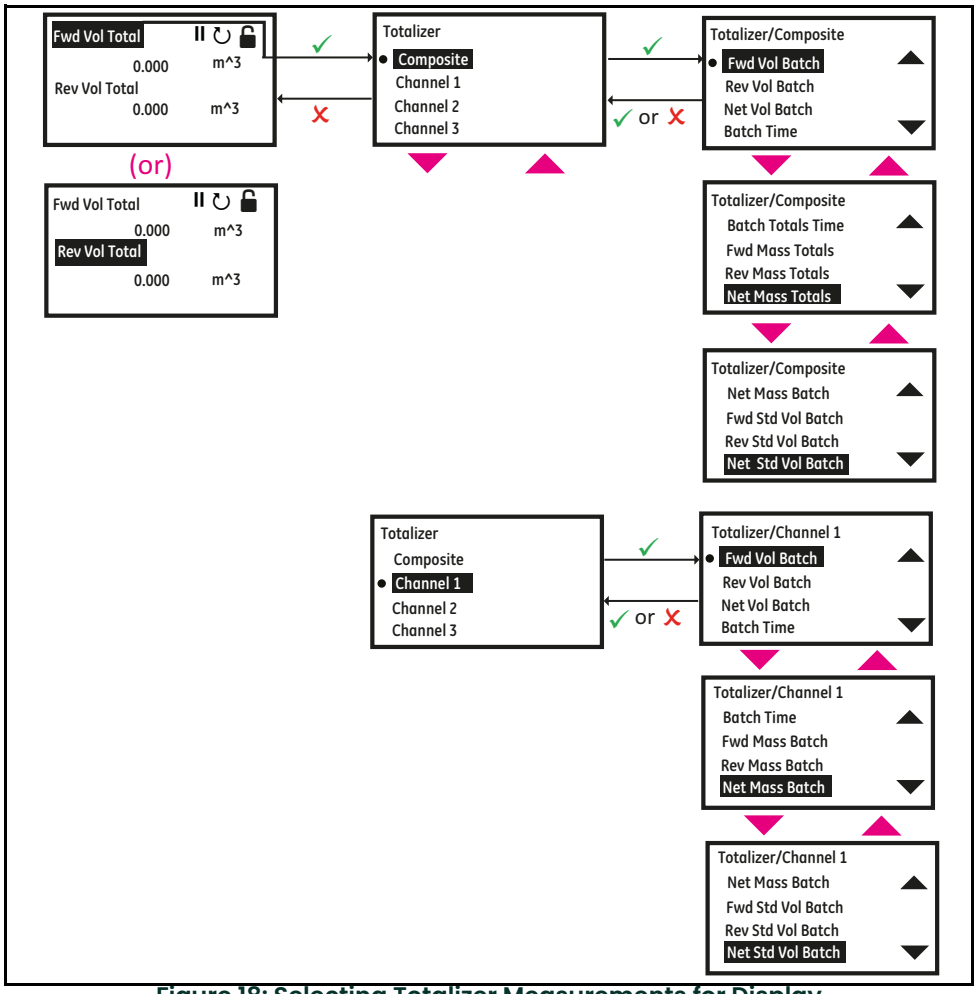


Figure 18: Selecting Totalizer Measurements for Display

3.3.2 Log-in and Primary Pages

To Log-in into the meter perform the following steps:

1. Press [►] until the lock icon on the meter's *Measurement View* display is highlighted, then press **[ENTER]**.
2. In the *Main Menu* Scroll down and select **[Program]**, then press **[ENTER].**
3. Scroll and select desired access level **[Operator]**, then press **[ENTER]**.
4. Enter the password for Operator access level, and press **[ENTER]**.
5. After completing the log-in steps you will see the primary pages as shown in the Figure 19. To move from one page to the next, press [◄] or [►] and to scroll to options within a page press [▲] and [▼].

Note: *For ease of navigation up and down scroll is circular, meaning if you press [▲] when the first option is highlighted, then you will be taken to the last option in the page. Similarly, when you press [▼] when the last option is highlighted, then you will be taken to the first option in the page.*

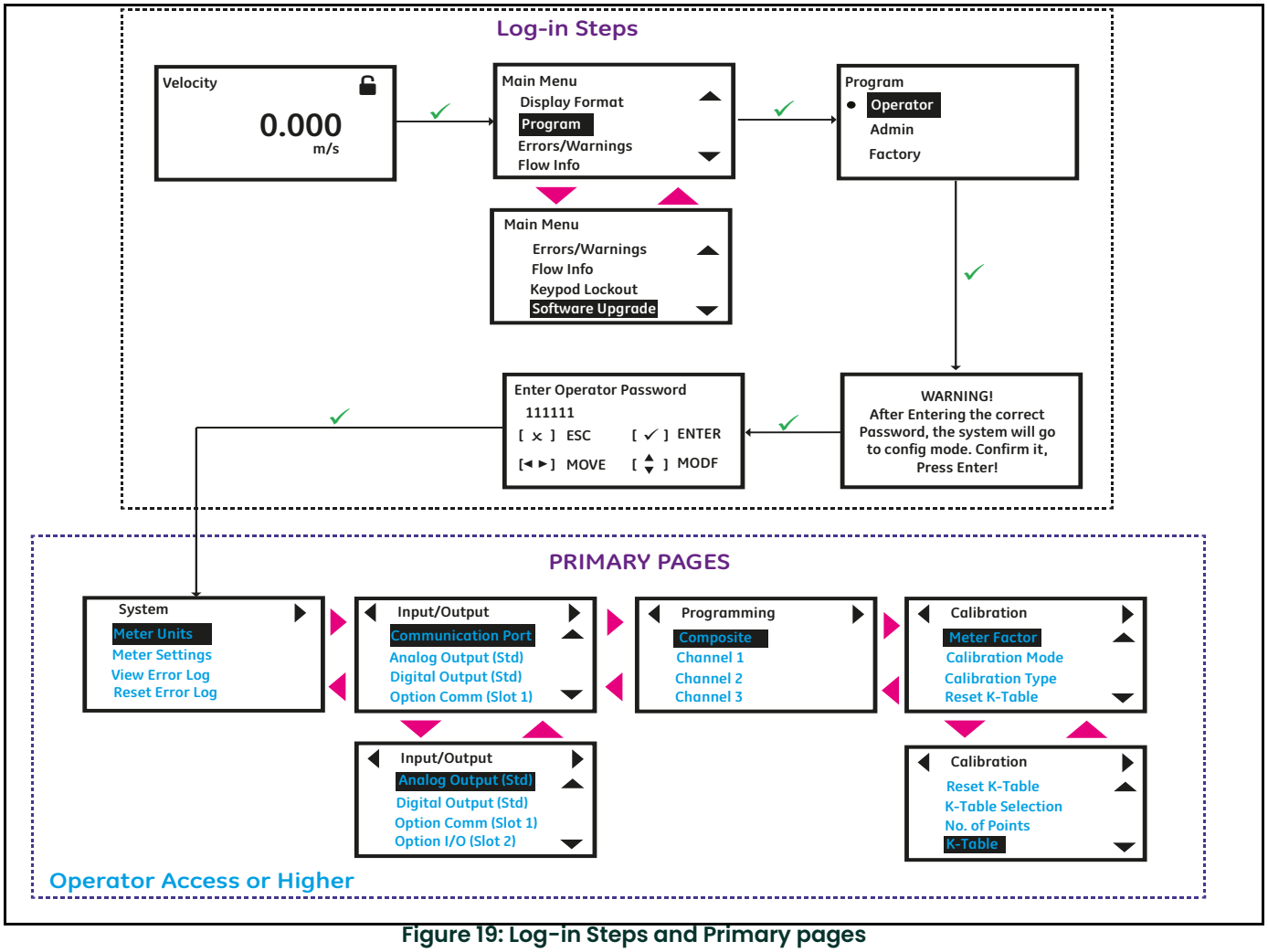


Figure 19: Log-in Steps and Primary pages

IMPORTANT: *If the keypad has not been pressed for 5 minutes, the XMT1000 exits the Program and returns to displaying measurements. Because changes can only be retained after the user confirms them, the meter discards any unconfirmed configuration changes.*

3.4 System Settings

3.4.1 Selecting Units

The operator can select the preferred units of measurements. Use steps as in Section 3.3.2 to navigate to the *System* settings page. Then highlight **[Unit Settings]** and press **[ENTER]**, you will now have measurement types listed as in the Figure 20 below, for which you can select your preferred respective units.

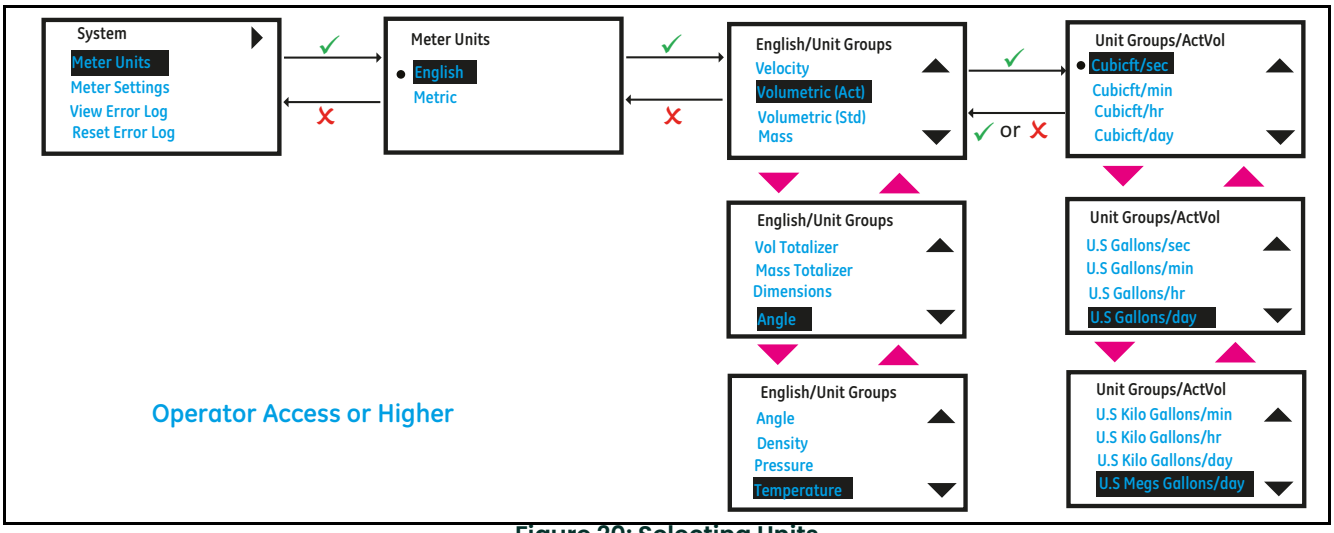


Figure 20: Selecting Units

3.4.1.1 Supported Unit Groups and Units

The Table 1 specifies the unit groups and its respective units supported in PanaFlow Z3.

Table 1: Unit groups and supported units

Unit Group	Supported Metric Units	Supported English Units
Velocity Units	m/s	ft/s
Volumetric Units	m^3/s, m^3/min, m^3/h, m^3/d, L/s, L/min, L/h, ML/d	ft^3/s, ft^3/min, ft^3/h, ft^3/d, gal/s, gal/min, gal/h, gal/d, bbl/s, bbl/min, bbl/h, bbl/d, kgal/min, kgal/h, kgal/d, kbbl/min, kbbl/h, kbbl/d, ac-ft/min, ac-ft/h, ac-ft/d, ac-in/s, ac-in/min, ac-in/h, ac-in/d, impgal/s, impgal/min, impgal/h, impgal/d, Mbbl/d, Mimpgal/d, Mgal/d
Standard Volumetric Units	SL/s, SL/min, SL/hr, SL/d, Sm^3/s, Sm^3/min, Sm^3/hr, Sm^3/d	SCFH, SCFM, SBBLD, SBBLH, SBBLM, SBBLS, SCFD, SCFS
Mass Units	kg/s, kg/min, kg/h, kg/d, Ton/s, Ton/min, Ton/h, Ton/d	lb/s, lb/min, lb/h, lb/d, klb/s, klb/min, klb/h, klb/d, STon/s, STon/min, STon/h, STon/d
Volumetric Totals Units	m^3, L, Sm^3, SL, ML, Mm^3	ft^3, Mft^3, gal, Mgal, bbl, Mbbl, ac-ft, ac-in, impgal, Sft^3
Mass Totals Units	kg, MTon	Lb, STon
Dimension Units	mm	in
Density Units	kg/m^3, g/cm^3, Ton/m^3, kg/L, g/mL, kg/dm^3	oz/in^3, lb/in^3, lb/ft^3, lb/gal
Pressure Units	kg/m2, Pa, MPa, KPa, bar, mBar, Torr, atm	Psi-g, Psi-a
Angle Units	Degree, Radians	Degree, Radians
Temperature Units	°C, K, °F, °R	°C, K, °F, °R
Viscosity Units	cSt, m^2/s	ft2/s

3.4.2 Meter Settings

In order to change the Language, display settings, System Date, Meter Tag, Label, Change password or view About meter, use steps as in section “Log-in and Primary Pages” to navigate to the System settings page. Then highlight [Meter Settings] and press [ENTER]. Figure 21 below, shows the options available.

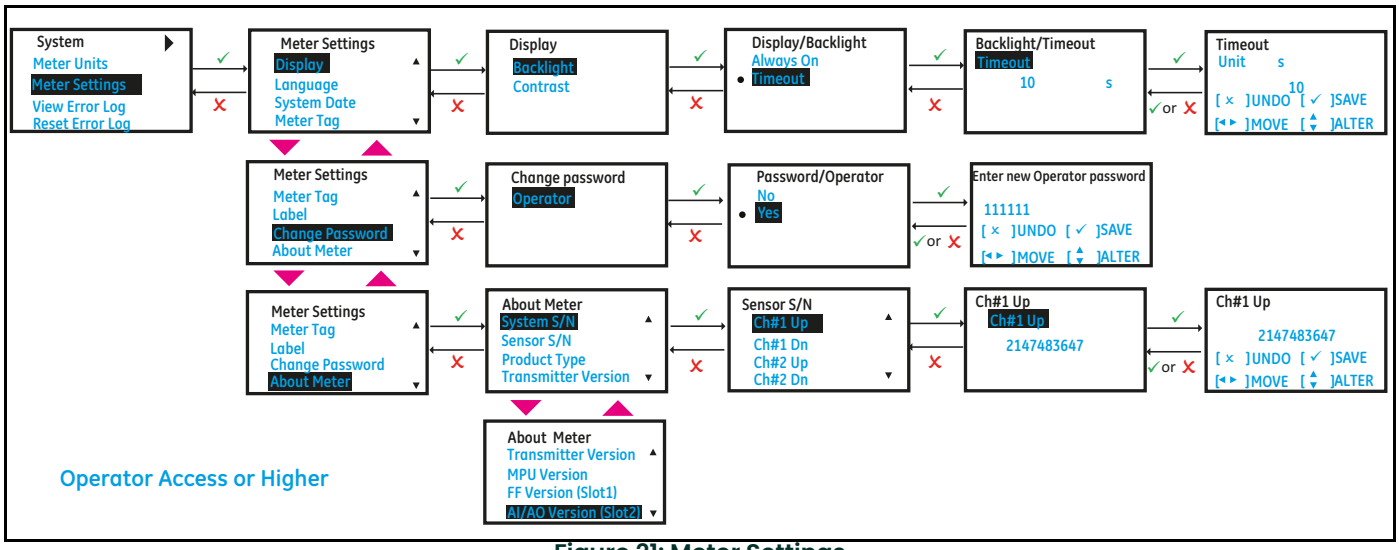


Figure 21: Meter Settings

3.5 Inputs and Outputs

3.5.1 Modbus Port Settings

The XMT 1000 meter supports digital communications using the MODBUS/RTU protocol, with 3-wire RS-485 as the physical layer interfaces. Baud rate can be specified from 2400 to 115,200 bits per second (bps), with selectable parity, and number of stop bits (Default = 115200, Even, 1 Stop Bit). Use steps as in Section 3.3.2 to navigate to the *Input/Output* settings page. Then select **[Communication Port]** and press **[ENTER]**. Figure 22 below, shows the options available.

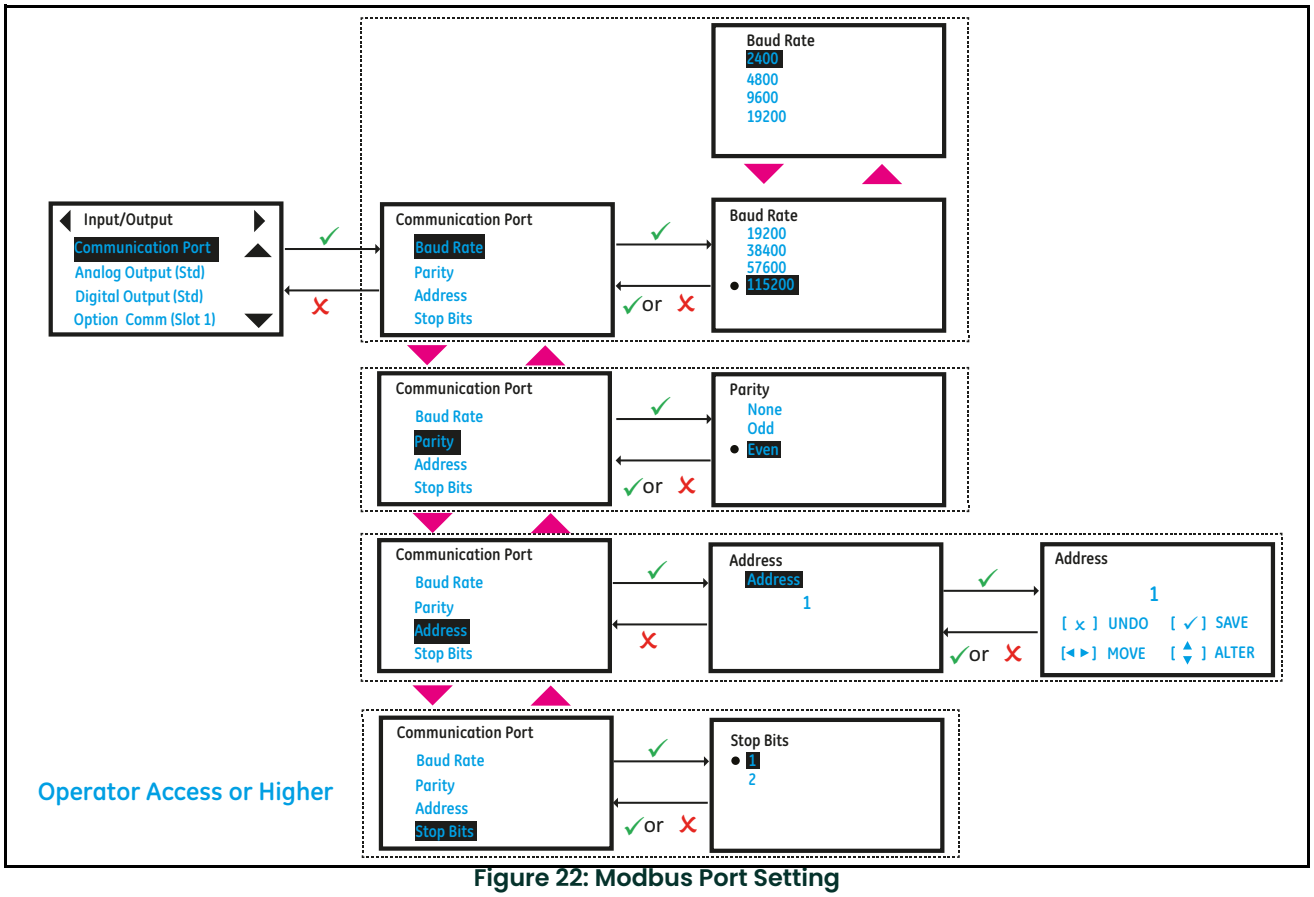


Figure 22: Modbus Port Setting

3.5.2 Standard Analog Output

The PanaFlow Z3 has one *Analog Output* and one *Digital Output* in Standard configuration.

3.5.2.1 Setting up Analog Output

The PanaFlow Z3 meter has one Analog Output in standard configuration. For additional Analog outputs Optional I/O boards may be purchased. Use steps as in section "Log-in and Primary Pages" to navigate to the *Input/Output* settings page.

1. Select **[Analog Output (Std)]** and press **[ENTER]**.
2. If you do not wish to connect an Analog Output, you should turn Analog Output selection to OFF.
3. If you are connecting an Analog Output, choose 4-20mA option. The Figure 23 below, shows the available options.
4. Select the Measurement to be sent out on the 4-20mA output, followed by the **[Base Value]** and **[Full Value]** selection. Refer Table 2 to see measurement options available for Analog output.
5. Select **[Error Handling]**. Refer to Section 3.5.2.2 to choose an option that suits your needs.

Table 2: Measurement Options for Analog output

Measurement Channel	Measurement Options for Analog Output
Composite	Velocity, Actual Volumetric, Standard Volumetric, Mass Flow, Average Volumetric Flow Rate, Sound speed, Reynolds#
Channel x	Velocity, Actual Volumetric, Standard Volumetric, Mass Flow, Average Volumetric Flow rate, Sound speed, Standard Deviation of Gain, Gain and SNR

3.5.2.2 Understanding the Error Handling Option

The following Table 3 shows the response to each of the Error Handling options. For a multi-channel meter, the [Path Error Handling] set to ON (see Figure 36) changes the Output response. See Table 4 for Analog Output response with Path Error Handling set to ON.

Note: *Table 4 assumes Composite Actual Volumetric is chosen as Measurement for Analog Output.*

Table 3: Analog Output Error Handling options

Option	Output Response
Low	Forces Output to 4mA on error
High	Forces Output to 20mA on error
Hold	Holds the last "good" reading
Other	Enables the user to enter a value between 4mA and 20mA, to be output during an error

Table 4: Analog Output Error Handling with Path Error Handling set to ON

Ch1 in Error	Ch2 in Error	Ch3 in Error	Error displayed in Meter	Expected Composite Volumetric(Act) behavior	Analog Output Response
No	No	No	No Error	Measured Composite Volumetric(Act)	mA proportional to the Measured Composite Volumetric(Act)
Yes	No	No	E22: SingleChAccuracy	Measured Composite Volumetric(Act)	mA proportional to the Measured Composite Volumetric(Act)

Table 4: Analog Output Error Handling with Path Error Handling set to ON

Ch1 in Error	Ch2 in Error	Ch3 in Error	Error displayed in Meter	Expected Composite Volumetric(Act) behavior	Analog Output Response
No	Yes	No	E22: SingleChAccuracy	Measured Composite Volumetric(Act)	mA proportional to the Measured Composite Volumetric(Act)
No	No	Yes	E22: SingleChAccuracy	Measured Composite Volumetric(Act)	mA proportional to the Measured Composite Volumetric(Act)
Yes	Yes	No	E23: MultiChAccuracy	Measured Composite Volumetric(Act)	mA proportional to the Measured Composite Volumetric(Act)
No	Yes	Yes	E23: MultiChAccuracy	Measured Composite Volumetric(Act)	mA proportional to the Measured Composite Volumetric(Act)
Yes	No	Yes	E23: MultiChAccuracy	Measured Composite Volumetric(Act)	mA proportional to the Measured Composite Volumetric(Act)
Yes	Yes	Yes	E23: MultiChAccuracy	Measured Composite Volumetric(Act) will hold the last good value	mA value based on the [Error Handling] setting

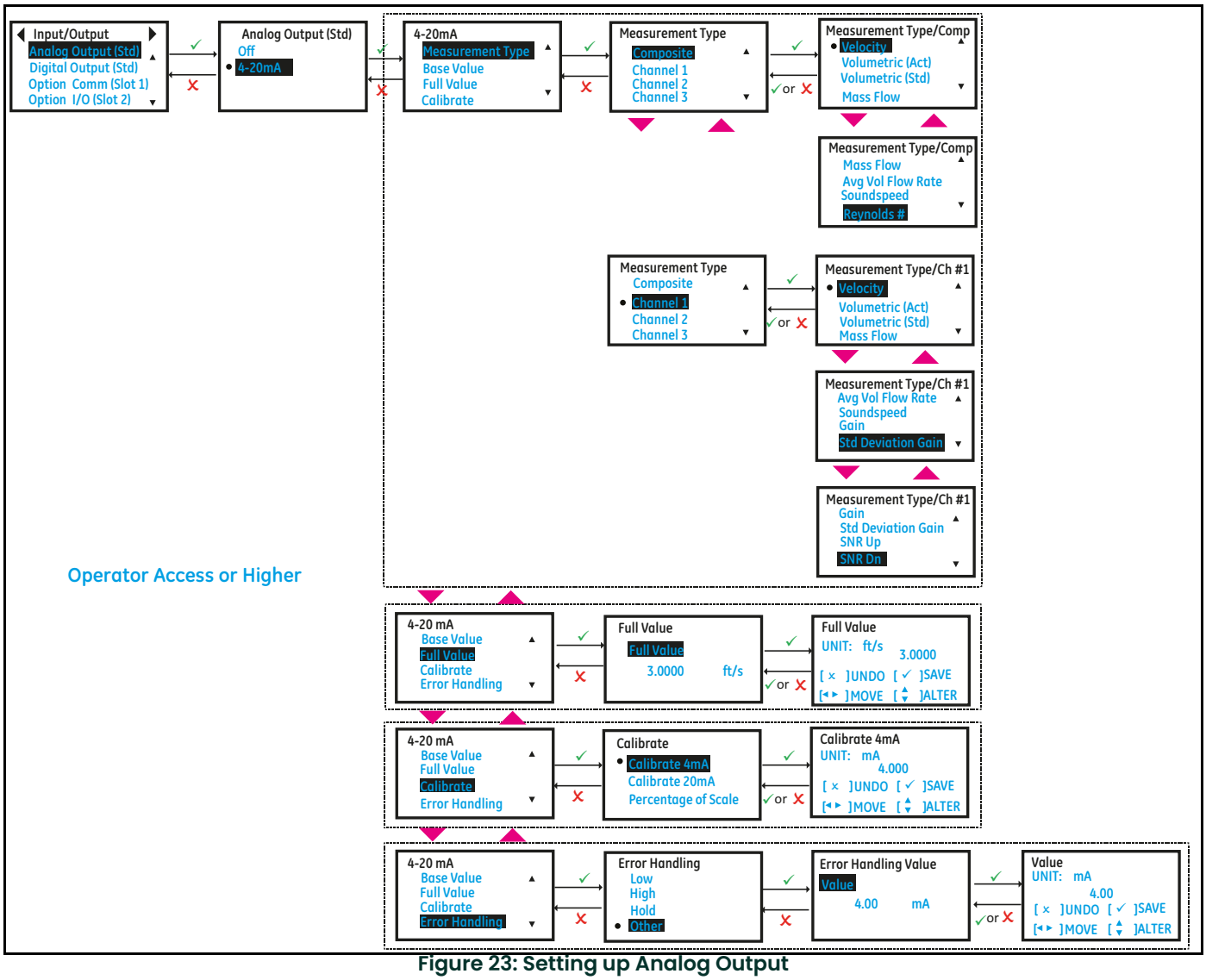


Figure 23: Setting up Analog Output

3.5.2.3 Calibrating Analog Output

To calibrate Analog Output, use steps as in section "Log-in and Primary Pages" to navigate to the *Input/Output* settings page. You may use a multimeter or DCS/SCADA to calibrate the Analog Output. Regardless of whether multimeter or DCS/SCADA is used, the steps below remain the same. For better readability, the steps below only indicate multimeter and does not repeat multimeter or DCS/SCADA.

1. Turn ON the multimeter (if used), and set it to measure Current (mA) DC. Connect test lead from positive side (Aout+) of the Main Analog Output to the positive terminal of multimeter, and the negative lead to the negative terminal (Aout-).
2. In Meter Menu, select **[Analog Output (std)]** and press **[ENTER]**. Then select **[4-20mA]** and press **[ENTER]**.
3. Scroll down and select **[Calibrate]** option.
4. Select **[Calibrate 4mA]** and check if the reading on the multimeter reads 4.00mA ± 0.01mA. If the value on the multimeter is not 4.00mA ± 0.01mA, input the value read on the multimeter into the *Calibrate 4mA* value and press **[ENTER]**. Check multimeter again verify the Current reads 4.00mA within ±0.01mA.
5. Select **[Calibrate 20mA]** and check if the reading on the multimeter reads 20.00mA ± 0.01mA. If the value on the multimeter is not 20.00mA ± 0.01mA, input the value read on the multimeter into the *Calibrate 20mA* value and press **[ENTER]**. Check multimeter again verify the Current reads 20.00mA within ±0.01mA.

6. Select **[Percentage of Scale]** and adjust the scale to 0.00% and press **[ENTER]**, then verify the reading on the multimeter is 4.00mA within ±0.01mA. Then adjust the scale to 50.00% and press **[ENTER]**, then verify the reading on the multimeter is 12.00mA within ±0.01mA. Then adjust the scale to 100.00% and press **[ENTER]**, then verify the reading on the multimeter is 20.00mA within ±0.01mA.
7. If Steps 4, 5, and 6 were successfully completed and verified, the Analog output is successfully calibrated.

3.5.3 Standard Digital Output

3.5.3.1 Setting up Pulse Output

To program a Pulse Output, use steps as in Section 3.3.2 to navigate to the *Input/Output* settings page:

1. In Meter Menu, select **[Digital Output (Std)]** and press **[ENTER]**. Then select [Pulse] option.
2. Setup the **[Polarity], [Measurement], [Pulse Value], [Pulse width]** and **[Error Handling]** options to suit your needs. The Figure 24 below, shows the available options. Also refer to the Table 5 below to understand each option.

Table 5: Pulse Output Options

Option	Functional Description
Polarity	Choose the Negative or Positive edge of the pulse
Measurement	Choose the channel and Measurement to output
Pulse Value	Choose how many units of the chosen measurement is accumulated before a pulse is output
Pulse Width	Choose the duration of each pulse that is output **IMPORTANT:** *Make sure the meter is not configured to output more than one pulse during this time, as this could lead to missed pulses.*
Error Handling	Choose the Pulse output response during an error condition

For measurement options available on Pulse Output refer to Table 6.

Table 6: Measurement options for Pulse Output

Measurement Channel	Measurement Options for Pulse Output
Composite	Forward Volumetric Totals, Reverse Volumetric Totals, Net Volumetric Totals, Forward Mass Totals, Reverse Mass Totals, Net Mass Totals, Forward Std Volumetric Totals, Reverse Std Volumetric Totals, Net Std Volumetric Totals
Channel x	Forward Volumetric Totals, Reverse Volumetric Totals, Net Volumetric Totals, Forward Mass Totals, Reverse Mass Totals, Net Mass Totals, Forward Std Volumetric Totals, Reverse Std Volumetric Totals, Net Std Volumetric Totals

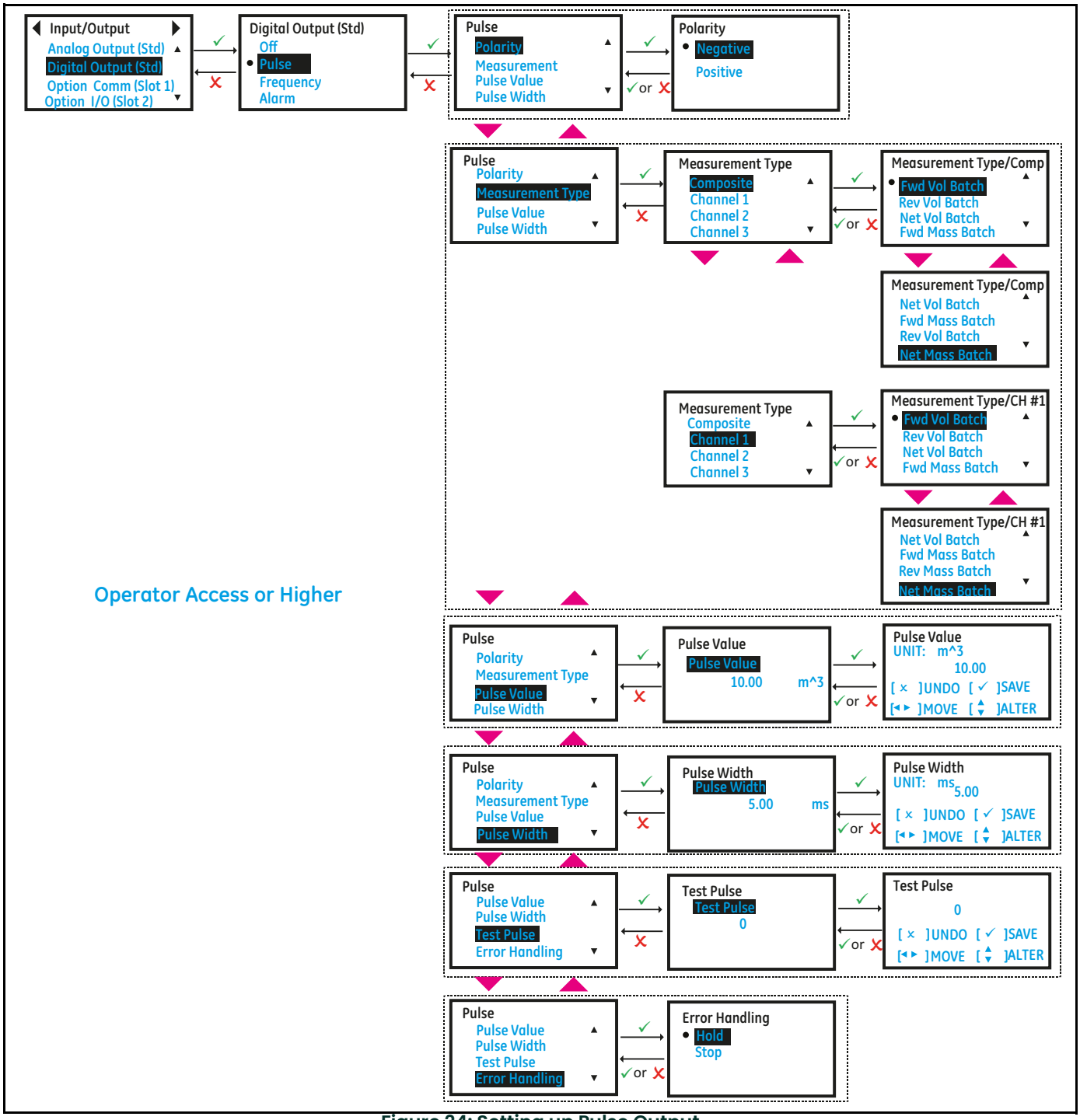


Figure 24: Setting up Pulse Output

3.5.3.2 Setting up Frequency Output

To program a *Frequency Output*, use steps as in Section 3.3.2 to navigate to the *Input/Output* settings page:

1. In Meter Menu, select **[Digital Output (Std)]** and press **[ENTER]**. Then highlight **[Frequency]** option and press **[ENTER]**.
2. Setup the **[Measurement], [Base Value], [Full Value], [Full Frequency]** and **[Error Handling]** options to suit your needs. The Figure 25 below, shows the available options. Also refer to the Table 8 below to understand each option.

For measurement options available on Frequency Output refer to Table 7.

Table 7: Measurement options for Frequency Output

Measurement Channel	Measurement Options for Frequency Output
Composite	Velocity, Actual Volumetric, Standard Volumetric, Mass Flow, Average Volumetric Flow Rate, Sound speed, Reynolds #
Channel x	Velocity, Actual Volumetric, Standard Volumetric, Mass Flow, Average Volumetric Flow rate, Sound speed, Standard Deviation of Gain, Gain and SNR

Table 8: Frequency Output Options

Option	Functional Description
Measurement	Choose the channel and Measurement to output
Base Value	Enter measurement value that should correspond to the min. value of the frequency range
Full Value	Enter measurement value that should correspond to the max. value of the frequency range
Fspan	Enter the highest value of the Frequency range you want to output
Error Handling	Choose the Frequency output response during an error condition: Low, High, Hold, or Other Value. During a meter error, the chosen Error Handling value will be sent to the Frequency Output.

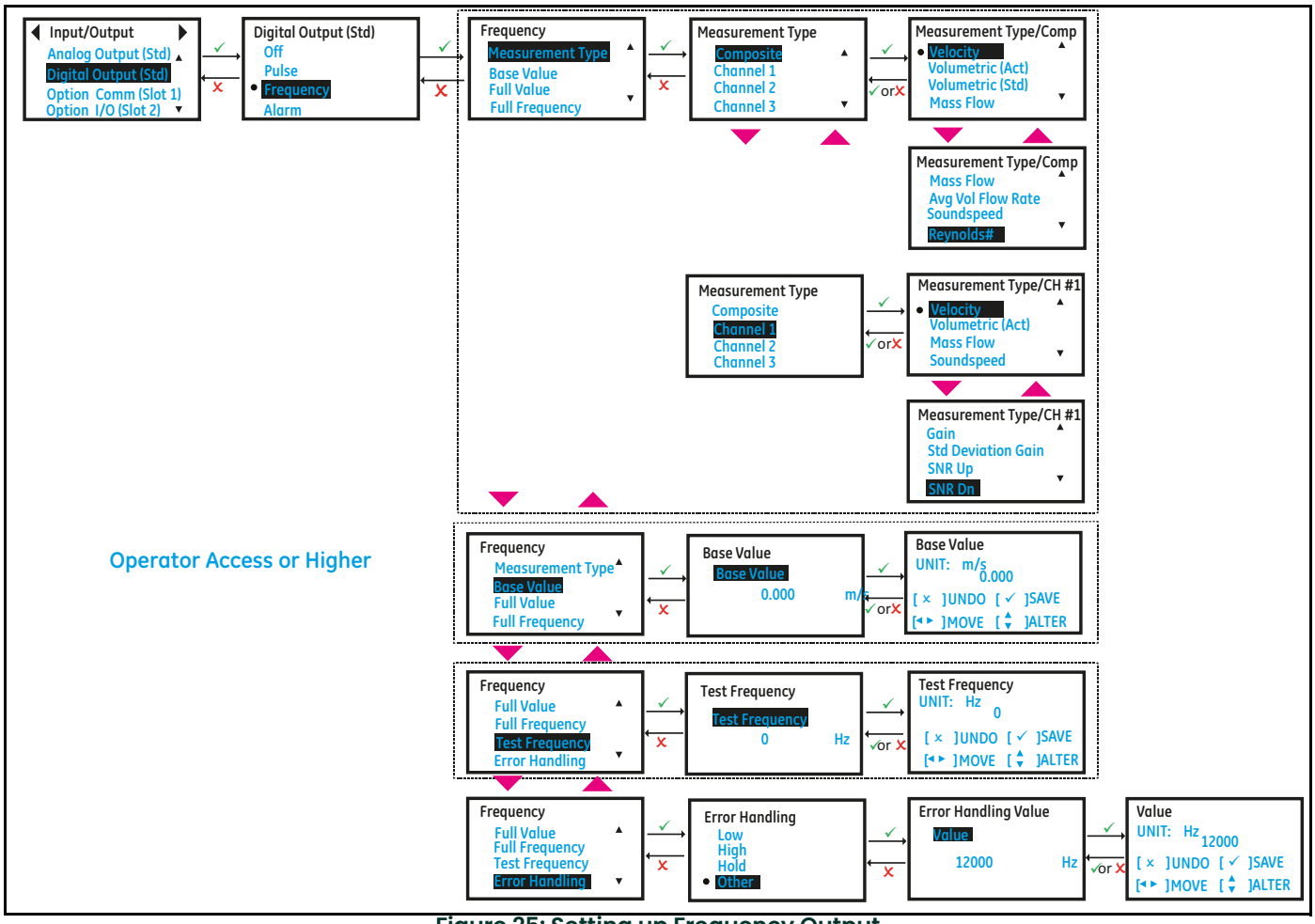


Figure 25: Setting up Frequency Output

3.5.3.3 Understanding the Error Handling Option

The Table 9 shows the response to each of the Frequency Output Error Handling options. For a multi-path meter, the **[Path Error Handling]** set to ON (see Figure 36) changes the Output response. See Table 10 for Analog Output response with Path Error Handling set to ON.

Note: *Table 10 assumes Composite Actual Volumetric is chosen as Measurement for Frequency Output and the Path configuration is 3 paths.*

Table 9: Frequency Output Error Handling options

Option	Output Response
Low	Forces Output to 0Hz on error
High	Forces Output to 10000Hz on error
Hold	Holds the last "good" Hz reading
Other	Enables the user to enter a value between 0Hz and 12000Hz to be output during an error

Table 10: Frequency Output Error Handling with Path Error Handling set to ON

Ch1 in Error	Ch2 in Error	Ch3 in Error	Error displayed in Meter	Expected Composite Volumetric(Act) behavior	Analog Output Response
No	No	No	No Error	Measured Composite Volumetric(Act)	Frequency proportional to the Measured Composite Volumetric(Act)
Yes	No	No	E22: SingleChAccuracy	Measured Composite Volumetric(Act)	Frequency proportional to the Measured Composite Volumetric(Act)
No	Yes	No	E22: SingleChAccuracy	Measured Composite Volumetric(Act)	Frequency proportional to the Measured Composite Volumetric(Act)
No	No	Yes	E22: SingleChAccuracy	Measured Composite Volumetric(Act)	Frequency proportional to the Measured Composite Volumetric(Act)
Yes	Yes	No	E23: MultiChAccuracy	Measured Composite Volumetric(Act)	Frequency proportional to the Measured Composite Volumetric(Act)
No	Yes	Yes	E23: MultiChAccuracy	Measured Composite Volumetric(Act)	Frequency proportional to the Measured Composite Volumetric(Act)
Yes	No	Yes	E23: MultiChAccuracy	Measured Composite Volumetric(Act)	Frequency proportional to the Measured Composite Volumetric(Act)
Yes	Yes	Yes	E23: MultiChAccuracy	Measured Composite Volumetric(Act) will hold the last good value	Frequency value based on the [Error Handling] setting

3.5.3.4 Setting up Alarm Output

To program an *Alarm Output*, use steps as in Section 3.3.2 to navigate to the *Input/Output* settings page:

1. In Meter Menu, select **[Digital Output (Std)]** and press **[ENTER]**. Then select **[Alarm]** option.
2. Select the **[Alarm State], [Alarm type], [Measurement]** and **[Alarm Value]** options to suit your needs. The Figure 26 below, shows the available options. Also refer to the Table 12 below to understand each option.

For measurement options available on Alarm Output refer to Table 11.

Table 11: Measurement options for Alarm output

Measurement Channel	Measurement Options for Frequency Output
Composite	Velocity, Actual Volumetric, Standard Volumetric, Mass Flow, Average Volumetric Flow Rate, Sound speed, Reynolds #
Channel x	Velocity, Actual Volumetric, Standard Volumetric, Mass Flow, Average Volumetric Flow rate, Sound speed, Standard Deviation of Gain, Gain and SNR

Table 12: Alarm Output Options

Option	Functional Description
Alarm State	Choose if the Alarm State should be Normally Open, Normally Closed or Failsafe
Alarm Type	For *Alarm State* selected as *Normally Open* or *Normally Closed*, *Alarm Type* can be set to *High* or *Low*. If set to high, Alarm will be triggered if the selected *Measurement* goes above the programmed *Alarm Value*
Measurement	Choose the channel and *Measurement* that is monitored for Alarm Trigger
Alarm Value	Enter measurement value that should be a trigger point

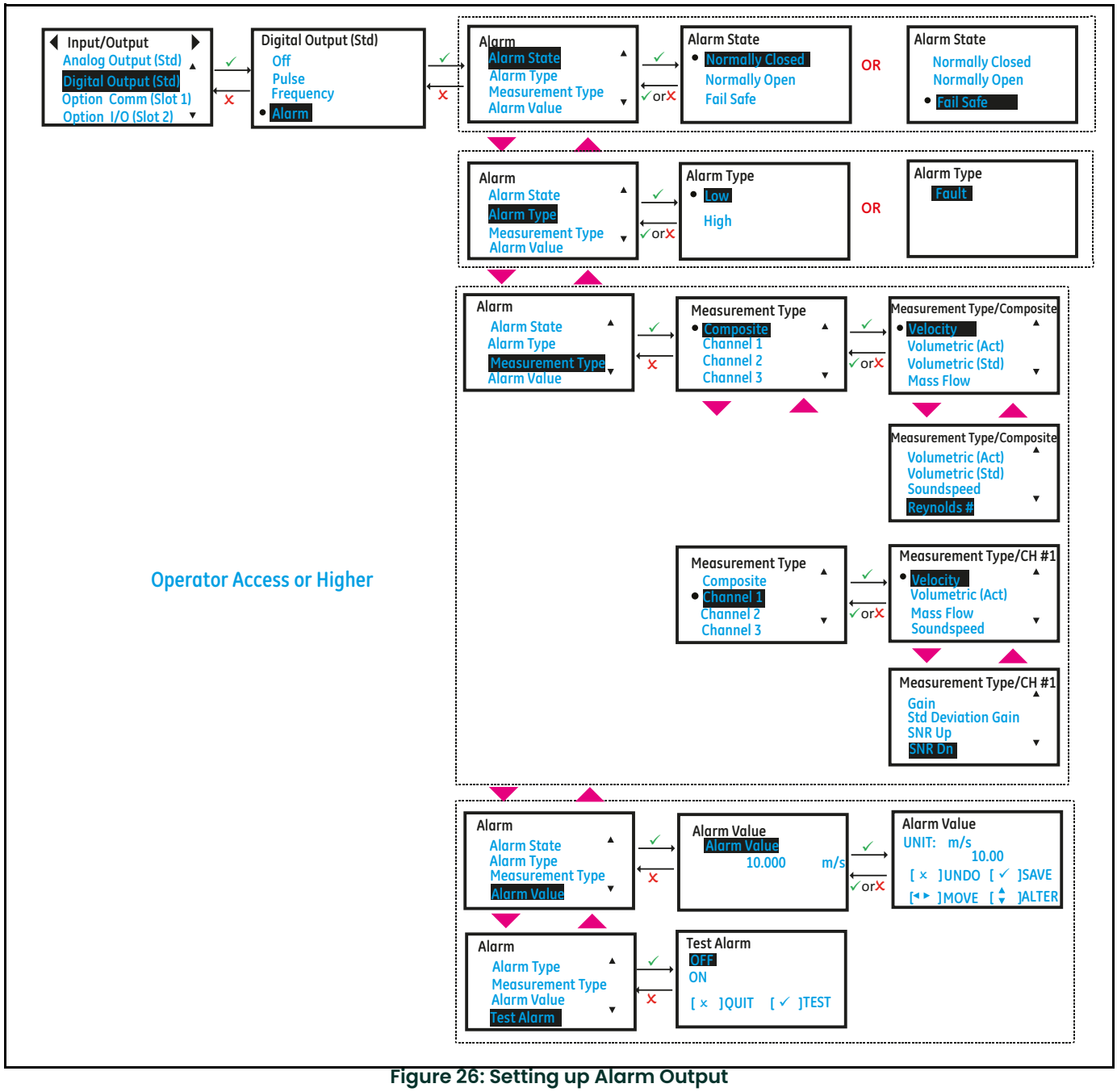


Figure 26: Setting up Alarm Output

3.5.4 Option Comm Slot-1 (optional)

3.5.4.1 Option Slot-1 Configured as HART

Use steps as in section "Log-in and Primary Pages" to navigate to the *Input/Output* settings page.

1. Select **[Option Comm (Slot 1)]** and press **[ENTER]**. Then select **[HART]** and press **[ENTER].**
2. You can set *Analog Output* with HART option. Refer to Figure 27 and section "Section 3.5.2.3".
3. You can also view the HART hardware and software revision numbers in *About HART* option.

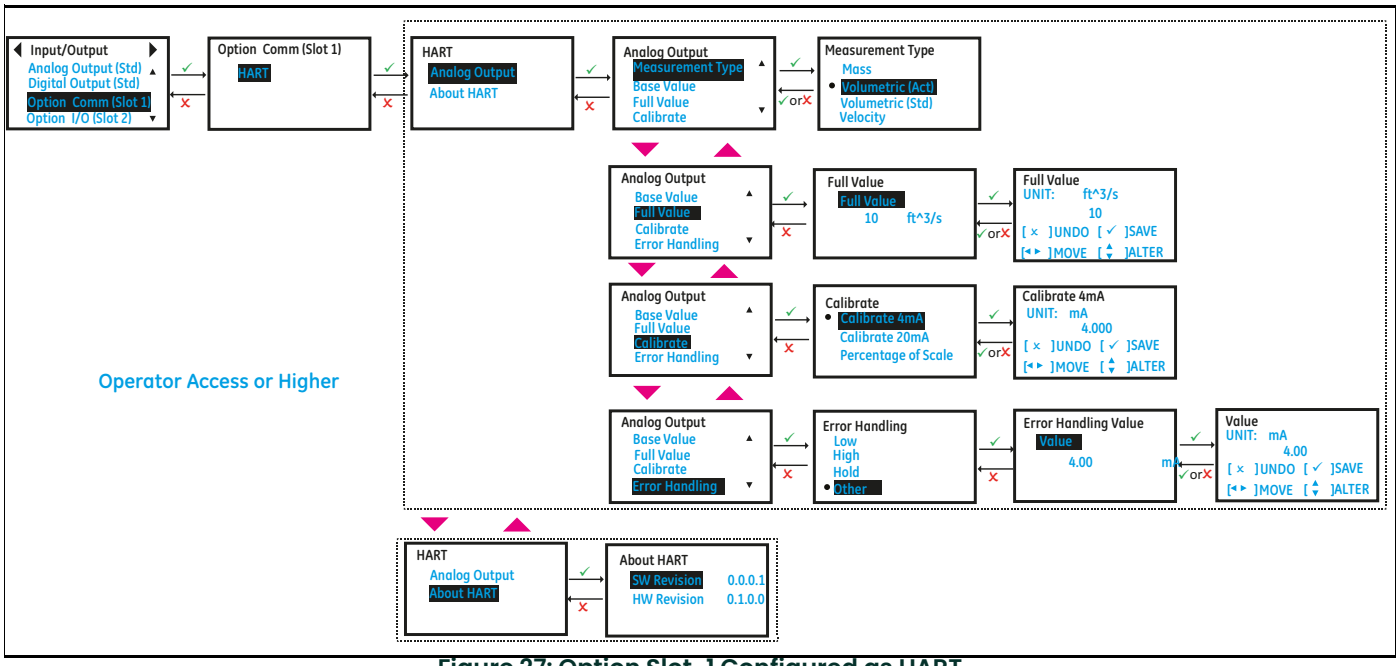


Figure 27: Option Slot-1 Configured as HART

3.5.4.2 Option Slot-1 Configured as FF

Use steps as in section "Log-in and Primary Pages" to navigate to the *Input/Output* settings page.

1. Select **[Option Comm (Slot 1)]** and press **[ENTER]**. Then select **[FF]** and press **[ENTER]**.
2. You can view the FF hardware and software revision numbers in *About FF* option.

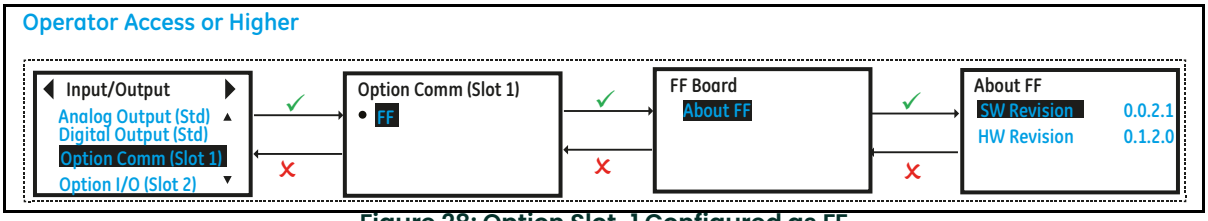


Figure 28: Option Slot-1 Configured as FF

3.5.5 Option I/O Slot-2 (Optional)

For extended I/O capability XMT1000 supports an Optional I/O that provides 2 additional Analog Outputs (AO-AO), with up to 2 Analog Inputs (AI-AI) or 2 RTD (R-R) inputs. See Table 13 for all available options.

Table 13: Optional I/O available options

Board Option #	Input / Output Options Available
1	AO-AO-AI-AI
2	AO-AO-AI-R 3 Wire, 100 Ohm
3	AO-AO-R-R 3 Wire, 100 Ohm
4	AO-AO-AI-R 4 Wire, 100 Ohm
5	AO-AO-R-R 4 Wire, 100 Ohm
6	AO-AO-AI-R 3 Wire,1000 Ohm
7	AO-AO-R-R 3 Wire, 1000 Ohm
8	AO-AO-AI-R 4 Wire, 1000 Ohm
9	AO-AO-R-R 4 Wire, 1000 Ohm

In this chapter AO-AO-AI-R 3 Wire,1000 Ohm option will be used as an example. Other options have similar capabilities and menu map.

3.5.5.1 Option IO (Slot2): Setting up Analog Output

Use steps as in Section 3.3.2 to navigate to the *Input/Output* settings page.

1. Select **[Option I/O (Slot 2)]** and press **[ENTER]**.
2. Then select **[AO-AO-AI-R-1000-3W]** and press **[ENTER]**. Then select **[Analog Output(S2:1)]** or **[Analog Output(S2:2)]** and press **[ENTER]**.
3. If you do not wish to connect an Analog Output, you should turn Analog Output selection to OFF.
4. If you are connecting an Analog Output, choose 4-20mA option. Figure 29 below, shows the options available.
5. Select the Measurement to be sent out on the 4-20mA output, followed by the **[Base Value]** and **[Full Value]** selection. Refer to Table 2 to see measurement options available for Analog output.
6. Select **[Error handling]**. Refer to Section 3.5.2.2 to choose an option that suits your needs.

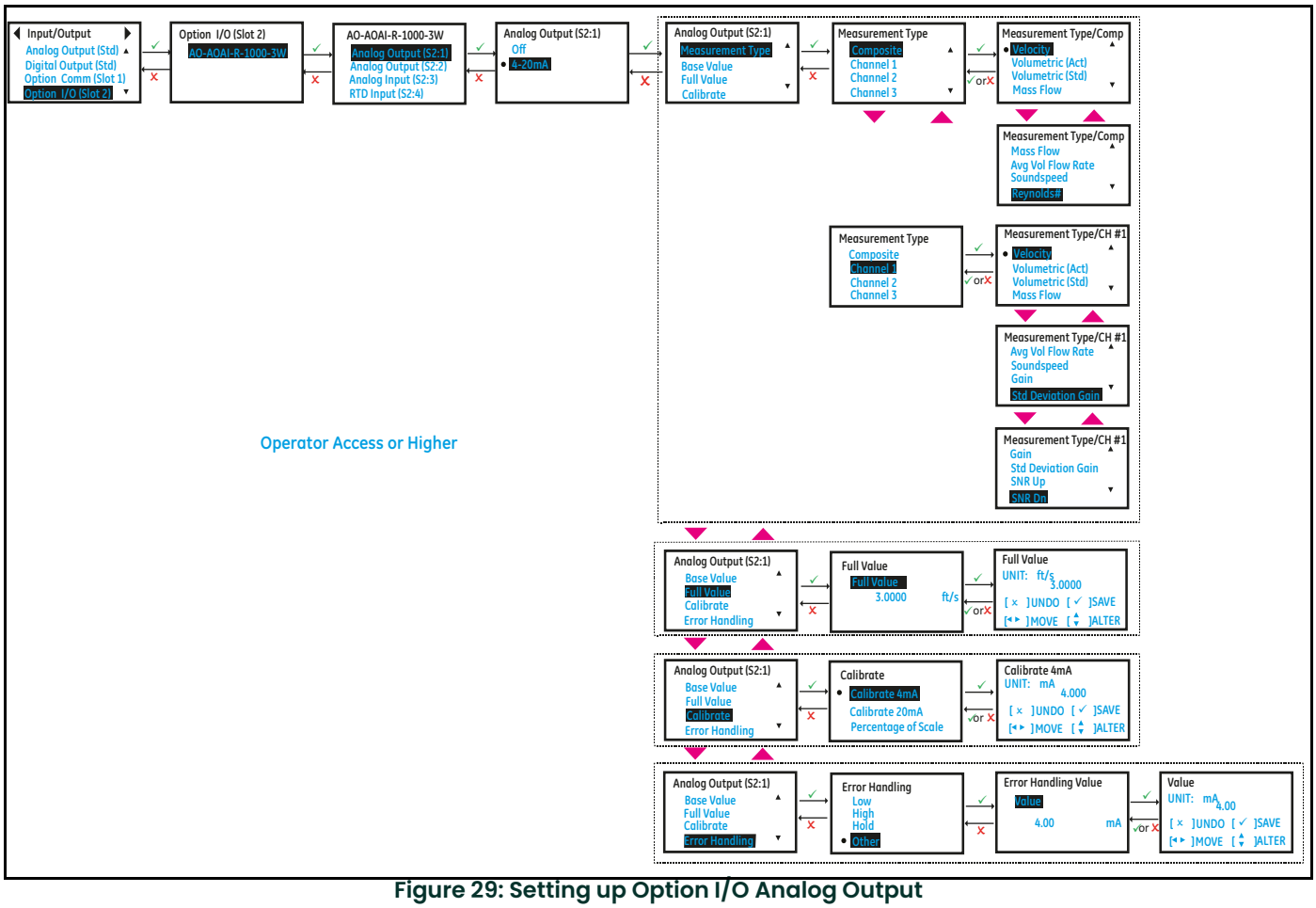


Figure 29: Setting up Option I/O Analog Output

3.5.5.2 Option IO (Slot2): Calibrating Analog Output

To calibrate Option I/O Analog Output, use steps as in Section 3.3.2 to navigate to the *Input/Output* settings page. You may use a multimeter or DCS/SCADA to calibrate the Analog Output. Regardless of whether multimeter or DCS/SCADA is used, the steps below remain the same. For better readability, the steps below only indicate multimeter and does not repeat multimeter or DCS/SCADA.

Note: *Optional I/O menu uses Slot:Channel convention for clarity. For Example, Analog Output(S2:1) indicates Analog Output on Slot 2, Channel 1. Optional I/O is installed in the Slot2 of the electronics stack.*

1. Connect the Analog Output as in Figure 30.
2. Turn ON the multimeter (if used) and set it to measure Current (mA) DC. Connect test lead from positive side (Analog Output Channel 1: **I/O 1**) or (Analog Output Channel 2: **I/O 3**) of the optional I/O Analog Output to the positive terminal of multimeter, and the negative lead to the negative terminal (Analog Output Channel 1: **I/O 2**) or (Analog Output Channel 2: **I/O 4**).
3. Select **[Option I/O (Slot 2)]** and press **[ENTER]**.
4. Then select **[AO-AO-AI-R-1000-3W]** and press **[ENTER]**. Then select **[Analog Output (S2:1)]** or **[Analog Output (S2:2)]** and press **[ENTER].**
5. Then select **[4-20mA]** and press **[ENTER]**.
6. Scroll down and select **[Calibrate]** option.
7. Select **[Calibrate 4mA]** and check if the reading on the multimeter reads 4.00mA ± 0.01mA. If the value on the multimeter is not 4.00mA ± 0.01mA, input the value read on the multimeter into the Calibrate 4mA value and press **[ENTER]**. Check the multimeter again verify that the Current reads 4.00mA within ±0.01mA.

8. Select **[Calibrate 20mA]** and check if the reading on the multimeter reads 20.00mA ± 0.01mA. If the value on the multimeter is not 20.00mA ± 0.01mA, input the value read on the multimeter into the Calibrate 20mA value and press **[ENTER]**. Check the multimeter again verify that the Current reads 20.00mA within ±0.01mA.
9. Select **[Percentage of Scale]** and adjust the scale to 0.00% and press **[ENTER]**, then verify the reading on the multimeter is 4.00mA within ±0.01mA. Adjust the scale to 50.00% and press **[ENTER]**, then verify the reading on the multimeter is 12.00mA within ±0.01mA. Adjust the scale to 100.00% and press **[ENTER]**, then verify the reading on the multimeter is 20.00mA within ±0.01mA.
10. If Steps 4, 5 and 6 were successfully completed and verified, the Analog output is successfully calibrated.
11. Once calibration is complete, select either [Save] or [Save & Logout] option to save calibration data.

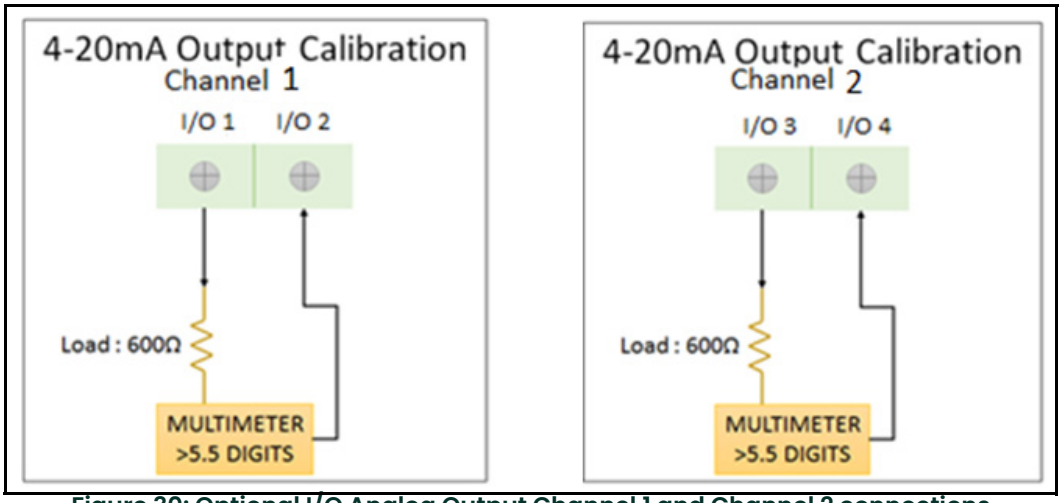


Figure 30: Optional I/O Analog Output Channel 1 and Channel 2 connections

3.5.5.3 Option IO (Slot2): Setting up Analog Input

Use steps as in Section 3.3.2 to navigate to the *Input/Output* settings page.

1. Select **[Option I/O (Slot 2)]** and press **[ENTER]**.
2. Then select **[AO-AO-AI-R-1000-3W]** and press **[ENTER]**. Then select **[Analog Input(S2:3)]** and press **[ENTER]**.
3. If you do not wish to connect an Analog Input, you should turn Analog Input selection to OFF.
4. If you are connecting an Analog Input, choose **[4-20mA]** option. Figure 31 below, shows the options available.
5. Select the Measurement to input over 4-20mA input, followed by the **[Base Value]** and **[Full Value]** selection. Refer to Table 2 to see measurement options available for Analog output.

Table 14: Analog Input Measurement Types

Measurement Options for Analog Input
Temperature, Pressure

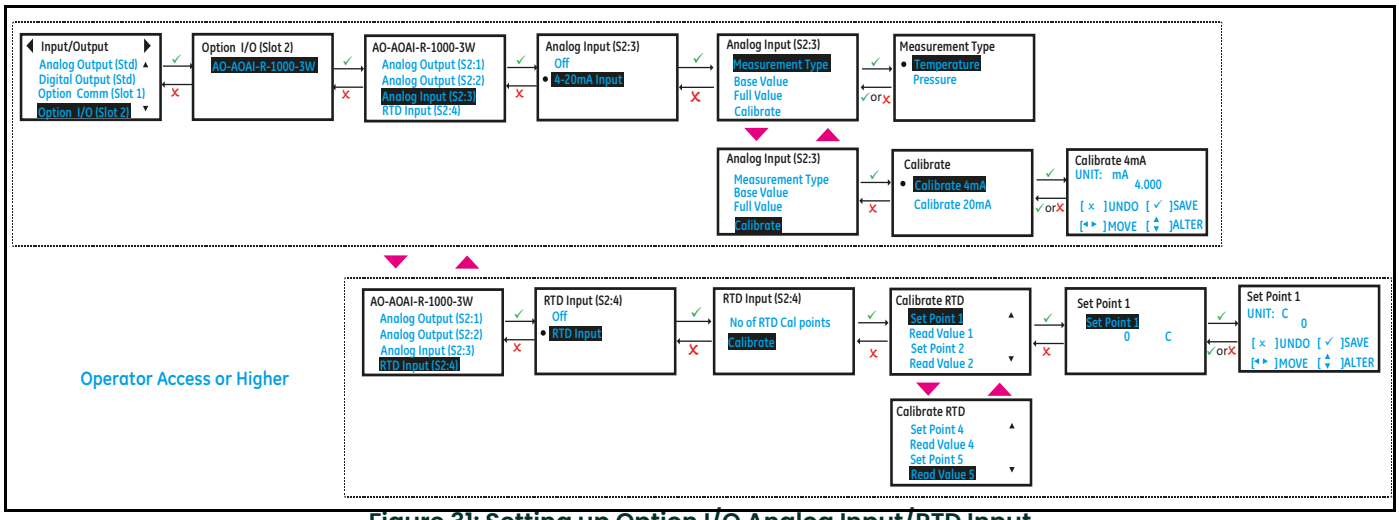


Figure 31: Setting up Option I/O Analog Input/RTD Input

3.5.5.4 Option IO (Slot2): Calibrating Analog Input

To calibrate Option I/O Analog Input, use steps as in section "Log-in and Primary Pages" to navigate to the *Input/Output* settings page.

Note: *Optional I/O menu uses Slot:Channel convention for clarity. For Example, Analog Input(S2:3) indicates Analog Input on Slot 2, Channel 3. Optional I/O is installed in the Slot2 of the electronics stack.*

1. Connect the Analog Input as in Figure 32.
2. Turn ON the calibrator and set it to measure Current (mA) DC. Connect test lead from positive side (Analog Input Channel 3: **I/O 7**) of the optional I/O Analog Input to the positive terminal of multimeter, and the negative lead to the negative terminal (Analog Output Channel 3: **I/O 8**).
3. Select **[Option I/O (Slot 2)]** and press **[ENTER]**.
4. Then select **[AO-AO-AI-R-1000-3W]** and press **[ENTER]**. Then select **[Analog Input(S2:3)]** and press **[ENTER]**.
5. Then highlight **[4-20mA]** and press **[ENTER]**.
6. Scroll down and select **[Calibrate]** option.
7. Select **[Calibrate 4mA]** in the meter Menu. Set **[4mA]** current on calibrated current source and check the reading on the XMT1000 is 4.00mA ±0.01mA. Once reading is stabilized on the LCD, Press **[ENTER]** to accept the current 4 mA value or Press **[ESCAPE]** to cancel the calibration.
8. Select **[Calibrate 20mA]** in the meter Menu. Set **[20mA]** current on calibrated current source and check the reading on the XMT1000 is 20.00mA ±0.01mA. Once reading is stabilized on the LCD, Press **[ENTER]** to accept the current 20 mA value or Press **[ESCAPE]** to cancel the calibration.
9. Once calibration is complete, select either **[Save]** or **[Save & Logout]** option to save calibration data.

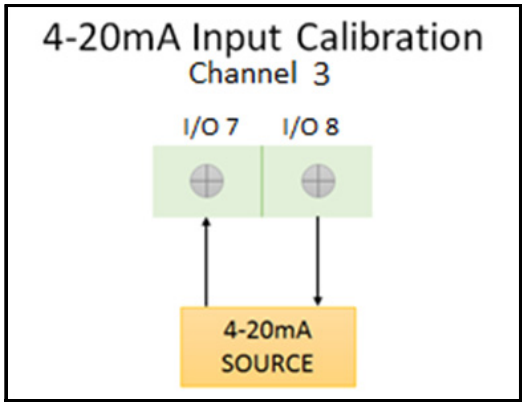


Figure 32: Option I/O Analog Input connections

3.5.5.5 Option IO (Slot2): Calibrating RTD Input

1. Insert RTD sensor and master RTD in temperature bath and turn ON, and set it to desired temperature set point.
2. Use steps as in Section 3.3.2 to navigate to the *Input/Output* settings page. Refer to Figure 31 above, select **[Option I/O (Slot 2)]** and press **[ENTER]**.
3. Select **[AO-AO-AI-R-1000-3W]** and press **[ENTER]**. Then select **[RTD Input(S2:4)]** and press **[ENTER]**.
4. Select **[RTD Input]** and press **[ENTER]**.
5. Set the number of Calibration points by selecting **[No. of RTD Cal points]**.
6. Scroll down and select **[Calibrate]** option.
7. Select **[Set point 1]**, press **[ENTER]** and set [Set point 1] to the temperature value selected on the calibrator. Press **[ESCAPE]**.
8. Select **[Read Value 1]**, press **[ENTER]**, and check the **[Read Value 1]** reads **[Set point 1]** value. Once reading is stabilized on the **[Read Value 1]**, Press **[ENTER]** to accept the value or Press **[ESCAPE]** to cancel the calibration.
9. Repeat steps 7 and 8 for other set points.
10. Once all set points are calibrated, select either **[Save]** or **[Save & Logout]** option to save calibration data.

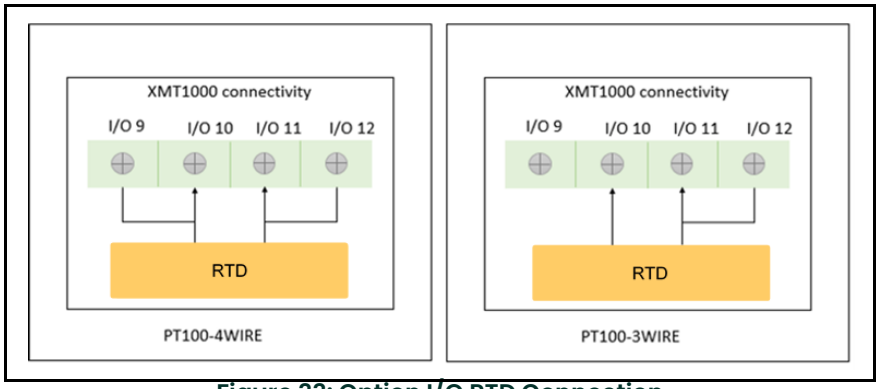


Figure 33: Option I/O RTD Connection

3.6 Programming Menu Options

The options in the Programming Page should be selected to best suit your application. The configurations selected in programming page are critical for accurate flow measurements. Incorrect programming settings can give erroneous measurements and impact accuracy.

Note: *Consult the factory or BakerHughes Services if you are unsure of the appropriate settings for your application.*

IMPORTANT: The configurations in the Programming page are pre-selected to best suit your applications. Consult the factory or BakerHughes Services before changing any of these settings. Modifying any of the settings can give erroneous measurements and impact accuracy.

3.6.1 Programming the Pipe

The Pipe menu allows the user to specify all pipe parameters that are required to ensure accurate ultrasonic flow rate measurements. Use steps as in Section 3.3.2 to navigate to the Programming page.

1. Highlight **[Composite]** and press **[ENTER]**. Then Select **[Pipe]** and press **[ENTER]**.
2. Pipe dimensions like **[Outer Diameter]** (OD), **[Wall Thickness]** and **[Inner Diameter]** (ID) can be programmed in this menu.

Note: *The measurement units used for pipe size parameters depend on the choices made in the Section 3.4.1.*

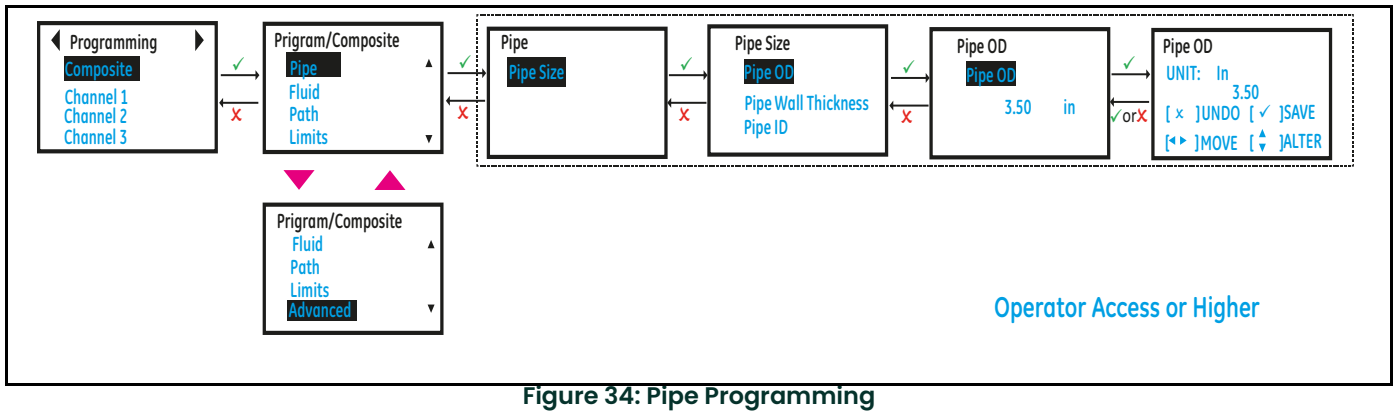


Figure 34: Pipe Programming

3.6.2 Programming the Fluid

The *Fluid* menu (see Figure 35) allows the user to specify all the parameters of the fluid flowing through the pipe that is required to ensure accurate ultrasonic flow rate measurements. Use steps as in section Section 3.3.2 to navigate to the Programming page.

1. Select **[Composite]** and press **[ENTER].** Scroll down, select **[Fluid]** and press **[ENTER]**.
2. Select **[Density]**, press **[ENTER]** and program the actual density **[Density (Act)]** and reference density **[Density (Ref)]** of the process fluid.
3. Then select **[Kinematic Viscosity]**, press **[ENTER]** and program the kinematic viscosity of the process fluid.
4. Then select **[Tracking]** option. The tracking window is used to scan through the speed of sound range programmed to detect the signal when the user is unsure of the fluid sound speed. The meter also supports a list of standard fluid types. If the process fluid is not listed in standard fluids list and if you are unsure of the fluid sound speed, set tracking window to On and program the *minimum* and *maximum* sound speed range to scan. Tracking window should be set to On.
5. For standard fluids list (see Table 15) supported in the meter, the *minimum*, *maximum* and *nominal sound speeds* are automatically selected.
6. Also program the process **[Fluid Temperature]** and **[Ambient Temperature]** see Section 3.6.5.

IMPORTANT: Consult the factory before setting Tracking Window to Off.

Table 15: Standard Fluid List

Tracking On	Tracking Off
Other	Other
Water (0 to 260 C)	Water (0 to 260C)
LNG	LNG
Oil 22C	Oil 22 C Sea Water
	Lube Oil
	Crude Oil
	Methanol (20 C) Ethanol
	Freon R12
	Diesel
	Gasoline Liquid Nitrogen (-199C)

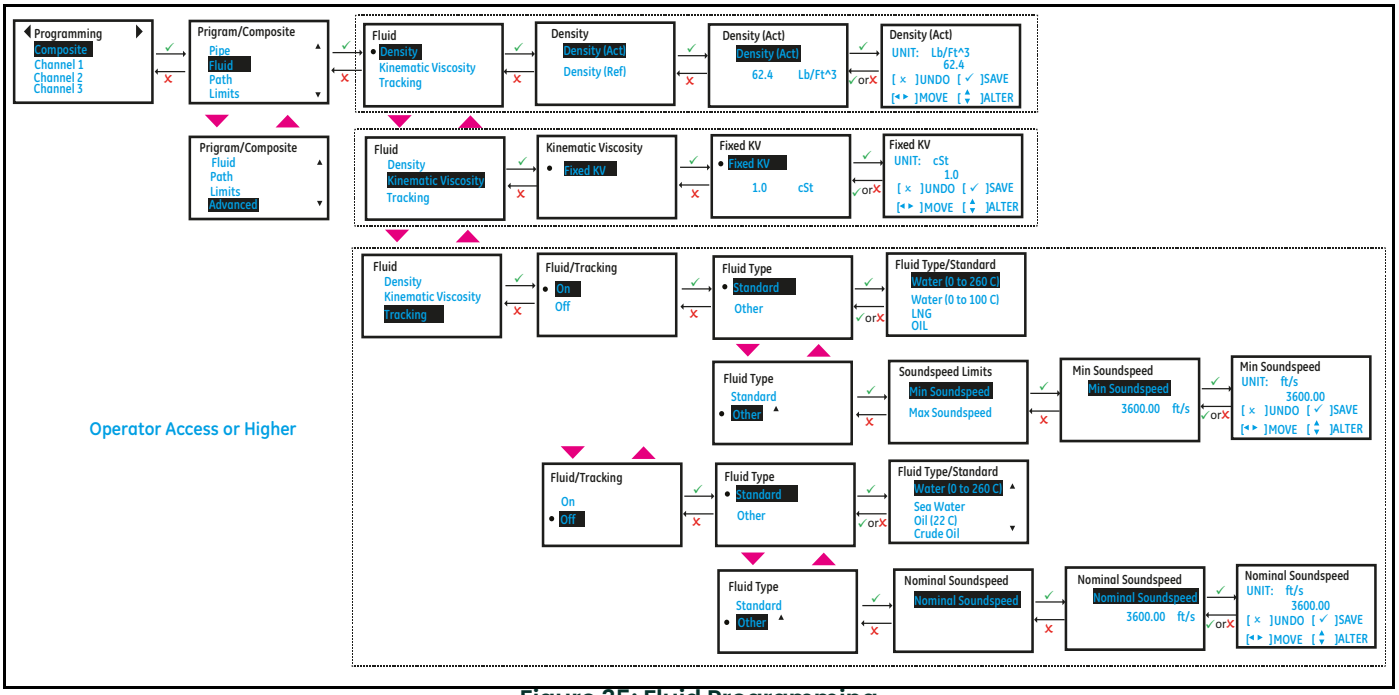


Figure 35: Fluid Programming

3.6.3 Programming the Path Configuration

Use steps as in Section 3.3.2 to navigate to the *Programming page*. Refer to Figure 36 for the Path configuration options.

1. Select **[Composite]** and press **[ENTER].** Scroll down and select **[Path]** and press **[ENTER]**.
2. Select **[Path Configuration], [Path Weights]** and **[Path Error Handling]**.
3. Path Weights are used in Composite flow velocity calculations as in the following equation:

$$Velocity_{Composite} = \frac{((Velocity_{Ch1} \times PathWeight_{Ch1}) + (Velocity_{Ch2} \times PathWeight_{Ch2}) + (Velocity_{Ch3} \times PathWeight_{Ch3}))}{(PathWeight_{Ch1} + PathWeight_{Ch2} + PathWeight_{Ch3})}$$

4. If Path Error Handling is set to On, the meter will continue to provide measurements even if one or two channels are in error. Unless, all three channels are in error the flow measurement continues.

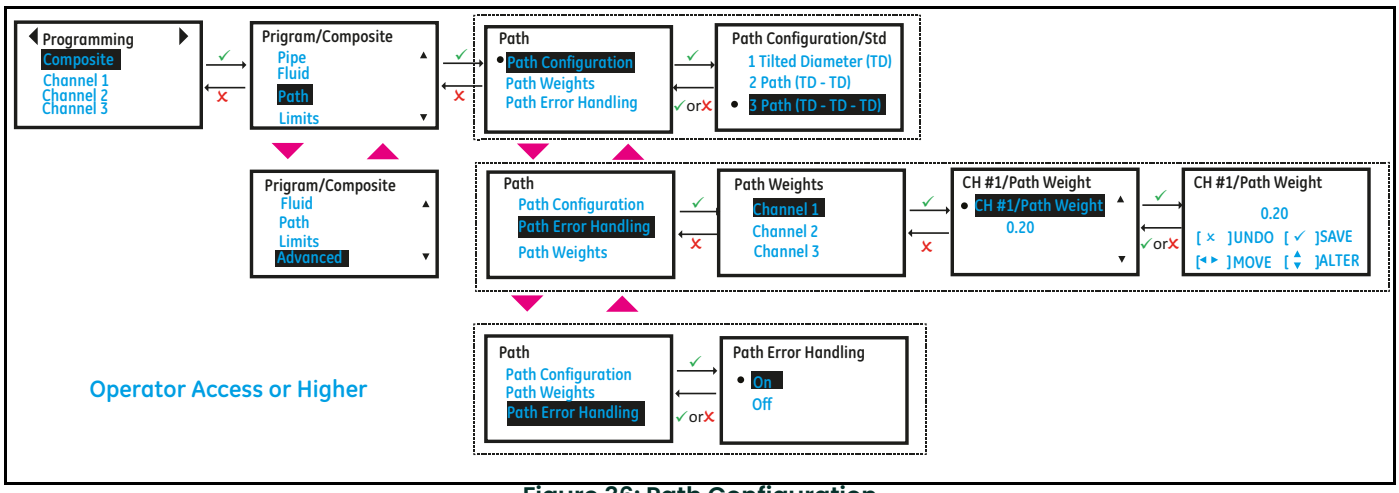


Figure 36: Path Configuration

3.6.4 Programming the Flow and Diagnostic Limits

Use steps as in Section 3.3.2 to navigate to the *Programming page*. Refer to Figure 37 for the Limit selection options.

1. Select **[Composite]** and press **[ENTER]**. Scroll down and select **[Limits]** and press **[ENTER]**.
2. Program the minimum flow velocity in **[Min Velocity]** and maximum flow velocity in **[Max Velocity]**.
3. Program the appropriate velocity warning limits in **[Min Vel Warn Limit]** and **[Max Vel Warn Limit]**. The values programmed in the warning limits should be tighter than those programmed in **[Min Velocity]** and **[Max Velocity]** for early warning indications on the LCD and Errors.
4. To cutoff the near zero measurements program an appropriate value in **[Zero Cutoff]**.
   a. In order to see stable averaged flow, program the time window for which flow should be averaged in **[Flow Averaging]**. For example if a value 16 is programmed in for **[Flow Averaging]**, the flow value will have the average of the last 16s of flow values. This allows the flow values on the display and the outputs to be less noisy.
5. If in section "Programming the Fluid" on page 41, Tracking was selected as *OFF*, program the **[Soundspeed Error %]**. This configuration will be used to validate if the measured sound speed is within the programmed range of the nominal sound speed. In case the measured sound speed is outside the **[Soundspeed Error %]** of the nominal sound speed a E2: Soundspeed Error is reported.

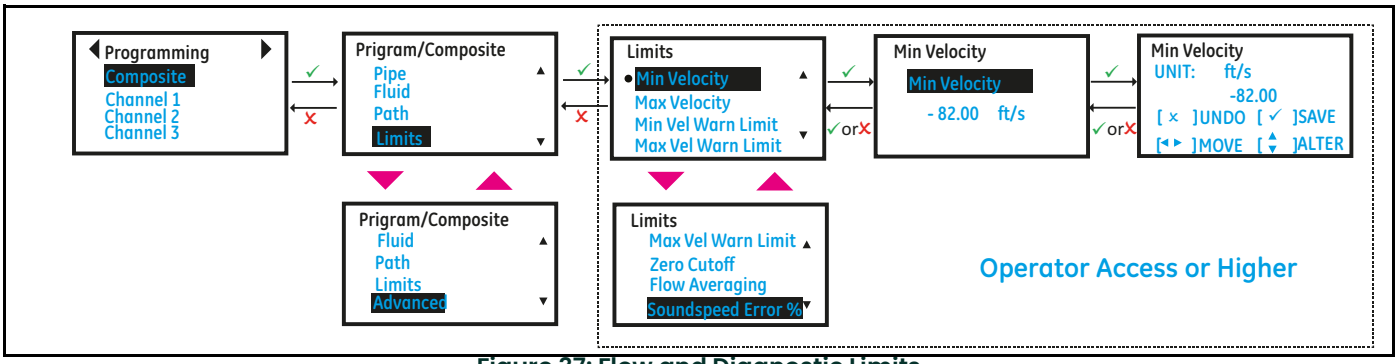


Figure 37: Flow and Diagnostic Limits

3.6.5 Programming Advanced Settings

Use steps as in Section 3.3.2 to navigate to the *Programming page*. Refer to Figure 38 for the Path configuration options.

1. Select **[Composite]** and press **[ENTER].** Scroll down and select **[Advanced]** and press **[ENTER]**.
2. Select **[Inputs]** and set the process **[Fluid Temperature]**. The Fluid temperature can be either fixed/static (average process fluid temperature) or can be live values read from an Analog input or RTD (available as an option).
3. Also set the **[Ambient Temperature]**.
4. The **[Transmit Voltage]** should be set based on the viscosity of the process fluid and Pipe size. High viscous fluids or large pipe sizes may need high voltage setting for signals to pass through.
5. Choose the **[Refresh Rate]** based on how fast you want the meter should make a measurement. The refresh rate selection will not change the update rate on the Analog or Digital outputs. The Analog output and Digital outputs are always updated at 4Hz.
6. This completes the basic programming options that may need to be updated based on flow application. Advanced programming is already done at BakerHughes Factory and during commissioning. Exit programming by pressing **[ESC]** until Save options are displayed on the menu. Highlight **[Save]** or **[Save & Logout]** and Press **[ENTER]** to save settings. The meter will not use the changed setting to make measurements until the settings are explicitly saved.

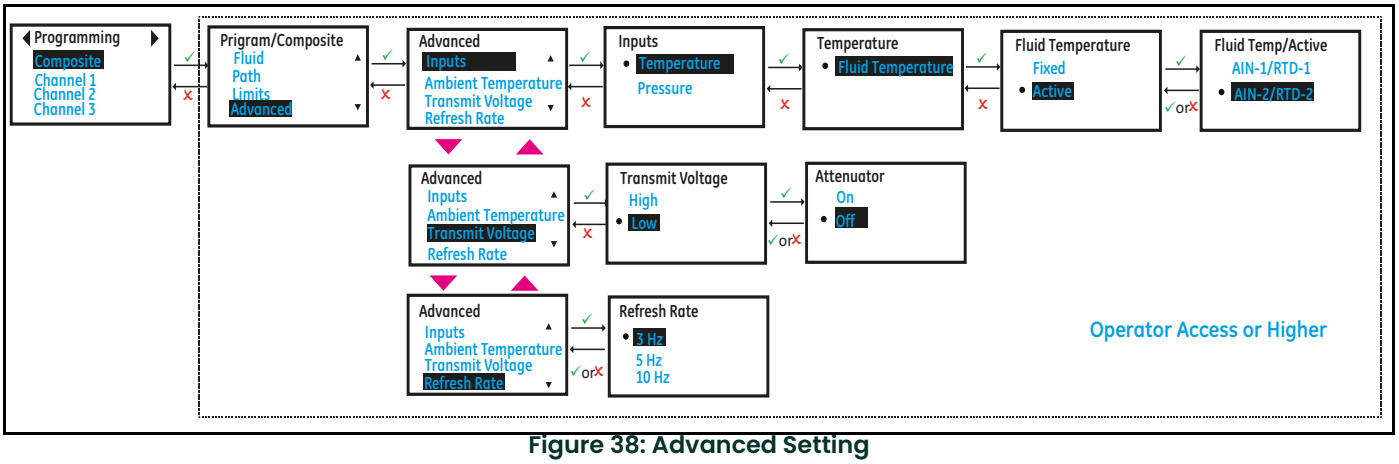


Figure 38: Advanced Setting

3.7 Software Upgrade

The XMT1000 meter software can be upgraded using a USB Flash drive. XMT1000 meter has 3 subsystems which need to be upgraded in the following sequence

1. Transmitter board
2. Flow board

3. Option I/O board

Note: *Consult the factory or BakerHughes Services before you upgrade software.*

IMPORTANT: *The upgrade process may wipe out the configurations. It is important to save a site file before beginning the upgrade process. Use USB flash drive 8GB or 16GB for upgrade. 32GB flash drive is not supported.*

3.0.1 Perform Software Upgrade

The XMT1000 software upgrade requires password entry. The Upgrade password is unique to the System serial number of your meter. The meter will automatically be exited from Upgrade mode after 5 minutes of inactivity. Ensure the meter keypad is in unlock mode. If the meter keypad is locked, use steps outlined in Section 3.2.1 to unlock the keypad. Log-in into Operator access level and navigate to About Meter and note the System Serial Number. Open the GENPASS_SW_UPGRADE application, enter the noted System Serial Number. The GENPASS_SW_UPGRADE application will show the Upgrade Access password for your meter.

To perform Software Upgrade, do the following steps and refer Figure 39:

1. Copy the Transmitter, Flow board or Option I/O board software into the USB flash drive and insert the USB flash drive to the meter.
2. In the meter HMI press **[►]** until the lock icon on the meter's Measurement View display is highlighted, and press **[ENTER]**.
3. In the Main Menu select **[Software Upgrade]**, then press **[ENTER]**.
4. Enter the password for your meter when prompted.
5. Select the board you want to upgrade as outlined in the recommended sequence above.
6. Confirm the initiation of upgrade by selecting **[Yes]**. Once confirmed the upgrade process will start. The display indicates the steps in the process. The upgrade of each subsystem could take up to 10 minutes. At the end of the upgrade the meter displays if the upgrade was successful or not. The meter would restart after upgrade of each subsystem is complete. But it is recommended to power cycle the meter after successfully upgrading all sub systems.

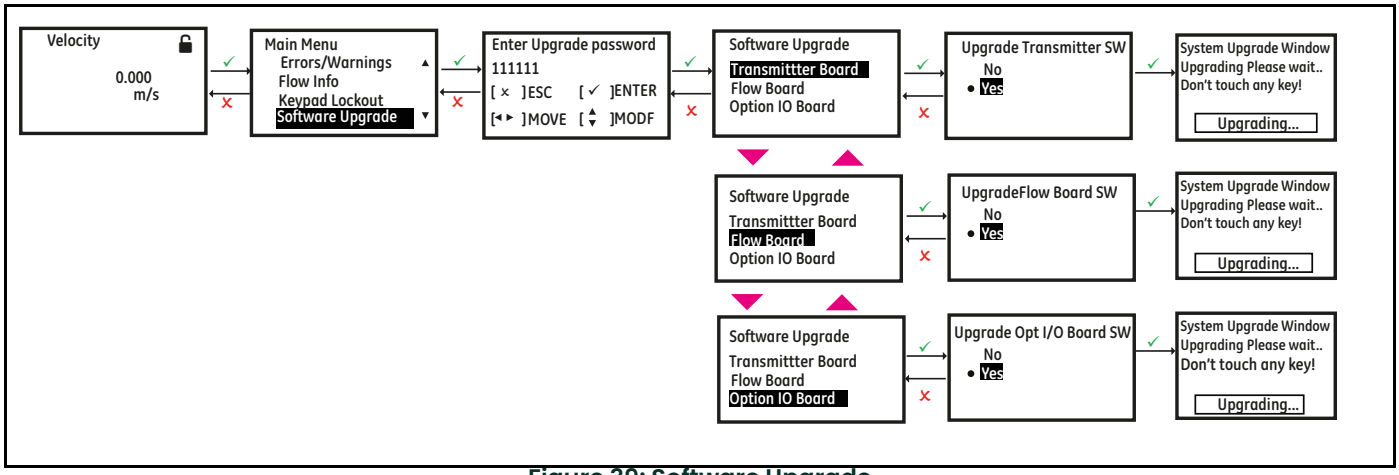


Figure 39: Software Upgrade

[no content intended for this page]

Chapter 4. Error Codes and Troubleshooting

4.1 Introduction

The PanaFlow Z3 flow transmitter is a reliable, easy to maintain instrument. When properly installed and operated, as described in Chapter 1, Installation, the meter provides accurate flow rate measurements with minimal user intervention. However, if a problem should arise with the electronics enclosure or transducers, this chapter explains how to troubleshoot the PanaFlow Z3 flow meter. Indications of a possible problem include:

- Display of an error message on the LCD screen
- Erratic flow readings
- Readings of doubtful accuracy (e.g., readings that are not consistent with readings from another flow measuring device connected to the same process).

If any of the above conditions occur, proceed with the instructions presented in this chapter.

Note: *For high electrical noise areas, it is recommended that you use the CE Installation methods in Appendix B.*

4.2 Error Classification and Error Codes

The PanaFlow Z3 electronics includes two or more subsystems. The Transmitter, Flow Measurement unit and/or Option I/O. The purpose of the Error codes and string is to convey to the operator about the issues in the specific subsystem. The communication error indicates that the Transmitter subsystem has lost communication with Flow measurement sub-system or the Option I/O sub-system.

Errors in PanaFlow Z3 are classified into five types as indicated in the table below:

Table 16: PanaFlow Z3 error classification

Error Classification	Error Number	Subsystem
Communication Errors	C_n where n is the Error number	Transmitter to Flow or Option I/O
Flow Errors	E_n where n is the Error number	Flow subsystem
System Errors	S_n where n is the Error number	Transmitter or Flow subsystem
Transmitter Errors	X_n where n is the Error number	Transmitter subsystem
Option I/O Errors	A_n where n is the Error number	Option I/O subsystem

If a problem occurs with the electronics or transducers, a built-in error code message system greatly simplifies the troubleshooting process.

All the possible *PanaFlow Z3* error code messages are discussed in this chapter, along with the possible causes and the recommended actions. When an error code is generated, it will appear in the lower left corner of the LCD screen, as discussed in Programming Chapter.

If an error message appears on the display screen during operation of the *PanaFlow Z3*, refer to the appropriate section of this chapter for instructions on how to proceed. You may be asked to contact BakerHughes. Providing all of the diagnostic data and parameter information as in the *Diagnostics Data Table* prior to calling your local sales or service center will help to speed up the issue resolution.

4.3 Flow Errors (E-Errors)

4.3.1 General Guidelines for Troubleshooting Flow Errors with Error codes

If the Error code on the LCD or Vitality PC software indicate E22: SingleChAccuracy or E23: MultiChAccuracy, Refer to the appropriate section below. Also, refer to table below for causes and recommended actions for each Error code.

4.3.1.1 Single Channel Error

If only one channel is in error, the most likely cause is:

1. Incorrect programming on Error Limits or flow condition changes that now make previous programming invalid.

2. Defective/Damaged cables, transducers, couplant, buffer or electronics.

After you have tried eliminating/correcting for any most likely causes mentioned above, if error still exists, also check Process/flow conditions change.

1. Excessive turbulence.
2. Discontinuities in fluid characteristics such as multi-phase flow, flashing, pockets of gas, presence of bubbles or solid particles, cavitation or rapidly changing fluid type.
3. Extreme fluid properties, such as pressure or temperature.
4. Wax build-up on face of buffer/transducer. Clogged ports due to sedimentation.
5. Half-full pipe.

4.3.1.2 Multi-Channel Error

If more than one channel is in error, the most likely cause is changes in process/flow conditions.

1. Excessive turbulence.
2. Discontinuities in fluid characteristics such as multi-phase flow, flashing, pockets of gas, presence of bubbles or solid particles, cavitation or rapidly changing fluid type.
3. Extreme fluid properties, such as pressure or temperature.
4. Wax build-up on face of buffer/transducer. Clogged ports due to sedimentation.
5. Half-full pipe.

After you have tried eliminating/correcting for any most likely causes mentioned above, if error still exists, also check,

1. Incorrect programming on Error Limits or flow condition changes that now make previous programming invalid.
2. Defective/Damaged cables, transducers, couplant, buffer or electronics.

In case you are unable to clear the errors, collect diagnostic data and parameter information for each channel in the *Diagnostics Data Table* prior to calling your local sales or service center.

4.3.1.3 Viewing Channel Specific Error/Warnings

To indicate the health of the meter, PanaFlow Z3 has built-in Error codes. The Channel specific errors are very critical

in determining the corrective actions required Figure 40 shows the steps to view current channel specific

errors/warnings. The description of the Error Codes and the recommended actions are provided in Table 17.

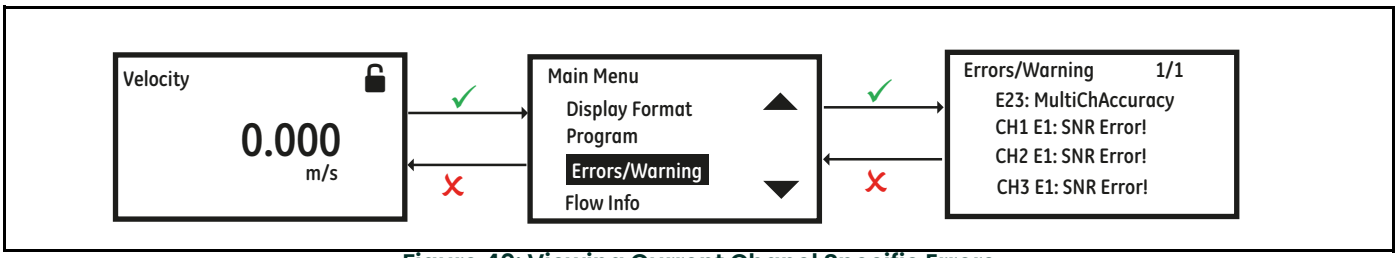


Figure 40: Viewing Current Chanel Specific Errors

4.3.1.4 Viewing Flow diagnostics

To enable troubleshooting with additional flow diagnostics PanaFlow Z3 has Flow Info page that allows the user to scroll through all critical flow diagnostics. The Channel specific errors are very critical in determining the corrective actions required. Figure 40 shows the steps to view current channel specific errors/warnings. The description of the Error Codes and the recommended actions are provided in Table 17.

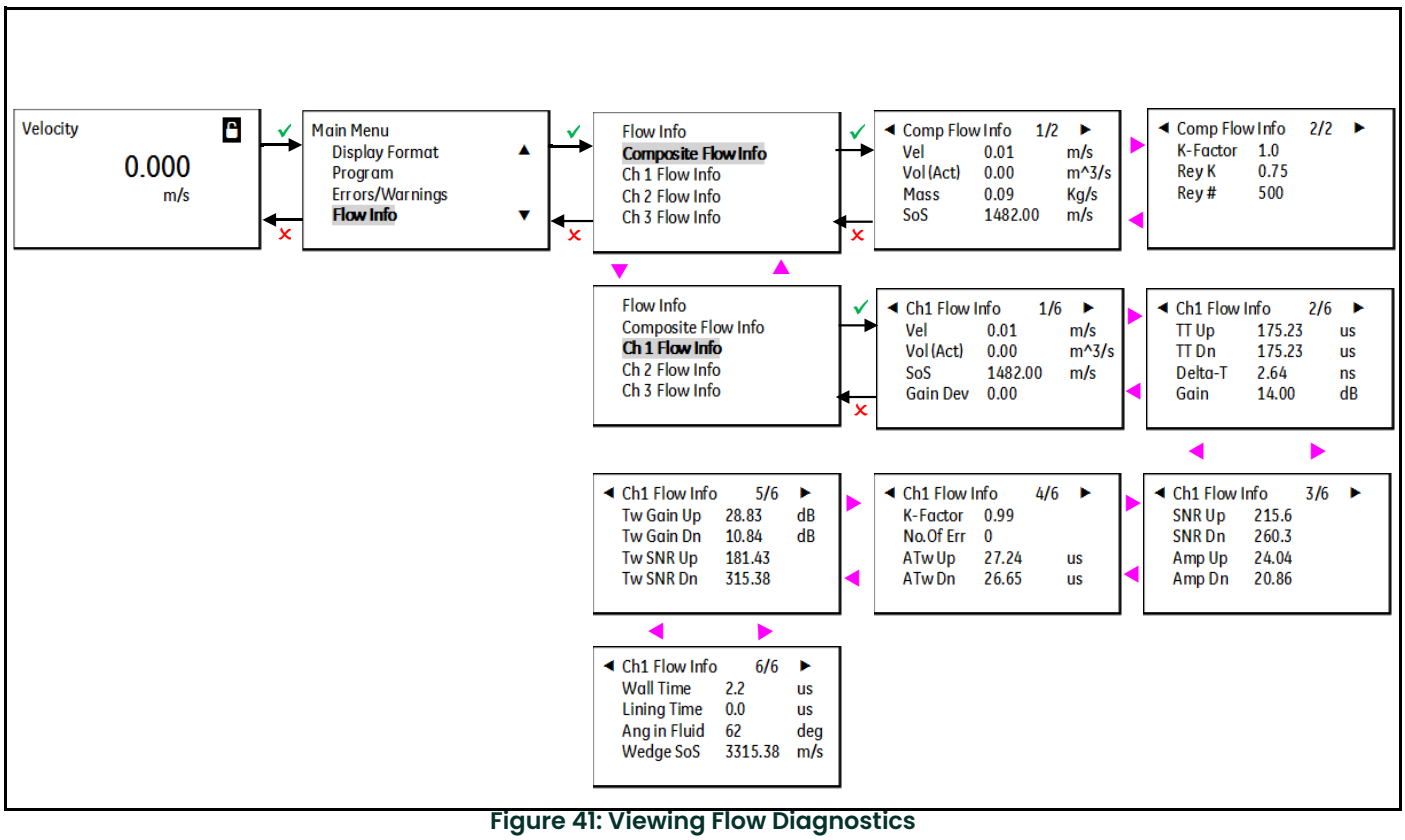


Figure 41: Viewing Flow Diagnostics

Table 17: Flow Error description and Recommended Actions

Error Code	Problem	Cause	Recommended Action
E1: SNR	The Signal to Noise ratio is low	The acoustic signal from the process is very low. This could be due to bubbles, other fluid conditions, an empty pipe, broken cables, transducers, couplant or buffers	Check if the Active Tw measurement on upstream and downstream transducers is valid. If Active Tw measurement is valid then this error is an indication of the problem with the process conditions. If Active Tw measurement is not valid then check the value entered in SNR Min Error Limits option (Refer Programming Chapter). Also, refer to “Fluid and Pipe Problems” and “Transducer Problems” sections to correct for any issues
E2: Soundspeed	The measured sound speed exceeds programmed limits	The error may be caused by incorrect programming, poor flow conditions or poor transducer orientation. It may also occur if signal quality is poor	Compare the measured sound speed to programmed nominal values for the process fluid and correct any programming errors. Refer to “Fluid and Pipe Problems” and “Transducer Problems” sections to correct for any issues. In case you are unable to clear the errors, gather the required diagnostics before contacting BakerHughes

Table 17: Flow Error description and Recommended Actions

Error Code	Problem	Cause	Recommended Action
E3: Velocity Range	The measured velocity exceeds programmed limits	This error may be caused by incorrect programming, poor flow conditions and/or excessive turbulence	Make sure the actual flow rate is within the programmed Error limits (Refer Programming Chapter). Refer to *"Fluid and Pipe Problems"* and *"Transducer Problems"* sections to correct any issues
E4: Signal Quality	The signal quality is lower than the programmed limits	This means the signal shape, upstream to downstream reciprocity, or signal correlation value has fallen below the correlation peak limit. The cause is usually the same as E6 or E5	Make sure the Signal Quality is greater than the programmed Error limits (Refer Programming Chapter). Refer to *"Fluid and Pipe Problems"* and *"Transducer Problems"* sections to correct any issues. Gather required diagnostics data before contacting BakerHughes
E5: Amplitude	The signal amplitude exceeds the programmed limits	This error may occur due to high signal attenuation or amplification due to changes in fluid properties, transducer/buffer/ couplant issues	Make sure the amplitude is within the programmed limits. If the gain is negative and Amplitude > 32, change the Transmit Voltage to *"Low"*. If it is still negative, enable Attenuator. Do not enable Attenuator if the Transmit Voltage is high. If the gain is greater than 35 dB, change the Transmit Voltage to *"High"* (Refer Programming Chapter). Refer to *"Fluid and Pipe Problems"* and *"Transducer Problems"* sections to correct any issues. Gather required diagnostics data before contacting BakerHughes
E6: Cycle Skip	A cycle skip is detected while processing the signal for measurement	This is usually due to incorrect programming, poor signal integrity, possibly because of bubbles in the pipeline, sound absorption by very viscous fluids, or cavitation.	If this error is caused by changes in flow rate, this error will be auto corrected when flow rate stabilizes after initial acceleration. But, if the error stays refer to *"Fluid and Pipe Problems"* section to correct any issues. Check Threshold Peak percentage, and gather required diagnostics data before contacting BakerHughes
E15: Active Tw	The Active Tw measurement is invalid	A transducer, cable is damaged, or a transducer needs to be re-coupled. This may also be due to incorrect programming, or extreme process temperatures	Refer to *"Transducer Problems"* sections to correct any issues. In case you are unable to clear the errors, gather required diagnostics before contacting BakerHughes
E22: Single Channel Accuracy	One of the measurement channels is in error	One measurement channel is in error; accuracy of the measurement may be compromised because the meter might be using a sister chord substitution	Check individual channel errors, refer to this table for recommended actions to correct channel errors

Table 17: Flow Error description and Recommended Actions

Error Code	Problem	Cause	Recommended Action
E23: Multi Channel Accuracy	Two or more measurement channels are in error	Two or more measurement channels are in error; accuracy of the measurement may be compromised because the meter is using a sister chord substitution	Check individual channel errors, refer to this table for recommended actions to correct channel errors
E27: Invalid K-Table	K-Table is invalid	The entered K-table is invalid.	Check the K-table values and ensure the Velocity or Reynolds Number in the table is in ascending order.
E28: Software Fault	Software malfunction	This is a Software malfunction. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory	The condition is not self-recovering and will not automatically correct itself. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
E29: Velocity Warning	The measured velocity exceeds programmed warning limits	This error may be caused by incorrect programming, poor flow conditions and/or excessive turbulence	Make sure the actual flow rate is within the programmed Warning limits (Refer Programming Chapter). Refer to *"Fluid and Pipe Problems"* and *"Transducer Problems"* sections to correct any issues
E31: Not Calibrated	The flow meter has not been calibrated	The flow meter has not been calibrated and hence not making measurements. Please contact BakerHughes factory	The condition is not self-recovering and will not automatically correct itself. Contact BakerHughes factory to get more information on the meter setup

4.4 Fluid and Pipe Problems

If preliminary troubleshooting with the *Error Code Messages* and the *Diagnostic Parameters* indicates a possible problem, proceed with this section. Measurement problems fall into two categories:

- Fluid problems
- Pipe problems

Read the following sections carefully to determine if the problem is related to the fluid or the pipe. If the instructions in this section fail to resolve the problem, contact BakerHughes for assistance.

4.4.1 Fluid Problems

Most fluid-related problems result from a failure to observe the flow meter system installation instructions, as described in Chapter, Installation. Refer to Installation Chapter to correct any installation problems.

If the physical installation of the system meets the recommended specifications, it is possible that the fluid itself may be preventing accurate flow rate measurements. The fluid being measured must meet the following requirements:

- *The fluid must be homogeneous, single-phase, relatively clean and flowing steadily.*

Although a low level of entrained particles may have little effect on the operation of the *PanaFlow Z3*, excessive amounts of solid particles will absorb or disperse the ultrasound signals. This interference with the ultrasound transmissions through the fluid will cause inaccurate flow rate measurements. In addition, temperature gradients in the fluid flow may result in erratic or inaccurate flow rate readings.

- *The fluid must not cavitate near the measurement point.*

Fluids with a vapor pressure relatively close to process pressure may cavitate near the measurement point. This causes problems resulting from gas bubbles in the fluid. Cavitation can usually be controlled through proper system design.

- *The fluid must not excessively attenuate ultrasound signals.*

Some fluids, particularly those that are very viscous, readily absorb ultrasound energy. In such a case, signal warning and error message will appear on the display screen to indicate that the ultrasonic signal strength is insufficient for reliable measurements.

- *The fluid soundspeed must not vary excessively.*

The *PanaFlow Z3* will tolerate relatively large changes in the fluid soundspeed, as may be caused by variations in fluid composition and/or temperature. However, such changes must occur slowly. Rapid fluctuations in the fluid soundspeed, to a value that is considerably different from that programmed into the *PanaFlow Z3*, will result in erratic or inaccurate flow rate readings. This may occur when changing batch fluids, though most likely the *PanaFlow Z3* will recover.

Note: *Refer to Chapter 3, Programming, to make sure the appropriate soundspeed is programmed into the meter.*

4.4.2 Pipe Problems

Pipe-related problems may result from improper choice in meter location or errors in programming. The following may result in problematic installations:

- *The collection of material at the transducer location(s).*

Accumulated debris at the transducer location(s) will interfere with transmission of the ultrasound signals. Choose an installation point for the meter where solid particles will not settle into the transducer ports. Refer to Chapter 2, Installation, for more details on proper installation practices.

- *The inside of the pipe must be relatively clean.*

Excessive buildup of scale, rust or debris will change the inner dimensions of the pipe and will result in inaccuracies in the calculation of the flow from the velocity measurement.

4.5 Transducer/Buffer Problems

Ultrasonic transducers are rugged, reliable devices. However, they are subject to physical damage from mishandling and chemical attack. The following list of potential problems is grouped according to transducer type. Contact BakerHughes if you cannot solve a transducer-related problem.

4.5.1 Wetted Transducer Problems

- **Leaks:** Leaks may occur around the transducer buffers and/or the flowcell fittings. Repair such leaks immediately. If the leaking fluid is corrosive, carefully check the transducer and cables for damage, after the leak has been repaired.
- **Corrosion Damage:** If the transducer buffer material was not properly chosen for the intended application, they may suffer corrosion damage. The damage usually occurs either at the electrical connector or on the face. If corrosion is suspected, remove the transducer from the flowcell and carefully inspect the buffer electrical connector and the transducer face for roughness and/or pitting. Any transducer damaged in this manner must be replaced. Contact BakerHughes for information on transducers in materials suitable for the application.
- **Internal Damage:** An ultrasonic transducer consists of a ceramic crystal bonded to the transducer case. The bond between the crystal and the case or the crystal itself may be damaged by extreme mechanical shock and/or temperature extremes. Also, the internal wiring can be corroded or shorted if contaminants enter the transducer housing.
- **Physical Damage:** Transducers may be physically damaged by dropping them onto a hard surface or striking them against another object. The transducer connector is the most fragile part and is most subject to damage. Minor damage may be repaired by carefully bending the connector back into shape. If the connector cannot be repaired, the transducer must be replaced.

IMPORTANT: *Transducers must be replaced in pairs. Refer to Chapter 3, Programming, to enter the new transducer data into the meter.*

4.6 Service Test Points

Service tests points can be found on the *PanaFlow Z3* Main board just inside the front cover. There are 6 pins found on the bottom left front side of the main PCB that are accessible to service personnel. These test points are easily connected by standard oscilloscope probes and allow the service person to look at critical signals.

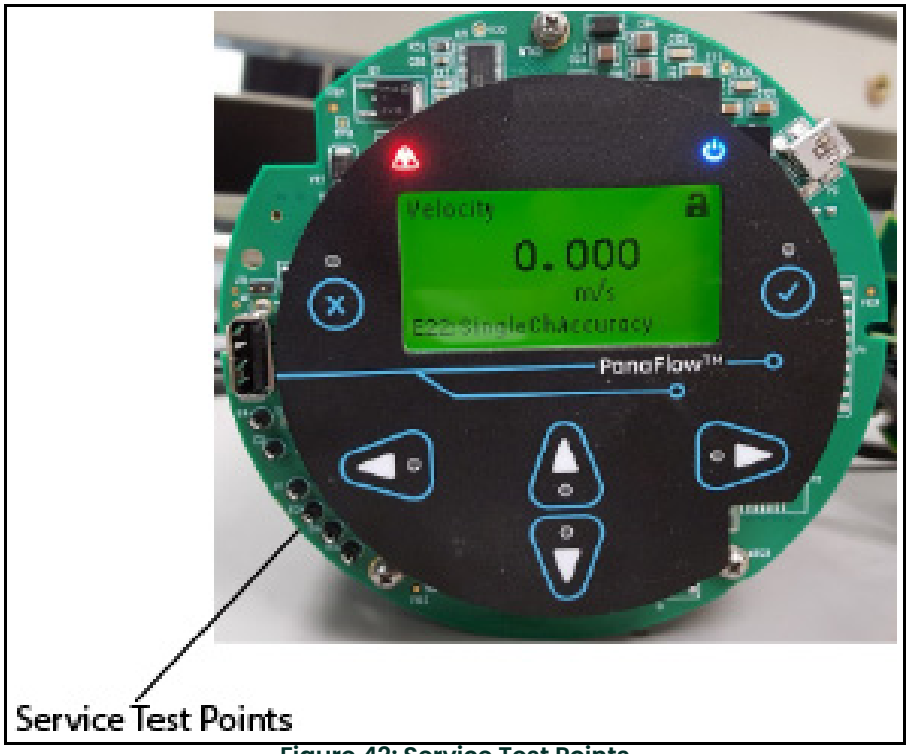


Figure 42: Service Test Points

The test points are:

Table 18: Test points

E1	DRTN
E2	Gate
E3	TWIND
E4	RWIND
E5	ARTN
E6	RCV

GATE: Gate connection is input to start and stop flow calibration process. This input detects an outside source contact closure. A closure can be programmed to stop totals or clear totals. Use DRTN along with GATE.

Table 19: Gate connections

TWIND: Transmit Window	use DRTN with TWIND
RWIND: Receive Window	use DRTN with RWIND

RCV: Receive signal allows the user to look at the receive signal before it is processed by the meter. It is usually looked at along with the TWIND and RWIND. Use ARTN with RCV signal.

4.7 System Errors (S-Errors)

These errors are from the Flow subsystem. The system errors have 4 types of indications.

1. Indicator
2. Warning
3. Error
4. Fault

The indicator is just a notification to the operator, no action is needed. The warnings are usually indicative of an operator error. Errors indicate failures that need attention. Operator should perform recommended actions to recover from these errors. Faults are usually indicative of more serious failures related to background hardware / software integrity checks performed by PanaFlow Z3 meter. See the table below for error codes, error messages, error type and recommended actions.

Table 20: System Error Description and Recommended Actions

Error Code	Error Message	Description / Recommended Action
S1: In Config Mode	In configuration mode indicator	**Indicator:** This is displayed when a user has logged in to either Operator, Admin or Factory access level. The indicator will clear automatically when the user logs out or save the configuration changes
S2: Invalid User	Invalid user warning	**Warning:** The passcode entered for access level is incorrect. Please log in with the correct access level and passcode
S3: Invalid Request	Invalid request warning	**Warning:** An invalid communication packet was received and discarded. Or, the requested operation is invalid. Please send a valid packet or operation request
S4: Invalid Param Range	Invalid parameter range warning	**Warning:** The value programmed for the parameter was out of range and hence discarded. Please enter a valid range
S5: Unsupported Parameter	This parameter is not supported	**Warning:** A read or write request to an unsupported parameter was received
S6: Flow Measurement	One or more flow measurement channels are in error	**Error:** One or more flow measurement channels are in error; accuracy of the measurement may be compromised. For more details please check flow (E) errors
S7: Persistent Param CRC	Persistent parameter CRC fault	**Fault:** Persistent parameter CRC failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S11: Clock Frequency	Clock frequency error	**Fault:** Input clock frequency failure. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S12: CPU	CPU error	**Fault:** CPU registers have stuck bits. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S13: Invariable Flash Memory	Flash memory fault	**Fault:** Flash memory test failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S14: Invariable SRAM	Invariable SRAM fault	**Fault:** Invariable SRAM memory test failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S15: Variable Memory	Variable SRAM fault	**Fault:** Variable SRAM test failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S16: FPGA Config	FPGA configuration error	**Fault:** FPGA configuration validation failure. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory

Table 20: System Error Description and Recommended Actions

Error Code	Error Message	Description / Recommended Action
S17: Temperature	Temperature error	**Error:** Temperature of the electronics is outside the pre-defined operating range. Make sure that the ambient temperature is not outside the meter operating range
S18: Driver Fault	Driver failure	**Fault:** Driver failure. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S19: Watch Dog Failure	Watch dog failure	**Fault:** Watch dog test failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S21: Stack Overflow	Stack overflow	**Fault:** Stack overflow. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S22: Sequence or Window Watchdog	Sequence failed	**Fault:** Sequence failure detected. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S23: Initialization Failed	Initialization failed	**Error:** Initialization failed. Please verify all the configuration parameters. If error persists, contact BakerHughes factory
S24: DSP Hardware Errors	DSP hardware failed	**Fault:** DSP hardware failure detected. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S25: DSP Exception	DSP exception	**Fault:** DSP exception. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S26: Default ISR	Exception within the ISR	**Fault:** Exception within the ISR. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S27: DSP Reset ISR	Exception within the DSP ISR	**Fault:** Exception within the DSP ISR. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S28: Software Fault	Software malfunction	**Error:** Software malfunction. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
S30: Flash Save Failed	Save to Flash Failed	**Error:** Request to Save failed. Try again. If error persists, contact BakerHughes factory.

4.8 Communication Errors (C-Errors)

The communication error indicates that the Transmitter subsystem has lost communication with Flow measurement sub-system or the Option I/O sub-system.

Table 21: Communication Error Description and Recommended Actions

Error Code	Error Message	Description / Recommended Action
C1: Flow COMM Error	Flow board communication error	Transmitter cannot communicate to the flow measurement unit. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
C3: Option I/O COMM Error	Optional I/O subsystem communication error	Transmitter cannot communicate to the Optional I/O in Slot-2. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory.

4.9 Transmitter Errors

These errors are from the Transmitter subsystem. Should you encounter one of the Transmitter Errors, follow recommended actions and contact BakerHughes factory.

Table 22: Transmitter Error Description and Recommended Actions

Error Code	Error Message	Description / Recommended Action
X1: MCU RAM Error	Transmitter RAM Fail	Memory test on transmitter RAM failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
X2: MCU Flash CRC Error	Flash memory test failed	Flash memory test failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
X7: MPU not Detected	No flow board detected	Flow board is not detected by the transmitter. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
X12: System Command Fail	System command failed	System command failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
X13: Get GUI Node Fail	Failed to generate GUI	Failed to generate GUI. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
X14: Node Memory Fail	GUI node memory failed	GUI node memory failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
X15: Font API Initialize Fail	Failed to generate font	Failed to generate font. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
X16: XML File Initialize Fail	XML file initialization failed	XML file initialization failed. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
X17: Disconnect Std Dout	Digital Output is disconnected	Conflicting configuration detected. Please turn off Frequency Calibration before using Digital Output
X18: Aout(Std) Out Of Range	The Analog Output value is Out of range	This error occurs when output from analog output exceeds 20 mA or less than 4 mA. Please check the Analog output settings and the measurements values sent out on the Analog Output.

4.10 Option I/O Errors

Table 23: Option I/O Errors Description

Error Code	Error Message	Description
A1:AnalogCh(S2:3) Error!	ADC Channel(S2:3) is not responding	Analog input /RTD input is not working. If error persists after power cycle, contact BakerHughes factory
A2:AnalogCh (S2:4) Error!	ADC Channel(S2:4) is not responding	Analog input /RTD is not working. If error persists after power cycle, contact BakerHughes factory
A3:AnalogCh (S2:1) Error!	DAQ Channel (S2:1) is not responding	Analog output (4-20mA) is not working. If error persists after power cycle, contact BakerHughes factory
A4:AnalogCh (S2:2) Error!	DAQ Channel (S2:2) is not responding	Analog output (4-20mA) is not working. If error persists after power cycle, contact BakerHughes factory
A6:(S2:3)Ch Not Calibrated	Error occurs when Analog Input/RTD(S2:3) are not calibrated	Calibrate the Analog Input/RTD input. If error persists after calibration, contact BakerHughes factory
A7:(S2:4)Ch Not Calibrated	Error occurs when Analog Input/RTD (S2:4) are not calibrated	Calibrate the Analog Input/RTD input. If error persists after calibration, contact BakerHughes factory
A10:(S2:3)Input NotConnect!	Analog Input: Error occurs when (4-20mA) input is not connected at Channel (S2:3). RTD Input: Error occurs when RTD input is not connected or temp greater than 390 deg C at Channel (S2:3)	Check connectivity for Analog Input/RTD input and RTD temperature. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
A11:(S2:4)Input NotConnect!	Analog Input: Error occurs when (4-20mA) input is not connected at Channel (S2:4). RTD Input: Error occurs when RTD input is not connected or temp greater than 390 deg C at Channel (S2:4)	Check connectivity for Analog Input/RTD input and RTD temperature. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
A12:(S2:3)Ch OverRange Err!	Exceeds input values. For analog input (S2:3) greater than 21mA	Ensure analog input current less than 21mA. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
A13:(S2:4)Ch OverRange Err!	Analog input(S2:4) greater than 21mA	Ensure analog input current less than 21mA. Try power cycling the meter. If error persists after power cycle, contact BakerHughes factory
A24:Aout(S2:1)OutOfRange!	When output from analog output(S2:1) exceeds 21 mA or less than 3.6 mA	Check the flow velocity. If velocity is within limits and error still persists, contact BakerHughes factory
A25:Aout(S2:2)OutOfRange!	When output from analog output(S2:2) exceeds 21 mA or less than 3.6 mA	Check the flow velocity. If velocity is within limits and error still persists, contact BakerHughes factory
A31:(S2:3)Ch UnderRange!	Lesser input values. For analog input(S2:3) between 3.6 mA to 0.25mA	Check input analog current is between 3.6 mA to 21mA. If error persists, contact BakerHughes factory
A32:(S2:4)Ch UnderRange!	Lesser input values. For analog input(S2:4) between 3.6 mA to 0.25mA.	Check input analog current is between 3.6 mA to 21mA. If error persists, contact BakerHughes factory

4.11 Meter Health with Diagnostics Data

To determine the health of the meter, PanaFlow Z3 has built-in diagnostic parameters. Please refer to the table below for diagnosing any problems with the system. If the meter shows errors and the diagnostics data indicate issues, fill in the User/Service record appendix before contacting BakerHughes factory.

Table 24: Diagnostic Parameter Description

Parameter	Description	Good	Bad
Sound Speed	Measured speed of sound of the fluid	• Under ideal conditions sound speed should be within 1 ft/s (0.3 m/s) between channels. • If oil is viscous and flow is near laminar (very low flow), there might be stratification in the pipe. In this case make sure that there is a steady gradient (change) in sound speed from top channel to bottom channel	• Under ideal conditions, sound speed spread of 5 ft/s (1.5 m/s) or more between the sound speed measurement of the channels can be an indication of a problem with the path. • When there is stratification in the pipe and there is no steady gradient (change) in sound speed from top channel to bottom channel then that can be an indication of a problem with the path.
SNR Up	Signal to noise ratio of the upstream transducer	>30	<5 SNR value between 5 and 30 shall provide valid measurements but can be an indication of a problem with the path. Verify the transducers, couplant, all the other connections
SNR Down	Signal to noise ratio of the downstream transducer	>30	<5 SNR value between 5 and 30 shall provide valid measurements but can be an indication of a problem with the path. Verify the transducers, couplant, all the other connections
Gain Up / Gain Down	Gain setting	>0 dB and <35 dB • In water applications, under ideal conditions, gain should be greater than 0 dB and less than 20 dB • For higher viscous liquids, gain between 20dB and 35 dB is acceptable.	>35 dB or <0 dB • Gain spreads of 10dB or more between the channels can be an indication of a problem with the path • If the gain is negative, change the Transmit Voltage to “Low”. If it is still negative, enable Attenuator. Do not enable Attenuator if the Transmit Voltage is high • If the gain is greater than 35 dB, change the Transmit Voltage to “High”.
Peak Index Up	Threshold peak of the upstream transmit correlation signal	400 - 700	<400 or >700
Peak Index Down	Threshold peak of the downstream transmit correlation signal	400 - 700	<400 or >700

Parameter	Description	Good	Bad
Active Tw Up	Time in upstream transducer buffer	Within 20% of the programmed Static Tw value	Over or under 20% of the programmed Static Tw value
Active Tw Down	Time in downstream transducer buffer	Within 20% of the programmed Static Tw value	Over or under 20% of the programmed Static Tw value
Active Tw Gain Up	Active Tw gain setting on upstream transducer	<20 dB	>20 dB
Active Tw Gain Down	Active Tw gain setting on downstream transducer	<20 dB	>20 dB
Transit Time Up	Upstream ultrasonic signal transit time	N.A	N.A
Transit Time Down	Downstream ultrasonic signal transit time	N.A	N.A
Delta T	Transit time difference between upstream and downstream signals	N.A	N.A
Signal Quality Up	Signal quality of the upstream transducer	>1000	<1000
Signal Quality Down	Signal quality of the downstream transducer	>1000	<1000
Amplitude Up	Signal amplitude of the upstream transducer	>14 and <32	>32 or <14
Amplitude Down	Signal amplitude of the downstream transducer	>14 and <32	>32 or <14

[no content intended for this page]

Chapter 5. Maintenance and Service

5.1 Hardware Maintenance and Inspection

WARNING! **Before opening the vessel, it must not contain any pressure! This warning pertains to all three interfaces described below (flange interface, transmitter connection and sensor ports). The appropriate procedure should be followed to properly relieve any pressure build up in the system prior to servicing the equipment.**

WARNING! **All equipment should be de-energized prior to servicing!**

Only trained and qualified personnel should be servicing the meter body. The system has three serviceable interfaces (shown in *Figure 43*):

- Flanges
- Sensor Ports
- Transmitter Connection

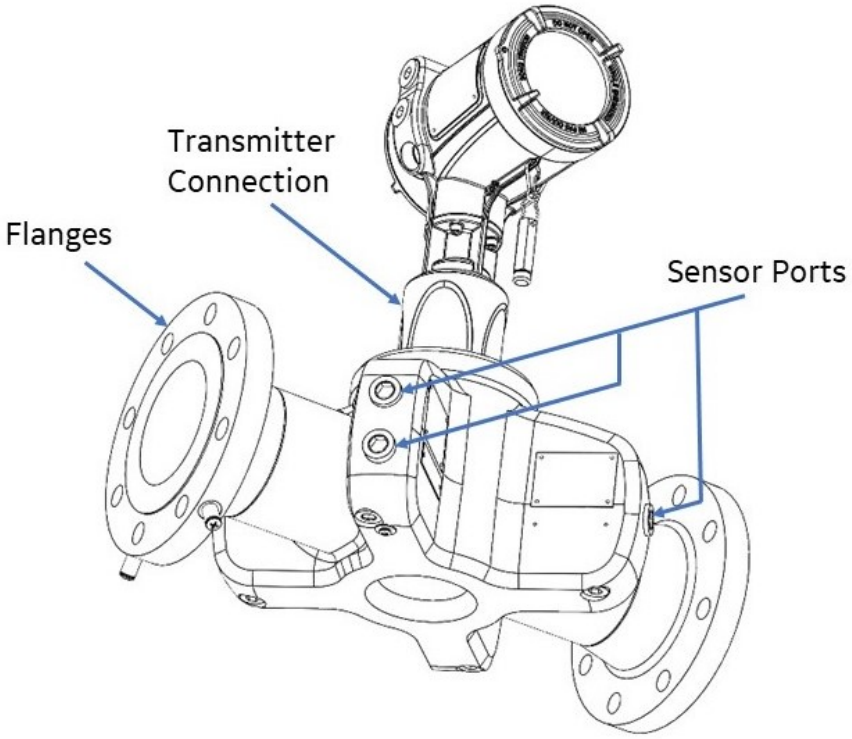


Figure 43: Serviceable Interfaces

5.1.1 Servicing the Pipe Interface

WARNING! **Before opening the meter body, it must not contain any pressure.**

Only properly trained personnel (i.e. pipe fitters) should service the pipe flanges. The proper gasket material, nuts, bolts, nut and bolt torque and tightening sequence should always be used.

5.1.2 Servicing the Sensor Ports or Transmitter Interface

WARNING! **Before you open the sensor ports or transmitter interface, the system must not contain any pressure.**

The sensor ports contain the sensors and sensor wiring. These ports should only be serviced by properly trained and qualified service technicians. Modification or alteration in any manner may impact performance of the system.

5.1.2.1 Required Equipment

- 10 mm hex drive socket or wrench
- 12 mm hex drive socket or wrench

5.1.2.2 Instructions to Relieve Pressure in the Sensor Port or Transmitter Interface

1. Locate the upstream "A" plane sensor quadrant. This is the plane with two transducer paths along it and is highlighted in *Figure 44*, *Figure 45*, and *Figure 46*. The opposite flow path, with only one pair of transducers, is referred to as the "B" plane sensor quadrant. On larger flowcell sizes, all transducer paths may be located on the same plane.
2. Relieve potential pressure build-up by loosening the Pressure Relief Plug on the bottom of the Upstream "A" Plane Sensor Quadrant as shown in step 1 above, using 10 mm hex tool. Slowly loosen the pressure relief plug 2-3 full turns or until the plug bottoms out on the built-in safety stop.
3. Listen and observe for:
   a. Any hissing is heard (air or gas release), stop loosening the plug and wait for the hissing to stop. If hissing continues for more than 10 minutes, retighten the plug and consult the factory.
   b. Any liquid discharge is observed, stop loosening the plug and retighten completely

WARNING! **If any liquid discharge is observed at the pressure relief plug, then the process pressure must be removed from the pipeline prior to servicing the sensor ports or transmitter interface.**

   c. If no hissing or discharge is observed and the plug has been backed out to the safety stop, then any pressure buildup has been released and the ports are now serviceable.

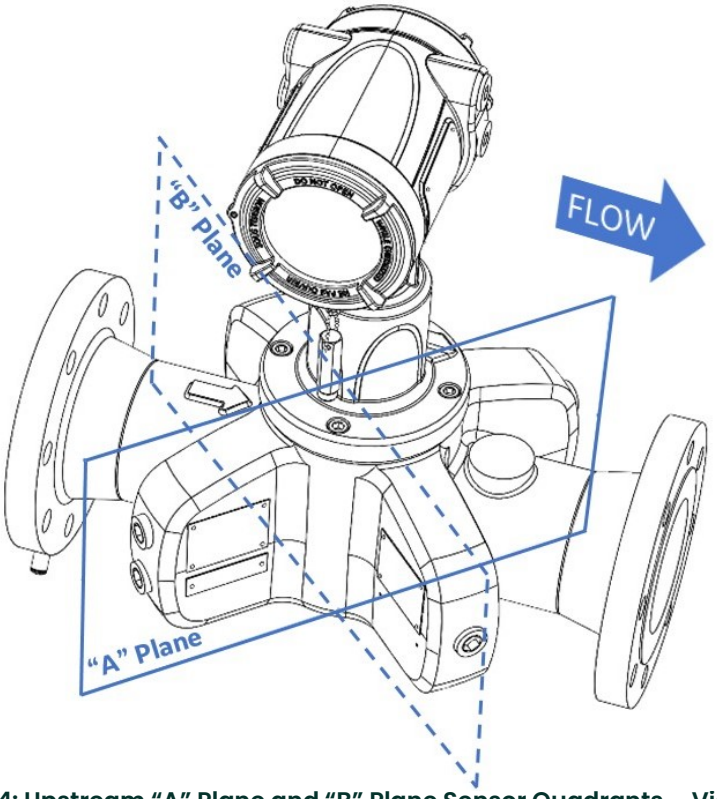


Figure 44: Upstream "A" Plane and "B" Plane Sensor Quadrants – View 1 (Top)

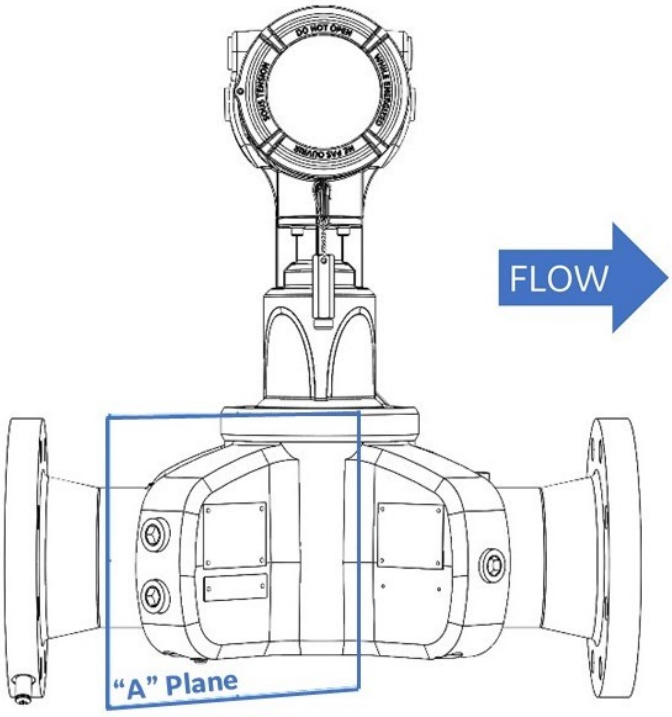


Figure 45: Upstream "A" Plane Sensor Quadrant – View 2 (Front)

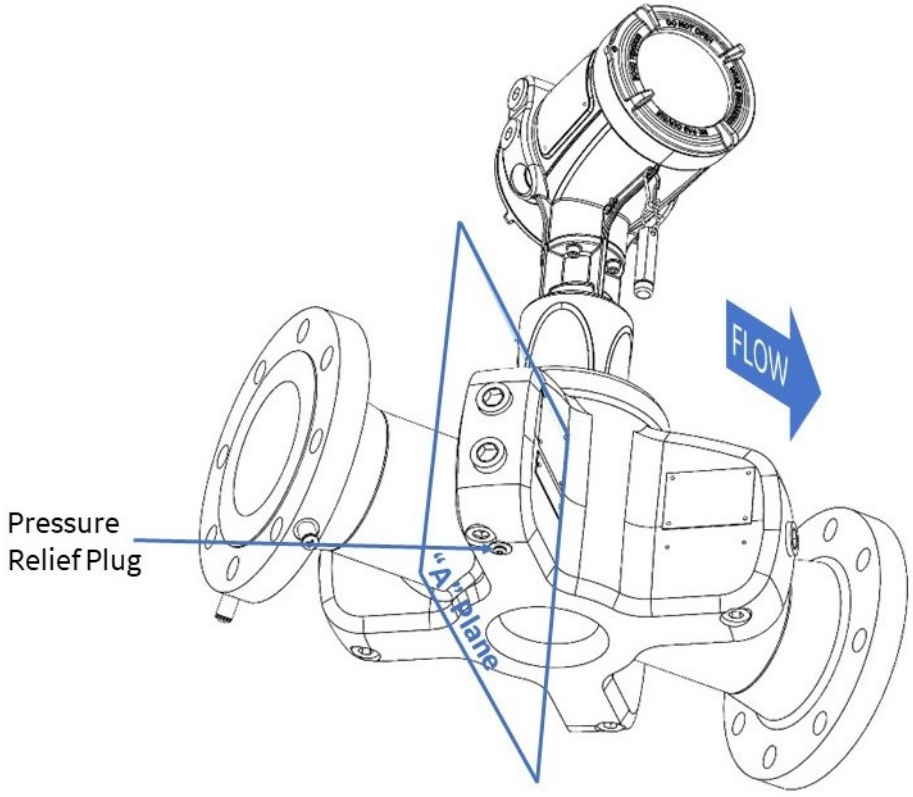


Figure 46: Upstream "A" Plane Sensor Quadrant – View 3 (Bottom)

5.1.2.3 Instructions to Rotate the XMT1000 Transmitter

WARNING! **All equipment should be de-energized prior to servicing.**

1. Before performing any rotation of the XMT1000 Transmitter, ensure that the enclosure is de-energized. Locate the back of the XMT1000 Transmitter and remove the rear enclosure cover by turning it counter-clockwise.
2. Locate the connection ports within the transmitter enclosure and carefully unplug all six cables. It may be useful to make a note of the cable configuration, as it must be restored at the end of this procedure. Allow the cables to freely sit within the enclosure and ensure that no cables are caught or tangled after this is complete.
3. Locate the four screws that affix the transmitter to the adapter and remove them using an appropriate hex drive tool. Once these are completely removed, they can be stored in a safe location.
4. The entire XMT1000 Transmitter should now be free to rotate about the axis of rotation shown in Figure 47. Rotate the transmitter enclosure to your desired position, ensuring that screw hole alignment is maintained.
5. Align and affix the XMT1000 Transmitter by reinserting the four screws to each screw hole. Tighten these screws using a hex drive tool.
6. Reconnect all six transducer cables to the XMT1000 electronics. Make sure that all cables are connected to the appropriate port.
7. Reinstall the back cover to the transmitter enclosure by turning it in a clockwise direction. Continue rotating the back cover until the end of the threads is reached. During this process, make sure that the transducer cables are not damaged and are not pinched when the back cover is reinstalled.

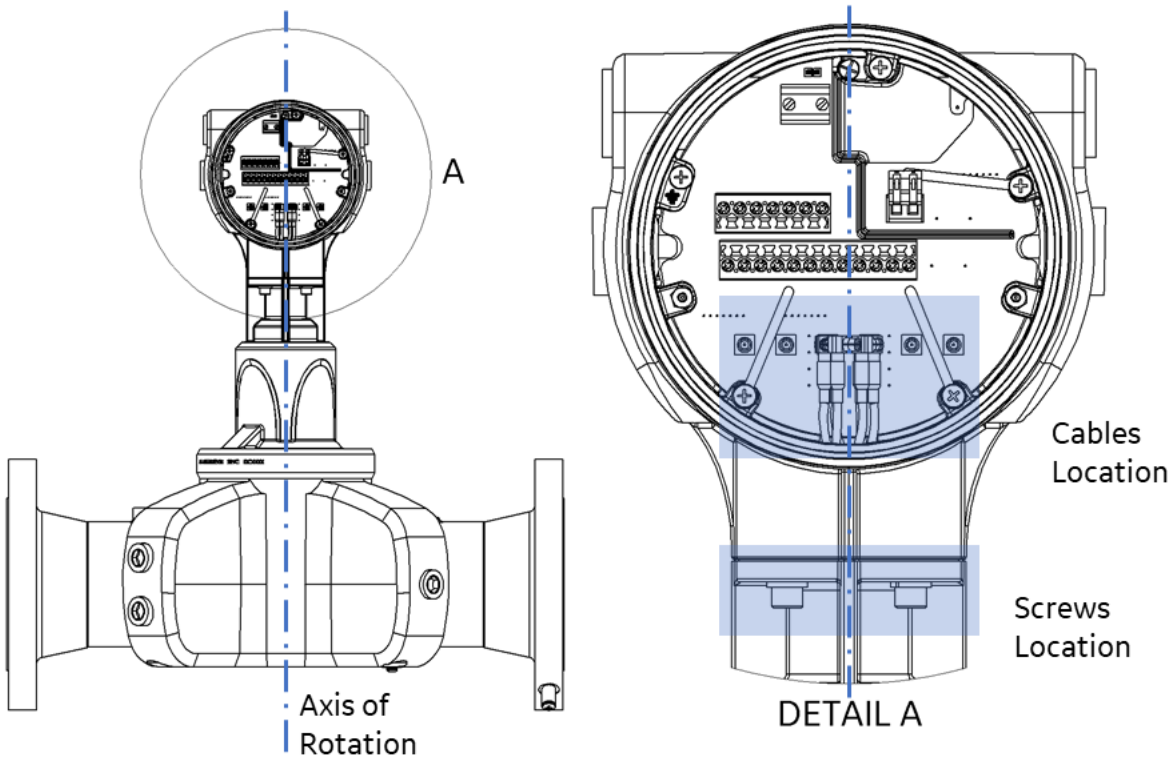


Figure 47: Disassembly Required for XMT1000 Transmitter Rotation (Back View)

5.1.2.4 Removing the XMT1000 Transmitter

Only properly trained personnel and qualified service technicians should remove the XMT1000 Transmitter from the flow meter adapter. The XMT1000 Transmitter contains transducer wiring and sensitive electronics. Modification or alteration in any manner may impact performance of the system. If it is appropriate to replace the XMT1000 Transmitter, the Panametrics & Panametrics Flow meter field service team is trained and equipped to perform the replacement on-site.

5.2 Service

The PanaFlow Z3 is a calibrated process flow meter. Local requirements may not allow field replacement of any components in this flow metering system without a proper calibration of the entire system at an approved calibration facility. Check with your local Panametrics & Panametrics Flow meter representative to determine if field replacement of components is allowed.

5.2.1 Spare Parts

If a fault is found with the flow meter electronics, the entire measurement head can be replaced to ensure hardware and firmware compatibility. To ensure that the correct part number is ordered, provide your local Panametrics & Panametrics Flow meter representative with the serial number of the meter, located as shown on the "Part String and Serial Number Tag Plate".

If it is determined that a flow transducer has been damaged or is faulty, it may also be replaced in the field. Please consult the factory for the appropriate part number.

5.2.2 Installing Replacement Parts

If it is appropriate to replace any component of the flow metering system, the Panametrics & Panametrics Flow meter field service team is trained and equipped to perform the replacement on-site. Installation of these field replaceable parts by a BakerHughes field service team member will maintain the accuracy of the system and any applicable warranty. Transducer and electronics replacement has been proven to maintain calibration. Please consult the factory to order the appropriate components and to schedule installation in the field.

Appendix A. Specifications and Model Configurations

A.1 Operation and Performance

Fluid Types

Liquids: acoustically conductive fluids, including most clean liquids, and many liquids with small amounts of entrained solids or gas bubbles.

Flow Measurement

- Correlation transit time model

Accuracy

3 to 24 in (80 to 600 mm)

- ±0.25% of reading for velocities above 1.6 ft/s (0.5 m/s)
- ±1.25 mm/s for velocities below 1.6 ft/s (0.5 m/s)

2 in (50 mm)

- ±0.5% of reading for velocities above 1.6 ft/s (0.5 m/s)
- ±2.5 mm/s for velocities below 1.6 ft/s (0.5 m/s)

Accuracy statement assumes measurement of a single phase homogenous liquid with a fully developed symmetrical flow profile passing through the meter (typically 10 diameters upstream and 5 diameters downstream of straight pipe run). Applications with piping arrangements that create an asymmetrical flow profile may require extended piping straight runs and/or flow conditioning for the meter to perform to this specification.

Calibration

All meters are water calibrated at ambient conditions and include a calibration certificate.

- 3 points as found 2, 5, and 10 ft/s (0.6, 1.5 and 3 m/s) and 2 points as left 3 and 7 ft/s (0.9 and 2.1 m/s)

Repeatability

- ±0.15% of reading 3 to 24 in (80 to 600 mm)
- ±0.2% of reading 2 in (50 mm)

Range (Bidirectional)

- -82 to 82 ft/s (-25 to 25 m/s)

A.2 Meter Body/Transducer

Meter Body Materials

Low temperature carbon steel: ATSM SA352 Gr. LCC
Stainless steel: ASTM SA351 Gr. CF8M
Duplex stainless steel: ASTM SA995 GR. CD3MWCuN

Transducer System and Material

LX transducers with inserts 316 SS or A479 UNS S32760 (Duplex) Wetted components Seals: FKM or EPDM

Process Fluid Temperature Range

Local mount: -40°F to 302°F (-40°C to 150°C)
Remote mount: -40°F to 302°F (-40°C to 150°C)

*Maximum process temperature is 203°F (95°C) when additional analog input/output options are selected.

Pressure Range

Up to maximum allowable flange operating pressure at temperature per ASME B16.5 or EN1092-1

Piping Design

ASME B31.3
NACE MR0103/MR0175
PED PER B31.3, CAT II, A2 CRN

Weights and Dimensions

See Drawings 712-2166 (Figure 50 to Figure 52) and 712-2167 (Figure 53 to Figure 1) for details.

Drawing	Drawing Description
712-2166	Outline & installation, Z3, 2 – 24-inch flow meter system, local mount
712-2167	Outline & installation, Z3, 2 – 24-inch flow meter system, remote mount

A.3 Transmitter

Enclosures

Powder coated aluminum or stainless steel (SS316) conformal coated

Classifications

US/CAN: Class I, Division 1, Groups B, C, D;

Class I, Zone 1, Ex db IIB+H2 T6...150C;

IP 66/67 Type 4X

SINGLE SEAL

ATEX/IECEx: Ex db IIB+H2 T6...150C FISCO outputs

Ta = -40°C to +65°C, IP 66/67

Operating: -40°F to 149°F (-40°C to +65°C*)

Storage: -40°F to 158°F (-40°C to 70°C)

*Maximum ambient temperature is 60°C (140°F when foundation fieldbus option selected)

Transmitter Mounting

Local or remote mounting

Paths

Three paths: 3 to 24 in (80 to 600 mm)

Two paths: 2 in (50 mm)

Display

English
128 x 64 mono-color LCD display, configurable for single or dual measurement parameters

Keypad

Built-in magnetic, six-button, lockable keypad

Cable Entries

¾" NPT
M20 Adapters

Power Supplies

Universal 100-240 VAC 50/60 Hz ±10% or 12 to 28 VDC (15W max, 7W typical)

Standard Inputs/Outputs

One 4 to 20 mA isolated output, 600-ohm maximum load, NAMUR NE43
One additional output, may be configured as either a pulse or frequency

Optional Inputs/Outputs

Analog and digital I/O are available in specific combinations. See ordering information below for details:

- Two additional 4 to 20 mA isolated outputs, 600 Ohm maximum load, NAMUR NE43

- One or two 4 to 20 mA isolated inputs, 24-VDC loop power, NAMUR NE43
- One or two isolated, three-wire RTD (temperature) inputs, –148°F to 662°F (–100°C to 350°C), 100 Ohm or 1000 Ohm platinum.
- One or two isolated, four-wire RTD (temperature) inputs, –148°F to 662°F (–100°C to 350°C), 100 Ohm or 1000 Ohm platinum

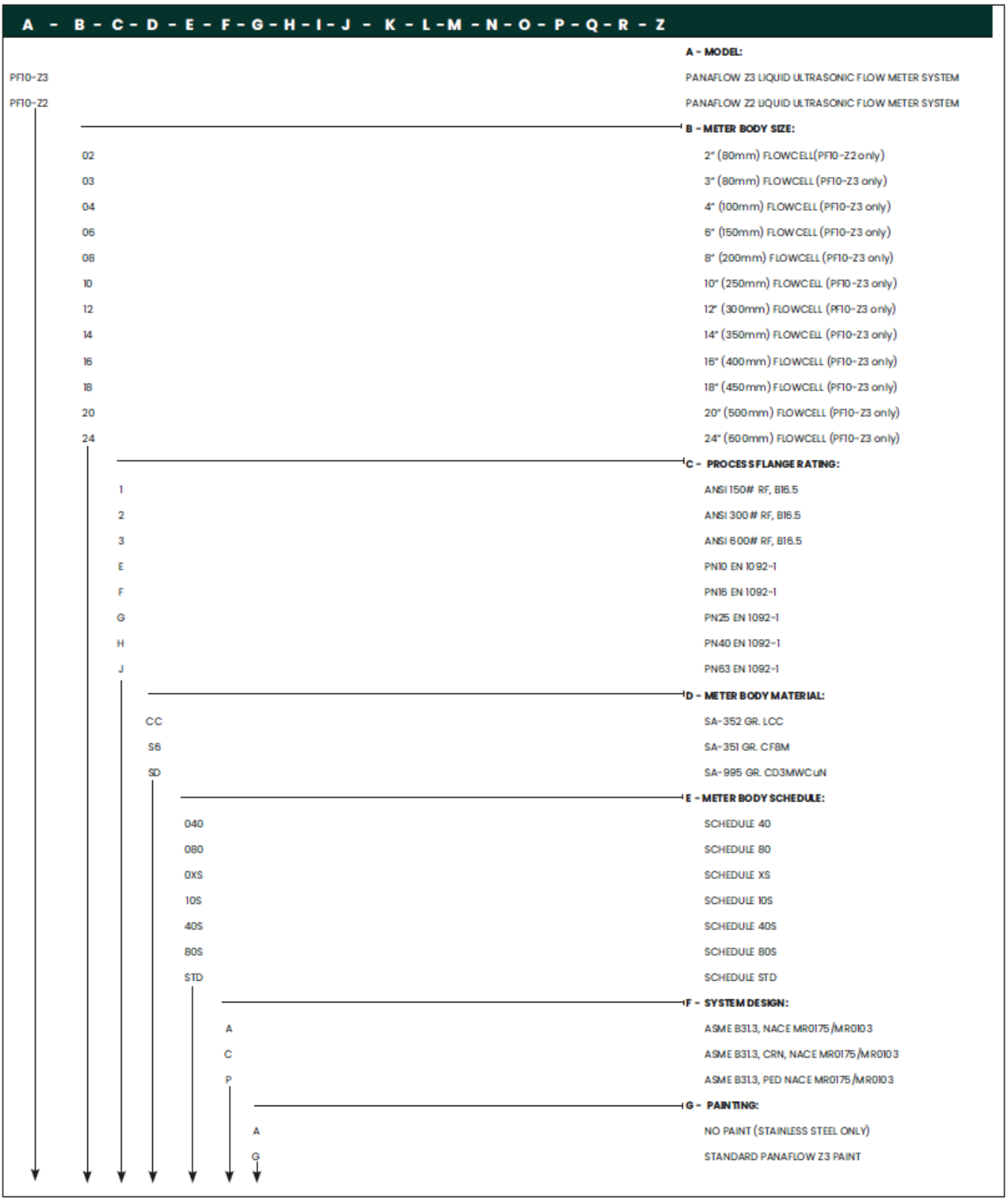
Digital Interfaces

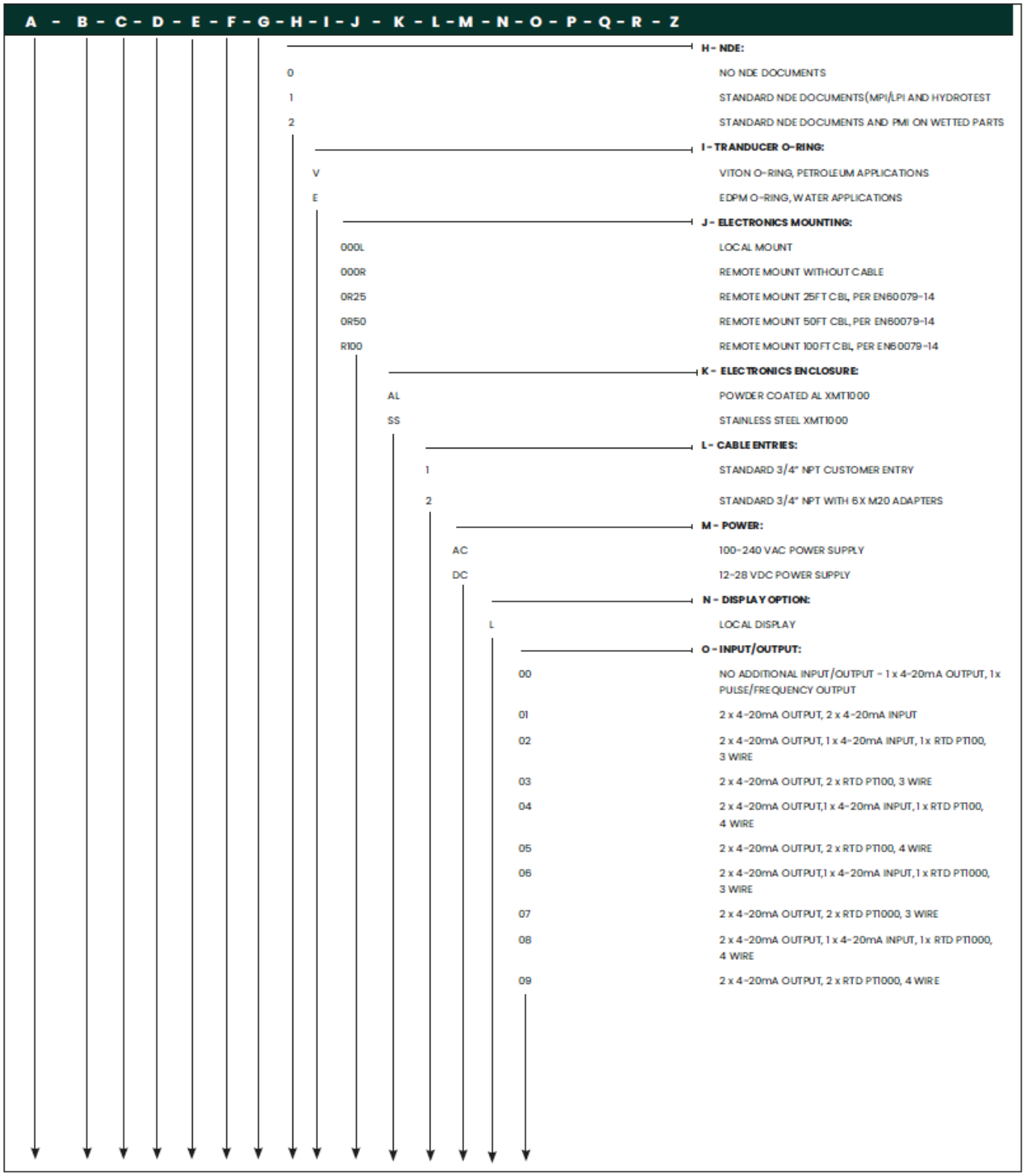
Standard: RS485/Modbus® Optional: HART® 7.0 protocol, with 4 dynamic variables, includes one additional 4 to 20 mA analog output NAMUR NE43

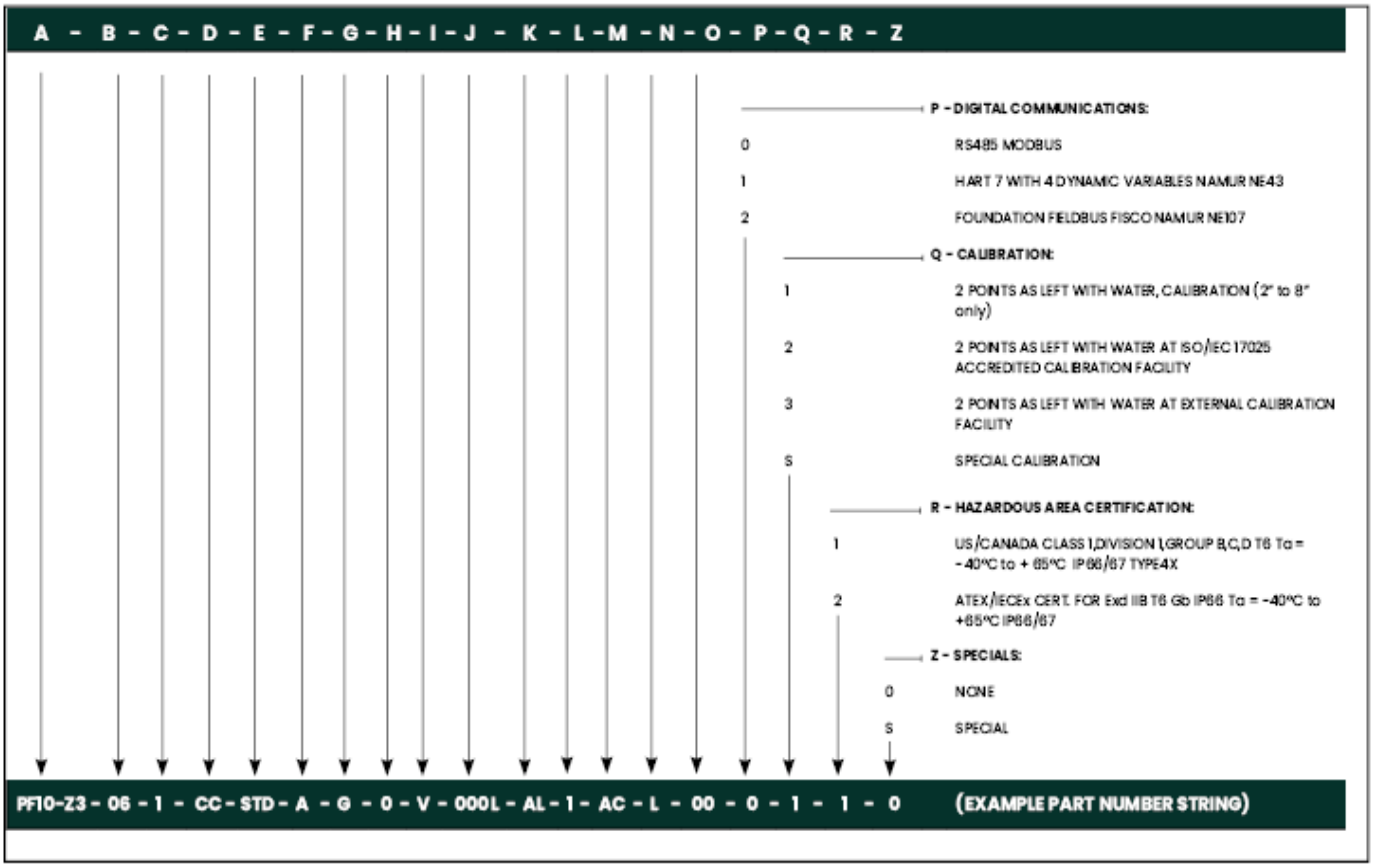
Optional: Foundation Fieldbus® FISCO, LAS capable NAMUR NE107 with five AI blocks and a PID block.

Note: *Maximum ambient operating temperature range of transmitter with Foundation Fieldbus® is +60°C.*

A.4 Serial Number Information




A - B - C - D - E - F - G - H - I - J - K - L - M - N - O - P - Q - R - Z
H - NDE:
0 NO NDE DOCUMENTS
1 STANDARD NDE DOCUMENTS (MPI/LPI AND HYDROTEST
2 STANDARD NDE DOCUMENTS AND PMI ON WETTED PARTS
I - TRANDUCER O-RING:
V VITON O-RING, PETROLEUM APPLICATIONS
E EDPM O-RING, WATER APPLICATIONS
J - ELECTRONICS MOUNTING:
000L LOCAL MOUNT
000R REMOTE MOUNT WITHOUT CABLE
0R25 REMOTE MOUNT 25FT CBL, PER EN60079-14
0R50 REMOTE MOUNT 50FT CBL, PER EN60079-14
R100 REMOTE MOUNT 100FT CBL, PER EN60079-14
K - ELECTRONICS ENCLOSURE:
AL POWDER COATED AL XMT1000
SS STAINLESS STEEL XMT1000
L - CABLE ENTRIES:
1 STANDARD 3/4" NPT CUSTOMER ENTRY
2 STANDARD 3/4" NPT WITH 6X M20 ADAPTERS
M - POWER:
AC 100-240 VAC POWER SUPPLY
DC 12-28 VDC POWER SUPPLY
N - DISPLAY OPTION:
L LOCAL DISPLAY
O - INPUT/OUTPUT:
00 NO ADDITIONAL INPUT/OUTPUT - 1 x 4-20mA OUTPUT, 1 x PULSE/FREQUENCY OUTPUT
01 2 x 4-20mA OUTPUT, 2 x 4-20mA INPUT
02 2 x 4-20mA OUTPUT, 1 x 4-20mA INPUT, 1 x RTD PT100, 3 WIRE
03 2 x 4-20mA OUTPUT, 2 x RTD PT100, 3 WIRE
04 2 x 4-20mA OUTPUT,1 x 4-20mA INPUT, 1 x RTD PT100, 4 WIRE
05 2 x 4-20mA OUTPUT, 2 x RTD PT100, 4 WIRE
06 2 x 4-20mA OUTPUT,1 x 4-20mA INPUT, 1 x RTD PT1000, 3 WIRE
07 2 x 4-20mA OUTPUT, 2 x RTD PT1000, 3 WIRE
08 2 x 4-20mA OUTPUT, 1 x 4-20mA INPUT, 1 x RTD PT1000, 4 WIRE
09 2 x 4-20mA OUTPUT, 2 x RTD PT1000, 4 WIRE



Note: *Other meter body materials can be offered on request. Please consult factory.*

A.5 Pressure Derating Information

ASME B16.5

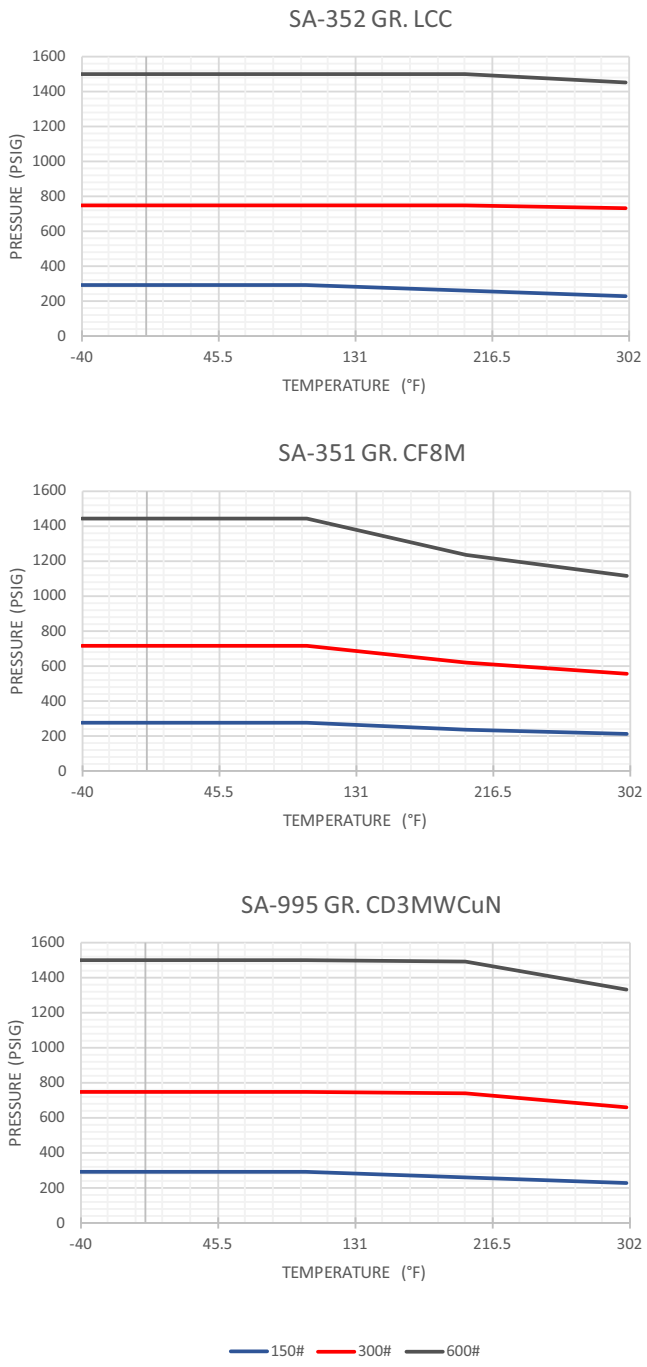


Figure 48: Pressure derating information as per ASME 16.5 standards

EN 1092-1

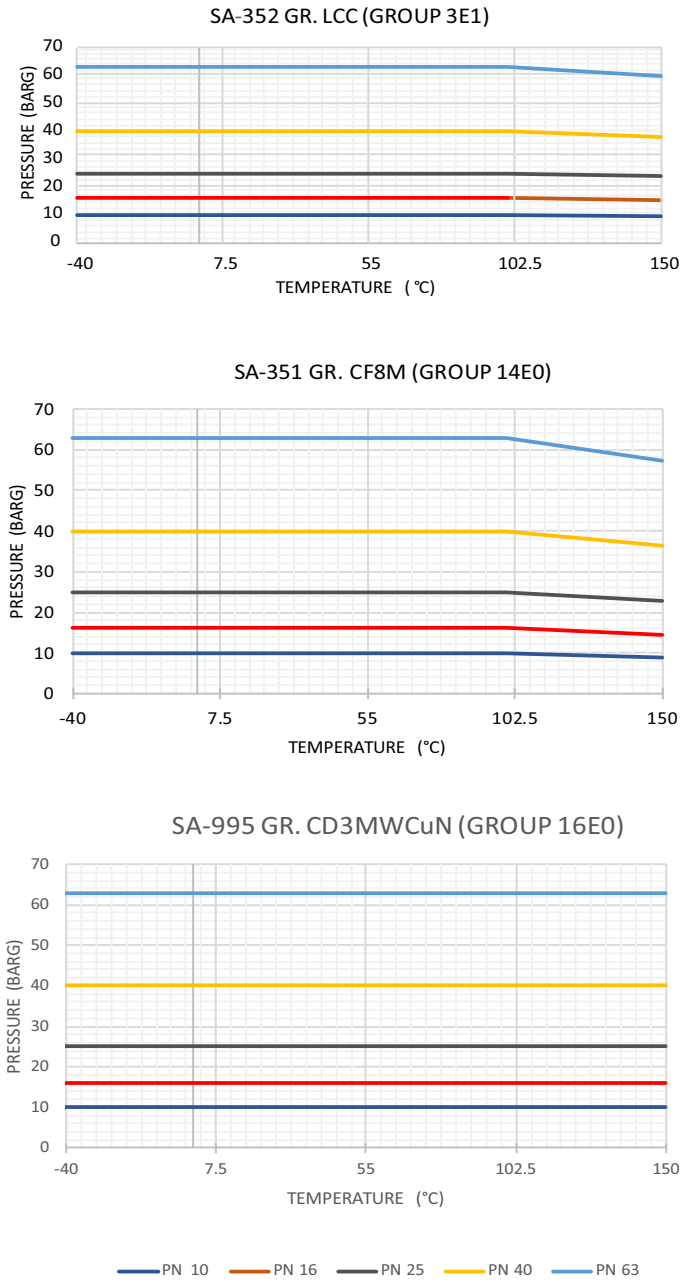


Figure 49: Pressure derating information as per EN 1092-1 DIN standards

A.6 O-Ring Chemical Compatibility

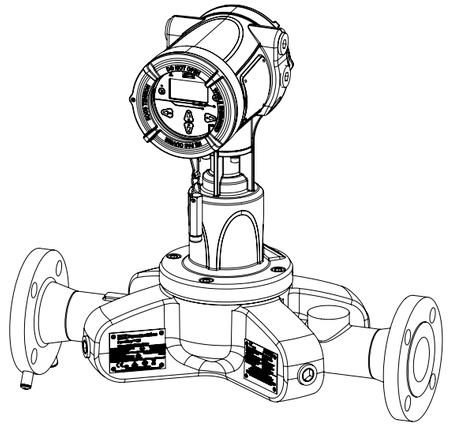
O-rings composed of both EPDM and Viton are used in the Panaflow Z3 flowmeter. Certain process fluids may detriment the performance of these O-rings, therefore impacting the effectiveness and safety of the system overall. Typical applications of O-rings composed of EPDM or Viton:

- For most water application: use EPDM
- For most Oil application: use Viton

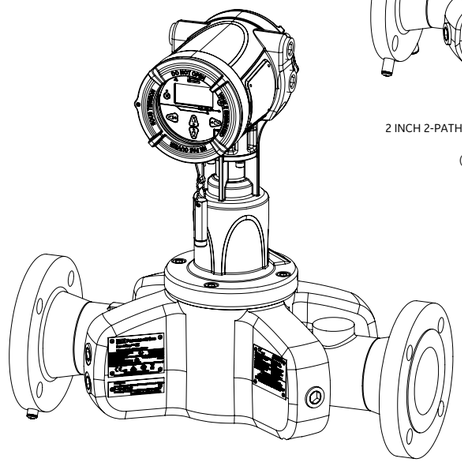
Please consult the factory for questions related to the chemical compatibility of O-ring materials for your specific process fluids.

TABLE-1

SL. NO	PIPE SIZE	FLANGE RATING	A	C	D	X	Y	Z	CX	CY	CZ	APPROX. ASSY WEIGHT.(Kg)
1	2 IN	ASME 150# RF (WN)	12.3 [312]	16.2 [411]	6.0 [152]	20 [508]	19.2 [487]	9.5 [241]	44 [1117]	43.2 [1097]	33.5 [850]	54
2		ASME 300# RF (WN)			6.5 [165]	20 [508]	19.4 [494]		44 [1117]	43.5 [1103]		56
3		ASME 600# RF (WN)			6.5 [165]	20 [508]	19.4 [494]		44 [1117]	43.5 [1103]		58
4		EN 1092-1/PN 10 (WN/TYPE 11)			6.5 [165]	20 [508]	19.4 [494]		44 [1117]	43.5 [1103]		55
5		EN 1092-1/PN 16 (WN/TYPE 11)			6.5 [165]	20 [508]	19.4 [494]		44 [1117]	43.5 [1103]		55
6		EN 1092-1/PN 25 (WN/TYPE 11)			6.5 [165]	20 [508]	19.4 [494]		44 [1117]	43.5 [1103]		55
7		EN 1092-1/PN 40 (WN/TYPE 11)			6.5 [165]	20 [508]	19.4 [494]		44 [1117]	43.5 [1103]		55
8		EN 1092-1/PN 63 (WN/TYPE 11)			7.1 [180]	20 [508]	19.7 [501]		44 [1117]	43.7 [1111]		59
9	3 IN	ASME 150# RF (WN)	12.7 [322]	17.1 [433]	7.5 [190]	20 [508]	20.8 [528]	9.8 [247]	44 [1117]	44.8 [1137]	33.8 [857]	72
10		ASME 300# RF (WN)			8.3 [209]	20 [508]	21.2 [537]		44 [1117]	45.2 [1147]		76
11		ASME 600# RF (WN)			8.3 [209]	20 [508]	21.2 [537]		44 [1117]	45.2 [1147]		78
12		EN 1092-1/PN 10 (WN/TYPE 11)			7.9 [199]	20 [508]	21.0 [533]		44 [1117]	45 [1142]		70
13		EN 1092-1/PN 16 (WN/TYPE 11)			7.9 [199]	20 [508]	21.0 [533]		44 [1117]	45 [1142]		70
14		EN 1092-1/PN 25 (WN/TYPE 11)			7.9 [199]	20 [508]	21.0 [533]		44 [1117]	45 [1142]		72
15		EN 1092-1/PN 40 (WN/TYPE 11)			7.9 [199]	20 [508]	21.0 [533]		44 [1117]	45 [1142]		72
16		EN 1092-1/PN 63 (WN/TYPE 11)			8.5 [214]	20 [508]	21.3 [540]		44 [1117]	45.3 [1150]		75
17	4 IN	ASME 150# RF (WN)	11.7 [297]	17.4 [441]	9 [228]	20 [508]	21.9 [556]	11.7 [297]	44 [1117]	45.9 [1165]	35.7 [907]	83
18		ASME 300# RF (WN)			10 [254]	20 [508]	22.4 [568]		44 [1117]	46.4 [1178]		92
19		ASME 600# RF (WN)			10.8 [273]	20 [508]	22.8 [578]		44 [1117]	46.8 [1188]		103
20		EN 1092-1/PN 10 (WN/TYPE 11)			8.7 [219]	20 [508]	21.7 [551]		44 [1117]	45.7 [1161]		79
21		EN 1092-1/PN 16 (WN/TYPE 11)			8.7 [219]	20 [508]	21.7 [551]		44 [1117]	45.7 [1161]		83
22		EN 1092-1/PN 25 (WN/TYPE 11)			9.3 [234]	20 [508]	22.0 [559]		44 [1117]	46 [1169]		83
23		EN 1092-1/PN 40 (WN/TYPE 11)			9.3 [234]	20 [508]	22.0 [559]		44 [1117]	46 [1169]		83
24		EN 1092-1/PN 63 (WN/TYPE 11)			9.8 [249]	20 [508]	22.3 [566]		44 [1117]	46.3 [1176]		88
25	6 IN	ASME 150# RF (WN)	14 [355]	18.6 [471]	11 [279]	22 [558]	24.1 [610]	14.0 [355]	46 [1168]	48.1 [1220]	38 [965]	112
26		ASME 300# RF (WN)			12.5 [317]	24 [609]	24.8 [629]		48 [1219]	48.8 [1239]		133
27		ASME 600# RF (WN)			14 [355]	26 [660]	25.5 [648]		50 [1270]	49.6 [1258]		163
28		EN 1092-1/PN 10 (WN/TYPE 11)			11.2 [284]	22 [558]	24.2 [613]		46 [1168]	48.2 [1223]		109
29		EN 1092-1/PN 16 (WN/TYPE 11)			11.2 [284]	22 [558]	24.2 [613]		46 [1168]	48.2 [1223]		109
30		EN 1092-1/PN 25 (WN/TYPE 11)			11.8 [299]	24 [609]	24.5 [621]		48 [1219]	48.5 [1230]		118
31		EN 1092-1/PN 40 (WN/TYPE 11)			11.8 [299]	24 [609]	24.5 [621]		48 [1219]	48.5 [1230]		118
32		EN 1092-1/PN 63 (WN/TYPE 11)			13.6 [344]	26 [660]	25.3 [643]		50 [1270]	49.3 [1253]		139
33	8 IN	ASME 150# RF (WN)	15.8 [401]	19.6 [497]	13.5 [342]	26 [660]	26.3 [669]	15.8 [401]	50 [1270]	50.4 [1278]	39.8 [1010]	157
34		ASME 300# RF (WN)			15 [381]	28 [711]	27.1 [688]		52 [1320]	51.1 [1297]		187
35		ASME 600# RF (WN)			16.5 [419]	30 [762]	27.8 [707]		54 [1371]	51.9 [1316]		232
36		EN 1092-1/PN 10 (WN/TYPE 11)			13.4 [340]	26 [660]	26.3 [667]		50 [1270]	50.3 [1277]		148
37		EN 1092-1/PN 16 (WN/TYPE 11)			13.4 [340]	26 [660]	26.3 [667]		50 [1270]	50.3 [1277]		148
38		EN 1092-1/PN 25 (WN/TYPE 11)			14.2 [359]	28 [711]	26.7 [677]		52 [1320]	50.7 [1287]		161
39		EN 1092-1/PN 40 (WN/TYPE 11)			14.8 [374]	28 [711]	27.0 [685]		52 [1320]	51 [1294]		169
40		EN 1092-1/PN 63 (WN/TYPE 11)			16.3 [415]	30 [762]	27.7 [705]		54 [1371]	51.8 [1314]		198



2 INCH 2-PATH LOCAL MOUNT FLOWMETER ASSEMBLY
DUAL PLANE DESIGN
(ALUMINUM ENCLOSURE SHOWN)



3 INCH TO 4 INCH 3-PATH LOCAL MOUNT FLOWMETER ASSEMBLY
DUAL PLANE DESIGN

NOTES:

1. DIMENSIONS AND WEIGHTS ARE REFERENCE ONLY AND SUBJECT TO CHANGE. CONTACT PANAMETRICS FOR ADDITIONAL INFORMATION.
2. 6X 3/4" NPT PORTS ARE SUPPLIED TO BE USED FOR CUSTOMER CONNECTIONS. REFER TO MANUAL FOR ADDITIONAL INSTALLATION INSTRUCTIONS.
3. CLEARANCE SPACE IS REQUIRED AROUND THE FLOWMETER FOR MAINTENANCE PURPOSES AT THE CUSTOMER SITE. CUSTOMER TO REFER TO "CX", "CY" & "CZ" DIMENSIONS FROM TABLE 1 DURING INSTALLATION.
4. ALL DIMENSIONS ARE IN INCH [MM].

DIMENSIONS ARE IN INCHES

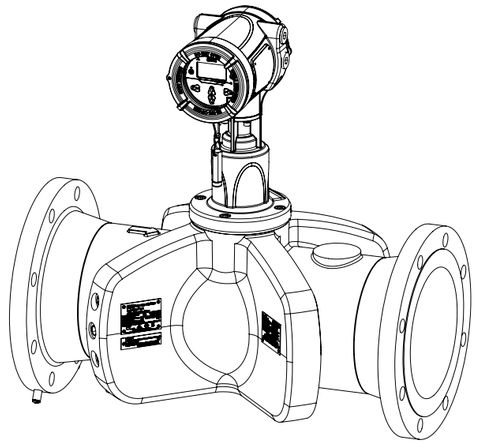
Figure 50: 712-2166 Outline & installation, Z3, 2 – 24-inch flow meter system, local mount

TABLE-1 (CONT..)

SL. NO	PIPE SIZE	FLANGE RATING	A	C	D	X	Y	Z	CX	CY	CZ	APPROX. ASSY WEIGHT.(Kg)
41	10 IN	ASME 150# RF (WN)	19.4 [493]	20.8 [529]	16.0 [406]	28.0 [711]	28.8 [732]	19.4 [493]	52 [1320]	52.8 [1342]	43.4 [1102]	239
42		ASME 300# RF (WN)			17.5 [444]	30.0 [762]	29.6 [751]		54 [1371]	53.6 [1361]		282
43		ASME 600# RF (WN)			20.0 [508]	32.0 [812]	30.8 [783]		56 [1422]	54.8 [1392]		367
44		EN 1092-1/PN 10 (WN/TYPE 11)			15.6 [394]	28.0 [711]	28.6 [726]		52 [1320]	52.6 [1336]		227
45		EN 1092-1/PN 16 (WN/TYPE 11)			15.9 [404]	28.0 [711]	28.8 [731]		52 [1320]	52.8 [1341]		229
46		EN 1092-1/PN 25 (WN/TYPE 11)			16.7 [424]	30.0 [762]	29.2 [741]		54 [1371]	53.2 [1351]		247
47		EN 1092-1/PN 40 (WN/TYPE 11)			17.7 [450]	30.0 [762]	29.7 [754]		54 [1371]	53.7 [1363]		267
48		EN 1092-1/PN 63 (WN/TYPE 11)			18.5 [469]	32.0 [812]	30.1 [764]		56 [1422]	54.1 [1373]		296
49	12 IN	ASME 150# RF (WN)	21.3 [540]	21.8 [554]	19 [482]	30 [762]	31.3 [796]	21.3 [540]	54 [1371]	55.3 [1405]	45.3 [1149]	313
50		ASME 300# RF (WN)			20.5 [520]	32 [812]	32.1 [815]		56 [1422]	56.1 [1424]		370
51		ASME 600# RF (WN)			22 [558]	36 [914]	32.8 [834]		60 [1524]	56.8 [1443]		467
52		EN 1092-1/PN 10 (WN/TYPE 11)			17.5 [445]	30 [762]	30.6 [777]		54 [1371]	54.6 [1386]		282
53		EN 1092-1/PN 16 (WN/TYPE 11)			18.1 [459]	30 [762]	30.9 [784]		54 [1371]	54.9 [1394]		289
54		EN 1092-1/PN 25 (WN/TYPE 11)			19.1 [484]	32 [812]	31.4 [797]		56 [1422]	55.4 [1406]		313
55		EN 1092-1/PN 40 (WN/TYPE 11)			20.3 [515]	32 [812]	32.0 [812]		56 [1422]	56 [1421]		343
56		EN 1092-1/PN 63 (WN/TYPE 11)			20.9 [530]	36 [914]	32.3 [819]		60 [1524]	56.3 [1429]		389
57	14 IN	ASME 150# RF (WN)	22.8 [577]	22.6 [573]	21.0 [533]	36 [914]	33.1 [840]	22.8 [577]	60 [1524]	57.1 [1450]	46.8 [1187]	399
58		ASME 300# RF (WN)			23.0 [584]	38 [965]	34.1 [865]		62 [1574]	58.1 [1475]		483
59		ASME 600# RF (WN)			23.8 [603]	40 [1016]	34.4 [875]		64 [1625]	58.5 [1485]		554
60		EN 1092-1/PN 10 (WN/TYPE 11)			19.9 [504]	36 [914]	32.5 [826]		60 [1524]	56.5 [1435]		361
61		EN 1092-1/PN 16 (WN/TYPE 11)			20.5 [519]	36 [914]	32.8 [833]		60 [1524]	56.8 [1443]		373
62		EN 1092-1/PN 25 (WN/TYPE 11)			21.9 [554]	38 [965]	33.5 [851]		62 [1574]	57.5 [1460]		413
63		EN 1092-1/PN 40 (WN/TYPE 11)			22.8 [579]	38 [965]	34.0 [863]		62 [1574]	58 [1473]		450
64		EN 1092-1/PN 63 (WN/TYPE 11)			23.6 [599]	40 [1016]	34.4 [873]		64 [1625]	58.4 [1483]		505
65	16 IN	ASME 150# RF (WN)	24.2 [615]	24.9 [632]	23.5 [596]	38 [965]	36.6 [930]	24.2 [615]	62 [1574]	60.6 [1540]	48.2 [1225]	501
66		ASME 300# RF (WN)			25.5 [647]	40 [1016]	37.6 [955]		64 [1625]	61.6 [1565]		605
67		ASME 600# RF (WN)			27 [685]	42 [1066]	38.4 [974]		66 [1676]	62.4 [1584]		731
68		EN 1092-1/PN 10 (WN/TYPE 11)			22.2 [564]	38 [965]	36.0 [914]		62 [1574]	60 [1524]		450
69		EN 1092-1/PN 16 (WN/TYPE 11)			22.8 [579]	38 [965]	36.3 [922]		62 [1574]	60.3 [1531]		469
70		EN 1092-1/PN 25 (WN/TYPE 11)			24.4 [620]	40 [1016]	37.1 [942]		64 [1625]	61.1 [1551]		521
71		EN 1092-1/PN 40 (WN/TYPE 11)			26 [659]	40 [1016]	37.9 [962]		64 [1625]	61.9 [1571]		584
72		EN 1092-1/PN 63 (WN/TYPE 11)			26.4 [670]	42 [1066]	38.1 [967]		66 [1676]	62.1 [1576]		643
73	18 IN	ASME 150# RF (WN)	26.8 [679]	26.6 [675]	25 [635]	38 [965]	39.1 [993]	26.8 [679]	62 [1574]	63.1 [1602]	50.8 [1289]	604
74		ASME 300# RF (WN)			28 [711]	40 [1016]	40.6 [1031]		64 [1625]	64.6 [1640]		719
75		ASME 600# RF (WN)			29.3 [742]	44 [1117]	41.2 [1047]		68 [1727]	65.2 [1656]		878
76		EN 1092-1/PN 10 (WN/TYPE 11)			24.2 [614]	38 [965]	38.7 [983]		62 [1574]	62.7 [1592]		548
77		EN 1092-1/PN 16 (WN/TYPE 11)			25.2 [640]	38 [965]	39.2 [995]		62 [1574]	63.2 [1605]		573
78		EN 1092-1/PN 25 (WN/TYPE 11)			26.4 [670]	40 [1016]	39.8 [1010]		64 [1625]	63.8 [1620]		637
79		EN 1092-1/PN 40 (WN/TYPE 11)			27.0 [685]	40 [1016]	40.1 [1018]		64 [1625]	64.1 [1627]		682

TABLE-1 (CONT..)

SL. NO	PIPE SIZE	FLANGE RATING	A	C	D	X	Y	Z	CX	CY	CZ	APPROX. ASSY WEIGHT.(Kg)
80	20 IN	ASME 150# RF (WN)	29.1 [740]	26.8 [681]	27.5 [698]	46 [1168]	40.6 [1031]	29.1 [740]	70 [1778]	64.6 [1640]	53.1 [1349]	741
81		ASME 300# RF (WN)			30.5 [774]	48 [1219]	42.1 [1069]		72 [1828]	66.1 [1678]		909
82		ASME 600# RF (WN)			32.0 [812]	50 [1270]	42.8 [1088]		74 [1879]	66.9 [1697]		1100
83		EN 1092-1/PN 10 (WN/TYPE 11)			26.4 [670]	46 [1168]	40.0 [1017]		70 [1778]	64 [1626]		670
84		EN 1092-1/PN 16 (WN/TYPE 11)			28.2 [715]	46 [1168]	40.9 [1039]		70 [1778]	64.9 [1649]		715
85		EN 1092-1/PN 25 (WN/TYPE 11)			28.7 [729]	48 [1219]	41.2 [1046]		72 [1828]	65.2 [1656]		786
86		EN 1092-1/PN 40 (WN/TYPE 11)			29.7 [754]	48 [1219]	41.7 [1059]		72 [1828]	65.7 [1669]		840
87	24 IN	ASME 150# RF (WN)	32.8 [832]	28.7 [729]	32.0 [812]	48 [1219]	44.7 [1135]	32.8 [832]	72 [1828]	68.7 [1745]	56.8 [1442]	1012
88		ASME 300# RF (WN)			36.0 [914]	50 [1270]	46.7 [1186]		74 [1879]	70.7 [1796]		1270
89		ASME 600# RF (WN)			37.0 [939]	52 [1320]	47.2 [1199]		76 [1930]	71.2 [1808]		1525
90		EN 1092-1/PN 10 (WN/TYPE 11)			30.7 [780]	48 [1219]	44.0 [1119]		72 [1828]	68.1 [1729]		907
91		EN 1092-1/PN 16 (WN/TYPE 11)			33.1 [839]	48 [1219]	45.3 [1149]		72 [1828]	69.3 [1759]		986
92		EN 1092-1/PN 25 (WN/TYPE 11)			33.3 [845]	50 [1270]	45.3 [1152]		74 [1879]	69.4 [1761]		1050
93		EN 1092-1/PN 40 (WN/TYPE 11)			35.0 [890]	50 [1270]	46.2 [1174]		74 [1879]	70.2 [1784]		1206



6 INCH TO 24 INCH 3-PATH LOCAL MOUNT FLOWMETER ASSEMBLY
SINGLE PLANE DESIGN

Figure 51: 712-2166 Outline & installation, Z3, 2 – 24-inch flow meter system, local mount

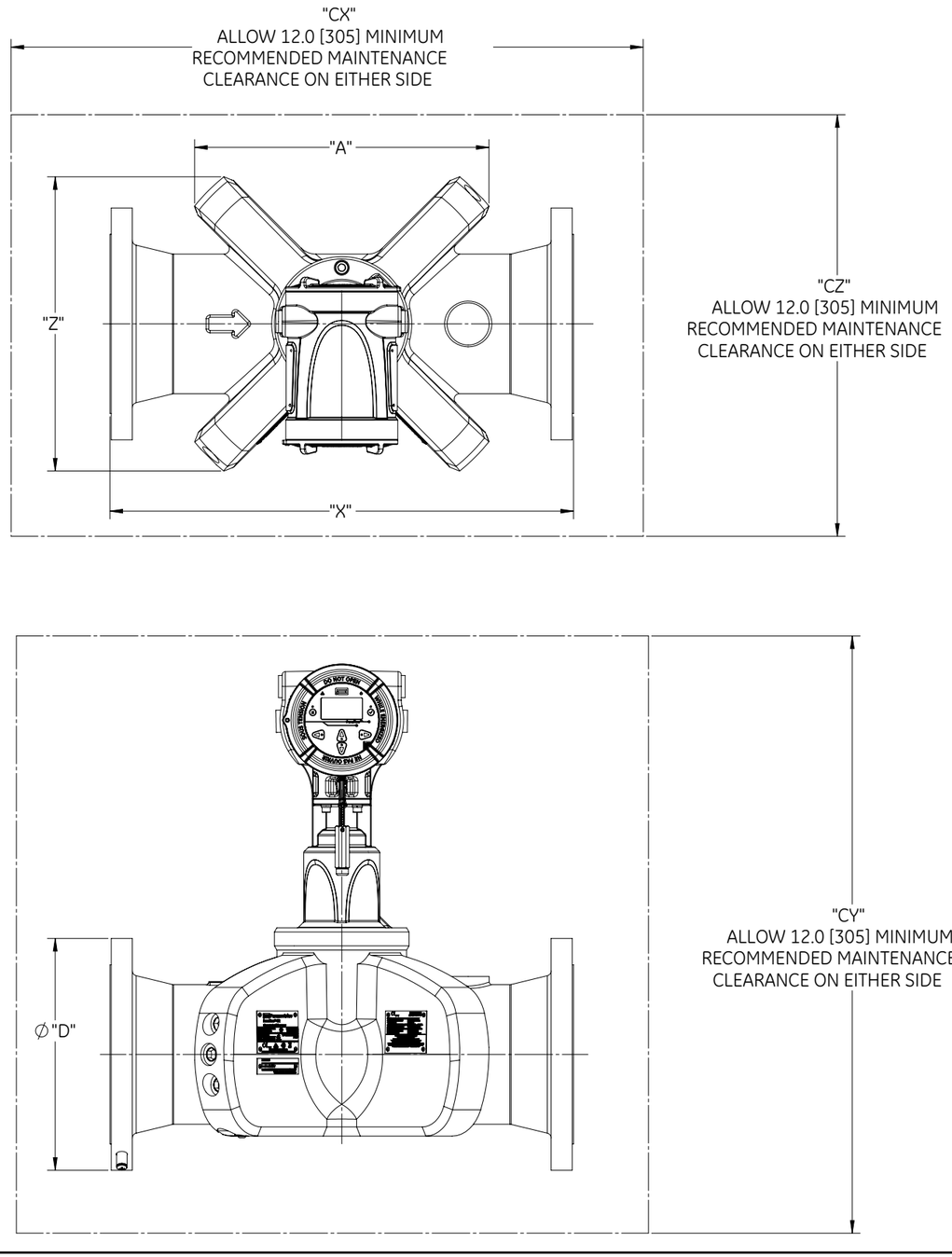
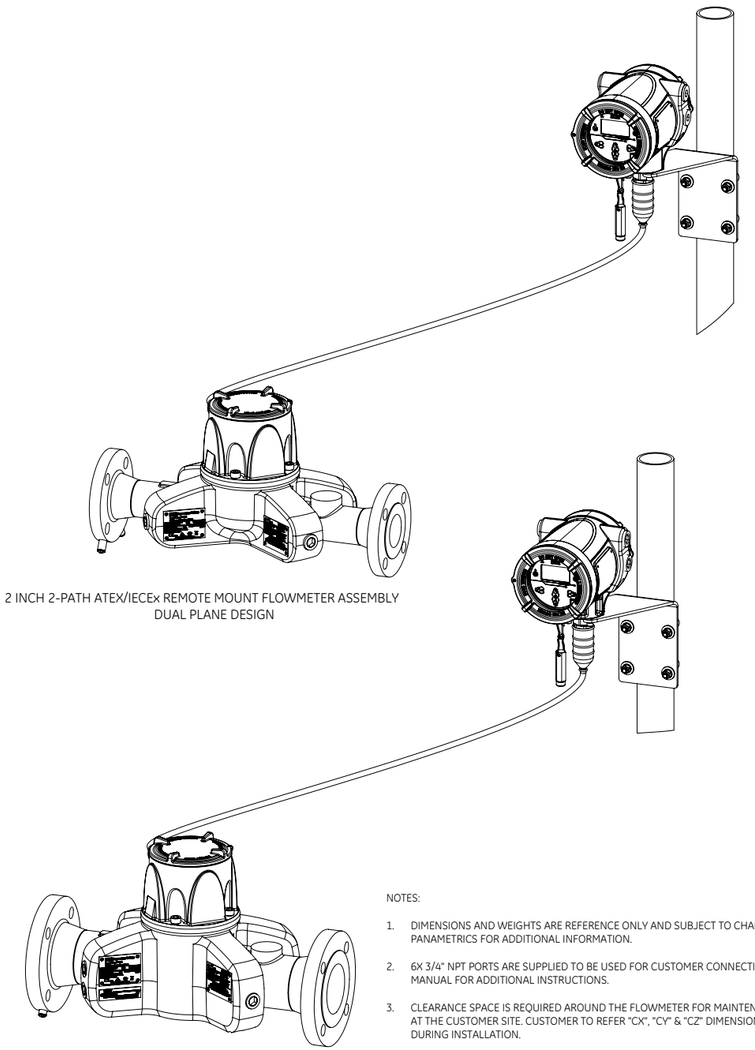


Figure 52: 712-2166 Outline & installation, Z3, 2 – 24-inch flow meter system, local mount

TABLE-1												
SL. NO	PIPE SIZE	FLANGE RATING	A	C	D	X	Y	Z	CX	CY	CZ	APPROX. ASSY WEIGHT.(Kg)
1	2 IN	ASME 150# RF (WN)	12.3 [312]	8 [203]	6 [152]	20 [508]	11 [279]	9.5 [241]	44 [1117]	35 [889]	33.5 [850]	47
2		ASME 300# RF (WN)			6.5 [165]	20 [508]	11.3 [285]		44 [1117]	35.3 [895]		49
3		ASME 600# RF (WN)			6.5 [165]	20 [508]	11.3 [285]		44 [1117]	35.3 [895]		51
4		EN 1092-1/PN 10 (WN/TYPE 11)			6.5 [165]	20 [508]	11.3 [285]		44 [1117]	35.3 [895]		48
5		EN 1092-1/PN 16 (WN/TYPE 11)			6.5 [165]	20 [508]	11.3 [285]		44 [1117]	35.3 [895]		48
6		EN 1092-1/PN 25 (WN/TYPE 11)			6.5 [165]	20 [508]	11.3 [285]		44 [1117]	35.3 [895]		48
7		EN 1092-1/PN 40 (WN/TYPE 11)			6.5 [165]	20 [508]	11.3 [285]		44 [1117]	35.3 [895]		48
8		EN 1092-1/PN 63 (WN/TYPE 11)			7.1 [180]	20 [508]	11.5 [293]		44 [1117]	35.5 [902]		52
9	3 IN	ASME 150# RF (WN)	12.7 [322]	8.9 [224]	7.5 [190]	20 [508]	12.6 [320]	9.8 [247]	44 [1117]	36.6 [929]	33.8 [857]	65
10		ASME 300# RF (WN)			8.3 [209]	20 [508]	13 [329]		44 [1117]	37 [939]		69
11		ASME 600# RF (WN)			8.3 [209]	20 [508]	13 [329]		44 [1117]	37 [939]		71
12		EN 1092-1/PN 10 (WN/TYPE 11)			7.9 [199]	20 [508]	12.8 [324]		44 [1117]	36.8 [934]		63
13		EN 1092-1/PN 16 (WN/TYPE 11)			7.9 [199]	20 [508]	12.8 [324]		44 [1117]	36.8 [934]		63
14		EN 1092-1/PN 25 (WN/TYPE 11)			7.9 [199]	20 [508]	12.8 [324]		44 [1117]	36.8 [934]		64
15		EN 1092-1/PN 40 (WN/TYPE 11)			7.9 [199]	20 [508]	12.8 [324]		44 [1117]	36.8 [934]		64
16		EN 1092-1/PN 63 (WN/TYPE 11)			8.5 [214]	20 [508]	13.1 [332]		44 [1117]	37.1 [941]		68
17	4 IN	ASME 150# RF (WN)	11.7 [297]	9.2 [233]	9 [228]	20 [508]	13.7 [347]	11.7 [297]	44 [1117]	37.7 [957]	35.7 [907]	76
18		ASME 300# RF (WN)			10 [254]	20 [508]	14.2 [360]		44 [1117]	38.2 [970]		85
19		ASME 600# RF (WN)			10.8 [273]	20 [508]	14.6 [370]		44 [1117]	38.6 [979]		96
20		EN 1092-1/PN 10 (WN/TYPE 11)			8.7 [219]	20 [508]	13.5 [343]		44 [1117]	37.5 [953]		72
21		EN 1092-1/PN 16 (WN/TYPE 11)			8.7 [219]	20 [508]	13.5 [343]		44 [1117]	37.5 [953]		76
22		EN 1092-1/PN 25 (WN/TYPE 11)			9.3 [234]	20 [508]	13.8 [351]		44 [1117]	37.8 [960]		76
23		EN 1092-1/PN 40 (WN/TYPE 11)			9.3 [234]	20 [508]	13.8 [351]		44 [1117]	37.8 [960]		76
24		EN 1092-1/PN 63 (WN/TYPE 11)			9.8 [249]	20 [508]	14.1 [358]		44 [1117]	38.1 [968]		81
25	6 IN	ASME 150# RF (WN)	14 [355]	10.4 [262]	11 [279]	22 [558]	15.9 [402]	14.0 [355]	46 [1168]	39.9 [1012]	38 [965]	105
26		ASME 300# RF (WN)			12.5 [317]	24 [609]	16.6 [421]		48 [1219]	40.6 [1031]		125
27		ASME 600# RF (WN)			14 [355]	26 [660]	17.4 [440]		50 [1270]	41.4 [1050]		156
28		EN 1092-1/PN 10 (WN/TYPE 11)			11.2 [284]	22 [558]	16 [405]		46 [1168]	40 [1014]		102
29		EN 1092-1/PN 16 (WN/TYPE 11)			11.2 [284]	22 [558]	16 [405]		46 [1168]	40 [1014]		102
30		EN 1092-1/PN 25 (WN/TYPE 11)			11.8 [299]	24 [609]	16.3 [412]		48 [1219]	40.3 [1022]		111
31		EN 1092-1/PN 40 (WN/TYPE 11)			11.8 [299]	24 [609]	16.3 [412]		48 [1219]	40.3 [1022]		111
32		EN 1092-1/PN 63 (WN/TYPE 11)			13.6 [344]	26 [660]	17.1 [435]		50 [1270]	41.1 [1044]		132
33	8 IN	ASME 150# RF (WN)	15.8 [401]	11.4 [289]	13.5 [342]	26 [660]	18.2 [461]	15.8 [401]	50 [1270]	42.2 [1070]	39.8 [1010]	150
34		ASME 300# RF (WN)			15 [381]	28 [711]	18.9 [480]		52 [1320]	42.9 [1089]		180
35		ASME 600# RF (WN)			16.5 [419]	30 [762]	19.7 [499]		54 [1371]	43.7 [1108]		225
36		EN 1092-1/PN 10 (WN/TYPE 11)			13.4 [340]	26 [660]	18.1 [459]		50 [1270]	42.1 [1069]		141
37		EN 1092-1/PN 16 (WN/TYPE 11)			13.4 [340]	26 [660]	18.1 [459]		50 [1270]	42.1 [1069]		141
38		EN 1092-1/PN 25 (WN/TYPE 11)			14.2 [359]	28 [711]	18.5 [469]		52 [1320]	42.5 [1079]		154
39		EN 1092-1/PN 40 (WN/TYPE 11)			14.8 [374]	28 [711]	18.8 [477]		52 [1320]	42.8 [1086]		162
40		EN 1092-1/PN 63 (WN/TYPE 11)			16.3 [415]	30 [762]	19.6 [497]		54 [1371]	43.6 [1106]		191



2 INCH 2-PATH ATEX/IECEx REMOTE MOUNT FLOWMETER ASSEMBLY
DUAL PLANE DESIGN

3 INCH TO 4 INCH 3-PATH ATEX/IECEx REMOTE
MOUNT FLOWMETER ASSEMBLY
DUAL PLANE DESIGN

NOTES:

1. DIMENSIONS AND WEIGHTS ARE REFERENCE ONLY AND SUBJECT TO CHANGE. CONTACT PANAMETRICS FOR ADDITIONAL INFORMATION.
2. 6X 3/4" NPT PORTS ARE SUPPLIED TO BE USED FOR CUSTOMER CONNECTIONS. REFER TO MANUAL FOR ADDITIONAL INSTRUCTIONS.
3. CLEARANCE SPACE IS REQUIRED AROUND THE FLOWMETER FOR MAINTENANCE PURPOSES AT THE CUSTOMER SITE. CUSTOMER TO REFER "CX", "CY" & "CZ" DIMENSIONS FROM TABLE 1 DURING INSTALLATION.
4. ALL DIMENSIONS ARE IN INCH [MM].
5. WEIGHTS IN TABLE 1 DO NOT INCLUDE CABLE OR TRANSMITTER.
6. FLOWCELL REMOTE MOUNT ADAPTER CONNECTION IS 1X 3/4" NPT AND CABLE CONNECTORS ARE RIGHT ANGLE SMB PLUG. FOR USA AND CANADA SYSTEMS CUSTOMER IS RESPONCIBLE FOR SUPPLYING RIGID CONDUIT AND CONDUIT SEALS IN ACCORDANCE WITH APPLICABLE LOCAL SAFETY STANDARDS.
7. TRANSMITTER HEAD BOTTOM CONNECTION FOR TRANSDUCER CABLES IS 1/2" NPT WITH A 1/2" TO 3/4" ADAPTER PROVIDED. CABLE CONNECTORS ARE RIGHT ANGLE MCX PLUG. FOR USA AND CANADA SYSTEMS CUSTOMER IS RESPONCIBLE FOR SUPPLYING RIGID CONDUIT AND CONDUIT SEALS IN ACCORDANCE WITH APPLICABLE LOCAL SAFETY STANDARDS.

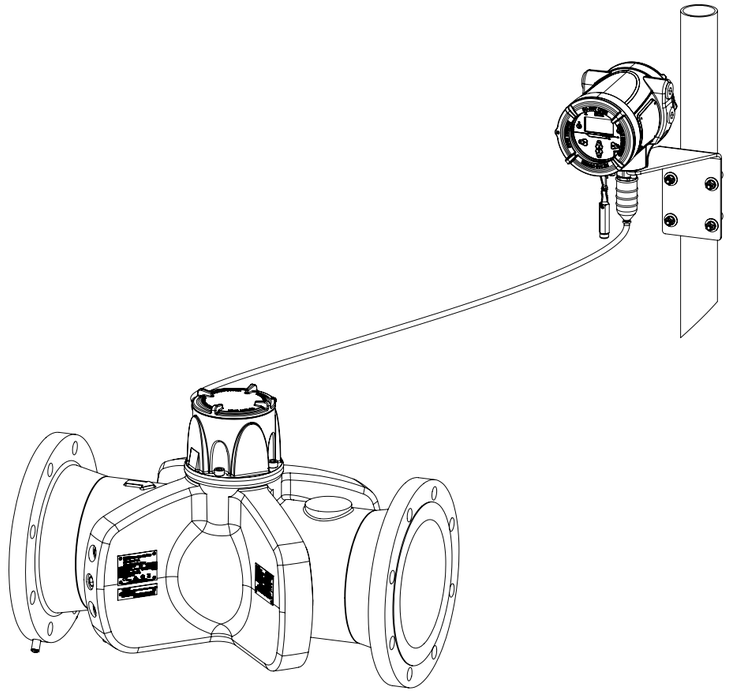
Figure 53: 712-2167 Outline & installation, Z3, 2 – 24-inch flow meter system, remote mount

TABLE-1 (CONT..)

SL. NO	PIPE SIZE	FLANGE RATING	A	C	D	X	Y	Z	CX	CY	CZ	APPROX. ASSY WEIGHT.(Kg)
41	10 IN	ASME 150# RF (WN)	19.4 [493]	12.6 [321]	16 [406]	28 [711]	20.6 [524]	19.4 [493]	52 [1320]	44.6 [1133]	43.4 [1102]	231
42		ASME 300# RF (WN)			17.5 [444]	30 [762]	21.4 [543]		54 [1371]	45.4 [1152]		274
43		ASME 600# RF (WN)			20 [508]	32 [812]	22.6 [575]		56 [1422]	46.6 [1184]		360
44		EN 1092-1/PN 10 (WN/TYPE 11)			15.6 [394]	28 [711]	20.4 [518]		52 [1320]	44.4 [1128]		220
45		EN 1092-1/PN 16 (WN/TYPE 11)			15.9 [404]	28 [711]	20.6 [523]		52 [1320]	44.6 [1133]		222
46		EN 1092-1/PN 25 (WN/TYPE 11)			16.7 [424]	30 [762]	21 [533]		54 [1371]	45 [1143]		240
47		EN 1092-1/PN 40 (WN/TYPE 11)			17.7 [450]	30 [762]	21.5 [546]		54 [1371]	45.5 [1155]		260
48		EN 1092-1/PN 63 (WN/TYPE 11)			18.5 [469]	32 [812]	21.9 [556]		56 [1422]	45.9 [1165]		289
49	12 IN	ASME 150# RF (WN)	21.3 [540]	13.6 [346]	19 [482]	30 [762]	23.1 [587]	21.3 [540]	54 [1371]	47.1 [1197]	45.3 [1149]	306
50		ASME 300# RF (WN)			20.5 [520]	32 [812]	23.9 [606]		56 [1422]	47.9 [1216]		363
51		ASME 600# RF (WN)			22 [558]	36 [914]	24.6 [625]		60 [1524]	48.6 [1235]		460
52		EN 1092-1/PN 10 (WN/TYPE 11)			17.5 [445]	30 [762]	22.4 [568]		54 [1371]	46.4 [1178]		275
53		EN 1092-1/PN 16 (WN/TYPE 11)			18.1 [459]	30 [762]	22.7 [576]		54 [1371]	46.7 [1186]		282
54		EN 1092-1/PN 25 (WN/TYPE 11)			19.1 [484]	32 [812]	23.2 [588]		56 [1422]	47.2 [1198]		306
55		EN 1092-1/PN 40 (WN/TYPE 11)			20.3 [515]	32 [812]	23.8 [604]		56 [1422]	47.8 [1213]		336
56		EN 1092-1/PN 63 (WN/TYPE 11)			20.9 [530]	36 [914]	24.1 [611]		60 [1524]	48.1 [1221]		382
57	14 IN	ASME 150# RF (WN)	22.8 [577]	14.4 [365]	21 [533]	36 [914]	24.9 [632]	22.8 [577]	60 [1524]	48.9 [1241]	46.8 [1187]	392
58		ASME 300# RF (WN)			23 [584]	38 [965]	25.9 [657]		62 [1574]	49.9 [1267]		476
59		ASME 600# RF (WN)			23.8 [603]	40 [1016]	26.3 [667]		64 [1625]	50.3 [1276]		547
60		EN 1092-1/PN 10 (WN/TYPE 11)			19.9 [504]	36 [914]	24.3 [617]		60 [1524]	48.3 [1227]		354
61		EN 1092-1/PN 16 (WN/TYPE 11)			20.5 [519]	36 [914]	24.6 [625]		60 [1524]	48.6 [1235]		365
62		EN 1092-1/PN 25 (WN/TYPE 11)			21.9 [554]	38 [965]	25.3 [643]		62 [1574]	49.3 [1252]		406
63		EN 1092-1/PN 40 (WN/TYPE 11)			22.8 [579]	38 [965]	25.8 [655]		62 [1574]	49.8 [1265]		443
64		EN 1092-1/PN 63 (WN/TYPE 11)			23.6 [599]	40 [1016]	26.2 [665]		64 [1625]	50.2 [1275]		497
65	16 IN	ASME 150# RF (WN)	24.2 [615]	16.7 [423]	23.5 [596]	38 [965]	28.4 [722]	24.2 [615]	62 [1574]	52.4 [1331]	48.2 [1225]	494
66		ASME 300# RF (WN)			25.5 [647]	40 [1016]	29.4 [747]		64 [1625]	53.4 [1357]		598
67		ASME 600# RF (WN)			27 [685]	42 [1066]	30.2 [766]		66 [1676]	54.2 [1376]		724
68		EN 1092-1/PN 10 (WN/TYPE 11)			22.2 [564]	38 [965]	27.8 [706]		62 [1574]	51.8 [1315]		443
69		EN 1092-1/PN 16 (WN/TYPE 11)			22.8 [579]	38 [965]	28.1 [713]		62 [1574]	52.1 [1323]		462
70		EN 1092-1/PN 25 (WN/TYPE 11)			24.4 [620]	40 [1016]	28.9 [733]		64 [1625]	52.9 [1343]		514
71		EN 1092-1/PN 40 (WN/TYPE 11)			26.0 [659]	40 [1016]	29.7 [753]		64 [1625]	53.7 [1363]		577
72		EN 1092-1/PN 63 (WN/TYPE 11)			26.4 [670]	42 [1066]	29.9 [758]		66 [1676]	53.9 [1368]		636
73	18 IN	ASME 150# RF (WN)	26.8 [679]	18.4 [467]	25 [635]	38 [965]	30.9 [784]	26.8 [679]	62 [1574]	54.9 [1394]	50.8 [1289]	597
74		ASME 300# RF (WN)			28 [711]	40 [1016]	32.4 [822]		64 [1625]	56.4 [1432]		712
75		ASME 600# RF (WN)			29.3 [742]	44 [1117]	33 [838]		68 [1727]	57 [1448]		871
76		EN 1092-1/PN 10 (WN/TYPE 11)			24.2 [614]	38 [965]	30.5 [774]		62 [1574]	54.5 [1384]		541
77		EN 1092-1/PN 16 (WN/TYPE 11)			25.2 [640]	38 [965]	31 [787]		62 [1574]	55 [1397]		566
78		EN 1092-1/PN 25 (WN/TYPE 11)			26.4 [670]	40 [1016]	31.6 [802]		64 [1625]	55.6 [1411]		630
79		EN 1092-1/PN 40 (WN/TYPE 11)			27.0 [685]	40 [1016]	31.9 [809]		64 [1625]	55.9 [1419]		675

TABLE-1 (CONT..)

SL. NO	PIPE SIZE	FLANGE RATING	A	C	D	X	Y	Z	CX	CY	CZ	APPROX. ASSY WEIGHT.(Kg)
80	20 IN	ASME 150# RF (WN)	29.1 [740]	18.7 [473]	27.5 [698]	46 [1168]	32.4 [822]	29.1 [740]	70 [1778]	56.4 [1432]	53.1 [1349]	734
81		ASME 300# RF (WN)			30.5 [774]	48 [1219]	33.9 [861]		72 [1828]	57.9 [1470]		9.2
82		ASME 600# RF (WN)			32 [812]	50 [1270]	34.7 [880]		74 [1879]	58.7 [1489]		1092
83		EN 1092-1/PN 10 (WN/TYPE 11)			26.4 [670]	46 [1168]	31.8 [808]		70 [1778]	55.8 [1418]		663
84		EN 1092-1/PN 16 (WN/TYPE 11)			28.2 [715]	46 [1168]	32.7 [831]		70 [1778]	56.7 [1440]		707
85		EN 1092-1/PN 25 (WN/TYPE 11)			28.7 [729]	48 [1219]	33 [838]		72 [1828]	57 [1448]		779
86		EN 1092-1/PN 40 (WN/TYPE 11)			29.7 [754]	48 [1219]	33.5 [851]		72 [1828]	57.5 [1460]		832
87	24 IN	ASME 150# RF (WN)	32.8 [832]	20.5 [521]	32 [812]	48 [1219]	36.5 [927]	32.8 [832]	72 [1828]	60.5 [1537]	56.8 [1442]	1005
88		ASME 300# RF (WN)			36 [914]	50 [1270]	38.5 [978]		74 [1879]	62.5 [1588]		1262
89		ASME 600# RF (WN)			37 [939]	52 [1320]	39 [991]		76 [1930]	63 [1600]		1517
90		EN 1092-1/PN 10 (WN/TYPE 11)			30.7 [780]	48 [1219]	35.9 [911]		72 [1828]	59.9 [1520]		900
91		EN 1092-1/PN 16 (WN/TYPE 11)			33.1 [839]	48 [1219]	37.1 [941]		72 [1828]	61.1 [1550]		979
92		EN 1092-1/PN 25 (WN/TYPE 11)			33.3 [845]	50 [1270]	37.2 [943]		74 [1879]	61.2 [1553]		1044
93		EN 1092-1/PN 40 (WN/TYPE 11)			35 [890]	50 [1270]	38 [966]		74 [1879]	62 [1575]		1200



6 INCH TO 24 INCH 3-PATH ATEX/IECEx REMOTE MOUNT FLOWMETER ASSEMBLY SINGLE PLANE DESIGN

Figure 1: 712-2167 Outline & installation, Z3, 2 – 24-inch flow meter system, remote mount

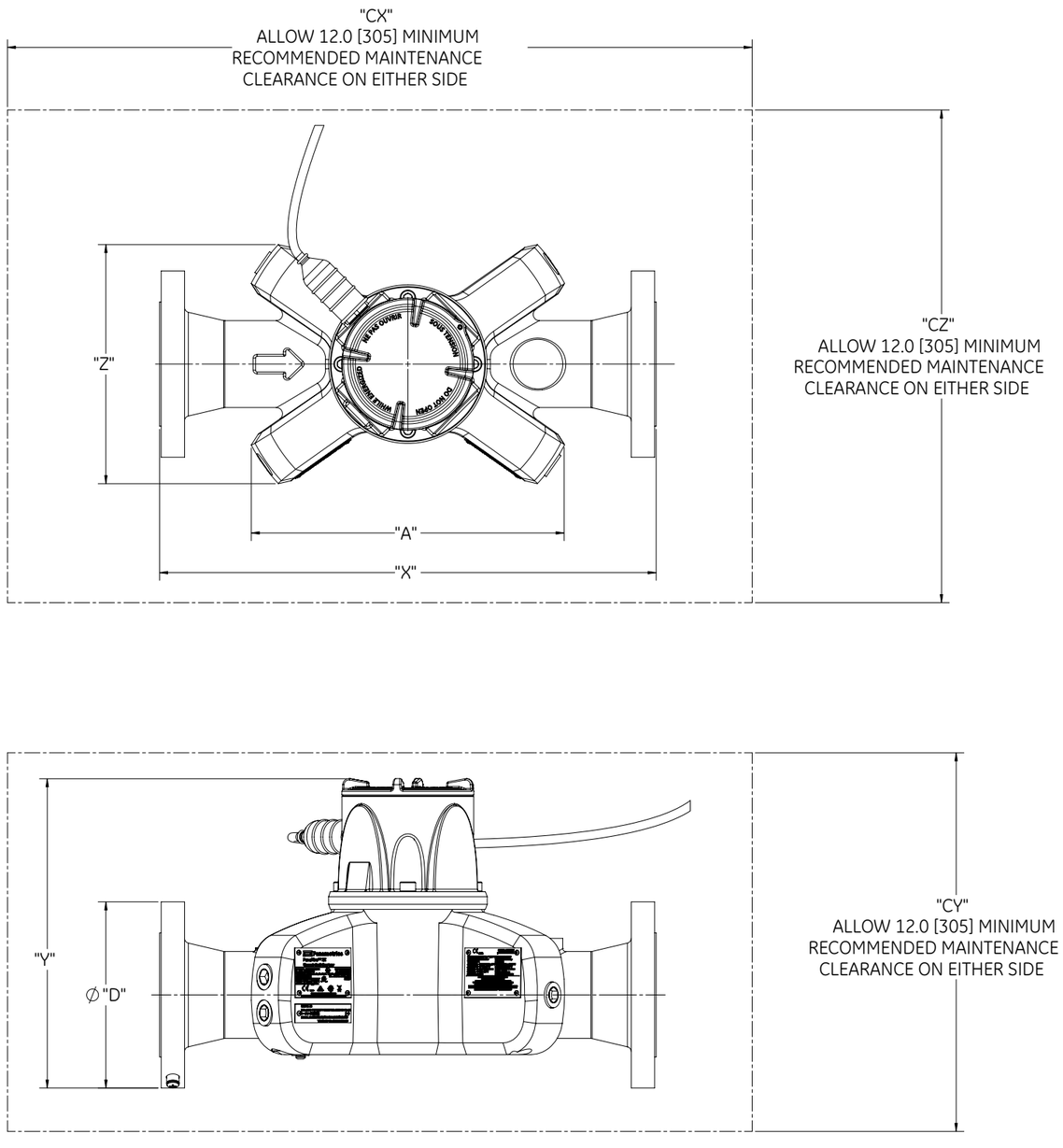


Figure 1: 712-2167 Outline & installation, Z3, 2 – 24-inch flow meter system, remote mount

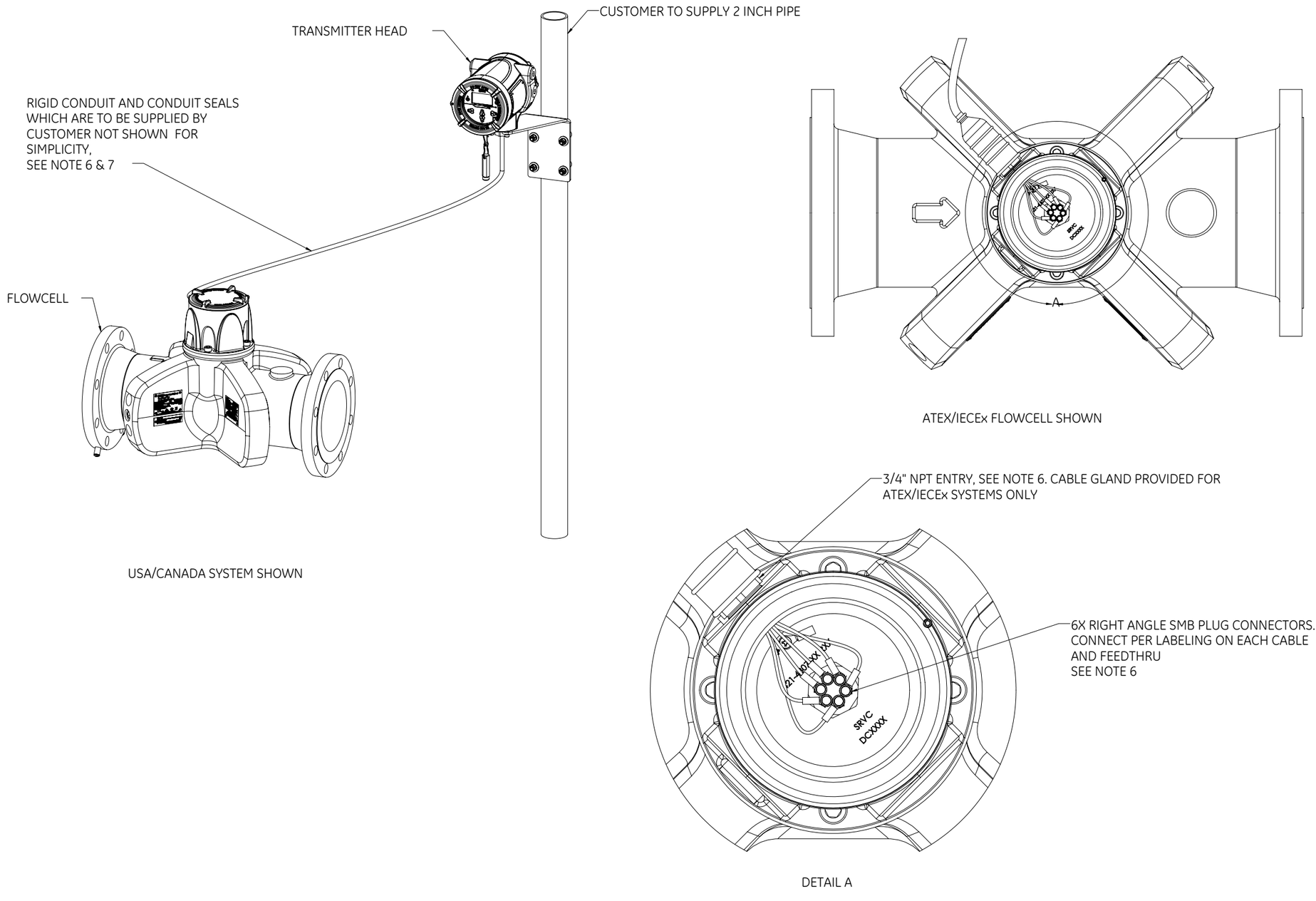
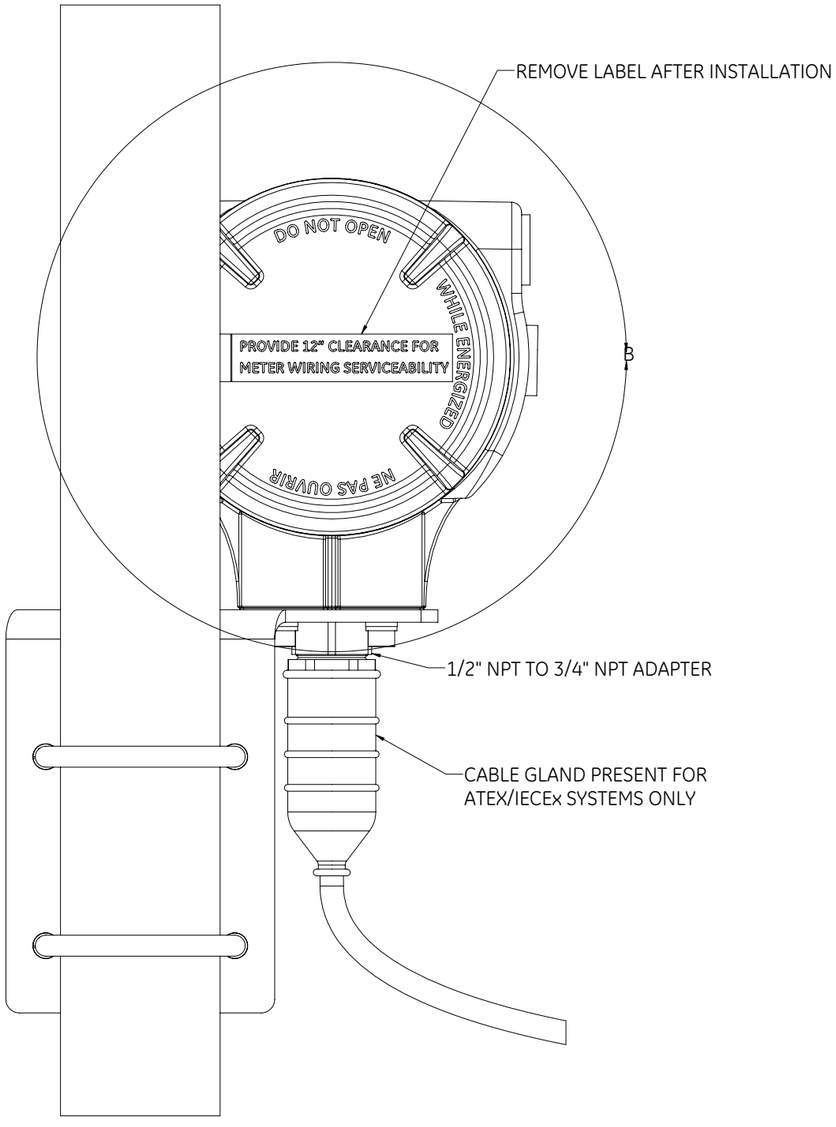
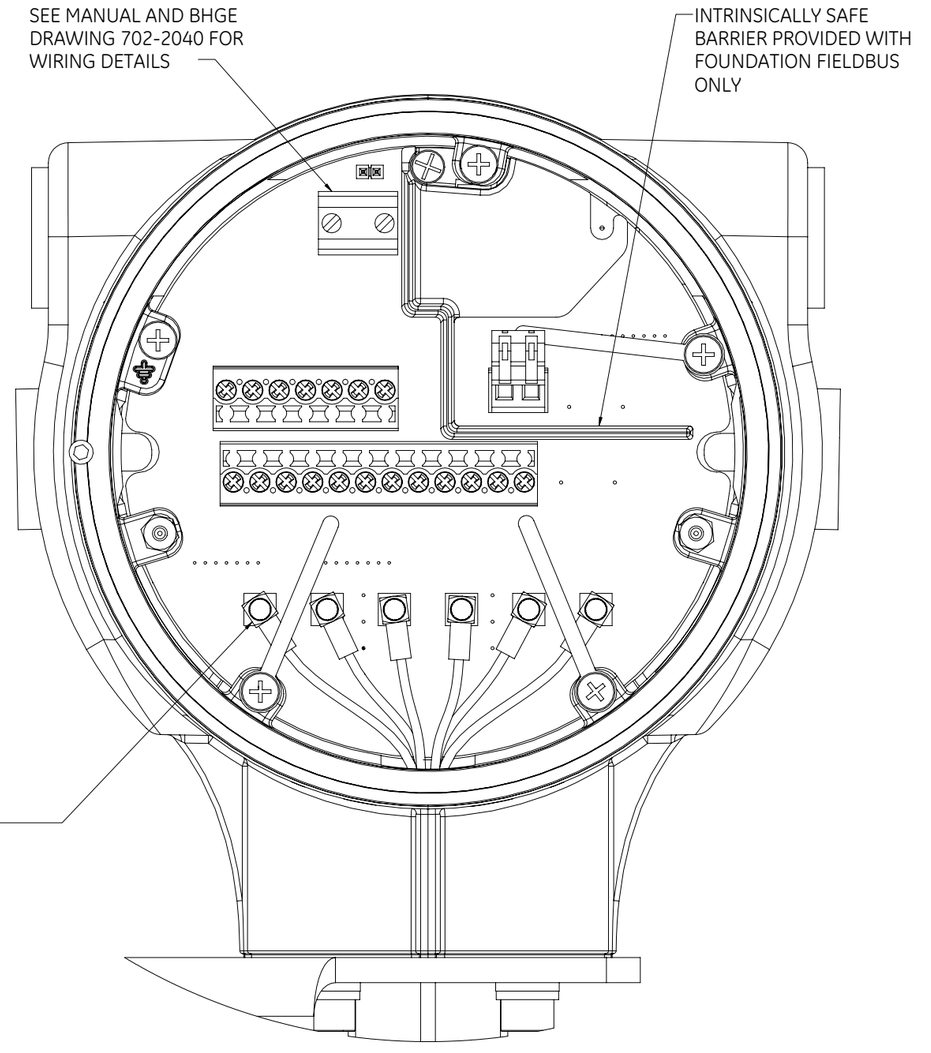


Figure 1: 712-2167 Outline & installation, Z3, 2 – 24-inch flow meter system, remote mount



TRANSMITTER HEAD
ASSEMBLY ~14 KG



DETAIL B

Figure 1: 712-2167 Outline & installation, Z3, 2 – 24-inch flow meter system, remote mount

Appendix B. Data Records

B.1 Electronics

B.1.1 Data Entry

Record complete and detailed service data for the PanaFlow Z3 in *Table 25* below. Make additional copies of the table as needed.

Table 25: Service Record

Date	Description of Service	Performed By

Table 25: Service Record (cont.)

Date	Description of Service	Performed By

B.2 Initial Settings

The values for the initial measurement settings immediately after initial installation of the meter and verification of proper operation should be entered in *Table 26* below.

Table 26: Initial Settings

Parameter	Initial Value
Velocity	
Volumetric	
Mass Flow	
Forward Batch Totals	
Reverse Batch Totals	
Totalizer Time	
Sound Speed	
Current Correction Factor	
Current Reynolds Number	
Current Operating Temperature	
Standard Volumetric	
Net Batch Totals	
Inventory Forward	
Inventory Reverse	
Inventory Net	
Inventory Time	
Channel 1 Velocity	
Channel 1 Sound Speed	
Channel 1 Transit Time Up	
Channel 1 Transit Time Down	
Channel 1 Delta T	
Channel 1 Up Signal Quality	
Channel 1 Down Signal Quality	
Channel 1 Up Amp Disc	
Channel 1 Down Amp Disc	
Channel 1 SNR on Up	
Channel 1 SNR on Down	
Channel 1 Time in Buffer on Up	
Channel 1 Time in Buffer on Down	
Channel 1 Signal Gain Up	
Channel 1 Signal Gain Down	
Channel 1 Up Peak	
Channel 1 Down Peak	
Channel 1 Dynamic Threshold Up	
Channel 1 Dynamic Threshold Down	
Channel 2 Velocity	
Channel 2 Sound Speed	
Channel 2 Transit Time Up	
Channel 2 Transit Time Down	

Table 26: Initial Settings (cont.)

Parameter	Initial Value
Channel 2 Delta T	
Channel 2 Up Signal Quality	
Channel 2 Down Signal Quality	
Channel 2 Up Amp Disc	
Channel 2 Down Amp Disc	
Channel 2 SNR on Up	
Channel 2 SNR on Down	
Channel 2 Time in Buffer on Up	
Channel 2 Time in Buffer on Down	
Channel 2 Signal Gain Up	
Channel 2 Signal Gain Down	
Channel 2 Up Peak	
Channel 2 Down Peak	
Channel 2 Dynamic Threshold Up	
Channel 2 Dynamic Threshold Down	
Channel 3 Velocity	
Channel 3 Sound Speed	
Channel 3 Transit Time Up	
Channel 3 Transit Time Down	
Channel 3 Delta T	
Channel 3 Up Signal Quality	
Channel 3 Down Signal Quality	
Channel 3 Up Amp Disc	
Channel 3 Down Amp Disc	
Channel 3 SNR on Up	
Channel 3 SNR on Down	
Channel 3 Time in Buffer on Up	
Channel 3 Time in Buffer on Down	
Channel 3 Signal Gain Up	
Channel 3 Signal Gain Down	
Channel 3 Up Peak	
Channel 3 Down Peak	
Channel 3 Dynamic Threshold Up	
Channel 3 Dynamic Threshold Down	

B.3 Diagnostic Parameters

The values for the diagnostic parameters immediately after initial installation of the meter and verification of proper operation should be entered in *Table 27* below. These initial values can then be compared to current values to help diagnose any future malfunction of the system.

Table 27: Diagnostic Parameters

Parameter	Channel 1		Channel 2		Channel 3	
	Initial	Current	Initial	Current	Initial	Current
Velocity						
Soundspeed						
Transit Time Dn						
Transit Time Up						
Delta T						
Up Signal Quality						
Dn Signal Quality						
Up Amp Disc						
Dn Amp Disc						
SNR Up						
SNR Dn						
Active TWup						
Active TWdn						
Gainup						
Gaindn						
Error Status						
Report Error						
Peak Up						
Peak Dn						
Peak% Up						
Peak% Dn						
Error						

[no content intended for this page]

Appendix C. Modbus Map

C.1 Input Registers Map

					Composite Register Address		Channel 1 Register Address		Channel 2 Register Address		Channel 3 Register Address	
Category	Measurement	Type	Number of Registers	Format	In Decimal	In Hex	In Decimal	In Hex	In Decimal	In Hex	In Decimal	In Hex
Primary Measurements	Velocity	F	2	Float	33280	0x8200	34352	0x8630	35376	0x8A30	36400	0x8E30
	Volumetric	F	2	Float	33282	0x8202	34350	0x862E	35374	0x8A2E	36398	0x8E2E
	Std Volumetric	F	2	Float	33306	0x821A	34392	0x8658	35416	0x8A58	36440	0x8E58
	Mass flow	F	2	Float	33284	0x8204	34354	0x8632	35378	0x8A32	36402	0x8E32
	Avg Volumetric Flow Rate	F	2	Float	33340	0x823C	34400	0x8660	35424	0x8A60	36448	0x8E60
Flow Totals	Forward Volumetric Totals	F	2	Float	33286	0x8206	34356	0x8634	35380	0x8A34	36404	0x8E34
	Reverse Volumetric Totals	F	2	Float	33288	0x8208	34358	0x8636	35382	0x8A36	36406	0x8E36
	Net Volumetric Totals	F	2	Float	33308	0x821C	34364	0x863C	35388	0x8A3C	36412	0x8E3C
	Fwd Std Volumetric Totals	F	2	Float	33332	0x8234	34394	0x865A	35418	0x8A5A	36442	0x8E5A
	Rev Std Volumetric Totals	F	2	Float	33334	0x8236	34396	0x865C	35420	0x8A5C	36444	0x8E5C
	Net Std Volumetric Totals	F	2	Float	33336	0x8238	34398	0x865E	35422	0x8A5E	36446	0x8E5E
	Forward Mass Totals	F	2	Float	33318	0x8226	34368	0x8640	35392	0x8A40	36416	0x8E40
	Reverse Mass Totals	F	2	Float	33320	0x8228	34370	0x8642	35394	0x8A42	36418	0x8E42
	Net Mass Totals	F	2	Float	33326	0x822E	34376	0x8648	35400	0x8A48	36424	0x8E48
	Elapsed Total Time	F	2	Float	33290	0x820A	34384	0x8650	35408	0x8A50	36432	0x8E50
Primary Diagnostics	Soundspeed	F	2	Float	33292	0x820C	34306	0x8602	35330	0x8A02	36354	0x8E02
	Raw Velocity	F	2	Float	33338	0x823A	34304	0x8600	35328	0x8A00	36352	0x8E00
	Transit Time Up	F	2	Float	Not Applicable		34308	0x8604	35332	0x8A04	36356	0x8E04
	Transit Time Down	F	2	Float			34310	0x8606	35334	0x8A06	36358	0x8E06
	DeltaT	F	2	Float			34312	0x8608	35336	0x8A08	36360	0x8E08
	Active Tw Up	F	2	Float			34332	0x861C	35356	0x8A1C	36380	0x8E1C
	Active Tw Down	F	2	Float			34314	0x860A	35338	0x8A0A	36362	0x8E0A
Transit Time Diagnostics	Gain Up[dB]	F	2	Float	Not Applicable		34324	0x8614	35348	0x8A14	36372	0x8E14
	Gain Down[dB]	F	2	Float			34326	0x8616	35350	0x8A16	36374	0x8E16
	SNR Up	F	2	Float			34328	0x8618	35352	0x8A18	36376	0x8E18
	SNR Down	F	2	Float			34330	0x861A	35354	0x8A1A	36378	0x8E1A
	Amplitude Up	F	2	Float			34320	0x8610	35344	0x8A10	36368	0x8E10
	Amplitude Down	F	2	Float			34322	0x8612	35346	0x8A12	36370	0x8E12
	Gain Std.Dev	F	2	Float			34388	0x8654	35412	0x8A54	36436	0x8E54
	Soundspeed Std. Dev	F	2	Float	33330	0x8232	Not Applicable					
	Peak Up	I	2	Integer	Not Applicable		34564	0x8704	35588	0x8B04	36612	0x8F04
	Peak Down	I	2	Integer			34566	0x8706	35590	0x8B06	36614	0x8F06
	Peak % Up	I	2	Integer			34568	0x8708	35592	0x8B08	36616	0x8F08
	Peak % Down	I	2	Integer			34570	0x870A	35594	0x8B0A	36618	0x8F0A
Active Tw Diagnostics	Active Tw Gain Up[dB]	F	2	Float	Not Applicable		34342	0x8626	35366	0x8A26	36390	0x8E26
	Active Tw Gain Down[dB]	F	2	Float			34344	0x8628	35368	0x8A28	36392	0x8E28
	Active Tw SNR Up	F	2	Float			34334	0x861E	35358	0x8A1E	36382	0x8E1E
	Active Tw SNR Down	F	2	Float			34336	0x8620	35360	0x8A20	36384	0x8E20
	Active Tw Amplitude Up	F	2	Float			34338	0x8622	35362	0x8A22	36386	0x8E22
	Active Tw Amplitude Down	F	2	Float			34340	0x8624	35364	0x8A24	36388	0x8E24
	Active Tw Peak Up	I	2	Integer			34574	0x870E	35598	0x8B0E	36622	0x8F0E
	Active Tw Peak Down	I	2	Integer			34576	0x8710	35600	0x8B10	36624	0x8F10
	Active Tw Peak % Up	I	2	Integer			34578	0x8712	35602	0x8B12	36626	0x8F12
	Active Tw Peak % Down	I	2	Integer			34580	0x8714	35604	0x8B14	36628	0x8F14
Factors	Reynolds #	F	2	Float	33316	0x8224	Not Applicable					
	Reynolds Factor	F	2	Float	33302	0x8216	Not Applicable					
	Calibration Factor	F	2	Float	33300	0x8214	34348	0x862C	35372	0x8A2C	36396	0x8E2C
Inputs	Fluid Temperature Input	F	2	Float	16900	0x4204	Not Applicable					
	Supply Temperature Input	F	2	Float	16902	0x4206						
	Return Temperature Input	F	2	Float	16904	0x4208						
	Pressure Input	F	2	Float	16906	0x420A						
	Density Input	F	2	Float	16898	0x4202						
Meter Health Indicators	Flow Health Code	B	2	Unsigned integer - Bit field	33536	0x8300	34560	0x8700	35584	0x8B00	36608	0x8F00
	Prioritized Flow Error	I	2	Unsigned integer	33540	0x8304	34562	0x8702	35586	0x8B02	36610	0x8F02
	System Health Code	B	2	Unsigned integer - Bit field	33538	0x8302	Not Applicable					
Comm Settings	Baud Rate	I	2	Unsigned	1408	0x0580	Not Applicable					
	Parity	I	2	Unsigned integer	1410	0x0582						
	Stop Bits	I	2	Unsigned integer	1412	0x0584						
	Meter Addr	I	2	Unsigned integer	1414	0x0586						

Note: *Most Modbus Masters add an offset of 1 to the actual register addresses.*
For Example: Meter Modbus address = 0x8200, Address to input in the Modbus master application = 0x8201

Appendix D. CE Mark Compliance

D.1 Introduction

For CE Mark compliance, the PanaFlow Z3 flow meter must be wired in accordance with the instructions in this appendix.

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

D.2 Wiring

The PanaFlow Z3 must be wired with the recommended cable, and all connections must be properly shielded and grounded. Refer to *Table 28* below for the specific requirements.

Table 28: Wiring Requirements

Connection	Cable Type	Ground Termination
Transducer	Armored Bundled RG-316 provided by Panametrics	Grounded using a cable gland.
Input/Output	Armored 22 AWG shielded (e.g. Baystate #78-1197) with armored material added to outside of jacket	Grounded using a cable gland.
Power	Armored 14 AWG 3 conductor	Grounded using a cable gland.

Note: *If the PanaFlow Z3 is wired as described in this appendix, the unit will comply with the EMC Directive.*

[no content intended for this page]

Warranty

Each instrument manufactured by Panametrics flow meter from Baker Hughes company 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 & Panametrics Flow meter. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If Panametrics & Panametrics Flow meter determines that the equipment was defective, the warranty period is:

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

If Panametrics & Panametrics Flow meter 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 & Panametrics Flow meter, the repairs are not covered under this warranty.

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

Return Policy

If a Panametrics & Panametrics Flow meter 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 & Panametrics Flow meter will issue a RETURN AUTHORIZATION NUMBER (RAN), and shipping instructions for the return of the instrument to a service center will be provided.
2. If Panametrics & Panametrics Flow meter 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 & Panametrics Flow meter 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 & Panametrics Flow meter 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]

Certification and Safety Statements for PF10-Zx Ultrasonic Flowmeter up to 3750/3750 psig

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

- The end user must ensure that any cable and cable entry devices used with the equipment are suitable for use at temperatures above 90°C.
- Where meter head has potential for exposure to direct sunlight at high end of ambient temperature specifications, a sunshade should be installed.
- Connecting cables shall be mounted securely and protected from mechanical damage, pulling and twisting.
- Cable entries are ¾" NPT, 6X in local mount configuration and 1x in remote mount configuration.
- For USA/CAN certification, process fluid shall be limited to 3705 psig.
- Cable glands of an approved flameproof design are required. These must be installed according to the manufacturer's instructions. Where the cable glands are provided by Panametrics, the manufacturer's instructions, as supplied to Panametrics, will be included in the documentation.
- The system is covered by the certificate numbers as shown on the labels on the following page. The system temperature code is dependent upon the maximum process fluid temperature range.
- Unused entries must be sealed using a suitably certified threaded plug. Teflon tape or other sealing compounds are required when installing NPT threads.
- Modifications to the flameproof enclosure are not permitted.
- The apparatus should be de-energized before opening.
- Installation shall be in accordance with the installation instructions and the National Electrical Code® ANSI/ NFPA 70, the Canadian Electrical Code C22.1, or IEC/EN 60079-14, as applicable.
- The product contains no exposed parts which produce surface temperature infrared, electromagnetic ionizing, or non-electrical dangers.
- The product must not be subjected to mechanical or thermal stresses in excess of those permitted in the certification documentation and the instruction manual.
- The product cannot be repaired by the user; it must be replaced by an equivalent certified product. Repairs should only be carried out by the manufacturer or by an approved repairer.
- Only trained, competent personnel may install, operate, and maintain the equipment.
- The product is an electrical apparatus and must be installed in the hazardous area in accordance with the requirements of the EC Type Examination Certificate. The installation must be carried out in accordance with all the appropriate international, national and local standard codes and practices and site regulations for flameproof apparatus and in accordance with the instructions contained in the manual. Access to the circuitry must not be made during operation.
- For local mount configuration, the maximum process temperature shall be 95°C for meters with Hart or Foundation Fieldbus and IO Cards present. For meters with only Hart or Foundation Fieldbus and no IO Card present, maximum process temperature shall be 150°C. Maximum ambient temperature for local mount shall be 60°C for meters with Foundation Fieldbus and 65°C for all other configurations.

Special Conditions for Safe Use

- Contact the manufacturer if dimensional information of flameproof joints is needed.

- Field connections to the XMT1000 (e.g. ultrasonic transducers, accessories, or similar peripherals) shall be appropriately certified for the location and installed in accordance with wiring method requirements of the local electrical code as applicable.
- Follow the manufacturer's instructions to reduce the potential of an electrostatic charging hazard.
- It is end-user's responsibility to ensure that the ambient around the equipment does not exceed the permitted ambient of +60°C/+65°C.
- Only approved certified entry devices shall be used.
- The end user must ensure that any cable and cable entry devices used with the equipment are suitable for use at temperatures above 90°C.
- The end user is to ensure appropriate earthing upon installation.
- The temperature code rating of the PanaFlow™ PF10 Ultrasonic Liquid Flow Meter local mount and remote mount is dependent on the maximum process temperature (see tables below):

For ATEX/IEC

Maximum Process	Maximum Workig	Temperature Class
80°C	1500 psig - low pressure version	T6
95°C		T5
130°C	3750 psig - high pressure version	T4
150°C		T3

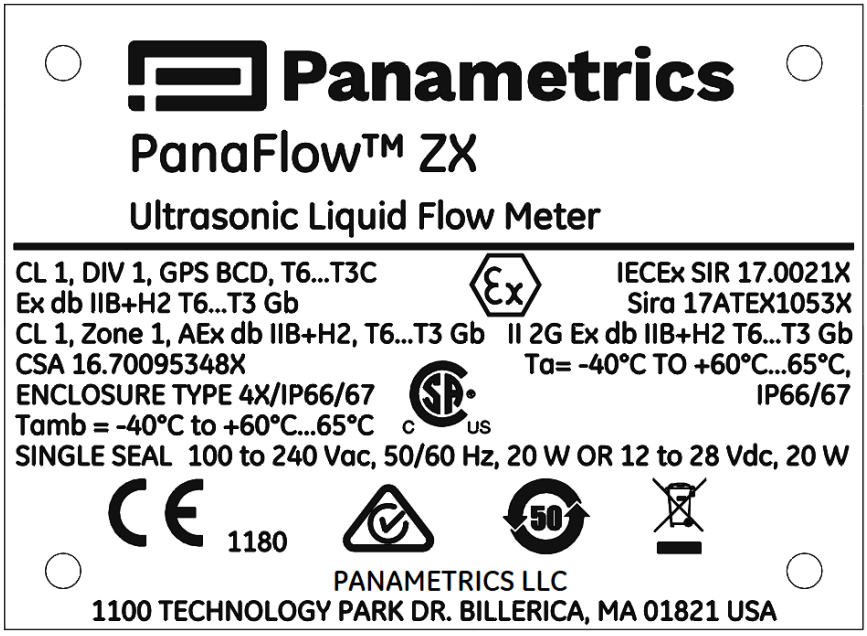
For USA/CANADA

Maximum Process	Maximum Workig	Temperature Class
80°C	1500 psig - low pressure version	T6
95°C		T5
115°C	3750 psig - high pressure version	T4A
130°C		T4
150°C		T3C or T3

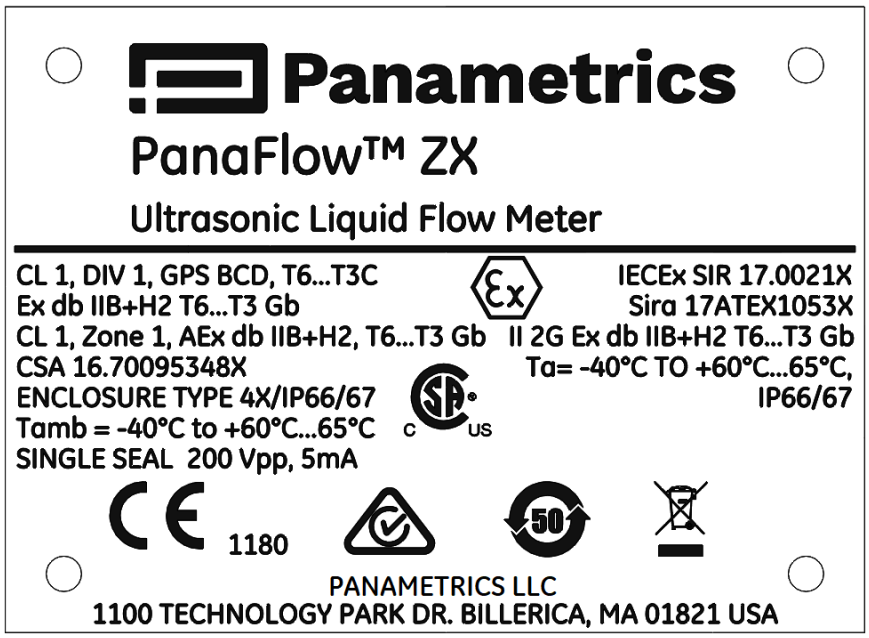
Markings

Markings applicable to system certification shall appear on the flowcell, as shown below:

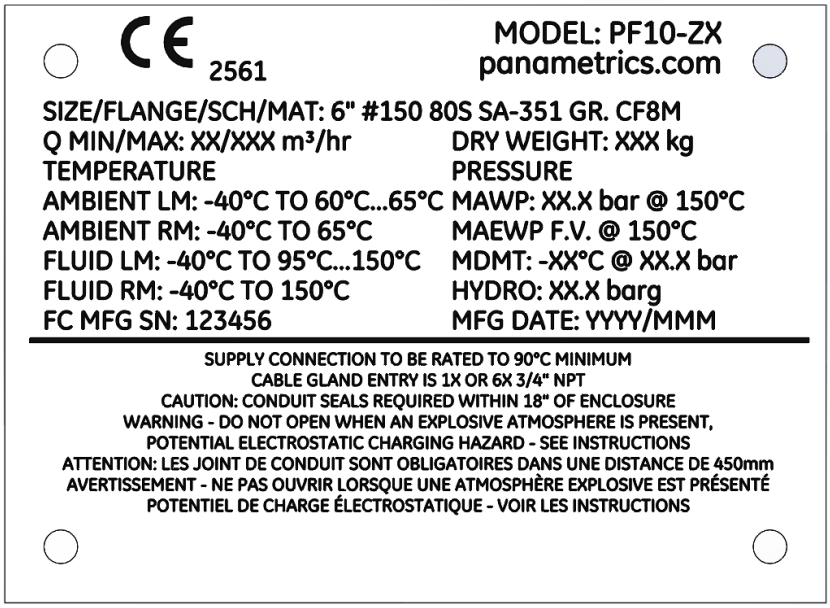
LOCAL MOUNT CERTIFICATION TAG



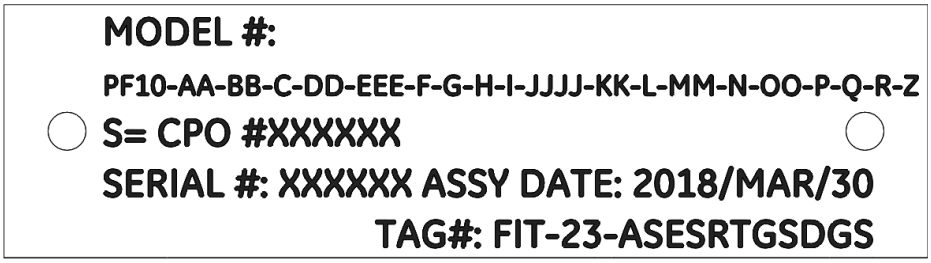
REMOTE MOUNT CERTIFICATION TAG



FLOWCELL SPECIFICATION TAG

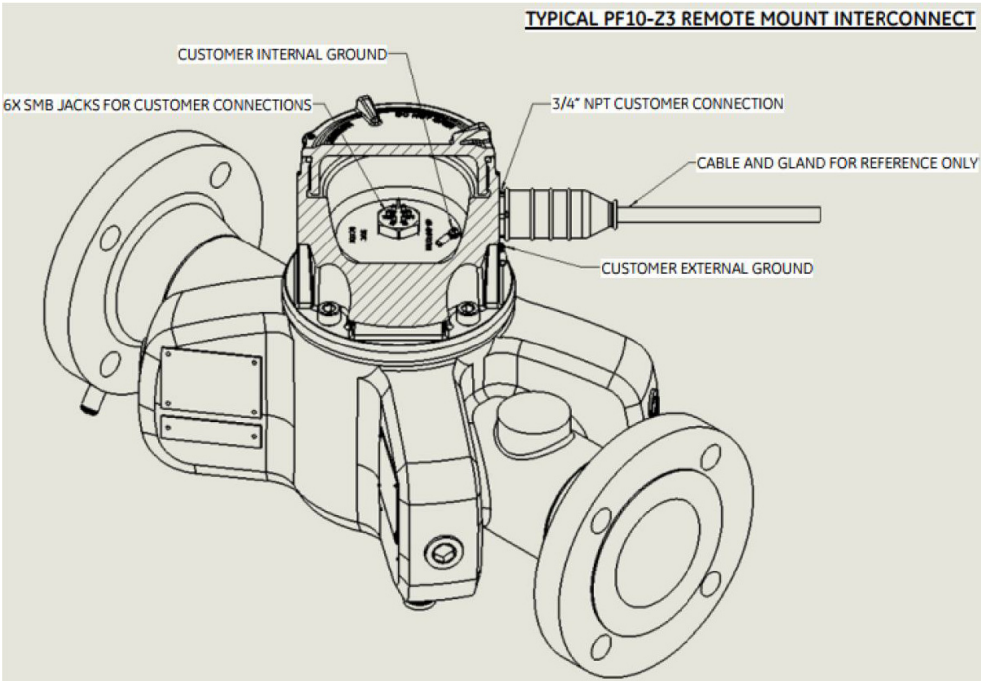


SERIAL NUMBER AND MODEL CODE TAG

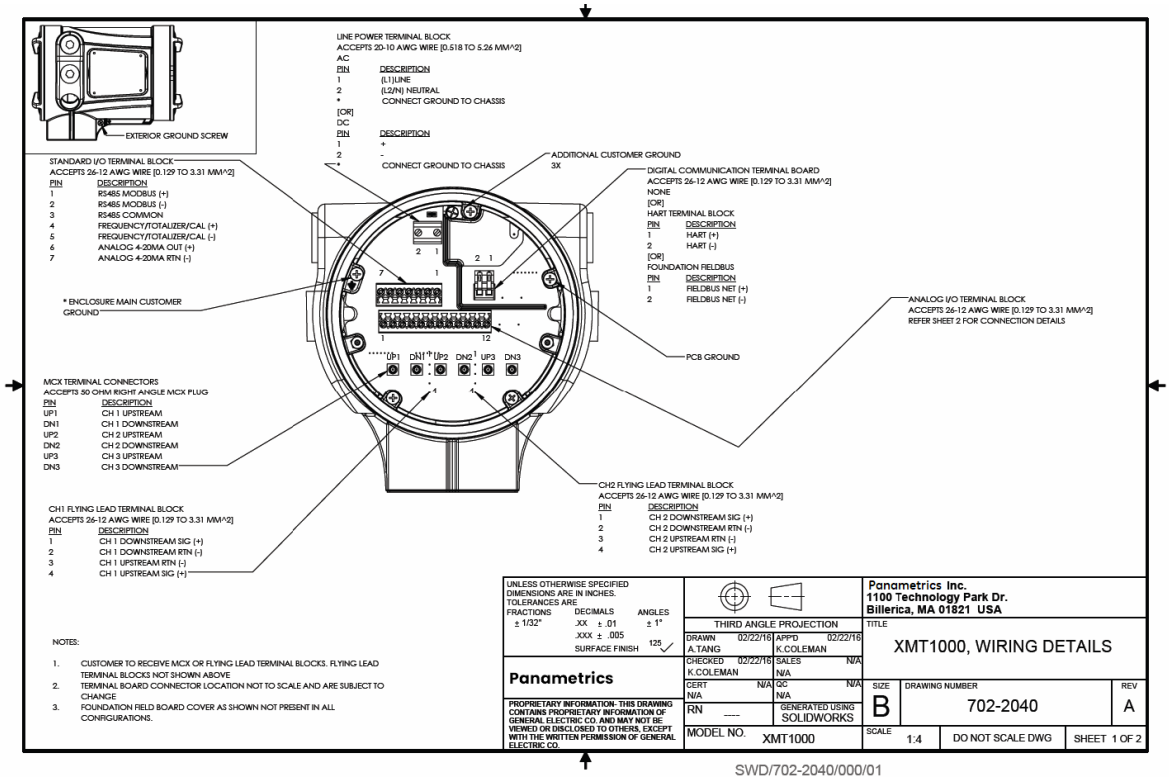


Connection and Wiring Diagram

REMOTE MOUNT WIRING



LOCAL MOUNT WIRING



-01	
PIN	DESCRIPTION
1	ANALOG 4-20MA OUT1 (+)
2	ANALOG 4-20MA OUT1 (-)
3	ANALOG 4-20MA OUT2 (+)
4	ANALOG 4-20MA OUT2 (-)
5	24V SUPPLY OUTPUT1
6	ANALOG 4-20MA IN1 (+)
7	ANALOG 4-20MA IN1 (-)
8	24V SUPPLY RETURN1
9	24V SUPPLY OUTPUT2
10	ANALOG 4-20MA IN2 (+)
11	ANALOG 4-20MA IN2 (-)
12	24V SUPPLY RETURN2

-02 & -06	
PIN	DESCRIPTION
1	ANALOG 4-20MA OUT1 (+)
2	ANALOG 4-20MA OUT1 (-)
3	ANALOG 4-20MA OUT2 (+)
4	ANALOG 4-20MA OUT2 (-)
5	24V SUPPLY OUTPUT1
6	ANALOG 4-20MA IN1 (+)
7	ANALOG 4-20MA IN1 (-)
8	24V SUPPLY RETURN1
9	NO CONNECTION
10	RTD1 SOURCE (+)
11	RTD1 VOLTAGE (+)
12	RTD1 VOLTAGE (-)

-03 & -07	
PIN	DESCRIPTION
1	ANALOG 4-20MA OUT1 (+)
2	ANALOG 4-20MA OUT1 (-)
3	ANALOG 4-20MA OUT2 (+)
4	ANALOG 4-20MA OUT2 (-)
5	NO CONNECTION
6	RTD1 SOURCE (+)
7	RTD1 VOLTAGE (+)
8	RTD1 RETURN
9	NO CONNECTION
10	RTD2 SOURCE (+)
11	RTD2 VOLTAGE (+)
12	RTD1 VOLTAGE (-)

-04 & -08	
PIN	DESCRIPTION
1	ANALOG 4-20MA OUT1 (+)
2	ANALOG 4-20MA OUT1 (-)
3	ANALOG 4-20MA OUT2 (+)
4	ANALOG 4-20MA OUT2 (-)
5	24V SUPPLY OUTPUT1
6	ANALOG 4-20MA IN1 (+)
7	ANALOG 4-20MA IN1 (-)
8	24V SUPPLY RETURN1
9	RTD1 SOURCE (+)
10	RTD1 VOLTAGE (+)
11	RTD1 VOLTAGE (-)
12	RTD1 SOURCE (-)

-05 & -09	
PIN	DESCRIPTION
1	ANALOG 4-20MA OUT1 (+)
2	ANALOG 4-20MA OUT1 (-)
3	ANALOG 4-20MA OUT2 (+)
4	ANALOG 4-20MA OUT2 (-)
5	RTD1 SOURCE (+)
6	RTD1 VOLTAGE (+)
7	RTD1 VOLTAGE (-)
8	RTD1 SOURCE (-)
9	RTD2 SOURCE (+)
10	RTD2 VOLTAGE (+)
11	RTD2 VOLTAGE (-)
12	RTD2 SOURCE (-)

Panametrics

DRAWN 02/22/16 A. TANG	APP'D 02/22/16 K. COLEMAN	SIZE B	DRAWING NUMBER 702-2040 REV A
CHECKED 02/22/16 K. COLEMAN	SALES		
CERT	QC	SCALE 1:4	DO NOT SCALE DWG SHEET 2 OF 2

SWD/702-2040/000/01

Customer Support Centers

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

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

910-311 Rev. C