Panametrics
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PanaFlow™ Z3

User's Manual

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Ultrasonic Liquid Flowmeter

User's Manual

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panametrics.com

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Services

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

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

Typographical Conventions

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

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

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

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

Safety Issues

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

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

Auxiliary Equipment

Local Safety Standards

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

Working Area

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

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

Qualification of Personnel

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

Personal Safety Equipment

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

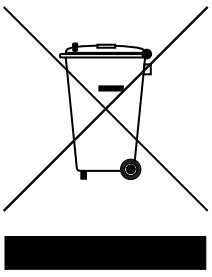
Unauthorized Operation

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

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

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



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

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

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

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

Chapter 1. Introduction

Chapter 2. Installation

Chapter 3. Programming

Chapter 4. Error Codes and Troubleshooting

Chapter 5. Maintenance and Service

Chapter 1. Introduction

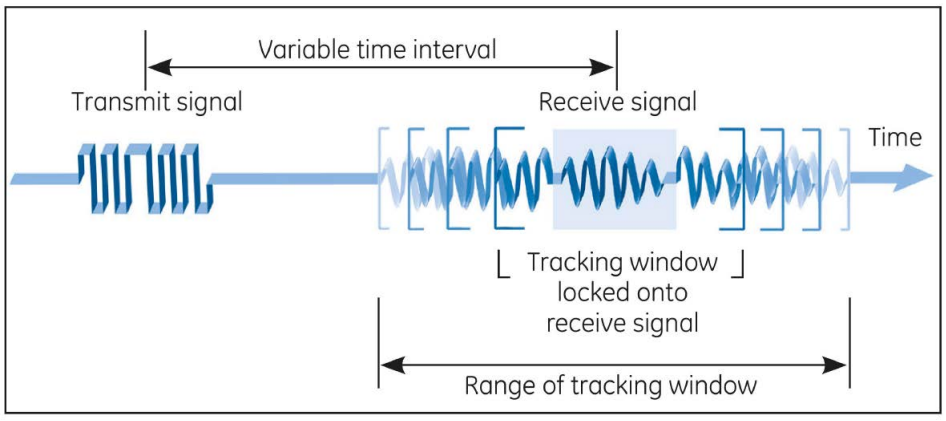
1.1 Overview

Thank you for purchasing the PanaFlow Z3 ultrasonic flowmeter. 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. With a sleek industrial design and ultra-reliable electronics, it provides operators a cost-effective choice when measurement accuracy and reliability are critical.

Figure 1: PanaFlow Z3

1.2 Theory of Operation

The PanaFlow™ Z3 uses a procedure called Transit-Time Flow Measurement. In this method, the flowmeter transmits ultrasonic pulses through a moving liquid. The pulses that travel in the same direction as the fluid flow (downstream) travel slightly faster than the pulses that travel against the fluid flow (upstream). The difference in transit times is then used to calculate flow velocity.



ATW ensures accuracy when fluid conditions change

Figure 2: Transit – Time Flow Measurement

Figure 3: Transducer Paths Across Flow Directions

1.3 SIL Application

The PanaFlow Z3 with appropriate flow meter selection can be a SIL2 ultrasonic flowmeter (sensor) with the capability of providing a SIL3 system in a redundant design configuration. The PanaFlow Z3 system is IEC61508 certified (when selection) through a complete design validation from a third-party organization. By achieving a third-party certification, we have proven the required design rigor through the product safety lifecycle, and the implementation of functional safety management. This added design, manufacturing, and control rigor ensures that it is the optimal ultrasonic flowmeter for your safety or process control system.

CAUTION! **Only qualified and trained personnel are allowed to change and validate safety parameters. Please refer to the XMT1000 safety manual for details on these parameters.**

Chapter 2. Installation

2.1 Introduction

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
- Selecting suitable sites for the electronics enclosure and the meter body
- Installing the meter body
- Installing the electronics enclosure - (if remote mounted)
- Wiring transducers to the XMT1000 electronics
- Wiring PanaFlow Z3 transmitter

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

Be sure to follow all applicable local safety codes and regulations for installing electrical equipment and working with hazardous 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*.

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

2.2 Unpacking

Before removing the PanaFlow Z3 system from the crate, please inspect the flowmeter. Each instrument manufactured by Panametrics is warranted 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. The discarding of an important item along with the packing materials is all too common. If anything is missing or damaged, contact Panametrics Customer Care immediately for assistance.

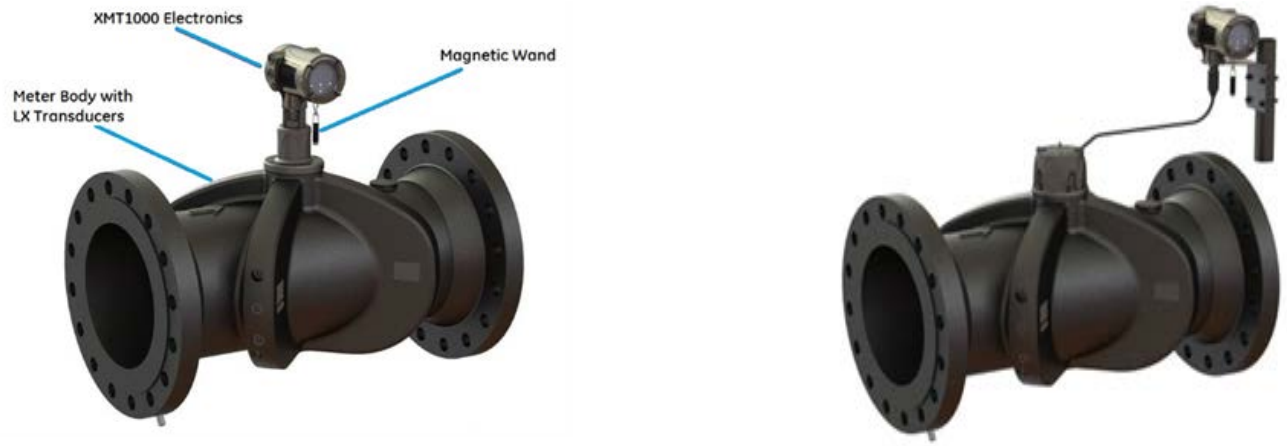


Figure 4: PanaFlow Z3 Local mount and Remote mount identification

The PanaFlow Z3 meter has two separate labels for identification, depending on configuration.

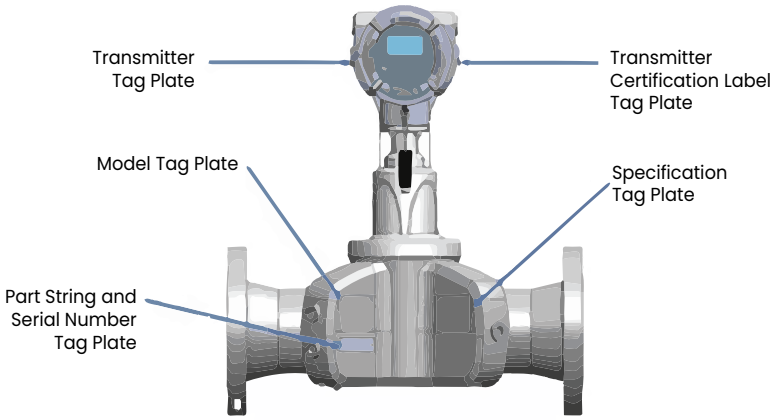


Figure 5: Identification

2.2.1 Panaflow Z3 Transmitter Identification

The Panaflow Z3 is supplied with both a serial number label and a certification label for identification of the instrument. See figure below.

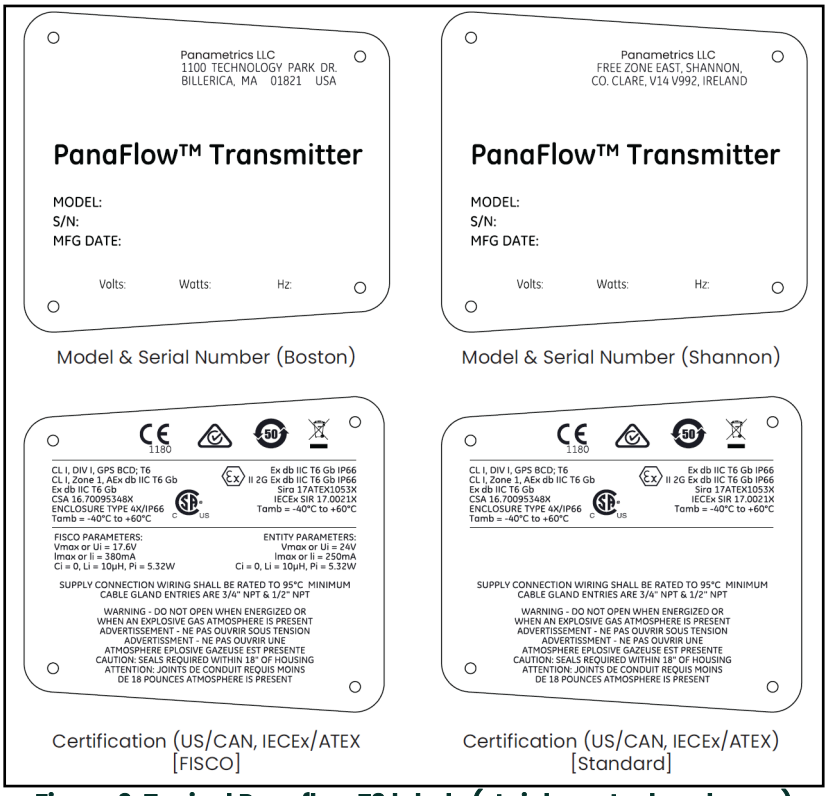


Figure 6: Typical Panaflow Z3 labels (stainless steel enclosure)

2.2.1.1 Meter Body Identification

The PanaFlow Z3 meter will have labels for hazardous area, specification, and part string/serial number tag plate. Below are examples of each for reference.

Figure 7: Meter body identification

2.2.2 Transport of PanaFlow Z3 Meter Body

Below 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 wight of the flowcell. The transmitter cannot support the weight of the pressure vessel.**

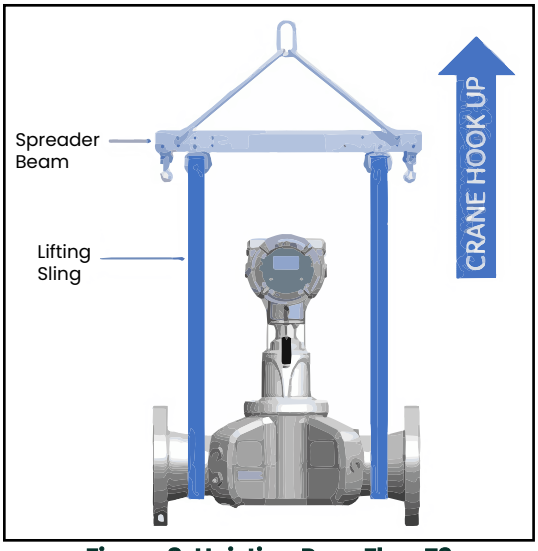


Figure 8: Hoisting PanaFlow Z3

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.

2.3.1 Meter Body Location

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.

2.3.1.1 Transducer location

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

- Locate the meter body so that there are at least 10 pipe diameters of straight, undisturbed flow upstream and 5 pipe diameters of straight, undisturbed flow downstream from the measurement point. Undisturbed flow means avoiding sources of turbulence in the fluid such as valves, flanges, expansions, and elbows; avoiding swirl; and avoiding cavitation.

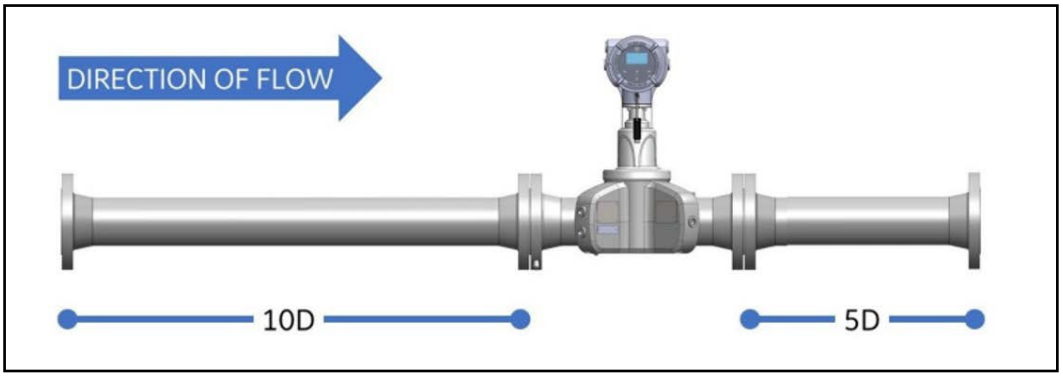


Figure 9: Recommended location for the transducer

- Locate the transducers on a common axial plane along the pipe. 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 is no similar restriction with vertical pipes as long as the flow of fluids is upward to prevent free falling of the fluid or a less than full pipe.

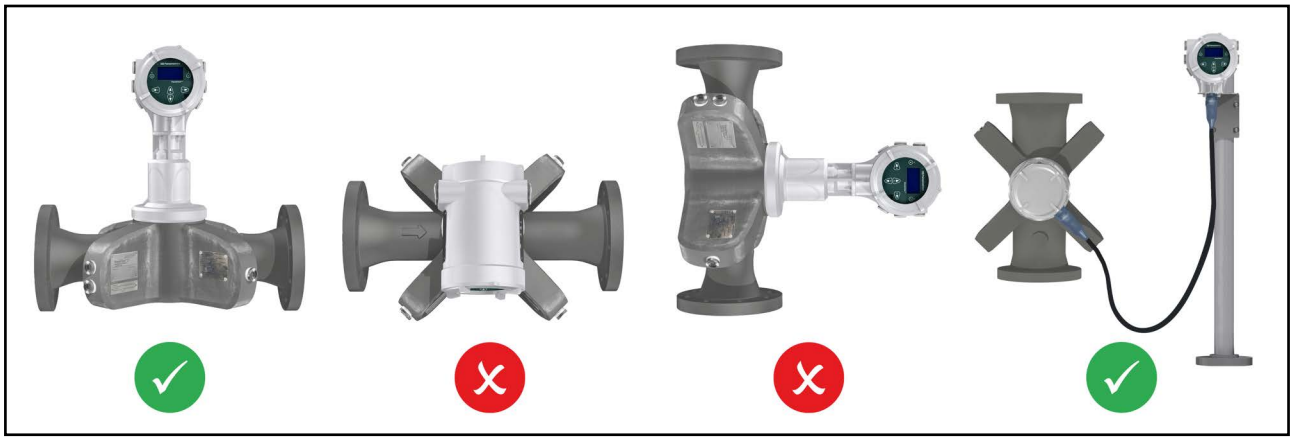


Figure 10: Transducer placement in horizontal/vertical pipes

2.3.2 Panaflow Z3 Electronics Mounting & Location

Typically, the enclosure is mounted as close as possible to the transducers. When choosing a site for remote mount installation, make sure the location permits easy access to the electronics enclosure for programming, maintenance, and service. The maximum standard distance is 1000 feet (300 meters). If longer cable is required, please consult Panametrics for assistance.

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

CAUTION! **Local mounting of the XMT1000 meter is not permitted for vertical pipes.**

CAUTION! **Remote mounting of the XMT1000 meter is always required with vertical pipes. For vertical pipes, the fluid flow is / must be upwards as the measurement method requires the pipe to be full.**

See *Figure 11* for mounting the Panaflow Z3 electronics.

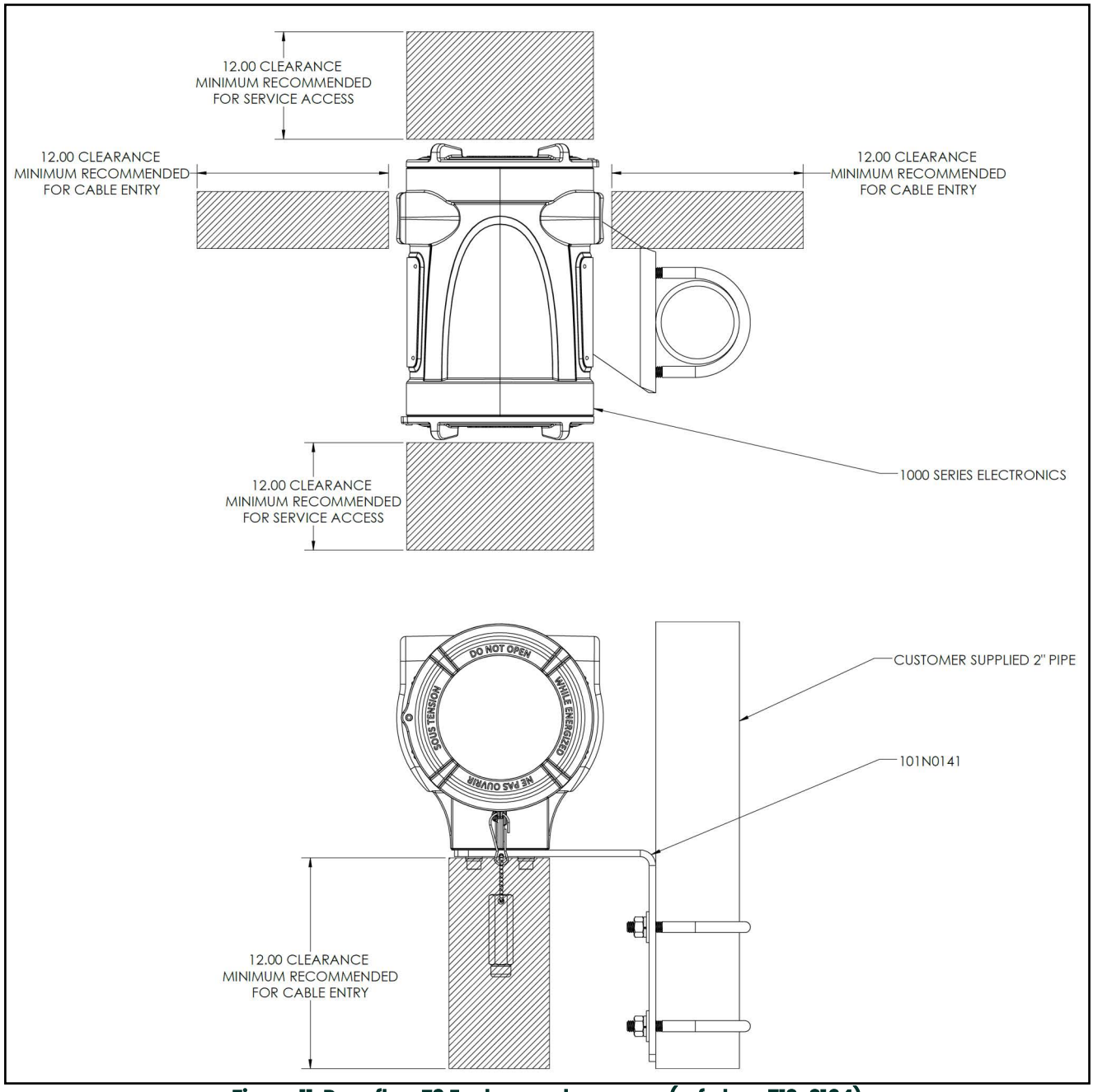


Figure 11: Panaflow Z3 Enclosure clearances (ref. dwg. 712-2164)

2.4 Making Electrical Connections

Refer to XMT1000 User Manual for the wiring of:

- Analog outputs
- Digital outputs (totalizer, frequency, calibration)
- Modbus or Service port
- Hart or Foundation Field Ports (if applicable)
- Additional analog input or output (if applicable)
- Additional SIL analog output (If applicable)
- Transducer (flying leads)
- Line power

2.4.1 Local Mount Configuration Transducer Wiring

The wiring between transmitter and transducers has been completed by Panametrics. No further work is required on this portion of the wiring.

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 12*. A more detailed representation of how this equipment shall be wired is described in *Figure 13*. 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 12: Connection Port to Flowcell

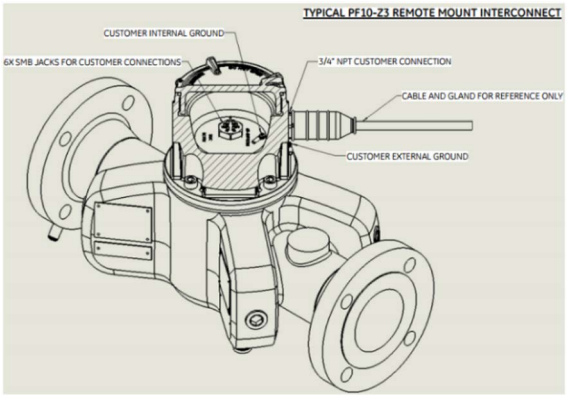


Figure 13: Remote Mount Wiring Diagram

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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: Only qualified and trained personnel are allowed to change and validate Safety parameters. Please refer to the XMT1000 safety manual for details on these parameters. 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 14: 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: Panametrics 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 15*) shows a lock icon on the top right of the display, use the following steps to unlock the meter from keypad lockout mode.

- Press ESC-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

3.3.1 Measurement View

On power up, the PanaFlow Z3 meter shows the following screens:

- Panametrics Logo screen
- Meter Initialization screens
- Power-on self-tests and results
- Finally, the *Measurement View* (Refer *Figure 15*)

This screen (Refer *Figure 15*) 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.

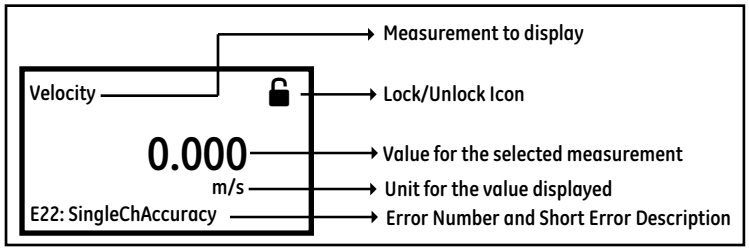


Figure 15: Measurement View

3.3.1.1 Changing Display Format

To change Display Format, do the following steps and refer *Figure 16*.

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.

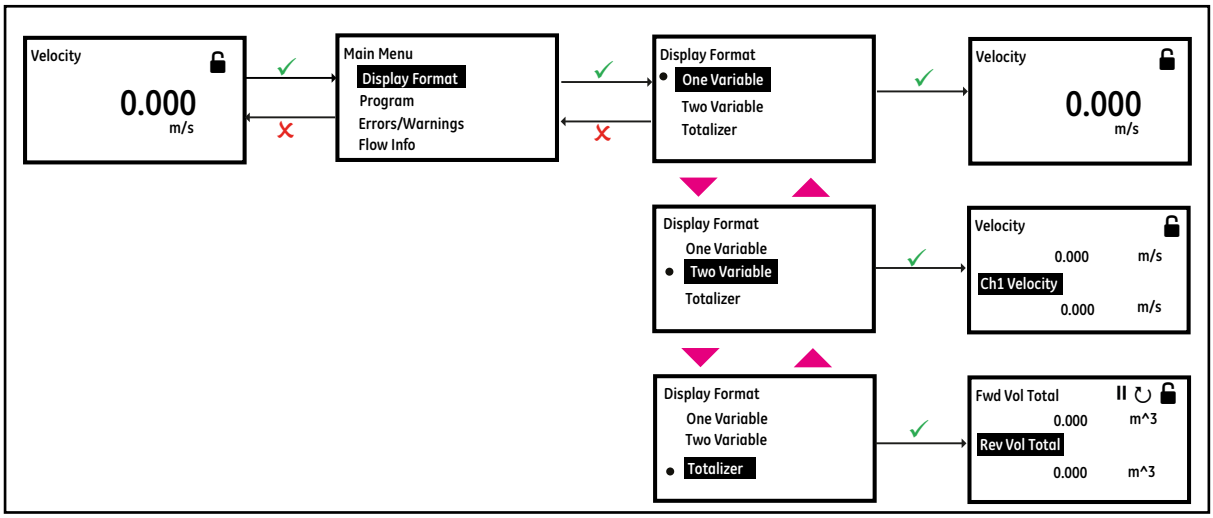


Figure 16: Changing Display Format

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 17*.

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]**.

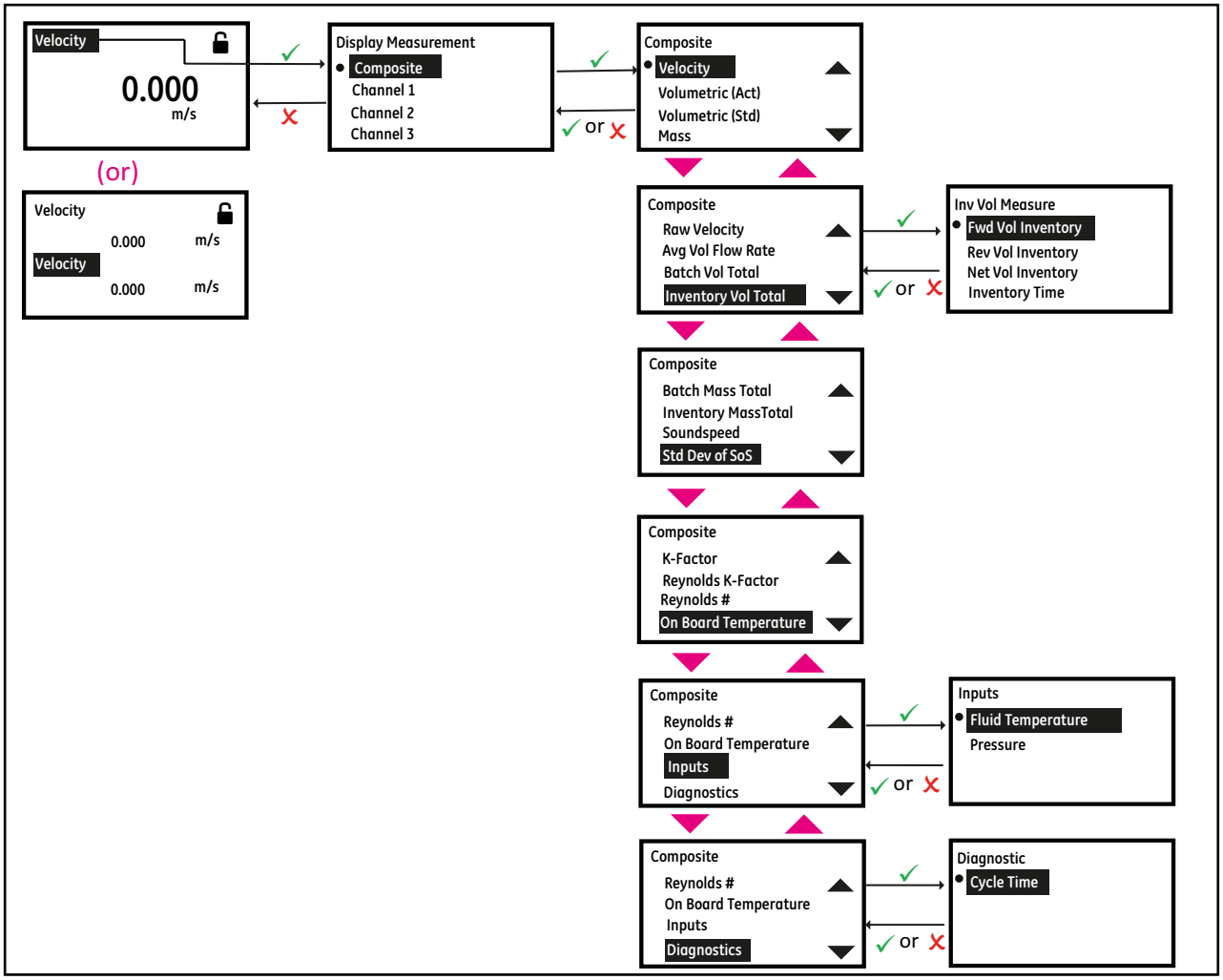


Figure 17: Selecting a Composite Measurement to Display

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 18*.

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]**.

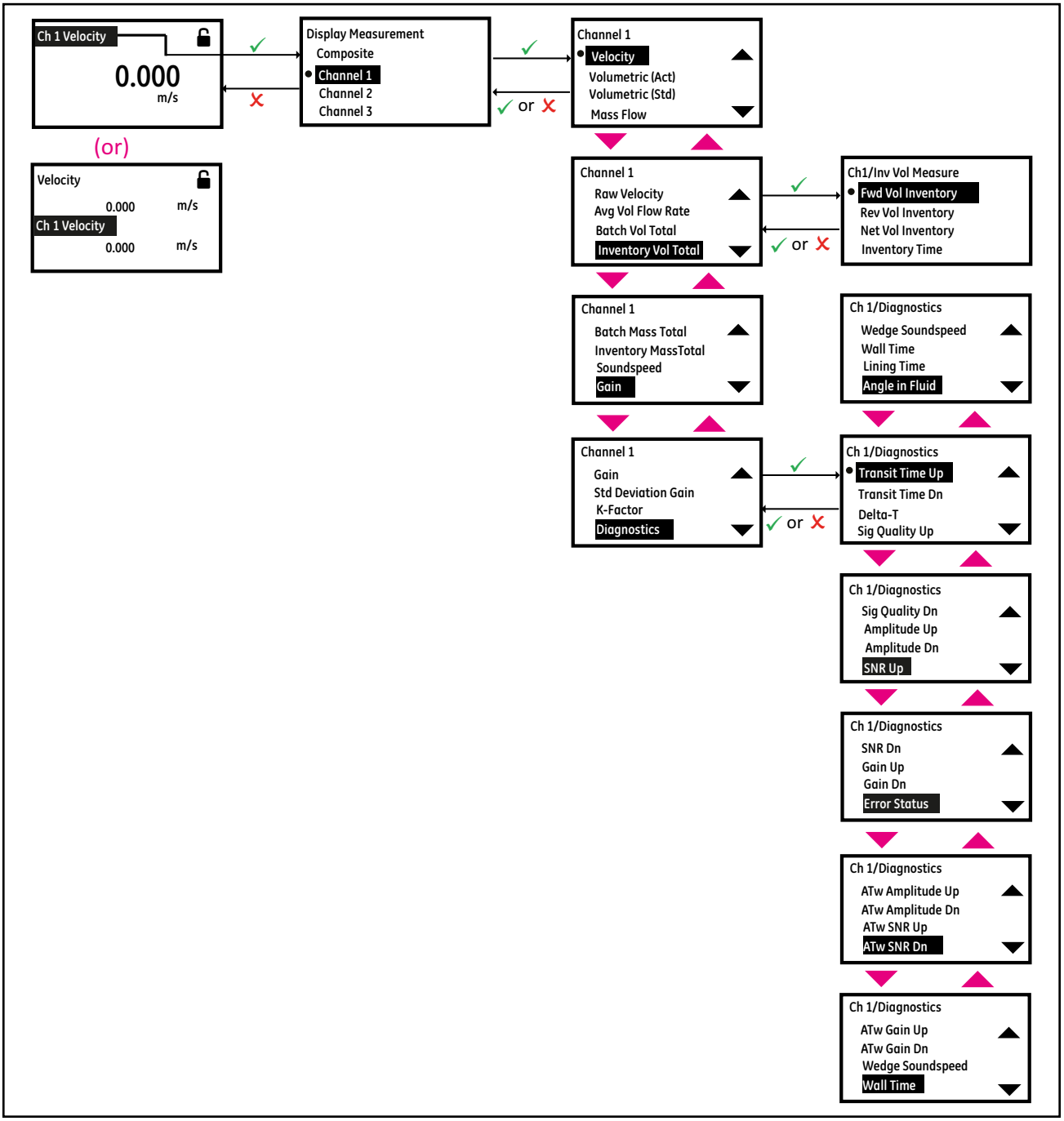


Figure 18: Selecting a Channel Measurement to Display

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 16* 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 19*.

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.

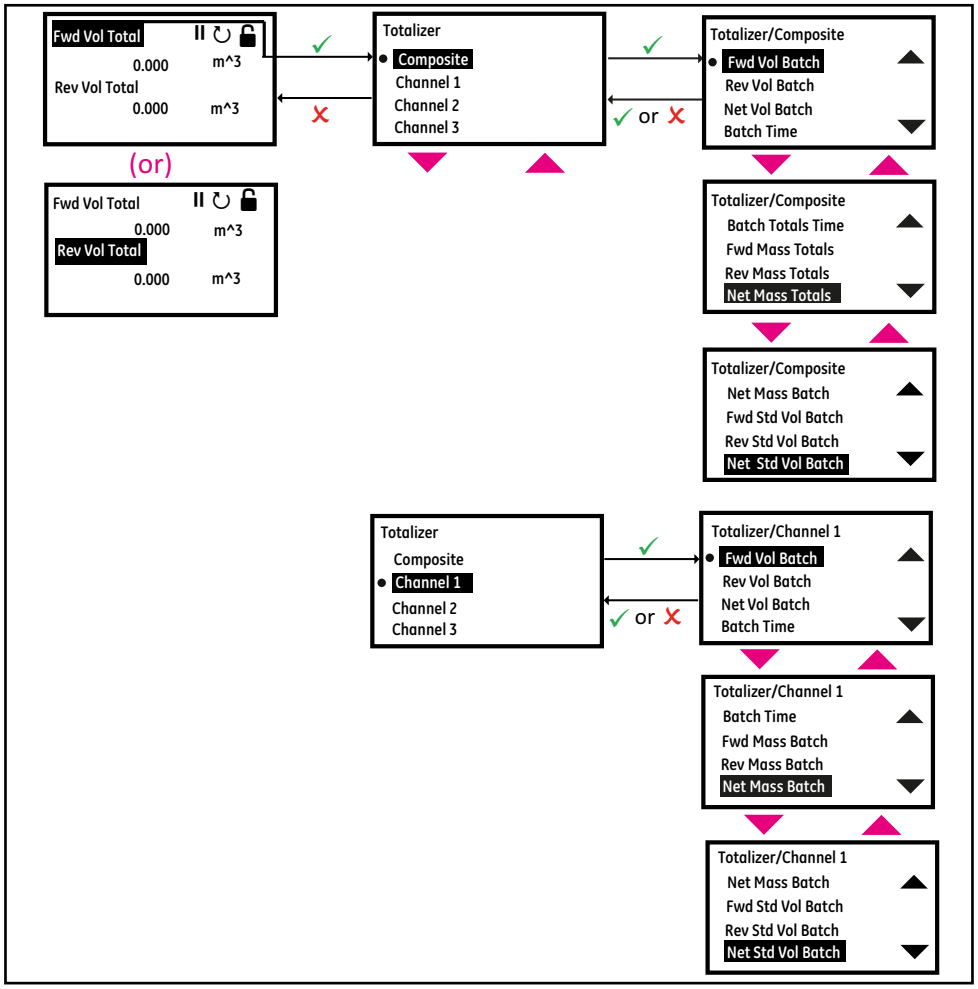


Figure 19: Selecting Totalizer Measurements for Display

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 Operator access level, and press **[ENTER]**.

5. After completing the log-in steps you will see the primary pages as shown in the *Figure 20*. 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.*

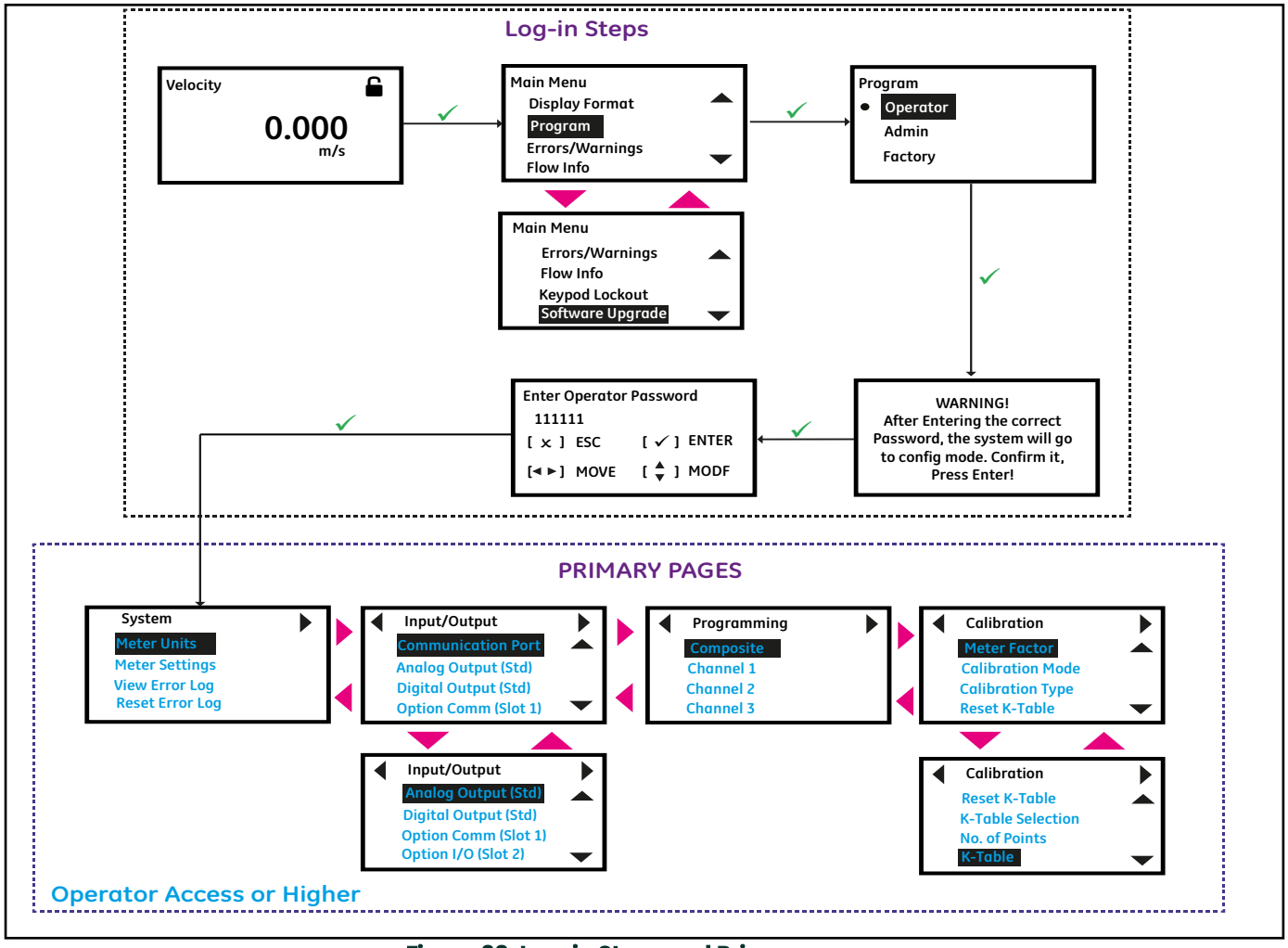


Figure 20: Log-in Steps and Primary pages

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 Main Program

Please refer to the XMT1000 User's manual for detailed programming of the XMT1000 Electronics such as System Settings, Inputs/Outputs, Wetted Meter Programming, and Calibration. See chapter "Programming" for instrument programming step-by-step instructions, or refer to appendix "Menu map" for the full menu map reference guide.

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: 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, Vitality PC software, or HART
- 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 Installation methods in Appendix D, CE Mark Compliance,.*

4.2 Error Classification and Error Codes

The XMT1000 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 5 types as indicated in the table below:

Table 1: PanaFlow Z3 error classification

Error Classification	Error Number	Subsystem
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
Communication Errors	C_n where n is the Error number	Transmitter to Flow or Option I/O
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 Panametrics. 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.

In addition to the local display, error messages are provided in the relevant Modbus register using bit-field representation. For the location of the appropriate register see *Appendix C, Error code bit-field representation,*

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 2* 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 causes are:

1. Incorrect programming on Error Limits or flow condition changes that now make previous programming invalid.
2. Defective/Damaged cables, transducers, incorrect physical spacing, 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 such as:

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 inside the pipe.
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 such as:

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 inside the pipe.
5. Partially filled 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, incorrect physical spacing, 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 21* below shows the steps to view current channel specific errors/warnings. The description of the Error Codes and the recommended actions are provided in *Table 2* below.

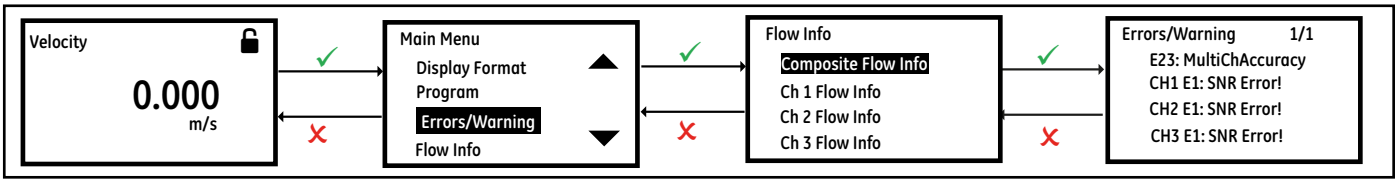


Figure 21: Viewing Current Channel Specific Errors

Table 2: 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 weak. 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 Panametrics
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 Panametrics
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 and/or 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 Panametrics

Table 2: Flow Error description and Recommended Actions(Continued)

Error Code	Problem	Cause	Recommended Action
E6: Cycle Skip	A cycle skip is detected while processing the signal for measurement	This is usually due to 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 Panametrics
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 Panametrics
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
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.	This condition is not self-recovering and will not automatically correct itself. Try power cycling the meter. If error persists after power cycle, contact Panametrics 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 at the factory and hence not making measurements. Please contact Panametrics factory	The condition is not self-recovering and will not automatically correct itself. Contact Panametrics 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 Panametrics 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.

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 *XMT1000*, 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. 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 sound speed, as may be caused by variations in fluid composition and/or temperature. However, such changes must occur slowly. Also, fluctuations in fluid sound speed due to changes in temperature will likely recover independently. Rapid fluctuations in the fluid sound speed, to a value that is beyond ± 20% from that programmed into the *XMT1000*, will result in erratic or inaccurate flow rate readings. This may occur when changing batch fluids.

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 locations will interfere with the transmission of the ultrasound signals. As a result, accurate flow rate measurements are not possible. Realignment of the transducers often corrects these problems but, in some cases, wetted transducers must be used. Refer to *Chapter: Installation* for more details on proper installation practices.
- *Inaccurate pipe measurements.*
  The flow rate measurement accuracy relies greatly on the accuracy of the programmed pipe dimensions. Measure the pipe wall thickness and diameter with the same accuracy desired in the flow rate readings. Also, check the pipe for dents, pitting or rough surfaces, eccentricity, weld deformity, straightness and other factors that may cause inaccurate readings. Refer to the *Chapter: Programming*, for instructions on entering the pipe data.
- *The inside of the pipe or pipe is not sufficiently clean.*
  Excessive buildup of scale, rust or debris inside the pipe will interfere with flow measurements. Generally, a thin coating or a solid well-adhered build up on the pipe wall will not cause problems. Loose scale and thick coatings (such as tar or oil) will interfere with ultrasound transmission and may result in incorrect or unreliable flow rate measurements.

4.5 Transducer 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 Panametrics if you cannot solve a transducer-related problem.

4.5.1 Transducer Problems

- **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 can not 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 System Errors (S-Errors)

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

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 the PanaFlow Z3 meter. See the table below for error codes, error messages, error type and recommended actions.

Table 3: 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 saves 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 Panametrics factory
S11: Clock Frequency	Clock frequency error	**Fault:** Input clock frequency failure. Try power cycling the meter. If error persists after power cycle, contact Panametrics factory

Table 3: System Error Description and Recommended Actions(Continued)

Error Code	Error Message	Description / Recommended Action
S12: CPU	CPU error	**Fault:** CPU registers have stuck bits. Try power cycling the meter. If error persists after power cycle, contact Panametrics 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 Panametrics 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 Panametrics factory
S15: Variable Memory	Variable SRAM fault	**Fault:** Variable SRAM test failed. Try power cycling the meter. If error persists after power cycle, contact Panametrics factory
S16: FPGA Config	FPGA configuration error	**Fault:** FPGA configuration validation failure. Try power cycling the meter. If error persists after power cycle, contact Panametrics factory
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 Panametrics 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 Panametrics factory
S21: Stack Overflow	Stack overflow	**Fault:** Stack overflow. Try power cycling the meter. If error persists after power cycle, contact Panametrics factory
S22: Sequence or Window Watchdog	Sequence failed	**Fault:** Sequence failure detected. Try power cycling the meter. If error persists after power cycle, contact Panametrics factory
S23: Initialization Failed	Initialization failed	**Error:** Initialization failed. Please verify all the configuration parameters. If error persists, contact Panametrics 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 Panametrics factory
S25: DSP Exception	DSP exception	**Fault:** DSP exception. Try power cycling the meter. If error persists after power cycle, contact Panametrics 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 Panametrics 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 Panametrics factory
S28: Software Fault	Software malfunction	**Error:** Software malfunction. Try power cycling the meter. If error persists after power cycle, contact Panametrics factory

Table 3: System Error Description and Recommended Actions(Continued)

Error Code	Error Message	Description / Recommended Action
S29: Output A Loop Open!	SIL Analog Output Open Error	**Fault:** SIL Analog Output is disconnected. Connect the SIL Analog output and try power cycling the meter. If error persists after power cycle, contact Panametrics factory
S30: Flash Save Failed	Save to Flash Failed	**Error:** Request to Save failed. Try again. If error persists, contact Panametrics factory.

4.7 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 4: 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 Panametrics factory
C2: MODE MISMATCH	Mode Mismatch Error	**Fault:** Mode Mismatch Error, Try power cycling the meter. If error persists after power cycle, contact Panametrics 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 Panametrics factory

4.8 Transmitter Errors

These errors are from the Transmitter subsystem. Should you encounter one of the Transmitter Errors, follow recommended actions as indicated in *Table* and contact Panametrics factory.

Table 5: 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 Panametrics 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 Panametrics 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 Panametrics factory
X12: System Command Fail	System command failed	System command failed. Try power cycling the meter. If error persists after power cycle, contact Panametrics 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 Panametrics 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 Panametrics 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 Panametrics 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 Panametrics factory
X17: Disconnect Std Dout	Transmitter Error	**Fault:** Transmitter Error. Connect the digital input to meter. If error persists , contact Panametrics factory
X18: Aout(Std) Out Of Range	Transmitter Out Of Range Error	**Fault:** Transmitter Out Of Range Error, Configure analog out with in the range, If error persists, contact Panametrics factory

4.9 Option I/O Errors

Table 6: 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 Panametrics 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 Panametrics 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 Panametrics 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 Panametrics 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 Panametrics 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 Panametrics factory
A8: (S2:1)Ch Not Calibrated	Error occurs when Analog Input/RTD (S2:1) are not calibrated	Calibrate the Analog Input/RTD input. If error persists after calibration, contact Panametrics factory
A9: (S2:2)Ch Not Calibrated	Error occurs when Analog Input/RTD (S2:1) are not calibrated	Calibrate the Analog Input/RTD input. If error persists after calibration, contact Panametrics 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 Panametrics 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 Panametrics 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 Panametrics 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 Panametrics factory
A18:SerialNo Error!	Optional I/O Serial Number Error	**Fault:** Optional I/O Serial Number Error. Try power cycling the meter. If error persists after power cycle, contact Panametrics 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 Panametrics factory

Table 6: Option I/O Errors Description(Continued)

Error Code	Error Message	Description
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 Panametrics factory
A30:Board Option Err!	Optional I/O Error	**Fault:** Optional I/O Error. Try power cycling the meter. If error persists after power cycle, contact Panametrics 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 Panametrics 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 Panametrics factory

4.10 Diagnostics Data

To determine the health of the meter, PanaFlow™ Z3 has built-in diagnostic parameters. Please refer to *Table 7* 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 Panametrics factory.

Table 7: Diagnostic Parameter Description and Health Indicators

Parameter	Description	Good	Bad
Sound Speed	Measured speed of sound of the fluid	• Under ideal conditions sound speed should be within 5 ft/s (1.5 m/s) between channels. • Depending on flow viscosity, flow rate, there can be slightly different sound speed showing on different channels. This could be normal due to different signal path.	• Under ideal conditions, sound speed spread of 30 ft/s (9 m/s) or more between the sound speed measurement of the channels can be an indication of a problem with the pipe installation or any other different local pipe condition.
SNR Up	Signal to noise ratio of the upstream transducer	>5	<2 SNR value between 2 and 5 shall provide valid measurements but can be an indication of a problem with the pipe installation or any other different local pipe condition. Verify the clamping fixture alignment, transducer spacing, transducers, couplant, all the other connections.
SNR Down	Signal to noise ratio of the downstream transducer	>5	<2 SNR value between 2 and 5 shall provide valid measurements but can be an indication of a problem with the pipe installation or any other different local pipe condition. Verify the clamping fixture alignment, transducer spacing, transducers, couplant, all the other connections.

Table 7: Diagnostic Parameter Description and Health Indicators(Continued)

Parameter	Description	Good	Bad
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 pipe installation or any other different local pipe condition. • 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	• For pipe sizes greater than 1 inch, index should be between 400 - 700. • For pipe sizes less than 1 inch, the index should be between 150 - 350.	• For pipe sizes greater than 1 inch, if the index <400 or >700 then there is an indication of problem with receive window location. • For pipe sizes less than 1 inch, if the index <150 or >350 then there is an indication of problem with receive window location.
Peak Index Down	Threshold peak of the downstream transmit correlation signal	• For pipe sizes greater than 1 inch, index should be between 400 - 700. • For pipe sizes less than 1 inch, the index should be between 150 - 350.	• For pipe sizes greater than 1 inch, if the index <400 or >700 then there is an indication of problem with receive window location. • For pipe sizes less than 1 inch, if the index <150 or >350 then there is an indication of problem with receive window location.
Wall Time	Transit time inside the pipe wall	N.A	If the value is negative, then there is an indication of problem with the configuration parameters.
Lining Time	Transit time inside the pipe lining	N.A	If the value is negative, then there is an indication of problem with the configuration parameters
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

Chapter 5. Maintenance and Service

Local requirements may or 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.

5.1 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 or possibly specific electronic boards. To ensure that the correct part numbers are 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".

5.2 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 Baker Hughes field service team member will maintain the accuracy of the system and any applicable warranty. Please consult Panametrics to order the appropriate components and to schedule installation in the field.

5.3 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 22):

- Flanges
- Sensor Ports
- Transmitter Connection

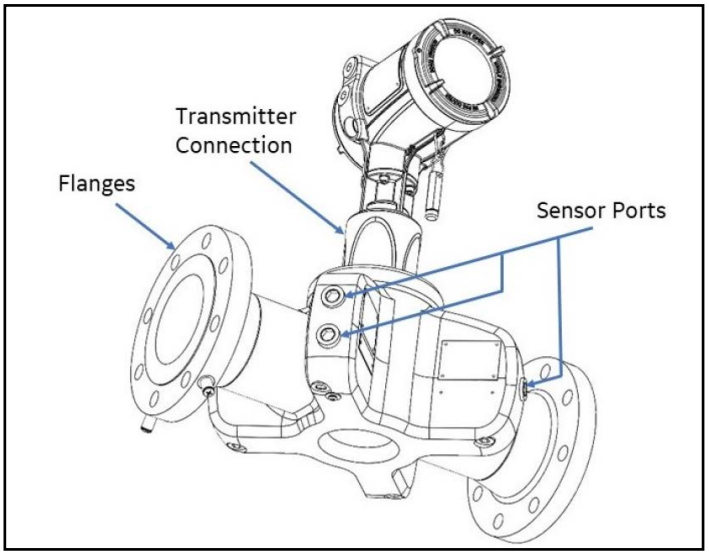


Figure 22: Serviceable Interfaces

5.3.1 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.

5.3.2 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.

5.3.2.1 Required Equipment

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

5.3.2.2 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 23, Figure 24, and Figure 25. 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:
   - 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.
   - 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.**

   - 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.

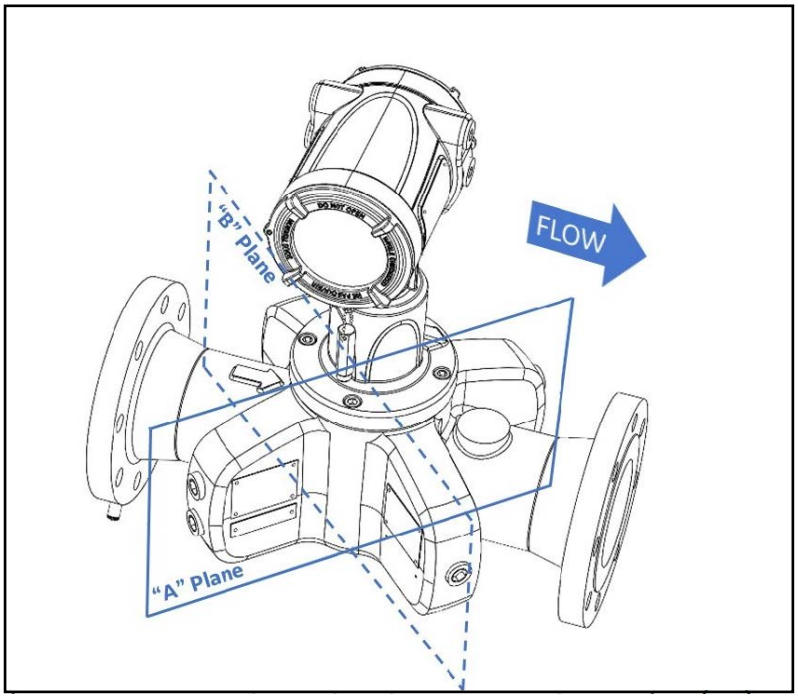


Figure 23: Upstream "A" Plane and "B" Plane Sensor Quadrants – View 1 (Top)

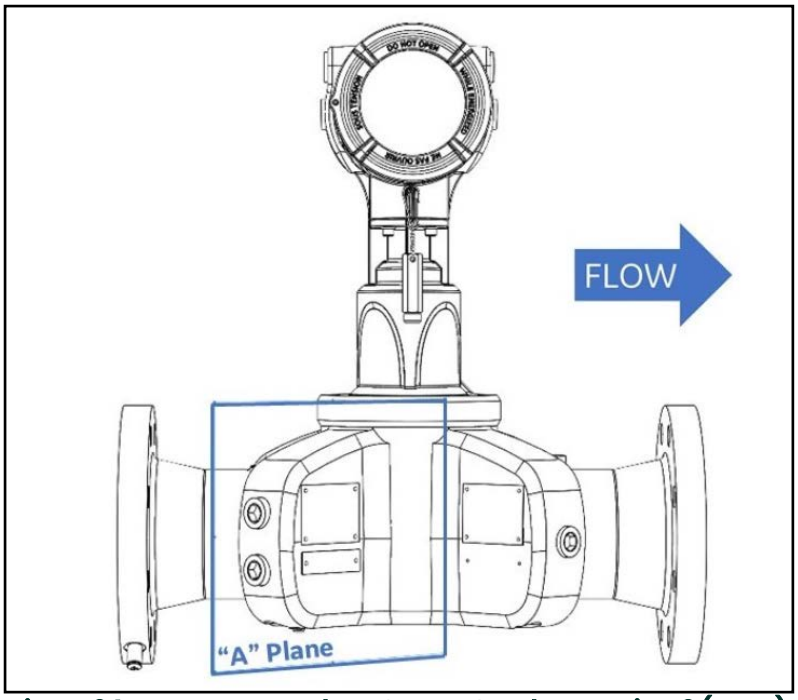


Figure 24: Upstream "A" Plane Sensor Quadrant – View 2 (Front)

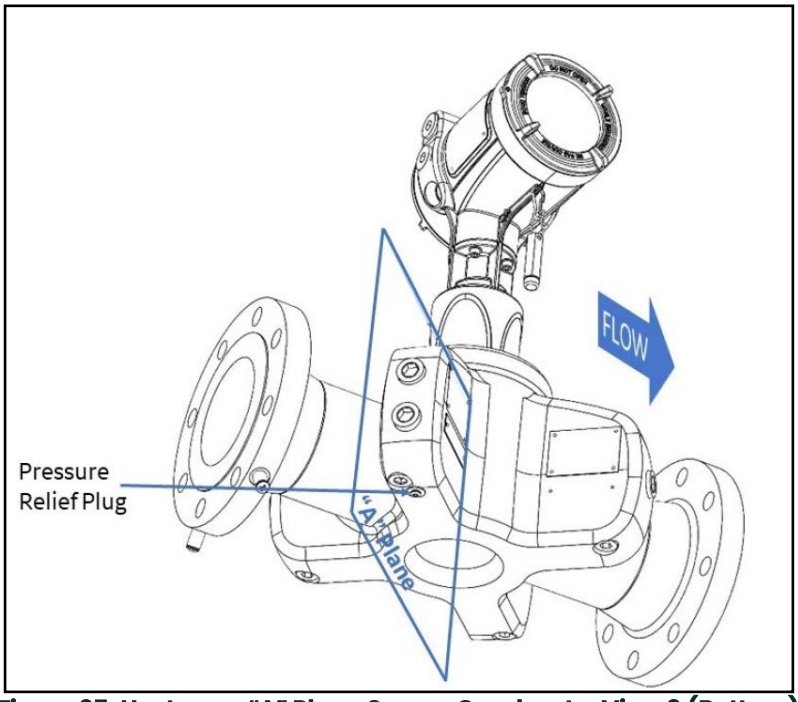


Figure 25: Upstream "A" Plane Sensor Quadrant – View 3 (Bottom)

5.3.2.3 Instructions to Rotate the PanaFlow Z3 Transmitter

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

1. Before performing any rotation of the PanaFlow Z3 Transmitter, ensure that the enclosure is de-energized. Locate the back of the PanaFlow Z3 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 PanaFlow Z3 Transmitter should now be free to rotate about the axis of rotation shown in *Figure 26*. Rotate the transmitter enclosure to your desired position, ensuring that screw hole alignment is maintained.
5. Align and affix the PanaFlow Z3 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.

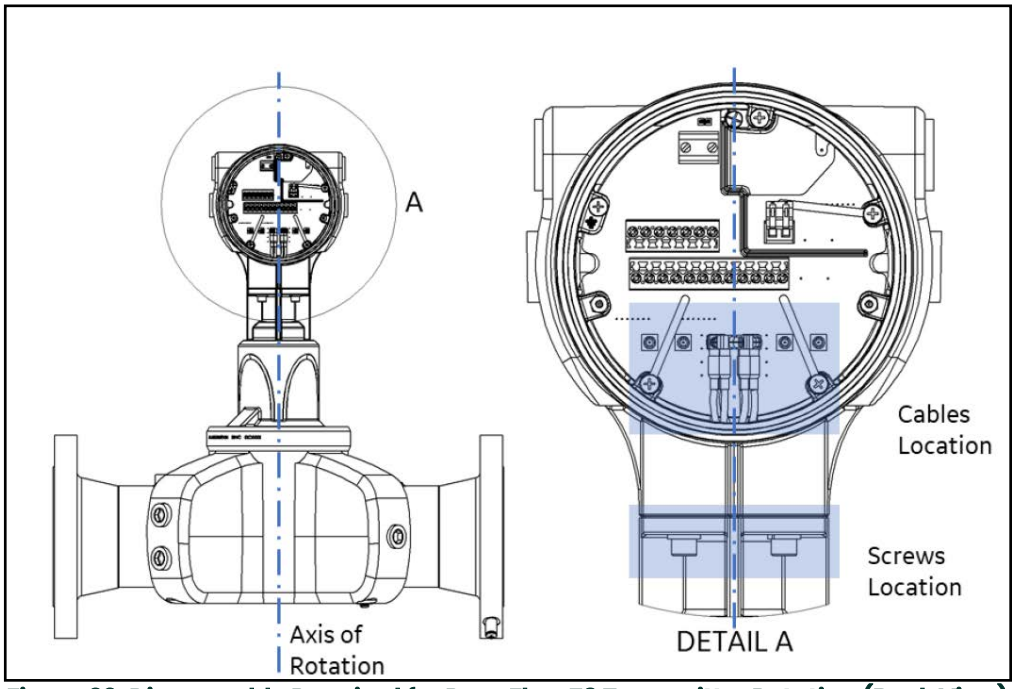


Figure 26: Disassembly Required for PanaFlow Z3 Transmitter Rotation (Back View)

5.3.2.4 Removing the PanaFlow Z3 Transmitter

Only properly trained personnel and qualified service technicians should remove the PanaFlow Z3 Transmitter from the flow meter adapter. The PanaFlow Z3 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 PanaFlow Z3 Transmitter, the Panametrics & Panametrics Flow meter field service team is trained and equipped to perform the replacement on-site.

[no content intended for this page]

Appendix A. Specifications

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 and 712-2167 for details.

A.3 Pressure Derating Information

ASME B16.5

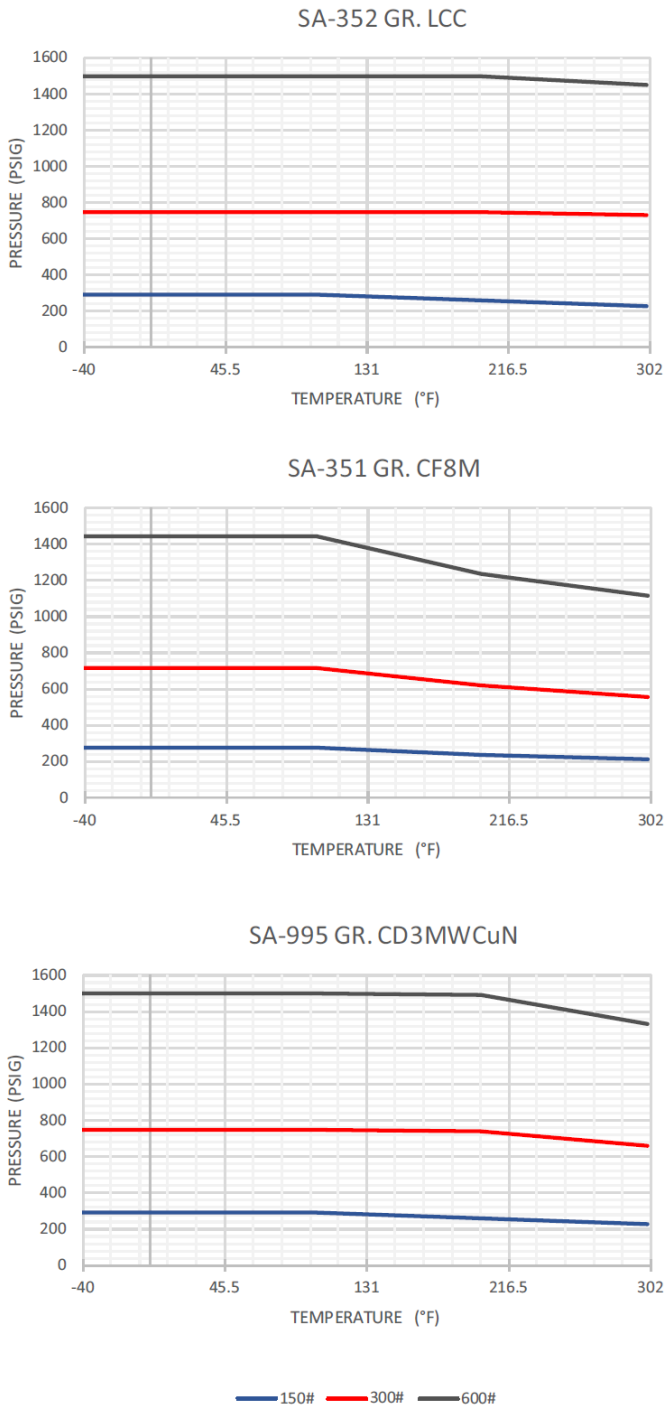


Figure 27: Pressure derating information as per ASME 16.5 standards

EN 1092-1

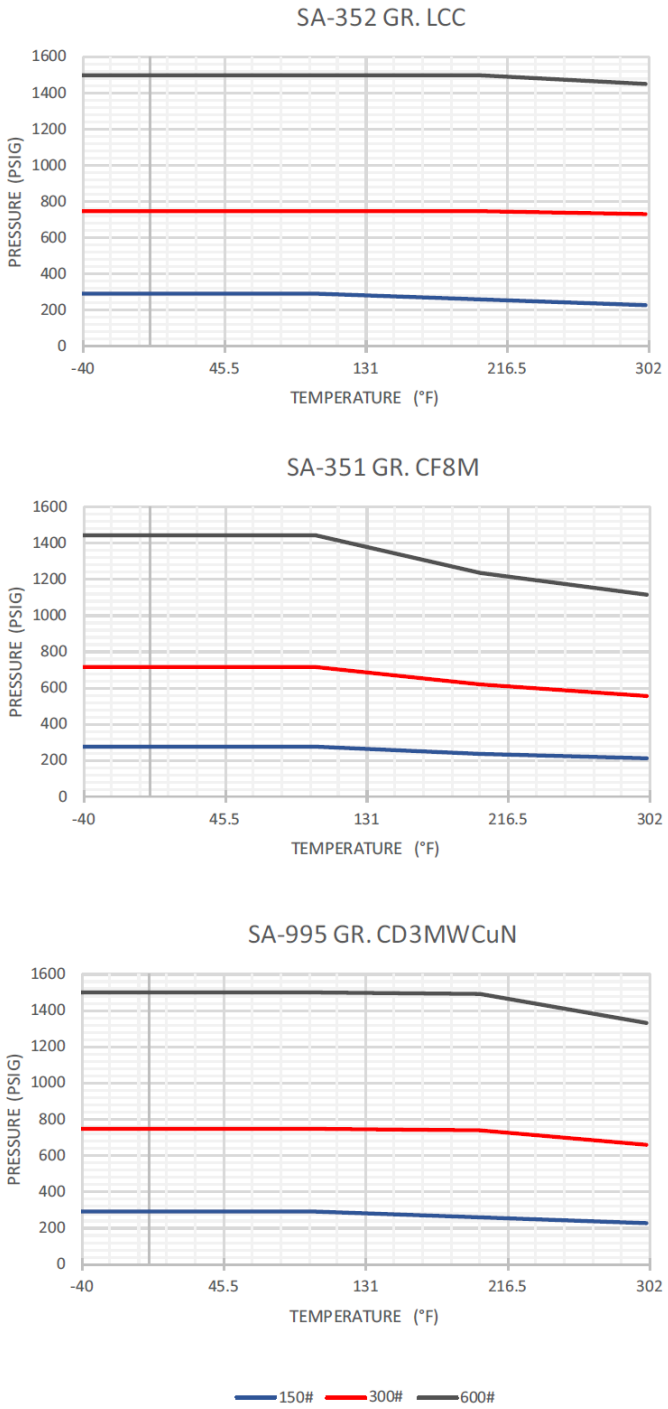


Figure 28: Pressure derating information as per EN 1092-1 DIN standards

A.4 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.

A.5 Electronics

See XMT1000 User Manual for specifications

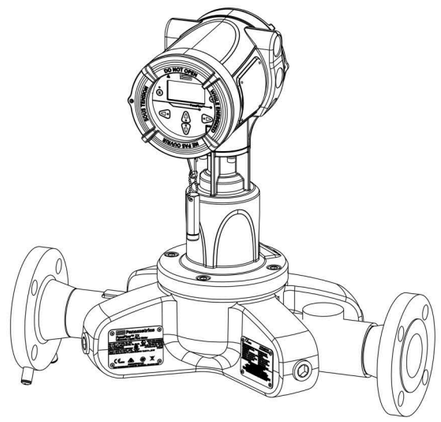
A.6 Drawings

Table 8: Installation Drawings

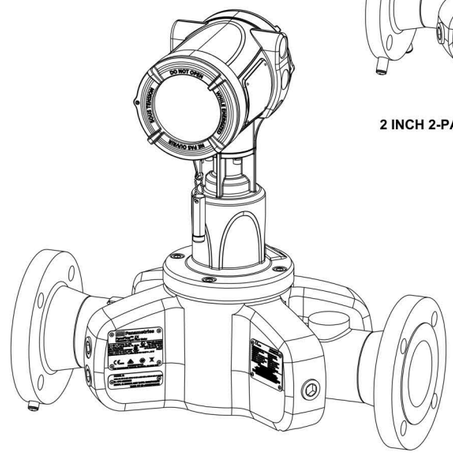
Drawings	Description
712-2166	Outline & installation, Z#, 2-24 inch flow meter system, local mount
712-2167	Outline & installation, Z#, 2-24 inch flow meter system, remote mount

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]	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



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].

THIRD ANGLE PROJECTION

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± 1/32" DECIMALS XX ± .01 XXX ± .005 ANGLES ± 1° SURFACE FINISH 125

TITLE: GA, PF10-ZX, 2"-24" LOCAL MOUNT SYSTEM

ECM 500000412271 | UPDATED 7/14/2021

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SIZE D | DRAWING NUMBER 712-2166 | REV B | VERSION 02

GENERATED USING SOLIDWORKS | DRAWING NOT TO SCALE | SHEET 1 OF 3

SWD/712-2166/000/02

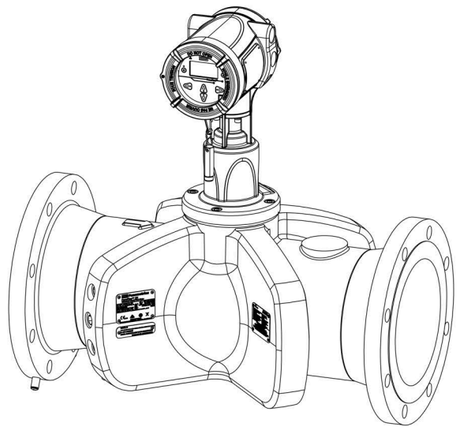
Figure 29: Outline and Installation drawing – local mount (712-2166, sheet 1)

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

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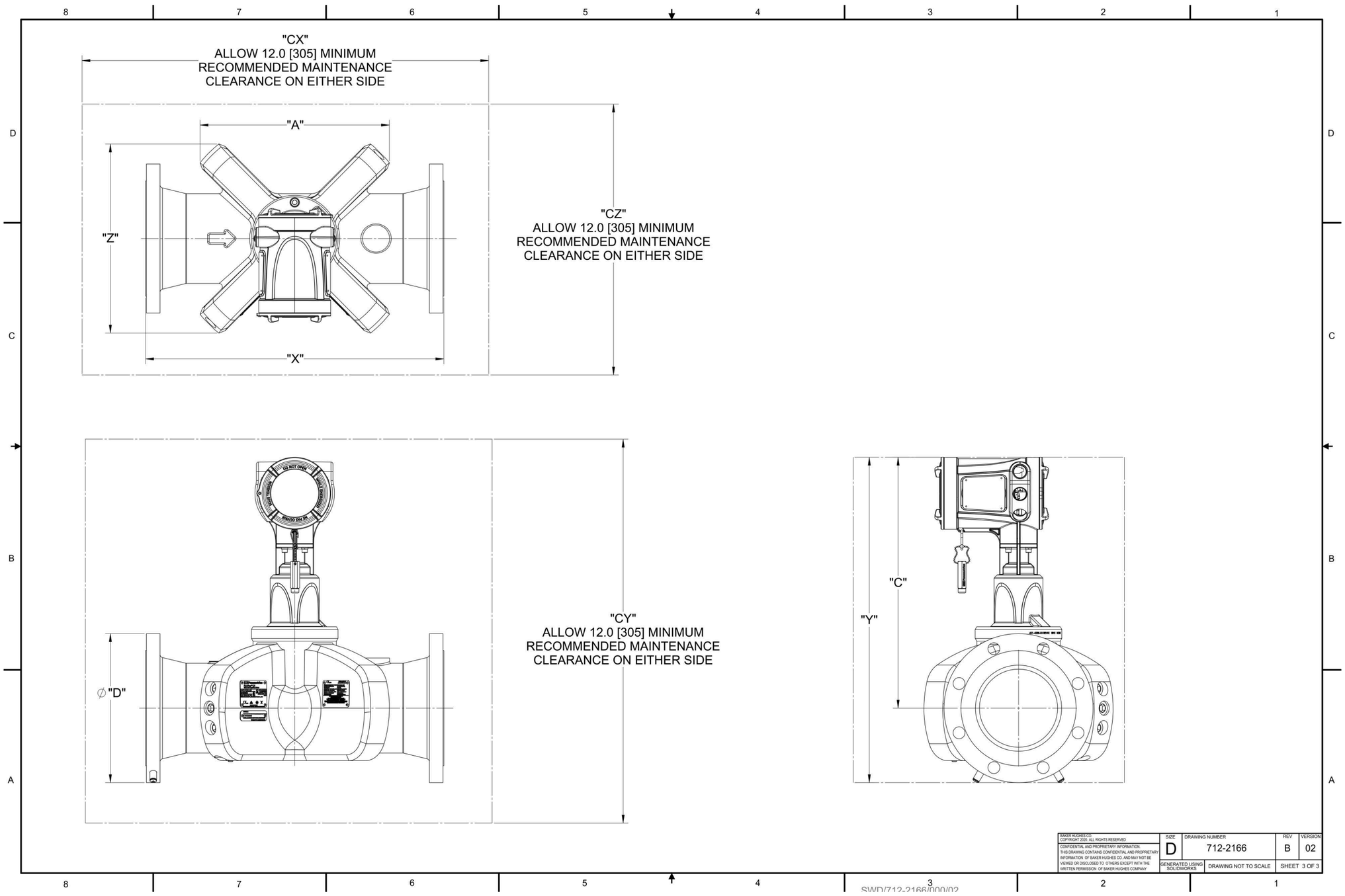
SIZE	DRAWING NUMBER	REV	VERSION
D	712-2166	B	02
GENERATED USING SOLIDWORKS	DRAWING NOT TO SCALE	SHEET 2 OF 3	

SWD/712-2166/000/02

Figure 30: Outline and Installation drawing – local mount (712-2166, sheet 2)



BAKER HUGHES CO. COPYRIGHT 2020. ALL RIGHTS RESERVED	SIZE	DRAWING NUMBER	REV	VERSION
CONFIDENTIAL AND PROPRIETARY INFORMATION. THIS DRAWING CONTAINS CONFIDENTIAL AND PROPRIETARY INFORMATION OF BAKER HUGHES CO. AND MAY NOT BE VIEWED OR DISCLOSED TO OTHERS EXCEPT WITH THE WRITTEN PERMISSION OF BAKER HUGHES COMPANY	D	712-2166	B	02
	GENERATED USING SOLIDWORKS	DRAWING NOT TO SCALE	SHEET 3 OF 3	

SWD/712-2166/000/02

Figure 31: Outline and installation drawing – local mount (712-2166, sheet 3)

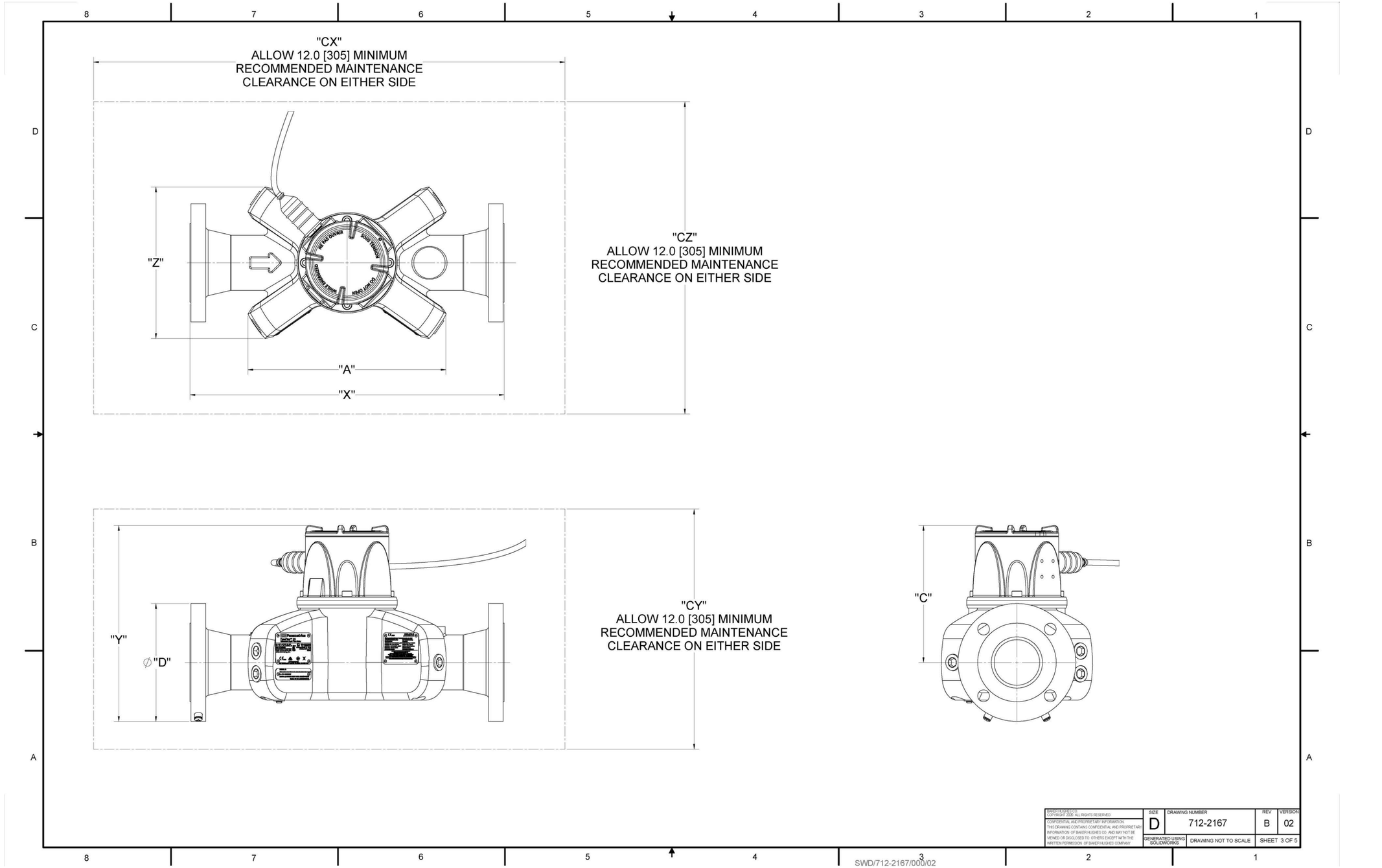


Figure 32: Outline and installation drawing – remote mount (712-2167, sheet 3)

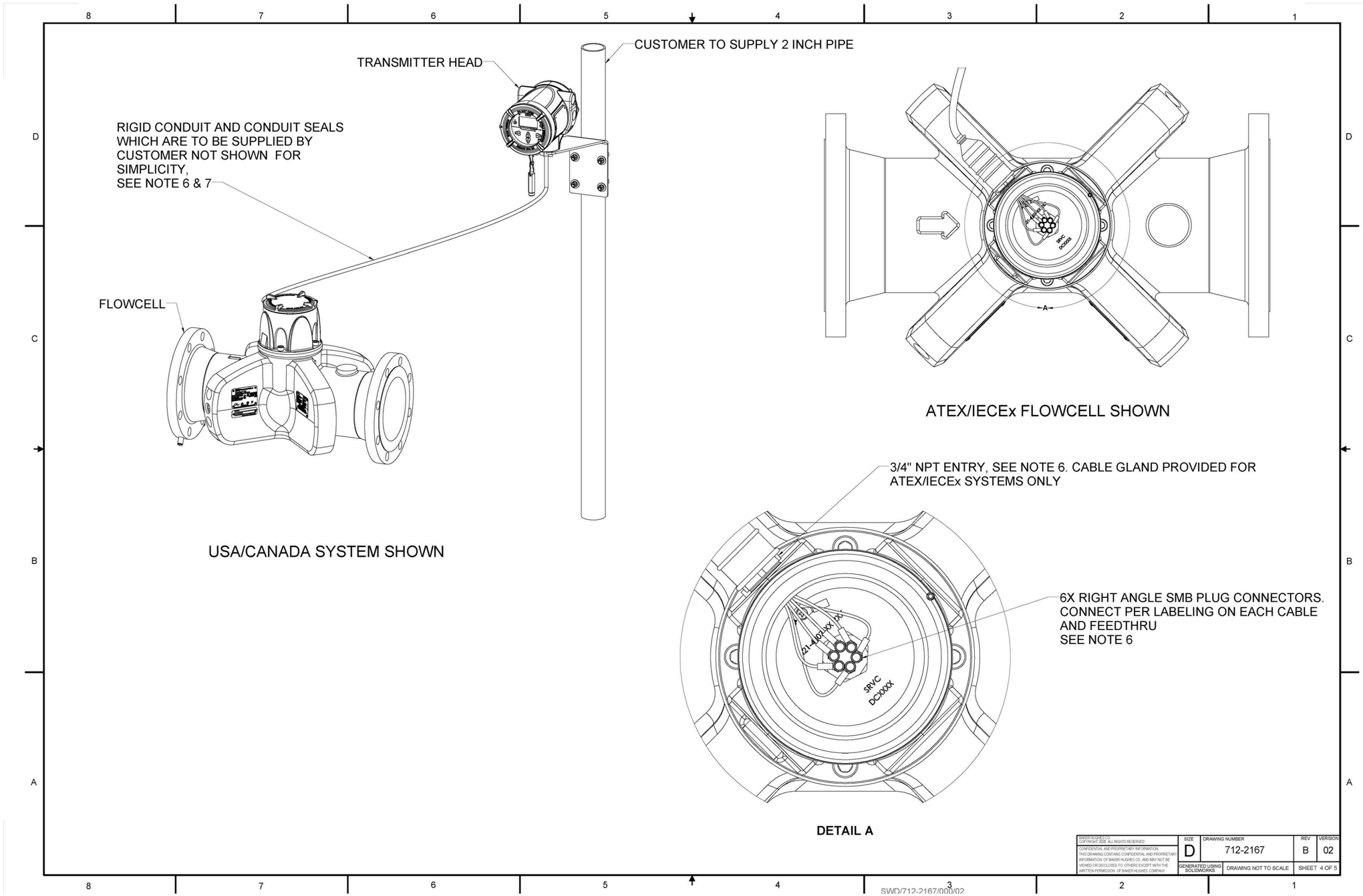


Figure 33: Outline and Installation drawing - remote mount (712-2167, sheet 4)

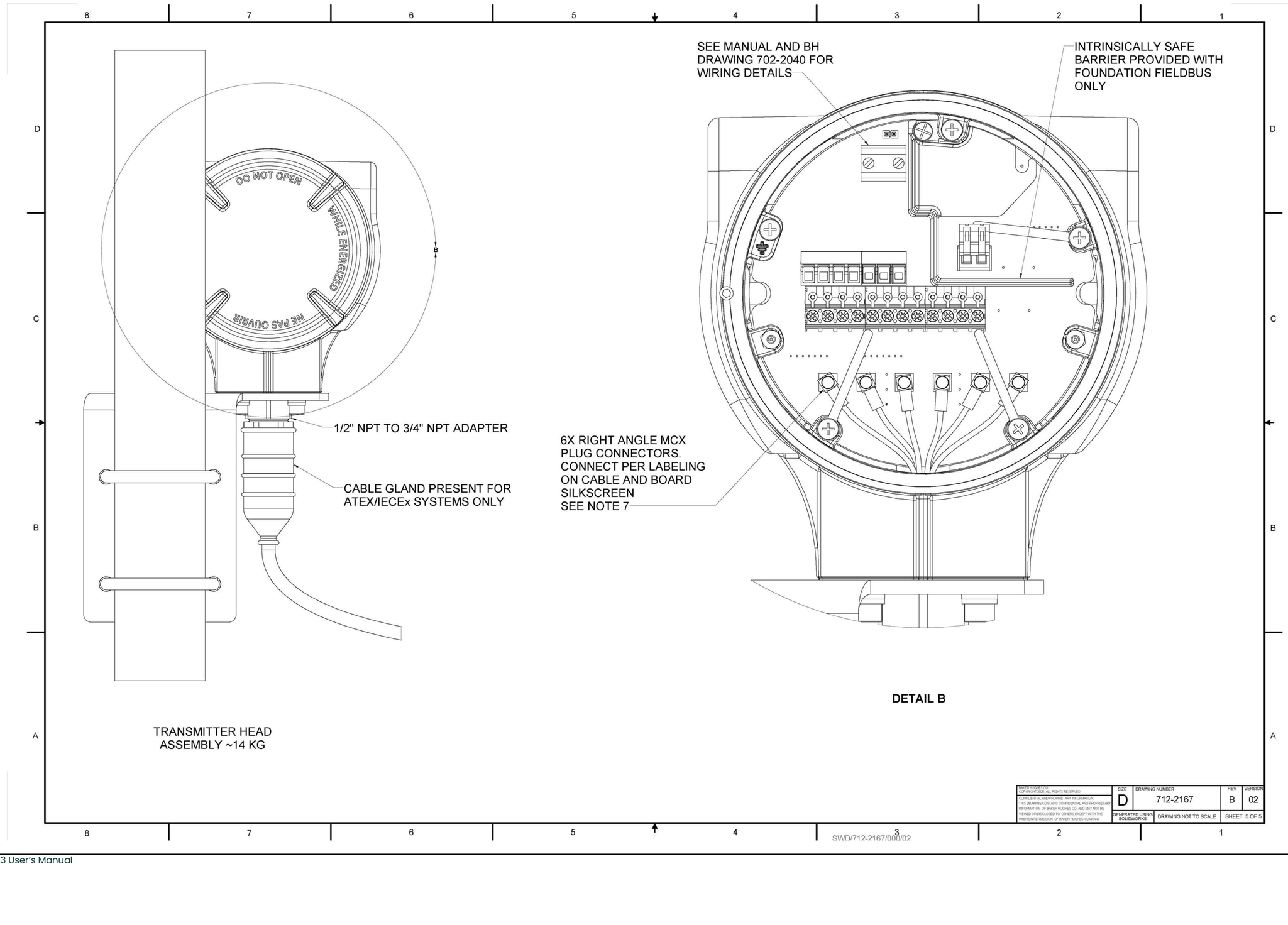


Figure 34: Outline and installation drawing - remote mount (712-2167, sheet 5)

Appendix B. -Digital Communications

For information on how to communicate using Foundation Fieldbus, Modbus, HART, or Wireless HART, refer to the XMT1000 User Manual appendix section.

[no content intended for this page]

Appendix C. Error code bit-field representation

Table 9: Flow Error Codes in Bit Field Values

Error representation	Error Description	Error code (in Hex)
E0	No Error	0x00000000
E29	Velocity Warning	0x00000001
E22	Single Channel Accuracy Error	0x00000002
E23	Multi-Channel Accuracy Error	0x00000004
E15	Active TW Error	0x00000008
E6	Cycle Skip Error	0x00000010
E5	Amplitude Error	0x00000020
E4	Signal Quality Error	0x00000040
E3	Velocity Range Error	0x00000080
E2	Sound Speed Error	0x00000100
E1	SNR Error	0x00000200
E27	Invalid K-Table Error	0x08000000
E28	Software Fault	0x10000000
E31	Not Calibrated Error	0x40000000

Table 10: System Error Codes in Bit Field Values

Error representation	Error Description	Error code (in Hex)
S0	No Error	0x00000000
S1	In Config Mode	0x00000001
S2	Invalid User	0x00000002
S3	Invalid Request	0x00000004
S4	Invalid Parameter Range	0x00000008
S5	Unsupported Parameter	0x00000010
S6	Flow Measurement	0x00000020
S7	Persistent Parameters CRC failed	0x00000040
S8	Multiplexer Switch Test Failed	0x00000080
S9	ADC Bit Test Failed	0x00000100
S10	VGA Test Failed	0x00000200
S11	Clock Frequency Test Failed	0x00000400
S12	CPU Test Failed	0x00000800
S13	Invariable Flash Memory Test Failed	0x00001000
S14	Invariable SRAM Memory Test Failed	0x00002000
S15	Variable Memory Test Failed	0x00004000
S16	FPGA Configuration Test Failed	0x00008000
S17	Temperature Test Failed	0x00010000
S18	Driver Fault	0x00020000
S19	Watch-dog Test Failed	0x00040000
S20	Analog Readback Failure	0x00080000

Table 10: System Error Codes in Bit Field Values

Error representation	Error Description	Error code (in Hex)
S21	Stack overflow	0x00100000
S22	Sequence or Windowed watchdog failure	0x00200000
S23	Initialization failed	0x00400000
S24	DSP Hardware Errors	0x00800000
S25	DSP Exception	0x01000000
S26	Default ISR	0x02000000
S27	DSP Reset	0x04000000
S28	Software Fault	0x08000000
S29	Output A loop Open	0x10000000
S30	Flash Save Failed	0x20000000

Table 11: Communication Error Codes in Bit Field Values

Error representation	Error Description	Error code (in Hex)
C0	No Error	0x00000000
C1	Flow COMM Error	0x00000001
C2	MODE MISMATCH	0x00000002
C3	Option I/O COMM Error	0x00000004

Table 12: Transmitter Error Codes in Bit Field Values

Error representation	Error Description	Error code (in Hex)
X0	No Error	0x00000000
X1	MCU RAM Error	0x00000001
X2	Flash memory test failed	0x00000002
X3	MCU key chip error	0x00000004
X4	MCU voltage chip error	0x00000008
X5	MCU RTC chip error	0x00000010
X6	OPT board not detected	0x00000020
X7	MPU board not detected	0x00000040
X8	MCU voltage out of limit	0x00000080
X9	MCU Pulse registration fail	0x00000100
X10	MCU file read fail	0x00000200
X11	MCU register access fail	0x00000400
X12	System Command failed	0x00000800
X13	Get GUI Node Fail	0x00001000
X14	Node Memory Fail	0x00002000
X15	Font API Initialize Fail	0x00004000
X16	XML File Initialize Fail	0x00008000
X17	Disconnect Std Dout	0x00010000
X18	Aout(std) Out Of Range	0x00020000

Table 13: Option I/O Errors in Bit Field Values

Error representation	Error Description	Error code (in Hex)
A0	No Error	0x00000000
A1	AnalogCh (S2:3) Error!	0x00000001
A2	AnalogCh (S2:4) Error!	0x00000002
A3	AnalogCh (S2:1) Error!	0x00000004
A4	AnalogCh (S2:2) Error!	0x00000008
A6	(S2:3) Ch Not Calibrated	0x00000020
A7	(S2:4) Ch Not Calibrated	0x00000040
A8	(S2:1) Ch Not Calibrated	0x00000080
A9	(S2:2) Ch Not Calibrated	0x00000100
A10	(S2:3) Input NotConnect!	0x00000200
A11	(S2:4) Input NotConnect!	0x00000400
A12	(S2:3) Ch OverRange Err!	0x00000800
A13	(S2:4)Ch OverRange Err!	0x00001000
A18	SerialNo Error!	0x00020000
A24	Aout(S2:1)OutOfRange!	0x00800000
A25	Aout(S2:2)OutOfRange!	0x01000000
A30	Board Option Err!	0x20000000
A31	(S2:3) Ch UnderRange!	0x40000000
A32	(S2:4) Ch UnderRange!	0x80000000

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™ HT must be wired with the recommended cable, and all connections must be properly shielded and grounded. Grounding of the chassis must be within 10 ft (3 m) of the transmitter. Refer to *Table 14* below for the specific requirements.

Table 14: Wiring Requirements

Connection	Cable Type	Ground Termination
Transducer	Armored RG-62 a/U or equivalent	Grounded using a cable gland.
Input/Output	Armored 22 AWG shielded with armored material added to outside of jacket	Grounded using a cable gland.
Power	Armored 14 AWG 2 conductor	Grounded using a cable gland.

Note: *If the PanaFlow Z3, is wired as described above, the unit will comply with the EMC and LVD Directives.*

[no content intended for this page]

Warranty

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

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

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

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

Return Policy

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

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

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

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

[no content intended for this page]

Customer Support Centers

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

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

Scan here for Panametrics support and service information

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