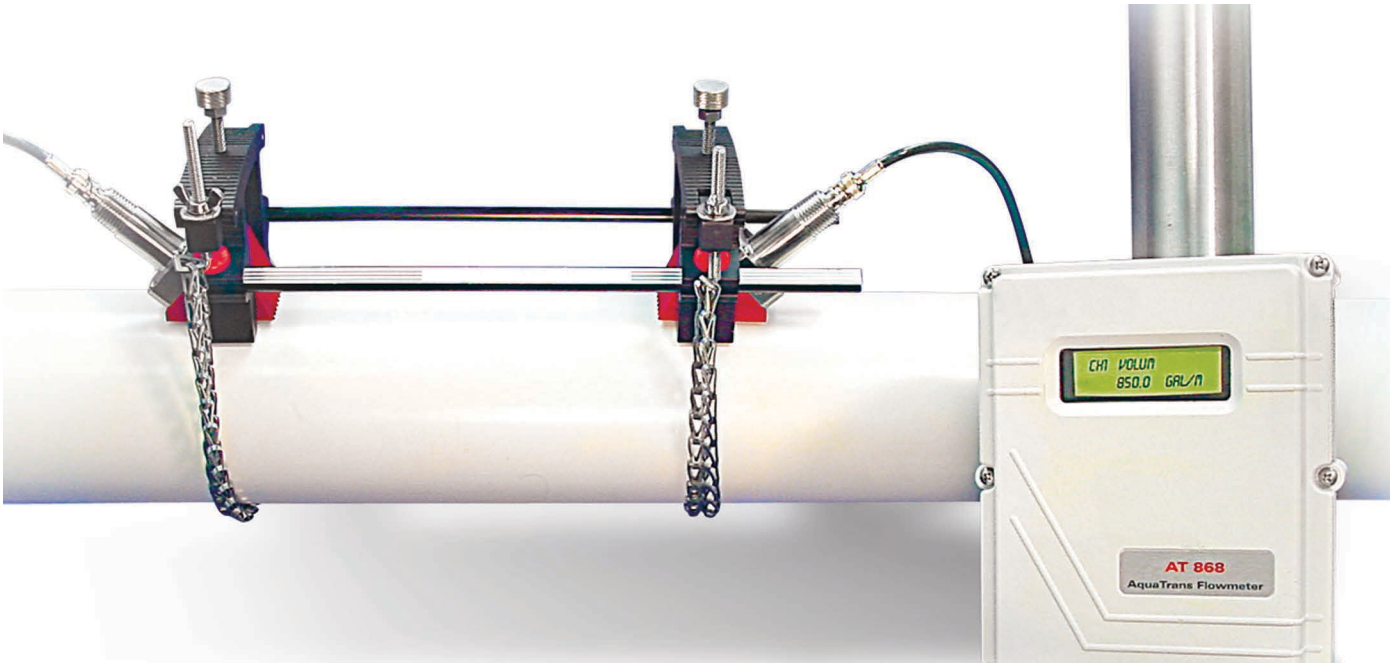
Panametrics

User's Manual

AquaTrans™ AT868

Liquid Flow Ultrasonic Transmitter



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Services

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Please visit https://panametrics.com/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 minor personal injury and/or damage to the equipment unless these instructions are followed carefully.

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

Safety Issues

WARNING! It is the responsibility of the user to follow all site rules and applicable regulatory requirements.

IMPORTANT Any instructions on grounding and cable termination in this manual are necessary for compliance with global EMC / RFI standards. Such compliance may be required by National EMC / RFI legislation.

Local Safety Standards

The user shall ensure that he operates the equipment in accordance with the applicable local codes, standards, regulations, or laws.

Qualification of Personnel

Ensure that all personnel have applicable training to use the equipment.

Personal Safety Equipment

Ensure that operators and maintenance personnel have all safety equipment applicable.

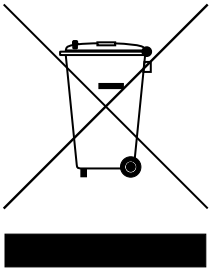
Unauthorized Operation

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

Environmental Compliance

Waste Electrical and Electronic Equipment

This apparatus required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment. To avoid the dispersal of these substances into our environment and to reduce the pressure on natural resources, we encourage you to use an appropriate “take-back” resource recovery scheme. These schemes will reuse or recycle most of the materials of your end-of-life equipment in an environmentally responsible way. The crossed-out wheeled bin symbol marked on the product invites you to use such a scheme.



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

As part of its commitment to the environment and the EU's WEEE Directive 2012/19/EU, Panametrics participates in a take-back scheme.

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

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Chapter 1. Installation

1.1 Introduction

To ensure safe and reliable operation of the Model AT868 Flowmeter, the system must be installed and programmed in accordance with the guidelines established by Panametrics engineers. Those guidelines, explained in detail in this chapter, include the following topics:

- Unpacking the Model AT868 system
- Selecting suitable sites for the electronics enclosure and the flowcell/transducers
- Installing the flowcell/transducers

Note: *See the applicable Panametrics* Transducer Installation Guide *for detailed instructions.*

- Installing the electronics enclosure
- Wiring the electronics enclosure

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

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

1.2 Unpacking

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

1.3 Site Considerations

Because the relative location of the flowcell and the electronics enclosure is important, use the guidelines in this section to plan the AT868 installation.

1.3.1 Electronics Enclosure Location

The standard Model AT868 electronics enclosure is a powder-coated aluminum Type 4X, IP66 weatherproof. Typically, the enclosure is mounted as close as possible to the transducers. When choosing a site, make sure the location permits easy access to the electronics enclosure for programming, maintenance and service.

Note: *For compliance with the European Union 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.*

1.3.2 Flowcell Location

Ideally, choose a section of pipe with unlimited access; for example, a long stretch of pipe that is above ground. However, if the flowcell is to be mounted in an underground pipe, dig a pit around the pipe to facilitate installation of the transducers.

1.3.3 Transducer Location

For a given fluid and pipe, the AT868 accuracy depends primarily on the location and alignment of the transducers. In addition to accessibility, when planning for transducer location, adhere to the following guidelines:

- Locate the transducers 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.
- 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. However, vertical pipes with downward flow should be avoided in order to insure a full pipe at the measurement point.

1.3.4 Cable Lengths

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

1.3.5 Transducer Cables

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

Note: *If you are using your own cables to connect the transducers to the electronics console, they must have electrical characteristics identical to the cables supplied by the factory. For transducer frequencies up to 2 MHz, the cables in each pair must be the same length within ±4 in. (10 cm). For transducer frequencies above 2 MHz, the cables in each pair must be the same length within ±0.5 in. (1.25 cm).*

1.4 Installing a Flowcell

A flowcell is the section of pipe where the transducers are mounted. It can be created either by mounting the transducers on the existing pipeline or by mounting them on a spoolpiece. A spoolpiece is a separately manufactured pipe section, matched to the existing pipe, which contains ports for mounting the transducers. This approach allows the transducers to be aligned and calibrated before inserting the spoolpiece into the pipeline. For detailed instructions on installing the transducers and/or spoolpiece, refer to the supplied drawings and the applicable Panametrics *Transducer Installation Guide*.

1.5 Mounting the AT868 Electronics Enclosure

The standard Model AT868 electronics package is housed in an power-coated aluminum Type 4X, IP66 weatherproof enclosure suitable for indoor or outdoor use. Refer to *Figure 3 on page 9* for the mounting dimensions and the weight of this enclosure.

1.6 Making the Electrical Connections

This section contains instructions for making all the necessary electrical connections to the AT868 flow transmitter. Refer to *Figure 4 on page 10* for a complete wiring diagram.

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

WARNING! Always disconnect the line power from the Model AT868 before removing front cover.

1.6.1 Preparing the Unit

Prepare the unit as described below before making any electrical connections.

1. Disconnect any previously wired power line from the unit.
2. Remove the screws on the front cover.
3. Remove the plastic shield that protects the electrical connections by loosening the two screws and lifting the plastic shield.

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

4. Install any required cable clamps in the appropriate conduit holes on the bottom of the enclosure.
5. Note the labels inside the enclosure to assist in wiring.

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

1.6.2 Wiring the Line Power

The AT868 may be ordered for operation with power inputs of 85-265 VAC or 12-28 VDC. The label on the side of the electronics enclosure lists the required line voltage and power rating. The fuse size is listed on the label located beneath the fuse. Be sure to connect the meter only to the specified line voltage.

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.*

Refer to *Figure 4 on page 10* to locate the power terminal block and connect the line power as follows:

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

1. See *"Preparing the Unit" on page 3* before you connect the power.
2. Prepare the line power leads by trimming the line and neutral AC power leads (or the positive and negative DC power leads) to a length 0.5 in. (1 cm) shorter than the ground lead. This ensures that the ground lead is the last to detach if the power cable is forcibly disconnected from the meter.
3. Install a suitable cable clamp in the conduit hole where the line power is fed through. If possible, avoid using a conduit hole containing input/output cables for this purpose, to minimize any interference in the circuitry from the AC power line.

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

4. Strip 1/4-in. of insulation from the end of each of the three line power leads.
5. Route the cable through the conduit hole and connect the line power leads to the power terminal block as shown in *Figure 4 on page 10*.
6. Leaving a bit of slack, secure the power line with the cable clamp.

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

7. Either proceed to the next section to continue wiring the AT868 or reinstall the plastic shield, replace the front cover on the enclosure and tighten the screws.

1.6.3 Wiring Transducers

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

Note: *For transducer frequencies below 2 MHz, the cable lengths must be within 4 in. (10 cm) of each other. If the transducer frequency exceeds 2 MHz, the cable lengths must be within 0.5 in. (1.25 cm) of each other.*

1. See *"Preparing the Unit" on page 3* before you connect the power.
2. Locate the CH1 transducer cables and connect them to the two CH1 transducers. Feed the free ends of the cables through the selected conduit hole in the electronics enclosure.
3. If an optional lightening protector is being installed, connect it between the meter and the transducers.
4. Refer to the wiring diagram in *Figure 4 on page 10* and connect the transducer cables to the terminal block labeled DN and UP for Channel 1. Then, secure the cable clamp.

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

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

5. For a 2-Channel/2-Path AT868, repeat steps 2-4 to connect the CH2 transducers to DN and UP terminal block for Channel 2. It is not required that both channels/paths of a 2-Channel unit be connected.

Note: *The AT868 uses two channels or paths to make more accurate flow measurement by averaging, subtracting or adding the channels/paths together.*

6. Either proceed to the next section to continue wiring the AT868 or reinstall the plastic shield, replace the front cover on the enclosure and tighten the screws.

Note: *A channel must be activated before it can begin taking measurements. See Chapter 2,* Programming Site Data*, for instructions.*

1.6.4 Wiring Std 0/4-20 mA Analog Outputs

The Model AT868 flow transmitter has a pair of isolated 0/4-20 mA analog output per channel (designated as Output A and Output C). These outputs can be configured independently. Typically, Output A is used for Channel 1 and Output C is used for Channel 2. However, each analog output can be configured to measure either channel.

Connections to this output may be made with standard twisted-pair wiring, but the current loop impedance for these circuits must not exceed 600 ohms. To wire the analog outputs, complete the following steps:

1. See *"Preparing the Unit" on page 3* before you connect the power.
2. Refer to *Figure 4 on page 10* for the locations of the appropriate terminal blocks and wire the analog outputs as shown. Secure the cable clamp.

Note: *Analog outputs 1 and 2 in the wiring diagram correspond to analog outputs A and C in the AT868 software.*

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

3. Either proceed to the next section to continue wiring the AT868 or reinstall the plastic shield, replace the front cover on the enclosure and tighten the screws.

Note: *Prior to use, the analog output must be set up and calibrated. See Chapter 4,* Calibration*, for detailed instructions.*

1.6.5 Wiring the Totalizer/Frequency Output

The Model AT868 also provides a second pair of outputs per channel (designated as Output B and Output D) that can be configured as a totalizer or frequency output.

Like the analog outputs, these outputs can also be configured independently. Typically, Output B is used for Channel 1 and Output D is used for Channel 2. However, each output can be configured to measure either channel. *Figure 1* below shows a sample wiring diagram of a totalizer and frequency output circuit.

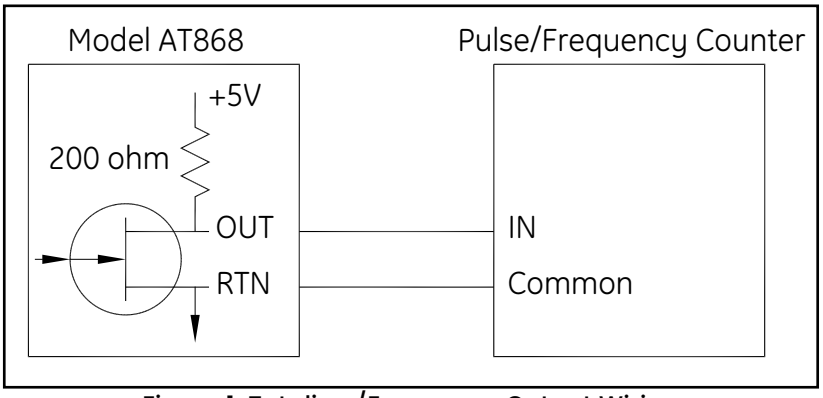


Figure 1: Totalizer/Frequency Output Wiring

WARNING! DO NOT CONNECT EXTERNAL POWER TO THE PULSE/FREQUENCY OUTPUT TERMINALS.

To wire the totalizer/frequency outputs, complete the following steps:

1. See *"Preparing the Unit" on page 3* before you connect the power.
2. Refer to *Figure 4 on page 10* for the location of the appropriate terminal blocks and wire the totalizer/frequency outputs as shown. Secure the cable clamp.

Note: *Analog outputs 1 and 2 in the wiring diagram correspond to analog outputs B and D in the AT868 software.*

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

3. Either proceed to the next section to continue wiring the AT868 or reinstall the plastic shield, replace the front cover on the enclosure and tighten the screws.

1.6.6 Wiring the Serial Port

The AT868 flow transmitter is equipped with a built-in serial communications port. The standard port is an RS232 interface, but an optional RS485 interface is available upon request. Proceed to the appropriate section for wiring instructions. For more information on serial communications refer to the Panametrics *EIA-RS Serial Communications* Manual (916-054).

1.6.6.1 Wiring an RS232 Interface

Use the serial port to connect the AT868 flow transmitter to a printer, an ANSI terminal or a personal computer. The RS232 interface is wired as Data Terminal Equipment (**DTE**), and the signals available at the **COMMUNICATION** terminal block are shown in *Table 1* below.

1. See *"Preparing the Unit" on page 3* before you connect the power.
2. Use the information in *Table 1* below to construct a suitable cable for connecting the AT868 to the external device. If desired, an appropriate cable may be purchased from Panametrics.

Table 1: RS232 Connection to DCE or DTE Device

COMMUNICATION Terminal Block	Colors for Panametrics Cable (flying leads)*	Signal Description	DCE DB25 Pin #	DCE DB9 Pin #	DTE DB25 Pin #	DTE DB9 Pin #
5	White	DTR (Data Terminal Ready)	20	4	20	4
4	Yellow	CTS (Clear to Send)	4	7	5	8
3	Green	COM (Ground)	7	5	7	5
2	Red	RX (Receive)	2	3	3	2
1	Black	TX (Transmit)	3	2	2	3
*For standard Panametrics cables 704-659, -660, -661 and -662.						

Note: *Signal names that imply direction (e.g., transmit and receive) are named from the point of view of the DTE device, which is usually the Panametrics meter. When the RS232 standard is strictly followed, these signals are labeled with the same name and pin # on the DCE device side as well. Unfortunately, that convention is not followed because the DTE and DCE side get confused. Therefore, connections that imply direction are changed to reflect their direction on the DCE side.*

3. Feed the flying leads end of the cable through the conduit hole and wire the leads to the **COMMUNICATON** terminal block as shown in *Figure 4 on page 10*. Connect the other end of the cable to the printer, ANSI terminal or personal computer, and secure the cable clamp.

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

4. Either proceed to the next section to continue wiring the AT868 or reinstall the plastic shield, replace the front cover on the enclosure and tighten the screws.

1.6.6.2 Wiring an RS485 Interface

Use the optional RS485 serial port to network multiple AT868 flow transmitters to a single computer terminal. Upon request, the standard RS232 port on the AT868 may be configured as a two-wire, half-duplex RS485 interface, through a device such as the *INMAC Model 800052 RS232-RS422/RS485* converter.

Note: *If the AT868 is configured at the factory for RS485 operation, the INMAC converter is not necessary.*

Refer to one of the following sections to wire the interface:

- Using an INMAC Converter (see below).
- Using a Factory-Configured Serial Interface (see page 7).

1.6.6.3 Using an INMAC Converter

To wire the RS485 serial port, refer to *Figure 4 on page 10* and complete the following steps:

1. See *"Preparing the Unit" on page 3* before you connect the power.
2. Feed one end of the cable through the conduit hole and wire the leads to the **COMMUNICATION** terminal block as shown in *Figure 4 on page 10*. Secure the cable clamp.
3. Connect the other end of the cable to the converter (see *Figure 2* below).

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

4. Either proceed to the next section to continue wiring the AT868 or reinstall the plastic shield, replace the front cover on the enclosure and tighten the screws.

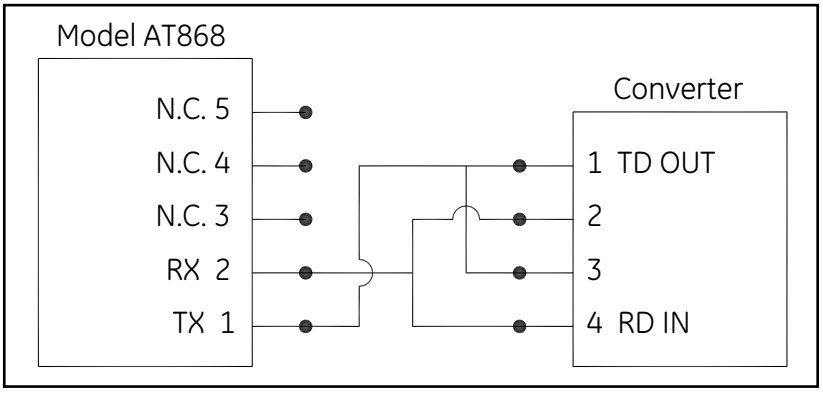


Figure 2: Typical RS485 Connections

1.6.6.4 Using a Factory-Configured Serial Interface

Use the following steps to link the AT868 to the control system using a factory-configured RS485 interface:

1. See *"Preparing the Unit" on page 3* before you connect the power.
2. Feed the wires through the conduit hole and wire lead **TMT+** to pin 2 (**RX**) on the **COMMUNICATION** terminal block (refer to *Figure 4 on page 10* for the terminal block location).
3. Wire lead **TMT-** to pin 1 (**TX**) on the **COMMUNICATION** terminal block and secure the cable clamp.
4. Connect the other end of the cable to the control system.

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

5. Either proceed to the next section to continue wiring the AT868 or reinstall the plastic shield, replace the front cover on the enclosure and tighten the screws.

1.6.7 Wiring an External Totalizer Reset Switch

Your AT868 can be wired with an external switch for resetting the meter's totalizer values. When properly configured, pressing the switch will reset the totalizer values to zero for both Channel 1 and Channel 2 (if present).

IMPORTANT: The AT868 only supplies the capability to connect and use the switch.The user must supply the actual switch and the wire to connect it.

Use the steps below to connect an external reset switch:

WARNING! **Always disconnect the line power from the Model AT868 before removing front cover.**

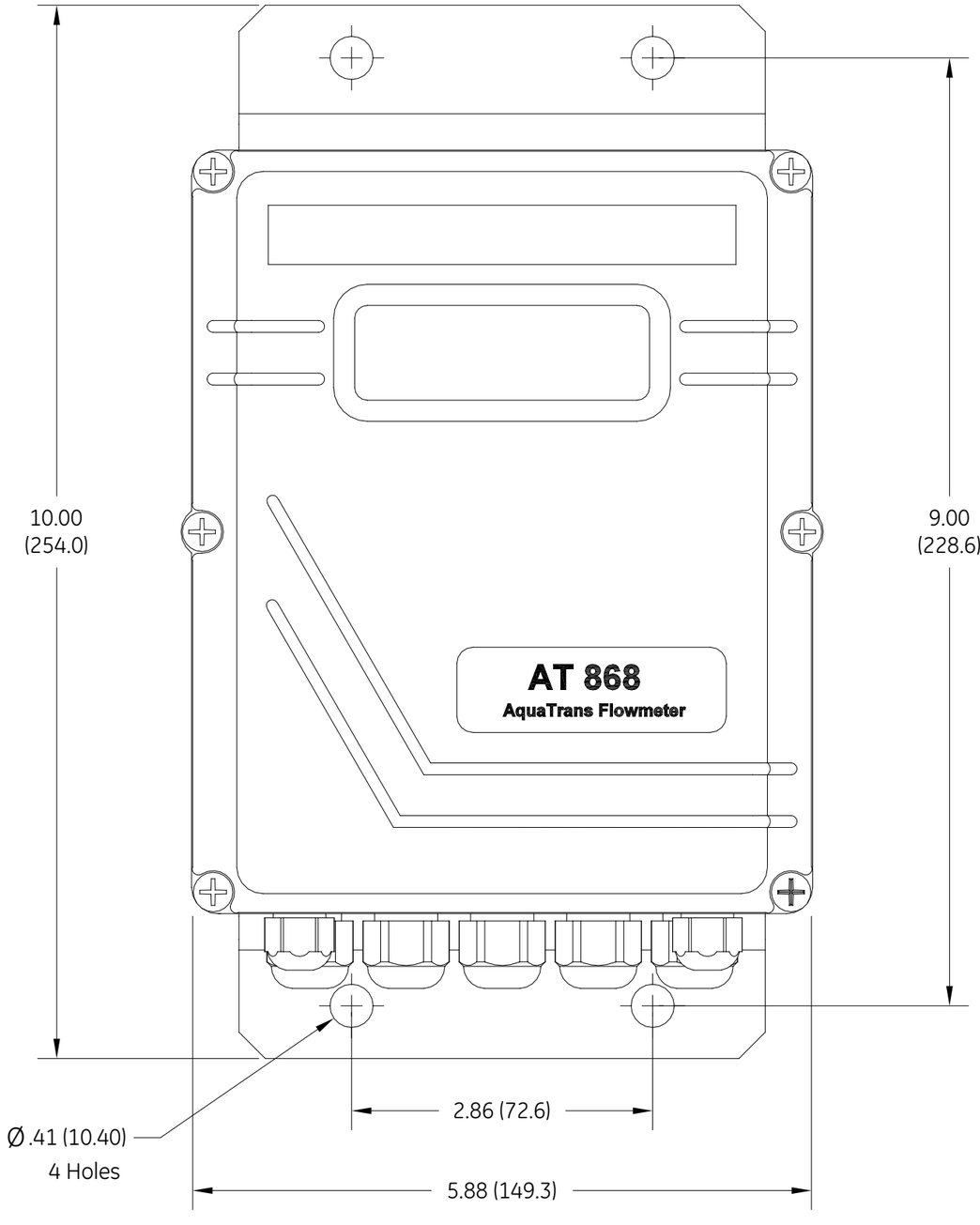
1. See *"Preparing the Unit" on page 3* before you connect the power.
2. Refer to *Figure 4 on page 10* to properly connect the external switch to the AT868.

IMPORTANT: Before you can used the external switch it must be configured as described in Chapter 2.

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

3. After the AT868 has been completely installed and wired, reconnect line power and proceed to Chapter 2, *Programming Site Data*, to program the meter for taking flow rate measurements.

Note:
1. All dimensions are in inches (millimeters).



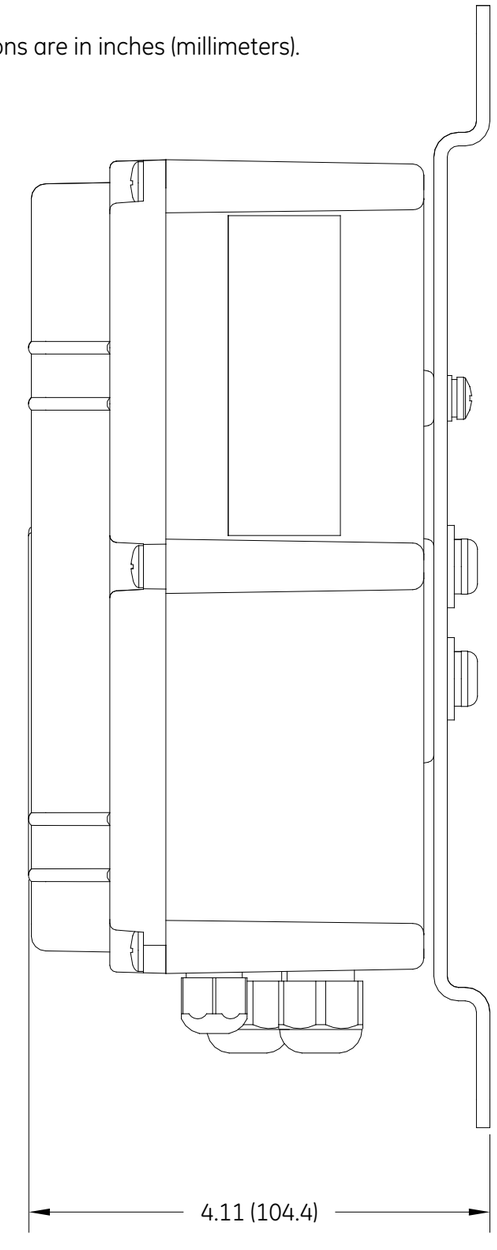


Figure 3: Outline & Installation - Wall Mount (Ref. Dwg. #712-1106C, Sheet 1)

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.*

TB3: 0/4-20 mA Analog Outputs	
Pin No.	**Description**
7 OUT1-	Output 1 RTN (-)
6 OUT1+	Output 1 SIG (+)

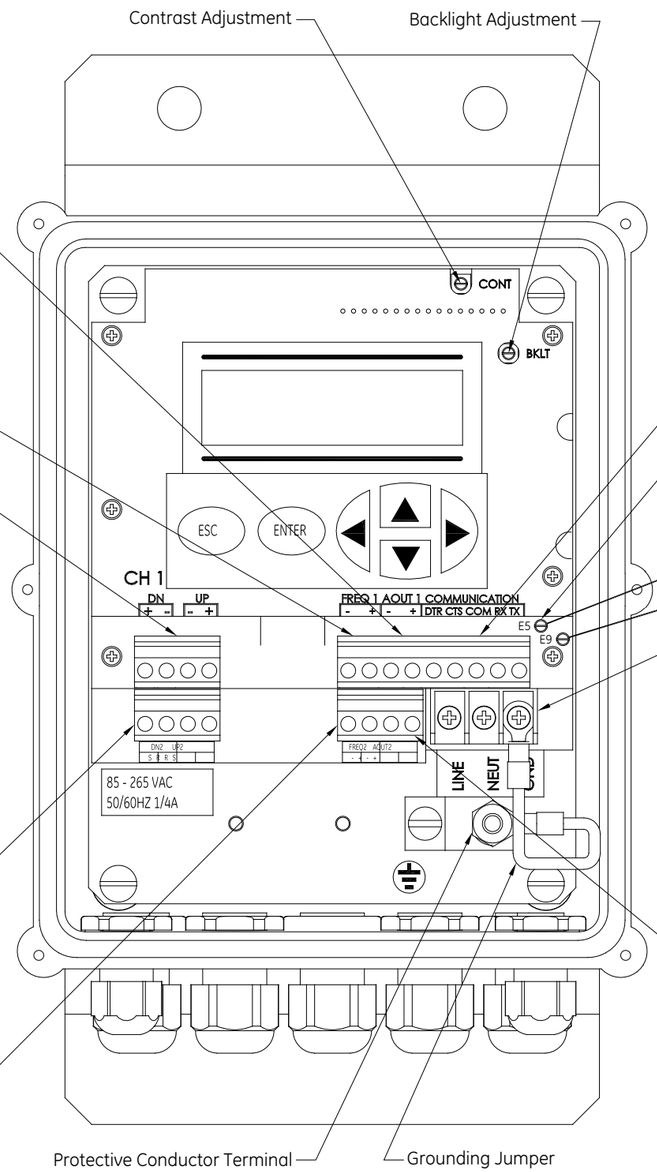
TB3: Frequency/Totalizer Outputs	
Pin No.	**Description**
9 FREQ1-	Output 1 RTN (-)
8 FREQ1+	Output 1 SIG (+)

TB1: CH1 Transducer	
Pin No.	**Description**
4 SIGDN	Downstream SIG (+)
3 RTNDN	Downstream RTN (-)
2 RTNUP	Upstream RTN (-)
1 SIGUP	Upstream SIG (+)

TB2: CH2 Transducer	
Pin No.	**Description**
4 SIGDN	Downstream SIG (+)
3 RTNDN	Downstream RTN (-)
2 RTNUP	Upstream RTN (-)
1 SIGUP	Upstream SIG (+)

TB4: Frequency/Totalizer Outputs	
Pin No.	**Description**
4 FREQ1-	Output 1 RTN (-)
3 FREQ1+	Output 1 SIG (+)

NOTE: *For compliance with the European Union's Low Voltage Directive,a transparent plastic shield protects the electrical connections. The shieldd must remain in place, except while wiring the unit. Reinstall the shieldd after the wiring has been completed.*



TB3: RS232/RS485 Serial Port		
Pin No.	**Color***	**Description**
5 DTR	White	Data Terminal Ready
4 CTS	Yellow	Clear to Send
3 COM	Green	Ground
2 RX	Black	Receive
1 TX	Red	Transmit
* for standard factory cables 704-659, 660, 661, 662		

External Totalizer Reset Switch*	
Test Point	**Description**
E5	Pole 1 of Switch
E9	Pole 2 of Switch
*Switch hardware is user-supplied.	

AC Power Input	
Pin No.	**Description**
LINE	Line Power
NEUT	Line Neutral
GND	Earth Ground
DC Power Input	
Pin No.	**Description**
1	Line Positive
2	Line Negative
3	No Connection

TB4: 0/4-20 mA Analog Outputs	
Pin No.	**Description**
2 OUT2-	Output 2 RTN (-)
1 OUT2+	Output 2 SIG (+)

Figure 4: Wiring Diagram (Ref. Dwg. #702-425)

Chapter 2. Programming Site Data

2.1 Introduction

The AT868 flow transmitter has a user program that provides access to the various programmable features of the unit. To program the AT868 you can use either the internal keypad or *Panaview*™, a PC-based, non-resident Panametrics software program that communicates with the AT868 through its serial port.

Note: *If you are using* Panaview, *the AT868 is configured with the Meter Address as 1 and the baud rate as 9600.*

This chapter describes step-by-step programming instructions using the internal keypad. For more information on programming with *PanaView*™, refer to Appendix F, *PanaView™*.

Refer to the appropriate section for a discussion of the following programming menus:

- **CHx-ACTIV** - activate one or both channels/paths.

Note: *The AT868 uses two channels or paths to make more accurate flow measurement by averaging, substracting or adding the channels/paths together.*

- **CHx-SYSTM** - select volumetric, totalizer and mass flow units and other parameters.
- **CHx-PIPE** - enter the pipe geometry and other parameters.
- **CHx-I/O** - set up the analog and totalizer/frequency outputs.
- **CHx-SETUP** - set the signal limits, response times and activating mass flow.
- **GLOBL-SYSTM** - select system units (English and metrics).
- **GLOBL-I/O** - set up error handling, outputs and display.
- **GLOBL-COMM** - set the serial port parameters.

Note: *The "x" in* CHx *represents the channel/path number. If you are using a single channel meter, only Channel 1 will appear.*

To get the AT868 up and running as quickly as possible, you must (as a minimum) activate the channel/path(s) and enter channel/path data, global system data, and pipe parameters. At the end of each section are directions to help you in programming both the required (quick startup) data and the optional data.

Also, as a programming aid, a complete set of menu maps for the user program (**PROG**) are included in Appendix A, *Menu Maps*. The specific figure numbers are referenced throughout this chapter.

Note: *In this manual, only the programming of Channel 1 is described. To program Channel 2 of a 2-channel/path meter, simply repeat the same procedures presented for Channel 1.*

2.2 Activating a Channel/Path - CHx-ACTIV

The **ACTIV** submenu is used to activate/deactivate the channel/path. The channel/path should be activated when you receive your unit; however, you should verify that the channel/path is active before you begin programming.

While following the programming instructions, refer to *Figure 10 on page 79*. Remember to record all programmed data in Appendix C, Data Records.

2.2.1 Accessing the ACTIV Submenu

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until ACTIV appears and press [ENTER].
5. Press [▶] until TRANS appears and press [ENTER]. Selecting TRANS activates the channel/path. If you have a 2-channel/path unit, you can also disable a channel/path. If you select OFF you will not be able to program that channel/path.

Procedure Options

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

- To continue entering *"quick startup"* data, press [ESC] once and proceed to Step 3 in the following section.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] three times.

2.3 Entering System Data for a Channel/Path - CHx-SYSTM

The CHx-SYSTM submenu is used to enter system parameters for the individual channels/paths. When channels/paths operate separately, the AT868 uses the system parameters in this menu. When channels/paths are averaged together, the AT868 uses parameters selected in the GLOBL-SYSTM submenu.

While following the programming instructions, refer to *Figure 10 on page 79*. Remember to record all programmed data in Appendix C, *Data Records*.

2.3.1 Accessing the CHx-SYSTM Submenu

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until SYSTM appears and press [ENTER].
5. Enter the desired CHANNEL LABEL (up to 5 characters) by using the arrow keys. Press [◀] and [▶] to move the cursor to the desired location and press [▲] and [▼] to change a letter. Then press [ENTER].
6. Use the arrow keys to enter the desired SITE MESSAGE (up to 16 characters) and press [ENTER]. (For a 2-channel/path meter, this prompt is called CHANNEL MESSAGE.)

2.3.2 Selecting the Volumetric Units

1. Use the arrow keys to select the desired volumetric units for the flow rate display and press [ENTER].
2. Use the arrow keys to select the desired number of digits to the right of the decimal point in the volumetric flow rate display and press [ENTER].

2.3.3 Selecting the Totalizer Units

1. Use the arrow keys to select the desired units for the totalized flow rate display and press [ENTER].
2. Use the arrow keys to select the desired number of digits to the right of the decimal point in the totalized flow rate display and press [ENTER].
3. Do one of the following:
   - If MASS FLOW is ON and both channels are active (for 2-channel units only), proceed to *"Selecting Mass Flow Units" on page 14*.
   - If MASS FLOW is OFF and/or only one channel is active, the meter returns to the Channel PROGRAM window. Go to *"Procedure Options" on page 14*.

Note: *To activate mass flow, refer to "Activating Mass Flow - MASS" on page 28.*

2.3.4 Selecting Mass Flow Units

1. Press [◀] and [▶] to select the desired mass flow units for the flow rate display and press [ENTER]. The available units for this prompt are determined by the selection made at SYSTEM UNITS.
2. Press [◀] and [▶] to select the desired time units for the mass flow rate display and press [ENTER].
3. Press [◀] and [▶] to select the desired number of digits to the right of the decimal point in the mass flow rate display and press [ENTER].
4. Press [◀] and [▶] to select the desired units for the totalized mass flow rate display and press [ENTER]. The available units for this prompt are determined by the selection made at SYSTEM UNITS.
5. Press [◀] and [▶] to select the desired number of digits to the right of the decimal point in the totalized mass flow rate display and press [ENTER].

Procedure Options

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

- To continue entering *"quick startup"* data, press [ESC] once and proceed to Step 3 in the following section.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] three times.

2.4 Entering Transducer and Pipe Parameters - CHx-PIPE

Enter the transducer and pipe parameters via the **PIPE** submenu. While following the programming instructions, refer to *Figure 10 on page 79*. Remember to record all programmed data in Appendix C, *Data Records*.

2.4.1 Accessing the PIPE Submenu

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until PIPE appears and press [ENTER].
5. Do one of the following:
   - ***Standard transducers:*** Enter the transducer number by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER]. Proceed to the next step.
   - ***Special transducers:*** Proceed to *"Special Transducers" on page 16*.

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

6. Go to one of the following sections:
   - ***Standard clamp-on transducers:*** Proceed to *"Pipe Material" on page 17*.
   - ***Standard wetted transducers:*** Proceed to *"Pipe Outside Diameter" on page 18*.

2.4.2 Special Transducers

1. For a special transducer, press [▶] to move the cursor to STD and press [▲] until SPEC appears and press [ENTER].
2. Assign a number between 90 and 99 to the special transducer. Enter the number by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER].
3. Press [◀] and [▶] to select the wedge type (supplied by Panametrics PanametricsSensing) and press [ENTER].
4. Press [◀] and [▶] to select the transducer frequency (supplied by Panametrics Sensing) and press [ENTER].

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

5. Enter the special transducer time delay value (supplied by Panametrics Sensing) by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER].

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

2.4.3 Special Clamp-On Transducers

The following two prompts appear only if special clamp-on transducers are being used. If special wetted transducers are being used, proceed to *Pipe Outside Diameter* on page 18.

1. Enter the wedge angle (supplied by Panametrics) of the transducer by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER].
2. Enter the wedge sound speed (supplied by Panametrics) of the transducer by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER]. Proceed to *"Pipe Outside Diameter" on page 18*.

2.4.4 Pipe Material

If a standard clamp-on transducer is being used, the programming sequence should be rejoined here.

1. Press [◀] and [▶] to select one of the pipe materials listed in *Table 2* below and press [ENTER].

Note: *Some of the pipe materials require additional selections.*

Table 2: Pipe Material Choices

Material	Types
STEEL	Carbon Stainless Steel
IRON	Ductile Cast
Cu (Copper)	no additional selection required
Al (Aluminum)	no additional selection required
BRASS	no additional selection required
CuNi (Copper Nickel)	70% Cu 30% Ni 90% Cu 10% Ni
GLASS	Pyrex Heavy silicate flint Light borate crown
Plastic	Nylon Polyethylene Polypropylene PVC, CPVC Acrylic
OTHER	Enter the sound speed of the pipe material by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER]. If the sound speed is unknown, refer to the *Sound Speeds and Pipe Size Data* manual (914-004).

2.4.5 Pipe Outside Diameter

The programming sequence should be rejoined here for all transducers.

1. Press [▶] to move the cursor to the outside diameter units and press [▲] and [▼] to select the desired units and press [ENTER].
2. Enter the known pipe outside diameter or circumferences by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER].

   Obtain the required information by measuring either the pipe outside diameter (OD) or circumference at the transducer installation site. The data may also be obtained from standard pipe size tables found in the Panametrics *Sound Speeds and Pipe Size Data* reference (914-004).
3. Enter the know thickness of the pipe wall by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER]. If the pipe wall thickness is not available, look up the value in a table of standard pipe size data which can be found in the Panametrics *Sound Speeds and Pipe Size Data* reference (914-004).
4. Do one of the following:
   - All wetted transducers - proceed to *Path and Axial Length* below.
   - All clamp-on transducers - proceed to *Lining* on page 19.

2.4.6 Path and Axial Length

1. Enter the path length of the ultrasonic signal.
2. Select the desired units and press [ENTER].

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

3. Enter the axial length of the ultrasonic signal and press [ENTER].
4. Select the desired units and press [ENTER].
5. Proceed to *"Setting Up a Tracking Window" on page 19*.

2.4.7 Lining

1. Press [◀] and [▶] to select whether the pipe has a lining and press [ENTER].
2. Do one of the following:
   - If you selected No, proceed to *"Setting Up a Tracking Window" on page 19* and *"Fluid Type" on page 20*.
   - If you selected Yes, proceed to the next step.
3. Press [◀] and [▶] to select the lining material and press [ENTER].
4. If you selected OTHER, enter the lining sound speed by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER].
5. Enter the lining thickness by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER].

2.4.8 Setting Up a Tracking Window

The *Tracking Window* feature is used to "track" the fluid sound speed. This feature enables you to make accurate measurements when the fluid sound speed is unknown or when the fluid sound speed varies widely (due to temperature variations or other factors).

1. At the TRACKING WINDOWS prompt select:
   - YES - If you **do not** know the fluid sound speed, proceed to Step 2.
   - NO - If you **do** know the fluid sound speed, proceed to *"Fluid Type" on page 20*.
2. Do one of the following:
   - If the fluid sound speed varies over a wide range, the Tracking Window must remain active. Proceed to *"Fluid Type" on page 20* to complete programming your meter.
   - If the sound speed is fairly constant, or you want to determine if the sound speed is constant, proceed to Step 3.
3. Proceed to *"Fluid Type" on page 20* to complete programming your meter. When you have completed programming, proceed to *"Using the Tracking Window" on page 55*.

2.4.9 Fluid Type

1. The selections for fluid type vary depending on whether the *Tracking Window* is enabled or disabled. Press [◀] and [▶] to select the desired fluid and press [ENTER]. Refer to *Table 1* below for a list of available fluids.

Table 3: Fluid Types

Tracking Windows =	
DISABLED	ENABLED
WATER	W100 (Water, 0°-100°C)
OTHER	W260 (Water, 0°-260°C)
	Oil, Tracking
	OTHER

2. If you selected OTHER, enter the additional information as prompted by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER].

2.4.10 Reynolds Correction

1. Press [◀] and [▶] to select whether to activate or deactivate the *Reynolds Correction Factor* and press [ENTER].

Note: *Typically, Reynolds Correction is set to active.*

2. Do one of the following:
   - If you selected OFF, enter the *Calibration Factor* and press [ENTER]. Then, proceed to one of the following sections:
     - ***Clamp-on Transducers:*** Proceed to Number of Traverses and Transducer Spacing on page 21.
     - ***Wetted Transducers:*** The meter returns to the Channel PROGRAM window. At this point, you can continue programming in this submenu as desired. To leave the Channel PROGRAM window, press [ESC] three times. To complete setting up the meter, you must enter data in the GLOBL-SYSTM submenu as described on page 30.
   - If you selected ACTIV, proceed to *"KV Input Selection" on page 21*.

2.4.11 KV Input Selection

1. Press [◀] and [▶] to enter a static kinematic viscosity or a table of values and press [ENTER].
2. Do one of the following:
   - If you selected Table, enter the ***Calibration Factor*** by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Press [ENTER].

Note: *The values in the KV/SS table can be edited as described in "Entering KV/SS Table - KV/SS" on page 26.*

   - If you selected STATC, the AT868 will select and automatically display the *Kinematic Viscosity* (see note below). If you want to enter a different number use the [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER]. Then enter the *Calibration Factor* in a similar manner and press [ENTER].

Note: *If you select* OTHER *as the fluid type, you must enter the* Kinematic Viscosity. *The* AT868 *only approximates the Kinematic Viscosity if you select any fluid option besides* OTHER.

3. Proceed to one of the following sections:
   - ***Clamp-on Transducers:*** Proceed to *Number of Traverses and Transducer Spacing* on page 21.
   - ***Wetted Transducers:*** The meter returns to the Channel PROGRAM window. At this point, you can continue programming in this submenu as desired. To leave the Channel PROGRAM window, press [ESC] three times. To complete setting up the meter, you must enter data in the GLOBL-SYSTM submenu as described in *"Entering Global System Data - GLOBL-SYSTM" on page 30*.

2.4.12 Number of Traverses and Transducer Spacing

1. Press [◀] and [▶] to select the number of traverses and press [ENTER].
2. Enter the value for the transducer spacing by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER].

Procedure Options

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

- To continue entering *"quick startup"* data, press [ESC] once and proceed to Step 3 in the following section.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] three times.

2.5 Entering the Zero Cutoff Value - CHx-I/O

Near a zero flow rate, the Model AT868 readings may fluctuate due to small offsets caused by thermal drift or similar factors. To force a zero display reading when there is minimal flow, enter a *zero cutoff value* as described below.

While programming these parameters, refer to *Figure 10 on page 79*. Remember to record all programmed data in Appendix C, *Data Records*.

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until I/O appears and press [ENTER].
5. Enter a value from 0 to 1 ft/sec (0 to 0.30 m/sec) for the zero cutoff by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER]. The recommended setting is 0.1 ft/sec (0.03 m/sec).

Procedure Options

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

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] three times.

2.6 Entering Setup Data - CHx-SETUP

The signal limits and response times for the AT868 are specified via the **SETUP** menu. The following menus are included in this section:

- **SIGNL** - set the parameters related to the transducer signal
- **AVRG** - specify the response of the meter to step changes
- **INIT** - initialize all parameters to default values
- ADVAN - enable mass flow, edit kinematic viscosity vs. sound speed table, activate K factors, and select transmit code length.

While following the programming instructions, refer to *Figure 12 on page 81*. Remember to record all programmed data in Appendix C, *Data Records*.

2.6.1 Set Transducer Signal Settings - SIGNL

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

CAUTION! **The SIGNL default settings are suitable for most applications. Consult the factory before changing any of these parameters.**

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until SETUP appears and press [ENTER].
5. Press [▶] until SIGNL appears and press [ENTER].
6. Using *Table 4* below as a reference, determine the new signal values. Enter or select the new values using the arrow keys, then press [ENTER].

Procedure Options

After completing the above step, the user program returns to the SET UP window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] four times.

Table 4: Transducer Signal Parameters

Transducer Signal Parameters	Range	Default Value	Description
Signal Low Limit	-20 to 100	40	The E1:LOW SIGNAL error message appears when the signal strength falls below the programmed SIGNAL LOW LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Correlation Peak Limit	0 to 500	100	The E4: SIGNAL QUALITY error message appears when the signal quality falls below the programmed COR. PEAK LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Soundspeed ± Limit	1 to 50%	20%	The E2:SOUNDSPEED error message appears when the calculated fluid sound speed differs from the fluid sound speed entered in the Channelx-System menu by more than the programmed SOUNDSPEED ± LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Velocity Low Limit	–328 to 328 ft/sec (–100 to 100 m/sec)	–40.0 ft/sec (–12 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity is less than the programmed VELOCITY LOW LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Velocity High Limit	–328 to 328 ft/sec (–100 to 100 m/sec)	40.0 ft/sec (12 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity exceeds the programmed VELOCITY HIGH LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Acceleration Limit	0 to 100 ft/sec^2 (0 to 30 m/sec^2)	15.0 ft/sec^2 (4.6 m/sec^2)	The E6: CYCLE SKIP error message appears when the calculated fluid velocity changes by more than the programmed ACCLERATION LIMIT value from one reading to the next. See Chapter 5, *Error Codes*, for a discussion of error codes.

Table 4: Transducer Signal Parameters(Continued)

Transducer Signal Parameters	Range	Default Value	Description
Amplitude Discriminator Low	0 to 100	14	The amplitude measures the transducer signal received by the Model AT868. The E5: AMPLITUDE error message appears when the amplitude discriminator falls below the programmed AMP. DISCRIM. LOW value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Amplitude Discriminator High	0 to 100	34	The amplitude discriminator measures the transducer signal received by the Model AT868. The E5: AMPLITUDE error message appears when the amplitude discriminator exceeds the programmed AMP. DISCRIM. LOW value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Delta T Offset	–1000 to 1000 msec	0 msec	An offset between the upstream and downstream transit times is specified at this prompt.
% of Peak	-100 to 100%	- 40%	The percentage of peak used to calculate the transit times and Delta T is specified at this prompt. ***Note:*** *This setting is a starting point for detecting the signal. The meter automatically adjusts this value if the calculated transit time is unacceptable. You can set the limits for this value using the MIN. PEAK% and MAX. PEAK% discussed at the end of this table.*
Transmitter Voltage	Low or High	High	The transmitter voltage can be set to low or high to reduce power consumption. LOW (default setting) is typically selected for smaller pipes with a single-phase fluid. The LOW setting is normally sufficient. HIGH is usually selected for large pipes or liquids with one or more phases.
Xmit Sample Size	2, 4, 8, 16 or 32	8	Both upstream and downstream transducers transmit ultrasonic pulses in bursts, which consist of a series of transmit pulses. XMIT SAMPLE SIZE determines how many bursts are sent in one direction before sending in the other direction.
# of Errors	0 to 16	8	Use this prompt to enter the number of errors the AT868 can record before it displays an error message.
Minimum Peak% Limit	-100 to 100	-100	Use this prompt to enter the minimum percent of peak that the AT868 can use to measure transit time.
Maximum Peak% Limit	-100 to 100	100	Use this prompt to enter the maximum percent of peak that the AT868 can use to measure transit time.

2.6.2 Setting Response Time - AVRG

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

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until SETUP appears and press [ENTER].
5. Press [▶] until AVRG appears and press [ENTER].
6. Press [◀] and [▶] to select the response and press [ENTER]. For best results, select STATS (statistics). This increases the response time under steady flow conditions while still allowing a rapid response time to changes in flow rate.

Procedure Options

After completing the above step, the user program returns to the SET UP window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] four times.

2.6.3 Initializing Setup Parameters - INIT

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

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until SETUP appears and press [ENTER].
5. Press [▶] until INIT appears and press [ENTER].
6. Select YES or NO.

Procedure Options

After completing the above step, the user program returns to the SET UP window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] four times.

2.6.4 Using Advanced Features - ADVAN

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

- KV/SS - Calculate the kinematic viscosity (KV) based on signal strength (SS). See *"Entering KV/SS Table - KV/SS" on page 26*.
- MULTK - Enter a table of K-factors (based on velocity or reynolds number) that compensates for non-linear flow rates. See *"Entering KV/SS Table - KV/SS" on page 26*.
- MASS - Enable mass flow (calculated for static fluid density). See *"Activating Mass Flow - MASS" on page 28*.
- CODEL - Select the size of the transducer transmission signal. See *"Selecting Transmitter Code Length - CODEL" on page 29*.

2.6.4.1 Entering KV/SS Table - KV/SS

Use this option to calculate the kinematic viscosity (KV) based on signal strength (SS). Complete the following steps to enter KV and SS values:

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until SETUP appears and press [ENTER].
5. Press [▶] until ADVAN appears and press [ENTER].
6. Press [▶] until KV/SS appears and press [ENTER].
7. Enter the number of kinematic viscosity/sound speed pairs (2 to 20) by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
8. Enter the signal strength value (50.0 to 85.0) by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number and press [ENTER].

IMPORTANT: You must enter the KV vs. SS pairs in descending order of KV and ascending order of SS. For example, if pair 1 is KV = 10 centistokes and SS = 62, then pair 2 must be KV ≤ 10 centistokes and SS ≥ 62.

9. Enter the kinematic viscosity values (0.050 to 500) in descending order by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
10. Repeat Steps 8 and 9 for each pair of values.

Procedure Options

After completing the above step, the user program returns to the Advanced Feature window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] five times.

2.6.4.2 Entering Multiple K Factors - MULTK

Use this option to enter a table of K-factors. K-factors are used to create a curve for the flow range (based on velocity or reynolds number) that compensates for non-linear flow rates. Complete the following steps to enter multiple K factors for velocity or reynolds values:

Note: *The K-factors are supplied by Panametrics. The K-factor table cannot be edited without them.*

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until SETUP appears and press [ENTER].
5. Press [▶] until ADVAN appears and press [ENTER].
6. Press [▶] until MULTK appears and press [ENTER].
7. Press [▶] to select whether to activate or deactivate multiple K factors and press [ENTER].

Note: *If you select* NO*, go to "Procedure Options" on page 27.*

8. Press [▶] to select the type of value to customize (velocity or reynolds value) and press [ENTER].
9. Press [▶] to select whether you wish to edit the table and press [ENTER].

Note: *If you select* NO*, go to "Procedure Options" on page 27.*

10. Enter the number of K factors (2 to 20) in the table by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
11. Enter the velocity/reynolds value for K-factor number "X" by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].

IMPORTANT: When editing the K-factor table, the velocities must be entered in ascending order.

12. Enter the K-factor corresponding to velocity/reynolds number "X" (0.333 to 3.0) by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
13. Repeat Steps 11 and 12 for each pair of data points.

Procedure Options

After completing the above step, the user program returns to the Advanced Feature window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] five times.

2.6.4.3 Activating Mass Flow - MASS

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

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until SETUP appears and press [ENTER].
5. Press [▶] until ADVAN appears and press [ENTER].
6. Press [▶] until MASS appears and press [ENTER].
7. Press [▶] to select whether to activate or deactivate mass flow (mass flow is calculated from a static density) and press [ENTER].

Note: *If you select* NO*, go to "Procedure Options" on page 28.*

8. Enter the fluid density by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].

Procedure Options

After completing the above step, the user program returns to the Advanced Feature window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] five times.

2.6.4.4 Selecting Transmitter Code Length - CODEL

Use this option to select the size of the transducer transmission signal. This option is helpful when measuring flow on small pipes. Complete the following steps to select the code length.

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [▶] until SETUP appears and press [ENTER].
5. Press [▶] until ADVAN appears and press [ENTER].
6. Press [▶] until CODEL appears and press [ENTER].
7. Press [▶] to select the transmitter code length from the options listed below and then press [ENTER].
   - ***Automatic:*** The meter determines the appropriate code length (short or long) automatically, based on pipe size and transducer type.
   - ***Short Code:*** This option includes only a few pulses with no code pattern built in. In some cases, the diameter of the pipe is too small which does not give each transducer the necessary time to send a series of signals before receiving a series of signals. This is also a good selection for pipes made of materials which tend to blur the signal pattern, such as Teflon®.
   - ***Long Code:*** This option includes a series of approximately a dozen pulses which have a distinctive binary pattern that is easily recognizable during auto correlation.

Procedure Options

After completing the above step, the user program returns to the Advanced Feature window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] five times.

2.7 Entering Global System Data - GLOBL-SYSTM

While completing these instructions, refer to *Figure 11 on page 80.* Remember to record all programmed data in Appendix C, *Data Records*.

Proceed to the following sections to enter system information in the **GLOBL** menu.

2.7.1 Selecting the GLOBL-SYSTM Units

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until GLOBL appears and press [ENTER].
4. Press [▶] until SYSTM appears and press [ENTER].
5. Enter a short message of up to 16 characters by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to select the desired letter/space/symbol. Then, press [ENTER].

2.7.2 Selecting the System Units

1. Press [▶] to select the system units and press [ENTER].

Note: *For single-channel units, go to "Setting Up the External Totalizer Reset Switch" on page 31. For 2-channel/path units, proceed with the following steps.*

2. Press [▶] to select the volumetric units for the flow rate display and then press [ENTER].
3. Press [▶] to select the number of digits to the right of the decimal point in the volumetric flow rate display and then press [ENTER].
4. Press [▶] to select the desired units for the totalized flow rate display and then press [ENTER].
5. Press [▶] to select the desired number of digits to the right of the decimal point in the totalized flow rate display and the press [ENTER].

2.7.3 Setting Up the External Totalizer Reset Switch

The GATE OPTION enables you to configure an external reset switch that can reset totals by activating a switch that is located remotely from the electronics. To connect an external reset switch, refer to *"Wiring an External Totalizer Reset Switch" on page 8*.

IMPORTANT: The hardware for the switch is user-supplied. Panametrics provides only the software needed to configure the switch and the terminals used to connect the switch.

1. At the GATE OPTION prompt, press [▶] to select one of the following options and press [ENTER].
   - RESET - The meter resets the current totals to zero for both channels and then immediately resumes data collection.
   - HOLD - The meter holds the current totals for both channels, and it will not resume data collection as long as the switch remains closed. This option is typically used for calibration.
2. Do one of the following:
   - If MASS FLOW is ON and both channels are active (for 2-channel units only), proceed to *"Selecting Mass Flow Units" on page 32*. Both channels must be active
   - If MASS FLOW is OFF and/or one channel is active, the meter returns to the Global PROGRAM window. Go to *"Procedure Options" on page 32*.

Note: *To activate mass flow, refer to "Activating Mass Flow - MASS" on page 28.*

2.7.4 Selecting Mass Flow Units

1. Press [◀] and [▶] to select the desired mass flow units for the flow rate display and press [ENTER]. The available units for this prompt are determined by the selection made at SYSTEM UNITS on the previous page.
2. Press [◀] and [▶] to select the desired time units for the mass flow rate display and press [ENTER].
3. Press [◀] and [▶] to select the desired number of digits to the right of the decimal point in the mass flow rate display and press [ENTER].
4. Press [◀] and [▶] to select the desired units for the totalized mass flow rate display and press [ENTER]. The available units for this prompt are determined by the selection made at SYSTEM UNITS on the previous page.
5. Press [◀] and [▶] to select the desired number of digits to the right of the decimal point in the totalized mass flow rate display and press [ENTER].

Procedure Options

After completing the above step, the user program returns to the Global PROGRAM window. Do one of the following:

- You have completed entering all required *"quick startup"* data. To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] three times.

2.8 Setting Up the Inputs and Outputs - GLOBL-I/O

Set up the AT868 inputs and outputs via the **Input/O**utput menu. While following the programming instructions, refer to *Figure 11 on page 80*. Remember to record all programmed data in Appendix C, *Data Records*.

The GLOBL-I/O submenu consists of the following options:

- **ERROR** - Program the meter's response during an error condition. See *"Selecting Error Handling - ERROR" on page 33*.
- **OPTN** - Set up the analog and totalizer/frequency outputs. See *"Setting Up Analog and Totalizer/Frequency Outputs - OPTN" on page 35*.
- **LCD** - Set up the LCD display. See *"Setting Up the Display" on page 42*.

2.8.1 Selecting Error Handling - ERROR

This menu option lets you set how the AT868 handles the outputs for measurements and average (two-path) measurements during an error condition. See *Chapter 5, Error Codes,* for a discussion of the built-in error codes.

Use the steps below to select the error handling options:

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until GLOBL appears and press [ENTER].
4. Press [▶] until I/O appears and press [ENTER].
5. Press [▶] until ERROR appears and press [ENTER].
6. Press [▶] to select the desired option for error handling and press [ENTER]. See *Table 5* below and *Table 6 on page 33* for a description of error handling options available and how the totalizers and display respond to them for a 1-channel/path meter and for a 2-channel/path meter.

Table 5: Error Options and Responses for a 1-Channel Meter

Option	Output Response	Totalizer Response
HOLD	Holds last "good" reading.	Holds last "good" reading and continues to totalize, based on that reading.
NO UP		Stops totalizing.

Table 6: Error Options and Responses for a 2-Channel/Path Meter

When Measuring	Display Response	Totalizer Response When Error Handling is	
		HOLD	LOW, HIGH, HHIGH
CH1 or CH2 (vel, vol, etc.)	Holds last "good" reading.	Holds last "good" reading and continues to totalize based on that "good" reading.	Stops totalizing.
SUM	Adds two channels/paths using the last "good" reading.	Holds last "good" reading and continues to totalize based on two channels/paths.	Stops totalizing if either or both channels/paths go into error.
DIF	Subtracts two channels/paths using the last "good" reading.	Holds last "good" reading and continues to totalize based on two channels/paths.	Stops totalizing if either or both channels/paths go into error.
AVE	See *Error Handling for Average Measurements* below.		

7. The ERROR-HANDLING D display appears. This allows the user to set a time delay before the instrument reports that an error has occurred. Enter the desired time delay in seconds by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].

8. Do one of the following:
   - For a 1-channel meter, go to *Procedure Options* on *"Procedure Options" on page 34*.
   - For a 2-channel/path meter, proceed to *Step 9 on page 34*.
9. Press [▶] to activate or deactivate two-path error handling and press [ENTER]. The **2PATH ERROR HAND** option is intended for applications where two sets of transducers are installed in the same location in the same pipe to improve accuracy and the meter is operated in **AVE** mode. With this function enabled, the AT868 performs error handling only if both channels/paths are in error. If this function is disabled, error handling occurs when either channel/path goes into error.

Specific responses of the display and the totalizer to the two-path error handling option available at the above prompt are listed in *Table 7* below.

Table 7: 2-Path Error Response Options

Option	Display Response	Totalizer Response
NO	Displays the average of channels/paths 1 and 2, regardless of the error state of either channel/path.	Outputs the average of channels/paths 1 and 2 totals, regardless of the error state of either channel/path.
YES	1. If one channel/path is in error, the other channel/path value is displayed as the average. 2. If both channels/paths are in error, the last average reading is held.	1. If one channel/path is in error, totalizing continues. 2. If both channels/paths are in error, totalizing stops.

Procedure Options

After completing the above step, the user program returns to the Global I/O window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] four times.

2.8.2 Setting Up Analog and Totalizer/Frequency Outputs - OPTN

The AT868 has one built-in analog output and one totalizer/frequency output for each channel which must be set up. To accomplish this, refer to one of the following sections:

- ***Analog Output:*** See *"Accessing Analog Outputs" on page 35*.
- ***Totalizer/Frequency Output:*** See *"Accessing a Totalizer/Frequency Output" on page 36*.

2.8.2.1 Accessing Analog Outputs

Outputs A and C are analog outputs that can be configured independently. Typically Output A is used for Channel 1 and Output C is used for Channel 2. However, either analog output can be configured to measure either channel. Proceed as follows:

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until GLOBL appears and press [ENTER].
4. Press [▶] until I/O appears and press [ENTER].
5. Press [▶] until OPTN appears and press [ENTER].
6. Press [▶] to select A or C and press [ENTER].

2.8.2.2 Setting Up the Analog Output Scale

1. Press [▶] to select the desired output scale and press [ENTER].
2. Do one of the following:
   - If you selected OFF, the meter returns to the Global I/O window. Go to *"Procedure Options" on page 35*.
   - If you are using a 1-channel meter, go to Step 4.
   - If you are using a 2-channel/path meter, go to Step 3.
3. At Channel, press [▶] to select the desired channel/path and press [ENTER].
4. Press [▶] to select the desired measurement parameter and press [ENTER].

Note: *The measurement units that appear in these prompts are those chosen in "Selecting the System Units" on page 30.*

5. At BASE, enter a flow rate value for the low end of the analog output range by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
6. At FULL, enter a flow rate value for the high end of the analog output range by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
7. At Error handling, press [▶] to select the desired option for handling errors (HOLD, LOW, HIGH, or OTHER) and press [ENTER].
8. If OTHER is selected, the Forced milliamps display appears. This allows the user to impose a set value for this option. Enter the desired forced milliamps by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].

Procedure Options

After completing the above step, the user program returns to the Global I/O window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] four times.

2.8.2.3 Accessing a Totalizer/Frequency Output

These outputs can be configured for frequency or totalizer output using Panametrics's *PanaView*™ software.

The totalizer output issues one pulse per each selected volume of flow. The meter produces a pulse each time the programmed amount of flow passes through the pipe. The frequency output issues a frequency that is proportional to the assigned measurement parameter, such as flow rate. Output B and D can be configured independently. Typically, Output B is used for Channel 1 and Output D is used for Channel 2. However, either output can be configured to measure either channel. Proceed as follows:

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until GLOBL appears and press [ENTER].
4. Press [▶] until I/O appears and press [ENTER].
5. Press [▶] until OPTN appears and press [ENTER].
6. Press [▶] to select B or D and press [ENTER].
7. Do one of the following:
   - For a frequency output, proceed to *"Setting Up a Frequency Output" on page 37*.
   - For a totalizer output, proceed to *"Setting Up a Totalizer Output" on page 38*.

2.8.2.4 Setting Up a Frequency Output

1. At Output B or D, select OFF or FREQ and press [ENTER].
2. Do one of the following:
   - If you selected OFF, the meter returns to the Global I/O window. Go to *"Procedure Options" on page 38*.
   - If you are using a 1-channel meter, go to Step 4.
   - If you are using a 2-channel/path meter, go to Step 3.
3. At Channel, press [▶] to select the desired channel/path and press [ENTER].
4. Press [▶] to select the desired measurement parameter and press [ENTER].

Note: *The measurement units that appear in these prompts are those chosen in "Selecting the System Units" on page 30.*

5. At BASE, enter a value for the low end of the output range (-2,000,000 to 2,000,000) by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
6. At FULL, enter a value for the high end of the output range (-2,000,000 to 2,000,000) by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number.
7. At FULL SCALE FREQU, enter a value for the full scale of the output (between 10 to 100,000) by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number.
8. At Error handling, press [▶] to select the desired option for handling errors (HOLD, LOW, HIGH, or OTHER) and then press [ENTER].
9. If OTHER is selected, the Error frequency display appears. This allows the user to impose a set value for this option. Enter the desired error frequency by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
10. Go to *"Procedure Options" on page 38*.

2.8.2.5 Setting Up a Totalizer Output

1. At Output B or D, select OFF or TTLZR and press [ENTER].
2. Do one of the following:
   - If you selected OFF, the meter returns to the Global I/O window. Go to *"Procedure Options" on page 38*.
   - If you are using a 1-channel meter, go to Step 4.
   - If you are using a 2-channel/path meter, go to Step 3.
3. At Channel, press [▶] to select the desired channel/path and press [ENTER].
4. Press [▶] to select the desired measurement parameter and press [ENTER].
5. Enter a value for the minimum pulse on time (between 50 μsec and 500,000 μsec) for the frequency of the totalizer pulses and press [ENTER]. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number.

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

6. At UNITS/PULSE enter a value for the number of measurement units represented by each pulse and then press [ENTER].

Procedure Options

After completing the above step, the user program returns to the Global I/O window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] four times.

2.9 Configuring the Communications Port - GLOBL-COMM

The AT868 flow transmitter is equipped with a built-in serial communications port. The standard port is an RS232 interface. However, an RS485 interface is available upon request.

The AT868 can receive and execute remote commands with *PanaView*, by connecting the meter's serial interface to the serial port of a PC. In addition, the AT868 can transmit stored data and displayed readings to a personal computer via this link.

Use the **GLOBL-COMM** submenu to set the communications port. While following the programming instructions, refer to *Figure 11 on page 80*. Remember to record all programmed data in Appendix C, *Data Records*.

Use the steps below to configure the communications port:

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until GLOBL appears and press [ENTER].
4. Press [▶] until COMM appears and press [ENTER].
5. Enter a meter address (between 1 and 254) by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. The default number is 1.

A meter address is necessary for communication with the *Panaview* software. See the *Panaview User's Manual* for more information.

IMPORTANT: If the meter address or baud rate is changed, communication via Panaview™ must be re-established with the new address number.

6. Press [▶] to select a baud rate and then press [ENTER].

Procedure Options

After completing the above step, the user program returns to the Global PROGRAM window. Do one of the following:

- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the user program, press [ESC] three times.

2.10 Configuring an Output as a Totalizer or Frequency Output

Outputs B and D can be configured as totalizer or frequency outputs using *PanaView* software. Before an output can be configured, the AT868 must be connected to a PC via its serial port (see*"Wiring the Serial Port" on page 6*).

Complete the following steps to configure the output:

1. Open the *SITE EDIT MENU* from the *CALIBRATION/TEST* menu.
2. Select *Hardware Test*.
3. Select *SET TOT/FREQ*.
4. Use the pull-down menu to select the desired output (frequency or totalizer) and press Next Item/Enter.
5. To leave the user program, press Exit Page twice.

[no content intended for this page]

Chapter 3. Displaying Data

3.1 Introduction

The AT868 flow transmitter is equipped with a *Liquid Crystal Display* (LCD), which may be programmed to display up to four variables in sequence. To ease viewing, both the brightness and the contrast of the LCD are adjustable. In addition, this chapter discusses resetting the totalizers and pausing the measurements.

3.2 Adjusting LCD Contrast and Brightness

Both the contrast and the brightness of the LCD may be adjusted to suit individual preferences. The AT868 has two adjustment potentiometers located on the LCD circuit board (see *Figure 5* below). To make LCD adjustments, complete the following steps:

1. Loosen the six set screws to remove the front cover.
2. With power still applied to the meter, carefully use a small screwdriver to adjust the LCD brightness. Turning the **BKLT** (backlight) potentiometer fully clockwise yields maximum brightness.
3. In a similar manner, adjust the **CONT** (contrast) potentiometer to set the LCD contrast as desired. At either extreme of the **CONT** pot, the display is unreadable. Turn the pot fully counterclockwise and then turn it clockwise very slowly until the display is clear.
4. Readjust the **BKLT** control as desired.
5. Replace the front cover on the AT868, and secure it in place with the set screws.

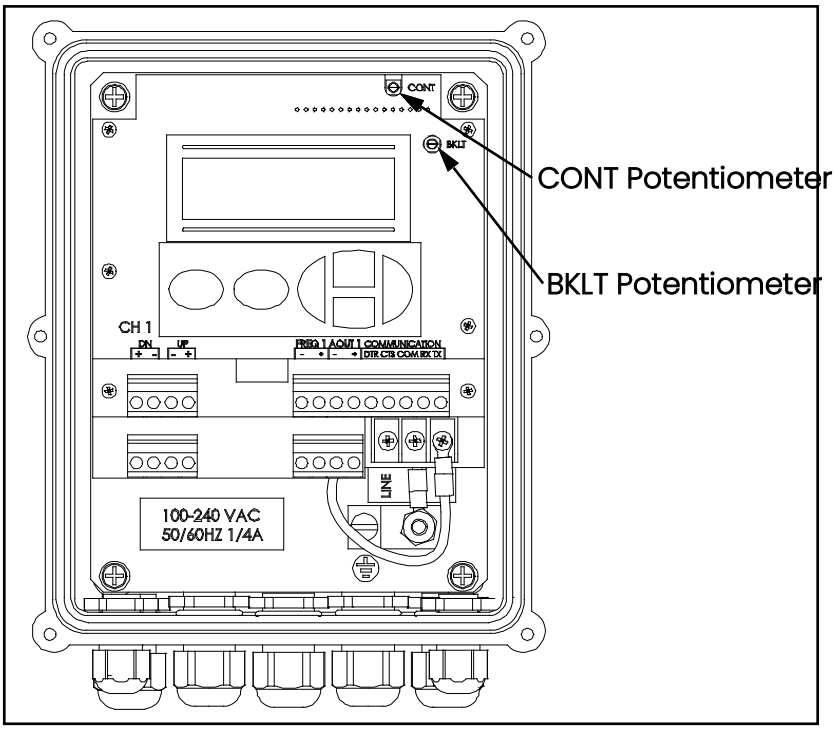


Figure 5: Location of CONT and BKLT Potentiometers

3.3 Setting Up the Display

Complete the following instructions to display the desired data on the display screen (see *Figure 11 on page 80).*

3.3.1 Accessing the Display Submenu

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until GLOBL appears and press [ENTER].
4. Press [▶] until I/O appears and press [ENTER].
5. Press [▶] until LCD appears and press [ENTER].

3.3.2 Configuring the Display

1. At # of LCD PARAMS, press [▶] to select the desired number of parameters to be sequentially displayed and then press [ENTER].

For a 1-channel/path AT868, proceed to Step 3. For a 2-channel/path meter, proceed to Step 2.

2. Press [▶] to select the desired channel/path option and then press [ENTER].
3. At Measurement Name, press [▶] to select the desired parameter and then press [ENTER].

Note: *The measurement units that appear in these prompts are those chosen in the* GLOBL-SYSTM *menu as described in "Selecting the GLOBL-SYSTM Units" on page 30.*

The previous two prompts repeat until all of the specified # of LCD PARAMS have been set up.

Procedure Options

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

- To perform another programming function, refer to Appendix A.,<Title Font> Menu Maps, to navigate to the desired menu.
- To leave the *User Program*, press [ESC] four times.

After leaving the *User Program*, the AT868 will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

3.4 Resetting Totals

To reset the totals, you can use either the internal keypad, *PanaView*™ software or an external switch. When resetting totals, the totals for both channels will be reset. Use the appropriate section below to reset the totalizers.

3.4.1 Resetting Totalizers Using the Internal Keypad

Refer to Figure A-4 on page A-4 in Appendix A.,<Title Font> Menu Maps and proceed as follows:

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until RESET appears and press [ENTER].
3. Press [▶] to select YES or NO and press [ENTER].

If you select YES, the AT868 resets the totals for both channels. If you select NO, the current totals continue.

4. To leave the *User Program*, press [ESC].

3.4.2 Resetting Totalizers Using PanaView™

Refer to Figure F-4 on page F-4 and proceed as follows:

1. Open the System menu.
2. Select Clear Instrument Totalizers.
3. *PanaView*™ automatically clears the totalizers and exits the System menu.

3.4.3 Resetting Totalizers Using the External Switch

While the meter is operating, press and hold the reset switch for 1 second. The totals will reset to zero and will immediately begin to accumulate again.

Note: *The external totalizer reset switch must be configured as described in "Setting Up the External Totalizer Reset Switch" on page 31.*

3.5 Taking Measurements

PanaView™ offers a unique command that enables you to pause and restart the measurements. When you pause the measurement, the AT868 suspends taking measurements. Therefore, all outputs are also affected. This option is only accessible using *PanaView*™ (refer to Figure F-4 on page F-4 in Appendix F, *PanaView™ for IDM-Compatible Meters*) and is not available via the meter keypad.

3.5.1 Pausing the Measurement Display

1. Open PAUSE MEASUREMENT from the Edit Functions menu.
2. Select Stop Measurement.
3. *PanaView*™ automatically stops taking measurements and exits the Edit Functions menu.

3.5.2 Restarting the Measurement Display

1. Open PAUSE MEASUREMENT from the Edit Functions menu.
2. Select Measure Flow.
3. *PanaView*™ automatically begins taking measurements and exits the Edit Functions menu.

Chapter 4. Calibration

4.1 Introduction

Use this menu to calibrate and test the analog and totalizer/frequency outputs. Refer to *Figure 13 on page 82*, while following the calibration instructions.

4.2 Calibrating and Testing the Analog Outputs

The AT868 flowmeter includes one built-in analog output per channel with a resolution of 5.0 µA (0.03% full scale). Although one analog output is provided for each channel, the outputs are channel independent. Typically Output A is used for Channel 1 and Output C is used for Channel 2. However, either analog output can be configured to measure either channel.

Both the zero-point and full-scale values for these outputs must be calibrated. After they have been calibrated, their linearity should be tested.

Note: *The zero point of the analog output may be set for either 0 mA or 4 mA. However, the calibration procedure always uses the 4 mA point, as the meter extrapolates this value to obtain the 0 mA point.*

4.2.1 Preparing for Calibration

Prepare for calibration by inserting an ammeter in series with the load on analog output 1 or 2 (see *Figure 6* below).

CAUTION! **DO NOT connect the ammeter directly across the terminals. Refer to *Figure 4 on page 10* for the locations of the analog outputs terminal blocks.**

Note: *Analog outputs 1 and 2 in the wiring diagram correspond to analog outputs A and C in the AT868 software.*

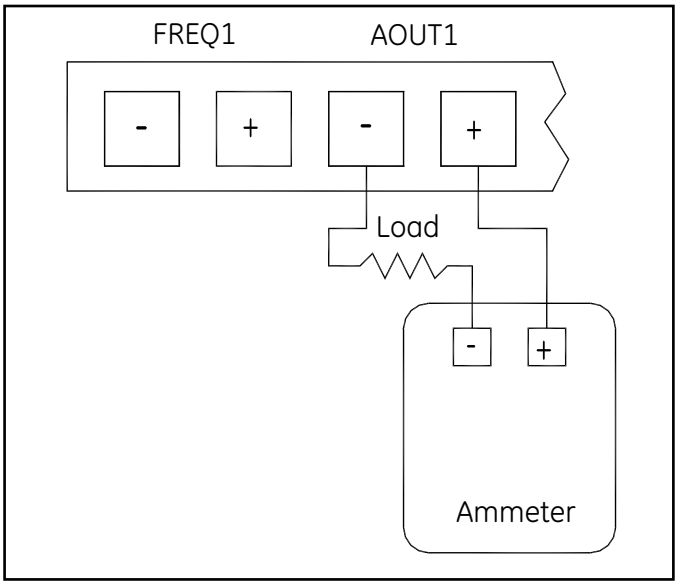


Figure 6: Ammeter Connection

4.2.2 Accessing the Calibration Menu

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until CALIB appears and press [ENTER].
3. Press [▶] until SLOT0 appears and press [ENTER].

4. Press [▶] until A or C appears and press [ENTER].

4.2.3 Calibrating the Low End of the Analog Output

1. Press [▶] to select 4 mA and press [ENTER].
2. Press [▶] to select UP or DOWN to adjust the 4 mA reading and press [ENTER].
3. When the desired reading is achieved, select STORE. If the ammeter reading cannot be adjusted to within ±5.0 μA of the 4 mA setting, select ABORT to end the calibration and contact Panametrics for assistance.

4.2.4 Calibrating the High End of the Analog Output

1. Press [▶] to select 20 mA and press [ENTER].
2. Press [▶] to view the options to adjust the 20 mA reading and press [ENTER].
3. When the desired reading is achieved, select STORE. If the ammeter reading cannot be adjusted to within ±5.0 μA of the 20 mA setting, select ABORT to end the calibration and contact Panametrics for assistance.

Procedure Options

After completing the above steps, the meter returns to the ANALOG OUTPUT window. Do one of the following:

- Proceed to *"Testing the Output Linearity" on page 47*.
- To perform another programming function, refer to Appendix A.,<Title Font> Menu Maps, to navigate to the desired menu.
- To leave the *User Program*, press [ESC] four times.

4.2.5 Testing the Output Linearity

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until CALIB appears and press [ENTER].
3. Press [▶] until SLOT0 appears and press [ENTER].
4. Press [▶] until A or C appears and press [ENTER].
5. Press [▶] to select Test and press [ENTER].
6. Under % Full Scale enter 50.00 by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
7. *Table 8* below lists the expected ammeter readings at various % Full Scale settings, for both 4-20 mA and 0-20 mA scales. Check the ammeter reading, and refer to this table to verify the accuracy of the measured ammeter readings.

Note: *If the linearity test readings are not with ±5 µA of the values listed in Table 8 below, check the accuracy and the connections of the ammeter. Then, repeat the low and high end calibrations. If the analog output still does not pass the linearity test, contact Panametrics for assistance.*

8. Repeat Step 2 with a different output setting (0-100%). Check the ammeter reading at this setting and press [ENTER] when done.

Table 8: Expected Ammeter Readings

% Full Scale	4-20 mA Scale*	0-20 mA Scale*
0	4.000	0.000
10	5.600	2.000
20	7.200	4.000
30	8.800	6.000
40	10.400	8.000
50	12.000	10.000
60	13.600	12.000
70	15.200	14.000
80	16.800	16.000
90	18.400	18.000
100	20.000	20.000
* all ammeter readings should be ±0.005 mA		

Procedure Options

After completing the above steps, the meter returns to the ANALOG OUTPUT window. Do one of the following:

- To perform another programming function, refer to Appendix A.,<Title Font> Menu Maps, to navigate to the desired menu.
- To leave the *User Program*, press [ESC] three times.

4.3 Testing the Totalizer/Frequency Outputs

Prepare for the testing procedure by connecting a frequency counter to the appropriate terminal blocks, as shown in *Figure 4 on page 10*.

Note: *Analog outputs 1 and 2 in the wiring diagram correspond to analog outputs B and D in the AT868 software.*

4.3.1 Calibrating the Frequency Output

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until CALIB appears and press [ENTER].
3. Press [▶] until SLOT0 appears and press [ENTER].
4. Press [▶] until B or D appears and press [ENTER].
5. Enter the frequency by using the arrow keys. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
6. Go to *"Procedure Options"* below.

4.3.2 Calibrating the Totalizer Output

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until CALIB appears and press [ENTER].
3. Press [▶] until SLOT0 appears and press [ENTER].
4. Press [▶] until B or D appears and press [ENTER].
5. Enter the desired pulse width in μsec. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
6. Enter the number of pulses. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER]. Your counter should increase by the number of pulses entered.
7. Repeat Steps 6 and 7 until you achieve the desired result.
8. Go to *"Procedure Options"* below.

Procedure Options

After completing the above steps, the meter returns to the Outputs window. Do one of the following:

- To perform another programming function, refer to Appendix A.,<Title Font> Menu Maps, to navigate to the desired menu.
- To leave the *User Program*, press [ESC] twice.

Chapter 5. Error Codes

5.1 Introduction

The AT868 ultrasonic 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, the transducers or the flowcell, a built-in error code message system greatly simplifies the troubleshooting process.

All of the possible AT868 error code messages are discussed in this chapter, along with the possible causes and the recommended actions. When an error code is generated, it appears on the **LCD** screen.

If an error message appears on the display screen during operation of the AT868, refer to the appropriate section of this chapter for instructions on how to proceed.

5.2 E0: No Error

Problem: No error condition currently exists.

Cause: This message appears briefly to confirm that the response to another error message has corrected the problem.

Action: No action is required.

5.3 E1: Low Signal

Problem: Poor ultrasonic signal strength or the signal exceeds the limits entered via the *User Program*.

Cause: Poor signal strength may be caused by a defective cable, a flowcell problem, a defective transducer or a problem in the electronics console. A signal that exceeds the programmed limits is probably caused by the entry of an improper value in the **SETUP-SIGNL** menu of the *User Program*.

Action: Using the procedures in *Chapter 6, Diagnostics*,, check the components noted above. Also, check the value entered into the **SETUP-SIGNL** submenu, as described on *"Set Transducer Signal Settings - SIGNL" on page 23*.

5.4 E2: Sound Speed Error

Problem: The sound speed exceeds the limits programmed in the **SETUP-SIGNL** submenu of the *User Program*.

Cause: The error may be caused by incorrect programming, poor flow conditions or poor transducer orientation.

Action: Compare the measured sound speed to tabulated nominal values for the fluid being used and correct any programming errors (see *"Set Transducer Signal Settings - SIGNL" on page 23*). Refer to *Chapter 6, Diagnostics,*, to correct any flowcell and/or transducer problems.

5.5 E3: Velocity Range

Problem: The velocity exceeds the limits programmed in the **SETUP-SIGNL** submenu of the *User Program*.

Cause: This error may be caused by the entry of improper programming data or by poor flow conditions and/or excessive turbulence.

Action: Make sure the actual flow rate is within the programmed limits. Also, check the value entered into the **SETUP-SIGNL** submenu, as described on *"Set Transducer Signal Settings - SIGNL" on page 23*. Refer to *Chapter 6, Diagnostics,*, to correct any flowcell and/or transducer problems.

5.6 E4: Signal Quality

Problem: The signal quality is outside the limits programmed in the **SETUP-SIGNL** submenu of the *User Program*.

Cause: The peak of the upstream or downstream correlation signals has fallen below the correlation peak limit, as set in the **SETUP-SIGNL** submenu. This may be caused by a flowcell or electrical problem.

Action: Check for sources of electrical interference and verify the integrity of the electronics console by temporarily substituting a test flowcell that is known to be good. Check the transducers and relocate them, if necessary. See *Chapter 6, Diagnostics,*, for instructions.

5.7 E5: Amplitude Error

Problem: The signal amplitude exceeds the limits programmed in the **SETUP-SIGNL** submenu of the *User Program*.

Cause: Solid or gas particulates may be present in the flowcell. Poor coupling for clamp-on transducers.

Action: Refer to *Chapter 6, Diagnostics,*, to correct any flowcell problems.

5.8 E6: Cycle Skip, Accel.

Problem: The acceleration exceeds the limits programmed in the **SETUP-SIGNL** submenu of the *User Program*.

Cause: This condition is usually caused by poor flow conditions or improper transducer alignment.

Action: Refer to *Chapter 6, Diagnostics,*, to correct any flowcell and/or transducer problems.

5.9 E7: Analog Out Error

Problem: The current in the analog output circuit exceeds the limits for the analog output port.

Cause: The output load exceeds the specified limits for the analog output port.

Action: Make sure the output load is <600 ohms for the analog outputs. Check the wiring.

5.10 E8: Unassigned

5.11 E9: Totalizer Overflow

Problem: The totalizers are unable to keep up with the total accumulated flow signals.

Cause: The programmed units/pulse value is too small.

Action: Select a larger number of units/pulse value or decrease PULSE ON TIME.

5.12 E10: Unassigned

5.13 E11: Unassigned

5.14 E12: Unassigned

5.15 E13: Volumetric Overflow

Problem: This error code message indicates that the present measurement exceeds the range of the meter.

Cause: A mathematical overflow has occurred in either the volumetric or mass flow calculations.

Action: Select larger measurement units or a shorter time interval for the current measurement parameter. For example, choose **MGAL/M** instead of **GAL/M** in the **CHx-SYSTM** menu (see *"Entering System Data for a Channel/Path - CHx-SYSTM" on page 13*).

[no content intended for this page]

Chapter 6. Diagnostics

6.1 Introduction

This chapter explains how to troubleshoot the AT868 if problems arise with the electronics enclosure, the flowcell, or the transducers. Indications of a possible problem include:

- Display of an error message on the LCD screen
- Erratic flow readings
- Readings of doubtful accuracy (e.g., readings that are inconsistent with readings from another flow measuring device connected to the same process).

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

6.2 Displaying Diagnostic Parameters

The AT868 has built-in *Diagnostic Parameters* to aid in the troubleshooting of flowcell, transducer and electrical problems. To access these parameters, refer to *Figure 11 on page 80* and proceed to the following sections.

6.2.1 Accessing the Display Menu

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until GLOBL appears and press [ENTER].
4. Press [▶] until I/O appears and press [ENTER].
5. Press [▶] until LCD appears and press [ENTER].

6.2.2 Configuring the Display

1. At **# of LCD PARAMS**, press [▶] to select the desired number of parameters to be sequentially displayed and then press [ENTER].

For a 1-channel/path AT868, proceed to Step 3. For a 2-channel/path meter, proceed to Step 2.

Note: *If you select* OFF*, the meter returns to the* Global I/O *window. Go to "Procedure Options" on page 55.*

2. Press [▶] to select the desired channel/path option and press [ENTER].
3. At **Measurement Name**, press [▶] to select the desired parameter (refer to *Table 9* below for a list of available diagnostic parameters) and press [ENTER].

Note: *The measurement units that appear in these prompts are those selected in the GLOBL-SYSTM menu as described in* Chapter 2, Programming Site Data*,.*

The previous two prompts repeat until all of the specified **# of LCD PARAMS** have been set up. When the entries are complete, go to *"Procedure Options" on page 55*.

Table 9: Available Diagnostic Parameters

Option Bar	Description	Good	Bad
SS up	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
SS dn	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
SNDSP	Displays the measured speed of sound in the fluid.	N.A.	N.A.
Tup	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
Tdown	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
DELTA	Displays the transit time difference between the upstream and downstream signals.	≤1 µsec	>1 µsec
REYN#	Displays the Reynolds number.		
K(RE)	K factor, based on the Reynolds number.	N.A.	N.A.
PEAK%	Displays the percentage of peak (set to +50 by default).	N.A.	N.A.
THETA	Theta 3 is the angle between the ultrasonic beam and the normal to the pipe wall. It is calculated from the measured transit time and the clamp-on parameters (clamp-ons only).	N.A.	N.A.
Qup	Displays the signal quality for the upstream transducer.	≥ 1200	–400 to +400
Qdown	Displays the signal quality for the downstream transducer.	≥ 1200	–400 to +400
AMPup	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29
AMPdn	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29
P#up	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300

Table 9: Available Diagnostic Parameters

Option Bar	Description	Good	Bad
NFup	Displays the normalization factor for the upstream transducer.	0.85-1.0	<0.85
NFdn	Displays the normalization factor for the downstream transducer.	0.85-1.0	<0.85
Cxdcr	Displays the speed of sound in the transducer (clamp-on only).	N.A.	N.A.

Procedure Options

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

- To perform another programming function, see Appendix A.,<Title Font> Menu Maps, to navigate to the desired menu.
- To leave the *User Program*, press [ESC] four times.

After leaving the *User Program*, the AT868 will reset itself and will begin to display the parameters specified in this section. If more than one parameter was set up, each of the parameters will be displayed in sequence, with a pause of several seconds between display changes.

6.3 Using the Tracking Window

Continuously tracking the sound speed adds to the measurement time. However, if the fluid sound speed is fairly constant, you can use the *Tracking Window* to determine the sound speed and then manually enter it into the meter. Use the procedure below to determine the fluid sound speed and enter it into the meter.

Note: *In order to perform the steps below, you must activate the* Tracking Window *as described in "Setting Up a Tracking Window" on page 19.*

6.3.1 Accessing the Display Submenu

1. Allow the AT868 to run for a few minutes in order to "track" the fluid sound speed.
2. Press [ESC], [ENTER], [ESC] to enter the user program.
3. Press [▶] until PROG appears and press [ENTER].
4. Press [▶] until GLOBL appears and press [ENTER].
5. Press [▶] until I/O appears and press [ENTER].
6. Press [▶] until LCD appears and press [ENTER].

6.3.2 Configuring the Display

1. At # of LCD PARAMS, press [▶] to select the desired number of parameters to be sequentially displayed and press [ENTER].

For a 1-channel/path AT868, proceed to Step 3. For a 2-channel/path meter, proceed to Step 2.

2. Press [▶] to select the desired channel/path option and press [ENTER].
3. At Measurement Name, press [▶] to select SNDSP and press [ENTER].
4. The previous two prompts repeat until all of the specified # of LCD PARAMS have been set up.
5. Press [ESC] four times to exit the *User Program*.
6. Wait for the AT868 to display the sound speed. If the sound speed remains fairly constant, record it and proceed to the next section. If the sound speed is not constant, leave the Tracking Window ON and reconfigure the display to show the desired measurements.

Note: *If you are unsure if the sound speed is fairly constant, consult Panametrics.*

6.3.3 Deactivating the Tracking Window

1. Press [ESC], [ENTER], [ESC] to enter the user program.
2. Press [▶] until PROG appears and press [ENTER].
3. Press [▶] until CH1 or CH2 appears and press [ENTER].
4. Press [▶] until PIPE appears and press [ENTER].
5. Press [ENTER] until TRACKING WINDOWS appears.
6. Select NO to deactivate the Tracking Window.

6.3.4 Entering the Constant Sound Speed

1. At FLUID TYPE, select OTHER.
2. At FLUID SOUNSPEED, enter the measured sound speed and press [ENTER]. Press [◀] and [▶] to move the cursor to desired location and press [▲] and [▼] to increase or decrease the number. Then, press [ENTER].
3. Press [ESC] three times to exit the *User Program*.

6.4 Diagnostic Record

The values for the diagnostic parameters immediately after initial installation of the meter and verification of proper operation should be entered in *Table 14 on page 93*. These initial values can then be compared to current values to help diagnose any future malfunction of the system.

6.5 Flowcell Problems

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

- Fluid problems
- Pipe problems.

Read the following sections carefully to determine if the problem is indeed related to the flowcell. If the instructions in this section fail to resolve the problem, contact Panametrics for assistance.

6.5.1 Fluid Problems

Most fluid-related problems result from a failure to observe the flowmeter system installation instructions. Refer to *Chapter 1, Installation,* 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 AT868, excessive amounts of solid or gas 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 flowcell.*
  Fluids with a high vapor pressure may cavitate near or in the flowcell. This causes problems resulting from gas bubbles in the fluid. Cavitation can usually be controlled through a properly designed installation.
- *The fluid must not excessively attenuate ultrasound signals.*
  Some fluids, particularly those that are very viscous, readily absorb ultrasound energy. In such a case, an **E1** error code message will appear on the display screen to indicate that the ultrasonic signal strength is insufficient for reliable measurements.
- *The fluid sound speed must not vary excessively.*
  The AT868 will tolerate relatively large changes in the fluid sound speed, as may be caused by variations in fluid composition and temperature. However, such changes must occur slowly. Rapid fluctuations in the fluid sound speed, to a value that is considerably different from that programmed into the AT868, will result in erratic or inaccurate flow rate readings. Refer to *Chapter 2, Programming Site Data,*, to make sure that the appropriate sound speed is programmed into the meter.

6.5.2 Pipe Problems

Pipe-related problems may result either from a failure to observe the installation instructions, as described in *Chapter 1, Installation,* or from improper programming of the meter. By far, the most common pipe problems are the following:

- *The collection of material at the transducer location(s).*
  Accumulated debris at the transducer location(s) will interfere with transmission of the ultrasound signals. As a result, accurate flow rate measurements are not possible. Realignment of the flowcell or transducers often cures such problems, and in some cases, transducers that protrude into the flow stream may be used. Refer to *Chapter 1, Installation,*, for more details on proper installation practices.
- *Inaccurate pipe measurements.*
  The accuracy of the flow rate measurements is no better than the accuracy of the programmed pipe dimensions. For a flowcell supplied by Panametrics, the correct data ise included in the documentation. For other flowcells, measure the pipe wall thickness and diameter with the same accuracy desired in the flow rate readings. Also, check the pipe for dents, eccentricity, weld deformity, straightness and other factors that may cause inaccurate readings. Refer to *Chapter 2, Programming Site Data,*, for instructions on programming the pipe data.

  In addition to the actual pipe dimensions, the path length (P) and the axial dimension (L), based on the actual transducer mounting locations, must be accurately programmed into the flowmeter. For a Panametrics flowcell, this data ise included with the documentation for the system. If the transducers are mounted onto an existing pipe, these dimensions must be precisely measured. See *Chapter D, Measuring P and L Dimensions,* for a thorough discussion of this topic.
- *The inside of the pipe or flowcell must be relatively clean.*
  Excessive build up of scale, rust or debris will interfere with flow measurement. 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 measurements.

6.6 Transducer Problems

Ultrasonic transducers are rugged, reliable devices. However, they are subject to physical damage from mishandling and chemical attack. Clamp-on transducers are also subject to installation variables such as physical misalignment and faulty coupling to the pipe on which they are mounted.

Because transducer problems are largely dependent on the type of transducers used, wetted or clamp-on, the following list of potential problems is grouped according to transducer type. Contact Panametrics if you cannot solve a transducer-related problem.

6.6.1 Wetted Transducer Problems

- **LEAKS:** Leaks may occur around the transducer and 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 material was not properly chosen for the intended application, the transducers may suffer corrosion damage. The damage usually occurs either at the electrical connector or on the transducer face. If corrosion is suspected, remove the transducer from the flowcell and carefully inspect the electrical connector and the transducer face for roughness and/or pitting. Any transducer damaged in this manner must be replaced. Contact Panametrics for information on transducers in materials suitable for the application.
- **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 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 2, Programming Site Data, to program the new transducer data into the meter.

If the instructions in this section fail to resolve the problem, contact Panametrics for assistance.

6.6.2 Clamp-on Transducer Problems

- **POOR COUPLING TO PIPE:** Clamp-on transducers must be in close contact with the pipe. Make sure the pipe wall is smooth and generally free of paint. The couplant material must fill voids between the transducer and the pipe, and must be firmly coupled or bonded to both the pipe and the transducer. The pipe and transducer must be clean and dry for permanent couplant, such as grease or epoxy, to adhere properly. Enough pressure must be applied to the transducer by its clamp to hold it firmly against the pipe.
- **MISALIGNMENT:** The transducer transmits relatively narrow beams of ultrasound; therefore; transducer alignment is critical to assure that the beam can travel from one transducer to the other without undue attentuation. Be sure to exactly follow the instructions that came with your transducers and clamping fixtures. Also, be sure that the transducer spacing agrees with the calculated spacing (S).
- **INTERNAL DAMAGE:** Ultrasonic transducers consist of a ceramic crystal bonded to the transducer case. The bond between the crystal and the case may be damaged by extreme shock and by temperature extremes. The crystal itself can also be damaged by the same conditions. 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. Usually the connector on the transducers is the part that is damaged, as it is the most fragile. Minor damage may be repaired by carefully bending the connector back into shape. If the connector cannot be repaired, replace the transducers.

IMPORTANT: Transducers must be replaced in pairs. Refer to Chapter 2, Programming Site Data, to program the new transducer data into the meter.

- **CYCLE SKIP CONDITION:** A cycle skip is usually caused by a distorted or altered signal due to poor couplant, bad wall or unusual fluid disturbances. To resolve a cycle skip, recouple both transducers with proper couplant. Check your couplant for temperature ranges. In addition, make sure the pipe wall is free of paint and rust.

If the instructions in this section fail to resolve the problem, contact Panametrics for assistance.

Chapter 7. Parts Replacement

7.1 Introduction

The AT868 has been designed to permit easy on-site upgrades and parts replacement. The instructions in this chapter, along with a few common tools, are all that is required to perform the following tasks:

- Replacing the LCD display/keypad
- Replacing the fuse
- Replacing the User Program

WARNING! **Prior to performing any maintenance procedures, be sure to disconnect the main power from the unit.**

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.*

Use *Figure 7 on page 67* and *Figure 8 on page 68* to locate the relevant components, while completing the service procedures discussed in this chapter.

IMPORTANT: Keep a detailed record of all AT868 parts installations and replacements in Appendix E, Service Record. This service history may prove very helpful in diagnosing any future problems.

7.2 Purchasing Parts

To purchase the parts mentioned in this chapter or any items not specifically discussed, contact Panametrics for assistance. To make sure the proper components are obtained, be sure to specify the *serial number* of your AT868 at the time of purchase.

7.3 Replacing the LCD Display/Keypad

The LCD display/keypad assembly normally provides years of dependable service, but it is easily field-replaceable when necessary. To replace the LCD display/keypad, see *Figure 7 on page 67* and *Figure 8 on page 68* for the component locations, and complete the following steps.

7.3.1 Removing the Old LCD/Keypad Board

1. Disconnect the power from the AT868 and move the electronics enclosure to a clean, flat work surface.

WARNING! **The main power to the Model AT868 must be disconnected before proceeding.**

2. Loosen the six set screws on the front cover, and remove the front cover.
3. Remove the four mounting screws on the LCD/keypad board. Make sure you remove the flat washers and lock washers with the screws.
4. Grasp the LCD/keypad board by the side edges and carefully pull it straight upward until it comes free from the Channel 1 board below it.
5. Disconnect the keypad ribbon on the board below by sliding the tabs on the connector upward and pulling the ribbon cable out.

7.3.2 Installing a New LCD/Keypad Board

1. Insert the keypad ribbon from the new board into the connector and re-lock the connector by sliding the tabs downward. Make sure the cable is not twisted.
2. Place the new LCD/keypad board in position over the Channel 1 board making sure to align the connector on the bottom of the LCD/keypad board with the pins on the Channel 1 board. Firmly push the two boards together.
3. Secure the LCD/keypad board to the Channel 1 board with the four screws, flat washers and lock washers previously removed.
4. Replace the cover and tighten the six set screws.

The meter is now ready to be placed back into service.

WARNING! **Before powering up the AT868, make sure all the flat washers and lock washers have been reinstalled. Loose washers or other metal components left inside the enclosure may cause electrical problems.**

7.4 Replacing the Fuse

Complete the steps below to replace the AT868 fuse (refer to *Figure 7 on page 67*):

1. Disconnect the power from the AT868 and move the electronics enclosure to a clean, flat work surface.

WARNING! **The main power to the Model AT868 must be disconnected before proceeding.**

2. Loosen the six set screws on the front cover, and remove the front cover.
3. Remove the four screws from the bottom mounting plate.
4. Loosen cable glands if necessary, and remove the mounting plate from the chassis.
5. From the cutout on the back of the mounting plate, pull the plastic cover off the fuse holder and remove the old fuse.
6. Obtain a new fuse of the same rating and type. Use only a **Type 3AG (1-1/4" x 1/4") Slo-Blo** fuse, having a rating as indicated in *Table 10* below.

Table 10: Line Voltages & Fuse Ratings

Line Voltage	Fuse Rating
85-265 VAC	0.25 A, Slo-Blo
12-28 VDC	2.0 A, Slo-Blo

7. Press the new fuse into the fuse holder and reinstall the plastic fuse cover.
8. Be sure to record the fuse replacement in Appendix E, *Service Record*.
9. Replace the mounting plate and the four screws previously removed. Then, tighten the cables and cable glands.
10. Replace the cover and secure it with the six set screws.

WARNING! **Before powering up the AT868, make sure all the flat washers and lock washers have been reinstalled. Loose washers or other metal components left inside the enclosure may cause electrical problems.**

7.5 Replacing the User Program

The AT868 *User Program* is stored on an erasable programmable read-only memory (**EPROM**) chip. The **EPROM**, which is designated as component **U4**, is mounted in a socket on the rear of the Channel 1 board. **EPROM** replacement may be required to replace a defective chip or to upgrade to a newer software version.

To replace the *User Program*, refer to *Figure 7 on page 67* and *Figure 8 on page 68* and proceed to the following sections.

7.5.1 Accessing the EPROM

1. Disconnect the power from the AT868 and move the electronics enclosure to a clean, flat work surface.

WARNING! **The main power to the Model AT868 must be disconnected before proceeding.**

2. Loosen the six set screws on the front cover, and remove the front cover.
3. Remove the plastic shield by removing the two screws that hold it in place.
4. Remove the four mounting screws on the LCD/keypad board. Make sure you remove the flat washers and lock washers with the screws.
5. Grasp the LCD/keypad board by the side edges and carefully pull it straight upward until it comes free from the Channel 1 board below it.
6. Disconnect the keypad ribbon on the board below by sliding the tabs on the connector upward and pulling the ribbon cable out.
7. Remove the four standoffs in the corners of the Channel 1 board.
8. Remove the screw in the middle of the Channel 1 board.
9. Carefully remove the Channel 1 board from the connectors on the Channel 2 board below it.

7.5.2 Locating the EPROM

1. Flip the Channel 1 board over and locate the **U4 EPROM** socket. It is the only socketed chip on this board and it has a white identification label.
2. Using a chip puller, remove the **EPROM** from its socket. If a chip puller is unavailable, a straightened paper clip may be used in the notches at the upper right and lower left corners of the socket. Gently pry the **EPROM** up, a little at a time, at each notch until it comes free.

WARNING! **The EPROM is easily damaged by static electricity. Before handling the new chip, touch a grounded metal object to discharge any built-up static electricity and avoid touching the leads on the side of the chip.**

3. Make sure that the beveled corner on the new **EPROM** is aligned with the beveled corner of the socket and place the **EPROM** into the socket.
4. By applying equal pressure on all four corners, gently press the **EPROM** into the socket until it is fully seated. Do not strike the **EPROM** or apply excessive force during this procedure.

7.5.3 Reassembling the Unit

1. Replace the Channel 1 board. To do this, carefully align the pins along the back of the board with the connectors on the Channel 2 board. Firmly press the Channel 1 board down until all of the connectors are completely seated.
2. Secure the Channel 1 board by replacing the screws and standoffs previously removed. Make sure you include the flat washers and lock washers for each screw.
3. Insert the keypad ribbon from the LCD/keypad board into the connector and re-lock the connector by sliding the tabs downward. Make sure the cable is not twisted.
4. Replace the LCD/keypad assembly by carefully aligning the pins on the back with the connectors on the Channel 1 board. Firmly press the LCD/keypad assembly down until the connector is completely seated.
5. Secure the LCD/keypad assembly to the Channel 1 board with the four screws, flat washers and lock washers previously removed.
6. Reinstall the plastic shield.
7. Replace the cover and secure it with the six set screws.

WARNING! **Before powering up the AT868, make sure all the flat washers and lock washers have been reinstalled. Loose washers or other metal components left inside the enclosure may cause electrical problems.**

Note: *Be sure to enter a complete and detailed account of any parts replacement performed on the AT868 in Appendix E,* Service Record.

[no content intended for this page]

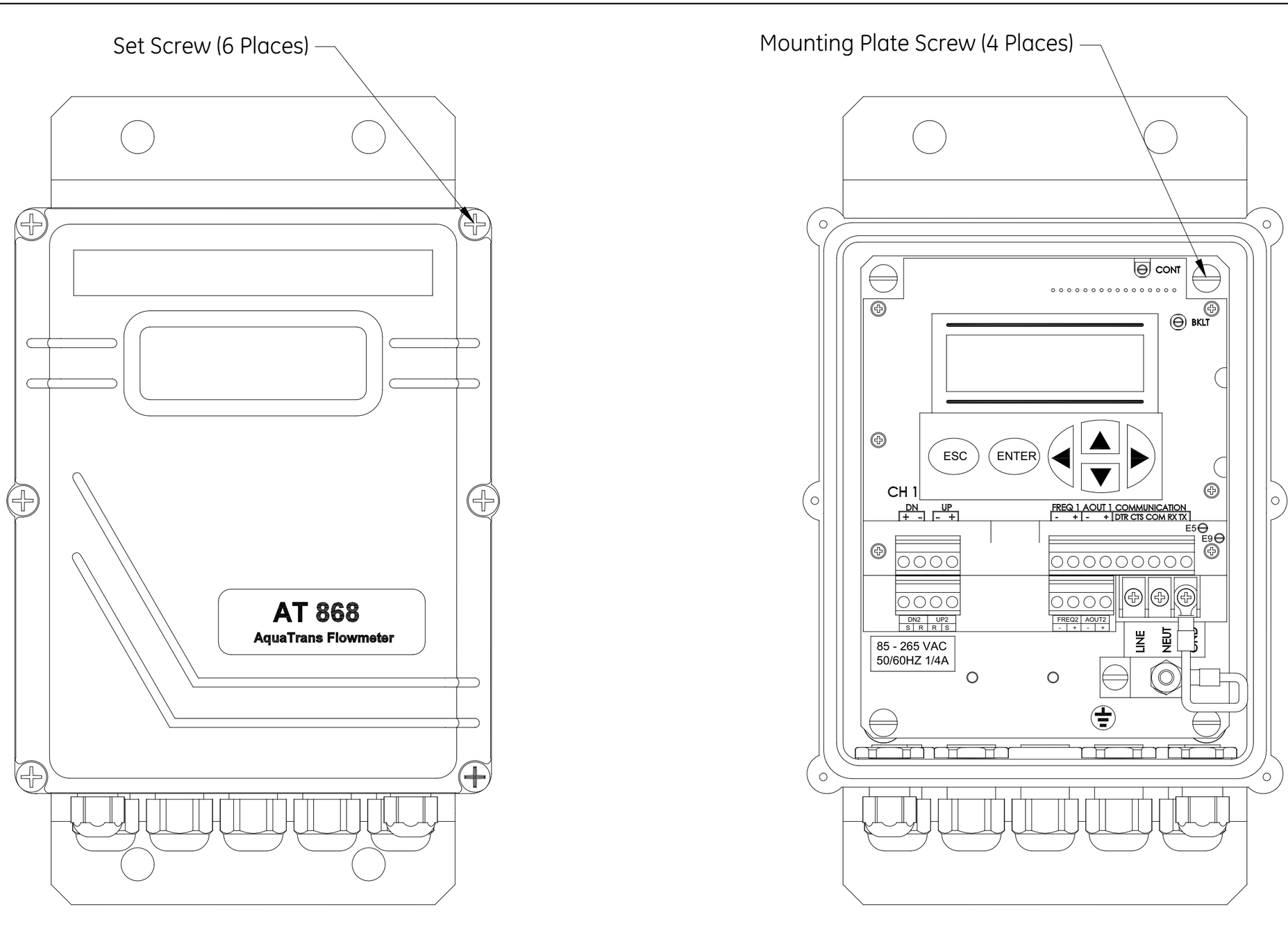


Figure 7: Electronics Console – Front View (with and without Cover)

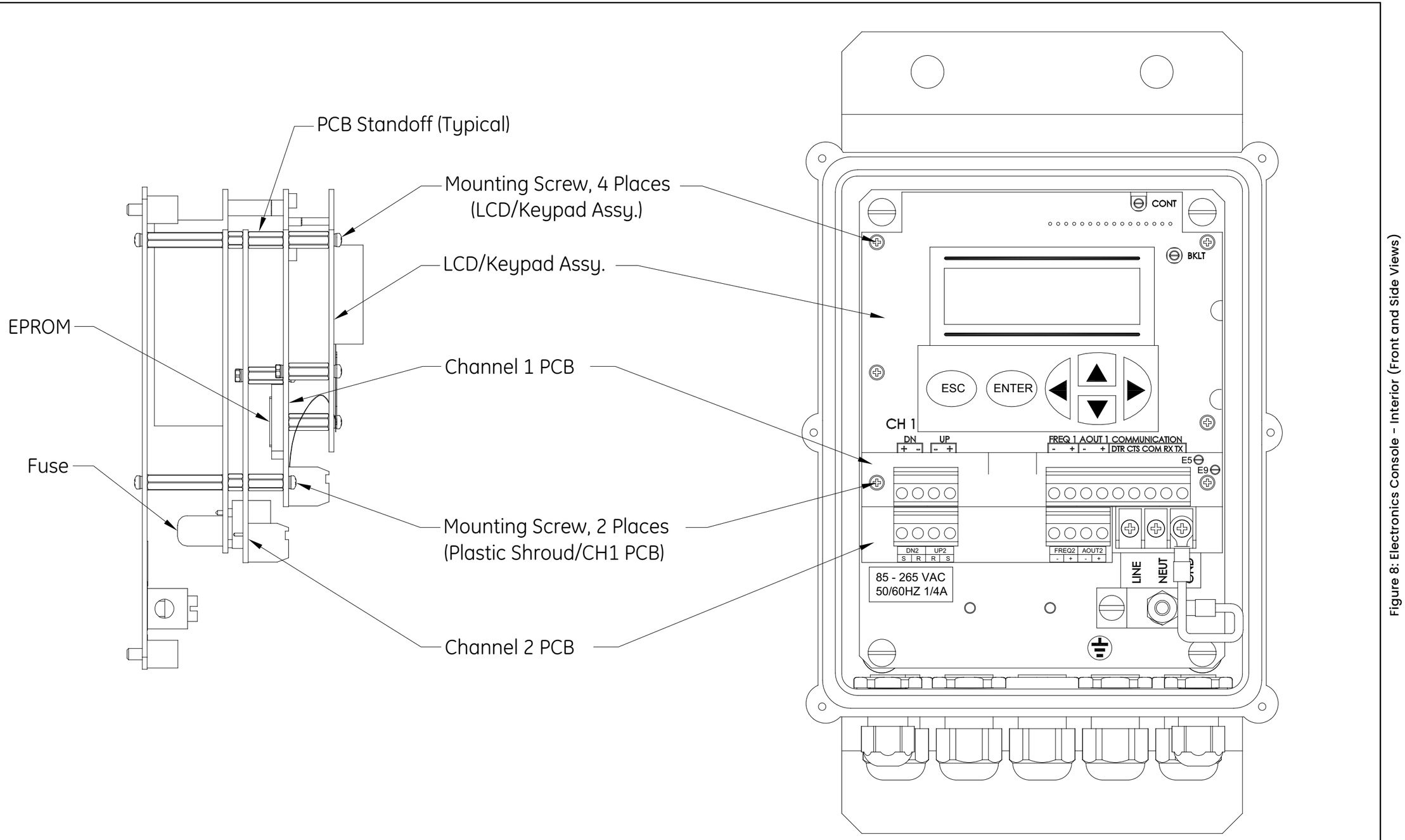
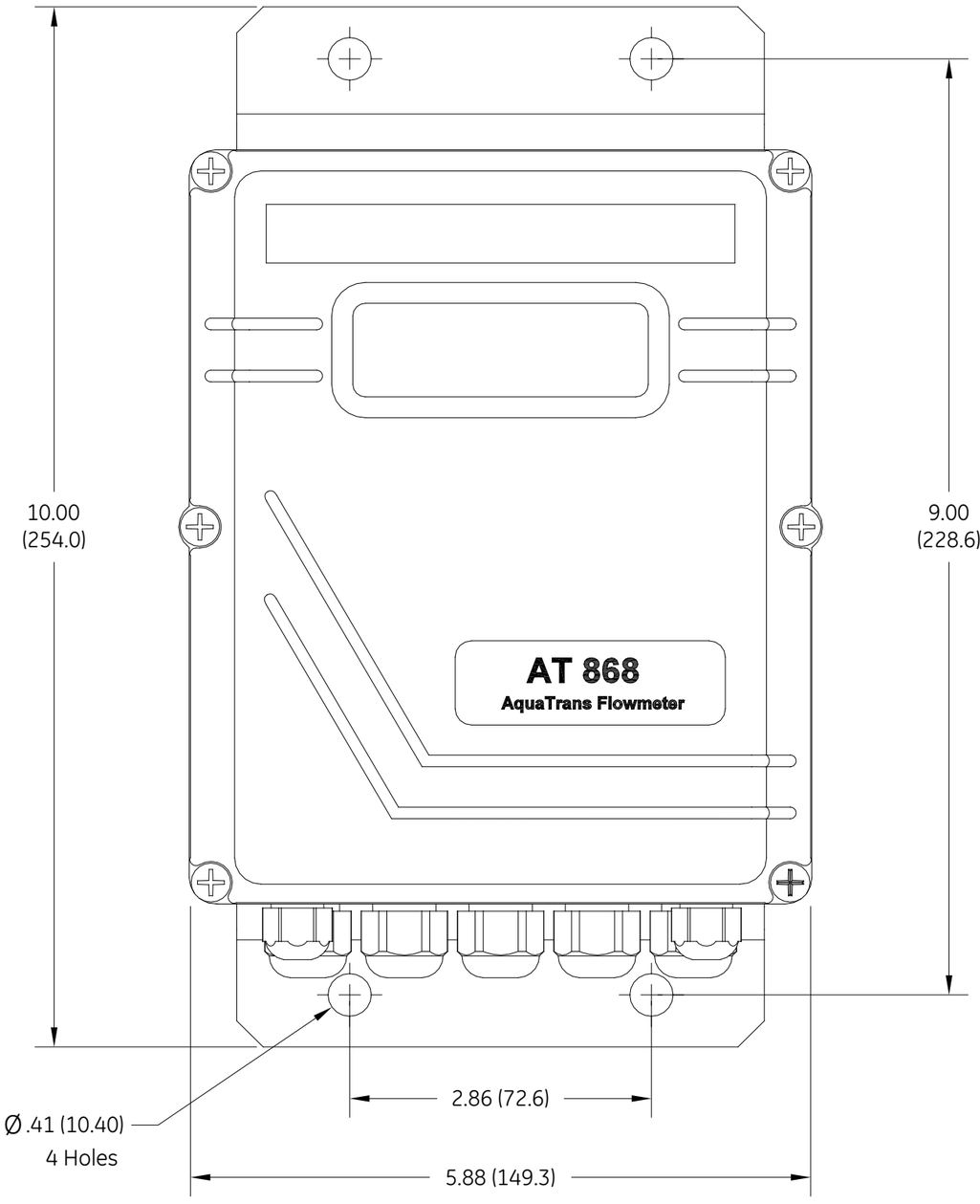


Figure 8: Electronics Console – Interior (Front and Side Views)

Figure 9:



Note:
1. All dimensions are in inches (millimeters).

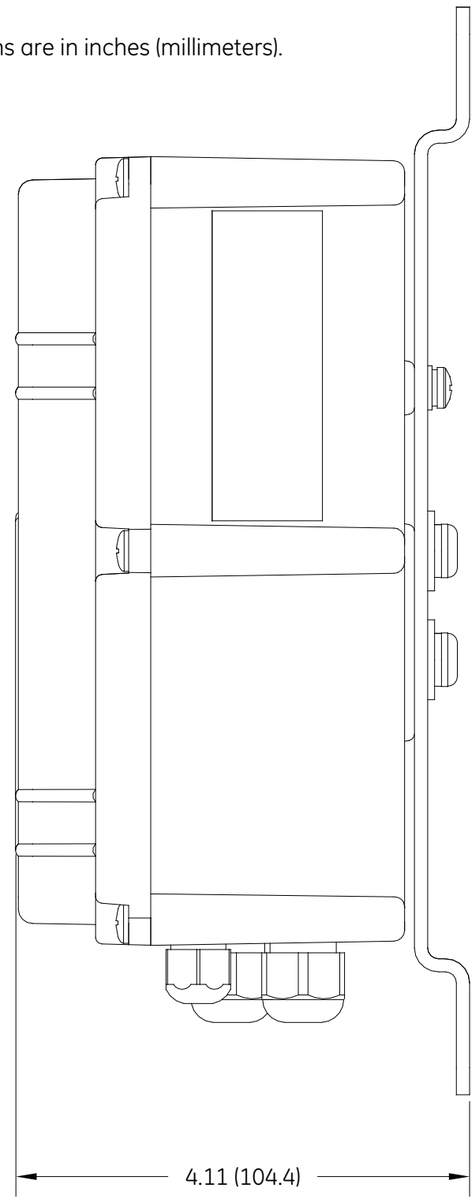


Figure 1: 712-2167 Outline & installation, Z3, 2 – 24-inch flow meter system, remote mount

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Chapter 8. Specifications

8.1 General Specifications

The general specifications for the AT868 flow transmitter are divided into the following categories:

8.1.1 Hardware Configuration

Channel Options
Standard: 1-Channel
Optional: 2-Channel/Path (2 paths per pipe)

Package Options:
General purpose Type 4X powder-coated aluminum wall mount

Dimensions:
2.2 lb (1 kg); 6 x 4 x 3 in. (152.4 x 101.6 x 76.2 mm)

8.1.2 Environmental

Ambient Operating Temperature:
14° to 131°F (–10° to 55°C)

Storage Temperature:
–40° to 158°F (–40° to 70°C)

8.1.3 Flow Accuracy (% of Reading)

Accuracy specifications assume a fully developed flow profile and a straight run of 10 pipe diameters upstream and 5 pipe diameters downstream from the measurement point.

Pipe Diameter (ID) >6 in. (150 mm):
Velocity > 1 ft/s (> 0.3 m/s); ± 2% typical (± 0.5 to 1% with calibration).
Velocity ≤ 1 ft/s (≤ 0.3 m/s); ± 0.03 ft/s (± 0.01 m/s) typical.

Pipe Diameter (ID) ≤ 6 in. (150 mm):
Velocity > 1 ft/s (> 0.3 m/s); ± 2 to 5% typical.
Velocity < 1 ft/s (< 0.3 m/s); ± 0.03 ft/s (± 0.01 m/s) typical.

8.1.4 Range

–40 to 40 ft/s (–12.2 to 12.2 m/s)

8.1.5 Rangeability

400:1

8.1.6 Repeatability

Wetted Transducers: ± 0.2% of full scale
Clamp-on Transducers: ± 0.2 to 0.5% of full scale

Note: *Specifications assume a fully developed flow profile, with a straight run of pipe 10 diameters upstream and 5 diameters downstream from the measurement point.*

8.1.7 Fluid Types

Water and wastewater

8.2 Electrical Specifications

The electrical specifications for the Model AT868 flow transmitter are divided into the following categories:

8.2.1 Power Supply

Options:
Standard: 85 to 265 VAC, 47-65 Hz, ± 10%
Optional: 12 to 28 VDC; ± 5%

Power Consumption:
10 W maximum (not including inrush current required for DC supply specification)

8.2.2 Operating Mode

Correlation Transit-Time™ Mode with clamp-on or wetted transducers

8.3 Input/Output Specifications

Digital Display:
2-line x 16-character LCD display, LED backlight, configurable to display up to 4 measurement parameters in sequence

Digital Communications:
Standard: RS232 serial port for PC, terminal or printer
Optional: RS485 serial port for PC, terminal or printer

Analog Outputs:
1 isolated 0/4-20 mA, 600 Ω max. load

1 pulse totalizer/frequency output, optically isolated, 3 A max., 100 VDC max., 1 W max., from 0.1 to 10 kHz

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

Frequency: pulse frequency proportional to magnitude of parameter (e.g., 10 Hz = 1 gal/min)

Optional: 2-channel option includes a second set of the standard outputs as described above. Outputs can be configured independent of channel

Cable and Length:
Standard: Pair of coaxial cables, type RG62 A/U, or as specified for transducer type. Length up to 3 ft (1 m).
Optional: Lengths up to 1,000 ft (330 m) max.

Output Units:
Velocity:
Feet per second (ft/s)
Meters per second (m/s)

Volumetric Flow:
Cubic feet (ft^3) per second, minute, hour
Million cubic feet (ft^3) per day
Gallons (gal) per second, minute, hour
Millions of gallons per day
Barrels per second, minute, hour
Millions of barrels per day
Acre inches per second, minute, hour, da
Acre feet per second, minute, hour, day
Cubic meters (m^3) per second, minute, hours, day
Liters (L) per second, minute, hour
Megaliters per day

Totalizer (forward and reverse):
Cubic feet (ft^3)
Million cubic feet (ft^3)
Gallons (gal)
Million of gallons
Barrels
Millions of barrels
Acre inches

Acre feet
Cubic meters (m^3)
Million cubic feet (ft^3)
Liters (L)
Megaliters
Barrels
Megabarrels

Certifications:
See the CE Declaration of Conformity at the back of this manual
1010 CSA/NRTL

PC Interface Software:
PanaView™ software option links the AT868 to a PC computer
Software package includes 3.5-inch diskette, interconnection cable and manual

8.4 Transducer Specifications

8.4.1 Wetted Transducers

Temperature Range
Standard: -40° to 212°F (-40° to 100°C)
Optional (overall range): -328° to 500°F (-200° to 260°C)

Pressure Range
Standard: 0 to 3,000 psig (0.1013 to 20 MPa)
Optional: Higher pressures available on request

Frequency:
Standard: 1 MHz (1-in. process connection) or 2 MHz (3/8-in. process connection)
Optional: 500 kHz or 4 MHz

Materials
Standard: 316 SS
Optional (for isolating PanAdapta Plugs): Titanium, Hastelloy, Monel, CPVC, PVDF and others

Conduit Connections:
1-in. NPTM or 3/8-in. NPTM

Process Connections:
Standard: 1-in. NPTM or 3/8-in. NPTM
Optional: RF flanged, socket weld, fuse bond & others

Mounting:
Spoolpiece, hot tap or cold tap

Housing:
Standard: None (splashproof)
Optional: Explosion-proof, Div. 1, Class 1, Group C&D,
INIEX-Certified EEx d IIC T6 or weatherproof (Type 4, IP65)

Other Options:
Transducers for special applications; fixtures; no organic bonds or insulators; cooling jackets for high temperatures.
Please consult Panametrics for details.

8.4.2 Clamp-on Transducers

Type:
Shear wave or longitudinal wave

Temperature Range
Standard: -40° to 212°F (-40° to 100°C)
Optional (overall range): -328° to 500°F (-200° to 260°C)

Frequency:
Standard: 1 MHz
Optional: 500 MHz, 2 MHz, or 4 MHz

Mounting:
SS chain or strap, welded or magnetic slide-track mounting fixtures

Housing:
Standard: None (splashproof)
Optional: Explosion-proof, Div. 1, Class 1, Group C&D, INIEX-certified EEx d IIC T6 or weatherproof (Type 4, IP65).

Other Options:
Transducers for special applications; fixtures; no organic bonds or insulators; cooling jackets for high temperatures.
Please consult Panametrics for details.

8.5 Pipe Size and Materials Specifications

8.5.1 Wetted Transducers

Materials:
All metals and most plastics (Consult Panametrics for concrete, glass and cement)

Pipe Sizes:
Inside Diameter: 0.04 to 200 in. (1 mm to 5 m) and larger

8.5.2 Clamp-on Transducers

Materials:
316 SS and most plastics (Consult Panametrics for concrete, composite materials and highly corroded or lined pipes.)

Pipe Sizes:
Outside Diameter: 0.5 to 200 in. (12.7 mm to 5 m) and larger

Pipe Wall Thickness:
Up to 3 in. (76.2 mm)

8.6 Tilted Diameter Spoolpiece Specifications

Pipe Sizes:
Standard: 2 to 200 in. (50 mm to 5 m), 100% interrogation
Optional: > 200 in.

Materials:
Standard: SS, carbon steel, plastic or fiberglass
Optional: Other metals, plastics, etc.

Process Connections:
Standard: Straight (welding), 150-lb flanged, 300-lb flanged and higher
Optional: MJ, Victaulic, RTJ flanged or cold-tap

Wetted Transducer Connections:
Standard: 1 in. NPTM for 6 in. sizes and 3/8 in. NPTM for 2 to 5 in. sizes
Optional: Flanged, hybrid design (PanAdapta™ Plug for isolation), saddle or insertion mechanism

Interrogation:

Standard: Conventional 45^{o} tilted diameter, one or more traverse.
Optional: Mid-radius chord or multi-chords including multiple paths.

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Appendix A. Menu Maps

This appendix includes the following AT868 menu maps:

- *Figure 10, "The CHx>ACTIV, SYSTM, PIPE, and I/O Menu Map" on page 79*
- *Figure 11, "The GLOBL Menu Map" on page 80*
- *Figure 12, "The CHx>SETUP Menu Map" on page 81*

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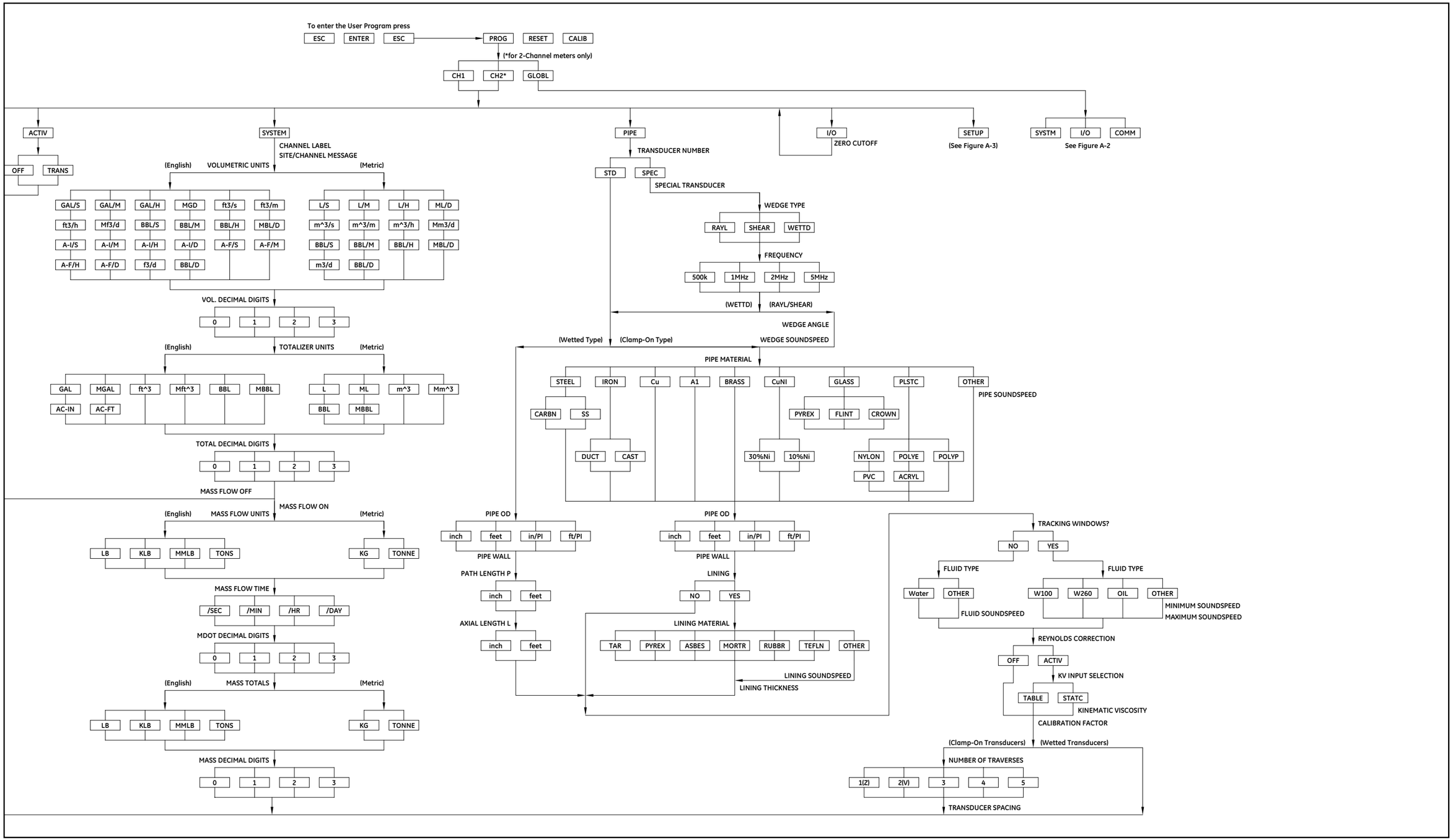

Figure 10: The CHx>ACTIV, SYSTM, PIPE, and I/O Menu Map

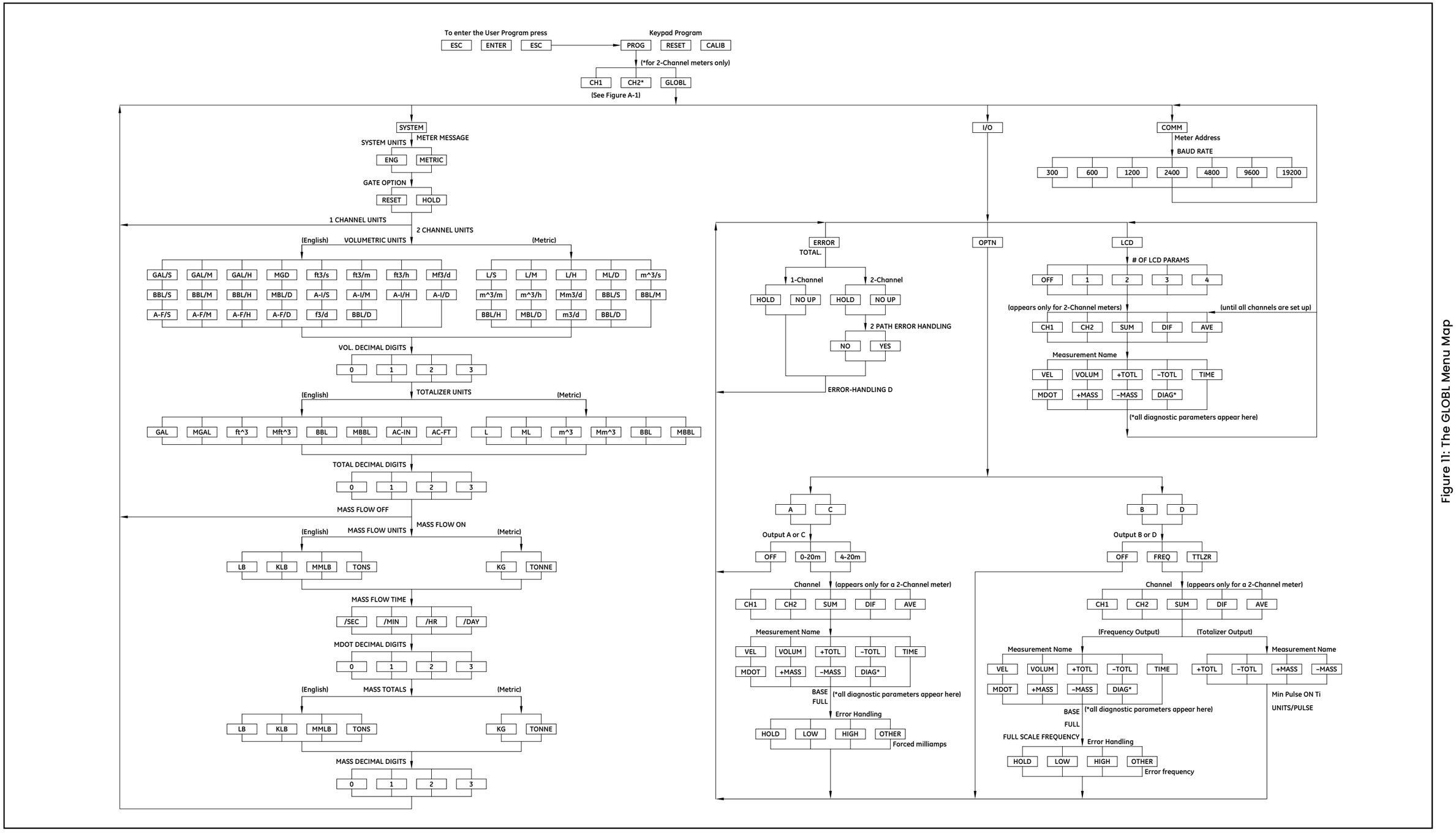

Figure 11: The GLOBL Menu Map

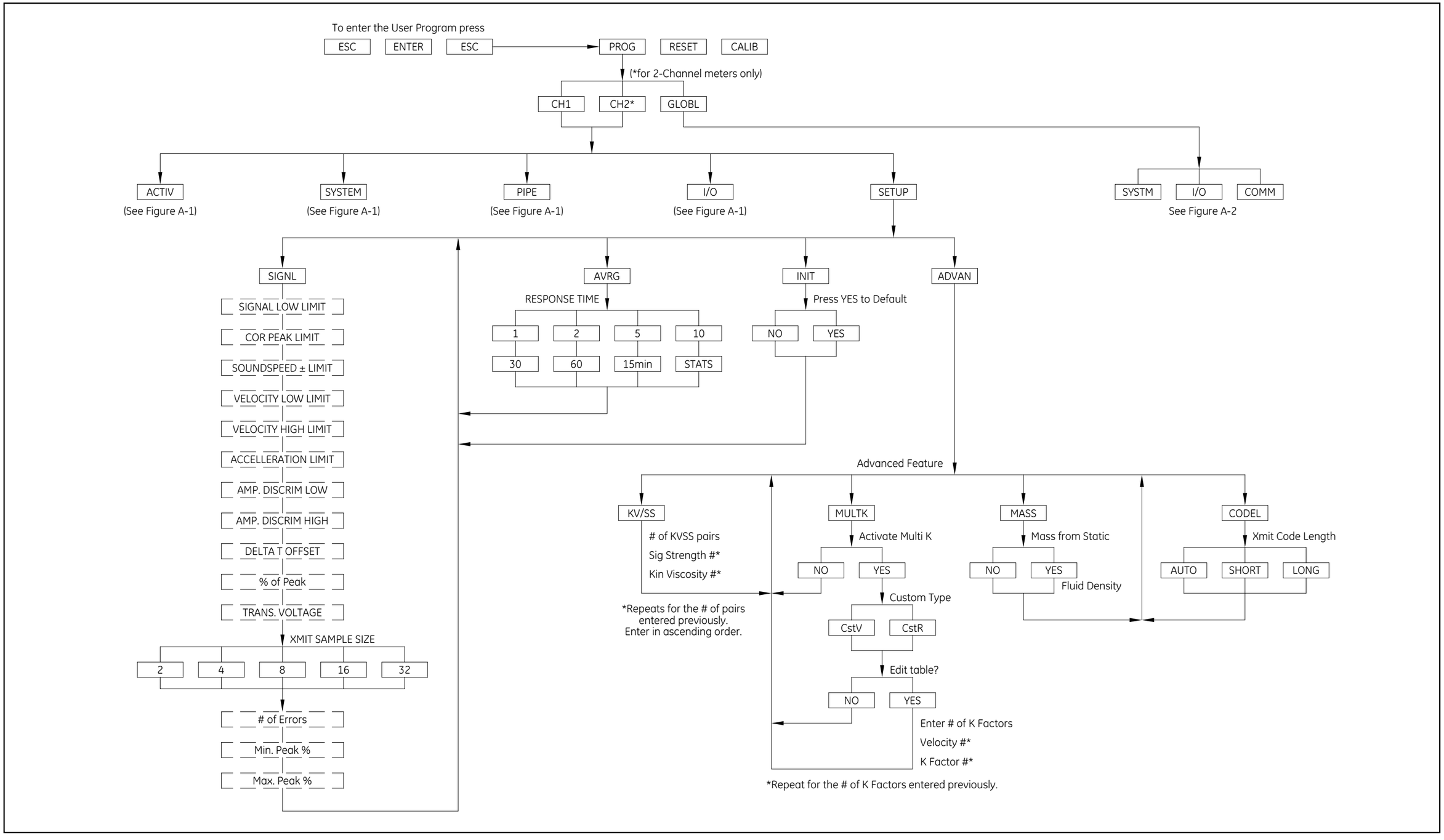

Figure 12: The CHx>SETUP Menu Map

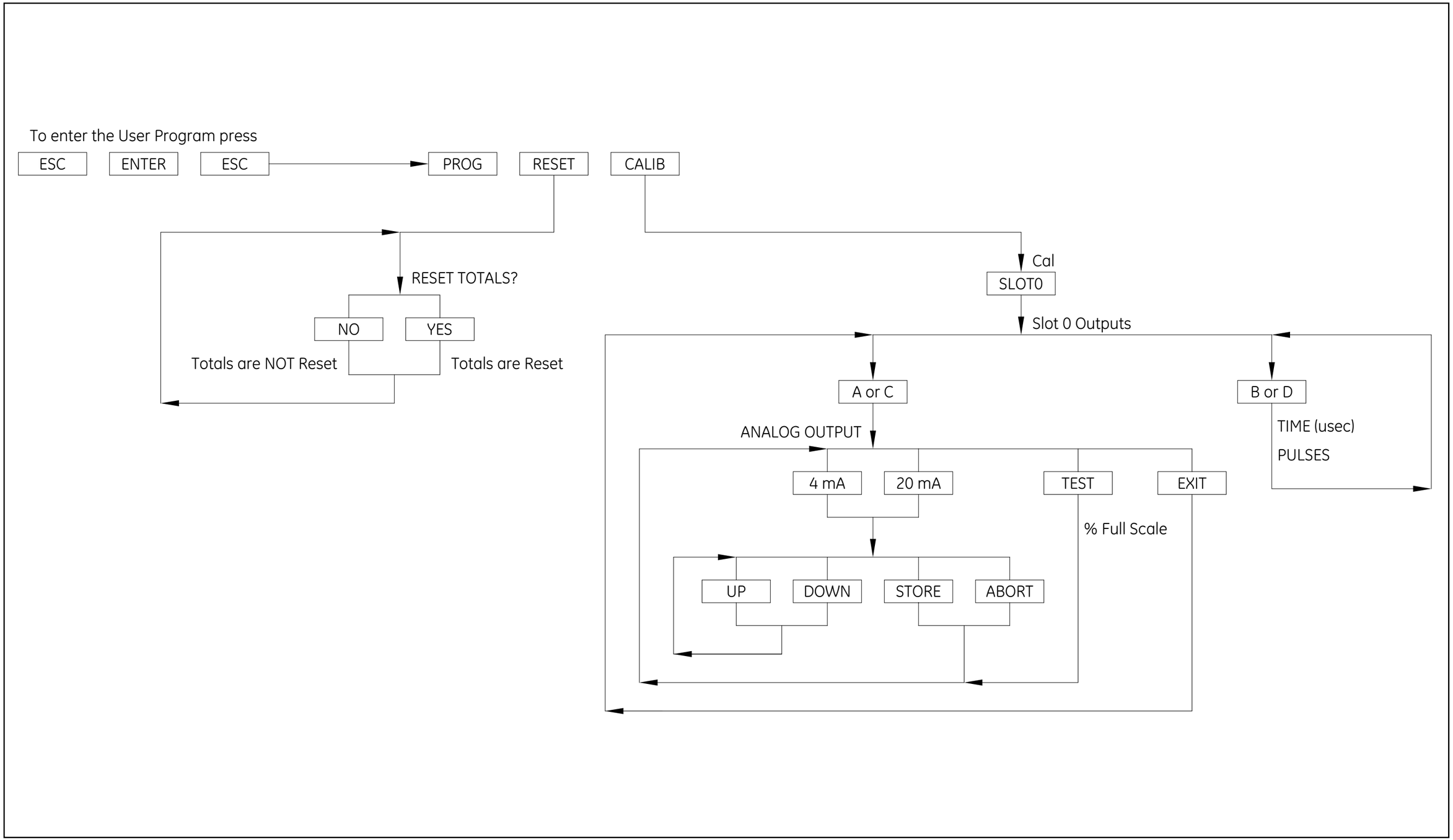

Figure 13: The RESET and CALIB Menu Map

Appendix B. CE Mark Compliance

B.1 Introduction

For CE Mark compliance, the AT868 flow transmitter must comply with both the EMC and LVD directives.

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

B.2 EMC Compliance

For EMC compliance, the electrical connections must be shielded and grounded as in *Table 11* below. Also refer to *Figure 14* and *Figure 15 on page 84* for wiring illustrations. After all the necessary electrical connections have been made, seal any unused cable entry holes with standard conduit plugs or equivalent.

Note: *If the instructions in this appendix are followed, the unit will comply with the EMC Directive.*

Table 11: Wiring Modifications

Connection	Cable Type	Termination Modification
Transducer	RG62 a/u	Add metallic cable clamp from braid to chassis ground.
	Armored RG62 a/u or conduit	Terminate RG62 a/u shield to chassis ground.
Input/Output	22 AWG Shield (e.g. Baystate #78-1197)	Terminate shield to chassis ground at the AT868.
	Armored conduit	None - grounded via cable gland.
Power	14 AWG, 3 conductor, shielded (e.g. Belden #19364)	Terminate shield to chassis ground at the AT868.
	Armored Conduit	None - grounded via cable gland.
Shielding	Wires enclosed in a properly-grounded metal conduit do not require additional shielding.	

B.3 LVD Compliance

For compliance with the European Union's Low Voltage Directive, the AT868 requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

Note: *If the instructions in this appendix are followed, the unit will comply with the Low Voltage Directive.*

Figure 14: AT868 Properly Wired for CE Mark Compliance

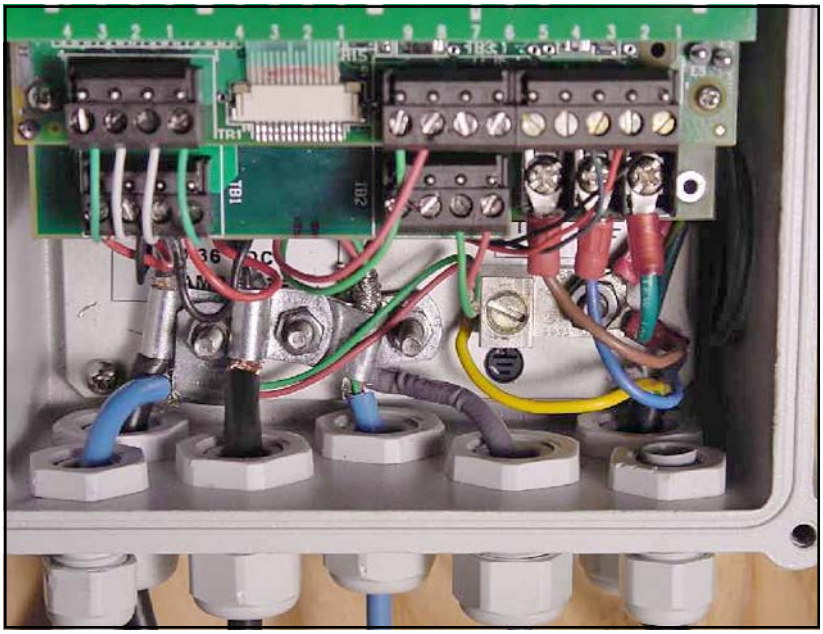

Figure 15: Close-Up of Wiring

Appendix C. Data Records

C.1 Site Data

After the AT868 flow transmitter has been installed, specific site data must be entered via the *User Program* prior to operation. Record that information in *Table 12* below.

Table 12: Site Data

General Information					
Model #			Serial #		
Software Vers.			Setup Date		
Global-System					
Meter Message			Mass Flow Units		
System Units	English	Metric	Mass Flow Time		
Vol. Units			MDOT Dec. Dig.		
Vol. Dec. Digits			Mass Totals		
Totalizer Units			Mass Dec. Dig.		
Tot. Dec. Dig.					
Global-Input/Output-Error Handling					
Error Handling			2-Path Error	No	Yes
Global-Communications					
Meter Address			Baud Rate		
Channelx-Status					
Channel 1			Channel 2 (if applicable)		
Channel Status	Off[1]	Transit	Channel Status	Off[1]	Transit
Channelx-System					
Channel 1			Channel 2 (if applicable)		
Channel Label			Channel Label		
Chan. Message[2]			Chan. Message[2]		
Vol. Units			Vol. Units		
Vol. Dec. Digits			Vol. Dec. Digits		
Totalizer Units			Totalizer Units		
Tot. Dec. Dig.			Tot. Dec. Dig.		
Mass Flow			Mass Flow		
Mass Flow Time			Mass Flow Time		
MDOT Dec. Dig.			MDOT Dec. Dig.		
Mass Totals			Mass Totals		
Mass Dec. Digits			Mass Dec. Digits		
[1]not available for 1-Channel meter, [2]"Site Message" for 1-Channel meter					
Channelx-Pipe Parameters					
Channel 1			Channel 2 (if applicable)		
Trans. Type	STD	SPEC	Trans. Type	STD	SPEC
Transducer #			Transducer #		

Table 12: Site Data(Continued)

Special Transducers				Special Transducers		
Wedge Type	Rayl Shear Wettd			Wedge Type	Rayl Shear Wettd	
Frequency Hz				Frequency Hz		
Trans. Tw				Trans. Tw		
Wedge Angle				Wedge Angle		
Wedge Sndspd				Wedge Sndspd		
Pipe Material				Pipe Material		
All Clamp-On and Wetted Transducers				All Clamp-On and Wetted Transducers		
Pipe O.D.				Pipe O.D.		
Pipe Wall				Pipe Wall		
Path Length (P)				Path Length (P)		
Axial Length (L)				Axial Length (L)		
Lining	Yes	No		Lining	Yes	No
Lining Material				Lining Material		
Lining Sndspd				Lining Sndspd		
Lining Thickness				Lining Thickness		
Track. Window.	Yes	No		Track. Window.	Yes	No
Fluid Type				Fluid Type		
Other/Sndspd				Other/Sndspd		
% of Water				% of Water		
Reynolds Corr.	Off	Active		Reynolds Corr.	Off	Active
KV Input Sel.	Table	Static		KV Input Sel.	Table	Static
Kin. Visc.				Kin. Visc.		
Cal. Factor				Cal. Factor		
# of Traverses				# of Traverses		
Trans. Spacing				Trans. Spacing		
ChannelX-Input/Output						
Zero Cutoff				Zero Cutoff		

Table 12: Site Data(Continued)

Channelx-SETUP-Signal						
Channel 1				Channel 2 (if applicable)		
Signal Low Lim.				Signal Low Lim.		
Corr. Peak Lim.				Corr. Peak Lim.		
SS +/- Limit				SS +/- Limit		
Vel. Low Limit				Vel. Low Limit		
Vel. High Limit				Vel. High Limit		
Accel. Limit				Accel. Limit		
Amp. Disc. Low				Amp. Disc. Low		
Amp. Disc. High				Amp. Disc. High		
Delta T Offset				Delta T Offset		
% of Peak				% of Peak		
Trans. Voltage				Trans. Voltage		
Xmit Sam. Size				Xmit Sam. Size		
# of Errors				# of Errors		
Min. Peak %				Min. Peak %		
Max. Peak %				Max. Peak %		
Channelx-SETUP-V Averaging						
Response Time				Response Time		
Channelx-SETUP-Advanced Features-Enter KV/SS Table						
KV/SS Pairs				KV/SS Pairs		
#	Sig. Stren.	Kin. Visc.		#	Sig. Stren.	Kin. Visc.
1				1		
2				2		
3				3		
4				4		
5				5		
6				6		
7				7		
8				8		
9				9		
10				10		
11				11		
12				12		
13				13		
14				14		
15				15		
16				16		
17				17		
18				18		
19				19		

Table 12: Site Data(Continued)

20				20		
ChannelX-SETUP-Advanced Features-Multiple K Factors						
Custom Type	CstV	CstR		Custom Type	CstV	CstR
K-Factor Table				K-Factor Table		
K-Factor #	Vel./Reyn.	K Factor		K-Factor #	Vel./Reyn.	K Factor
1				1		
2				2		
3				3		
4				4		
5				5		
6				6		
7				7		
8				8		
9				9		
10				10		
11				11		
12				12		
13				13		
14				14		
15				15		
16				16		
17				17		
18				18		
19				19		
20				20		
ChannelX-SETUP-Advanced Features-Mass Flow from Static						
Mass Flow	No	Yes		Mass Flow	No	Yes
Fluid Density				Fluid Density		
ChannelX-SETUP-Advanced Features-Code Length						
Code Length	Auto Short Long			Code Length	Auto Short Long	

Appendix D. Measuring P and L Dimensions

D.1 Measuring P and L

If you are using wetted transducers, the AT868 requires you to enter the path length (**P**) and the axial dimension (**L**). **P** is the transducer face-to-face distance, and **L** is the axial projection of P in the flow stream.

To determine **L**, physically measure the distance between the center of the transducer ports at the inside wall as shown in *Figure 16* below, if possible. If this is not possible in your installation, contact Panametrics for help.

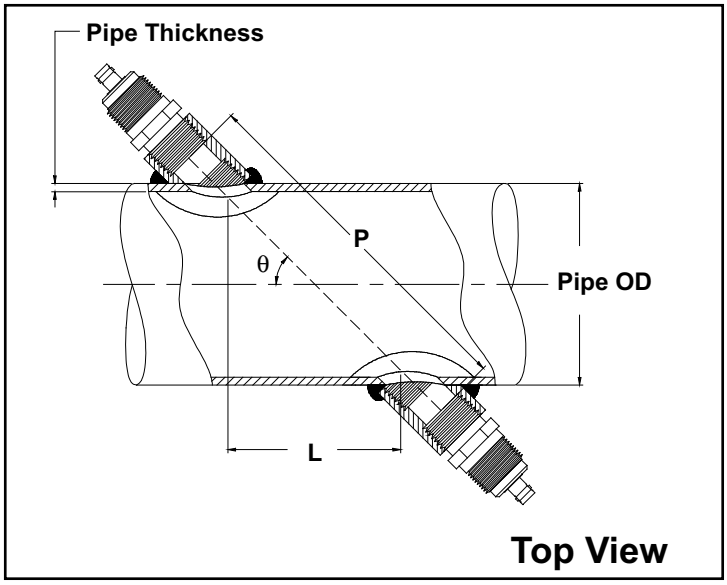

Figure 16: Typical 180° Transducer Installation

To determine **P**, you need to know the following:

- Pipe inside diameter (**ID**)
- Wall thickness (**WT**)
- Installed pipe coupling length (**CL**)
- Transducer face depth (**FD**)
- Mounting angle (**MA**)

Use *Figure 17* below to properly measure the coupling length. Typically, the transducer face is positioned just outside the inside diameter (**ID**) of the pipe, or slightly retracted inside the coupling.

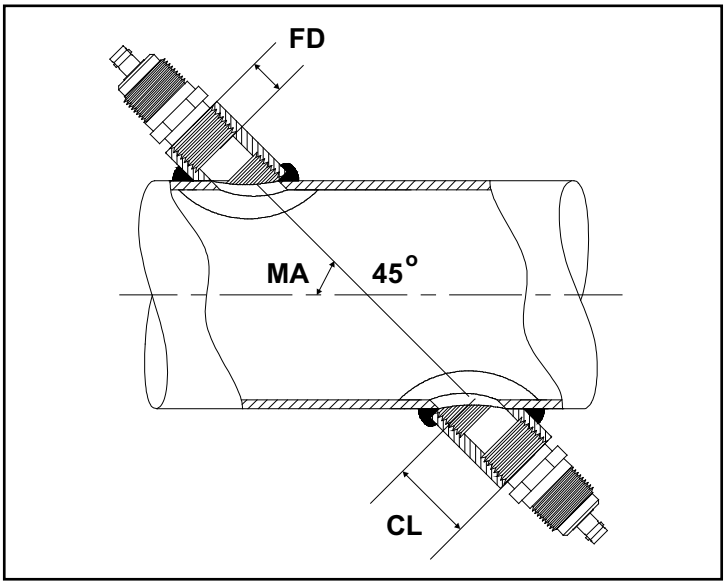

Figure 17: Determining the Coupling Length

Use the following formula to determine the P dimension:

$$[ID + 2 \times (WT)]/(\cos MA) + 2 \times (CL - FD) = P \text{ Dimension}$$

For example, given the following typical values:

- Pipe inside diameter (ID) = 48″
- Wall thickness (WT) = 3/8″
- Installed coupling length (CL) = 2.0″
- Transducer face depth (FD) = 1.75″
- Mounting angle (MA) = 45°

The P dimension would be: [48 + 2 x (3/8)]/(0.7071) + 2 x (2.0 - 1.75) = **69.4″**

Appendix E. Service Record

E.1 Introduction

Whenever any service procedure is performed on the AT868, the details of the service should be recorded in this appendix. An accurate service history can prove very helpful in troubleshooting any future problems.

E.2 Data Entry

Record complete and detailed service information for your AT868 in *Table 13* below.

Table 13: Service Record

Date	Description of Service	Performed By

Table 13: Service Record(Continued)

Date	Description of Service	Performed By

E.3 Diagnostic Parameters

After a successful initial installation of the AT868 and whenever any system malfunction is noticed, the values for the diagnostic parameters should be entered in *Table 14* below.

Table 14: Diagnostics Parameters

Parameter	Initial	Current	Parameter	Initial	Current
Channel 1			Channel 2		
UP Sig. Stren.			UP Sig. Stren.		
DN Sig. Stren.			DN Sig. Stren.		
Sound speed			Sound speed		
UP Transit			UP Transit		
DN Transit			DN Transit		
Delta T			Delta T		
Reynolds #			Reynolds #		
K(RE)			K(RE)		
PEAK%			PEAK%		
Theta 3[1]			Theta 3[1]		
UP Signal Q			UP Signal Q		
DN Signal Q			DN Signal Q		
UP Amp. Disc.			UP Amp. Disc.		
DN Amp. Disc.			DN Amp. Disc.		
UP +- Peak			UP +- Peak		
DN +- Peak			DN +- Peak		
UP Norm. F			UP Norm. F		
DN Norm. F			DN Norm. F		
CEE1			CEE1		
SIGMA			SIGMA		
#ERRS			#ERRS		
[1] available only for Clamp-on transducers					

[no content intended for this page]

Appendix F. Programming with PanaView™

F.1 Introduction

Panametrics's *PanaView*™ graphical user interface software offers interactive communications between Windows-based PCs and Panametrics instruments. With *PanaView*™, you can:

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

For detailed installation and setup instructions, refer to the *PanaView™ User's Manual* (910-211).

F.2 Wiring the RS232 Interface

For details on wiring your RS232 interface, refer to *"Wiring the Serial Port" on page 6* and to the Panametrics document *EIA-RS Serial Communications* (PANA073C11).

F.3 Starting Up

After the serial port has been connected, power up the AT868 and the PC. Then, start up *PanaView*™. If you see a message similar to that in *Figure 18* below, *PanaView*™ is unable to communicate with your meter. Select **Don't Load Meter (this session only)**, click **OK** and then proceed to *"Setting Up the Communications Port" on page 96*.

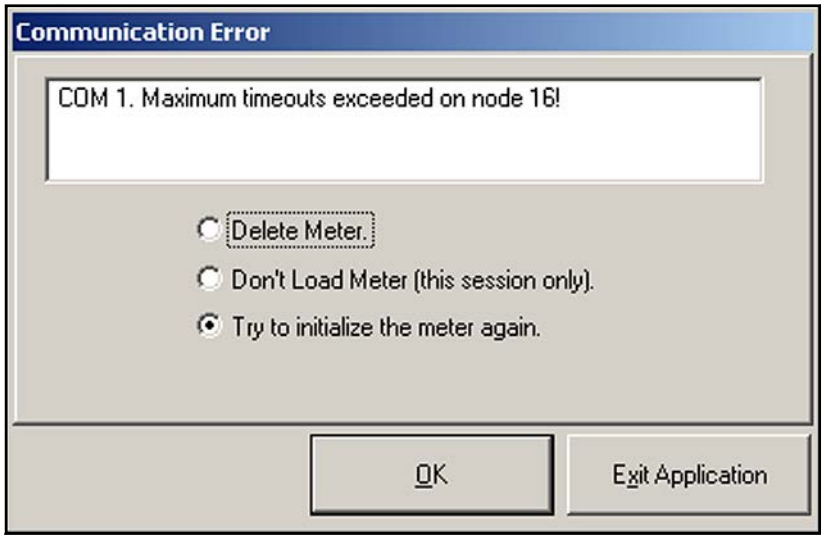

Figure 18: Communication Error Screen

F.3.1 Setting Up the Communications Port

Complete the steps below to establish communications with your AT868:

1. Open the *"New Meter Browser"* window and expand the network tree. Then, highlight the *My Computer(Name)* branch by clicking on it.
2. Drop down the *"Edit"* menu by clicking on it in the menu bar.
3. Click on the *"New"* menu option to select it, and a submenu opens with two choices (see *Figure 19* below).

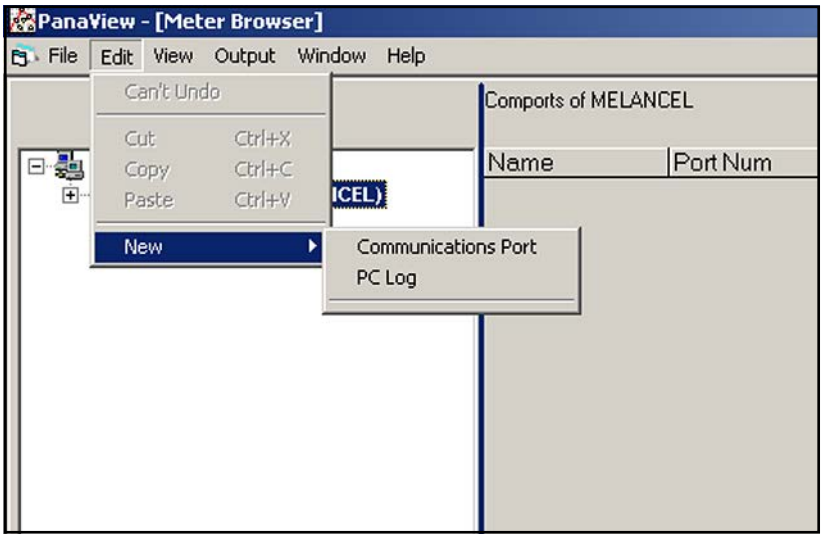

Figure 19: The Edit Menu

4. Click on the *"Communications Port"* option to select it. The *Setup Communications* screen appears similar to *Figure 20* below.

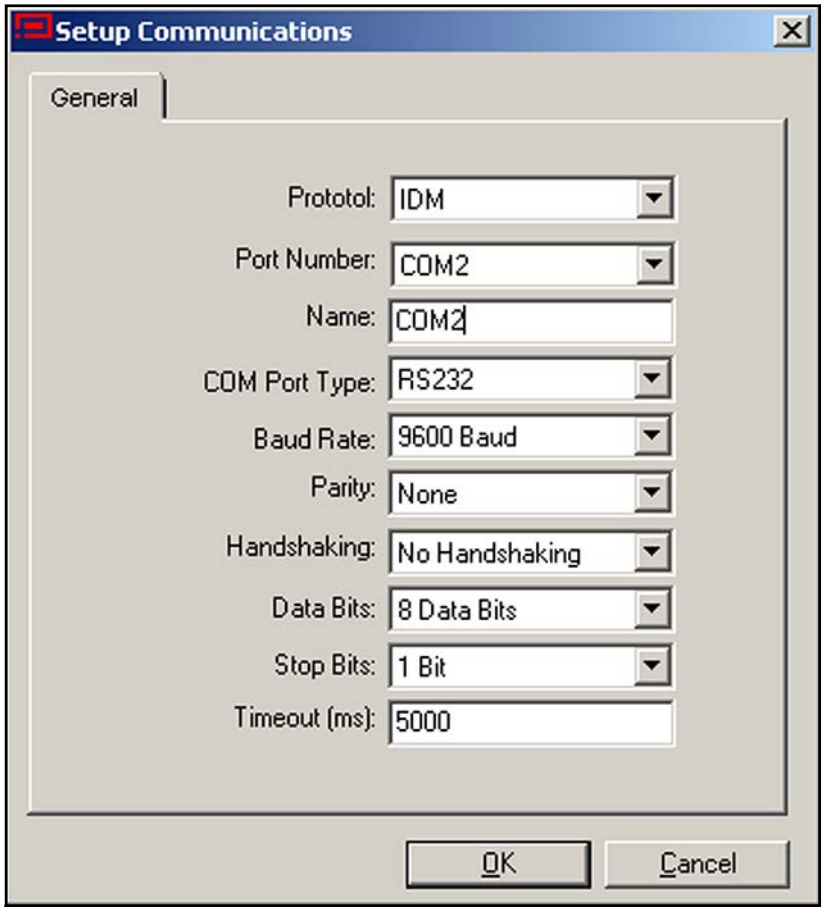

Figure 20: Setup Communications Screen

5. Open the *Protocol* menu and click on *IDM*.
6. Select any suitable available baud rate. A baud rate of 19,200 is appropriate for almost all applications. However, if you experience periodic communication unreliability problems, you may wish to consider lowering the baud rate on your instrument and in *PanaView*.

IMPORTANT: Be sure all the communications port settings match those made in setting up the AT868 serial port.

7. Click on [OK] to complete the settings.

F.4 Adding an IDM-Compatible Meter

To add a meter on the IDM-configured communications port, complete the following steps:

1. Highlight the communication port to which the meter will be added by clicking on it, and then open the *"Edit"* menu on the menu bar

Note: *if the communication port is not highlighted first, the* "New Meter" *option is not active in the* "Edit" *menu).*

2. Click on the *"New"* option in the *"Edit"* menu (see *Figure 21* below).

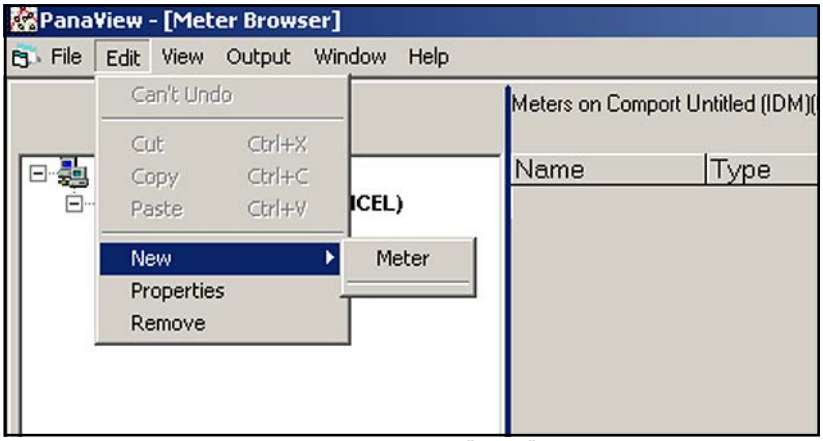

Figure 21: Edit Menu - "New" Option

3. After clicking on the *"New"* option, the *"Meter"* menu option appears. Click on this option to select it.
4. The *"New IDM Meter"* screen (shown in *Figure 22* below) opens. Enter the *Network ID* number for the meter, and click [OK].

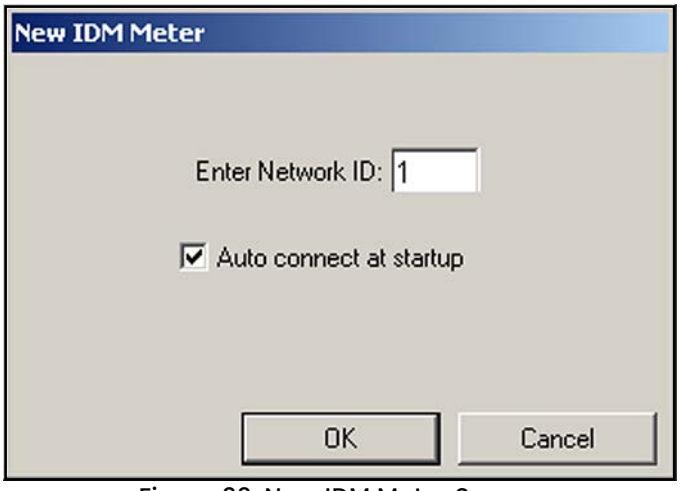

Figure 22: New IDM Meter Screen

IMPORTANT: The Network ID number must match the Network ID programmed in the meter Communications menu.

If the initialization is successful, the *Meter Browser* shows a listing similar to *Figure 23* below.

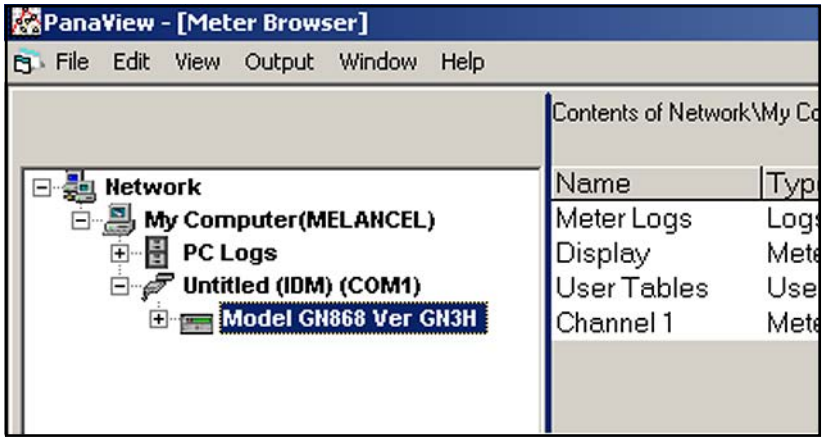

Figure 23: Updated Network Tree

However, if the settings do not match or there is some other difficulty, a screen similar to *Figure 24* below. opens

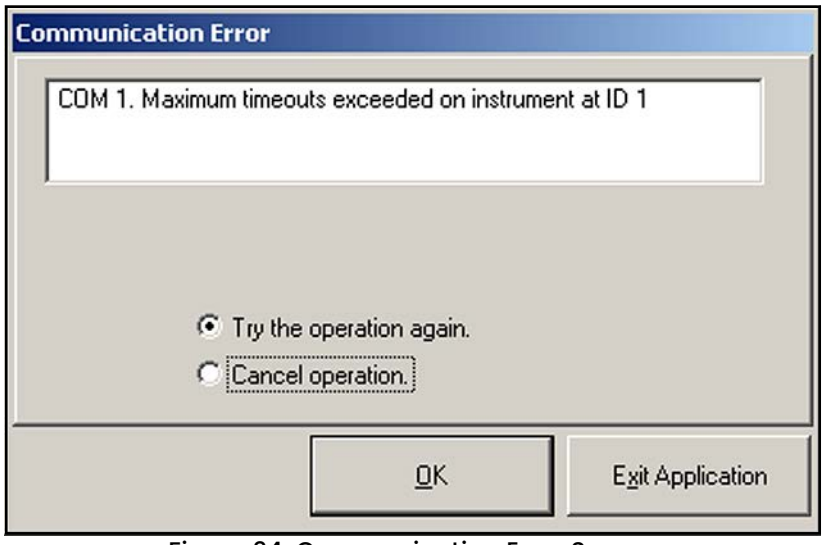

Figure 24: Communication Error Screen

The screen offers the options of trying again or of canceling the operation. Click on the desired choice, and then click either on [OK] to confirm the choice or on [Exit Application] to close *PanaView*.

F.5 Editing Meter the Properties

With *PanaView*, you can edit the properties of your flow transmitter, such as:

- Set the meter clock, or synchronize it with the PC clock
- Read, plot and save transducer signals
- Clear the totalizers
- Save site files to the meter or PC
- Clear site files from the meter
- Print site files to the PC

To edit the properties of your meter:

1. Highlight the meter (as shown in *Figure 23 on page 99*).
2. Open the *"Edit"* menu and select the *"Properties"* option, as shown in *Figure 25* below.

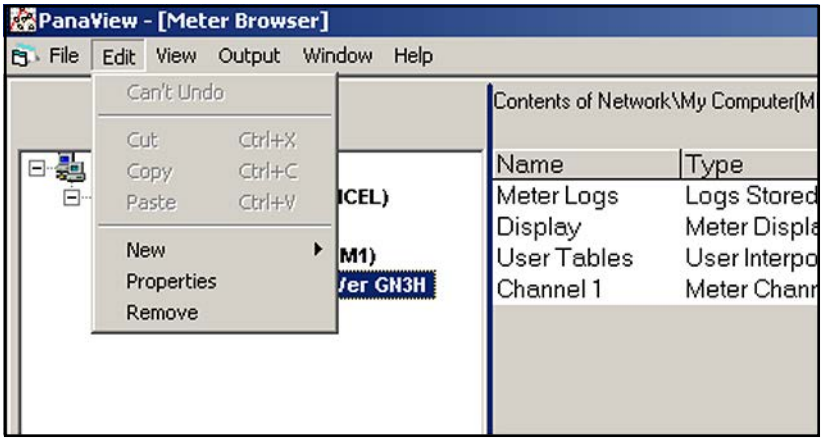

Figure 25: Edit Menu - Properties Option

The next window appears similar to *Figure 26* below. To perform a specific task, refer to the following sections:

- *"Setting the Meter Clock" on page 102*
- *"Reading the Transducer Signals" on page 103*
- *"Plotting the Transducer Signals" on page 104*
- *"Saving the Transducer Signals" on page 104*
- *"Clearing the Totalizers" on page 105*
- *"Handling Site Files" on page 105*

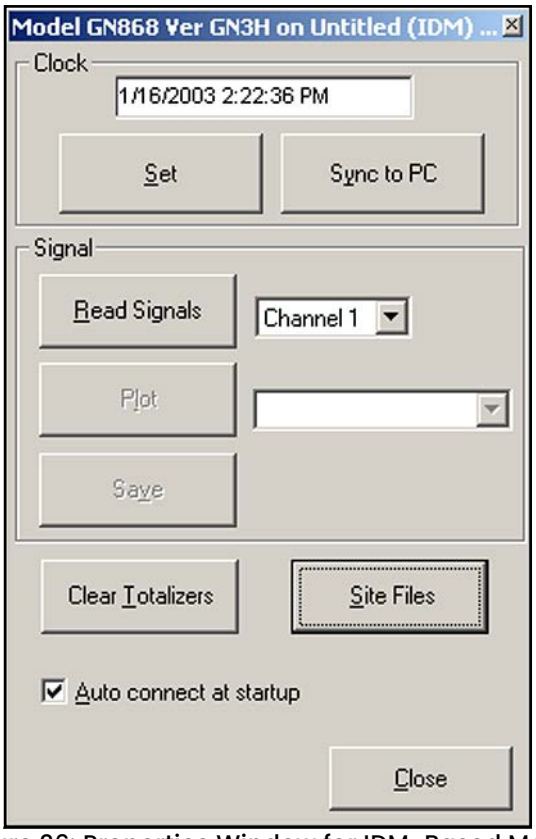

Figure 26: Properties Window for IDM-Based Meter

Note: *For illustration purposes, the meter shown here is a one-channel GN868 flowmeter. Specific parameters will vary with your particular meter.*

F.5.1 Setting the Meter Clock

The meter *Time* may be reset in three different ways:

- Manually enter the time and date in the text box
- Click on the [Sync to PC] option button to have *PanaView* set the time and date to the current PC setting
- Click on the [Set] option button to open the dialog box shown in *Figure 27* below. Set the desired date and time as indicated, and click on the [OK] button.

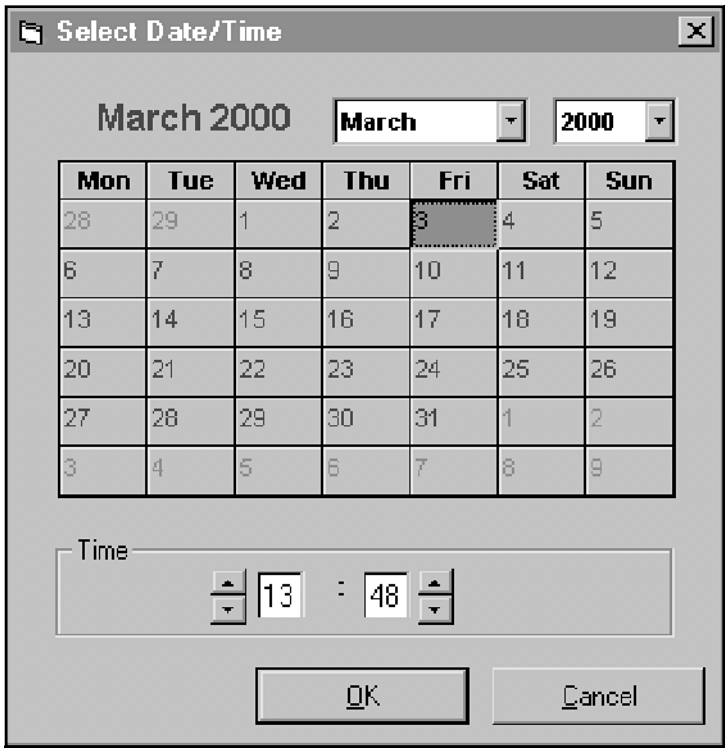

Figure 27: Time and Date Selection Screen

F.5.2 Reading the Transducer Signals

To read a transducer *Signal* from the meter, proceed as follows:

1. Click on the *Read Signals* button. For a 2-channel meter, open the Channel drop-down menu and click on the desired channel. After a moment, a *Properties* screen similar to *Figure 28* below opens.

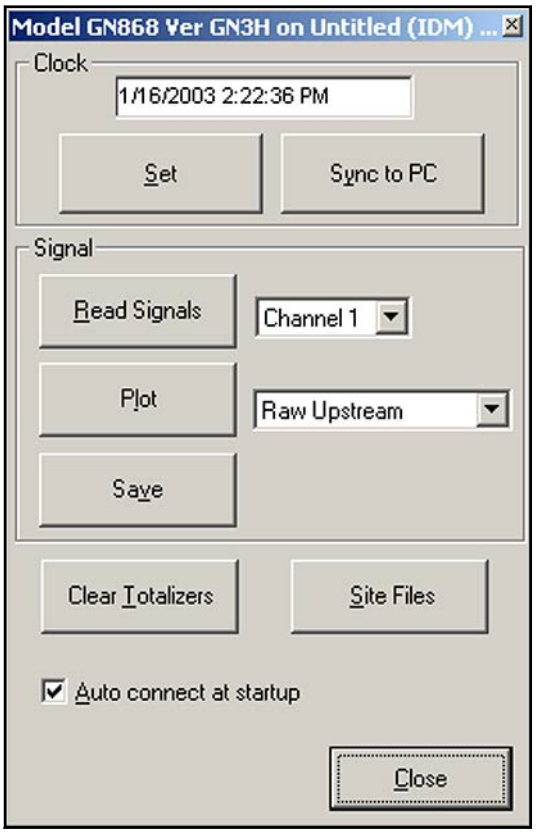

Figure 28: Properties Screen - Active Signal Options

2. To select a different signal type, open the signal menu at the right (shown here with *Raw Upstream* highlighted) and click on the desired signal.

F.5.3 Plotting the Transducer Signals

To *plot* the selected signal, click on *Plot* to open a graphical screen similar to *Figure 29* below.

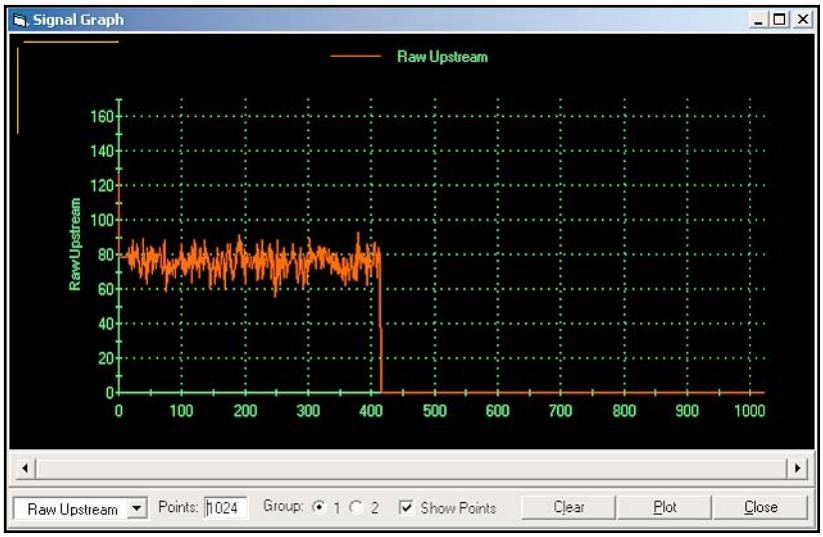

Figure 29: Signal Graph Screen

F.5.4 Saving the Transducer Signals

To *save* the raw signal, click *Save* to open a screen similar to *Figure 30* below. Enter the desired name, and click *Save* to save the signal as a text file.

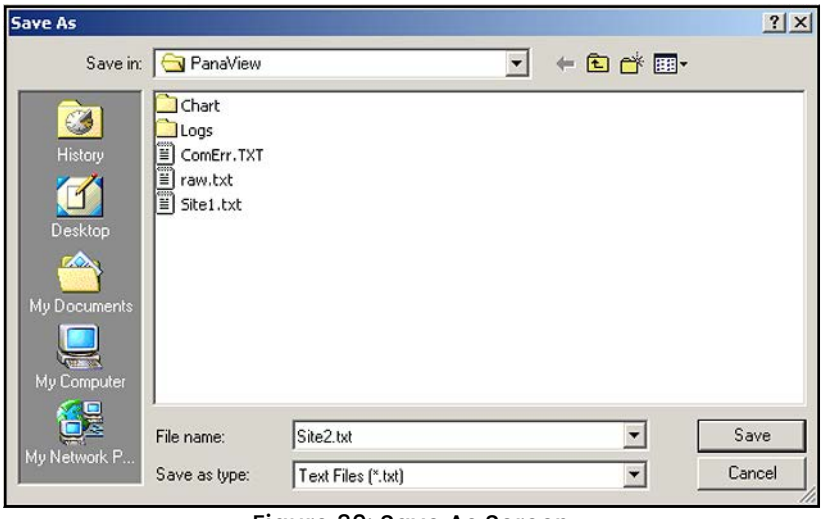

Figure 30: Save As Screen

F.5.5 Clearing the Totalizers

To clear the meter totalizers, click on the *Clear Totalizers* button in the *Properties* screen. The meter totalizers are immediately reset to 0.

F.5.6 Handling Site Files

To access your site files, click on the *Site Files* button in the *Properties* Screen to open the *Site File Operations* screen shown in *Figure 31* below.

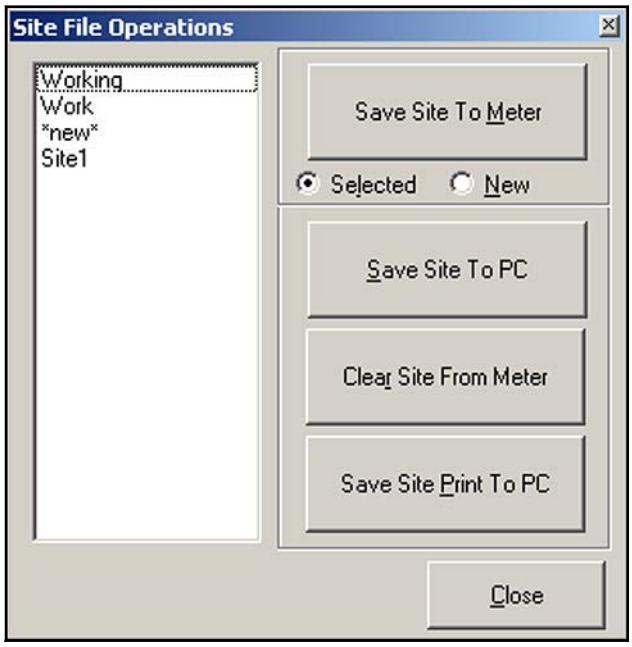

Figure 31: Site File Operations Screen

F.5.6.1 Saving an Existing Site to the Meter

To save an existing site file to the meter, proceed as follows:

1. Select the radio button for *Selected* and highlight an existing site file in the left pane.
2. Click on the *Save Site to Meter* button to open a screen similar to *Figure 32* below.

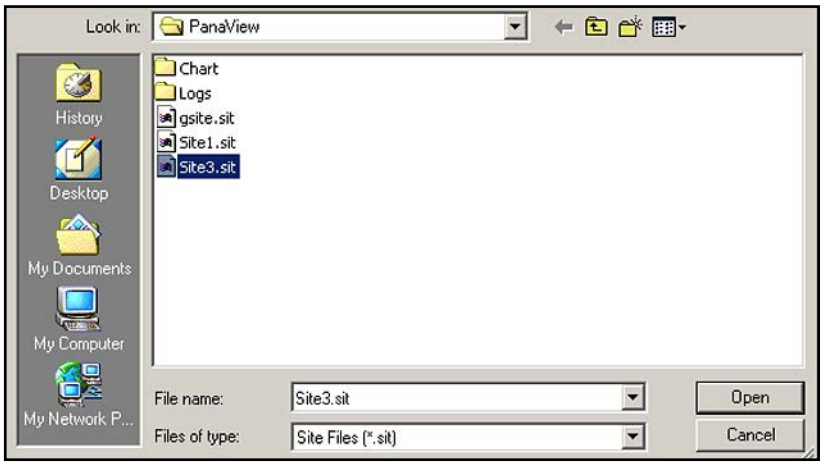

Figure 32: Site File Selection

3. Highlight the desired site and click *Open*. *PanaView*™ sends the site to the meter.

F.5.6.2 Saving a New Site File to the Meter

To save a new site file to the meter, proceed as follows:

1. Select the radio button for *New* and click on the *Save Site to Meter* button.
2. A window opens similar to *Figure 33* below. Enter the desired name, and click [OK].

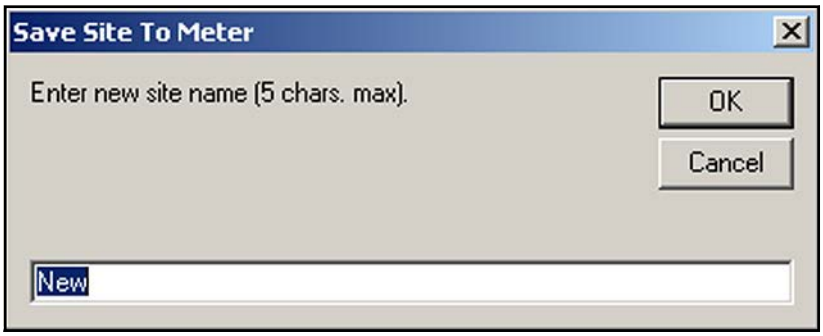

Figure 33: Site Name Screen

3. The *Site File Selection* screen (see *Figure 32* above) opens. Highlight a site file with the desired settings, and click [Open]. *PanaView* saves the site file in the meter with the new name and the desired settings.

F.5.6.3 Saving a Site File to the PC

To save a site file to the PC, Proceed as follows:

1. Highlight the desired site file in the left pane (see *Figure 31 on page 105*).
2. Click *Save Site to PC* to open a screen similar to *Figure 30 on page 104*.
3. Enter the desired site file name and click [Save]. *PanaView* saves the site file in the *PanaView*™ folder, unless otherwise specified.

Note: *If you have created a site file on the meter after opening the* Site File Operations *window, you must close and reopen the window to click on the new site file.*

F.5.6.4 Clearing a Site File from the Meter

To clear a site file from the meter, proceed as follows:

1. Highlight the site file in the left pane (see *Figure 31 on page 105*).
2. Click *Clear Site From Meter.*
3. Click [OK] to confirm your choice, and the meter deletes the designated file.

F.5.6.5 Saving a Site File in Text Form

To store the data from a site file as a text file for display or printout, proceed as follows:

1. Highlight the site file in the left pane (see *Figure 31 on page 105*).
2. Click *Save Site Print to PC*.
3. A *Site File Selection* screen similar to *Figure 32 on page 106* opens. Enter the desired site file name (now with a .prt suffix) and click [Save]. *PanaView* displays a text version of the site, as shown in *Figure 34* below.

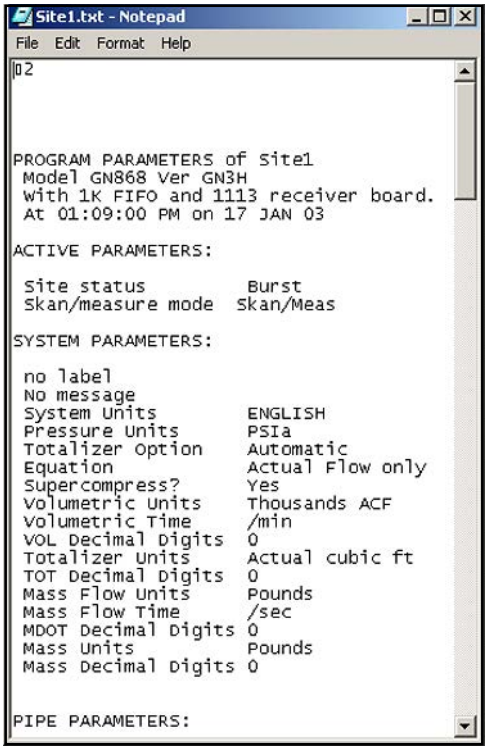

Figure 34: Site File Printout

4. Click [Close] once to close the *Site File Operations* screen, then click it a second time to close the *Properties* screen and return to the *Meter Browser*.

F.6 Changing Meter Settings

With *PanaView*, the following remote programming tasks can be completed:

- Program and change the meter operating parameters
- Set up, start, and stop logs
- Calibrate and test inputs and outputs
- Clear various files

To access the remote meter programming, proceed as follows:

1. Enter the *New Meter Browser* option from the "File" menu.
2. Expand the network tree until you reach the desired meter.
3. Expand the meter tree as shown in *Figure 35* below.

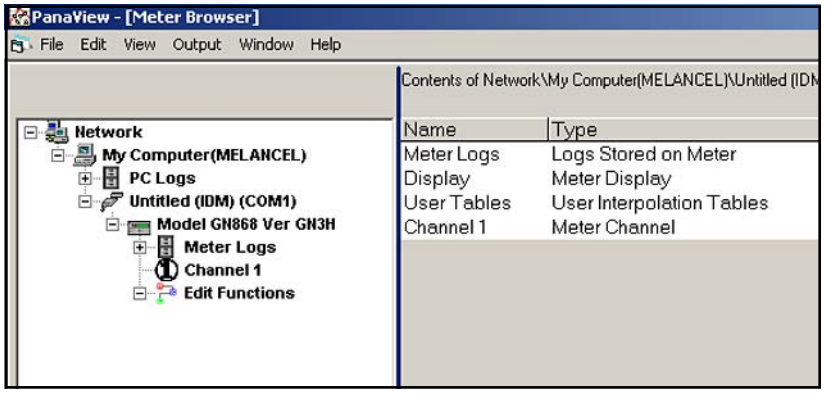

Figure 35: New Meter Browser - Meter Branch

4. From the meter tree, expand the *Edit Functions* option. A screen similar to *Figure 36* below opens, with a list of available menus. The menus listed are those available on the meter.

Note: *For illustration purposes only, the specific menus shown are those for a one-channel GN868 flowmeter.*

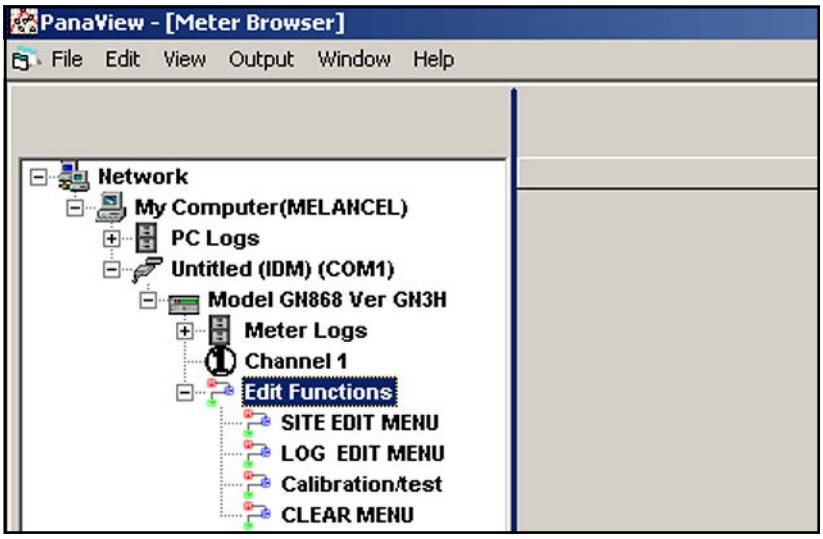

Figure 36: Meter Tree - Edit Functions Option

5. To open a particular menu, double-click on that menu on the tree. For example, if you double-click on the *Site Edit Menu*, a screen similar to *Figure 37* below opens.

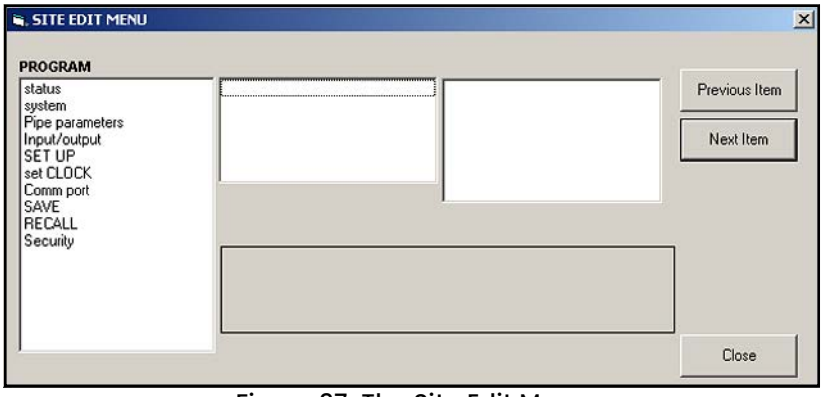

Figure 37: The Site Edit Menu

Note: *The options listed in the left pane correspond to the options available for the meter selected in Figure 36 above.*

6. To program a particular option, proceed as follows:
   a. Highlight and double-click on the desired option in the left pane. *Figure 38* below shows the first entry (*Transducer Number*) in the *Pipe Parameters* option. The title above the center pane lists the current entry, while the center pane displays the available selections for that entry.
   b. Click on the desired choice. If the entry requires a numeric value, change the value displayed in the right pane as desired.

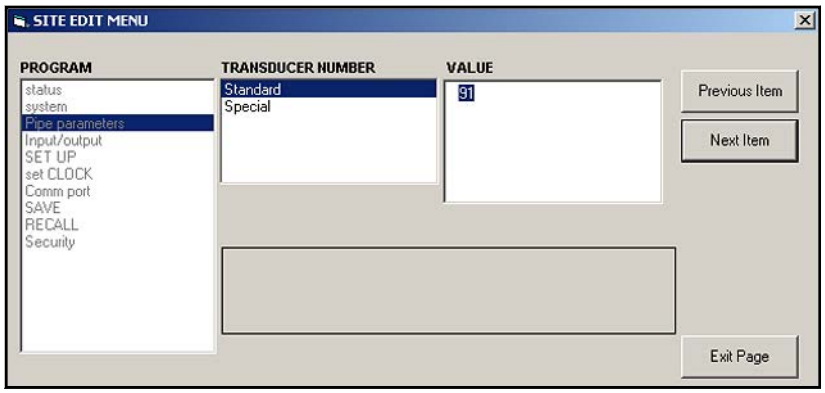

Figure 38: Site Edit Menu - Pipe Parameters Option

   c. Do one of the following:

   Click on [Next Item] to proceed to the next menu item,

   or

   Click on [Previous Item] as many times as necessary to return to a previous item.

Note: *If you click on either* [Next Item] *or* [Previous Item] *without changing the settings, the current settings remain unchanged.*

As you step through the menus, the bottom panel lists the current settings you have modified or left unchanged (see *Figure 39* below). If you modify or step through the menus more than five items, a scroll bar at the right of the panel lets you review the earlier settings.

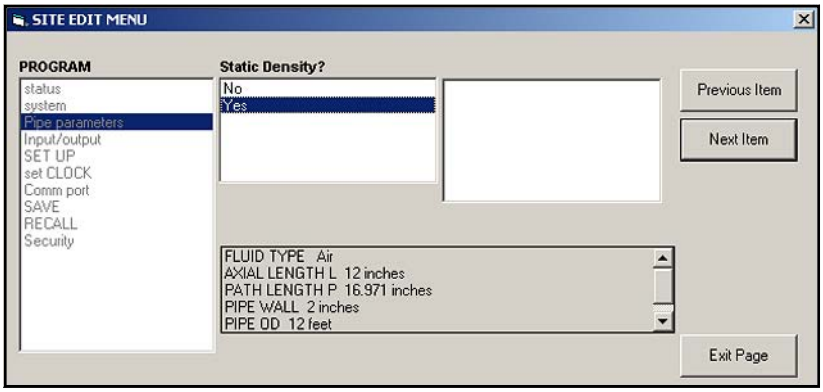

Figure 39: Site Edit Menu - Current Settings

7. After you have completed entering the parameters in a given option, click [Exit Page] to close the option. You can then double-click on another option, or click [Close] to close the window.

You can double-click on another menu to modify its settings, or return to the *New Meter Browser.* For additional *PanaView* functions, refer to the *PanaView User's Manual (PANA031C11).*

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