September 2001

Process Control Instrument Division

Model AT868 AquaTrans™ Ultrasonic Flow Transmitter for Water (1- & 2-Channel)

User's Manual *910-218A1*

PANAMETRICS

Warranty

Each Panametrics instrument is warranted to be free from defects in materials and workmanship. Liability under this warranty is limited to servicing an instrument returned to the factory for that purpose and/or replacing any defective parts. Fuses, batteries, and cables are specifically excluded from any liability. This warranty is effective for one year from the date of delivery to the original purchaser, provided the instrument has been installed and operated in the manner described in this Startup Manual. Panametrics must determine that the instrument was defective for this warranty to be valid. If damage is determined to have been caused by misuse or abnormal conditions of operation, the owner will be notified and approved repairs will be billed at standard rates.

Return Policy

If any problems develop, the following steps should be taken:

1. Notify Panametrics, giving full details of the difficulty, and provide the model and serial numbers of the instrument. Upon notification, Panametrics will then supply a RETURN AUTHORIZATION NUMBER and/or shipping instructions, depending on the problem.

2. If Panametrics provides instructions for returning the instrument to the factory, it must be sent prepaid to the authorized repair station specified in the shipping instructions.

3. If the warranty has expired or the damage has been caused by misuse or abnormal operating conditions, an estimate will be provided before any repairs are begun.

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Chapter 1

Installation

Introduction

To ensure safe and reliable operation of the Model AT868 Flowmeter, the system must be installed 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 enclosed* Liquid Transducer Installation Guide (916-055) *for detailed instructions on transducer installation.*

- 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.

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

Unpacking

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

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.

Electronics Enclosure Location

The standard Model AT868 electronics enclosure is an epoxy-coated aluminum NEMA 4, IP66 weatherproof enclosure. 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's Low Voltage Directive (73/23/EEC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the Model AT868.*

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 on an underground pipe, dig a pit around the pipe to facilitate installation of the transducers.

Transducer Location

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

- 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 should be avoided in order to insure a full pipe at the measurement point.

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 1,000 ft (300 m) in length for remote location of the electronics enclosure. If longer cables are required, consult the factory for assistance.

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 Panametrics. 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).*

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 enclosed Panametrics *Liquid Transducer Installation Guide (916-055)*.

Mounting the AT868 Electronics Enclosure

The standard model AT868 electronics package is housed in an epoxy-coated aluminum NEMA 4X, IP66 weatherproof enclosure suitable for indoor or outdoor use. Refer to Figure 1-3 on page 1-13 for the mounting dimensions and the weight of this enclosure.

Making the Electrical Connections

This section contains instructions for making all the necessary electrical connections to the Model AT868 flow transmitter. Refer to Figure 1-4 on page 1-14 for a complete wiring diagram.

!ATTENTION EUROPEAN CUSTOMERS!
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 either the front cover.

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

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

Wiring the Line Power

The Model AT868 may be ordered for operation with power inputs of 100-240 VAC or 12-28 VDC. The label on the side of the electronics enclosure lists the meter's required line voltage and power rating. The fuse size is listed on label located under 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 (73/23/EEC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the Model AT868.*

Refer to Figure 1-4 on page 1-14 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. Prepare the line power leads by trimming the line and neutral AC power leads (or the positive and negative DC power leads) to a length 0.5 in. (1 cm) shorter than the ground lead. This ensures that the ground lead is the last to detach if the power cable is forcibly disconnected from the meter.
2. Install a suitable cable clamp in the conduit hole where the line power is fed through. If possible, avoid using the other conduit holes for this purpose, to minimize any interference in the circuitry from the AC power line.

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

3. Strip 1/4-in. of insulation from the end of each of the three line power leads.
4. Route the cable through the conduit hole and connect the line power leads to the power terminal block as shown in Figure 1-4 on page 1-14.
5. Leaving a bit of slack, secure the power line with the cable clamp.

Wiring the Line Power (cont.)

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

Proceed to the next section to continue the initial wiring of the Model AT868 flow transmitter.

Wiring the Transducers

Before wiring the AT868 transducers, complete the following steps:

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

!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. Locate the CH1 transducer cables and connect them to the two CH1 transducers in the flowcell. Feed the free ends of the cables through the selected conduit hole in the electronics enclosure.
2. If an optional lightening protector is being installed, connect it between the meter and the transducers.
3. Refer to the wiring diagram in Figure 1-4 on page 1-14 and connect the transducer cables to the TB1 terminal block. Then, secure the cable clamp.

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

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

4. For a 2-Channel (path) AT868, repeat steps 1-3 to connect the CH2 transducers to terminal block TB2. 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, substracting or adding the channels/paths together.*

5. If wiring of the unit has been completed, reinstall 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.*

Proceed to the next section to continue the initial wiring of the unit.

Wiring the Standard 0/4-20 mA Analog Outputs

The Model AT868 flow transmitter has one isolated 0/4-20 mA analog output (designated as Output A). 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. Disconnect the main power to the unit and remove the front cover.
2. Install the required cable clamp in the chosen conduit hole on the bottom of the electronics enclosure.
3. Refer to Figure 1-4 on page 1-14 for the location of TB3 terminal block and wire the analog output to pins 1 and 2 as shown. Secure the cable clamp.

Note: *Analog outputs 1 and 2 in the wiring diagram correspond to analog outputs A and B in Slot 0 in the AT868 software.*

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

4. If wiring of the unit has been completed, reinstall 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.*

Proceed to the next section to continue the initial wiring of the unit.

Wiring the Totalizer/ Frequency Output

The Model AT868 has a second output (designated as Output B) that can be a totalizer or frequency. Figure 1-1 below shows a sample wiring diagram of a totalizer and frequency output circuit.

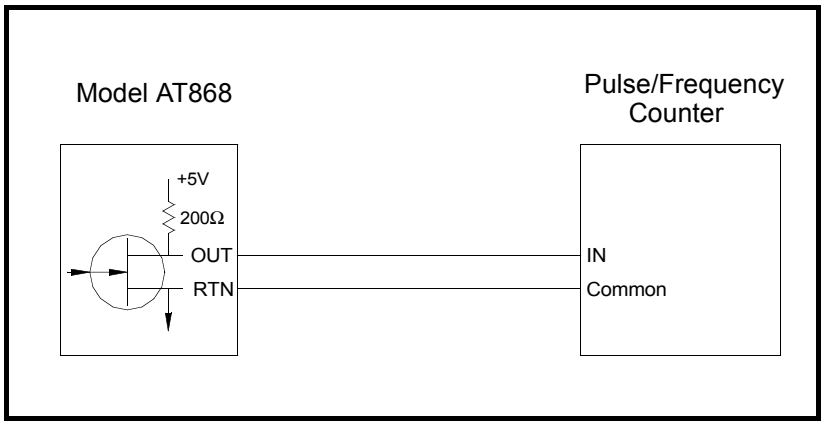


Figure 1-1: Totalizer/Frequency Output Wiring

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

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

1. Disconnect the main power to the unit and remove the front cover.
2. Install the required cable clamp in the chosen conduit hole on the bottom of the electronics enclosure.
3. Refer to Figure 1-4 on page 1-14 for the location of the TB3 terminal block and wire the totalizer/frequency output to pins 3 and 4 as shown. Secure the cable clamp.

Note: *Analog outputs 1 and 2 in the wiring diagram correspond to analog outputs A and B in Slot 0 in the AT868 software.*

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

4. If wiring of the unit has been completed, reinstall the front cover of the enclosure and tighten the screws.

Wiring the Serial Port

The Model 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 sub-section for wiring instructions. For more information on serial communications refer to the *EIA-RS Serial Communications* Manual (916-054).

Wiring the RS232 Interface

Use the serial port to connect the Model 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 terminal block TB3 are shown in Table 1-1 below. Refer to Figure 1-4 on page 1-14 and complete the following steps:

1. Disconnect the main power to the unit and remove the front cover.
2. Install the required cable clamp in the chosen conduit hole on the side of the electronics enclosure.
3. Use the information in Table 1-1 below to construct a suitable cable for connecting the Model AT868 to the external device. If desired, an appropriate cable may be purchased from Panametrics.

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

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

Note: *Signal names that imply direction (e.g., transmit and receive) are named from the point of view of the DTE device (the Panametrics meter is usually considered the DTE device). When the RS232 standard is strictly followed, these signals are labels with the same name and pin # on the DC device side as well. Unfortunately, the 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.*

Wiring the RS232 Interface (cont.)

4. Feed the flying leads end of the cable through the conduit hole and wire the leads to TB3 as shown in Figure 1-4 on page 1-14. Connect the other end of the cable to the printer, ANSI terminal or personal computer, and secure the cable clamp.

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

After the wiring has been completed, consult the *User's Manual* for the external device to configure it for use with the AT868.

Wiring the 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.

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 unit:

- Wiring the Serial Interface Using the INMAC Converter - see below.
- Wiring the Factory-Configured Serial Interface - see the next page.

Wiring the Serial Interface Using the INMAC Converter

To wire the RS485 serial port, refer to Figure 1-4 on page 1-14 and complete the following steps:

1. Disconnect the main power to the unit and remove the front cover.
2. Install the required cable clamp in the chosen conduit hole on the bottom of the electronics enclosure.
3. Feed one end of the cable through the conduit hole, wire the leads to TB3 as shown in Figure 1-4 on page 1-14 and secure the cable clamp. Connect the other end of the cable to the converter, as shown in Figure 1-2 on the following page.

Wiring the RS485 Interface (cont.)

Wiring the Serial Interface Using the INMAC Converter (cont.)

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

4. If wiring of the unit has been completed, reinstall the front cover on the enclosure and tighten the screws.

Proceed to the next section to continue the initial wiring of the unit.

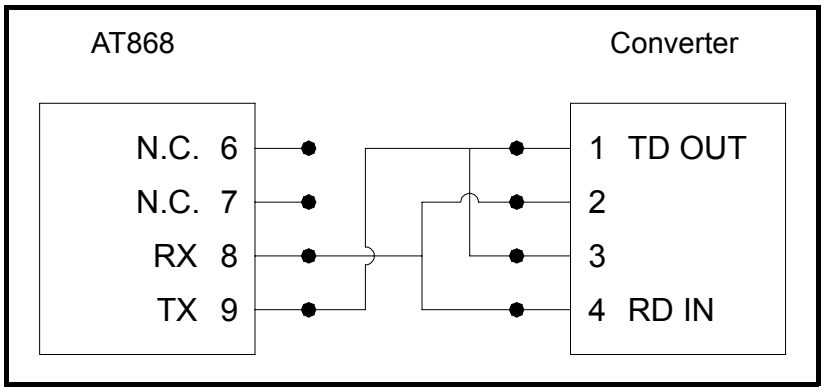


Figure 1-2: Typical RS485 Connections

Wiring the Factory-Configured Serial Interface

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

1. Disconnect the main power to the unit and remove the front cover.
2. Install the required cable clamp in the chosen conduit hole on the bottom of the electronics enclosure.
3. Feed the wires through the conduit hole and wire lead TMT+ to pin 8 on TB3 (refer to Figure 1-4 on page 1-14 for TB3 location).
4. Wire lead TMT- to pin 9 on TB3 and secure the cable clamp.
5. Connect the other end of the cable to the control system.

What's Next?

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

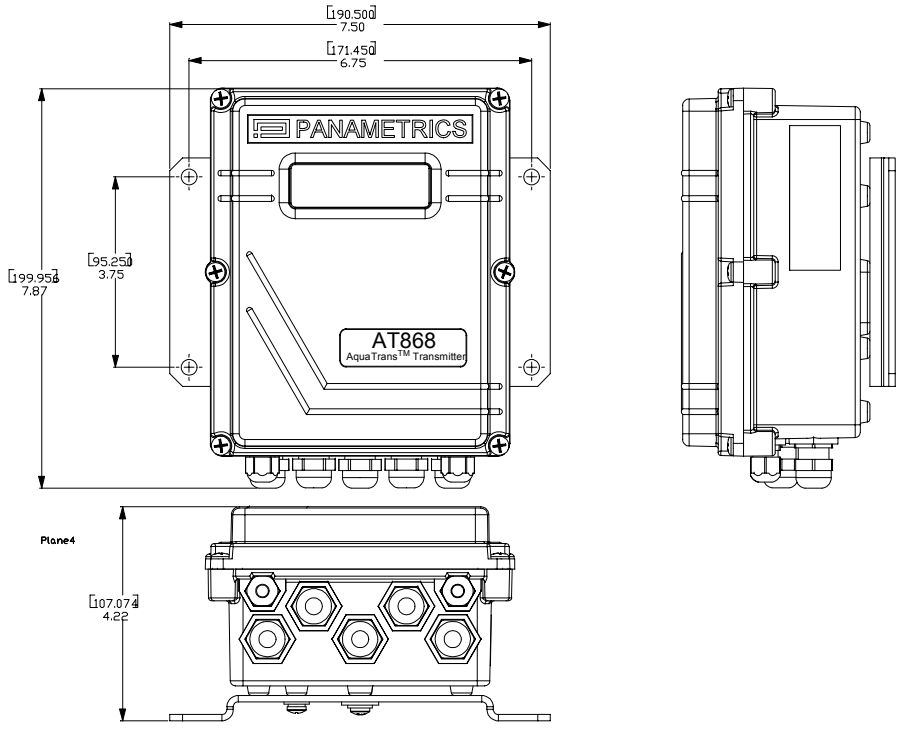
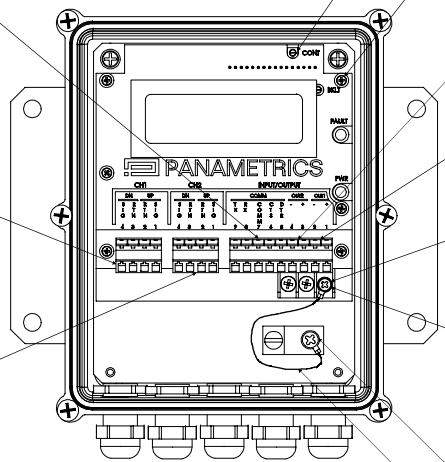


Figure 1-3: Model AT868 Outline Drawing #712-1106

NOTE: For compliance with the European Union's Low Voltage Directive (73/23/EEC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible and located within 1.8 m (6 ft) of the Model AT868.



Contrast Adjustment

Backlight Adjustment

TB3 - RS232/RS485 SERIAL PORT		
Pin No.	Color*	Description
9 TX	Red	Transmit
8 RX	Black	Receive
7 COM	Green	Ground
6 CTS	Yellow	Clear To Send
5 DTR	White	Data Terminal Ready

*For standard Panametrics cables 704-659, 660, 661 and 662.

TB3 - TOTALIZER OUTPUTS	
Pin No.	Description
4 OUT2-	Output 2 - RTN(-)
3 OUT2+	Output 2 - SIG(+)

TB3 - 0/4-20 mA ANALOG OUTPUTS	
Pin No.	Description
2 OUT1-	Output 1 - RTN(-)
1 OUT1+	Output 1 - SIG(+)

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

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

AC POWER INPUT	
Pin #	Description
LINE	Line Power
NEUT	Line Neutral
GND	Earth Ground

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

Protective Conductor Terminal

Grounding Jumper

Figure 1-4: Model AT868 Wiring Diagram #702-425

Chapter 2

Programming Site Data

Introduction

The Model AT868 flow transmitter has a *User Program* that provides access to the various programmable features of the unit. To program the AT868 you must use Instrument Data Manager (IDM), a PC-based, non-resident software program that communicates with the AT868 via its serial port.

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

Step-by-step programming instructions are presented in this chapter. Refer to the appropriate section for a discussion of the following *SITE EDIT MENU* features:

- *Channelx-Status* - activate one or both channels/paths.

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

- *Channelx-System* - select volumetric, totalizer and mass flow units and other parameters.
- *Channelx-Pipe Parameters* - enter the pipe geometry and other parameters.
- *Channelx-Input/Output* - set up the analog and totalizer outputs.
- *Channelx-Setup* - set the signal limits, response times and activating mass flow.
- *Global-System* - select system units (English and metrics).
- *Global-Input/Output* - set up error handling, outputs and display.
- *Global-Comm Port* - set the serial port parameters.

Note: *The "x" in* Channelx *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), enter channel/path and global system data, and pipe parameters. The *What's Next?* sections at the end of each menu will help you in programming required (quick startup) and optional data.

Also, as a programming aid, a complete set of menu maps for the *SITE EDIT MENU* are included in Appendix A, *Menu Maps*. The specific figure numbers will be referenced throughout this chapter, as required.

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

Activating a Channel/ Path

The *STATUS* 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 A-1 on page A-1 of Appendix A, *Menu Maps*. Remember to record all programmed data in Appendix C, Data Records.

To access the *Status* submenu:

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Channelx*.
3. Select *Status*.
4. Select *Transit* to activate the channel/path and press Next Item/ Enter. If you have a 2-channel/path unit, you can also disable a channel/path. If you select *Disabled* you will not be able to program that channel/path.

What's Next?

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

- To continue entering "quick startup" data, press Exit Page 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 Exit Page twice.

Entering System Data for a Channel/Path

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

While following the programming instructions, refer to Figure A-1 on page A-1 of Appendix A, *Menu Maps*. Remember to record all programmed data in Appendix C, *Data Records*.

Accessing the Channelx-System submenu

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Channelx*.
3. Select *System*.
4. Key in the desired CHANNEL LABEL (up to 5 characters) and press Next Item/Enter.
5. Key in the desired SITE MESSAGE (up to 21 characters) and press Next Item/Enter. (For a 2-channel/path meter, this prompt is called CHANNEL MESSAGE.)

Selecting the Volumetric Units

1. Use the pull-down menu to select the desired volumetric units for the flow rate display and press Next Item/Enter.
2. Use the pull-down menu to select the desired number of digits to the right of the decimal point in the volumetric flow rate display and press Next Item/Enter.

Selecting the Totalizer Units

1. Use the pull-down menu to select the desired units for the totalized flow rate display and press Next Item/Enter.
2. Use the pull-down menu to select the desired number of digits to the right of the decimal point in the totalized flow rate display and press Next Item/Enter.
3. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting the Mass Flow Units* below.
   - If MASS FLOW is OFF, the meter returns to the Channel PROGRAM window. Proceed to *What's Next?* on the following page.

Note: *To activate mass flow, refer to page 2-17.*

Entering System Data for a Channel/Path (cont.)

Selecting the Mass Flow Units

1. Use the pull-down menu to select the desired mass flow units for the flow rate display and press Next Item/Enter. The available units for this prompt are determined by the selection made at SYSTEM UNITS.
2. Use the pull-down menu to select the desired time units for the mass flow rate display and press Next Item/Enter.
3. Use the pull-down menu to select the desired number of digits to the right of the decimal point in the mass flow rate display and press Next Item/Enter.
4. Use the pull-down menu to select the desired units for the totalized mass flow rate display and press Next Item/Enter. The available units for this prompt are determined by the selection made at SYSTEM UNITS.
5. Use the pull-down menu to select the desired number of digits to the right of the decimal point in the totalized mass flow rate display and press Next Item/Enter.

What's Next?

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

- To continue entering "quick startup" data, press Exit Page 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 Exit Page twice.

Entering Transducer and Pipe Parameters

Enter the transducer and pipe parameters via the Pipe Parameters submenu. While following the programming instructions, refer to Figure A-1 on page A-1 of Appendix A, *Menu Maps*. Remember to record all programmed data in Appendix C, Data Records.

Access the Pipe Parameter submenu

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Channelx*.
3. Select *Pipe Parameters*.
4. For a standard transducer, enter the number engraved on the transducer head, then use the pull-down menu to select Standard and press Next Item/Enter.

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

5. Go to one of the following sections:
   - Special transducers - proceed to *Special Transducers* below.
   - Standard clamp-on transducers - proceed to *Pipe Material* on page 2-6.
   - Standard wetted transducers - proceed to *Pipe Outside Diameter* on page 2-7.

Special Transducers

1. Assign a number between 90 and 99 to the special transducer and press Next Item/Enter.
2. Use the pull-down menu to select the wedge type (supplied by Panametrics) and press Assign a number between 90 and 99 to the special transducer and press Next Item/Enter.
3. Use the pull-down menu to select the transducer frequency (supplied by Panametrics) and press Assign a number between 90 and 99 to the special transducer and press Next Item/Enter.

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

4. Enter the special transducer time delay value (supplied by Panametrics) and press Assign a number between 90 and 99 to the special transducer and press Next Item/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.

Special Clamp-On Transducers

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

1. Enter the wedge angle (supplied by Panametrics) of the transducer and press Next Item/Enter.
2. Enter the wedge sound speed (supplied by Panametrics) of the transducer and press Next Item/Enter.
3. Proceed to *Pipe Material* below.

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

Pipe Material

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

1. Use the pull-down menu to select the pipe material and press Next Item/Enter. Some of the pipe materials above require additional selections. See a complete list of choices in Table 2-1 below.

Table 2-1: 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 and press Next Item/Enter. If the sound speed is unknown, refer to the *Sound Speeds and Pipe Size Data* manual (914-004).

Pipe Outside Diameter

The programming sequence should be rejoined here for all transducers.

1. Enter the known pipe outside diameter or circumferences, then use the pull-down menu to select the units. Press Next Item/Enter.

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

2. Enter the know thickness of the pipe wall and press Next Item/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 *Sound Speeds and Pipe Size Data* manual (914-004).

3. Do one of the following:

   - All wetted transducers - proceed to *Path and Axial Length* below.
   - All clamp-on transducers - proceed to *Lining* on the next page.

Path and Axial Length

1. Enter the path length of the ultrasonic signal.

2. Select the desired units and press Next Item/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 Next Item/Enter.

4. Select the desired units and press Next Item/Enter.

5. Proceed to *Tracking Windows and Fluid Type* on the next page.

Lining

1. Use the pull-down menu to select whether the pipe has a lining and press Next Item/Enter.
2. Do one of the following:
   - If you selected *No*, proceed to *Tracking Windows and Fluid Type* below.
   - If you selected *Yes*, proceed to the next step.
3. Use the pull-down menu to select the lining material and press Next Item/Enter.
4. If you selected *OTHER*, enter the lining sound speed, press Next Item/Enter; then enter the lining thickness and press Next Item/Enter.

Tracking Windows and Fluid Type

1. At *TRACKING WINDOWS* select *Yes* or *No*.
2. The selections for fluid type vary depending on whether the Tracking Window is enabled or disabled. Use the pull-down menu to select the desired fluid and press Next Item/Enter. Refer to Table 2-2 below for a list of available fluids.

Table 2-2: Fluid Types

Tracking Windows =	
NO	**YES**
Methanol (25C)	Water, 0-100C
Ethanol (25C)	Water, 0-260C
LN2	Oil, Tracking
Freon	OTHER
OTHER	

3. If you selected OTHER, enter the additional information as prompted and press Next Item/Enter.

Reynolds Correction

1. Use the pull-down menu to select whether to activate or deactivate the Reynolds Correction Factor and press Next Item/Enter.
2. Do one of the following:
   - If you selected *Off*, enter the Calibration Factor and press Next Item/Enter. Then, proceed to one of the following sections:
     - For Clamp-on Transducers - proceed to *Number of Traverses and Transducer Spacing* on the next page.
     - For Wetted Transducers - IDM returns to the Channel PROGRAM window. At this point, you can proceed programming in this submenu as desired. To leave the Channel PROGRAM window, press EXIT PAGE. To complete setting up the meter, you must enter data in the Global System submenu as described on page 2-19.
   - If you selected *Active*, proceed to KV Input Selection below.

KV Input Selection

1. Use the pull-down menu to enter a static kinematic viscosity or a table of values and press Next Item/Enter.
2. Do one of the following:
   - If you selected *Use KV/SS table*, enter the Calibration Factor and press Next Item/Enter.

   Note: *The values in the KV/SS table can be edited as described in Entering KV/SS Table on page 2-15.*

   - If you selected Enter Static KV, enter the Kinematic Viscosity and press Next Item/Enter. Then enter the Calibration Factor and press Next Item/Enter.
3. Proceed to one of the following sections:
   - For Clamp-on Transducers - proceed to *Number of Traverses and Transducer Spacing* on the next page.
   - For Wetted Transducers - IDM returns to the Channel PROGRAM window. At this point, you can proceed programming in this submenu as desired. To leave the Channel PROGRAM window, press EXIT PAGE. To complete setting up the meter, you must enter data in the Global System submenu as described on page 2-19.

Number of Traverses and Transducer Spacing

1. Use pull-down menu to select the number of traverses and press Next Item/Enter.
2. Enter the value for the transducer spacing and press Next Item/Enter.

What's Next?

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

- To continue entering "quick startup" data, press Exit Page twice and proceed to *Entering Global System Data* on page 2-19.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *User Program*, press Exit Page twice.

Entering the Zero Cutoff Value

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

While programming these parameters, refer to Figure A-1 in Appendix A, *Menu Maps*. Remember to record all programmed data in Appendix C, *Data Records*.

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Channelx*.
3. Select *Input/Output*.
4. Enter a value from 0 to 1 ft/sec (0 to 0.30 m/sec) for the zero cutoff and press Next Item/Enter. The recommended setting is 0.1 ft/sec (0.03 m/sec).

What's Next?

After completing the above steps, IDM 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 Exit Page twice.

Entering Setup Data

The signal limits and response times for the Model AT868 are specified via the SETUP submenu. The following submenus are included in this section:

- Signal - set the parameters related to the transducer signal
- V average - specify the response of the meter to step changes
- Default Setup - initialize all parameters to default values
- Advanced Features - 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 A-3 in Appendix A, *Menu Maps*. Remember to record all programmed data in Appendix C, *Data Records*.

Set Transducer Signal Settings - Signal

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. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *ChannelX*.
3. Select *SET UP*.
4. Select *Signal*.
5. Use Table 2-3 on the next page to enter the desired values. Enter or select a value and press Next Item/Enter.

Set Transducer Signal
Settings - Signal (cont.)

Table 2-3: Transducer Signal Settings

Transducer Signal Parameters	Range	Default Value	Miscellaneous Information
Signal Low Limit	-20 to 100	20	The E1:LOW SIGNAL error message appears when the signal strength falls below the programmed SIGNAL LOW LIMIT value. See Chapter 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	-500 to 500 ft/sec (-150 to 150 m/sec)	-150.0 ft/sec (-46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity is less than the programmed VELOCITY LOW LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Velocity High Limit	-500 to 500 ft/sec (-150 to 150 m/sec)	150.0 ft/sec (46 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity exceeds the programmed VELOCITY HIGH LIMIT value. See Chapter 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.
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.

Set Transducer Signal
Settings - Signal (cont.)

Table 2-3: Transducer Signal Settings (cont.)

Transducer Signal Parameters	Range	Default Value	Miscellaneous Information
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 F Offset	-1000 to 1000 µsec	0 µsec	An offset between the upstream and downstream transit times is specified at this prompt.
% of Peak	-100 to 100%	50%	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 will automatically adjust 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	Low	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, 6, 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.

Set Transducer Signal Settings - Signal (cont.)

What's Next?

After completing the above steps, IDM returns to the Channel 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 Exit Page three times.

Setting Response Time - V averaging

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

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Channelx*.
3. Select *SET UP*.
4. Select *V averaging*.
5. Select the response time from the pull-down menu and press Next Item/Enter. For best results, select Statistics. This increases the response time under steady flow conditions while still allowing a rapid response time under steady flow conditions while still allowing a rapid response to changes in flow rate.

What's Next?

After completing the above steps, IDM returns to the Channel 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 Exit Page three times.

Initializing Setup Parameters - Default Setup

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

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Channelx*.
3. Select *SET UP*.
4. Select *Default Setup*.
5. Select *Yes* or *No*.

What's Next?

After completing the above steps, IDM returns to the Channel 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 Exit Page three times.

Using Advanced Features - Advanced Features

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

- calculate the kinematic viscosity (KV) based on signal strength (SS) - refer to the section below.
- enter a table of K-factors (based on velocity or reynolds number) that compensates for non-linear flow rates - refer to the next page.
- enable mass flow (calculated for static fluid density) - refer to page 2-17.
- select the size of the transducer transmission signal - refer to page 2-18.

Entering KV/SS Table

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. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *ChannelX*.
3. Select *SET UP*.
4. Select *Advanced Features*.
5. Select *Enter KV/SS table*.
6. Enter the number of kinematic viscosity/sound speed pairs (2 to 20) and press Next Item/Enter.
7. Enter the signal strength value (50.0 to 85.0) and press Next Item/Enter. 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.
8. Enter the kinematic viscosity values (0.050 to 500) in descending order and press Next Item/Enter.
9. Repeat Steps 7 and 8 for each pair.

What's Next?

After completing the above steps, IDM returns to the Advanced Features 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 Exit Page four times.

Entering Multiple K Factors

Use this option to enter a table of K-factors. K-factors are used to create a curve for the flow range (based on velocity 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 factors are supplied by Panametrics, without them the K-factor table cannot be edited.*

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Channelx*.
3. Select *SET UP*.
4. Select *Advanced Features*.
5. Select *Multiple K Factors*.
6. Use the pull-down menu to select whether to activate or deactivate multiple K factors and press Next Item/Enter.

Note: *If you select No, proceed to* What's Next? *below.*

7. Use the pull-down menu to select the type of value to customize (velocity or reynolds value) and press Next Item/Enter.
8. Use the pull-down menu to select whether to edit the table and press Next Item/Enter.

Note: *If you select No, proceed to* What's Next? *below.*

9. Enter the number of K factors (2 to 20) in the table and press Next Item/Enter.
10. Enter the velocity/reynolds value for K-factor number "X" and press Next Item/Enter.

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

11. enter the K-factor corresponding to velocity/reynolds number "X" (0.333 to 3.0) and press Next Item/Enter.
12. Repeat Steps 10 and 11 for each pair.

What's Next?

After completing the above steps, IDM returns to the Advanced Features 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 Exit Page four times.

Activating Mass Flow

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

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *ChannelX*.
3. Select *SET UP*.
4. Select *Advanced Features*.
5. Select *Mass flow from static*.
6. Use the pull-down menu to select whether activate or deactivate mass flow (mass flow is calculated from a static density) and press Next Item/Enter.

Note: *If you select NO, proceed to* What's Next? *below.*

7. Enter the fluid density and press Next Item/Enter.

What's Next?

After completing the above steps, IDM returns to the Advanced Features 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 Exit Page four times.

Selecting Transmitter Code Length

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. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Channelx*.
3. Select *SET UP*.
4. Select *Advanced Features*.
5. Select *Code length*.
6. Use the pull-down menu to select the transmitter code length and press Next Item/Enter.

   - *Automatic* - the meter will determine the code length (short or long) automatically based on pipe size and transducer type.
   - *Short Code* - is 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. Short is also a good selection for pipes made of materials which tend to blur the signal pattern, such as Teflon®.
   - *Long Code* - is a series of approximately a dozen that have a distinctive binary pattern which is easily recognizable during auto correlation.

What's Next?

After completing the above steps, IDM returns to the Advanced Features 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 Exit Page four times.

Entering Global System Data

While completing these instructions, refer to the menu maps in Figures A-1 through A-4 in Appendix A, *Menu Maps.* Remember to record all programmed data in Appendix C, *Data Records*.

Use the steps below to enter system information in the *Global* menu.

Accessing the Global-System Units

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Global*.
3. Select *System*.
4. Enter a short message up to 21 characters and press Next Item/ Enter.

Selecting System Units

1. Use the pull-down menu to select the system units and press Next Item/Enter.

For 1-channel units, IDM returns to the Global PROGRAM window. Proceed to *What's Next?* on the next page. For a 2-channel/path units, proceed with the following steps.

2. Use the pull-down menu to select the volumetric units for the flow rate display and press Next Item/Enter.
3. Use the pull-down menu to select the number of digits to the right of the decimal point in the volumetric flow rate display and press Next Item/Enter.
4. Use the pull-down menu to select the desired units for the totalized flow rate display and press Next Item/Enter.
5. Use the pull-down menu to select the desired number of digits to the right of the decimal point in the totalized flow rate display and press Next Item/Enter.
6. Do one of the following:
   - If MASS FLOW is ON, proceed to *Selecting the Mass Flow Units* on the following page.
   - If MASS FLOW is OFF, the meter returns to the Channel PROGRAM window. Proceed to *What's Next?* on the following page.

Note: *To activate mass flow, refer to page 2-17.*

Entering Global System Data (cont.)

Selecting the Mass Flow Units

1. Use the pull-down menu to select the desired mass flow units for the flow rate display and press Next Item/Enter. The available units for this prompt are determined by the selection made at SYSTEM UNITS.
2. Use the pull-down menu to select the desired time units for the mass flow rate display and press Next Item/Enter.
3. Use the pull-down menu to select the desired number of digits to the right of the decimal point in the mass flow rate display and press Next Item/Enter.
4. Use the pull-down menu to select the desired units for the totalized mass flow rate display and press Next Item/Enter. The available units for this prompt are determined by the selection made at SYSTEM UNITS.
5. Use the pull-down menu to select the desired number of digits to the right of the decimal point in the totalized mass flow rate display and press Next Item/Enter.

What's Next?

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

- You have completed entering "quick startup" data. You can continue programming or exit the user program as described below.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *User Program*, press Exit Page twice.

Setting Up the Inputs and Outputs

Set up the AT868's inputs and outputs via the Input/Output submenu. While following the programming instructions, refer to Figures A-1 and A-4 in Appendix A, *Menu Maps*. Remember to record all programmed data in Appendix C, *Data Records*.

The Input/Output submenu consists of the following:

- Error Handling - program the meter's response during an error condition - see below.
- Options - set up the analog and totalizer outputs - page 2-24.
- Display - set up the optional LCD display (refer to Chapter 3, *Setting Up the Display* on page 3-2).

Selecting Error Handling

This menu option lets you set how the AT868 will handle 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 enter system information in the *Global* menu.

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Global*.
3. Select *Input/Output*.
4. Select *Error Handling*.
5. Use the pull-down menu to select the desired option for error handling and press Next Item/Enter. See Table 2-4 and Table 2-5 on the following page for a description of error handling options available and how the totalizers and display responds to them for a single- and 2-channel/path meter.

Selecting Error Handling (cont.)

Table 2-4: Error Options and Responses for a 1-channel Meter

Option	Output Response	Totalizer Response
Hold Last Value	Holds the last "good" reading.	Holds the last "good" reading and continues to totalize, based on that reading.
Force Low	Forces the outputs to the low set point.	Stops totalizing.
Force High	Forces the outputs to the high set point.	Stops totalizing.
Force High High	Forces the outputs ≈10% above the high set point.	Stops totalizing.

Table 2-5: 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.		

6. Do one of the following:

- For a 1-channel meter, proceed to *What's Next?* on the next page.
- For a 2-channel/path meter, proceed to Step 7 on the next page.

Selecting Error Handling (cont.)

7. Use the pull-down menu to activate or deactivate two-path error handling and press Next Item/Enter. The 2PATH ERROR HANDLING option is intended for applications where two sets of transducers are installed in the same location in the same pipe to improve accuracy and the meter is operated in AVE mode. With this function enabled, the Model 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 2-6 below.

Table 2-6: 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's 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.

What's Next?

After completing the above steps, IDM 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 Exit Page three times.

Setting Up Analog and Totalizer Outputs

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

- Analog Output - refer to section below.
- Totalizer/Frequency Output - refer to the next page.

Analog Output

Accessing Output A

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Global*.
3. Select *Input/Output*.
4. Select *Options*.
5. Use the pull-down menu to select *Output A* and press Next Item/Enter.

Setting Up Output Scale

1. Use the pull-down menu to select the desired output scale and press Next Item/Enter.
2. Do one of the following:
   - If you selected *Off*, IDM returns to the Global Input/Output window. Proceed to *What's Next?* below.
   - 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*, use the pull-down menu to select the desired channel/path and press Next Item/Enter.
4. Use the pull-down menu to select the desired measurement parameter and press Next Item/Enter.

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

5. At Base, enter a flow rate value for the low end of the analog output range and press Next Item/Enter.
6. At Full, enter a flow rate value for the high end of the analog output range and press Next Item/Enter.

What's Next?

After completing the above steps, IDM returns to the Global Input/Output 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 Exit Page three times.

Totalizer/Frequency Output

This output is configured at the factory for frequency or totalizer output. The totalizer output issues one pulse per 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 square wave signal which has a frequency proportional to the assigned measurement parameter, such as flow rate.

Accessing Output B

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Global*.
3. Select *Input/Output*.
4. Select *Options*.
5. Select *Output B* and press Next Item/Enter.
6. If you are configuring a
   - frequency output, proceed to the next section *Setting Up the Frequency Output* below.
   - totalizer output, proceed to *Setting Up the Totalizer Output* on the next page.

Setting Up the Frequency Output

1. At *Output B*, select *Off* or *Frequency* and press Next Item/Enter.
2. Do one of the following:
   - If you selected *Off*, IDM returns to the Global I/O window. Proceed to *What's Next?* on the next page.
   - 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*, use the pull-down menu to select the desired channel/path and press Next Item/Enter.
4. Use the pull-down menu to select the desired measurement parameter and press Next Item/Enter.

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

5. Enter the low measurement level (value that corresponds to 0 Hz) and press Next Item/Enter.
6. Enter the high measurement level (value that corresponds to the maximum frequency and press Next Item/Enter.
7. Enter the maximum frequency and press Next Item/Enter.
8. Proceed to *What's Next?* on the following page.

Totalizer/Frequency Output (cont.)

Setting Up the Totalizer Output

1. At *Output B*, select *Off* or *Totalizer* and press Next Item/Enter.
2. Do one of the following:
   - If you selected *Off*, IDM returns to the Global I/O window. Proceed to *What's Next?* below.
   - 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*, use the pull-down menu to select the desired channel/path and press Next Item/Enter.
4. Use the pull-down menu to select the desired measurement parameter and press Next Item/Enter.

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

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 Next Item/Enter.

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. Enter a value for the number of measurement units represented by each pulse and press Next Item/Enter.
7. Proceed to *What's Next?* below.

What's Next?

After completing the above steps, IDM 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 Exit Page three times.

Configuring the Communications Port

The Model 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, using the *Instrument Data Manager* software, by connecting the meter's serial interface to the serial port of the PC. In addition, the Model AT868 can transmit stored data and displayed readings to a personal computer via this link.

Use the Comm Port submenu to set the communications port. While following the programming instructions, refer to Figure A-2 on page A-2 in Appendix A, *Menu Maps*. Remember to record all programmed data in Appendix C, *Data Records*.

Use the steps below to configure the communications port:

Note: *The default settings for the AT868 are Meter Address = 1 and baud rate = 9600.*

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Global*.
3. Select *Comm Port*.
4. Enter a meter address (between 1 and 254) and press Next Item/ Enter. The default number is 1.

A meter address is only necessary for communication with the Panametrics *Instrument Data Manager* software. See the *IDM User's Manual* for more information.

IMPORTANT: *If the meter address or baud rate is changed, communication with the* Instrument Data Manager *must be re-established with the new address number.*

5. Use the pull-down menu to select a baud rate and press Next Item/Enter.

What's Next?

After completing the above steps, IDM 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 Exit Page twice.

Chapter 3

Displaying Data

Introduction

If the Model AT868 flow transmitter is equipped with an optional Liquid Crystal Display (LCD), it may be programmed to display up to four variables in sequence. To ease viewing, both the brightness and the contrast of the LCD may be adjusted. In addition, the *User Program* offers a command to pause the measurement.

Adjusting LCD Contrast and Brightness

Both the contrast and the brightness of the optional LCD may be adjusted to suit individual needs. The Model AT868 has two adjustment potentiometer located on the LCD circuit board (see Figure 3-1 below). Using these pots for the LCD adjustment, 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) pot fully clockwise yields maximum brightness.
3. In a similar manner, adjust the CONT (contrast) pot 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.

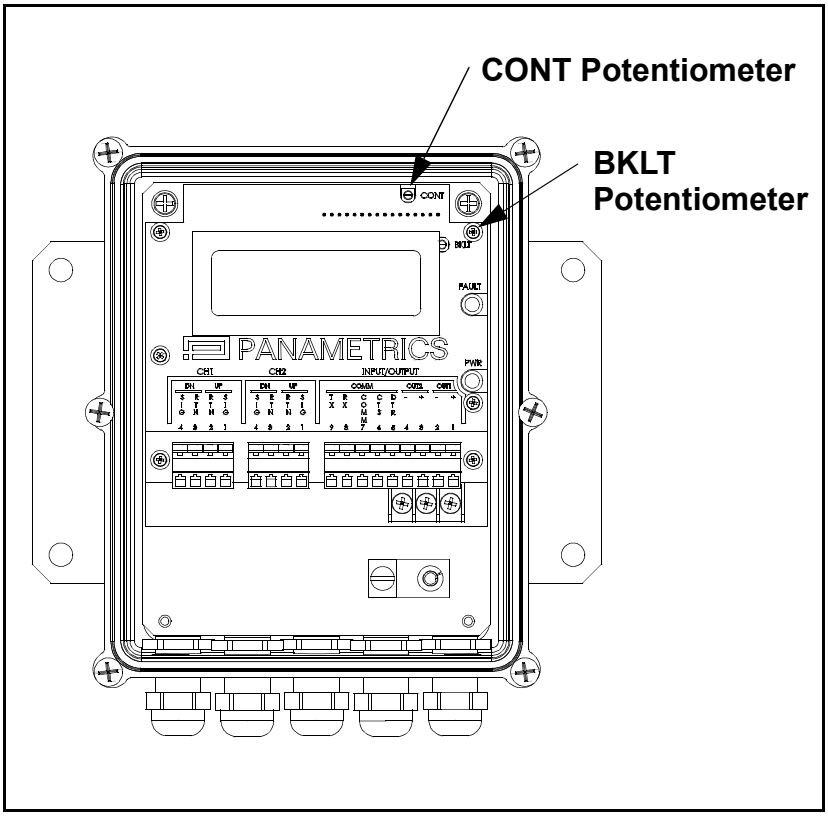


Figure 3-1: Location of CONT and BKLT Potentiometers

Adjusting LCD Contrast and Brightness (count.)

4. Readjust the BKLT control, as desired.
5. Replace the front cover on the AT868, and secure it in place with the set screws.

Setting Up the Display

Use IDM to establish communications with the AT868. Then, complete the following instructions to display the desired data on the LCD (refer to Figure A-2 on page A-2 in Appendix A, *Menu Maps*).

Accessing the Display submenu

1. Open the *SITE EDIT MENU* form the *Edit Functions* menu.
2. Select the Global.
3. Select Input/Output.
4. Select Display.

Configuring the Display

1. At *# of LCD PARAMS*, use the pull-down menu to select the desired number of parameters to be sequentially displayed and press Next Item/Enter.

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

2. Use the pull-down menu to select the desired channel/path option and press Next Item/Enter.
3. At *Measurement Name*, select the desired parameter and press Next Item/Enter.

Note: *The measurement units that appear in these prompts are those selected in the* Global System *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. Proceed to *What's Next?* below.

What's Next?

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

- To perform another programming function, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *User Program*, press Exit Page three 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.

Pausing and Restarting the Measurement

The *User Program* offers a command that enables you to pause and start the measurement display as follows (refer to Figure A-2 on page A-2 in Appendix A, *Menu Maps*.)

Pausing the Measurement Display

1. Open PAUSE MEASUREMENT from the *Edit Functions* menu.
2. Select *Stop Measurement*.
3. To leave the *User Program*, press Exit Page.

Restarting the Measurement Display

1. Open *PAUSE MEASUREMENT* from the *Edit Functions* menu.
2. Select *Measure Flow*.
3. To leave the *User Program*, press Exit Page.

Chapter 4

Calibration

Introduction

Use this menu to calibrate and test the analog and totalizer/frequency outputs. Refer to Figure A-4 on page A-4, in Appendix A, *Menu Maps*, while following the calibration instructions.

Calibrating and Testing the Analog Output

The Model AT868 flowmeter includes one built-in analog output (A) with a resolution of 5.0 µA (0.03% full scale). Both the zero-point and full-scale values for this output must be calibrated. Once it is calibrated, the linearity should be tested.

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

Preparing for Calibration

Prepare for calibration by inserting an ammeter in series with the load on analog output 1 at pins 1 and 2 (OUT1), as shown in Figure 4-1 below. **DO NOT** connect the ammeter directly across the terminals.

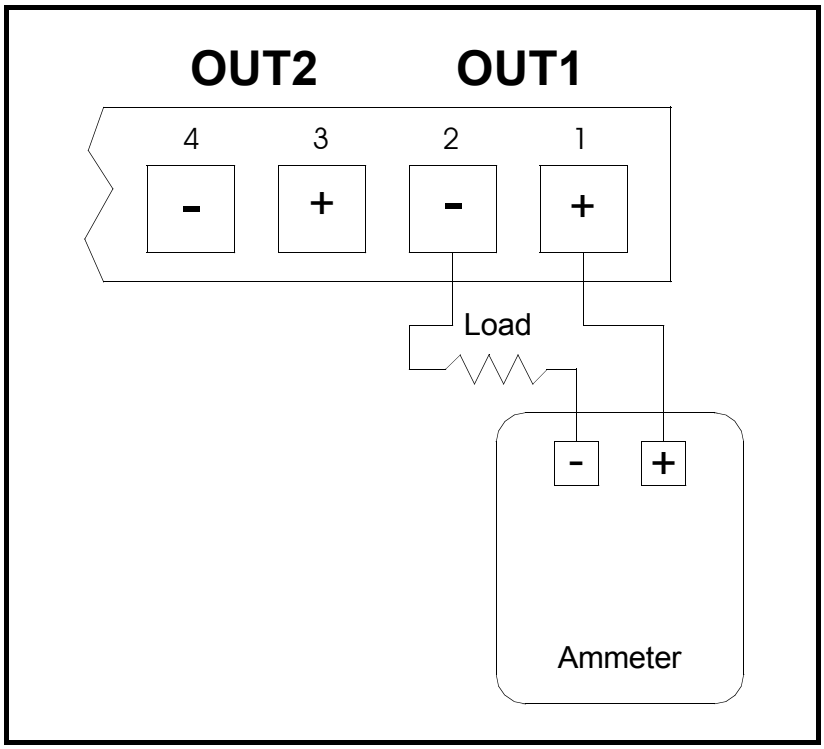


Figure 4-1: Ammeter Connection (Output 1)

Calibrating and Testing the Analog Output (cont.)

Accessing the Calibration Menu

1. Open the *CALIBRATION/TEST* from the *Edit Functions* menu.
2. Select *Calibration*.
3. Select *SLOT0*.
4. Select *Output A*.

Calibrating the Low End of the Analog Output

1. Select *4 mA*.
2. Select the desired option to adjust the 4 mA reading.
3. When the desired reading is achieved, select *STORE*. If the ammeter reading cannot be adjusted with 5.0 µA of the 4 mA setting, select *ABORT* to end calibration and contact the factory for assistance.

Calibrating the High End of the Analog Output

1. Select 20 *mA*.
2. Select the desired option to adjust the 20 mA reading.
3. When the desired reading is achieved, select *STORE*. If the ammeter reading cannot be adjusted with 5.0 µA of the 20 mA setting, select *ABORT* to end calibration and contact the factory for assistance.

What's Next?

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

- Proceed to Step 1 under *Testing Linearity* on the next page.
- To perform another programming function, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *User Program*, press Exit Page three times.

Testing the Output Linearity

Accessing the Calibration Menu

1. Open the *CALIBRATION/TEST* from the *Edit Functions* menu.
2. Select *Calibration*.
3. Select *SLOT0*.
4. Select *Output A*.

Testing Linearity

1. Select *%Test*.
2. Enter 50, press Next Item/Enter, and check the ammeter reading. Table 4-1 below submenu lists the expected ammeter readings at various % Full Scale settings, for both 4-20 mA and 0-20 mA scales. Refer to this table to verify the accuracy of the ammeter readings taken above.

Note: *If the linearity test readings are not with 5mA of the values listed in Table 4-1, check the accuracy and wiring of the ammeter. Then, repeat the low and high end calibrations. If the analog output still does not pass the linearity test, contact the factory for assistance.*

3. Enter a different output (0-100%) and press Next Item/Enter. Check the ammeter reading at this setting and press Next Item/Enter when done.

Table 4-1: Expected Ammeter Readings

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

What's Next?

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

- To perform another programming function, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *User Program*, press Exit Page three times.

Testing the Totalizer/ Frequency Output

Preparing for Calibration

Prepare for the testing procedure by connecting a frequency counter to pins 3 and 4 on the OUT2 terminal block.

Calibrating the Output

1. Open the *CALIBRATION/TEST* from the *Edit Functions* menu.
2. Select *Calibration*.
3. Select *SLOT0*.
4. Select *Output B*.
5. Enter the totalizer frequency (or frequency) and press Next Item/ Enter.

What's Next?

After completing the above steps, IDM returns to the OUTPUTS window. Do one of the following:

- To perform another programming function, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *User Program*, press Exit Page twice.

Chapter 5

Error Codes

Introduction

The Model AT868 ultrasonic flowmeter is a reliable, easy to maintain instrument. When properly installed and operated, as described in *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 Model 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 will appear in the LCD screen.

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

E0: No Error

Problem: No error condition currently exists.

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

Action: No action is required.

E1: Low Signal

Problem: Poor ultrasonic signal strength or the signal exceeds the limits entered via the *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 Signal sub-menu of the *User Program*.

Action: Using the procedures in Chapter 6, *Diagnostics*, check the components listed above. Also, check the value entered into the Setup Signal sub-menu, as described on page 2-11.

E2: Sound Speed Error

Problem: The sound speed exceeds the limits programmed in the Setup Signal sub-menu 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 page 2-11). Refer to Chapter 6, *Diagnostics*, to correct any flowcell and/or transducer problems.

E3: Velocity Range

Problem: The velocity exceeds the limits programmed in the Setup Signal sub-menu 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 Signal sub-menu, as described on page 2-11. Refer to Chapter 6, *Diagnostics*, to correct any flowcell and/or transducer problems.

E4: Signal Quality

Problem: The signal quality is outside the limits programmed in the Setup Signal sub-menu 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 Signal sub-menu. 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.

E5: Amplitude Error

Problem: The signal amplitude exceeds the limits programmed in the Setup Signal sub-menu of the *User Program*.

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

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

E6: Cycle Skip, Accel.

Problem: The acceleration exceeds the limits programmed in the Setup Signal sub-menu 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.

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.

E8: Unassigned

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.

E10: Unassigned

E11: Unassigned

E12: Unassigned

E13: Volumetric Overflow

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

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

Action: Select larger measurement units or a shorter time interval for the current measurement parameter. For example, choose MGAL/M instead of GAL/M in the Channelx System menu (see page 2-3).

Chapter 6

Diagnostics

Introduction

This chapter explains how to troubleshoot the Model 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 (i.e. readings that are not consistent with readings from another flow measuring device connected to the same process).

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

Displaying Diagnostic Parameters

The Model AT868 has built-in *Diagnostic Parameters* to aid in the troubleshooting of flowcell, transducer and/or electrical problems. To access these parameters, use IDM to establish communications with the AT868 and do the following (refer to Figure A-2 on page A-2 in Appendix A, *Menu Maps*):

Accessing the Display submenu

1. Open the *SITE EDIT MENU* from the *Edit Functions* menu.
2. Select *Global*.
3. Select *Input/Output*.
4. Select *Display*.

Configuring the Display

1. At *# of LCD PARAMS*, use the pull-down menu to select the desired number of parameters to be sequentially displayed and press Next Item/Enter.

Note: *If you select LCD OFF, IDM returns to the Global Input/Output window. Proceed to* What's Next? *on the following.*

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

2. Use the pull-down menu to select the desired channel/path option and press Next Item/Enter.

Displaying Diagnostic Parameters (cont.)

3. At *Measurement Name*, select the desired diagnostic parameter (refer to Table 6-1 below for a list of available diagnostic parameters) and press Next Item/Enter.

Note: *The measurement units that appear in these prompts are those selected in the Global System 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. Proceed to *What's Next?* on the following page.

Table 6-1: Available Diagnostic Parameters

Option Bar	Description	Good	Bad
UP Sig Strength	Displays the signal strength for the upstream transducer.	50–75	<50 or >75
DN Sig Strength	Displays the signal strength for the downstream transducer.	50–75	<50 or >75
Soundspeed	Displays the measured speed of sound in the fluid.	N.A.	N.A.
UP Transit	Displays the upstream ultrasonic signal transit time.	N.A.	N.A.
DN Transit	Displays the downstream ultrasonic signal transit time.	N.A.	N.A.
DeltaT	Displays the transit time difference between the upstream and downstream signals.	≤1 µsec	>1 µsec
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 3	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.
UP Signal Q	Displays the signal quality for the upstream transducer.	≥ 1200	–400 to +400
DN Signal Q	Displays the signal quality for the downstream transducer.	≥ 1200	–400 to +400
UP Amp Disc	Displays the value for the signal amplitude of the upstream transducer.	24 ± 5	<19 or >29

Displaying Diagnostic Parameters (cont.)

Table 6-1: Available Diagnostic Parameters (cont.)

Option Bar	Description	Good	Bad
DN Amp Disc	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29
UP +- Peak	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
DN +- Peak	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
UP Norm Factor	Displays the normalization factor for the upstream transducer.	0.85-1.0	<0.85
DN Norm Factor	Displays the normalization factor for the downstream transducer.	0.85-1.0	<0.85
CEE1	Displays the speed of sound in the transducer (clamp-on only).	N.A.	N.A.
SIGMA	Displays the statistical significance of the velocity reading.	near 1.0000	near 0.0000
#ERROR	Displays the number of errors in the last 16 readings.	0	>0

What's Next?

After completing the above steps, IDM returns to the Global Input/Output window. Do one of the following:

- To perform another programming function, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *User Program*, press Exit Page three 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.

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 E-2 in Appendix E, *Service Record*. These initial values can then be compared to current values to help diagnose any future malfunction of the system.

Flowcell Problems

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

- 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.

Fluid Problems

Most fluid-related problems result from a failure to observe the flowmeter system installation instructions, as described in *Installation*. 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:

1. *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 Model 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.
2. *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 proper installation design.
3. *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.

Fluid Problems (cont.)

4. *The fluid sound speed must not vary excessively.*
   The Model AT868 will tolerate relatively large changes in the fluid sound speed, as may be caused by variations in fluid composition and/or temperature. However, such changes must occur slowly. 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.

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:

1. *The collection of material at the transducer location(s).*
   Accumulated debris at the transducer location(s) will interfere with transmission of the ultrasound signals. As a result, accurate flow rate measurements are not possible. Realignment of the flowcell or transducers often cures such problems, and in some cases, transducers that protrude into the flow stream may be used. Refer to Chapter 1, *Installation*, for more details on proper installation practices.

2. *Inaccurate pipe measurements.*
   The accuracy of the flow rate measurements is no better than the accuracy of the programmed pipe dimensions. For a flowcell supplied by Panametrics, the correct data will be included in the documentation. For other flowcells, measure the pipe wall thickness and diameter with the same accuracy desired in the flow rate readings. Also, check the pipe for dents, eccentricity, weld deformity, straightness and other factors that may cause inaccurate readings. Refer to Chapter 2, *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 will be included with the documentation for the system. If the transducers are mounted onto an existing pipe, these dimensions must be precisely measured. See Appendix D, *Measuring P and L Dimensions*, for a thorough discussion of this topic.

Pipe Problems (cont.)

3. *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.

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.

Wetted Transducer Problems

1. **LEAKS:** Leaks may occur around the transducer and/or the flowcell fittings. Repair such leaks immediately. If the leaking fluid is corrosive, carefully check the transducer and cables for damage, after the leak has been repaired.
2. **CORROSION DAMAGE:** If the transducer material was not properly chosen for the intended application, the transducers may suffer corrosion damage. The damage usually occurs either at the electrical connector or on the transducer face. If corrosion is suspected, remove the transducer from the flowcell and carefully inspect the electrical connector and the transducer face for roughness and/or pitting. Any transducer damaged in this manner must be replaced. Contact Panametrics for information on transducers in materials suitable for the application.
3. **INTERNAL DAMAGE:** An ultrasonic transducer consists of a ceramic crystal bonded to the transducer case. The bond between the crystal and the case or the crystal itself may be damaged by extreme mechanical shock and/or temperature extremes. Also, the internal wiring can be corroded or shorted if contaminants enter the transducer housing.

Wetted Transducer Problems (cont.)

4. **PHYSICAL DAMAGE:** Transducers may be physically damaged by dropping them onto a hard surface or striking them against another object. The transducer connector is the most fragile part and is most subject to damage. Minor damage may be repaired by carefully bending the connector back into shape. If the connector can not be repaired, the transducer must be replaced.

IMPORTANT: *Transducers must be replaced in pairs. Refer to Chapter 2,* 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.

Clamp-on Transducer Problems

1. **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.
2. **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).
3. **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.
4. **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.

Clamp-on Transducer Problems (cont.)

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

5. **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.

Contact Panametrics if you cannot solve a transducer-related problem.

Chapter 7

Parts Replacement

Introduction

The Model AT868 has been designed to permit easy on-site upgrades and parts replacement. See Figure 7-1 on page 7-6 for details of the standard AT868 electronics enclosure assembly. 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
- replacing the fuse
- replacing the User Program

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

If the AT868 is installed in a hazardous environment, the electronics enclosure must be moved to a safe area prior to removing the cover.

Note: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the Model AT868.*

Use Figure 7-1 on page 7-6 to locate the relevant components, while completing the service procedures discussed in this chapter.

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

Replacing the LCD Display

An optional LCD display may be included with the Model AT868. The LCD display normally provides years of dependable service, but it is easily field-replaceable when necessary. To replace the LCD display, see Figure 7-1 on page 7-6 for the component locations, and complete the following steps:

1. Disconnect the power to the AT868 and move the electronics enclosure to a flat service.

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

2. Loosen the six set screws on the front cover. Remove the front cover.
3. Remove the four mounting screws on the LCD board assembly. Make sure you remove the falt and lock washers with the screws.
4. Grasp the LCD board assembly by the side edges and carefully pull it straight upward until it comes free from the terminal board.
5. Place the new LCD board assembly over the terminal board and align the connector on the top of the LCD board assembly. Firmly push the two boards together.
6. Secure the LCD board assembly to the terminal board with the four screw, flat washers and lock washers previously removed.

Note: *The display contrast and backlight brightness are adjustable via two potentiometers located on the LCD board assembly. Refer to Chapter 3,* Displaying Data*, for instructions.*

7. Replace the cover and the six set screws.

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

Replacing the Fuse

If it has been determined that the fuse in the AT868 has been blown, complete the following steps (refer to Figure 7-1 on page 7-6) to install a new fuse:

1. Disconnect the power to the AT868 and move the electronics enclosure to a flat service.

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

2. Loosen the six set screws on the front cover. Remove the front cover.
3. Locate the fuse along the left side of the power supply board, just below the terminal board.
4. Pull the plastic cover off the fuse holder and remove the old fuse.
5. Obtain a new fuse of the same rating and type. Use only a type 3AG (1-1/4" x 1/4") Slo-Blo fuse, having a rating as indicated in Table 7-1 below.

Table 7-1: Line Voltages & Fuse Ratings

Line Voltage	Fuse Rating
100-240 VAC	0.25 A, Slo-Blo
12-28 VDC	2.0 A, Slo-Blo

6. Press the new fuse into the fuse holder and reinstall the plastic fuse cover.
7. Be sure to record the fuse replacement in Appendix E, *Service Record*.
8. Replace the cover and secure the six set screws.

Replacing the User Program

The Model AT868's *User Program* is stored on an erasable programmable read only memory (EPROM) chip. The EPROM, which is designated as component U6, is mounted in a socket on the rear of the terminal 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 7-1 on page 7-6 and complete the following steps:

Accessing the EPROM

1. Disconnect the power to the AT868 and move the electronics enclosure to a flat service.

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

2. Loosen the six set screws on the front cover. Remove the front cover.
3. Remove the four mounting screws on the LCD board assembly. Remove the baord by carefully pulling it upwards until it comes free. Make sure you remove the flat and lock washers with the screws.
4. Remove the two screws on the bottom of the terminal board and the two standoffs on the top of the terminal board. Make sure you remove the flat and lock washers with the screws. Grasp the board at the top and bottom edges, and carefully pull it straight upward until is comes free from the power supply board.

Locating the EPROM

1. Flip the board over and locate the U6 EPROM socket. It is the only socketed chip on this board and it has a while 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.

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

Replacing the User Program (cont.)

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.

Assembling the Unit

1. Replace the terminal board. To do this, carefully align the pins along the back of the terminal board with the connectors on the power supply board. Firmly press the terminal board down until all of the connectors are completely seated.
2. Secure the assembly together by installing the two standoffs and two screws previously removed from the terminal board. Make sure you include the flat washer and lock washers for the screws.
3. Replace the LCD board assembly by carefully aligning the pins on the back of the LCD board with the connectors on the terminal board. Firmly press the LCD board assembly down until all of the connectors are completely seated.
4. Secure the boards together by installing the four screws previously removed from the LCD board assembly. Make sure you include the flat washers and lock washers for the screws.
5. Replace the cover and secure the six set screws.

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

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

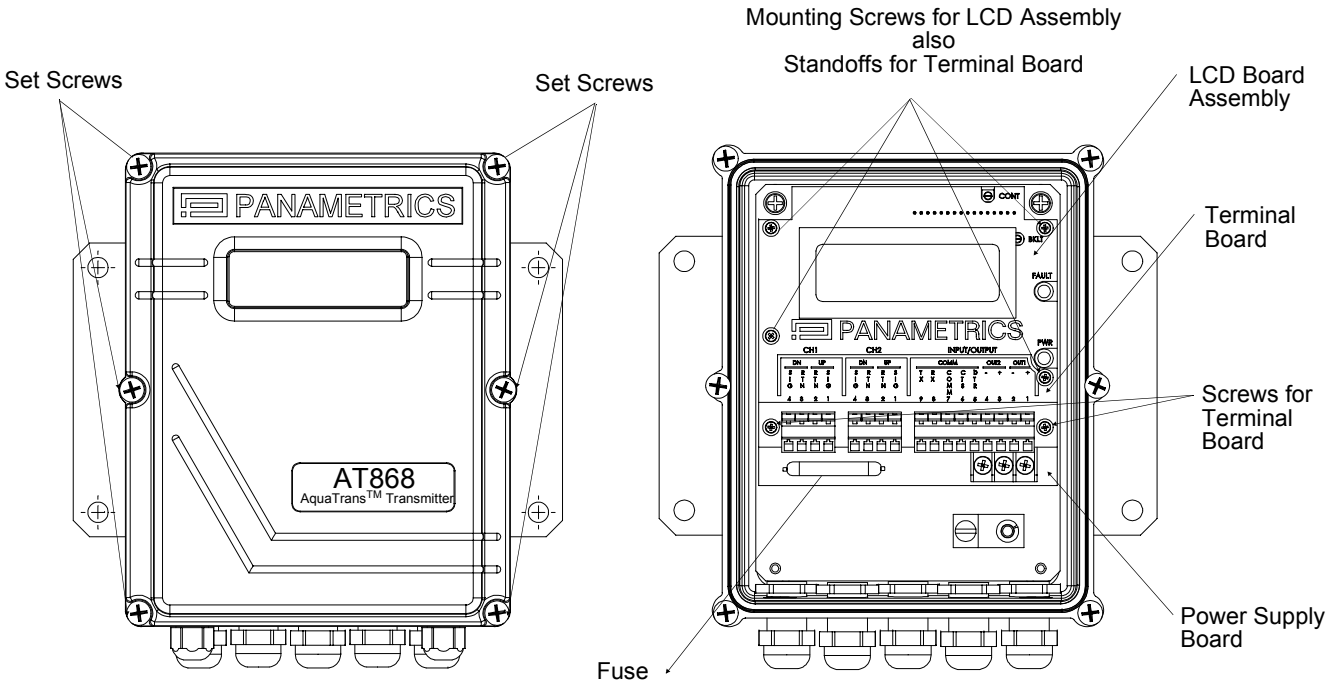


Figure 7-1: Model AT868 Electronics Console Assembly

Chapter 8

Specifications

General Specifications

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

Hardware Configuration

Channel Options

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

Package Options:

Epoxy-coated aluminum NEMA 4X, IP66 Weatherproof.

Dimensions:

2 lb (0.9 kg); 7.25 x 5.9 x 3.5 in. (184 x 150 x 89 mm).

Environmental

Operating Temperature:

-14° to 140°F (–10° to 60°C).

Storage Temperature:

-67° to 167°F (–55° to 75°C).

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.

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.

Range

-40 to 40 ft/s (-12.2 to 12.2. m/s).

Rangeability

400:1.

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 20 diameters upstream and 10 diameters downstream.*

Fluid Types

Acoustically-conductive fluids. This includes most clean liquids and many entrained solids or gas bubbles (the maximum void fraction depends on the transducer, interrogation carrier frequency, path length and pipe configuration). Consult Panametrics for additional information.

Electrical Specifications

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

Power Supply

Options:

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

Power Consumption:

20 W maximum.

Operating Mode

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

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 totalizer/frequency output, optically isolated, 3 A max., 100 VDC max., 1 W max., form 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)

Output Units:

Velocity in ft/s or m/s.

Cable and Length

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

PC Interface Software:

Instrument Data Manager (IDM) software option links the AT868 to a PC computer. Software package includes 3.5-inch diskette, interconnection cable and manual.

Input/Output Specifications (cont.)

Certifications

EMC Directive 89/336/EEC and 73/23/EEC. Low Voltage Directive (Installation Category II, Pollution Degree II). For EN 61000-4-3, product meets Performance Criteria A and, in a limited number of frequencies, Criteria B, per EN 61326.

CE Marking.

1010 CSA/NRTL.

PC Interface Software:

Instrument Data Manager (IDM) software option links the AT868 to a PC computer. Software package includes 3.5-inch diskette, interconnection cable and manual.

Transducer Specifications

Wetted Transducers

Temperature Range

Standard: -40^{o} to 212^{o}F (-40^{o} to 100^{o}C).

Optional (overall range): -310^{o} to 932^{o}F (-190^{o} to 500^{o}C).

Pressure Range

Standard: 0 to 3000 psig (0.1013 to 20 MPa).
Optional: Higher pressures available on request.

Materials

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

Process Connections:

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

Mounting:

Spoolpiece, hot tap or cold tap.

Housing:

Standard: None (splashproof).
Optional: Submersible or weatherproof (NEMA 4, IP65).

Clamp-on Transducers

Temperature Range

Standard: -40^{o} to 140^{o}F (-40^{o} to 60^{o}C).

Optional (overall range): -310^{o} to 572^{o}F (-190^{o} to 300^{o}C).

Mounting:

SS chain or strap, welded or magnetic clamping fixtures.

Housing:

Standard: None (splashproof).
Optional: Submersible or weatherproof (NEMA 4, IP65).

Pipe Size and Materials

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.

Clamp-on Transducers

Materials:

All metals 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).

Appendix A

Menu Maps

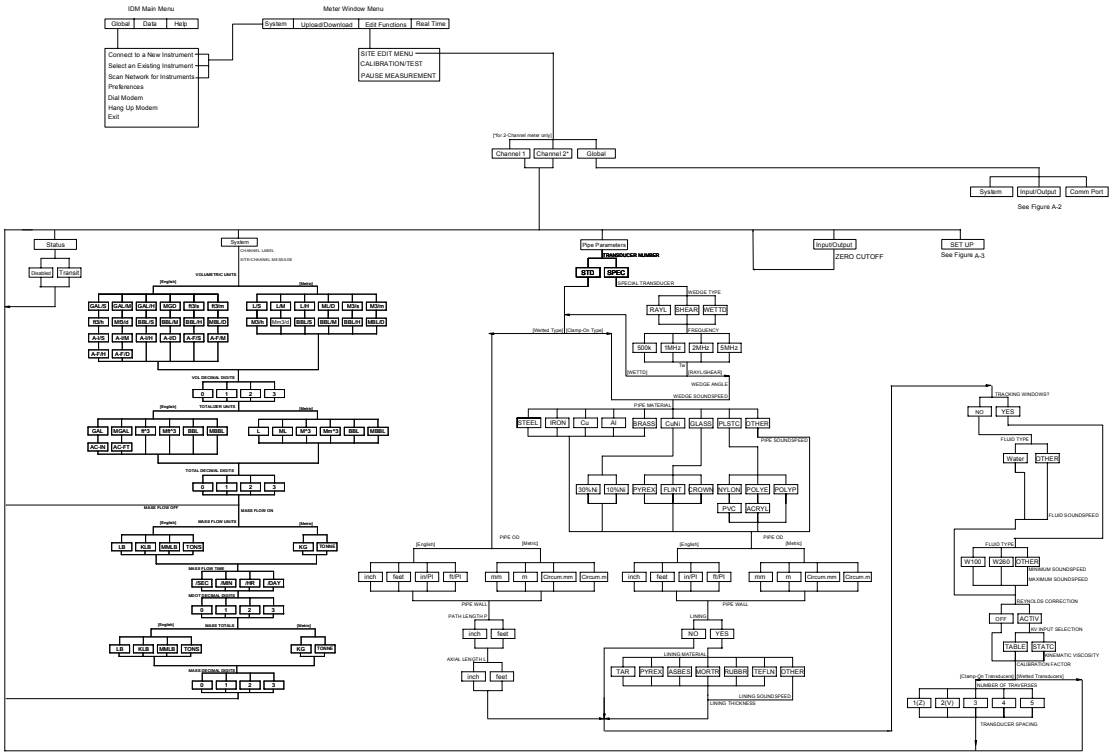


Figure A-1: The Channel Status, System, Pipe Parameters, and Input/Output Menu Map

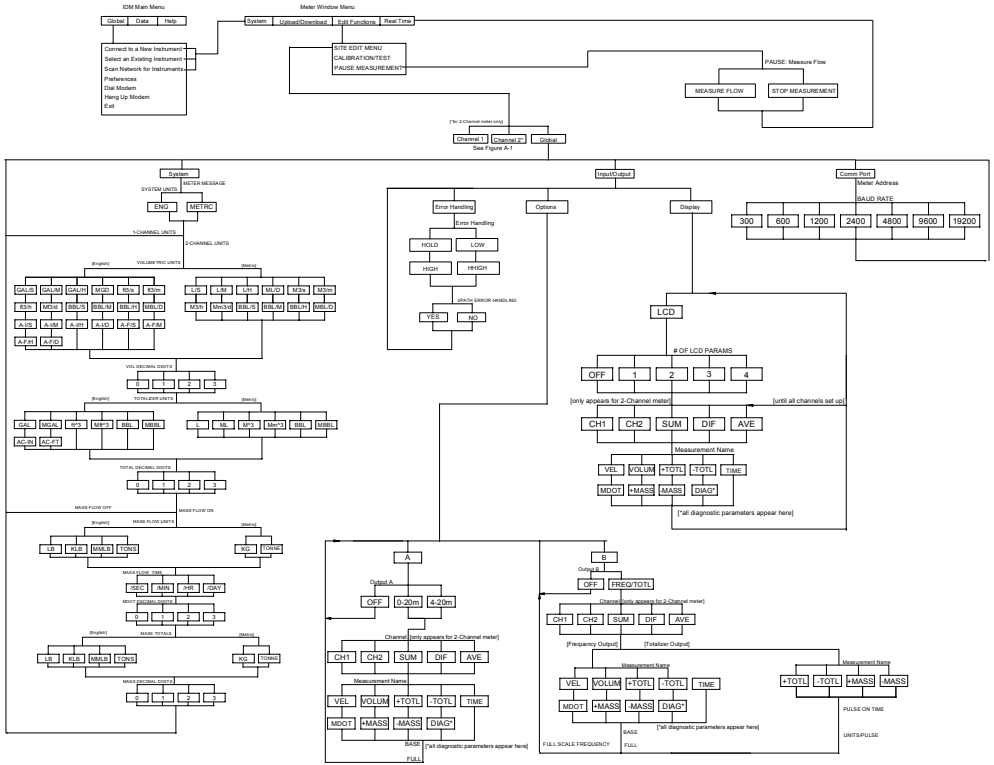


Figure A-2: The Global and Pause Menu Map

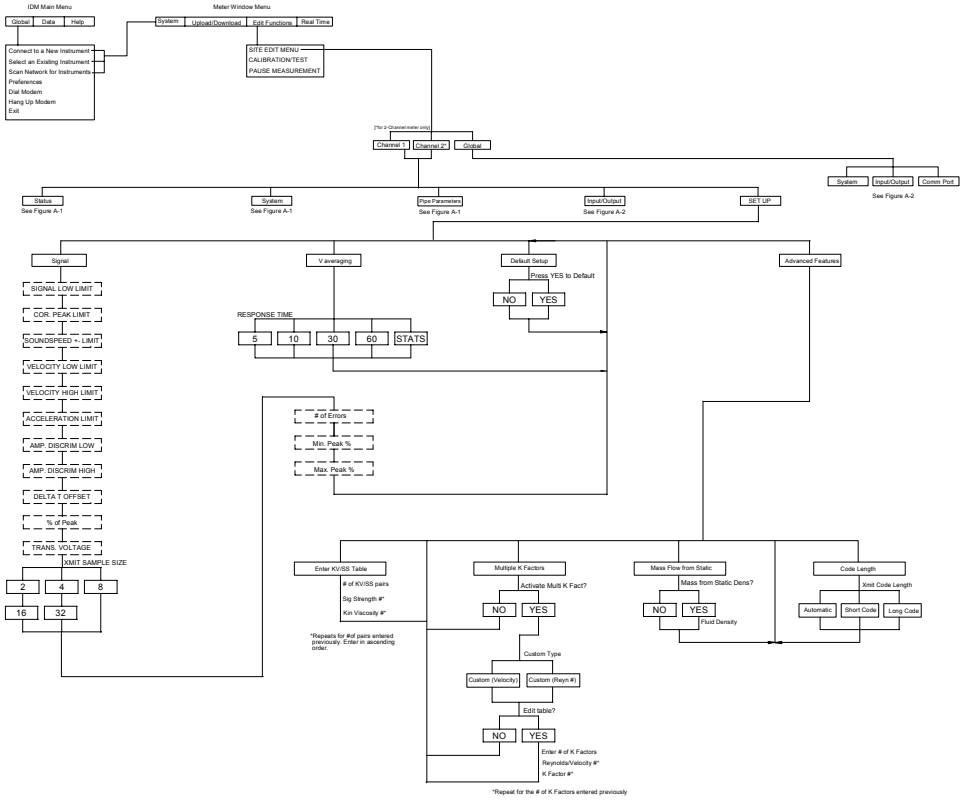


Figure A-3: The Channel SETUP Menu Map

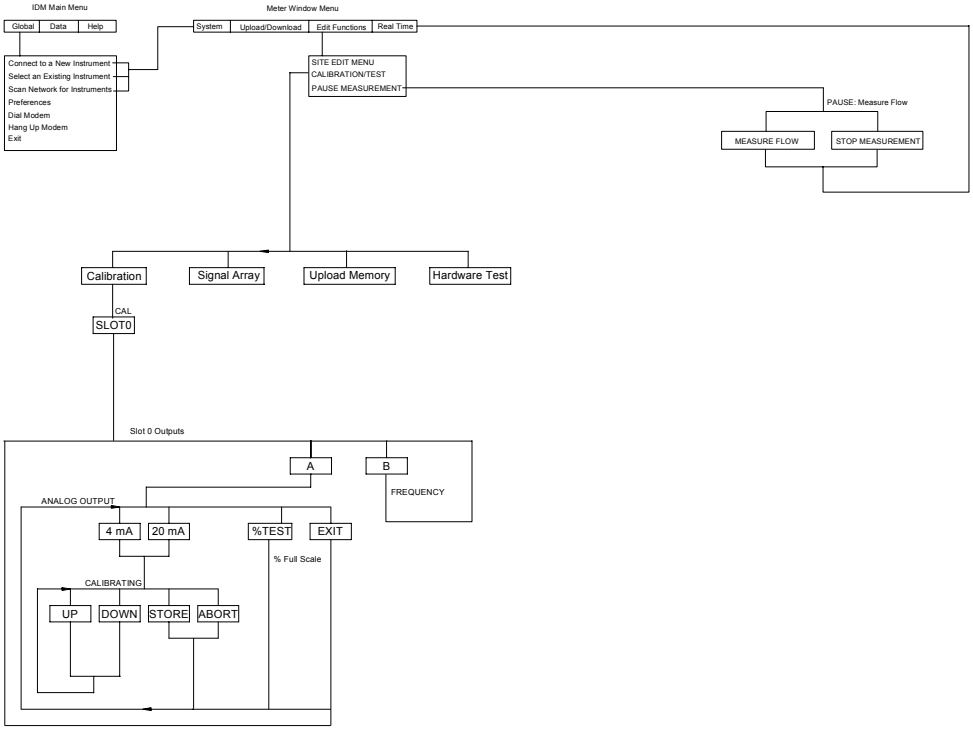


Figure A-4: The Calibration Menu Map

Appendix B

CE Mark Compliance

Introduction

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

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

IMPORTANT: *For EN 61000-4-3, product meets Performance Criteria A and, in a limited number of frequencies, Criteria B, per EN 61326.*

EMC Compliance

For EMC compliance, the electrical connections must be shielded and grounded as in Table B-1 below. Also refer to Figures B-1 and B-2 for illustrations of wiring. 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 89/336/EEC.*

Table B-1: Wiring Modifications

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

LVD Compliance

For compliance with the European Union's Low Voltage Directive (73/23/EEC). the analyzer requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft.) of the Model AT868.

Note: *If the instructions in this appendix are followed, the unit will comply with the Low Voltage Directive (73/23/EEC).*

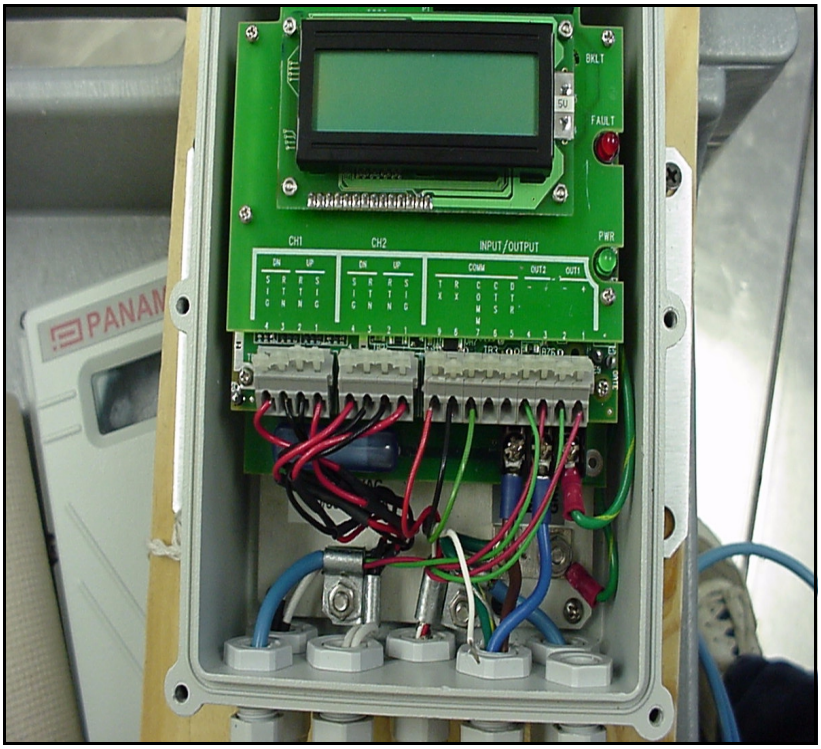


Figure B-1: Example of CE Wired AT868

LVD Compliance (cont.)

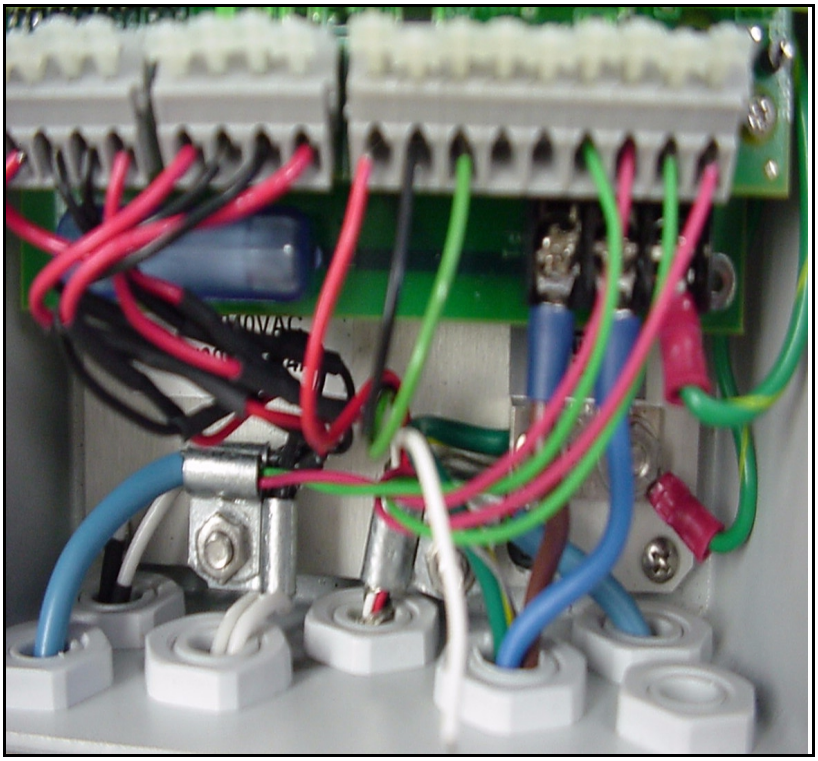


Figure B-2: Enlargement of B-1

Appendix C

Data Records

Site Data

After the Model AT868 flow transmitter has been installed, specific site data must be entered via the *User Program*, prior to operation. Record that information in Table C-1 below.

Table C-1: 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			MOD. Parity		
Baud Rate			MOD. Stop Bits		
MOD. Baud Rate			MOD. Address		
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

Table C-1: Site Data (cont.)

Channelx-Pipe Parameters						
Channel 1				Channel 2 (if applicable)		
Trans. Type	STD	SPEC		Trans. Type	STD	SPEC
Transducer #				Transducer #		
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 C-1: Site Data (cont.)

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		

Table C-1: Site Data (cont.)

Channelx-SETUP-Advanced Features-Enter KV/SS Table (cont.)					
KV/SS Pairs			**KV/SS Pairs**		
#	Sig. Stren.	Kin. Visc.	#	Sig. Stren.	Kin. Visc.
19			19		
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
Static Density			Static Density		
Channelx-SETUP-Advanced Features-Code Length					
Code Length	Auto Short Long		Code Length	Auto Short Long	

Appendix D

Measuring P and L Dimensions

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 D-1, if possible. If not, consult the factory.

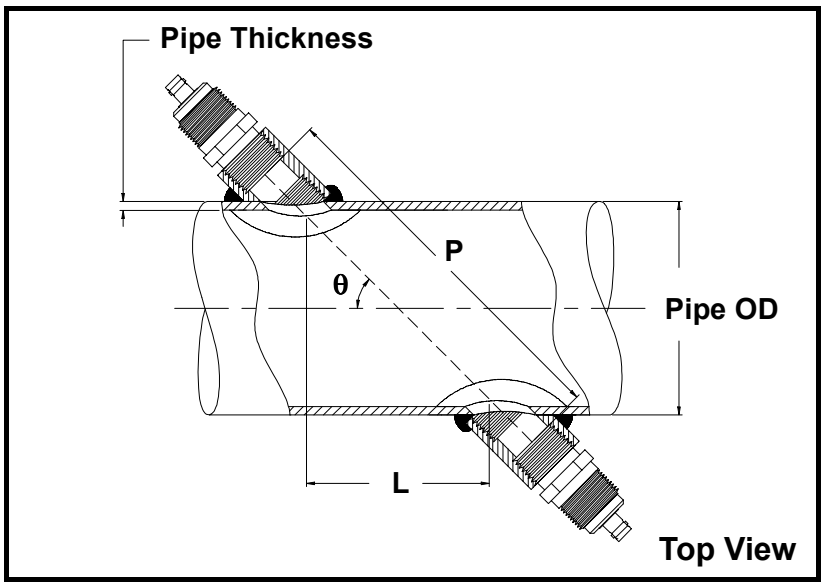


Figure D-1: 180^{O} Transducer Installations

To determine P, you need the following:

- the pipe inside diameter (ID)
- the wall thickness (WT)
- the installed pipe coupling length (CL)
- the transducers face depth (FD)
- the mounting angle (MA)

Measuring P and L (cont.)

Use Figure D-2 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.

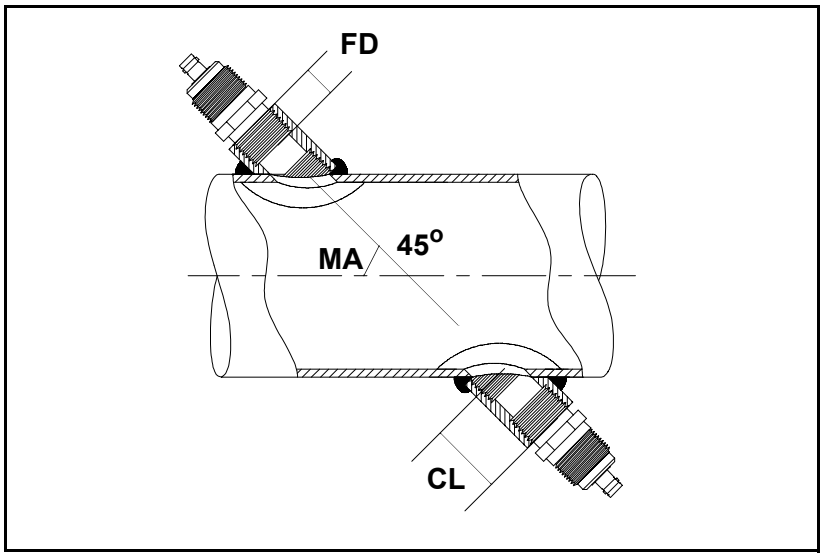


Figure D-2: Determining the Pipe Coupling Length

Use the following formula to determine P dimension:

[ID + 2(WT)]/(cos MA) + 2(CL) - FD) = P Dimension.

For example, given the following:

- inside diameter (ID) = 48”
- wall thickness (WT) = 3/8”
- installed coupling length (CL) = 2.0”
- a transducer face depth (FD) = 1.75”
- mounting angle (MA) - 45°

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

Appendix E

Service Record

Introduction

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

Data Entry

Record complete and detailed service data for the Model AT868 in Table E-1 below. Make additional copies of the table as needed.

Table E-1: Service Record

Date	Description of Service	Performed By

Table E-1: Service Record (cont.)

Date	Description of Service	Performed By

Diagnostic Parameters

After a successful initial installation of the Model AT868 and whenever any system malfunction is noticed, the values for the diagnostic parameters should be entered in Table E-2 below.

Table E-2: Diagnostic 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 #		
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

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DECLARATION OF CONFORMITY

PANAMETRICS

We,

Panametrics Limited
Shannon Industrial Estate
Shannon, Co. Clare
Ireland

declare under our sole responsibility that the

AT868 AquaTrans™ Ultrasonic Flow Transmitter

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

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

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

Shannon - August 1, 2001

Mr. James Gibson
GENERAL MANAGER

CE

I.S. EN ISO 9002
Shannon

TÜV
TÜV ESSEN
ISO 9001

DECLARATION DE CONFORMITE

PANAMETRICS

Nous,

Panametrics Limited
Shannon Industrial Estate
Shannon, Co. Clare
Ireland

déclarons sous notre propre responsabilité que le

AT868 AquaTrans™ Ultrasonic Flow Transmitter

rélatif á cette déclaration est en conformité avec les documents suivants:

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

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

Shannon - August 1, 2001

Mr. James Gibson
GENERAL MANAGER

CE

I.S. EN ISO 9002
Shannon

TÜV
TÜV ESSEN
ISO 9001

KONFORMITÄTSERKLÄRUNG

PANAMETRICS

Wir,

Panametrics Limited
Shannon Industrial Estate
Shannon, Co. Clare
Ireland

erklären, in alleiniger Verantwortung, daß das Produkt

AT868 AquaTrans™ Ultrasonic Flow Transmitter

folgende Normen erfüllt:

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

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

Shannon - August 1, 2001

Mr. James Gibson
GENERAL MANAGER

CE

I.S. EN ISO 9002
Shannon

TÜV
TÜV ESSEN
ISO 9001

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ISO 9001
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