October 2003

Process Control Instruments

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

User's Manual *910-218C1*

GE Panametrics

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Warranty

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

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

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

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

Return Policy

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

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

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

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

Chapter 1

Installation

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Introduction

To ensure safe and reliable operation of the Model AT868 Flowmeter, the system must be installed and programmed in accordance with the guidelines established by GE 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 a powder-coated aluminum NEMA 4X, IP66 weatherproof. Typically, the enclosure is mounted as close as possible to the transducers. When choosing a site, make sure the location permits easy access to the electronics enclosure for programming, maintenance and service.

Note: *For compliance with the European Union'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 in 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 with downward flow 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, GE 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 GE 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 GE Panametrics *Liquid Transducer Installation Guide (916-055)*.

Mounting the AT868 Electronics Enclosure

The standard Model AT868 electronics package is housed in an power-coated aluminum NEMA 4X, IP66 weatherproof enclosure suitable for indoor or outdoor use. Refer to Figure 1-3 on page 1-15 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 1-16 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 front cover.

Preparing the Unit Before Making Electrical Connections

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

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

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

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

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

Wiring the Line Power

The Model AT868 may be ordered for operation with power inputs of 85-265 VAC or 12-28 VDC. The label on the side of the electronics enclosure lists the 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 1-16 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. Follow the instructions on page 1-4 to prepare the unit before you connect power.
2. Prepare the line power leads by trimming the line and neutral AC power leads (or the positive and negative DC power leads) to a length 0.5 in. (1 cm) shorter than the ground lead. This ensures that the ground lead is the last to detach if the power cable is forcibly disconnected from the meter.
3. Install a suitable cable clamp in the conduit hole where the line power is fed through. If possible, avoid using a conduit hole containing input/output cables for this purpose, to minimize any interference in the circuitry from the AC power line.

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

4. Strip 1/4-in. of insulation from the end of each of the three line power leads.

Wiring the Line Power (cont.)

5. 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 1-16.
6. Leaving a bit of slack, secure the power line with the cable clamp.

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

7. Do one of the following:

   - Proceed to the next section to continue wiring the Model AT868 flow transmitter.
   - Reinstall the plastic shroud, replace the front cover on the enclosure and tighten the screws.

Wiring the Transducers

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

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

1. Follow the instructions on page 1-4 to prepare the unit before you connect power.
2. Locate the CH1 transducer cables and connect them to the two CH1 transducers. Feed the free ends of the cables through the selected conduit hole in the electronics enclosure.
3. If an optional lightening protector is being installed, connect it between the meter and the transducers.
4. Refer to the wiring diagram in Figure 1-4 on page 1-16 and connect the transducer cables to the terminal block labeled DN and UP for Channel 1. Then, secure the cable clamp.

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

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

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

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

6. Do one of the following:
   - Proceed to the next section to continue wiring the Model AT868 flow transmitter.
   - Reinstall the plastic shroud, replace the front cover on the enclosure and tighten the screws.

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

Wiring the Standard 0/4-20 mA Analog Outputs

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

Connections to this output may be made with standard twisted-pair wiring, but the current loop impedance for these circuits must not exceed 600 ohms.

To wire the analog outputs, complete the following steps:

1. Follow the instructions on page 1-4 to prepare the unit before you connect power.
2. Refer to Figure 1-4 on page 1-16 for the locations of the appropriate terminal blocks and wire the analog outputs as shown. Secure the cable clamp.

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

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

3. Do one of the following:
   - Proceed to the next section to continue wiring the Model AT868 flow transmitter.
   - Reinstall the plastic shroud, replace the front cover on the enclosure and tighten the screws.

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

Wiring the Totalizer/ Frequency Output

The Model AT868 also provides a second output per channel (designated as Output B and D) that can be configured as a totalizer or frequency output using the Instrument Data Manager (IDM) software.

Like the analog outputs, these outputs can also be configured independently. Typically, Output B is used for Channel 1 and Output D is used for Channel 2; however, outputs can be configured to measure either channel.

Figure 1-1 below shows a sample wiring diagram of a totalizer and frequency output circuit.

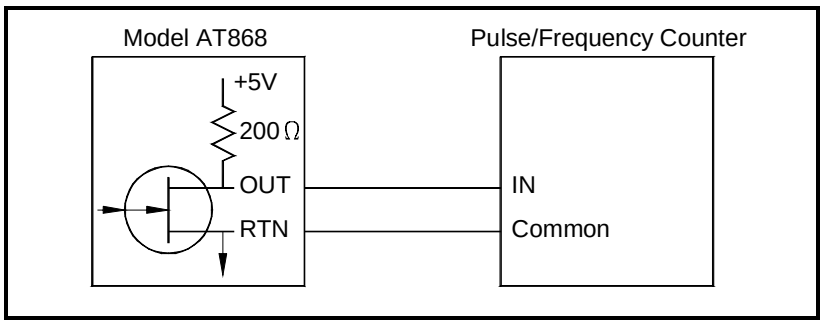


Figure 1-1: Totalizer/Frequency Output Wiring

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

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

1. Follow the instructions on page 1-4 to prepare the unit before you connect power.
2. Refer to Figure 1-4 on page 1-16 for the location of the appropriate terminal blocks and wire the totalizer/frequency outputs as shown. Secure the cable clamp.

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

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

3. Do one of the following:
   - Proceed to the next section to continue wiring the Model AT868 flow transmitter.

- Reinstall the plastic shroud, replace the front cover on 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 the COMMUNICATION terminal block are shown in Table 1-1 below.

1. Follow the instructions on page 1-4 to prepare the unit before you connect power.
2. 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 GE Panametrics.

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

COMMUNICATION TB	Colors for GE Panametrics Cable (flying leads)*	Signal Description	DCE DB25 Pin #	DCE DB9 Pin #	DTE DB25 Pin #	DTE DB9 Pin #
5	White	DTR (Data Terminal Ready)	20	4	20	4
4	Yellow	CTS (Clear to Send)	4	7	5	8
3	Green	COM (Ground)	7	5	7	5
2	Red	RX (Receive)	2	3	3	2
1	Black	TX (Transmit)	3	2	2	3

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

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

side as well. Unfortunately, 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.)

3. Feed the flying leads end of the cable through the conduit hole and wire the leads to the COMMUNICATON terminal block as shown in Figure 1-4 on page 1-16. 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, reinstall the plastic shroud, replace the front cover on the enclosure and tighten the screws. 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 1-16 and complete the following steps:

1. Follow the instructions on page 1-4 to prepare the unit before you connect power.
2. Feed one end of the cable through the conduit hole and wire the leads to the COMMUNICATION terminal block as shown in Figure 1-4 on page 1-16. Secure the cable clamp.
3. 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, replace the plastic shroud, reinstall the front cover on the enclosure and tighten the screws.

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

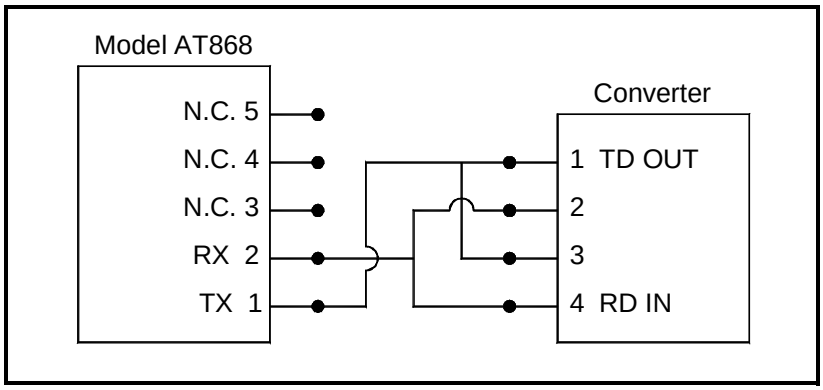


Figure 1-2: Typical RS485 Connections

Wiring the Factory-Configured Serial Interface

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

1. Follow the instructions on page 1-4 to prepare the unit before you connect power.

2. Feed the wires through the conduit hole and wire lead TMT+ to pin 2 (RX) on the COMMUNICATION terminal block (refer to Figure 1-4 on page 1-16 for the terminal block location).

3. Wire lead TMT- to TX pin 1 (TX) on the COMMUNICATION terminal block and secure the cable clamp.

4. Connect the other end of the cable to the control system.

Wiring the External Totalizer Reset Switch

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

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

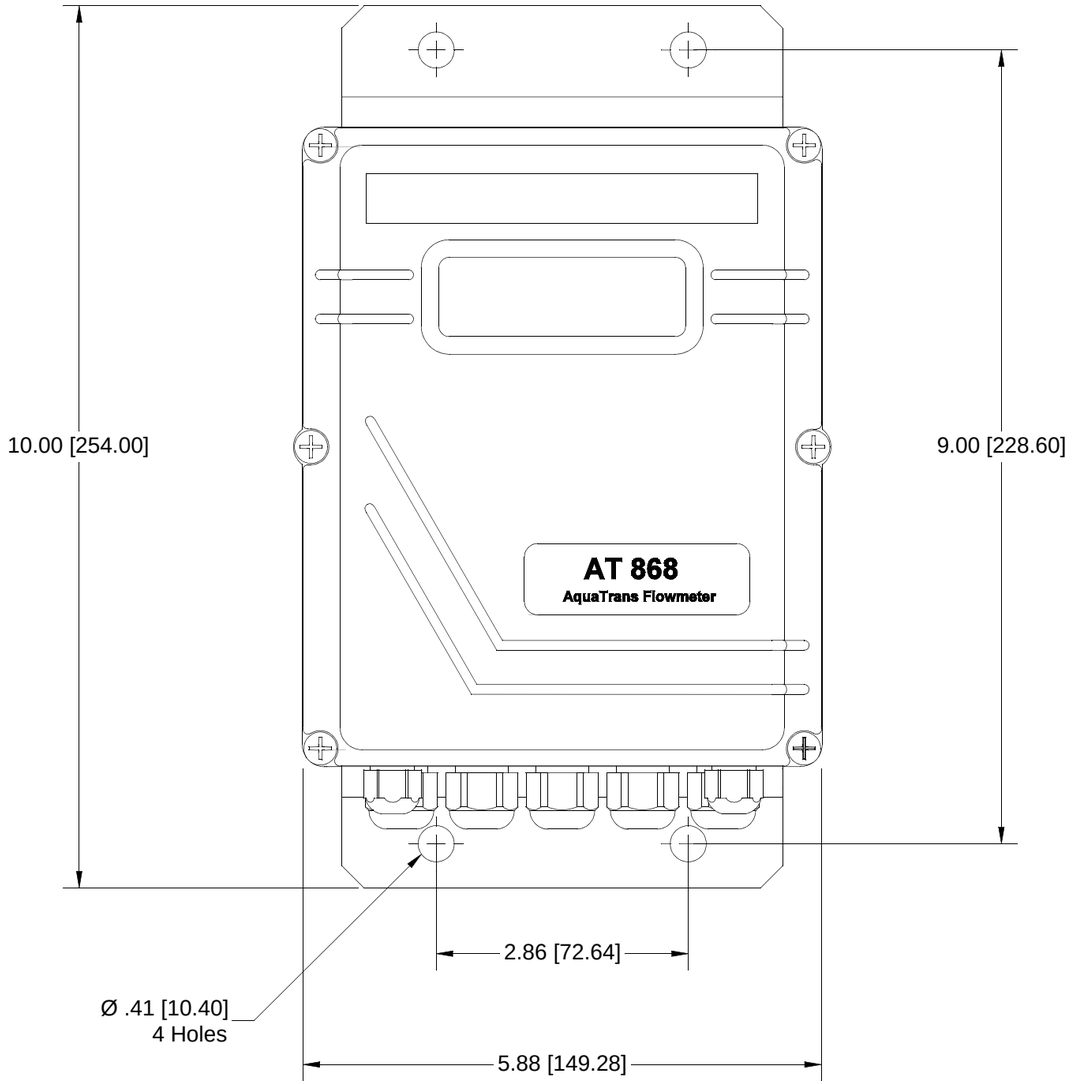
Use the steps below to connect an external reset switch:

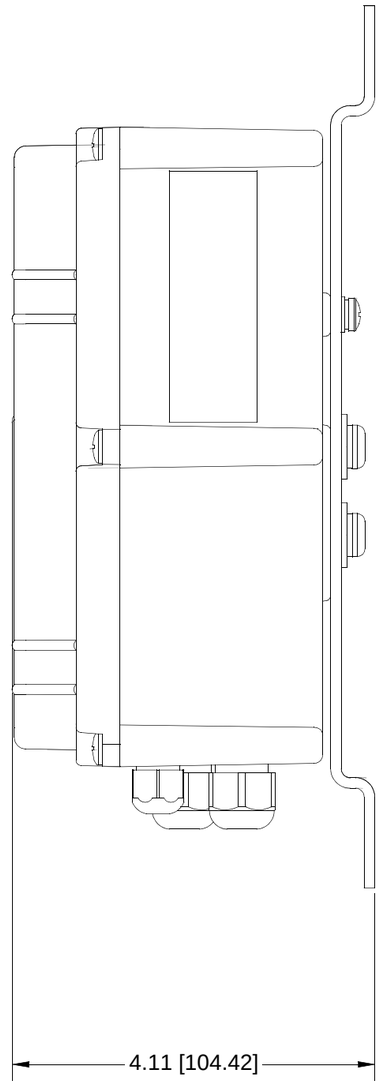
!WARNING!
Always disconnect the line power from the Model AT868 before removing front cover.

1. Follow the instructions on page 1-4 to prepare the unit before you connect power.
2. Use Figure 1-4 on page -16 to properly connect the external switch to the AT868.
3. If wiring of the unit has been completed, replace the plastic shroud, reinstall the front cover on the enclosure and tighten the screws.
4. Before you can used the external switch is must be configured as described on page 2-23.

What's Next?

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





NOTES:
1. ALL DIMENSIONS ARE INCHES [MM]

Figure 1-3: Outline & Installation Drawing - Wall Mount (#712-1106_C, SH 1)

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.

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

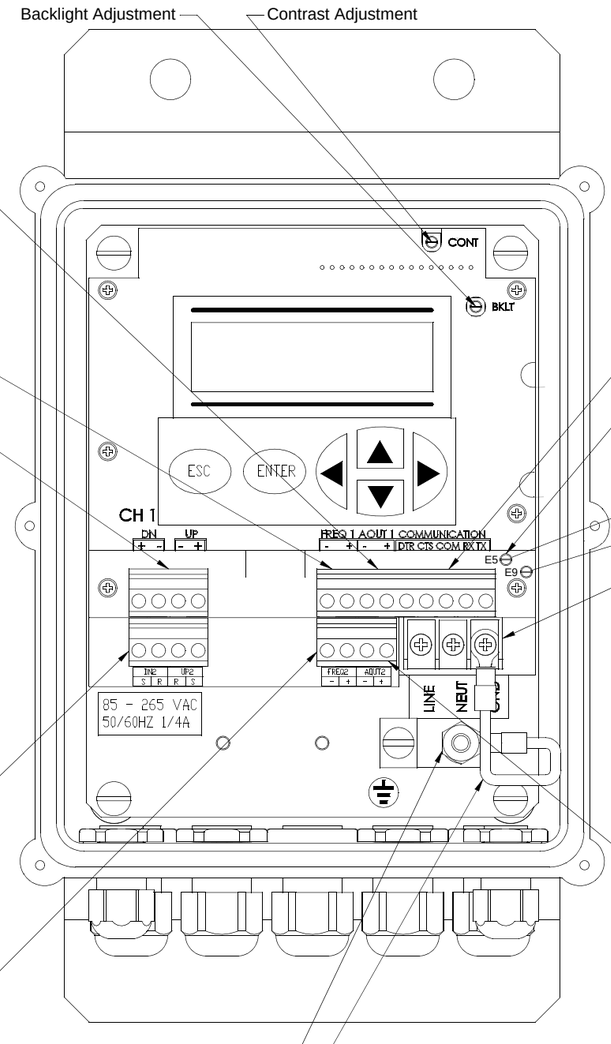
TB3: 0/4-20 mA Analog Outputs	
Pin No.	Description
7 OUT1-	Output 1 RTN (-)
6 OUT1+	Output 1 SIG (+)

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

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

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

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



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

External Totalizer Reset Switch*	
Test Point	Description
E5	Pole 1 of Switch
E9	Pole 2 of Switch
*Switch Hardware is User-Supplied	

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

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

Figure 1-4: Wiring Diagram (#702-425_1)

Chapter 2

Programming Site Data

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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 can use the internal keypad or 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.*

This section describes step-by-step programming instructions using the internal keypad. For more information on programming using IDM, refer to Appendix F, *Menu Maps for IDM*.

Refer to the appropriate section for a discussion of the following PROG features:

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

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

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

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

To get the AT868 up and running as quickly as possible you must, as a minimum, activate the channel/path(s), 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 PROG are included in Appendix A, *Menu Maps*. The specific figure numbers will be referenced throughout this chapter.

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 - CHx-ACTIV

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

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

To access the ACTIV submenu:

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

What's Next?

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

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

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

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

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

Accessing the CHx-SYSTM submenu

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [→] until SYSTM appears and press [ENTER].
5. Use the arrow keys to enter the desired CHANNEL LABEL (up to 5 characters) and press [ENTER].
6. Use the arrow keys to enter the desired SITE MESSAGE (up to 16 characters) and press [ENTER]. (For a 2-channel/path meter, this prompt is called CHANNEL MESSAGE.)

Selecting the Volumetric Units

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

Selecting the Totalizer Units

1. Press [←] and [→] to select the desired units for the totalized flow rate display and press [ENTER].
2. Press [←] and [→] to select the desired number of digits to the right of the decimal point in the totalized flow rate display and press [ENTER].
3. Do one of the following:
   - If MASS FLOW is ON and both channels are active (for 2-channel units only), proceed to *Selecting the Mass Flow Units* on the following page.
   - If MASS FLOW is OFF and/or only one channel is active, 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 2-20.*

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

Selecting the Mass Flow Units

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

What's Next?

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

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

Entering Transducer and Pipe Parameters - CHx-PIPE

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

Access the PIPE submenu

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [→] until PIPE appears and press [ENTER].
5. Do one of the following:
   - Standard transducers, enter the transducer number by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER]. Proceed to the next step.
   - Special transducers, proceed to *Special Transducers* below.

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

6. Go to one of the following sections:
   - Standard clamp-on transducers - proceed to *Pipe Material* on page 2-7.
   - Standard wetted transducers - proceed to *Pipe Outside Diameter* on page 2-8.

Special Transducers

1. For a special transducer, press [→] to move the cursor to STD and press [↑] until SPEC appears and press [ENTER].
2. Assign a number between 90 and 99 to the special transducer. Enter the number by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].
3. Press [←] and [→] to select the wedge type (supplied by GE Panametrics) and press [ENTER].

Special Transducers (cont.)

4. Press [←] and [→] to select the transducer frequency (supplied by GE Panametrics) and press [ENTER].

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

5. Enter the special transducer time delay value (supplied by GE Panametrics) by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

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

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 page 2-8.

1. Enter the wedge angle (supplied by GE Panametrics) of the transducer by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].
2. Enter the wedge sound speed (supplied by GE Panametrics) of the transducer by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER]. Proceed to *Pipe Material* below.

Pipe Material

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

1. Press [←] and [→] to select the pipe material and press [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 by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER]. If the sound speed is unknown, refer to the *Sound Speeds and Pipe Size Data* manual (914-004).

Pipe Outside Diameter

The programming sequence should be rejoined here for all transducers.

1. Press [→] to move the cursor to the outside diameter units and press [↑] and [↓] to select the desired units and press [ENTER].
2. Enter the known pipe outside diameter or circumferences by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

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

Path and Axial Length

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

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

3. Enter the axial length of the ultrasonic signal and press [ENTER].
4. Select the desired units and press [ENTER].
5. Proceed to *Using the Tracking Window* on the next page.

Lining

1. Press [←] and [→] to select whether the pipe has a lining and press [ENTER].
2. Do one of the following:
   - If you selected *No*, proceed to *Tracking Windows and Fluid Type* below.
   - If you selected *Yes*, proceed to the next step.
3. Press [←] and [→] to select the lining material and press [ENTER].
4. If you selected OTHER, enter the lining sound speed by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].
5. Enter the lining thickness by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

Setting Up the Tracking Window

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

1. At the TRACKING WINDOWS prompt select:
   - YES - If you **do not** know the fluid sound speed, proceed to Step 2.
   - NO - If you **do** know the fluid sound speed, proceed to *Fluid Type* on the next page.
2. Do one of the following:
   - If the fluid sound speed varies over a wide range, the Tracking Window must remain active. Proceed to *Fluid Type* on the next page to complete programming your meter.
   - If the sound speed is fairly constant, or you want to determine if the sound speed is constant, proceed to Step 3.
3. Proceed to *Fluid Type* on the next page to complete programming your meter. When you have completed programming, proceed to *Using the Tracking Window on* page 6-4.

Fluid Type

1. The selections for fluid type vary depending on whether the Tracking Window is enabled or disabled. Press [←] and [→] to select the desired fluid and press [ENTER]. Refer to Table 2-2 below for a list of available fluids.

Table 2-2: Fluid Types

Tracking Windows =	
NO	**YES**
WATER	W100 (Water, 0-100C)
OTHER	W260 (Water, 0-260C)
	Oil, Tracking
	OTHER

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

Reynolds Correction

1. Press [←] and [→] to select whether to activate or deactivate the Reynolds Correction Factor and press [ENTER].

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

2. Do one of the following:

- If you selected OFF, enter the Calibration Factor and press [ENTER]. Then, proceed to one of the following sections:
  - For Clamp-on Transducers - proceed to *Number of Traverses and Transducer Spacing* on page 2-12.
  - For Wetted Transducers - The meter 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 [ESC] three times. To complete setting up the meter, you must enter data in the GLOBL-SYSTM submenu as described on page 2-22.
- If you selected ACTIV, proceed to *KV Input Selection* on the next page.

KV Input Selection

1. Press [←] and [→] to enter a static kinematic viscosity or a table of values and press [ENTER].
2. Do one of the following:

   - If you selected Table, enter the Calibration Factor by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

   Note: *The values in the KV/SS table can be edited as described in Entering KV/SS Table on page 2-18.*

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

   Note: *If you select OTHER as the fluid type, you must enter the Kinematic Viscosity. The AT868 will only approximate the Kinematic Viscosity if you select one of the available fluid options other than OTHER (i.e. water, oil, etc.).*

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 - The meter 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 [ESC] three times. To complete setting up the meter, you must enter data in the GLOBL-SYSTM submenu as described on page 2-22.

Number of Traverses and Transducer Spacing

1. Press [←] and [→] to select the number of traverses and press [ENTER].
2. Enter the value for the transducer spacing by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

What's Next?

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

- To continue entering "quick startup" data, press [ESC] once and proceed to Step 3 in *Entering Global System Data* on page 2-22.
- To continue regular programming, refer to Appendix A, *Menu Maps*, to navigate to the desired menu.
- To leave the *User Program*, press [ESC] three times.

Entering the Zero Cutoff Value - CHx-I/O

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

What's Next?

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

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

Entering Setup Data - CHx-SETUP

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

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

While following the programming instructions, refer to Figure A-3 in Appendix A, *Menu Maps*. Remember to record all programmed data in Appendix C, *Data Records*.

Set Transducer Signal Settings - SIGNL

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

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

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [→] until SETUP appears and press [ENTER].
5. Press [→] until SIGNL appears and press [ENTER].
6. Use Table 2-3 on the next page to enter the desired values. Enter or select a value using the arrow keys and press [ENTER].

Set Transducer Signal Settings - SIGNL (cont.)

Table 2-3: Transducer Signal Settings

Transducer Signal Parameters	Range	Default Value	Miscellaneous Information
Signal Low Limit	-20 to 100	40	The E1:LOW SIGNAL error message appears when the signal strength falls below the programmed SIGNAL LOW LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Correlation Peak Limit	0 to 500	100	The E4: SIGNAL QUALITY error message appears when the signal quality falls below the programmed COR. PEAK LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Soundspeed+- Limit	1 to 50%	20%	The E2:SOUNDSPEED error message appears when the calculated fluid sound speed differs from the fluid sound speed entered in the Channelx-System menu by more than the programmed SOUNDSPEED +- LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Velocity Low Limit	-328 to 328 ft/sec (-100 to 100 m/sec)	-40.0 ft/sec (-12 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity is less than the programmed VELOCITY LOW LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Velocity High Limit	-328 to 328 ft/sec (-100 to 100 m/sec)	40.0 ft/sec (12 m/sec)	The E3: VELOCITY RANGE error messages appears when the calculated fluid velocity exceeds the programmed VELOCITY HIGH LIMIT value. See Chapter 5, *Error Codes*, for a discussion of error codes.
Acceleration Limit	0 to 100 ft/sec^2 (0 to 30 m/sec^2)	15.0 ft/sec^2 (4.6 m/sec^2)	The E6: CYCLE SKIP error message appears when the calculated fluid velocity changes by more than the programmed ACCLERATION LIMIT value from one reading to the next. See Chapter 5, *Error Codes*, for a discussion of error codes.
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 - SIGNL (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 T 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%	- 40%	The percentage of peak used to calculate the transit times and Delta T is specified at this prompt. **Note:** *This setting is a starting point for detecting the signal. The meter 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	High	The transmitter voltage can be set to low or high to reduce power consumption. LOW (default setting) is typically selected for smaller pipes with a single-phase fluid. The LOW setting is normally sufficient. HIGH is usually selected for large pipes or liquids with one or more phases.
Xmit Sample Size	2, 4, 8, 16 or 32	8	Both upstream and downstream transducers transmit ultrasonic pulses in bursts, which consist of a series of transmit pulses. XMIT SAMPLE SIZE determines how many bursts are sent in one direction before sending in the other direction.
# of Errors	0 to 16	8	Use this prompt to enter the number of errors the AT868 can record before it displays an error message.
Minimum Peak% Limit	-100 to 100	-100	Use this prompt to enter the minimum percent of peak that the AT868 can use to measure transit time.
Maximum Peak% Limit	-100 to 100	100	Use this prompt to enter the maximum percent of peak that the AT868 can use to measure transit time.

Set Transducer Signal Settings - SIGNL (cont.)

What's Next?

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

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

Setting Response Time - AVRG

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

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

What's Next?

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

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

Initializing Setup Parameters - INIT

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. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [→] until SETUP appears and press [ENTER].
5. Press [→] until INIT appears and press [ENTER].
6. Select YES or NO.

What's Next?

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

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

Using Advanced Features - ADVAN

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

- KV/SS - calculate the kinematic viscosity (KV) based on signal strength (SS) - refer to the next page.
- MULTK - enter a table of K-factors (based on velocity or reynolds number) that compensates for non-linear flow rates - refer to the next page.
- MASS - enable mass flow (calculated for static fluid density) - refer to page 2-20.
- CODEL - select the size of the transducer transmission signal - refer to page 2-21.

Entering KV/SS Table - KV/SS

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

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

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

9. Enter the kinematic viscosity values (0.050 to 500) in descending order by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].
10. Repeat Steps 8 and 9 for each pair.

What's Next?

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

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

Entering Multiple K Factors - MULTK

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

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

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

Note: *If you select* NO, *proceed to* What's Next? *on the following pages.*

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

Note: *If you select* NO, *proceed to* What's Next? *on the following page*.

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

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

12. Enter the K-factor corresponding to velocity/reynolds number "X" (0.333 to 3.0) by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].
13. Repeat Steps 11 and 12 for each pair.

Entering Multiple K Factors - MULTK (cont.)

What's Next?

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

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

Activating Mass Flow - MASS

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

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

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

8. Enter the fluid density by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

What's Next?

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

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

Selecting Transmitter Code Length - CODEL

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

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until the desired channel appears. Press [ENTER] at CH1 or CH2.
4. Press [→] until SETUP appears and press [ENTER].
5. Press [→] until ADVAN appears and press [ENTER].
6. Press [→] until CODEL appears and press [ENTER].
7. Press [→] to select the transmitter code length and press [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, the user program returns to the Advanced Feature window. Do one of the following:

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

Entering Global System Data - GLOBL-SYSTM

While completing these instructions, refer to Figure A-2 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 GLOBL menu.

Selecting the GLOBL-SYSTM Units

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until GLOBL appears and press [ENTER].
4. Press [→] until SYSTM appears and press [ENTER].
5. Enter a short message up to 16 characters by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to select the desired letter/space/symbol and press [ENTER].

Selecting the System Units

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

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

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

Entering Global System Data - GLOBL-SYSTM (cont.)

Setting Up the External Totalizer Reset Switch

The GATE OPTION enables you to configure an external reset switch that can reset totals by activating a switch that is remotely located from the electronics. To connect an external reset switch, refer to *Wiring the External Totalizer Reset Switch* on page 1-14.

IMPORTANT: *The hardware for the switch is user-supplied. GE Panametrics only supplies the software to configure the switch and test points to connect the switch.*

6. At the GATE OPTION prompt, press [→] to select one of the following and press [ENTER].

- RESET - the meter resets totals to zero for both channels and then immediately begins to accumulate again.
- HOLD - the meter holds totals at the current point for both channels. The meter will not accumulate as long as the switch remains closed. This option is typically used for calibration.

7. Do one of the following:

- If MASS FLOW is ON and both channels are active (for 2-channel units only), proceed to *Selecting the Mass Flow Units* on the following page. Both channels must be active
- If MASS FLOW is OFF and/or one channel is active, 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 2-20.*

Selecting the Mass Flow Units

1. Press [←] and [→] to select the desired mass flow units for the flow rate display and press [ENTER]. The available units for this prompt are determined by the selection made at SYSTEM UNITS on the previous page.

2. Press [←] and [→] to select the desired time units for the mass flow rate display and press [ENTER].

3. Press [←] and [→] to select the desired number of digits to the right of the decimal point in the mass flow rate display and press [ENTER].

Entering Global System Data - GLOBL-SYSTM (cont.)

Selecting the Mass Flow Units (cont.)

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

What's Next?

After completing the above steps, the meter 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 [ESC] three times.

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

Set up the AT868's inputs and outputs via the Input/Output submenu. While following the programming instructions, refer to Figure A-2 in Appendix A, *Menu Maps*. Remember to record all programmed data in Appendix C, *Data Records*.

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

- ERROR - program the meter's response during an error condition - see below.
- OPTN - set up the analog and totalizer/frequency outputs - page 2-28.
- LCD - set up the LCD display (refer to Chapter 3, *Setting Up the Display* on page 3-2).

Selecting Error Handling - ERROR

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 *Error Codes*, for a discussion of the built-in error codes.

Use the steps below to select error handling options.

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until GLOBL appears and press [ENTER].
4. Press [→] until I/O appears and press [ENTER].
5. Press [→] until ERROR appears and press [ENTER].
6. Press [→] to select the desired option for error handling and press [ENTER]. See Table 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 1- and 2-channel/path meter.

Selecting Error Handling - ERROR (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.		

7. 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 8 on the next page.

Selecting Error Handling - ERROR (cont.)

8. Press [→] to activate or deactivate two-path error handling and press [ENTER]. The 2PATH ERROR HAND option is intended for applications where two sets of transducers are installed in the same location in the same pipe to improve accuracy and the meter is operated in AVE mode. With this function enabled, the 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, the user program returns to the Global I/O window. Do one of the following:

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

Setting Up Analog and Totalizer/Frequency Outputs - OPTN

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

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

Analog Output

Accessing Output A or Output C

Output A and C are analog outputs that can be configured independently. Typically Output A is used for Channel 1 and Output C is used for Channel 2; however, analog outputs can be configured to measure either channel.

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

Setting Up Output Scale

1. Press [→] to select the desired output scale and press [ENTER].
2. Do one of the following:
   - If you selected OFF, the meter returns to the Global I/O window. Proceed to *What's Next?* on the following 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, press [→] to select the desired channel/path and press [ENTER].
4. Press [→] to select the desired measurement parameter and press [ENTER].

Note: *The measurement units that appear in these prompts are those selected in the* GLOBL-SYSTM *menu earlier in this section.*

5. At BASE, enter a flow rate value for the low end of the analog output range by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

Analog Output (cont.)

6. At FULL, enter a flow rate value for the high end of the analog output range by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

What's Next?

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

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

Totalizer/Frequency Output

This output can be configured for frequency or totalizer output using IDM.

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 frequency that is proportional to the assigned measurement parameter, such as flow rate.

Accessing Output B or Output D

Output B and D can be configured independently. Typically, Output B is used for Channel 1 and Output D is used for Channel 2; however, outputs can be configured to measure either channel.

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until GLOBL appears and press [ENTER].
4. Press [→] until I/O appears and press [ENTER].
5. Press [→] until OPTN appears and press [ENTER].
6. Press [→] to select B or D and press [ENTER].
7. If you are configuring a
   - frequency output, proceed to the next section *Setting Up the Frequency Output* on the next page.
   - totalizer output, proceed to *Setting Up the Totalizer Output* on the next page.

Totalizer/Frequency Output (cont.)

Setting Up the Frequency Output

1. At Output B or D, select OFF or FREQ and press [ENTER].

2. Do one of the following:

- If you selected OFF, the meter returns to the Global I/O window. 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, press [→] to select the desired channel/path and press [ENTER].

4. Press [→] to select the desired measurement parameter and press [ENTER].

Note: *The measurement units that appear in these prompts are those selected in the* GLOBL-SYSTM *menu earlier in this section.*

5. At BASE, enter a value for the low end of the output range (-2,000,000 to 2,000,000) by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

6. At FULL, enter a value for the high end of the output range (-2,000,000 to 2,000,000) by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number.

7. At FULL SCALE FREQU, enter a value for the full scale of the output (between 10 to 100,000) by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number.

8. Proceed to *What's Next?* on the following page.

Setting Up the Totalizer Output

1. At Output B or D, select OFF or TOTL and press [ENTER].

2. Do one of the following:

- If you selected OFF, the meter 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, press [→] to select the desired channel/path and press [ENTER].

Totalizer/Frequency Output (cont.)

Setting Up the Totalizer Output (cont.)

4. Press [→] to select the desired measurement parameter and press [ENTER].

5. Enter a value for the minimum pulse on time (between 50 µsec and 500,000 µsec) for the frequency of the totalizer pulses and press [ENTER]. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number.

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

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

7. Proceed to *What's Next?* on the following page.

What's Next?

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

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

Configuring the Communications Port - GLOBL-COMM

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 GLOBL-COMM 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:

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

A meter address is only necessary for communication with the GE 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.*

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

What's Next?

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

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

Configuring the Output as a Totalizer or Frequency Output

Output B and/or D can be configured as a totalizer or frequency output using *Instrument Data Manager* software. Before the output can be configured, the AT868 must be connected to a PC using the serial port (see *Wiring the Serial Port* on page 1-10).

Use the following steps to configure the output:

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

Chapter 3

Displaying Data

Introduction 3-1

Adjusting LCD Contrast and Brightness 3-1

Setting Up the Display 3-2

Resetting Totals 3-3

Pausing and Restarting the Measurement. 3-4

Introduction

The Model AT868 flow transmitter is equipped with a 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, this section discusses resetting totalizers and pausing the measurement.

Adjusting LCD Contrast and Brightness

Both the contrast and the brightness of the 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.

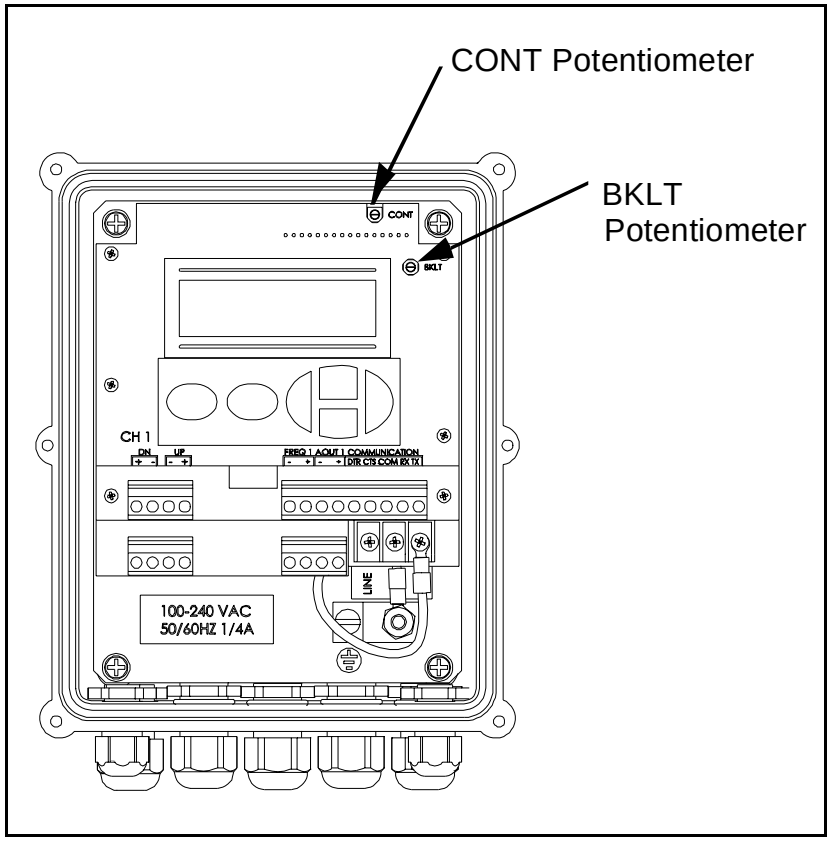

Figure 3-1: Location of CONT and BKLT Potentiometers

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

Complete the following instructions to display the desired data on the display screen (refer to Figure A-2 on page A-2 in Appendix A, *Menu Maps*

Accessing the Display Submenu

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until GLOBL appears and press [ENTER].
4. Press [→] until I/O appears and press [ENTER].
5. Press [→] until LCD appears and press [ENTER].

Configuring the Display

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

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

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

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

The previous two prompts repeat until all of the specified # of LCD PARAMS have been set up. Proceed to *What's Next?* below.

What's Next?

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

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

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

Resetting Totals

To reset the totals, you can use the internal keypad, IDM or an external switch. When resetting totals, the totals for both channels will be reset. Use the appropriate section that follows to reset totalizers.

Resetting Totalizers Using the Internal Keypad

Refer to Figure A-4 on page A-4 in Appendix A, *Menu Maps*.

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until RESET appears and press [ENTER].
3. Press [→] to select YES or NO and press [ENTER].

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

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

Resetting Totalizers Using IDM

Refer to Figure F-4 on page F-4 in Appendix F, *Menu Maps for IDM*.

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

Resetting Totalizers Using the External Switch

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

Note: *The external totalizer reset switch must be configured as described on page 2-23.*

Pausing and Restarting the Measurement

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

Pausing the Measurement Display

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

Restarting the Measurement Display

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

Chapter 4

Calibration

Introduction 4-1

Calibrating and Testing the Analog Outputs 4-1

Testing the Output Linearity 4-3

Testing the Totalizer/Frequency Outputs 4-4

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 Outputs

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

Both the zero-point and full-scale values for these outputs must be calibrated. Once they are 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 or 2 as shown in Figure 4-1 below. **DO NOT** connect the ammeter directly across the terminals. Refer to Figure 1-4 on page 1-15 for the locations of the analog outputs terminal blocks.

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

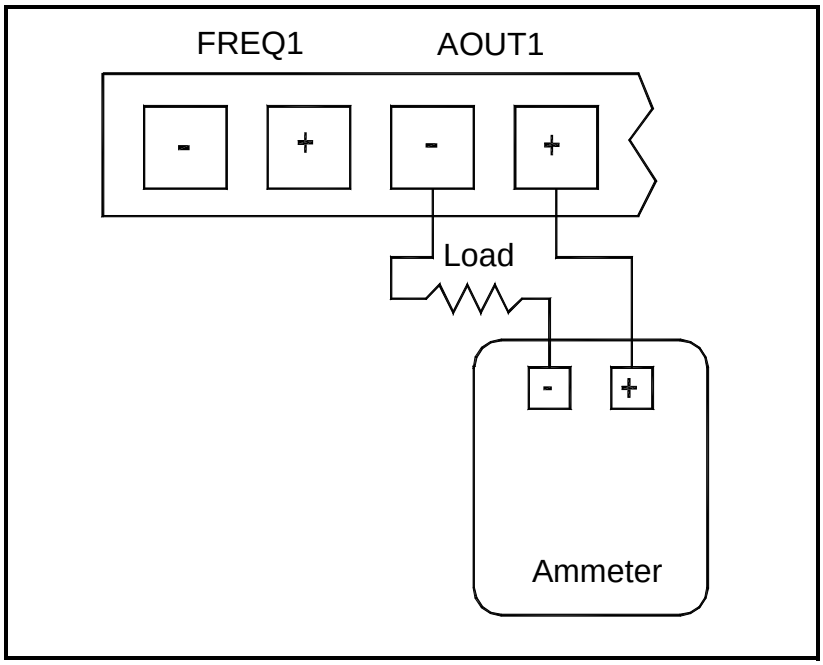

Figure 4-1: Ammeter Connection

Calibrating and Testing the Analog Outputs (cont.)

Accessing the Calibration Menu

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until CALIB appears and press [ENTER].
3. Press [→] until SLOT0 appears and press [ENTER].
4. Press [→] until A or C appears and press [ENTER].

Calibrating the Low End of the Analog Output

1. Press [→] to select 4 mA and press [ENTER].
2. Press [→] to select UP or DOWN to adjust the 4 mA reading and press [ENTER].
3. When the desired reading is achieved, select STORE. If the ammeter reading cannot be adjusted 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. Press [→] to select 20 mA and press [ENTER].
2. Press [→] to view the options to adjust the 20 mA reading and press [ENTER].
3. When the desired reading is achieved, select STORE. If the ammeter reading cannot be adjusted with 5.0 µA of the 4 mA setting, select ABORT to end calibration and contact the factory for assistance.

What's Next?

After completing the above steps, the meter 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 [ESC] four times.

Testing the Output Linearity

Accessing the Calibration Menu

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until CALIB appears and press [ENTER].
3. Press [→] until SLOT0 appears and press [ENTER].
4. Press [→] until A or C appears and press [ENTER].

Testing Linearity

1. Press [→] to select Test and press [ENTER].
2. Enter 50 by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].
3. Check the ammeter reading. Table 4-1 below 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 5 μA 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.*

4. Repeat Step 2 but enter a different output (0-100%). Check the ammeter reading at this setting and press [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		

Testing the Output Linearity (cont.)

What's Next?

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

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

Testing the Totalizer/ Frequency Outputs

Preparing for Calibration

Prepare for the testing procedure by connecting a frequency counter to the appropriate terminal blocks. Refer to Figure 1-4 on page 1-16.

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

Calibrating the Frequency Output

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until CALIB appears and press [ENTER].
3. Press [→] until SLOT0 appears and press [ENTER].
4. Press [→] until B or D appears and press [ENTER].
5. Enter the frequency by using the arrow keys. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].
6. Proceed to *What's Next?* on the following page.

Calibrating the Totalizer Output

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until CALIB appears and press [ENTER].
3. Press [→] until SLOT0 appears and press [ENTER].
4. Press [→] until B or D appears and press [ENTER].
5. Enter the desired pulse width in µsec. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].

Testing the Totalizer/ Frequency Outputs (cont.)

6. Enter the number of pulses. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER]. Your counter should increase the number of pulses entered.
7. Repeat Steps 6 and 7 until you achieve the desired result.
8. Proceed to *What's Next?* on the following page.

What's Next?

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

- To perform another programming function, refer to Appendix A, *Menu Maps* (or Appendix F, *Menu Maps for IDM*), to navigate to the desired menu.
- To leave the *User Program*, press [ESC] twice.

Chapter 5

Error Codes

Introduction 5-1

E0: No Error 5-1

E1: Low Signal 5-1

E2: Sound Speed Error 5-2

E3: Velocity Range 5-2

E4: Signal Quality. 5-2

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E6: Cycle Skip, Accel. 5-3

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E8: Unassigned 5-3

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E10: Unassigned 5-3

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E12: Unassigned 5-3

E13: Volumetric Overflow 5-3

Introduction

The Model AT868 ultrasonic flowmeter is a reliable, easy to maintain instrument. When properly installed and operated, as described in Chapter 1, *Installation*, the meter provides accurate flow rate measurements with minimal user intervention. However, if a problem should arise with the electronics enclosure, the transducers or the flowcell, a built-in error code message system greatly simplifies the troubleshooting process.

All of the possible 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 on 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-SIGNL submenu 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-SIGNL submenu, as described on page 2-13.

E2: Sound Speed Error

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

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

Action: Compare the measured sound speed to tabulated nominal values for the fluid being used and correct any programming errors (see page 2-13). 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-SIGNL submenu of the *User Program*.

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

Action: Make sure the actual flow rate is within the programmed limits. Also, check the value entered into the SETUP-SIGNL submenu, as described on page 2-13. 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-SIGNL submenu of the *User Program*.

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

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

E5: Amplitude Error

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

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

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

E6: Cycle Skip, Accel.

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

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

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

E7: Analog Out Error

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

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

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

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 or decrease PULSE ON TIME.

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

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

Chapter 6

Diagnostics

Introduction **6-1**

Displaying Diagnostic Parameters **6-1**

Using the Tracking Window **6-4**

Diagnostic Record **6-5**

Flowcell Problems **6-6**

Transducer Problems. **6-8**

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, do the following (refer to Figure A-2 on page A-2 in Appendix A, *Menu Maps*):

Accessing the Display submenu

1. Press [ESC], [ENTER], [ESC]. The meter enters the user program.
2. Press [→] until PROG appears and press [ENTER].
3. Press [→] until GLOBL appears and press [ENTER].
4. Press [→] until I/O appears and press [ENTER].
5. Press [→] until LCD appears and press [ENTER].

Configuring the Display

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

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

Note: *If you select* OFF, *the meter returns to the* Global I/O *window. Proceed to* What's Next? *on the following.*

2. Press [→] to select the desired channel/path option and press [ENTER].
3. At Measurement Name, press [→] to select the desired parameter (refer to Table 6-1 on the next page for a list of available diagnostic parameters) and press [ENTER].

Displaying Diagnostic Parameters (cont.)

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

The previous two prompts repeat until all of the specified # of LCD PARAMS have been set up. Proceed to *What's Next?* on the following page.

Table 6-1: Available Diagnostic Parameters

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

Displaying Diagnostic Parameters (cont.)

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

Option Bar	Description	Good	Bad
AMPdn	Displays the value for the signal amplitude of the downstream transducer.	24 ± 5	<19 or >29
P#up	Displays signal peaks for the upstream transducer.	100-2300	<100 or >2300
P#dn	Displays signal peaks for the downstream transducer.	100-2300	<100 or >2300
NFup	Displays the normalization factor for the upstream transducer.	0.85-1.0	<0.85
NFdn	Displays the normalization factor for the downstream transducer.	0.85-1.0	<0.85
Cxdcr	Displays the speed of sound in the transducer (clamp-on only).	N.A.	N.A.

What's Next?

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

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

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

Using the Tracking Window

If the fluid sound speed is fairly constant, you can use the Tracking Window to "find" the sound speed and then enter it rather than constantly track it since tracking adds to the measurement time.

Use the procedure below to determine the fluid sound speed and enter it into the meter.

Note: *In order to perform the steps below, you must activate the Tracking Window as described in Section 2, Setting Up the Tracking Window, on page 2-9.*

Accessing the Display submenu

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

Configuring the Display

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

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

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

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

Using the Tracking Window (cont.)

Deactivating the Tracking Window

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

Entering the Constant Sound Speed

1. At FLUID TYPE, select OTHER.
2. At FLUID SOUNSPEED, enter the measured sound speed and press [ENTER]. Press [←] and [→] to move the cursor to desired location and press [↑] and [↓] to increase or decrease the number and press [ENTER].
3. Press [ESC] three times to exit the *User Program*.
4. The AT868 returns to making measurements. If desired, reconfigure the display to show the desired measurement as discussed on the previous page.

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

Chapter 7

Parts Replacement

Introduction 7-1

Replacing the LCD Display/Keypad 7-2

Replacing the Fuse 7-3

Replacing the Fuse 7-3

Introduction

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

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

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

Note: *For compliance with the European Union's Low Voltage Directive (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 6-1 on page 6-7 and Figure 6-2 on page 6-8 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/Keypad

The LCD display/keypad assembly normally provides years of dependable service, but it is easily field-replaceable when necessary. To replace the LCD display/keypad, see Figure 6-1 on page 6-7 and Figure 6-2 on page 6-8 for the component locations, and complete the following steps.

Procedure for Removing LCD/Keypad Board

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/keypad board. Make sure you remove the flat and lock washers with the screws.
4. Grasp the LCD/keypad board by the side edges and carefully pull it straight upward until it comes free from the Channel 1 board below it.
5. Disconnect the keypad ribbon on the board below by sliding the tabs on the connector upward and pulling the ribbon cable out.

Procedure for Installing New LCD/Keypad Board

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

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

!WARNING!
Before powering up the AT868, make sure all the lock washers have been replaced. Washers or other metal components left inside the enclosure may cause electrical problems.

Replacing the Fuse

Use the steps below to replace the AT868 fuse (refer to Figure 6-1 on page 6-7):

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 screws from the bottom mounting plate.
4. Remove the mounting plate from the chassis. Loosen cable glands if necessary.
5. From the cutout on the back of the mounting plate, pull the plastic cover off the fuse holder and remove the old fuse.
6. Obtain a new fuse of the same rating and type. Use only a type 3AG (1-1/4" x 1/4") Slo-Blo fuse, having a rating as indicated in Table 7-1 below.

Table 7-1: Line Voltages & Fuse Ratings

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

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

!WARNING!
Before powering up the AT868, make sure all the lock washers have been replaced. Washers or other metal components left inside the enclosure may cause electrical problems

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 U4, is mounted in a socket on the rear of the Channel 1 board. EPROM replacement may be required to replace a defective chip or to upgrade to a newer software version.

To replace the *User Program*, refer to Figure 6-1 on page 6-7 and Figure 6-2 on page 6-8 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 plastic shroud by removing the two screws that hold it in place.
4. Remove the four mounting screws on the LCD/keypad board. Make sure you remove the flat and lock washers with the screws.
5. Grasp the LCD/keypad board by the side edges and carefully pull it straight upward until it comes free from the Channel 1 board below it.
6. Disconnect the keypad ribbon on the board below by sliding the tabs on the connector upward and pulling the ribbon cable out.
7. Remove the four standoffs in the corners of the Channel 1 board.
8. Remove the screw in the middle of the Channel 1 board.
9. Carefully remove the Channel 1 board from the connectors on the Channel 2 board below it.

Replacing the User Program (cont.)

Locating the EPROM

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

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.

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.

Reassembling the Unit

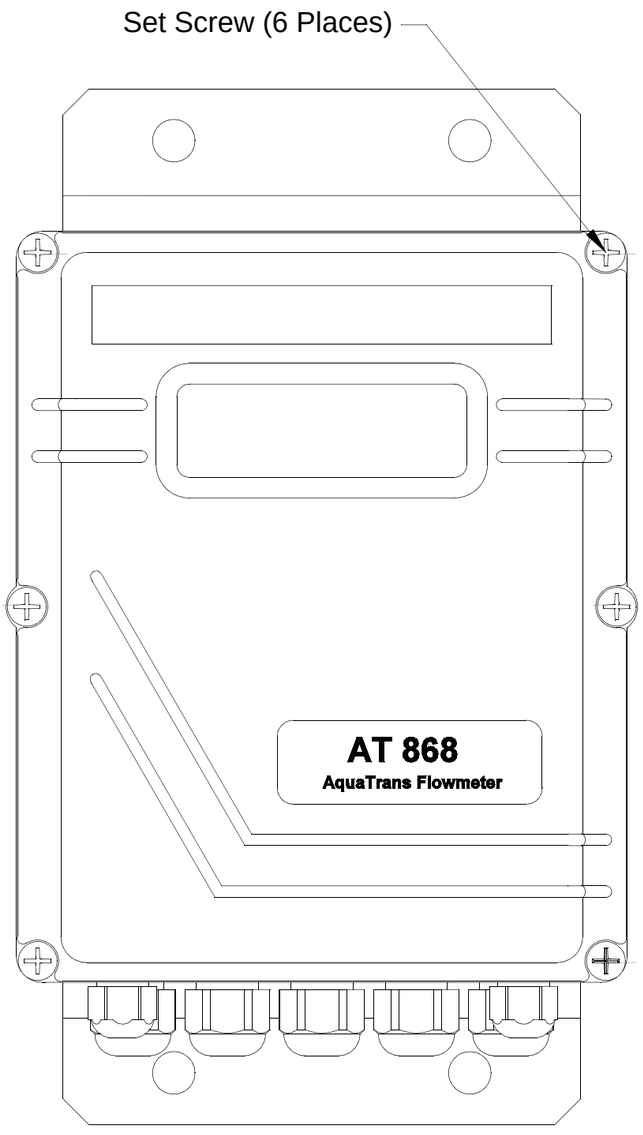
1. Replace the Channel 1 board. To do this, carefully align the pins along the back of the board with the connectors on the Channel 2 board. Firmly press the Channel 1 board down until all of the connectors are completely seated.
2. Secure the Channel 1 board by replacing the screw and standoffs previously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

Replacing the User Program (cont.)

!WARNING!
Before powering up the AT868, make sure all the lock washers have been replaced. Washers or other metal components left inside the enclosure may cause electrical problems.

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

To purchase the parts mentioned in this chapter or any items not specifically discussed, contact GE 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.



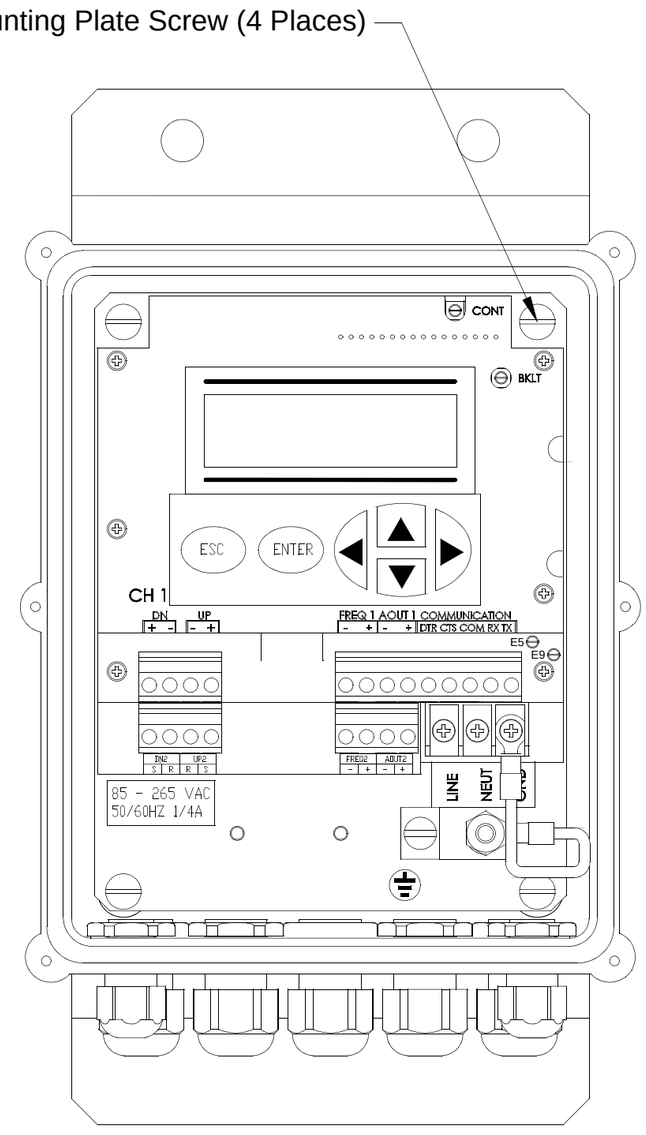


Figure 7-1: Electronics Console Front View (With and Without Cover)

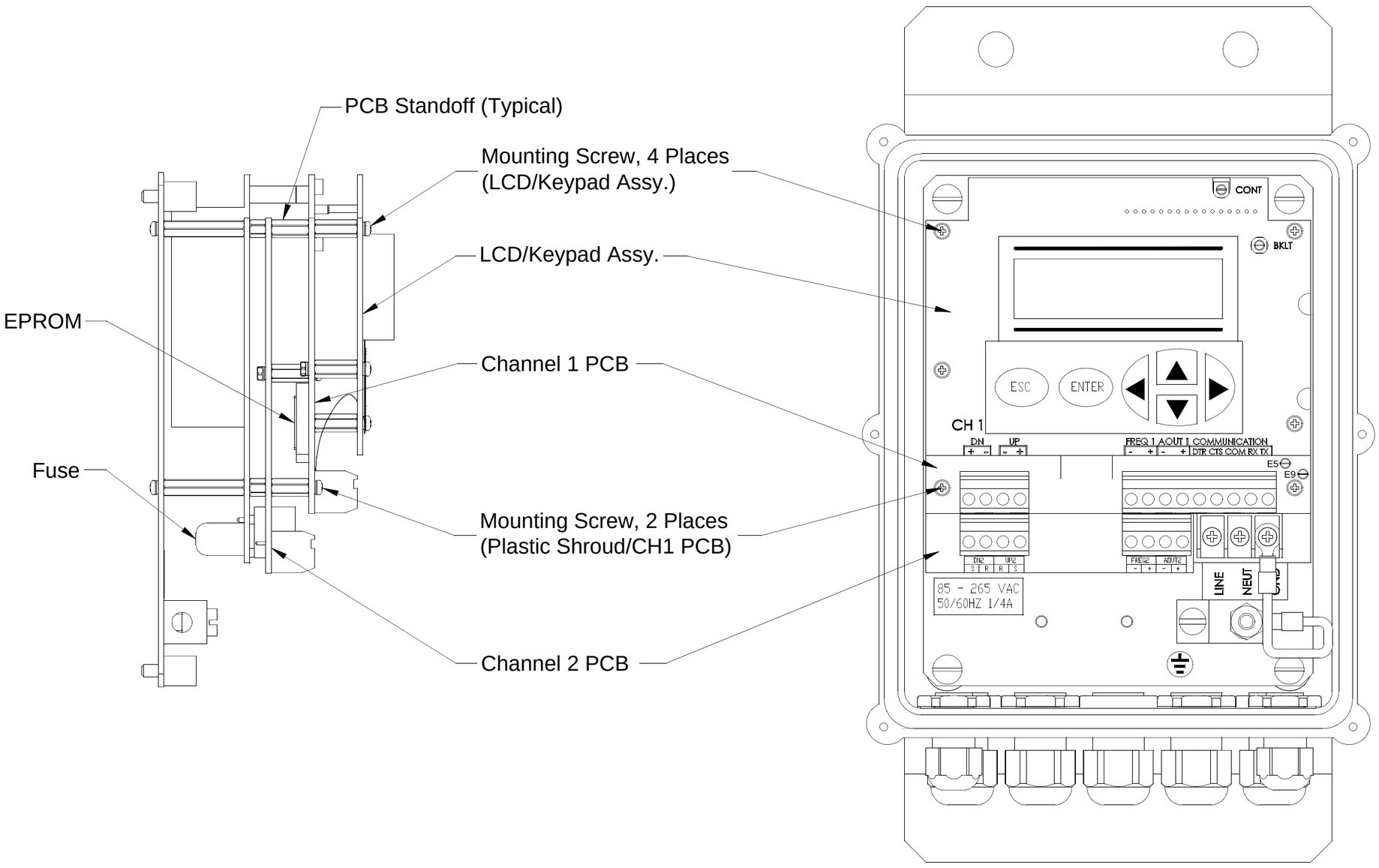


Figure 7-2: Electronics Console Interior (Side and Front Views)

Chapter 8

Specifications

General Specifications. 8-1

Electrical Specifications 8-2

Transducer Specifications. 8-4

Pipe Size and Materials 8-5

Tilted Diameter Spoolpiece 8-6

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:

General purpose NEMA 4X powder-coated aluminum. Wall mount.

Dimensions:

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

Environmental

Ambient Operating Temperature:

14° to 131°F (–10° to 55°C).

Storage Temperature:

-40° to 158°F (–40° to 70°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 10 diameters upstream and 5 diameters downstream.*

Fluid Types

Water and wastewater.

Electrical Specifications

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

Power Supply

Options:

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

Power Consumption:

10 W maximum (not including inrush current required for DC supply specification).

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

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

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

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

Cable and Length:

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

Input/Output Specifications (cont.)

Output Units:

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

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

Totalizer (forward and reverse):
Cubic feet (ft^3).
Million cubic feet (ft^3).
Gallons (gal).
Million of gallons.
Barrels.
Millions of barrels.
Acre inches.
Acre feet.
Cubic meters (m^3).
Million cubic feet (ft^3).
Liters (L).
Megaliters.
Barrels
Megabarrels.

Certifications:

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): -328^{o} to 500^{o}F (-200^{o} to 260^{o}C).

Pressure Range

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

Frequency:

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

Materials

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

Conduit Connections:

1-in. NPTM or 3/8-in. NPTM.

Process Connections:

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

Mounting:

Spoolpiece, hot tap or cold tap.

Housing:

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

Other Options:

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

Transducer Specifications (cont.)

Clamp-on Transducers

Type:

Shear wave or longitudinal wave.

Temperature Range

Standard: -40° to 212°F (-40° to 100°C).

Optional (overall range): -328° to 500°F (-200° to 260°C).

Frequency:

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

Mounting:

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

Housing:

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

Other Options:

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

Pipe Size and Materials

Wetted Transducers

Materials:

All metals and most plastics. (Consult GE 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:

316 SS and most plastics. (Consult GE 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).

Tilted Diameter Spoolpiece

Pipe Sizes:

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

Materials:

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

Process Connections:

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

Wetted Transducer Connections:

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

Interrogation:

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

Appendix A

Menu Maps

The CHx ACTIV, SYSTM, PIPE and I/O Menu Map A-1

The GLOBL Menu Map A-2

The CHx SETUP Menu Map A-3

The CALIB and RESET Menu Map A-4

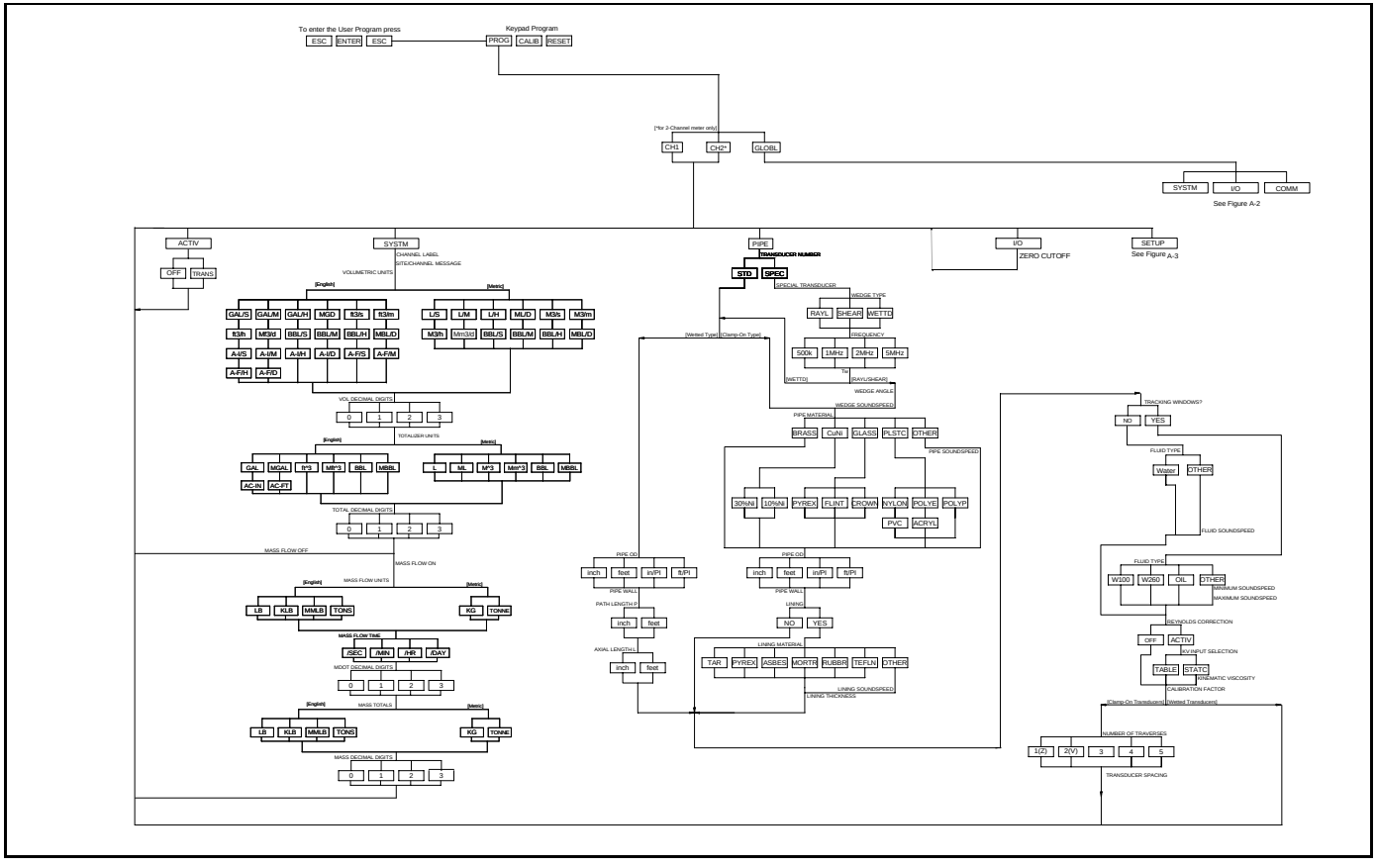


Figure A-1: The CHx ACTIV, SYSTM, PIPE, and I/O Menu Map

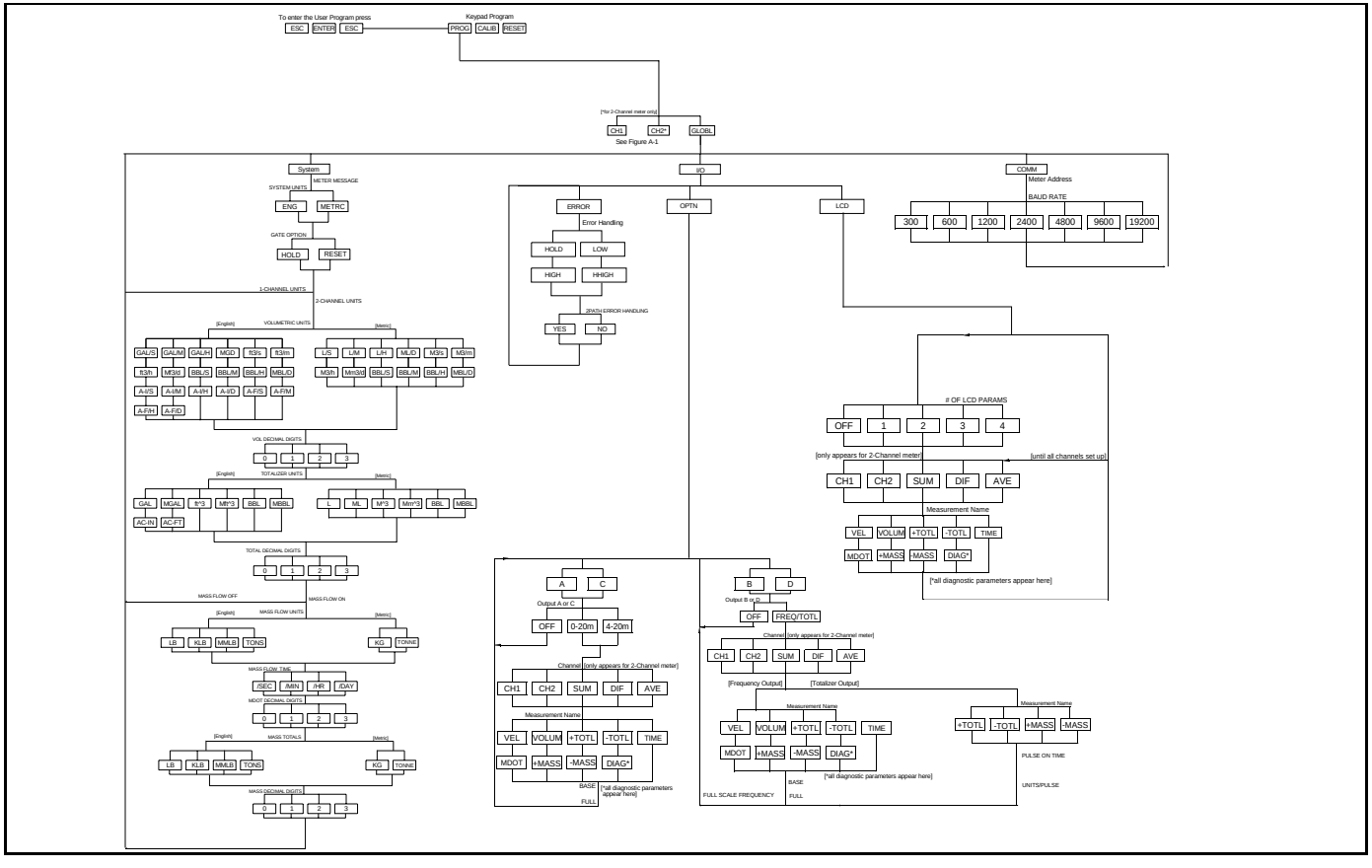


Figure A-2: The GLOBL Menu Map

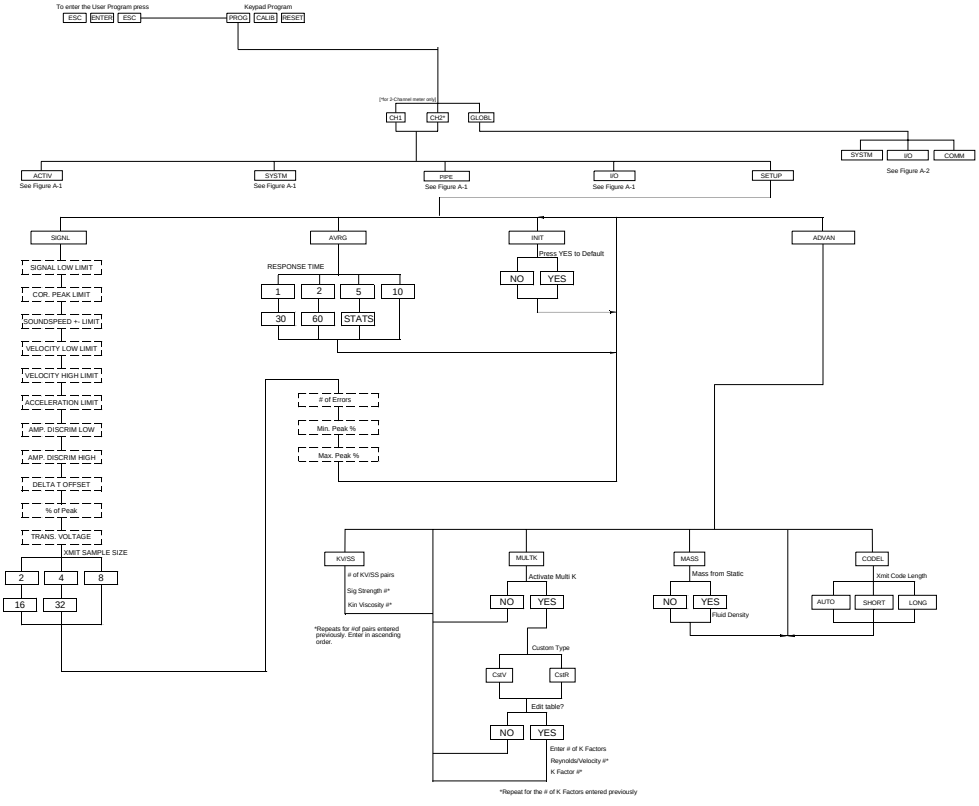


Figure A-3: The CHx SETUP Menu Map

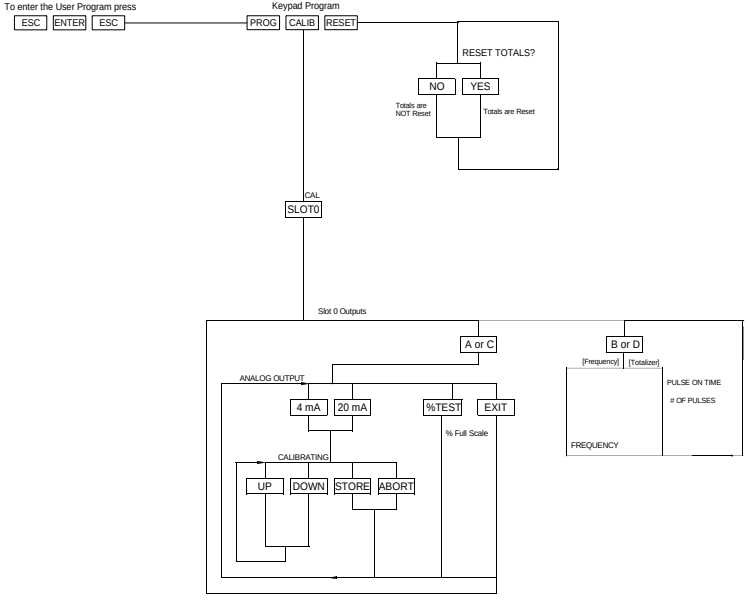


Figure A-4: The CALIB and RESET Menu Map

Appendix B

CE Mark Compliance

Introduction **B-1**

EMC Compliance **B-1**

LVD Compliance **B-2**

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.*

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 on the next page 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 at the AT868.
	Armored conduit	None - grounded via cable gland.
Power	14 AWG, 3 conductor, shielded (e.g. Belden #19364)	Terminate shield to chassis ground at the AT868.
	Armored Conduit	None - grounded via cable gland.
Shielding	Wires enclosed in a properly-grounded metal conduit do not require additional shielding.	

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).*

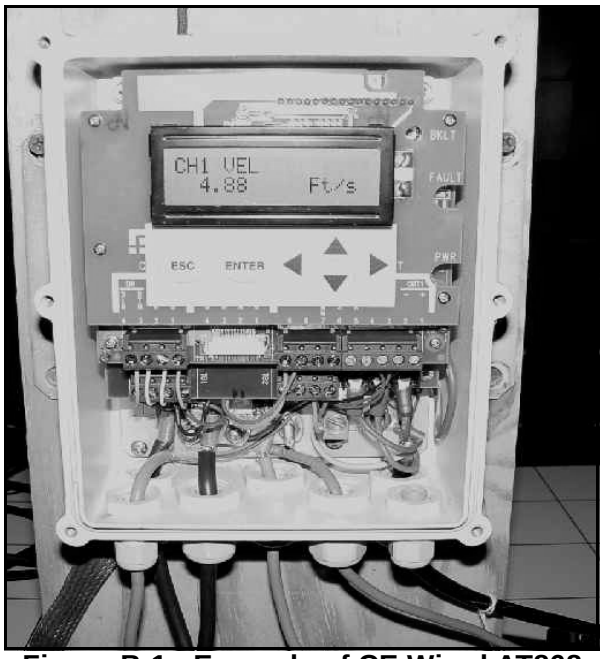


Figure B-1: Example of CE Wired AT868

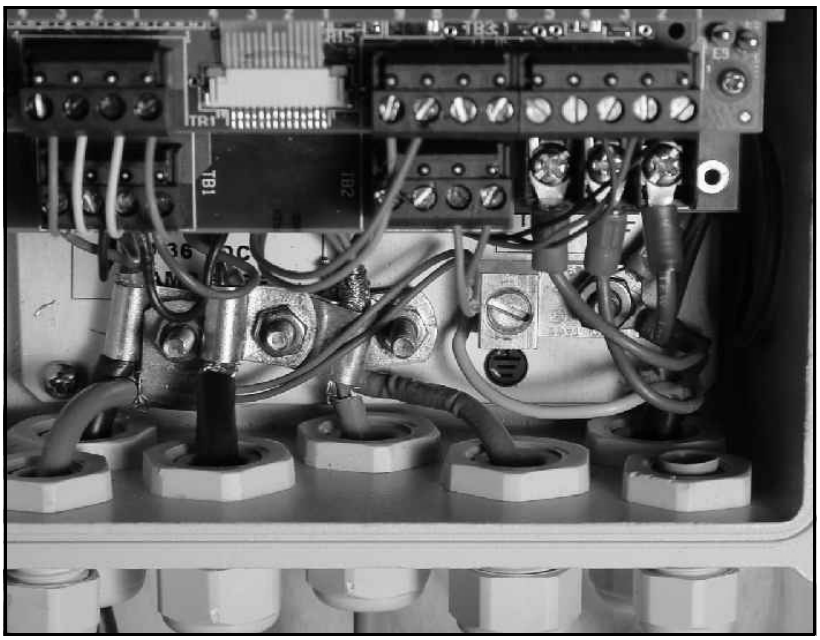


Figure B-2: Enlargement of B-1

Appendix C

Data Records

Site Data **C-1**

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			Baud Rate		
Channelx-Status					
Channel 1			Channel 2 (if applicable)		
Channel Status	Off[1]	Transit	Channel Status	Off[1]	Transit
Channelx-System					
Channel 1			Channel 2 (if applicable)		
Channel Label			Channel Label		
Chan. Message[2]			Chan. Message[2]		
Vol. Units			Vol. Units		
Vol. Dec. Digits			Vol. Dec. Digits		
Totalizer Units			Totalizer Units		
Tot. Dec. Dig.			Tot. Dec. Dig.		
Mass Flow			Mass Flow		
Mass Flow Time			Mass Flow Time		
MDOT Dec. Dig.			MDOT Dec. Dig.		
Mass Totals			Mass Totals		
Mass Dec. Digits			Mass Dec. Digits		

[1]not available for 1-Channel meter, [2]"Site Message" for 1-Channel meter

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	
Fluid Density				Fluid Density			
Channelx-SETUP-Advanced Features-Code Length							
Code Length	Auto	Short	Long	Code Length	Auto	Short	Long

Appendix D

Measuring P and L Dimensions

Measuring P and L D-1

Measuring P and L

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

To determine L, physically measure the distance between the center of the transducer ports at the inside wall as shown in Figure D-1 below, if possible. If not, consult the factory.

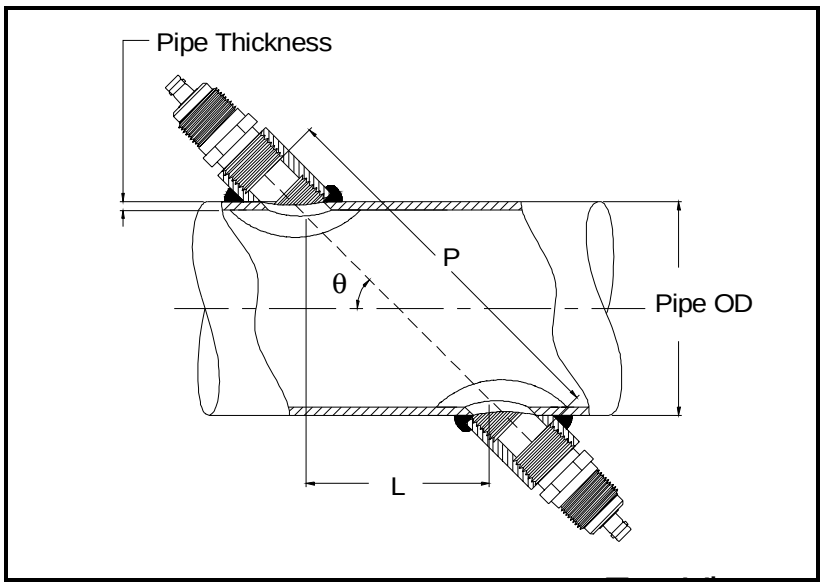


Figure D-1: 180^{o} Transducer Installations

To determine P, you need the following:

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

Measuring P and L (cont.)

Use Figure D-2 below to properly measure the coupling length. Typically, the transducer face is positioned just outside the inside diameter (ID) of the pipe, or slightly retracted inside the coupling.

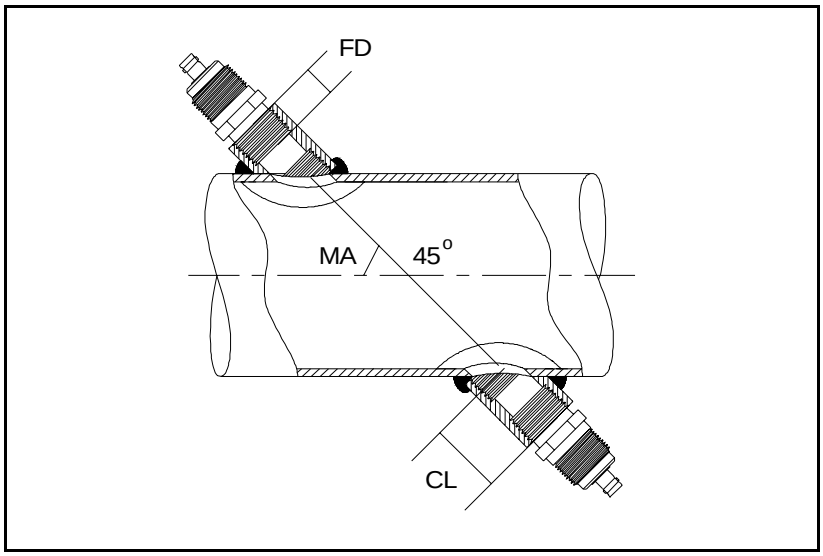


Figure D-2: Determining the Pipe Coupling Length

Use the following formula to determine the 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 **E-1**

Data Entry **E-1**

Diagnostic Parameters **E-3**

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 #		
K(RE)			K(RE)		
PEAK%			PEAK%		
Theta 3[1]			Theta 3[1]		
UP Signal Q			UP Signal Q		
DN Signal Q			DN Signal Q		
UP Amp. Disc.			UP Amp. Disc.		
DN Amp. Disc.			DN Amp. Disc.		
UP +- Peak			UP +- Peak		
DN +- Peak			DN +- Peak		
UP Norm. F			UP Norm. F		
DN Norm. F			DN Norm. F		
CEE1			CEE1		
SIGMA			SIGMA		
#ERRS			#ERRS		

[1] available only for Clamp-on transducers

Appendix F

Menu Maps for IDM

The Channel Status, System, Pipe Parameters, and Input/Output Menu Map F-1

The Global Menu Map F-2

The Channel SETUP Menu Map F-3

The Calibration/Test, Pause Measurement and Clear Totalizers Menu Map F-4

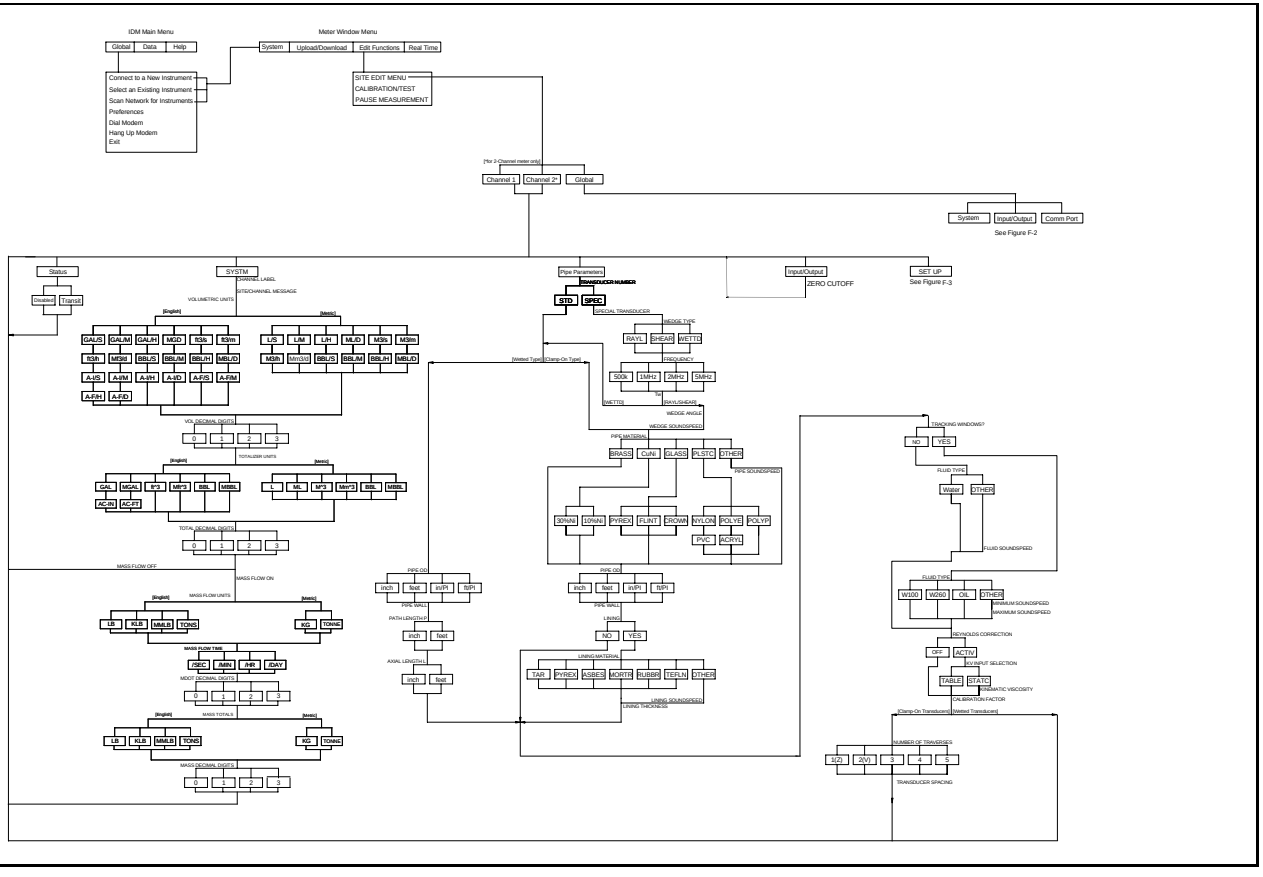


Figure F-1: The Channel Status, System, Pipe Parameters, and Input/Output Menu Map

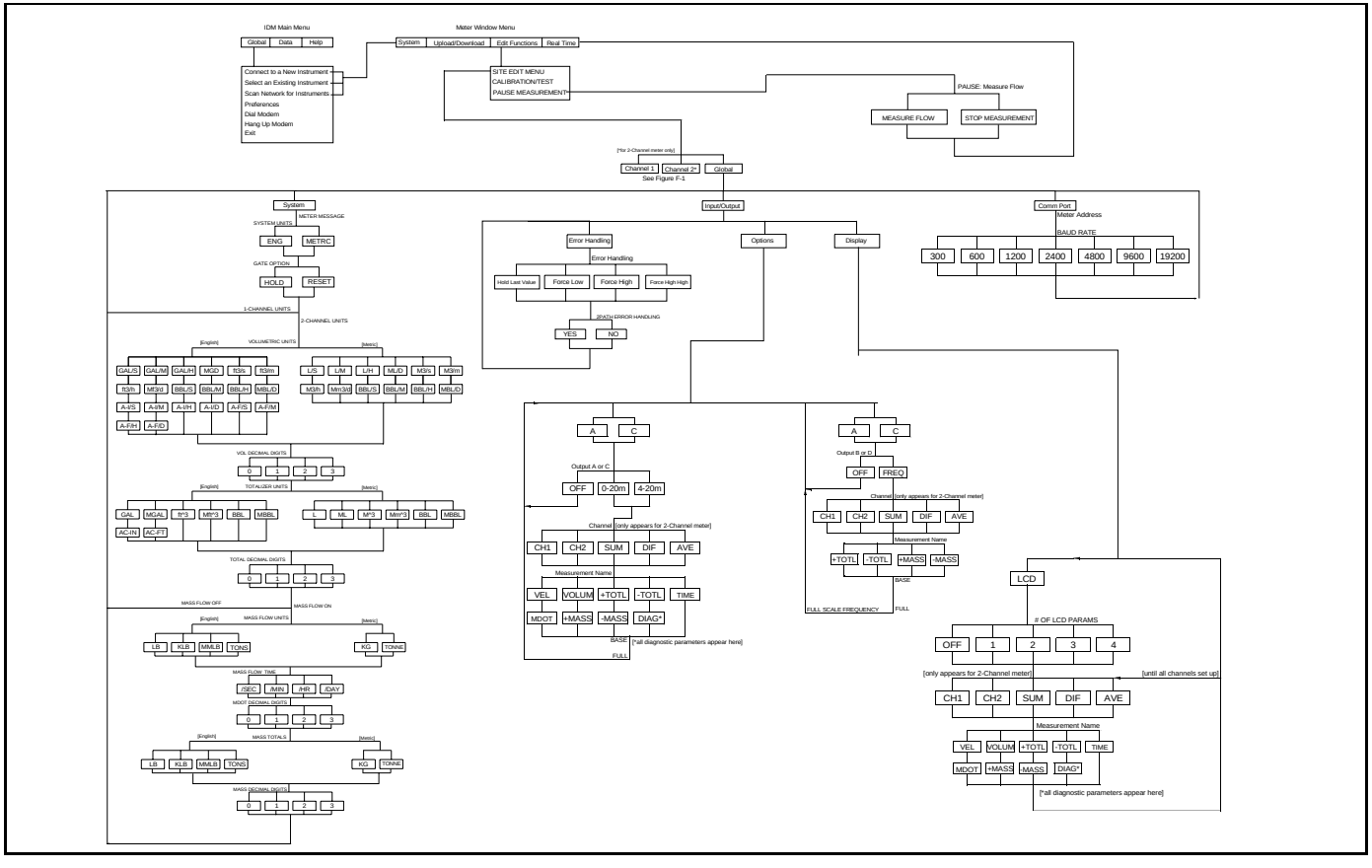


Figure F-2: The Global Menu Map

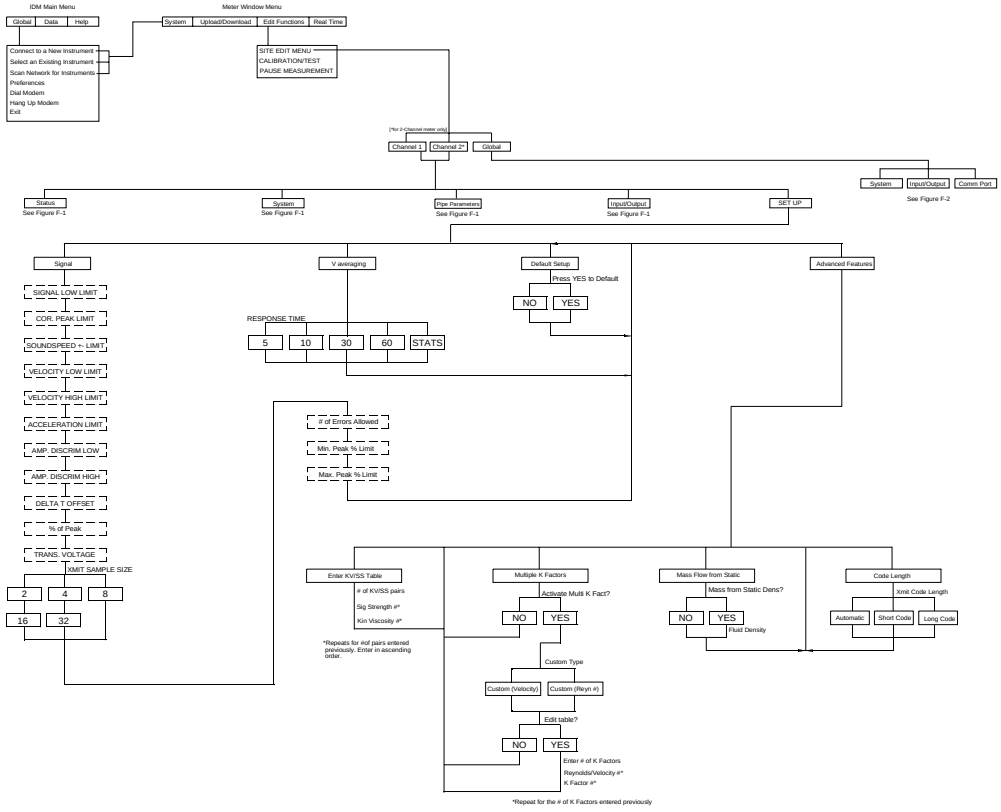


Figure F-3: The Channel SETUP Menu Map

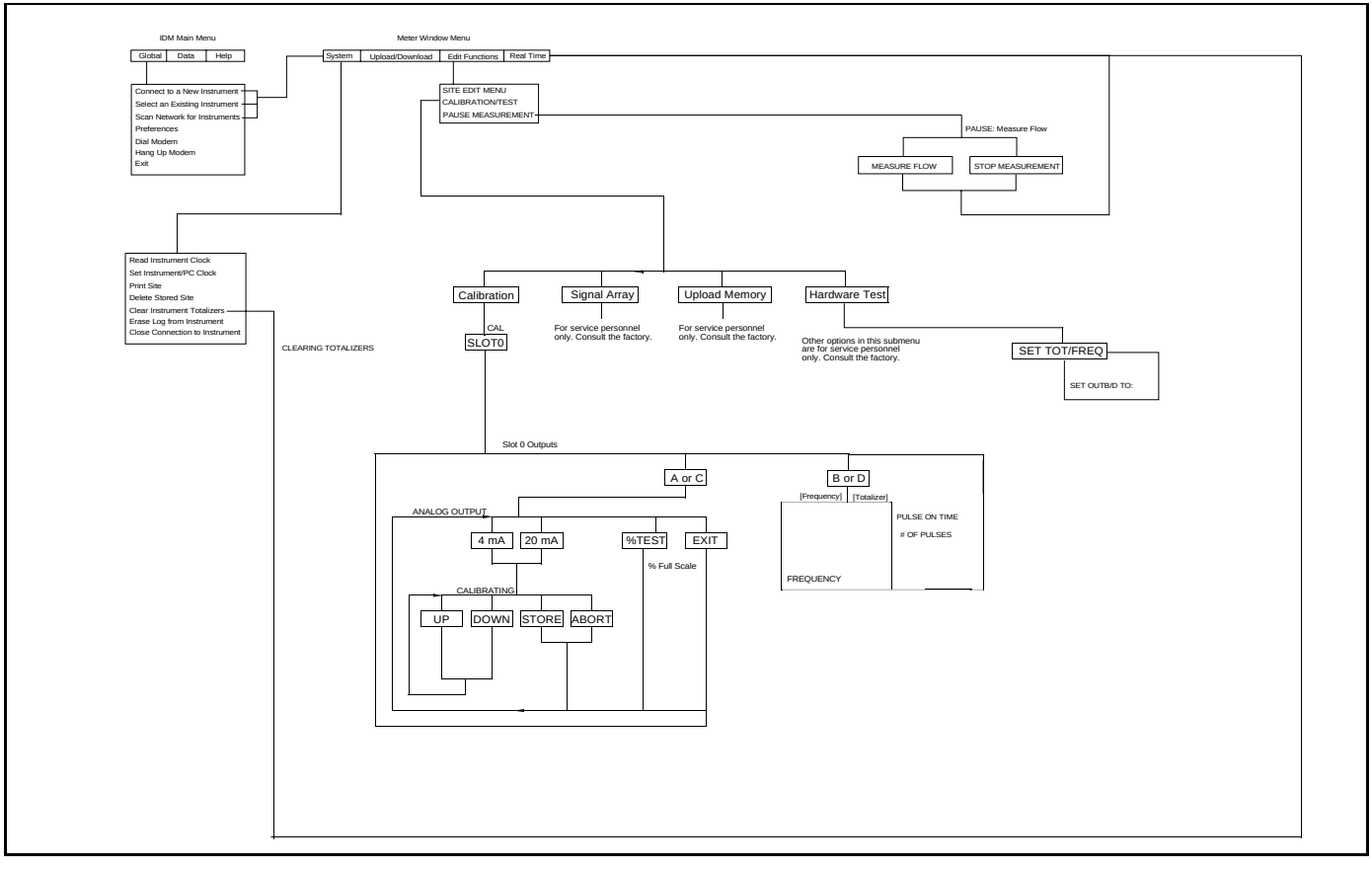


Figure F-4: The Calibration/Test, Pause Measurement and Clear Totalizers Menu Map

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GE Panametrics

DECLARATION OF CONFORMITY

We,

GE Panametrics
Shannon Industrial Estate
Shannon, Co. Clare
Ireland

declare under our sole responsibility that the

AT868 AquaTrans™ Ultrasonic Flowmeter
UPT868-P UltraPure Flow™ Measurement System

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

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

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

The *units listed above and any transducers supplied with them (spoolpieces are addressed under a separate declaration of conformity)* do not bear CE marking for the Pressure Equipment Directive, as they are supplied in accordance with Article 3, Section 3 (sound engineering practices and codes of good workmanship) of the Pressure Equipment Directive 97/23/EC for DN<25.

Shannon - June 1, 2002

Mr. James Gibson
GENERAL MANAGER

CE

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ISO 9001
U.S.

GE Panametrics

DECLARATION DE CONFORMITE

Nous,

GE Panametrics
Shannon Industrial Estate
Shannon, Co. Clare
Ireland

déclarons sous notre propre responsabilité que les

AT868 AquaTrans™ Ultrasonic Flowmeter
UPT868-P UltraPure Flow™ Measurement System

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

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

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

Les *matériels listés ci-dessus ainsi que les transducteurs pouvant être livrés avec (les manchettes faisant l'objet d'une déclaration de conformité séparée)* ne portent pas le marquage CE de la directive des équipements sous pression, car ils sont fournis en accord avec la directive 97/23/EC des équipements sous pression pour les DN<25, Article 3, section 3 qui concerne les pratiques et les codes de bonne fabrication pour l'ingénierie du son.

Shannon - June 1, 2002

Mr. James Gibson
DIRECTEUR GÉNÉRAL

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Shannon

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ISO 9001
U.S.

GE Panametrics

KONFORMITÄTS-ERKLÄRUNG

Wir,

GE Panametrics
Shannon Industrial Estate
Shannon, Co. Clare
Ireland

erklären, in alleiniger Verantwortung, daß die Produkte

AT868 AquaTrans™ Ultrasonic Flowmeter
UPT868-P UltraPure Flow™ Measurement System

folgende Normen erfüllen:

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

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

Die *oben aufgeführten Geräte und zugehörige, mitgelieferte Schallwandler (Messrohre werden in einer separaten Konformitätserklärung behandelt)* tragen keine CE-Kennzeichnung gemäß der Druckgeräte-Richtlinie, da sie in Übereinstimmung mit Artikel 3, Absatz 3 (gute Ingenieurpraxis) der Druckgeräte-Richtlinie 97/23/EG für DN<25 geliefert werden.

Shannon - June 1, 2002

Mr. James Gibson
GENERALDIREKTOR

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