Instruction

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I/A Series® MagEXPERT™ Transmitter Model IMT96 with HART Communications

Operation, Configuration, and Calibration Using a HART Communicator

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1. Introduction

Description

This I/A Series Magnetic Flowmeter system consists of two major components:

- A MagEXPERT (Model IMT96) Magnetic Flow Transmitter
- A Model 2800 Magnetic Flowtube.

An IMT96 Transmitter can be operated, configured, and calibrated locally from the transmitter optional keypad/display or remotely from an I/A Series Workstation, HART Communicator, or PC-based Configurator.

This document describes the remote operation, configuration, and calibration of the IMT96 with a HART Communicator. For information on operation, configuration, and calibration using a PC-Based Configurator or the IMT96 optional keypad/display, refer to Table 1.

For detailed instructions on the operation of a HART Communicator, refer to the Product Manual for the HART Communicator (available from the HART Communications Foundation).

Intended Audience

This document is intended for use by process operators, engineers, and instrument technicians. If you are interested only in operation, read the general information in the *Introduction* and the chapter titled *Operation*. If you are interested in calibration, read the *Introduction* and the chapters titled *Operation* and *Calibration and Presets*. If you are concerned with configuration read the entire manual, with special emphasis on the chapter titled *Configuration* and the menu structure diagrams in *Appendix A*. If you are not familiar with the use of the HART Communicator, read the chapter titled *HART Communicator*.

Summary of IMT96 Features

The following list summarizes the major functional capabilities and options available with the IMT96.

- UniDirectional or BiDirectional flow measurement capability with up to three independent upper range values that are selectable via Contact Inputs during operation.
- Analog (4 to 20 milliampere) output proportional to the flow rate.
- Pulse Output that is configurable as a scaled totalizer value or as a frequency that is proportional to the flow rate.
- Non-volatile Totalizer that maintains Forward Total and Reverse Total values in the user-specified volume units.
- Digital measurement values accessible via the HART communications protocol. The following process measurement values are provided: Flow rate in user-specified

engineering units, flow rate as a percent of upper range value (URV), the present milliampere and pulse output settings, and separate totalizer values for the forward flow and reverse flow. Net Total (forward flow minus reverse flow) and Grand Total (also forward flow minus reverse flow) values are also provided, along with transmitter status information. If desired, the Net Total Value can be reset in batch operations while the Grand Total continues to accumulate.

- Configurable Noise Reduction algorithm that reduces variability in noise generating applications without the need for high damping values.
- Alarms that can be configured to indicate that the flow rate is above or below a configurable alarm level, that the Totalizer has reached a specified count, or that the AutoZeroLock Detector (described below) has been triggered.
- Two Contact Inputs that can be programmed to acknowledge alarms, reset the Totalizer values, select the active URV, or lock the outputs at the Zero flow condition for maintenance purposes (manual Signal Lock).
- Two Relay Outputs that can be programmed to provide remote indication of alarm or diagnostic conditions, or flow direction.
- AutoZeroLock (AZL) Detector, which can be configured to trigger when an increase in the electrode impedance is detected, such as can occur when the pipe is empty. This feature can be used to issue an alarm or automatically lock all outputs at the zero flow condition.
- Write Protect switch that allows you to prevent undesired modification of the configuration parameters and Totalizer values.
- Optional 2-line x 16-character backlighted LCD display with keypad.

Functions

Using a HART Communicator, you can perform the following functions.

Operating Functions

- **Display measurement information**: The current value of the flow rate in engineering units (EGU), flow rate in percent of upper range value (URV), the milliampere and pulse output values, the Forward Total, Reverse Total, Net Total, and Grand Total.
- **Display the status of the transmitter**: The current operating mode, Contact Input settings, Relay Output settings, AutoZeroLock information, noise reduction, and write protection.
- **Display identity information**: Tag, message, and description plus identification data for the flowmeter, flowtube, transmitter software, and electronics.
- **Acknowledge Alarms and Diagnostic Conditions**.
- **Reset Totals**.

Configuration Functions

- **Display and modify all configurable parameters**.

Calibration Functions

- **Adjust the 4 to 20 mA output signal** (requires additional equipment).
- **Preset outputs to calibrate the control loop**.
- **Calibrate the AutoZeroLock Detector.**

HART Dynamic Variables

The HART dynamic variables in the IMT96 Transmitter cannot be mapped. They are defined as follows:

PV = Flow Rate
SV = Net Total
TV = Forward Total
QV = Reverse Total

Reference Documents

This document addresses remote communication with the transmitter for operation, configuration, and calibration of the unit using a HART Communicator. For other information regarding your IMT96 Transmitter, refer to the applicable documents listed in Table 1.

Table 1. Reference Documents

Document	Description
DP 021-367	IMT96 Magnetic Flow Transmitter
MI 020-484	HART Model 275 Communicator Messages
MI 021-120	2800 Series Flowtubes (1/10 to 12 inch sizes), Installation
MI 021-137	2800 Series Flowtubes (14 to 36 inch sizes), Installation
MI 021-141	2800 Series Sanitary Flowtubes (1/2 to 3 inch sizes), Installation
MI 021-402	IMT96 Transmitter, Installation and Wiring
MI 021-403	IMT96 Transmitter, Local Operation, Configuration, and Calibration with Integral Keypad/Display
MI 021-404	IMT96 Transmitter and 2800 Flowtube, System Maintenance
MI 021-501	PC50 Intelligent Field Device Tool - Installation
MI 021-520	PC50 Intelligent Field Device Tool with Advanced DTM Library
PL 008-747	IMT96 Magnetic Flow Transmitter
TI 27-71f	Magnetic Flowtubes, Material Selection Guide
TI 027-072	Electrical Conductivity of Process Liquids

2. HART Communicator

HART Communicator Hardware Installation

The HART Communicator can interface with the IMT96 at most wiring termination points in the 4 to 20 mA loop. You can also directly connect the HART Communicator to the IMT96 via the I/O port option.

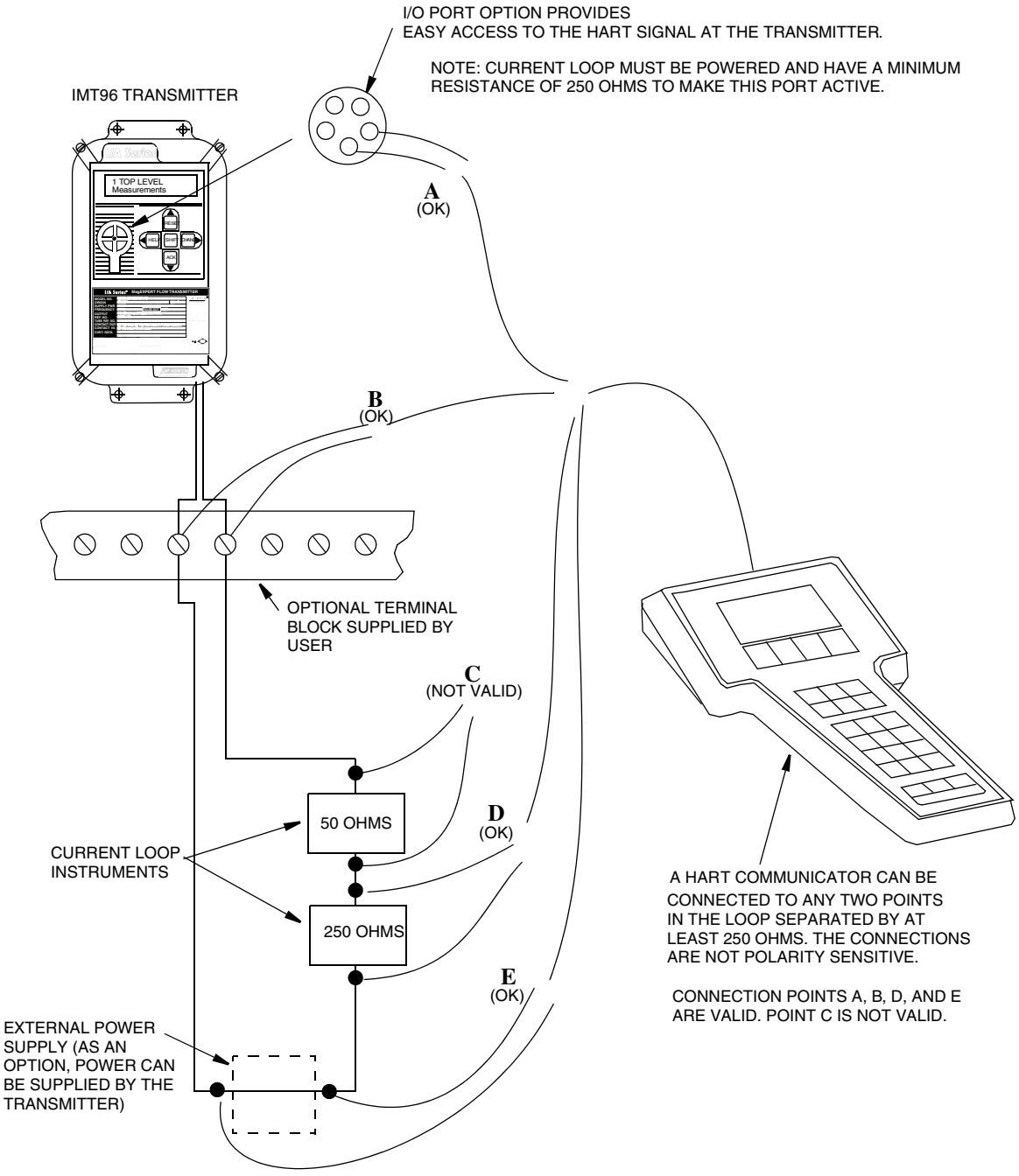

Figure 1. HART Communicator Connection Diagram

Using the HART Communicator

This section is intended for anyone who is unfamiliar with the HART Communicator.

In order to operate effectively with the IMT96, the HART Communicator must be programmed to contain the IMT96 Device Description (DD). The DD provides details of the IMT96-specific menu structure, database parameters, and commands.

Navigation Aids

The full menu structure is given in *Appendix A* in graphical form. This diagram can be useful for becoming familiar with the functions that are available on the IMT96 and how they are accessed using the HART Communicator.

The Fast-Key sequences given in *Appendix B* are used to locate a particular menu item quickly. The Fast-Key Table (Table 9) shows the shortest route from the Online menu to each configurable parameter and operation.

The Fast-Keys are useful for locating and changing individual parameters. However, this method may not be the most efficient means for changing multiple parameters. The preferred method for performing a large-scale reconfiguration of the IMT96 is to fill in the Configuration Worksheets in Tables 2 through 7, as described in the *Configuration* section. Using these tables, you can then step through the menu system to update all required items using a minimum of keystrokes.

3. Operation

This chapter describes the procedures that are used to display measurement values of the transmitter, determine the status of the unit, acknowledge alarms and diagnostic conditions, and reset the Totals values.

When the HART Communicator is connected to an IMT96 and powered on, the Online menu is displayed. The Online menu is shown in abbreviated form in Figure 2 and is also shown in the previous chapter. The Online menu shows the values of flow rate, percent of range, milliampere output setting, and current Upper Range Value (URV). All other menus are accessed from the Online menu. The parts of the menu structure that are used during normal operation are shown in bold print in Figure 2.

To view other process values (such as Totals) or to determine the status of the IMT96, press the **1** key to enter the Device Setup menu. As shown below, pressing the **1** key from this menu accesses the Process Variables menu. The Totals values can then be viewed by pressing the **4** key, or the Pulse Output values can be viewed by pressing the **5** key. The Pulse Residual value is also available on the Pulse Total Info menu. This value indicates the fraction of a Total Pulse that has accumulated. The menu structure is fully depicted in graphical form in *Appendix A*.

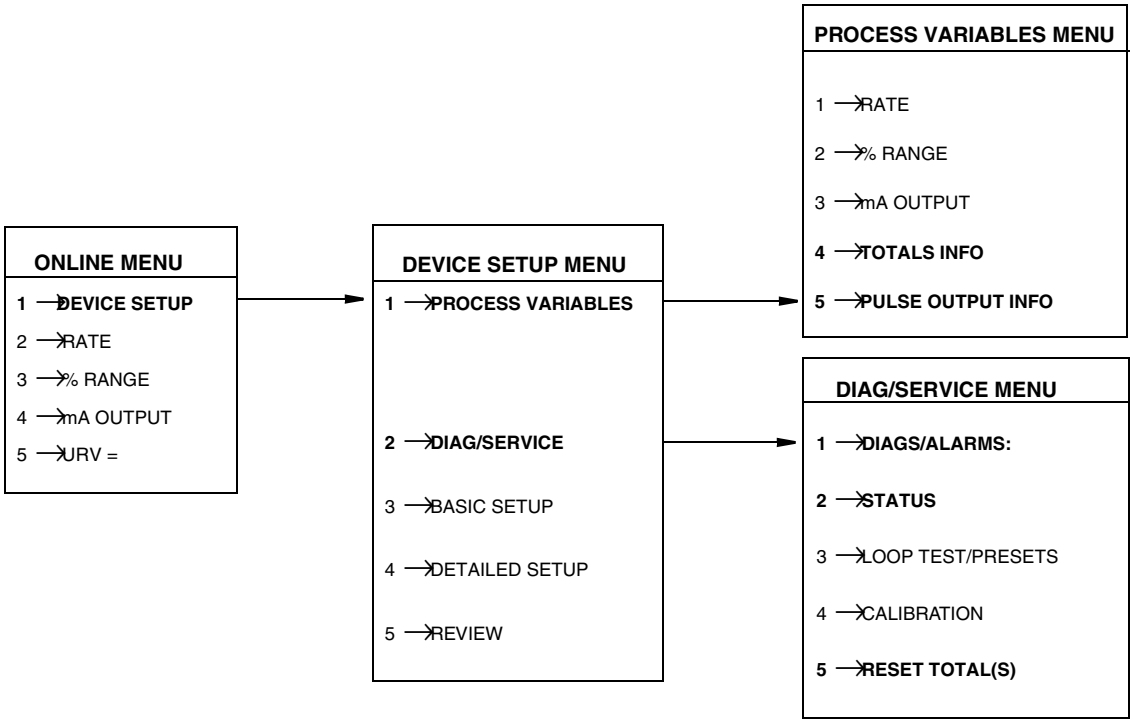

Figure 2. Menu Structure for Normal Operation

The Diag/Service menu provides the ability to determine the status of the IMT96, acknowledge alarms or diagnostic conditions, and reset the Totals values. Enter the Diag/Service menu by pressing the **2** key from the Device Setup menu.

The first item on the Diag/Service menu ("Diags/Alarms:") indicates whether any diagnostic conditions or alarms exist by displaying "EXIST" or "NONE". To reset the Totals values, select option **5** on this menu, then choose either "Reset Net/Fwd/Rev", "Reset Grand Total" or "Reset All Totals".

Additional details about the status of the transmitter can be obtained by selecting option **2** on the Diag/Service menu to enter the Status menu. The other items on the Diag/Service menu are described in the *Calibration and Presets* section.

The Status menu provides access to the following information and functions :

- **Diagnostic and Alarm conditions** detected by the IMT96. This screen shows whether any diagnostic conditions are presently active or were previously detected by the IMT96.

  Alarm Status is available by selecting option **3**. This indicates whether any rate, totalizer, or AutoZeroLock detector alarms are currently active or have been detected.

  This menu also provides selections for acknowledging alarms and diagnostic conditions.

- **Transmitter Status**. This screen shows the present transmitter mode (Online vs. Offline). The transmitter mode is shown as Offline whenever the IMT96 optional keypad is being used to perform configuration, calibration, or a preset of an output value. The present Write Protect status of the unit is also displayed. In addition, the status of the AutoZeroLock Detector is listed as Off (disabled), Empty, Not Empty, or Needs Cal (refer to the *Calibration* section).

- **Present URV Info**. This screen provides details of the Upper Range Value (URV) which is currently active. This value can change based upon the configured Flow Mode.

- **Contacts and Relays**. This screen summarizes the "Status" and "State" of the Contact Inputs and Relay Outputs. The "Status" indication can be Off (disabled), Inactive, or an indication that the configured function for the Contact Input or Relay Output is presently active. The "State" information tells whether each Contact Input or Relay Output is currently Open or Closed.

- **Output Owners**. This screen details the transmitter function which is presently controlling each of the outputs (the digital, milliampere and pulse outputs). Depending upon the present operating conditions and your configuration, each output may be controlled by a diagnostic or alarm condition, an automatic (AutoZeroLock) or manual (Signal Lock) forced-zero setting, a manual preset value, or the live process readings. Refer to *Output Owner Priority Structure* on page 8 for details regarding the priority of output ownership.

  The Output Owners screen also indicates whether AutoZeroLock and Signal Lock are disabled, inactive, or active.

Output Owner Priority Structure

The IMT96 provides digital measurement values, a milliampere output, and a pulse output. Each of these output signals usually reflects the live process measurement. However, under special circumstances, a higher priority "owner" can control these outputs.

For example, the AutoZeroLock Detector or the manual Signal Lock function can lock all of the outputs to the Zero flow condition. Alternately, you can manually preset (or override) each of the outputs. Similarly, diagnostic and alarm conditions can cause the milliampere and pulse outputs to be forced to the configured "failure" setting.

In addition, the milliampere and pulse outputs are forced to the Zero flow condition when the transmitter is taken offline for configuration using the optional keypad of the IMT96. Also, the milliampere output is frozen at 4.0 mA if the transmitter is configured for multi-drop operation of the HART communications output.

The following list summarizes the priority structure that determines ownership of the transmitter outputs. The highest priority functions are listed first.

- HART Multi-drop Operation (milliampere output only)
- Signal Lock or AutoZeroLock (all outputs)
- Offline condition (milliampere and pulse outputs)
- Manual Presets (all outputs)
- Diagnostic conditions (milliampere and pulse outputs)
- Alarm conditions (milliampere and pulse outputs)
- Live process conditions (all outputs)

4. Configuration

This chapter provides configuration worksheets and parameter descriptions that allow you to customize the IMT96 to suit your application. The configuration worksheets show the factory settings of all parameters and include cross-references to the *Parameter Descriptions* section of this chapter.

If you are familiar with the IMT96, refer to the Configuration Worksheets in the *Basic Setup* and *Detailed Setup* sections to find parameters that you may need to change for your application. Then use the parameter descriptions as a reference guide for determining the details of your configuration.

If you are not familiar with the IMT96, read this entire chapter to gain an understanding of the options that are available in the IMT96. Then refer to the Configuration Worksheets in the *Basic Setup* and *Detailed Setup* sections to fill in the details of your configuration.

Configuration Menu Structure

The configuration menus of the HART Communicator are divided into Basic Setup and Detailed Setup. The Basic Setup menus contain the most commonly used IMT96 parameters, and may include all of the options required in your application. Alternately, the Detailed Setup menu can be used to perform complete configuration of the IMT96. The path to the configuration menus is illustrated in Figure 3, with references to the Configuration Worksheet Tables for Basic Setup and Detailed Setup. The parts of the menu structure that are used during configuration are shown in bold print in Figure 3.

The Review menu permits viewing of the current configuration in read-only mode. This menu is subdivided into Sensor Review, Inputs Review, Outputs Review and Device Info Review for simplified access to the desired parameters.

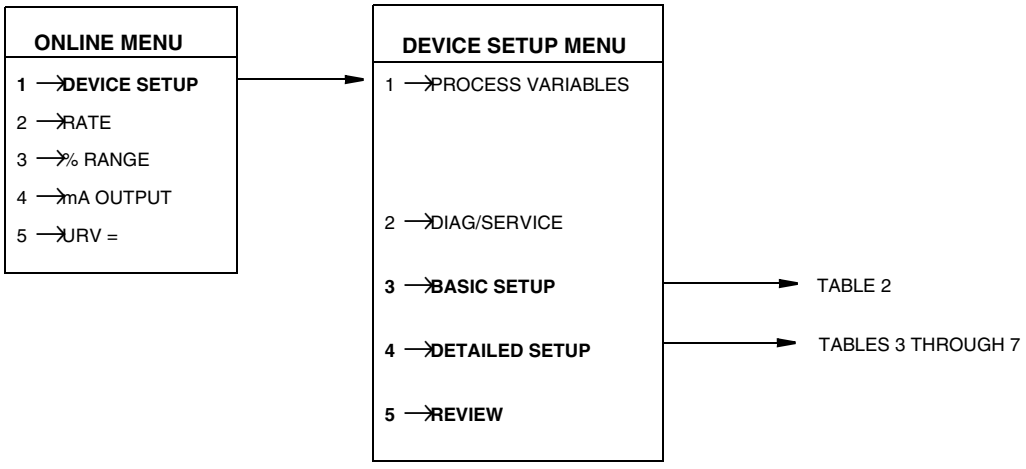

Figure 3. Configuration Menu Structure

Many configurable parameters are available from more than one location in the menu structure. This feature minimizes the number of keystrokes that are required to configure the IMT96. Each of the menu nodes with the same label is equivalent and refers to the same configurable parameter.

The operating configuration of the IMT96 is not altered until you choose to send the data to the transmitter. It is not necessary to send each modified parameter separately to the IMT96. Instead, you can complete an entire reconfiguration process, then send the data in a single step. In some instances this is required, since the IMT96 rejects attempts to establish an inconsistent configuration. For example, if your flow mode is set to UniDirectional MultiRange, the IMT96 requires that both Contact Input functions be set to Multirange Select. Prior to sending the "partial" flow mode selection, you must also configure the Contact Input functions. Additional information regarding parameter selections that interact is included in "Parameter Descriptions" on page 18.

The IMT96 includes a Write Protect feature that is controlled by a switch on the electronics module. When this function is enabled, the IMT96 rejects any attempt to change the database configuration. Refer to MI 021-402 for details on the use of the Write Protect switch.

Basic Setup

The Basic Setup menu is shown in tabular form in the configuration worksheet in Table 2. The table indicates the default value for each parameter. Entries in the column headed "Ref" provide a cross-reference to the appropriate portion of the "Parameter Descriptions" section beginning on page 18. Menu items that refer to configurable parameters are shown in bold print in Table 2.

Basic Setup is usually sufficient for configuring a typical IMT96 application, which only requires simple rate indication with an analog output. The Basic Setup menu is accessed by pressing the fast-key sequence **1, 3** from the Online menu.

Detailed Setup

The Detailed Setup menu provides access to all of the configurable IMT96 parameters. Tables 3 through 7 are configuration worksheets for use in determining any Detailed Setup parameters that may need to be changed. Entries in the column headed "Ref" provide a cross-reference to the appropriate portion of the *Parameter Descriptions* section. Menu items that refer to configurable parameters are shown in bold print in Tables 3 through 7.

The following list categorizes the configuration options that are available via the Detailed Setup menu, with references to an applicable Configuration Worksheet Table.

- Meter Identity (Tag, Message, Descriptor and Date): Table 7
- Flow Mode and Range Values: Table 3
- Flowmeter Info (AC Line Frequency): Table 3
- Flowtube Info (Meter Factor, Tube Direction): Table 3
- Totalizer: Table 6
- Pulse Total Output: Table 6
- Pulse Rate Output: Table 6

- Alarms: Table 4
- Contact Inputs: Table 3
- Relay Outputs: Table 3
- AutoZeroLock (AZL): Table 4
- Local Display: Table 5

Table 2. Configuration Worksheet for Basic Setup (Fast-Key Sequence from the Online Menu: 1, 3)

Basic Setup Menu	First Submenu Level	Second Submenu Level	Default Value	Ref	User's Value
1 →**Tag**			(spaces)	E1	
2 →Flow Mode + Ranges	1 →**Flow Mode**		UniDir Single	A1	
	2 →Rate Display Setup	**1 →Rate Units**	GPM	A2	
		2 →Custom Rate Units	GPM	A3	
		3 →Custom Rate Factor	1.0000	A3	
		4 →Rate Format	####.##	C1	
		5 →Display Damping	3.0 seconds	C2	
	3 →Rate Range Values	**1 →Primary URV**	100	A4	
		2 →Flow Mode	UniDir Single	A1	
		3 →URV2 Value	200	A4	
		4 →URV3 Value	300	A4	
	4 →Contact Inputs	**1 →CI1 Function**	Off	A5	
		2 →CI1 Operation	Normally Open	A5	
		3 →CI2 Function	Off	A5	
		4 →CI2 Operation	Normally Open	A5	
	5 →Relay Outputs	**1 →RO1 Function**	Off	D6	
		2 →RO1 Operation	Normally Open	D6	
		3 →RO1 Alarm	High Rate	D6	
		4 →RO1 Suppress	No	D6	
		5 →RO2 Function	Off	D6	
		6 →RO2 Operation	Normally Open	D6	
		7 →RO2 Alarm	Low Rate	D6	
		8 →RO2 Suppress	No	D6	
3 →Flowmeter Info	1 →Xmtr Model Code		(Per Sales Order)	A6	(Read Only)
	2 →Xmtr Serial Number		(By Factory)	A6	(Read Only)
	3 →**Line Frequency**		60 Hertz	A6	
4 →Flowtube Info	1 →**Meter Factor**		12.000	A7	
	2 →**Tube Model Code**		TUBEMS	A7	
	3 →**Tube Serial Number**		TUBES/N	A7	
	4 →**Flowtube Direction**		UniDir Positive	A7	
5 →Meter Identity	1 →**Tag**		(spaces)	E1	
	2 →**Descriptor**		(spaces)	E2	
	3 →**Message**		(spaces)	E3	
	4 →**Date**		(Date of Calib)	E4	
	5 →Revisions	1 →Universal rev	(By Factory)	E5	(Read Only)
		2 →Fld dev rev	(By Factory)	E6	(Read Only)
		3 →Software rev	(By Factory)	E7	(Read Only)
		4 →Software release	(By Factory)	E7	(Read Only)
		5 →Hardware rev	(By Factory)	E8	(Read Only)

Table 3. Configuration Worksheet for Detailed Setup/System Setup (Fast-Key Sequence from the Online Menu: 1,4,1)

System Setup Menu	First Submenu Level	Second Submenu Level	Default Value	Ref	User's Value
1 →Flow Mode + Ranges	1 →**Flow Mode**		UniDir Single	A1	
	2 →Rate Display Setup	1 →**Rate Units**	GPM	A2	
		2 →**Custom Rate Units**	GPM	A3	
		3 →**Custom Rate Factor**	1.0000	A3	
		4 →**Rate Format**	####.##	C1	
		5 →**Display Damping**	3.0 seconds	C2	
	3 →Rate Range Values	1 →**Primary URV**	100	A4	
		2 →**Flow Mode**	UniDir Single	A1	
		3 →**URV2 Value**	200	A4	
		4 →**URV3 Value**	300	A4	
	4 →Contact Inputs	1 →**CI1 Function**	Off	A5	
		2 →**CI1 Operation**	Normally Open	A5	
		3 →**CI2 Function**	Off	A5	
		4 →**CI2 Operation**	Normally Open	A5	
	5 →Relay Outputs	1 →**RO1 Function**	Off	D6	
		2 →**RO1 Operation**	Normally Open	D6	
		3 →**RO1 Alarm**	High Rate	D6	
		4 →**RO1 Suppress**	No	D6	
		5 →**RO2 Function**	Off	D6	
		6 →**RO2 Operation**	Normally Open	D6	
		7 →**RO2 Alarm**	Low Rate	D6	
		8 →**RO2 Suppress**	No	D6	
2 →Contact Inputs	1 →**CI1 Function**		Off	A5	
	2 →**CI1 Operation**		Normally Open	A5	
	3 →**CI2 Function**		Off	A5	
	4 →**CI2 Operation**		Normally Open	A5	
3 →Relay Outputs	1 →**RO1 Function**		Off	D6	
	2 →**RO1 Operation**		Normally Open	D6	
	3 →**RO1 Alarm**		High Rate	D6	
	4 →**RO1 Suppress**		No	D6	
	5 →**RO2 Function**		Off	D6	
	6 →**RO2 Operation**		Normally Open	D6	
	7 →**RO2 Alarm**		Low Rate	D6	
	8 →**RO2 Suppress**		No	D6	
4 →Flowmeter Info	1 →Xmtr Model Code		(Per Sales Order)	A6	(Read Only)
	2 →Xmtr Serial Number		(By Factory)	A6	(Read Only)
	3 →**Line Frequency**		60 Hertz	A6	
5 →Flowtube Info	1 →**Meter Factor**		12.000	A7	
	2 →**Tube Model Code**		TUBEMS	A7	
	3 →**Tube Serial Number**		TUBES/N	A7	
	4 →**Flowtube Direction**		Unidir Positive	A7	

Table 4. Configuration Worksheet for Detailed Setup/Signal Processing (Fast-Key Sequence from the Online Menu:1,4,2)

Signal Processing Menu	First Submenu Level	Second Submenu Level	Default Value	Ref	User's Value
1 →Alarm Setup	1 →**Alarming**		Off	B3	
	2 →**Alarm Clearing**		Auto ACK	B3	
	3 →Flow Alarms	1 →**Hi Rate**	Disabled	B3	
		2 →**Hi Setpt**	100.0	B3	
		3 →**Hi Deadband**	1.0	B3	
		4 →**Lo Rate**	Disabled	B3	
		5 →**Lo Setpt**	1.0	B3	
		6 →**Lo Deadband**	0.5	B3	
	4 →Total Alarms	1 →**Tot1**	Disabled	B3	
		2 →**Tot1 Setpt**	100,000	B3	
		3 →**Tot2**	Disabled	B3	
		4 →**Tot2 Setpt**	1,000,000	B3	
	5 →**AZL Alarms**		Disabled	B3	
	6 →**Alarm Out Effect**		No Effect	B3	
	7 →**Alarm Display**		Don't Blink	C5	
2 →**Noise Reduction**			On	B2	
3 →**mA/Pulse Damping**			3.0 seconds	B1	
4 →**Display Damping**			3.0 seconds	C2	
5 →AutoZeroLock Setup	1 →**AZL Enable**		Off	B4	
	2 →**AZL Out Effect**		None	B4	
	3 →**AZL Alarms**		Off	B3	
	4 →**AZL Cal**		(Calibration)		

Table 5. Configuration Worksheet for Detailed Setup/Local Display (Fast-Key Sequence from the Online Menu: 1,4,3)

Local Display Menu	First Submenu Level	Default Value	Ref	User's Value
1 →Rate Display Setup	1 →**Rate Units**	GPM	A2	
	2 →**Custom Rate Units**	GPM	A3	
	3 →**Custom Rate Factor**	1.0000	A3	
	4 →**Rate Format**	####.##	C1	
	5 →**Display Damping**	3.0 seconds	C2	
2 →Pulse Total Setup	1 →**Total Units**	GAL	D2	
	2 →**Custom Total Units**	GAL	D2	
	3 →**Custom Total Factor**	1.0000	D2	
	4 →**Max Tot Pulse**	10 Hz	D5	
	5 →**Net Total Format**	#######.	D3	
	6 →**Grand Total Format**	#########.	D4	
3 →Screen Setup	1 →**Default Display**	Rate EGU	C3	
	2 →**Dual Display**	Off	C4	
	3 →**Dual: Line 1**	Rate EGU	C4	
	4 →**Dual: Line 2**	Rate EGU	C4	
4 →**Alarm Display**		Don't Blink	C5	
5 →**Diag Display**		Blink	C6	

Table 6. Configuration Worksheet for Detailed Setup/Outputs (Fast-Key Sequence from the Online Menu: 1,4,4)

Outputs Menu	First Submenu Level	Second Submenu Level	Third Submenu Level	Default Value	Ref	User's Value
1 →Analog Output	1 →Flow Mode + Ranges	1 →**Flow Mode**		UniDir Single	A1	
		2 →Rate Display Setup	1 →**Rate Units**	GPM	A2	
			2 →**Custom Rate Units**	GPM	A3	
			3 →**Custom Rate Factor**	1.0000	A3	
			4 →**Rate Format**	####.##	C1	
			5 →**Display Damping**	3.0 seconds	C2	
		3 →Rate Range Values	1 →**Primary URV**	100	A4	
			2 →**Flow Mode**	UniDir Single	A1	
			3 →**URV2 Value**	200	A4	
			4 →**URV3 Value**	300	A4	
		4 →Contact Inputs	1 →**CI1 Function**	Off	A5	
			2 →**CI1 Operation**	Normally Open	A5	
			3 →**CI2 Function**	Off	A5	
			4 →**CI2 Operation**	Normally Open	A5	
		5 →Relay Outputs	1 →**RO1 Function**	Off	D6	
			2 →**RO1 Operation**	Normally Open	D6	
			3 →**RO1 Alarm**	High Rate	D6	
			4 →**RO1 Suppress**	No	D6	
			5 →**RO2 Function**	Off	D6	
			6 →**RO2 Operation**	Normally Open	D6	
			7 →**RO2 Alarm**	Low Rate	D6	
			8 →**RO2 Suppress**	No	D6	
	2 →**mA/Pulse Damping**			3.0 seconds	B1	
	3 →**Noise Reduction**			On	B2	
	4 →**Alarm Out Effect**			No Effect	B3	
	5 →**Diag Out Effect**			Go Downscale	D7	
	6 →**AZL Out Effect**			None	B4	
2 →Rate + Total Setup	1 →Rate Display Setup	1 →**Rate Units**		GPM	A2	
		2 →**Custom Rate Units**		GPM	A3	
		3 →**Custom Rate Factor**		1.0000	A3	
		4 →**Rate Format**		####.##	C1	
		5 →**Display Damping**		3.0 seconds	C2	
	2 →Pulse Total Setup	1 →**Total Units**		GAL	D2	
		2 →**Custom Total Units**		GAL	D2	
		3 →**Custom Total Factor**		1.0000	D2	
		4 →**Max Tot Pulse**		10 Hz	D5	
		5 →**Net Total Format**		#######.	D3	
		6 →**Grand Total Format**		#########.	D4	
	3 →**Totalizer**			Off	D1	
	4 →**Pulse Mode**			Off	D5	
	5 →**Reset Total(s)**			(Function)		

Table 6. Configuration Worksheet for Detailed Setup/Outputs (Fast-Key Sequence from the Online Menu: 1,4,4) (Continued)

Outputs Menu	First Submenu Level	Second Submenu Level	Third Submenu Level	Default Value	Ref	User's Value
3 →Pulse Rate Setup	1 →**Pulse Mode**			Off	D5	
	2 →**Max Pulse Rate**			2 kHz	D5	
	3 →**Pulse URV**			100	D5	
	4 →**mA/Pulse Damping**			3.0 seconds	B1	
	5 →**AZL Out Effect**			None	B4	
4 →Relay Outputs	1 →**RO1 Function**			Off	D6	
	2 →**RO1 Operation**			Normally Open	D6	
	3 →**RO1 Alarm**			High Rate	D6	
	4 →**RO1 Suppress**			No	D6	
	5 →**RO2 Function**			Off	D6	
	6 →**RO2 Operation**			Normally Open	D6	
	7 →**RO2 Alarm**			Low Rate	D6	
	8 →**RO2 Suppress**			No	D6	
5 →HART Output	1 →**Poll Addr**			00	D8	
	2 →Num req preams			(By Factory)	D9	(Read Only)

Table 7. Configuration Worksheet for Detailed Setup/Meter Identity (Fast-Key Sequence from the Online Menu: 1,4,5)

Meter Identity Menu	First Submenu Level	Default Value	Ref	User's Value
1 →**Tag**		(spaces)	E1	
2 →**Descriptor**		(spaces)	E2	
3 →**Message**		(spaces)	E3	
4 →**Date**		(Date of Calib)	E4	
5 →Revisions	1 →Universal rev	(By Factory)	E5	(Read Only)
	2 →Fld dev rev	(By Factory)	E6	(Read Only)
	3 →Software rev	(By Factory)	E7	(Read Only)
	4 →Software release	(By Factory)	E7	(Read Only)
	5 →Hardware rev	(By Factory)	E8	(Read Only)

Parameter Descriptions

This section describes all of the configurable parameters in the IMT96. Many of the parameters can be configured from more than one place in the menu structure. Within this section, the parameters are divided into categories that correspond to the menu structure of the Detailed Setup portion of the menu. The categories are identified with alphabetic characters and each item in the category is numbered. The combination of a letter and a number (for example, A3) is used as a cross-reference designation in the Configuration Worksheets in Tables 2 through 7. The categories and their contents are summarized below.

- **System Parameters** (flow mode, flow rate engineering units, range values, contact inputs, flowmeter and flowtube information)

- **Signal Processing Parameters** (milliampere and pulse rate damping, noise reduction, alarming, and AutoZeroLock setup)
- **Local Display Parameters** (rate display setup, display damping, screen setup, alarm and diagnostic display indications)
- **Output Parameters** (totalizer and pulse output setup, relay outputs, HART setup, diagnostic effect on outputs)
- **Meter Identity Parameters** (tag, descriptor, message, and date)

Throughout the remainder of this section, references to other parameter descriptions are given in the form "(ref: **A1**)". You can find additional information about the related parameter (Flow Mode, in this example) in the referenced section of "Parameter Descriptions".

— NOTE

Parameter names are printed in italics in this section. Bold print identifies the place where the parameter is described. Default values are also shown in bold print.

System Parameters

(A1) Flow Mode Parameter

Specifies the configured mode for measuring flow. The default setting for the ***Flow Mode*** parameter is **UniDirectional Single Range**. Available selections are:

- **UniDirectional Single Range**, which specifies unidirectional flow with a single upper range value (ref: **A4**).
- **UniDirectional MultiRange**, which specifies unidirectional flow with multiple URVs (ref: **A4**) selected by the Contact Inputs (ref: **A5**).
- **BiDirectional Dual Range**, which specifies two-way flow with 4 to 20 mA indicating the rate and an optional Relay Output (ref: **D6**) indicating flow direction. The upper range value for forward flow is parameter *URV*. The upper range value for reverse flow is parameter *URV2* (ref: **A4**). The relationship between the milliampere output and the flow rate in BiDirectional Dual Range mode is illustrated in Figure 4.

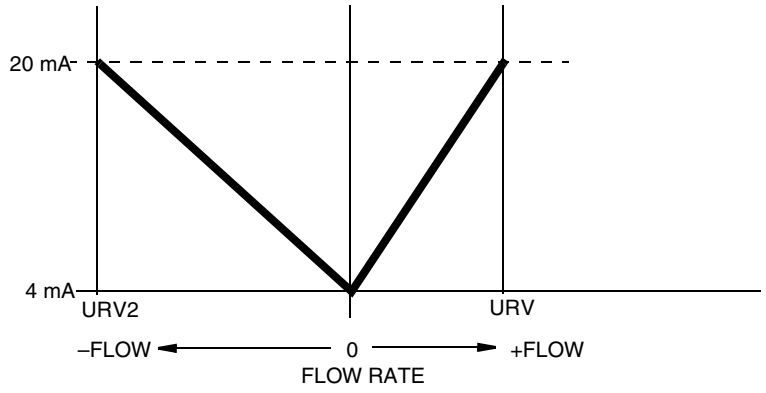

Figure 4. BiDirectional Dual Range Milliampere Output

- **BiDirectional Split Range**, which specifies two-way flow with 4 to 12 mA for reverse flow (URV2 to 0) and 12 to 20 mA for forward flow (0 to URV). An optional Relay Output (ref: **D6**) can be used to indicate flow direction. 4 mA indicates reverse flow at the URV2 rate, 12 mA is zero flow, and 20 mA indicates positive flow at the URV rate (ref: **A4**). The relationship between the milliampere output and the flow rate in BiDirectional Split Range mode is illustrated in Figure 5.

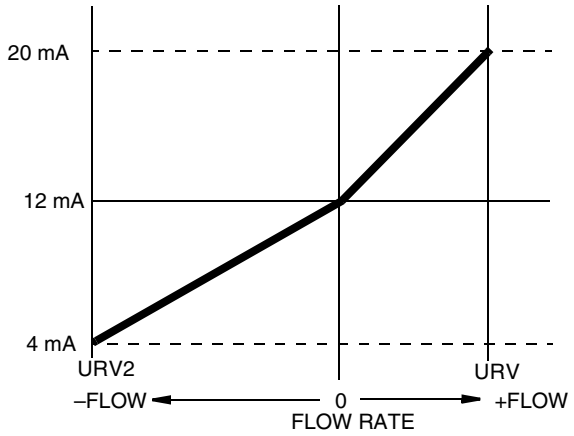

Figure 5. BiDirectional Split Range Milliampere Output

The *Flow Mode* must agree with *Flowtube Direction* (ref: **A7**). If you pick UniDirectional Single Range or MultiRange for *Flow Mode*, you must pick UniDirectional Forward or UniDirectional Reverse for *Flowtube Direction*. If you pick a BiDirectional Flow Mode, you must pick BiDirectional Positive or BiDirectional Reverse for *Flowtube Direction*.

If you pick UniDirectional MultiRange for *Flow Mode*, you must supply two Contact Inputs to the transmitter, and program both CI1 and CI2 for MultiRange (ref: **A5**). You must also program values for the primary *URV*, *URV2*, and *URV3* (ref: **A4**). The settings of the Contact Inputs indicate which of the three upper range values is active at any time. The active upper range value is used to scale the analog output. In this mode, at least one Contact Input must be in the active state at all times. Otherwise, the transmitter indicates an "Invalid MultiRange" diagnostic condition and the outputs are set to the configured upscale or downscale failure condition (ref: **D7**). The active URV is determined by the states of the Contact Inputs as shown in Table 8.

Table 8. URV Selection in UniDirectional MultiRange Flow Mode

Contact Input 1	Contact Input 2	Active URV
Active	Inactive	URV
Inactive	Active	URV2
Active	Active	URV3
Inactive	Inactive	INVALID

If you pick BiDirectional Dual Range or Split Range for *Flow Mode*, you should not enable the Pulse Output (ref: **D5**) since the Pulse Output is UniDirectional.

If you pick BiDirectional Dual for *Flow Mode*, you may want to program a Relay Output for flow direction (ref: **D6**). This is the only way to indicate remotely whether the analog output represents forward or reverse flow in this mode.

*(**A2**) **Rate Units** Parameter*

The ***Rate Units*** parameter indicates the engineering units label (EGUs) associated with the flow rate measurement. Available selections are GPM, GPH, GPD, LPM, LPH, LPD and CUSTOM. If CUSTOM is specified, the *Custom Rate Units* and *Custom Rate Factor* settings must be configured as desired (ref: **A3**). The default value for *Rate Units* is **GPM**.

*(**A3**) **Custom Rate Units** and **Custom Rate Factor** Parameters*

The ***Custom Rate Units*** label (EGUs) and ***Custom Rate Factor*** conversion factor are only relevant when the *Rate Units* selection (ref: **A2**) is CUSTOM.

The *Custom Rate Units* parameter can be up to 6 alphanumeric characters. You must also enter the *Custom Rate Factor* as the conversion factor that gives the equivalent custom engineering units to 1 GPM. For example, if you want to measure in cubic feet per minute, the *Custom Rate Factor* would be 0.13368, because 0.13368 cubic feet per minute equals 1 GPM. The default value for the *Custom Rate Units* and the *Custom Rate Factor* is **1.0 GPM**.

*(**A4**) Range Value Parameters (**URV, URV2, URV3**)*

The primary upper range value, parameter ***URV,*** specifies the upper range value in the configured rate units (ref: **A2**) for forward flow in all flow modes (ref: **A1**) except for UniDirectional MultiRange, where it is the URV for the 1st range. The default value is **100**.

Parameter ***URV2*** specifies the upper range value for reverse flow in the BiDirectional Dual and BiDirectional Split range flow modes, and the URV for the 2nd range in UniDirectional MultiRange flow mode. The default value is **200**.

Parameter ***URV3*** specifies the upper range value for the 3rd range in UniDirectional MultiRange flow mode. The default value is **300**.

The *Rate Format* setting (ref: **C1**) and the upper range limit of the flowtube restrict the value that can be entered for each URV value.

*(**A5**) Contact Input Parameters*

These parameters describe the function and operation of the two Contact Inputs, CI1 and CI2. ***CI1 Function*** and ***CI2 Function*** specify the function performed by Contact Input 1 and Contact Input 2 when the contact enters the active state. Available selections are Off, Acknowledge Alarms, Reset Net Total, Reset Grand Total, Reset All Totals, MultiRange Select, or Signal Lock. The Signal Lock function provides a means of manually locking the digital measurement values, the milliampere output, and the pulse output to the Zero flow condition. The default value for both the *CI1 Function* and the *CI2 Function* parameter is **Off**.

— NOTE

When the Write Protect switch of the IMT96 is in the "Enable" position, the only means of resetting the Totalizer values is to use an externally wired Contact Input configured to perform this function. Totalizer Reset is disabled via the HART Communicator and the IMT96 local keypad when the unit is Write Protected. Refer to MI 021-402 for details on the use of the Write Protect switch.

CI1 Operation and ***CI2 Operation*** specify the inactive state for Contact Input 1 and Contact Input 2 (normally open vs. normally closed). The default value for both parameters is **Normally Open**, indicating that each contact is inactive when open and active when closed. When a contact enters its active state, the configured function is enabled (for example, causing the IMT96 to enter the Signal Lock mode).

If you pick Unidirectional MultiRange for *Flow Mode* (ref: **A1**), you must supply two Contact Inputs to the transmitter and configure both *CI1 Function* and *CI2 Function* for MultiRange Select. You must also specify the values for the parameters *URV*, *URV2*, and *URV3* (ref: **A4**). The settings of the contacts determine which URV is used to scale the analog output as detailed in the *Flow Mode* parameter description (ref: **A1**). In this Flow Mode, at least one Contact Input must be in the active state at all times or else the IMT96 indicates a diagnostic error condition.

*(**A6**) Flowmeter Information*

The factory establishes the values of the read-only ***Xmtr Model Code*** and ***Xmtr Serial Number*** parameters at the time of manufacture. You cannot change these parameters.

The ***Line Frequency*** parameter specifies the local ac power frequency. This parameter should be properly configured even if you are using a dc powered IMT96. Select the local ac power frequency to ensure optimal performance. The available selections are 50 Hz and 60 Hz. The default value is **60 Hz**.

*(**A7**) Flowtube Information*

The ***Tube Model Code*** and ***Tube Serial Number*** parameters are reference identifiers that you configure. They do not control the operation of the IMT96. The default value for the *Tube Model Code* is **TUBEMS**. The default value for the *Tube Serial Number* is **TUBES/N**.

The ***Flowtube Direction*** parameter indicates the direction of positive flow and whether flow is UniDirectional or BiDirectional. The available selections are UniDirectional Positive, Unidirectional Reverse, BiDirectional Positive and BiDirectional Reverse. If the direction of positive flow matches the arrow on the flowtube, select Positive. Otherwise, select Reverse. If flow is to be measured in a single direction, select UniDirectional. Otherwise, select BiDirectional.

— NOTE

In some installations, the flowtube is installed with the arrow pointing upstream (opposite the positive flow direction), and the flowtube coil-drive wiring to the transmitter is reversed. This installation is perfectly acceptable. In this situation, select Positive for the Flowtube Direction parameter. Refer to MI 021-402, for details on flowtube wiring.

The performance of the flowtube is identical in either direction. The flowtube can be installed in the reverse direction if it provides better access for the flowtube wiring. Ensure that the *Flowtube Direction* parameter matches the installation.

The *Flowtube Direction* setting must agree with the *Flow Mode* setting (ref: **A1**). For example, if you pick UniDirectional Single Range or UniDirectional MultiRange for *Flow Mode*, you must pick UniDirectional Forward or UniDirectional Reverse for *Flowtube Direction*.

The default *Flowtube Direction* is **UniDirectional Positive**.

The ***Meter Factor*** parameter is a calibration value that must be entered by you. The default value is **25.00**. To determine the proper value, find the "IMT96 Cal Fact" that is stamped on the flowtube data label and enter that value for the *Meter Factor*.

NOTE

If the flowtube was previously connected to an E96 Transmitter and the data plate has a "Cal Factor" instead of an "IMT96 Cal Fact", refer to MI 021-412 to determine the Meter Factor.

Signal Processing Parameters

(B1) mA/Pulse Damping Parameter

The ***mA/Pulse Damping*** parameter specifies the damping time that is to be applied to the analog (milliamp) and pulse rate outputs. The default value is **3.0 seconds**.

The *Noise Reduction* parameter (ref: **B2**) also affects the digital output indirectly if it is enabled (On), since the *mA/Pulse Damping* time determines the timing of the noise reduction algorithm, which applies to all outputs.

(B2) Noise Reduction Parameter

The ***Noise Reduction*** feature slows the initial output response to a change. See Figure 6. *Noise Reduction* was designed to quiet the output flow signals with minimum impact on the transmitter's ability to respond to rapid flow rate changes. Specify *Noise Reduction* as On or Off. The amount of *Noise Reduction* applied to the outputs changes with the *mA/Pulse Damping* setting (ref: **B1**).

If the *Noise Reduction* parameter is enabled (On), it also affects the digital output indirectly since the *mA/Pulse Damping* time determines the timing of the noise reduction algorithm. Thus, noise reduction applies to the 4 to 20 mA, Pulse Rate, Display, and Digital outputs.

The default setting for the *Noise Reduction* parameter is enabled (**On**). This is the recommended setting for almost all applications. If you want to increase the transmitter's speed of response, leave *Noise Reduction* on and reduce the *mA/Pulse Damping* value.

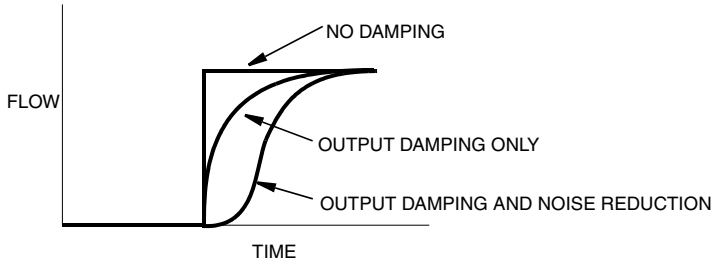

Figure 6. Noise Reduction

(B3) Alarming Parameters

The Alarm feature allows you to specify process conditions of interest (such as high flow rate) and actions that the IMT96 should take when the condition occurs (such as closing a Relay Output).

The ***Alarming*** parameter must be configured to On in order to use Alarming. The default setting is **Off**.

Each type of alarm condition is enabled separately. No action will occur unless the alarm condition is enabled. The following alarms are configurable.

- ***Hi Rate***: Triggers an alarm when the flow rate exceeds the *Hi Setpt* parameter value. The default value for the *Hi Setpt* is **100.0,** with the EGUs specified by the *Rate Units* parameter (ref: **A2**). Once it is triggered, the alarm condition continues to exist until the flow rate falls below (*Hi Setpt – Hi Deadband*). The default value for *Hi Deadband* is **1.0**.

  Enable the *Hi Rate* parameter to use this alarm. The default setting is **disabled**.

- ***Lo Rate***: Triggers an alarm when the flow rate falls below the *Lo Setpt* parameter value. The default value for the *Lo Setpt* is **1.0**, with the EGUs specified by the *Rate Units* parameter (ref: **A2**). Once it is triggered, the alarm condition continues to exist until the flow rate rises above (*Lo Setpt* + *Lo Deadband*). The default value for *Lo Deadband* is **0.5**.

  Enable the *Lo Rate* parameter to use this alarm. The default setting is **disabled**.

- ***Tot1*** and ***Tot2*** (Forward Total Alarms): Triggers an alarm when the Forward Total value exceeds the configured setting. Two Total Alarms, designated *Tot1* and *Tot2,* are available. Enable the *Tot1* and/or *Tot2* parameter to use these alarms. The default setting for each total alarm is **disabled**.

  The parameters ***Tot1 Setpt*** and ***Tot2 Setpt*** specify the Forward Total value that triggers an alarm condition. The default value for *Tot1 Setpt* is **100,000**, and the default value for *Tot2 Setpt* is **1,000,000**. The EGUs are specified by the *Total Units* parameter (ref: **D2**). Once it is triggered, the alarm condition continues to exist until the alarm is disabled, the Forward Total is reset, or the total value rolls over. Refer to the *Calibration and Presets* chapter for instructions on resetting totals.

  In order to use this alarm, the Totalizer must be enabled (ref: **D1**).

- ***AZL*** (AutoZeroLock Alarm): Triggers an alarm when the AutoZeroLock circuitry detects high electrode impedance. To use this alarm, the AutoZeroLock detector must

be enabled and calibrated, and the *AZL Alarms* parameter must be enabled. The default setting is **disabled**. Before using this alarm, refer to the AutoZeroLock parameter description (ref: **B4**).

The Alarm subsystem can be configured to affect the milliampere and pulse rate outputs by driving the outputs to the underrange or overrange setting, or to have no effect on the outputs. The default setting for the ***Alarm Out Effect*** parameter is **NoEffect**.

The optional display can be configured to blink (or not) when an alarm condition occurs (ref: **C5**). The default setting for the ***Alarm Display*** parameter is **Don't Blink**. Regardless of the *Alarm Display* setting, an active alarm causes an icon to be illuminated on the optional IMT96 display panel.

The Alarm subsystem can be configured to acknowledge an alarm automatically when the alarm condition no longer exists, or to require a manual acknowledgment. Once an alarm condition is no longer active and has been acknowledged (either manually or automatically), all outputs return to their normal conditions. The default setting for the ***Alarm Clearing*** parameter is **Auto ACK**. Alarms can be acknowledged via the optional keypad or by using the HART Communicator (as specified in the section titled *Operation*). A Contact Input can also be configured to acknowledge alarms (ref: **A5**).

A Relay Output can be configured to become active when the specified type of alarm condition occurs. In addition, the Suppress feature (which applies only to the Relay Outputs) can cause a relay to revert to the inactive state when the alarm is acknowledged and the alarm condition still exists. For example, you may have a Relay Output that is configured for High Rate Alarms and is connected to an alarm horn. When a High Rate Alarm occurs, the horn can be silenced via an Alarm Acknowledge if the Suppress feature is on. The horn does not sound again unless the flow rate falls below the alarm level and subsequently rises above that level. Refer to the Relay Output parameter description for additional details (ref: **D6**).

(B4) *AutoZeroLock Detector*

The AutoZeroLock Detector can be configured to trigger when an increase in electrode impedance is detected, such as can occur when the pipe is empty. In this situation the AutoZeroLock Detector can optionally force all outputs to the Zero flow condition, generate an Alarm condition, or both.

WARNING

Do not take any action that can cause danger to personnel or damage to equipment based on the assumption that a pipe is empty or full because of an AutoZeroLock indication.

To use the AutoZeroLock Detector, configure the ***AZL Enable*** parameter to On and send the changed parameter to the IMT96. Then, calibrate the AutoZeroLock Detector according to the instructions in the *Calibration and Presets* chapter. The default setting for *AZL Enable* is **Off**.

If you want the AutoZeroLock Detector to drive all outputs to the Zero flow condition when the detector is triggered, configure the ***AZL Out Effect*** parameter to the Auto Signal Lock setting. The default setting for the *AZL Out Effect* parameter is **None**. If the detector is enabled and *AZL Out Effect* is set to None, it is typically desirable to have the AutoZeroLock Detector generate an Alarm. Refer to the next paragraph. Alternately, both effects can be enabled.

The AutoZeroLock Detector can trigger an alarm condition when it is triggered. To use this feature, set the ***AZL Alarms*** parameter to enabled and ensure that the *Alarming* subsystem is enabled (ref: **B3**). The default setting for the *AZL Alarms* parameter is **disabled**.

Local Display Parameters

*(**C1) Rate Format** Parameter*

The engineering units for the flow rate value are determined by the *Rate Units* parameter (ref: **A2**). The format of the values displayed on the optional display and the HART Communicator are determined by the ***Rate Format*** parameter. The available options for this parameter are listed below.

- ###000. (display in thousands of units),
- ####00. (display in hundreds of units),
- #####0. (display in tens of units),
- ######. (display in single units),
- #####.# (display in tenths of units),
- ####.## (display in hundredths of units),
- ###.### (display in thousandths of units), and
- ##.#### (display in ten-thousandths of units).

Select a display setting that provides the desired precision without yielding excessive "jitter" in the displayed value due to process noise. The displayed value can also be damped to reduce flickering of the least significant digits (ref: **C2**). The default setting for the *Rate Format* parameter is ####.##.

*(C2) **Display Damping** Parameter*

The ***Display Damping*** parameter is used to reduce flickering of the least significant digits of the displayed value. The *Rate Format* parameter can also be used to help to stabilize the displayed value (ref: **C1**). The *Display Damping* parameter can be configured to any value from 0.0 to 99.9 seconds. The default value is **3.0 seconds**.

Noise Reduction (ref:**B2**) also affects damping of the displayed value if the feature is enabled.

(C3) Screen Setup Parameters

The ***Default Display*** parameter specifies the measurement value that should be displayed when the *Measurements* menu of the IMT96 optional display is entered. The available selections for this parameter are listed below.

- RATE EGU (flow rate in engineering units)
- RATE %RANGE (flow rate in percent of range)
- FWD TOTAL (forward total)
- REV TOTAL (reverse total)
- NET TOTAL (forward total minus reverse total)

- GRAND TOTAL (forward total minus reverse total)
- DUAL DISPLAY (two simultaneous measurement values)

If Dual Display is selected, the *Dual Display* option must be enabled (ref: **C4**).

The default value for the *Default Display* parameter is **RATE EGU**.

(C4) Dual Display Parameters

The Dual Display option provides two numeric measurement values on a single screen of the IMT96 optional display. Each line is configured separately from the following list using the parameters ***Dual: Line 1*** and ***Dual: Line 2***.

- RATE EGU (flow rate in engineering units)
- RATE %RANGE (flow rate in percent of range)
- FWD TOTAL (forward total)
- REV TOTAL (reverse total)
- NET TOTAL (forward total minus reverse total)
- GRAND TOTAL (forward total minus reverse total)

The ***Dual Display*** parameter is used to include the dual display in the Measurements menu of the IMT96 optional display. If the *Default Display* parameter (ref: **C3**) is set to Dual Display, this parameter must be enabled. If you want to be able to scroll to a Dual Display as one of the Measurements options on the optional display, this parameter must be enabled. The default setting for the *Dual Display* parameter is **Off** (disabled). The default settings for both the *Dual: Line 1* and *Dual: Line 2* parameters is **RATE EGU**.

(C5) Alarm Display Parameter

The IMT96 optional display can be configured to blink (or not) when an alarm condition occurs (ref: **B3**). The default setting for the ***Alarm Display*** parameter is **Don't Blink**. Regardless of the *Alarm Display* setting, an active alarm causes an icon to be illuminated on the optional display panel.

(C6) Diag Display Parameter

The IMT96 optional display can be configured to blink (or not) when a diagnostic condition occurs. The default setting for the ***Diag Display*** parameter is **Blink**. Regardless of the *Diag Display* setting, a diagnostic condition causes an icon to be illuminated on the optional display panel.

Output Parameters

(D1) Totalizer Enable Parameter

The totalizer provides an indication of the volume of flow that has accumulated since the last time that the totalizer was reset. The totalizer provides separate indications of the quantity of Forward flow and Reverse flow. Computed values for the Net Total (Forward flow minus Reverse flow) and the Grand Total (Forward flow minus Reverse flow) are also provided. If desired, the Net

Total value can be reset in batch operations while the Grand Total continues to accumulate. The totalizer is nonvolatile; that is, the accumulated values are retained over power cycles.

To use the totalizer or the Pulse Total output (ref: **D5**), the ***Totalizer*** parameter must be enabled (On). The default setting is **Off**.

— NOTE

When the IMT96 Write Protect switch is in the "Enable" position, the only means of resetting the Totalizer values is to use an externally wired Contact Input configured to perform this function. Totalizer Reset is disabled via the HART Communicator and the IMT96 local keypad when the unit is Write Protected. Refer to MI 021-402 for details on the use of the Write Protect switch.

(D2) Total Units, Custom Total Units, and Custom Total Factor Parameters

The engineering units associated with the totalizer are configured via the ***Total Units*** parameter. The available selections are GAL (gallons), LIT (liters) and CUSTOM. The default setting is **GAL**. The *Total Units* parameter also determines the engineering units for the Pulse Total output (ref: **D5**).

If CUSTOM is specified for the *Total Units* parameter, the ***Custom Total Units*** and ***Custom Total Factor*** parameters must be configured. These parameters are only relevant when the *Total Units* are configured to CUSTOM. The units label can be up to 6 alphanumeric characters long. You must also configure the *Custom Total Factor* parameter to be the conversion factor that gives the equivalent custom engineering units for 1 Gallon. For example, if you want to measure in cubic feet, the *Custom Total Factor* is 0.13368, because 0.13368 cubic feet equals one gallon. The default value for the *Custom Total Units* and *Custom Total Factor* parameters is **1.0 GAL**.

— NOTE

Changing the totalizer units re-scales all totals to the new engineering units. Changing these parameters can change the totals to zero if the total values exceed the limit of the configured format. For example, if Net Total Format (ref: **D3**) is #####.## and the present total is 50000.0 GAL, changing Total Units from GAL to LIT causes the re-scaled total to exceed the maximum displayable value and therefore resets it to zero.

(D3) Net Total Format Parameter

The ***Net Total Format*** parameter determines the resolution of the displayed values of Forward Total, Reverse Total and Net Total. This parameter also determines the volumetric quantity that causes a Total Pulse to be generated at the Pulse Total output if the unit is configured to generate this output (ref: **D5**). A total pulse is generated whenever the least significant digit in the configured format is incremented. Thus, if the *Net Total Format* specifies that the totalizer should indicate in tenths of a gallon (by setting the *Net Total Format* parameter to ######.# and the *Total Units* parameter to GAL), one total pulse is generated for each tenth of a gallon. The following selections are available for *Net Total Format*.

- #######.E4 (totalize in ten-thousands of units),
- #######.E3 (totalize in thousands of units),

- #######.E2 (totalize in hundreds of units),
- #######.E1 (totalize in tens of units),
- #######. (totalize in single units),
- ######.# (totalize in tenths of units),
- #####.## (totalize in hundredths of units),
- ####.### (totalize in thousandths of units)

The default setting for the *Net Total Format* parameter is #######.

— NOTE

Changing the Net Total Format can change the total to zero if it would otherwise exceed the limit of the new format. For example, if Net Total Format is ######.# and the present Net Total is 123456.7, changing the Net Total Format to #####.## would exceed the capacity of the format. This would reset the Forward, Reverse and Net Totals to Zero.

*(D4) **Grand Total Format** Parameter*

The ***Grand Total Format*** parameter determines the resolution of the displayed value for Grand Total. The following selections are available for *Grand Total Format*.

- #########.E4 (totalize in ten-thousands of units),
- #########.E3 (totalize in thousands of units),
- #########.E2 (totalize in hundreds of units),
- #########.E1 (totalize in tens of units),
- #########. (totalize in single units),
- ########.# (totalize in tenths of units),
- #######.## (totalize in hundredths of units),
- ######.### (totalize in thousandths of units)

The default setting for the *Grand Total Format* parameter is #########.

— NOTE

Changing the Grand Total Format can change the total to zero if it would otherwise exceed the limit of the new format. For example, if Grand Total Format is ########.# and the present Grand Total is 12345678.9, changing the Grand Total Format to #####.## would exceed the capacity of the format. This would reset the total to zero.

(D5) Pulse Output Parameters

The Pulse Output can be configured to provide either a Pulse Total or a Pulse Rate output signal. The Pulse Total output generates a pulse each time that the configured quantity passes through the pipe. The Pulse Rate output generates a pulse train whose frequency is scaled to the Pulse URV. The available selections for the ***Pulse Mode*** parameter are Total, Rate, and Off. The default setting is **Off**.

— NOTE

The Pulse Output is UniDirectional. Therefore, it should be configured Off if you have specified BiDirectional flow (ref: **A1**).

To use the Pulse Total output, set the *Pulse Mode* parameter to Total and enable the totalizer (ref: **D1**). Then select the desired *Total Units* (ref: **D2**) and indicate the quantity per pulse via the configuration of the *Net Total Format* (ref: **D3**). Finally, configure the ***Max Tot Pulse*** parameter to indicate the maximum frequency at which the Pulse Total output can generate pulses. The choices for this parameter are 10 Hz and 100 Hz. This setting also determines the on-time for the Pulse Total output, which is 50 milliseconds for the 10 Hz setting and 5 milliseconds for the 100 Hz setting. The default value for *Max Tot Pulse* is **100 Hz**.

— NOTE

The Pulse Total output never generates pulses faster than the Max Tot Pulse rate. However, the IMT96 can keep track of a limited number of "pending" pulses. This occurs when the flow rate temporarily increments the Totalizer faster than the Max Tot Pulse rate. In this situation the HART Communicator displays the message "Pulses Lag Total". The accumulated pulses are sent to the Pulse Output when the flow rate returns to a lower value.

To use the Pulse Rate output, set the *Pulse Mode* parameter to Rate. Then set the ***Pulse URV*** parameter to the flow rate value (in EGUs) that generates the full-scale pulse rate frequency. The engineering units of the *Pulse URV* parameter are established by the *Rate Units* parameter (ref: **A2**). The default setting for the *Pulse URV* parameter is **100**. Finally, configure the full-scale frequency for the Pulse Rate output via the ***Max Pulse Rate*** parameter. The available selections are 1 KHz, 2 KHz, 5 KHz and 10 KHz. The default setting for the *Max Pulse Rate* parameter is **2 KHz**.

The Pulse Rate output is damped in accordance with the *mA/Pulse Damping* (ref: **B1**) and *Noise Reduction* (ref: **B2**) parameter settings.

The normal Pulse Output value can be overridden by Presets, Signal Lock (ref: **A5**), AutoZeroLock (or AZL), Diagnostics, and Alarms in both the Pulse Total and Pulse Rate modes. Some of these effects are configurable. Specifically, the *AZL Out Effect* (ref: **B4**),*Diag Out Effect* (ref: **D7**) and *Alarm Out Effect* (ref: **B3**) parameters determine whether these conditions affect the outputs. Refer to *Output Owner Priority Structure* in the *Operation* chapter for further information on output ownership.

(D6) *Relay Output Parameters*

The IMT96 provides two Relay Outputs (RO1 and RO2) that can be configured to indicate certain status conditions. To use either Relay Output, first specify the inactive state of the Relay Output. This is the "normal" condition of the relay (the state when the configured condition does not exist). Specify either Normally Open or Normally Closed for parameters ***RO1 Operation*** and ***RO2 Operation***. The default setting for these parameters is **Normally Open**.

The following selections are available for the ***RO1 Function*** and ***RO2 Function*** parameters. The default setting for these parameters is **Off**.

- **Off** (the relay output is not in use)
- **Alarms** (the relay becomes active when any configured alarm occurs)

- **Alarms + Diags** (the relay becomes active when a diagnostic condition or the configured alarm occurs)
- **Diags** (the relay becomes active when a diagnostic condition occurs)
- **Flow Direction** (the relay becomes active when the flow rate is negative)

If you select Alarms or Alarms+Diags, ensure that the *Alarming* parameter is enabled and at least one alarm is enabled (ref: **B3**). You can specify a particular alarm condition that will activate the Relay Output or indicate that any alarm should activate the Relay Output. The following selections are available for the *RO1 Alarm* and *RO2 Alarm* parameters. The default setting for the ***RO1 Alarm*** parameter is **High Rate**. The default setting for the ***RO2 Alarm*** parameter is **Low Rate**.

- HIGH RATE
- LOW RATE
- HIGH FWD TOTAL 1
- HIGH FWD TOTAL 2
- AUTO ZERO LOCK
- ANY ALARM

If you select AUTO ZERO LOCK, ensure that the AutoZeroLock detector is enabled and calibrated (ref: **B4**). Also ensure that the *AZL Alarms* parameter is set to On (ref: **B3**).

If you select Alarms or Alarms+Diags, you can specify the Suppress function as On or Off. If Suppress is On, an Alarm Acknowledge that is performed when the alarm condition still exists resets the Relay Output to the inactive state. Re-assertion to the active state is suppressed unless the alarm condition clears and reappears. The acknowledgment does **not** clear an existing alarm condition. It only causes the relay to return to the inactive state.

For example, you may have a Relay Output that is configured for High Rate Alarms and is connected to an alarm horn. When a High Rate Alarm occurs, the horn can be silenced via an Alarm Acknowledge if the Suppress feature is On. The horn does not sound again unless the flow rate falls below the alarm level and subsequently rises above that level. Alarms can be acknowledged via the HART Communicator (see *Operation*), the optional IMT96 keypad, or a Contact Input (ref: **A5**). The Suppress feature is separately configurable for each Relay Output. Specify either On or Off for the ***RO1 Suppress*** and ***RO2 Suppress*** parameters. The default setting for both parameters is **Off**.

*(**D7**) **Diag Out Effect** Parameter*

The ***Diag Out Effect*** parameter determines the action taken when a diagnostic condition is detected by the IMT96. The available selections are Go Upscale and Go Downscale, specifying either the overrange or underrange settings for the milliampere and pulse outputs. The default setting is **Go Downscale**.

*(**D8**) **Poll Addr** Parameter*

The ***Poll Addr*** parameter specifies the polling address of the unit, which is used in identifying the unit to a HART Master device such as the HART Communicator. This parameter should always

be set to 00 unless the unit is being operated in a multi-drop environment. In multi-drop mode, more than one HART device is present on the same current loop.

The ***Poll Addr*** parameter can be set to any value from 00 to 15. If the parameter is set to any non-zero value (specifying multi-drop operation), the analog (milliampere) output of the device is constantly locked at 4.0 mA. Thus, the analog output no longer reflects process conditions or responds to Diagnostics, Alarms, or Presets. The default setting is **00**.

*(**D9**) **Num Req Preams** Parameter*

This read-only parameter indicates the number of request preambles that the IMT96 requires in order to reliably communicate with a HART Master device. It is displayed by the HART Communicator in accordance with HART conventions. There is normally no reason for you to be concerned with this parameter. However, if you intend to communicate with the IMT96 using a HART Master device other than the HART Communicator, ensure that the Master issues at least the displayed number of preamble characters at the start of each command message.

A different parameter sets the number of preamble characters that the IMT96 sends at the start of each HART response message. Depending upon the characteristics of the communication link, changing this parameter could disrupt communications. For this reason, the number of response preambles is only configurable via the IMT96 local keypad. Refer to MI 021-403 for details.

Meter Identity Parameters

***(E1) Tag** Parameter*

The ***Tag*** parameter is used to identify the unit. The *Tag* setting is shown on the top line of all menu displays in the Online menu structure. Specify up to 8 alphanumeric characters. The default setting is **spaces**.

***(E2) Descriptor** Parameter*

The ***Descriptor*** parameter is available for any desired purpose as a secondary description of the unit. This parameter performs no “control” function. Specify up to 16 alphanumeric characters. The default setting is **spaces**.

*(**E3**) **Message** Parameter*

The ***Message*** parameter is available for any desired purpose as a secondary description of the unit. This parameter performs no “control” function. Specify up to 32 alphanumeric characters. The default setting is **spaces**.

*(**E4**) **Date** Parameter*

The ***Date*** parameter is available for storing any desired date information, such as the date that the unit was last calibrated. This parameter performs no “control” function. Enter the date in numeric “mm/dd/yy” form to specify the desired month (mm), day (dd) and year (yy). The default setting is the **Date of Factory Calibration**.

(E5) Universal Rev Parameter

This read-only parameter indicates the HART Universal Command set that is supported by the IMT96. It is displayed by the HART Communicator in accordance with HART conventions. There is normally no reason for you to be concerned with this parameter. However, if you intend to communicate with the IMT96 using a HART Master device other than the HART Communicator, ensure that the Master supports the displayed Universal Command revision.

(E6) Fld Dev Rev Parameter

This read-only parameter indicates the Field Device Revision for the IMT96. It is displayed by the HART Communicator in accordance with HART conventions. There is normally no reason for you to be concerned with this parameter. However, if you intend to communicate with the IMT96 using a HART Master device other than the HART Communicator, the Master should support the command set described in the IMT96 Device Description for the displayed Field Device Revision.

(E7) Software Rev and Software Release Parameters

These read-only parameters indicate the major and minor revision codes for the software controlling the IMT96. If you ever experience a problem with your IMT96, you may be asked to supply this revision information to Customer Support personnel to assist in resolving the problem.

(E8) Hardware Rev Parameter

This read-only parameter indicates the revision codes for the electronics modules within the IMT96. If you ever experience a problem with your IMT96, you may be asked to supply this revision information to Customer Support personnel to assist in resolving the problem.

5. Calibration and Presets

This chapter describes the procedures used to calibrate the milliampere output and the AutoZeroLock Detector. It also describes the Preset functions which are used for manually setting the milliampere and pulse outputs as well as the primary digital measurement value. The Preset functions are used to calibrate control loop elements which are external to the IMT96. All of these functions are accessed from the Diag/Service menu. To get to the Diag/Service menu, press the Fast-Key sequence **1,2** from the Online menu.

Analog Output Calibration

Option **4** on the Diag/Service menu accesses the Calibration menu. This menu provides two selections that calibrate the analog (milliampere) output of the IMT96 using an external meter. The **mA Out Cal** selection sets the milliampere output to 4.0 mA and prompts you to key in the milliampere reading shown on the external meter. The IMT96 then adjusts the 4.0 mA setting to compensate for any observed discrepancy in the readings. This process continues until you are satisfied with the 4.0 mA output value, and then is repeated at the 20.0 mA setting. If you determine that the new values do not provide better accuracy than the original settings, abort the calibration procedure.

The **Scaled mA Out Cal** selection permits you to provide different numeric values for the lower and upper setpoints. Otherwise, the calibration procedure is identical to the **mA Out Cal** procedure. For example, you may choose to calibrate the milliampere output using 0 to represent the 4.0 mA point, and 100 to represent the 20.0 mA point. When the IMT96 outputs 4.0 mA, you are asked whether the external meter reads 0.0. If it does not, enter the appropriate meter reading. The process is repeated for the 20.0 mA setting with an expected meter reading of 100.0.

AutoZeroLock Detector Setup and Calibration

The intent of the AutoZeroLock detection feature is to prevent false flow readings that can occur with empty pipe conditions. Without this feature, the input to the transmitter could become an open circuit, causing the transmitter outputs to drift.

You can disable the AutoZeroLock Detector or configure the effect when the detector is triggered. Triggering can be set to force all of the transmitter outputs to the zero flow condition. Triggering of the detector can also generate an alarm condition. You can configure either or both of these options, depending upon the effect you desire.

The AutoZeroLock detection circuit monitors the conductivity between the electrodes. The AutoZeroLock Detector is triggered when the conductivity falls below a critical value determined during the AutoZeroLock calibration process. This feature does not reveal a partially full condition if the electrodes remain covered with fluid and does not indicate how empty a pipe is if the electrodes are exposed. Also, fouling of the electrodes can cause a false empty pipe condition and coating of the electrodes with a viscous fluid can cause a significant lag before an empty pipe condition is recognized.

WARNING

Due to the possibility of false empty readings, do **not** configure the AutoZeroLock Detector to force the zero flow condition in critical flow loops.

Option **4** on the Diag/Service menu accesses the Calibration menu. Option **3** on the Calibration menu accesses the AutoZeroLock setup menu. You are given the option of enabling the AutoZeroLock (AZL) Detector. The *AZL Out Effect* parameter can be configured for No Effect or Auto Signal Lock, which forces the Zero flow condition when the detector is triggered. The *AZL Alarms* parameter can be set to On to generate an Alarm condition.

WARNING

Do **not** take any action that can cause danger to personnel or damage to equipment based on the assumption that a pipe is empty or full because of an AutoZeroLock indication.

Once the AutoZeroLock Detector is enabled, send any changed parameter settings to the IMT96. The detector circuit must then be calibrated using option **4** on the AutoZeroLock setup menu. To perform AutoZeroLock calibration, the pipe must be filled with the process fluid. Calibration can be performed at any flow rate, including Zero. The calibration procedure does not require any external equipment. You are informed of the success or failure of the calibration procedure. The AutoZeroLock Detector cannot be used if the calibration procedure fails.

Failure of the AutoZeroLock Detector calibration process can be caused by any of the following situations.

- The conductivity of the process fluid may be too low to reliably calibrate the detector. The conductivity of some fluids may be high enough to produce a valid flow signal but not high enough for the calibration process.
- The buildup of an insulating coating on the electrodes can cause the electrode impedance to exceed the acceptable value for the calibration process.
- The electrode circuit may be incorrectly wired. Refer to MI 021-402 for details on flowtube wiring.

NOTE

The AutoZeroLock Detector calibration procedure should be repeated periodically in case the electrode impedance changes. This can occur if the process fluid leaves an insulating coating on the electrodes. Over time, the coating can cause false triggering of the AutoZeroLock Detector.

Loop Test/Presets

The Loop Test/Presets menu provides the ability to manually set the milliampere, pulse or digital output value for use in calibrating external elements of the control loop. The Loop Test/Presets menu is accessible via the Fast-Key sequence **1,2,3** from the Online menu.

The **Preset mA Output** procedure prompts you to select either 4.0 mA, 20.0 mA or a user-entered milliampere value to be output by the IMT96. The selected milliampere output value is held on the analog output until you choose to terminate the Preset procedure. Once you exit the

procedure, control of the milliampere output returns to the normal function. This is typically the online flow reading, but could also be AutoZeroLock, manual Signal Lock, or a diagnostic or alarm condition.

The Pulse Rate Test menu displays the current settings for the Pulse Mode, Max Pulse Rate and Pulse URV parameters. In order to perform the **Preset Pulse Rate** procedure, the IMT96 must be configured for Pulse Rate mode. The Preset Pulse Rate procedure prompts you to enter a pulse rate value that is less than or equal to the current Max Pulse Rate setting. Entering the value "zero" terminates the Preset procedure. The selected Pulse Rate output value is generated at the pulse output until you terminate the Preset procedure. Once you exit the procedure, control of the pulse output returns to the normal function. This is typically the online flow reading, but could also be AutoZeroLock, manual Signal Lock, or a diagnostic or alarm condition.

The Pulse Total Test menu displays the current settings for the Pulse Mode, Totalizer enable, Max Tot Pulse, and Net Total Format parameters. In order to perform the **Preset Pulse Total** procedure, the IMT96 must be configured for Pulse Total mode and the Totalizer must be enabled. The Preset Pulse Total procedure prompts you to enter a pulse count value (up to 65535). Entering the value "zero" terminates the Preset procedure. The selected count of pulses is then generated at the pulse output. Once you exit the procedure, control of the pulse output returns to the normal function. This is typically the online flow reading, but could also be AutoZeroLock, manual Signal Lock, or a diagnostic or alarm condition.

Appendix A. Menu Structure Diagram

Figures 7 through 12 present the complete menu structure for the online menus of the HART Communicator when used with the IMT96. Figures 7 and 8 contain the menus used for Operation, Calibration, Presets, and Database Review. Figures 9 and 10 contain the Basic Setup menu. Figures 11 and 12 contain the Detailed Setup menu.

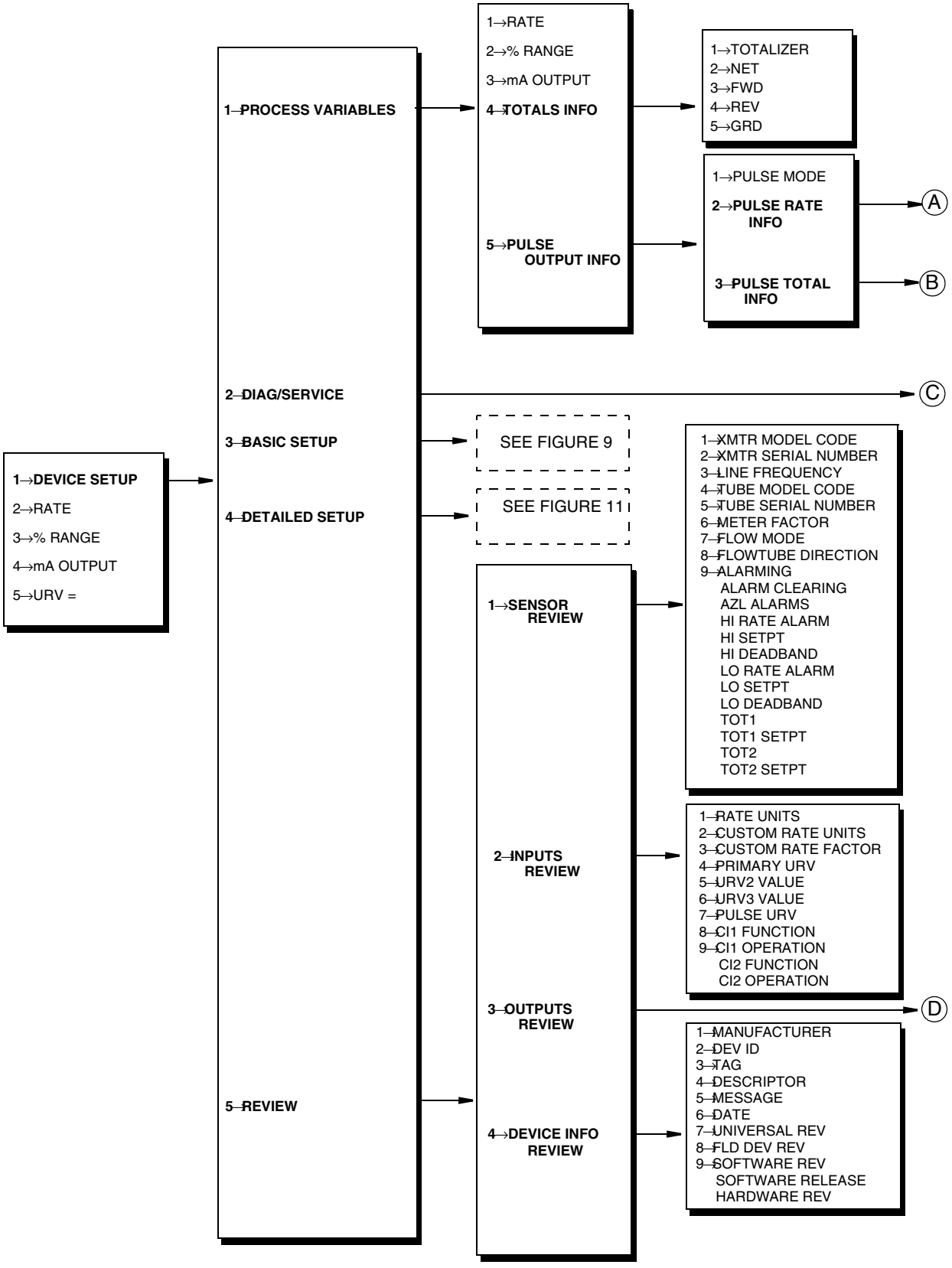

Figure 7. Menu Structure Diagram for Operation, Calibration, Presets, and Review (1 of 2)

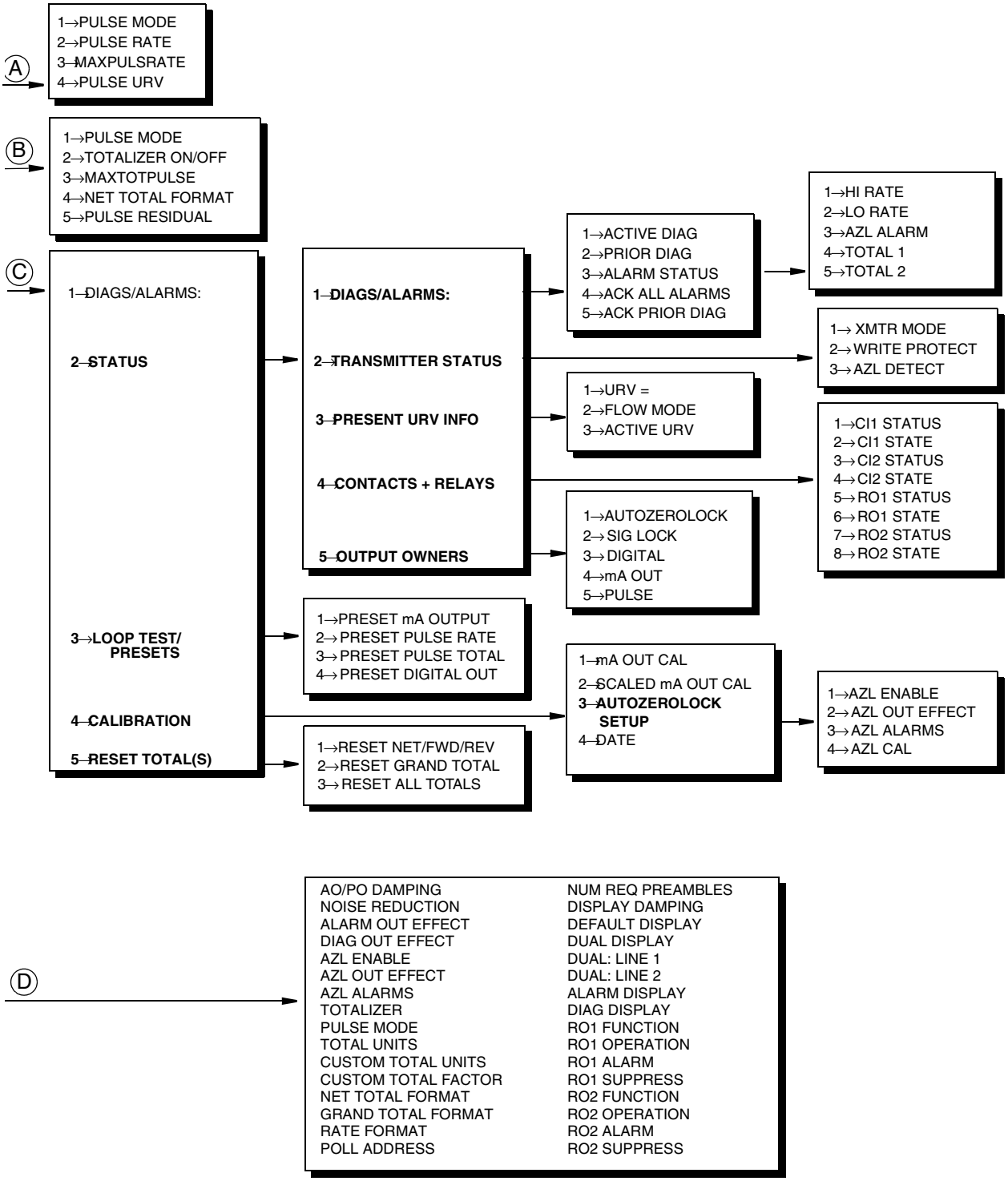

Figure 8. Menu Structure Diagram for Operation, Calibration, Presets, and Review (2 of 2)

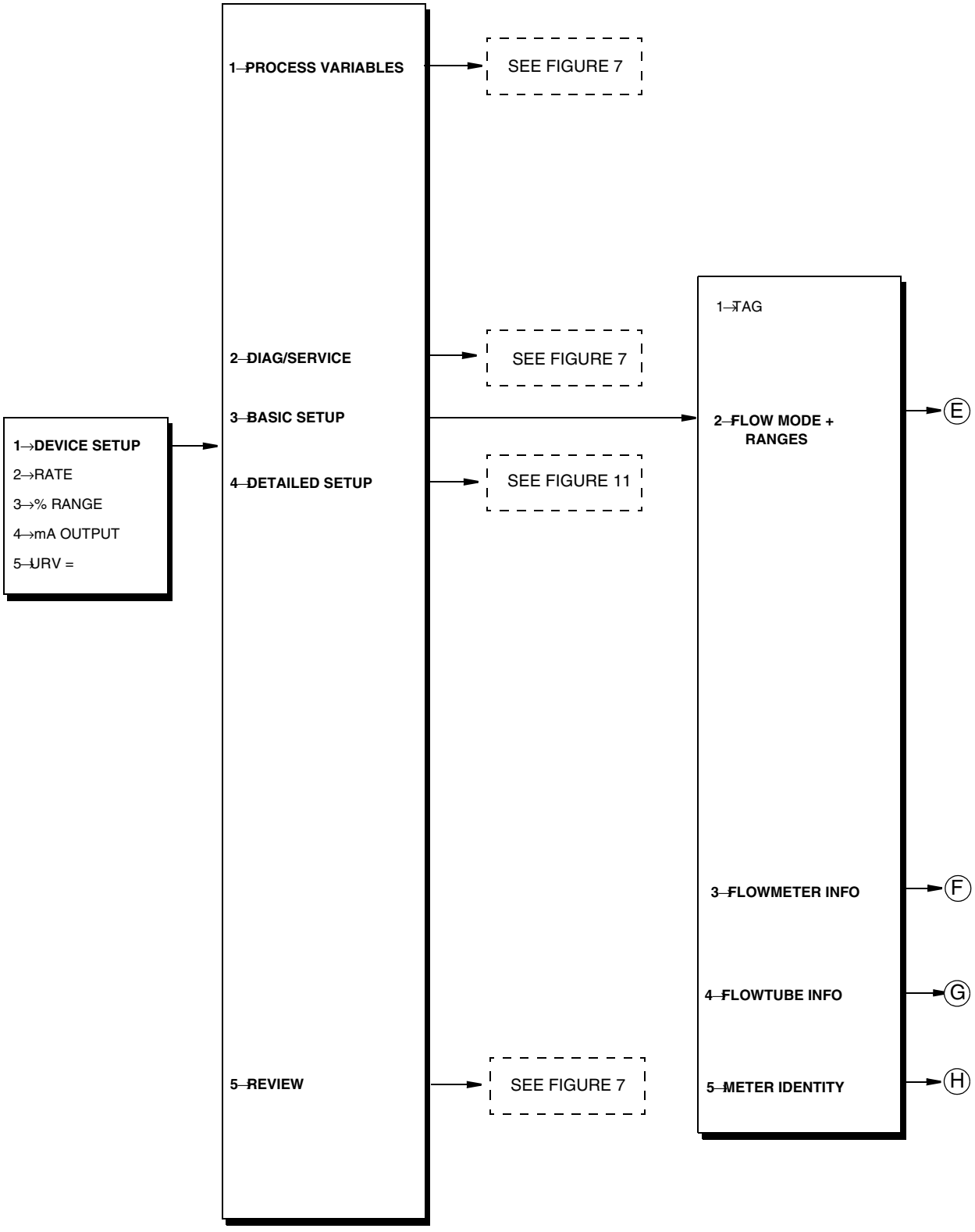

Figure 9. Menu Structure Diagram for Basic Setup (1 of 2)

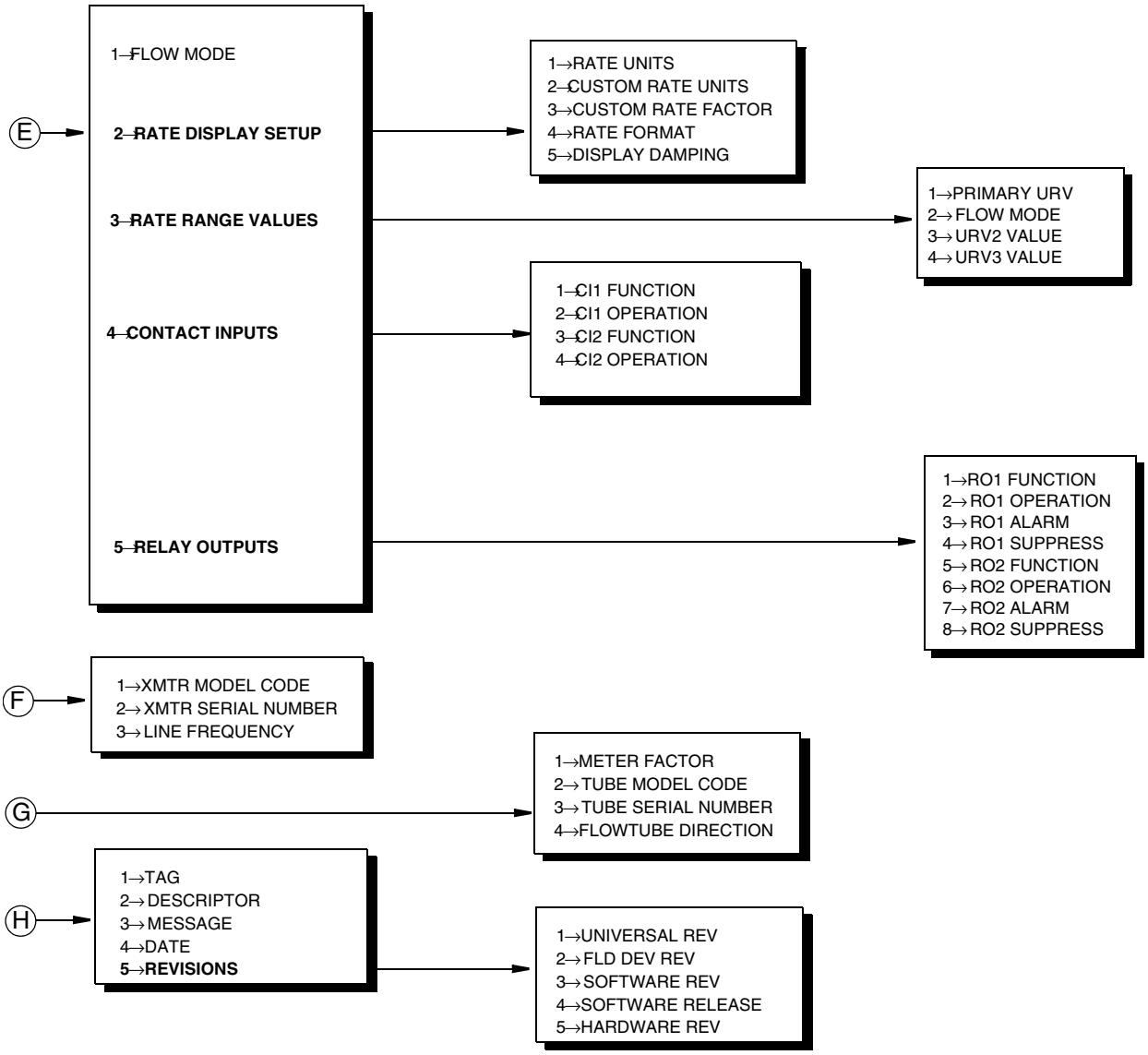

Figure 10. Menu Structure Diagram for Basic Setup (2 of 2)

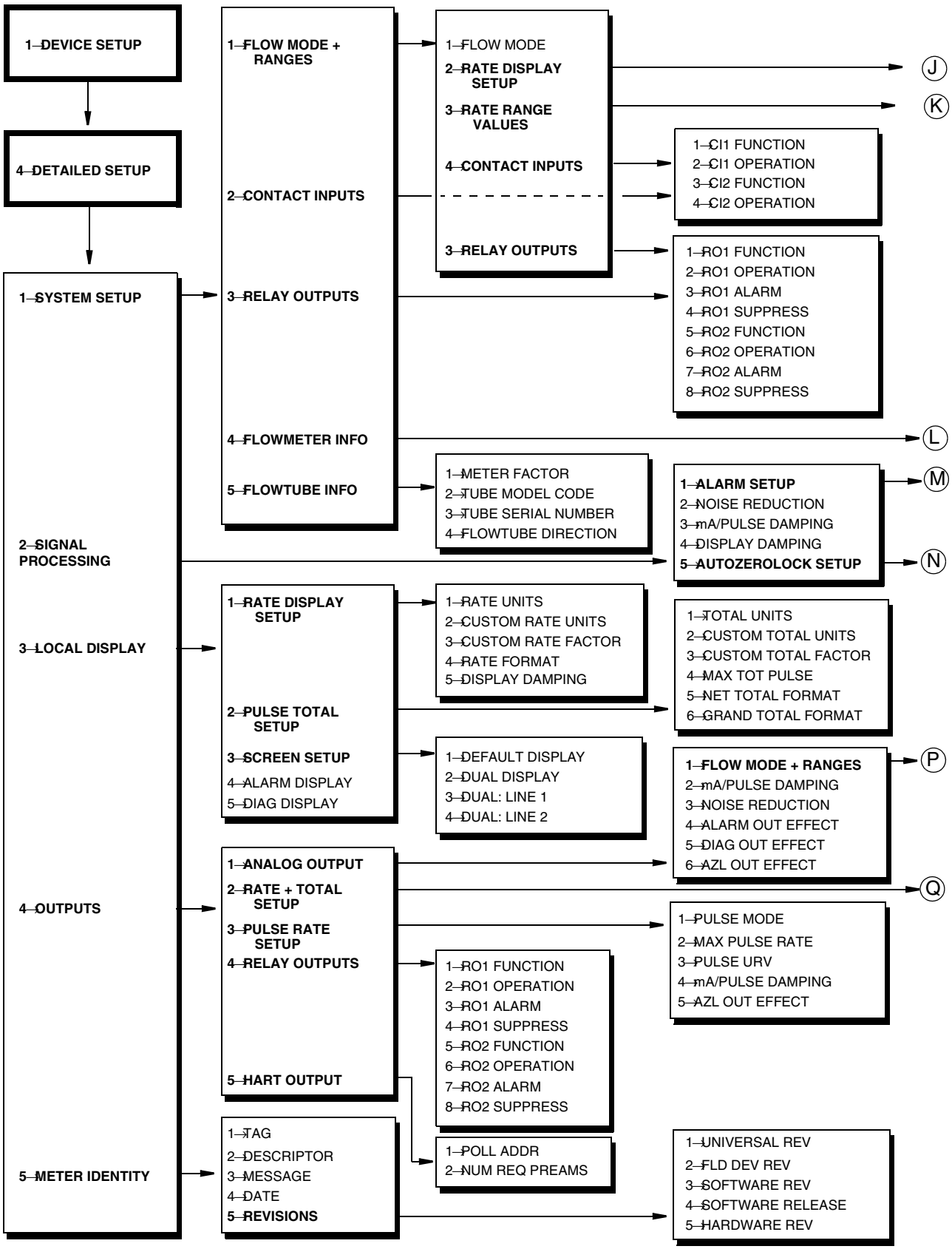

Figure 11. Menu Structure Diagram for Detailed Setup (1 of 2)

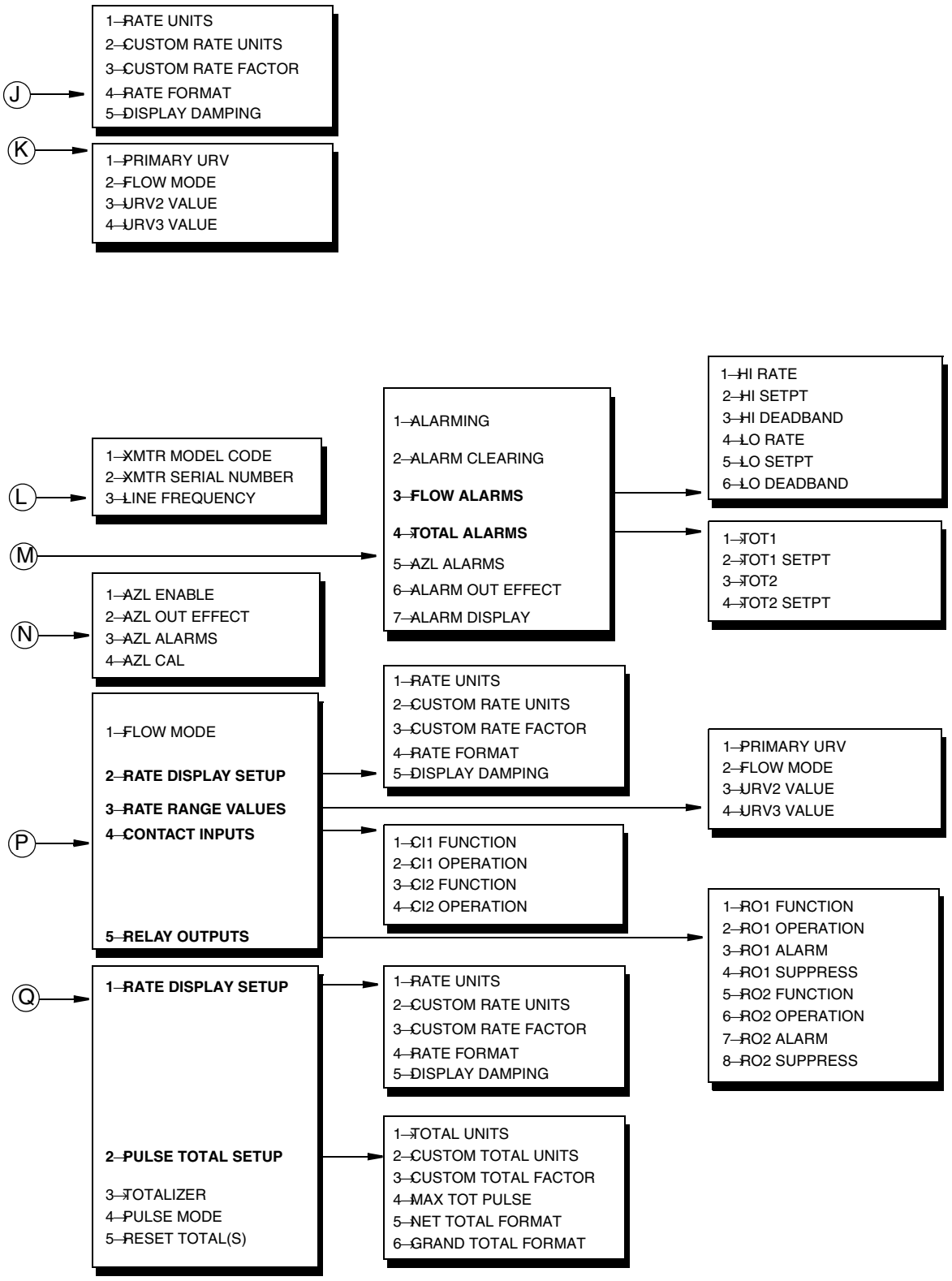

Figure 12. Menu Structure Diagram for Detailed Setup (2 of 2)

Appendix B. Fast-Key Sequences

Table 10 lists the Fast-Key sequence for each of the measurement values, configurable parameters, and functions contained in the menu tree for the IMT96. The Fast-Key sequence indicates the series of keystrokes that can be entered to move from the Online menu to any other place in the menu with the minimum number of key presses.

Table 9. Fast-Key Sequences

Menu Item	Fast-Key Sequence	Menu Item	Fast-Key Sequence	Menu Item	Fast-Key Sequence
% Range	3	Flow Mode	1,3,2,1	Rate Units	1,3,2,2,1
ACK All Alarms	1,2,2,1,4	Flowtube Direction	1,3,4,4	Reset All Totals	1,2,5,3
ACK Prior Diag	1,2,2,1,5	Forward Total	1,1,4,3	Reset Grand Total	1,2,5,2
Active Diag	1,2,2,1,1	Grand Total	1,1,4,5	Reset Net/Fwd/Rev	1,2,5,1
Active URV	1,2,2,3,3	Grand Total Format	1,4,3,2,6	Reset Totals	1,4,4,2,5
Alarm Clearing	1,4,2,1,2	Hardware rev	1,3,5,5,5	Reverse Total	1,1,4,4
Alarm Display	1,4,3,4	Hi Deadband	1,4,2,1,3,3	RO1 Alarm	1,3,2,5,3
Alarm Out Effect	1,4,4,1,4	Hi Rate Alarm	1,4,2,1,3,1	RO1 Function	1,3,2,5,1
Alarming	1,4,2,1,1	Hi Rate Alarm Status	1,2,2,1,3,1	RO1 Operation	1,3,2,5,2
AZL Alarm Status	1,2,2,1,3,3	Hi Setpt	1,4,2,1,3,2	RO1 State	1,2,2,4,6
AZL Alarms	1,4,2,1,5	Inputs Review	1,5,2	RO1 Status	1,2,2,4,5
AZL Cal	1,2,4,3,4	Line Frequency	1,3,3,3	RO1 Suppress	1,3,2,5,4
AZL Out Effect	1,4,2,5,2	Lo Deadband	1,4,2,1,3,6	RO2 Alarm	1,3,2,5,7
AZL Enable	1,4,2,5,1	Lo Rate Alarm	1,4,2,1,3,4	RO2 Function	1,3,2,5,5
AZL Status	1,2,2,5,1	Lo Rate Alarm Status	1,2,2,1,3,2	RO2 Operation	1,3,2,5,6
AZLDetect	1,2,2,2,3	Lo Setpt	1,4,2,1,3,5	RO2 State	1,2,2,4,8
CI1 Function	1,3,2,4,1	mA Out Cal	1,2,4,1	RO2 Status	1,2,2,4,7
CI1 Operation	1,3,2,4,2	mA Out Owner	1,2,2,5,4	RO2 Suppress	1,3,2,5,8
CI1 State	1,2,2,4,2	mA Output	4	Scaled mA Out Cal	1,2,4,2
CI1 Status	1,2,2,4,1	mA/Pulse Damping	1,4,2,3	Sensor Review	1,5,1
CI2 Function	1,3,2,4,3	Max Tot Pulse	1,4,3,2,4	Sig Lock Status	1,2,2,5,2
CI2 Operation	1,3,2,4,4	Message	1,3,5,3	Software release	1,3,5,5,4
CI2 State	1,2,2,4,4	Meter Factor	1,3,4,1	Software rev	1,3,5,5,3
CI2 Status	1,2,2,4,3	Net Total	1,1,4,2	Tag	1,3,1
Custom Rate Factor	1,3,2,2,3	Net Total Format	1,4,3,2,5	Tot1 Alarm	1,4,2,1,4,1
Custom Rate Units	1,3,2,2,2	Noise Reduction	1,4,2,2	Tot1 Setpt	1,4,2,1,4,2
Custom Total Factor	1,4,3,2,3	Num req preams	1,4,4,5,2	Total 1 Alarm Status	1,2,2,1,3,4
Custom Total Units	1,4,3,2,2	Outputs Review	1,5,3	Total 2 Alarm Status	1,2,2,1,3,5
Date	1,3,5,4	Poll Addr	1,4,4,5,1	Total Units	1,4,3,2,1
Default Display	1,4,3,3,1	Preset Digital Out	1,2,3,4	Totalizer	1,1,4,1
Descriptor	1,3,5,2	Preset mA Output	1,2,3,1	Tube Model Code	1,3,4,2
Device Info Review	1,5,4	Preset Pulse Rate	1,2,3,2	Tube Serial Number	1,3,4,3
Diag Display	1,4,3,5	Preset Pulse Total	1,2,3,3	Universal rev	1,3,5,5,1
Diag Out Effect	1,4,4,1,5	Primary URV	1,3,2,3,1	URV	1,3,2,3,1
Diags/Alarms:	1,2,1	Prior Diag	1,2,2,1,2	URV =	5
Digital Owner	1,2,2,5,3	Pulse Mode	1,4,4,2,4	URV2	1,3,2,3,3
Display Damping	1,4,2,4	Pulse Owner	1,2,2,5,5	URV3	1,3,2,3,4
Dual: Line 1	1,4,3,3,3	Pulse Rate	1,1,5,2,2	Write protect	1,2,2,2,2
Dual: Line 2	1,4,3,3,4	Pulse Residual	1,1,5,3,5	Xmtr Mode:	1,2,2,2,1
Dual Display	1,4,3,3,2	Rate	2	Xmtr Model Code	1,3,3,1
Fld dev rev	1,3,5,5,2	Rate Format	1,3,2,2,4	Xmtr Serial Number	1,3,3,2

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