

**I/A Series[®] Magnetic Flow Transmitter
Model IMT25**

Operation, Configuration, and Calibration

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1. Introduction

Description

An I/A Series Magnetic Flowmeter System consists of two major components:

- ◆ IMT25 Magnetic Flow Transmitter with Version 2 Software
- ◆ Magnetic Flowtube
 - ◆ 8000A wafer body
 - ◆ 2800, 8300, 9100A, 9200A, or 9300A flanged body

A system may be specified with the transmitter integrally mounted with the flowtube or with a remote mounted transmitter, which can be mounted either on a pipe or a flat surface.

Your transmitter has one of three communication protocols.

One is a FoxCom communications protocol. The digital output signal in this version is used for flowmeters serving as a primary measuring device in an I/A Series system. You can communicate with this version via the I/A Series system, the PC-based Configurator, or the optional local keypad/display.

Another has HART communications capability. You can communicate with this version via a HART Communicator, PC-Based Configurator, or the optional local keypad/display.

The third has FOUNDATION fieldbus communication capability. You can communicate with this version via a fieldbus host or the optional local keypad/display.

This document describes local operation, configuration, and calibration of an IMT25 Transmitter supplied with local keypad and display. For information on operation, configuration, and calibration from a PC-Based Configurator, a HART Communicator, or a FOUNDATION fieldbus host refer to the documents listed in “Reference Documents” on page 3.

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 chapters titled *Operation* and *Calibration*. If you are concerned with configuration, read the entire manual, with special emphasis on the chapter titles *Configuration* and the structure diagrams in Appendix A and the configuration worksheets in Appendix B.

Functions

Using the IMT25 front panel keypad/display, the functions you can perform are:

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 Forward Total, Reverse Total, Net Total, and Grand Total.
- ◆ **Display the Status of the Transmitter:** The current operating mode, Analog and Pulse Output values, Contact Input settings, Relay Output settings, noise reduction, AutoZeroLock information, and write protection as well as alarm and diagnostic status.
- ◆ **Display Identity Information:** Tag, description, and message plus identification data for the flowmeter, flowtube, and transmitter software.
- ◆ **Acknowledge Alarms and Diagnostic Conditions.**
- ◆ **Reset Totals.**

Calibration Functions

— **NOTE** —

These functions can be passcode protected from keypad changes.

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

Configuration Functions

— **NOTE** —

These functions can be passcode protected from keypad changes.

- ◆ Display and modify all configuration parameters
- ◆ Assign passcodes and set levels of privilege

Reference Documents

This document addresses operation, configuration, and calibration using the local keypad/display panel. For remote communication with your transmitter and other details of the flowmeter, refer to the applicable documents listed in Table 1.

Table 1. Reference Documents

Document	Description
Foxboro Documents:	
MI 021-387	IMT25 Transmitter - Installation
MI 021-391	IMT25 Transmitter - System Maintenance
MI 021-392	IMTSIM Magnetic Flowtube Simulator
MI 021-397	IMT25 Transmitter - Operation Using a HART Communicator
MI 021-399	IMT25 Transmitter - Operation from a Fieldbus Host
MI 020-495	PC20 Intelligent Device Field Configurator
MI 020-504	PC50 Intelligent Device Tool - Operation Using FoxCom Protocol
MI 020-520	PC50 Intelligent Device Tool - Operation Using HART Protocol
FOUNDATION Fieldbus Document:	
FD-043 Rev.2.0	Technical Overview — FOUNDATION Fieldbus

2. Quick Start

FoxCom or HART Protocol

Your IMT25 Transmitter can be configured with a PC-Based Configurator or with the keypad/display option. With the keypad/display, two configuration menus exist, Quick Start and Setup. Most basic applications can be configured in Quick Start mode.

Quick Start mode can be used for applications requiring **only**:

- ◆ A 4-20 mA output based on a flow rate in (US) GPM
- ◆ The transmitter display to show a flow rate in (US) GPM
- ◆ A FoxCom digital or HART flow rate signal.

Use Setup mode that is fully described in “Configuration” on page 29, for applications involving:

- ◆ Transmitters powered from 50 Hz sources
- ◆ Pulse and frequency outputs
- ◆ Totalizer functions
- ◆ Flow units other than (US) GPM
- ◆ Alarm functions
- ◆ Multi-range or bi-directional flow configurations.

To make Quick Start changes to the configuration, go to **1 TOP LEVEL/Quick Start** by pressing the Left arrow repeatedly until the display reads **1 TOP LEVEL**. Then use the up/down arrow keys to go to **1 TOP LEVEL/Quick Start**. The procedure to change your configuration is demonstrated by the following example:

- ◆ Flowmeter factor of 18.22 (refer to “Determining the Meter Factor” on page 8)
 - ◆ Forward direction of flow
 - ◆ Flow Range 0 to 150 GPM
1. Use the Right arrow key to move to **MFACTOR FORMAT? {###.#####}**. This format can be changed, if necessary, to accommodate the meter factor.
 - a. If no change is required, press the Right arrow key.
 - b. To change the format, press **Shift + Change** to enter Edit Mode. Then use the up/down arrow keys to step through the choices. When you reach the format you want, press the Right arrow key.
 2. The display reads **METER FACTOR? {###.#####}** (Default {012.000000}). Press **Shift + Change** to enter Edit Mode. Use the Right/Left arrow keys to move the cursor under the digits you want to change. Use the up/down arrow keys to change the digits to the desired values. In the case of this example, continue this procedure until the display reads **[018.220000]**. Use the Right arrow key to move the cursor out past the right bracket to save the setting. The display then reads **METER FACTOR? {018.219998}**. Note that in some cases, as with this example, a slightly different value

will appear. The magnitude of this difference is insignificant. Press the Right arrow key again.

— **NOTE** —

To determine the correct meter factor, refer to “Determining the Meter Factor” on page 8.

3. The display reads **RATE FORMAT? {#####.#}** This format can be changed, if necessary, to accommodate your flow rate.
 - a. If no change is required, press the Right arrow key.
 - b. To change the format, press **Shift + Change** to enter Edit Mode. Then use the up/down arrow keys to step through the choices. When you reach the format you want, press the Right arrow key.
4. The display reads **FORWARD URV? {#####.#}** (Default {00100.0}). Press **Shift + Change** to enter Edit Mode. Use the Right/Left arrow keys to move the cursor under the digits you want to change. Use the up/down arrow keys to change the digits to the desired values. In the case of this example, continue this procedure until the display reads **[00150.0]**. Use the Right arrow key to move the cursor out past the right bracket to save the setting. The display then reads **FORWARD URV? {00150.0}**.
5. Now that all changes have been made, press the Right arrow key. You are asked **Go On-Line?** Reply Yes by pressing the Right arrow key. Press the Right arrow key again to begin displaying flow measurements.

Foundation Fieldbus Protocol

Your transmitter has been preconfigured at the factory to the settings shown in Appendix B. Compare your needs to the factory configuration and note the changes to the configuration you must make.

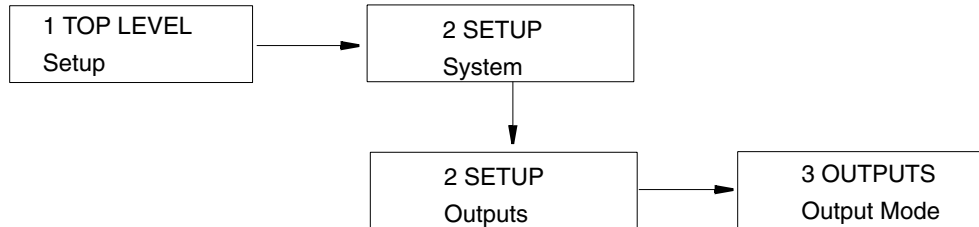
If the transmitter is not connected to a flowtube or IMTSIM, it is necessary to put a jumper wire between terminals Coil 1 and Coil 2 and also to provide power to the transmitter.

This section describes the procedures to quick start the transmitter from the optional local keypad/display. Note that after you quick start the transmitter from the local keypad, you should use the fieldbus host to ensure that parameter values associated with the host are changed to agree with those changed from the local keypad/display. Otherwise, mismatch errors occur when you attempt to place the transmitter into Auto mode.

To make changes to the configuration using the local keypad/display, go to **1 TOP LEVEL/Setup** by pressing the Left arrow repeatedly until the display reads **1 TOP LEVEL**. Then use the Up/Down arrow keys to go to **1 TOP LEVEL/Setup**. The procedure to change your configuration is demonstrated by the following example:

- ◆ Engineering units (EGUs) in GPM (factory default setting)
- ◆ Forward direction of flow (Unidir positive - factory default setting)
- ◆ Flow range 0 to 150 GPM
- ◆ Flowmeter factor of 18.22 (refer to “Determining the Meter Factor” on page 8)

1. Note that the factory default engineering units is already configured as GPM, so no change is required.
2. Note that the factory Output mode is also already configured as UniDir positive, so no change in the direction is required.
3. You must enter your flow upper range value however. To do this:
 - a. Go to Setup Level 2 by pressing the Right arrow key. Next move to **2 SETUP Outputs** with the Down arrow key. Then move to **3 OUTPUTS Output Mode** with the Right arrow key.



- b. Use the Down arrow key to go to **3 OUTPUTS Range Info** and the Right arrow key to go to **FORWARD URV? {#####.#} GPM** (Default {00100.0}).
 - c. Press the **Shift + Change** keys to enter Edit mode. You are asked **Go Offline?** Reply **Yes** by pressing the Right arrow key. The display shows **FORWARD URV? [#####.#] GPM**.
 - d. Use the Right/Left arrow keys to move the cursor under the digits you want to change. Use the Up/Down arrow keys to change the digits to the desired values. In the case of this example, continue this procedure until the display reads **[00150.0]**.
 - e. Using the Right arrow key, move the cursor under the right bracket and press the key to enter the URV. The display reads **FORWARD URV? {150.0} GPM**.
 - f. Press the key again to move back to **3 OUTPUTS Range Info**.
4. Lastly, you have to enter your flowmeter factor. To do this:
 - a. Use the Left arrow key to move to the Level 2 menu, **2 SETUP Outputs**.
 - b. Press the Down arrow key six times to move to **2 SETUP Calibration** and the Right arrow key to move to the Level 3 menu, **3 CALIBRATION Meter Factor**. See Figure A-5.
 - c. Use the Right arrow key to move to **MFACTOR FORMAT? {###.#####}**. This format can be changed, if necessary, to accommodate the meter factor.
 - d. Use the Right arrow key to move to **METER FACTOR? {###.#####}** (Default {012.000000}). Then press **Shift + Change** to enter Edit mode.
 - e. Use the Right/Left arrow keys to move the cursor under the digits you want to change. Use the Up/Down arrow keys to change the digits to the desired values. In the case of this example, continue this procedure until the display reads **[018.220000]**. Use the Right arrow key to move the cursor out past the right bracket to save the setting. The display then reads **METER FACTOR?**

{018.219998}. Note that in some cases, as with this example, a slightly different value appears. The magnitude of this difference is insignificant.

— **NOTE** —

To determine the correct meter factor, refer to “Determining the Meter Factor” on page 8.

- f. Press the Right arrow key again. The display reads **3 CALIBRATION Meter Factor**.
5. Now that all changes have been made, press the Left arrow key until you are asked **Go On-Line?** Reply Yes by pressing the Right arrow key. To display flow measurement, press the Right arrow key once more.

—  **CAUTION** —

If you change the upper range value or engineering units in the Transducer Block with the local display pushbuttons without making a corresponding change in the corresponding Analog Input Blocks from a fieldbus host, a mismatch error occurs and the Analog Input Block reverts to Out of Service mode.

Determining the Meter Factor

First find the “Cal Factor” or “IMT25 Cal Fact” on the flowtube data label.

If the flowtube data label has a “IMT25 Cal Fact.” listing, use that value as the “Meter Factor.”

If only a “Cal Factor” value is found on the flowtube data label, that value must be multiplied by the appropriate factor from Table 2 to calculate the “Meter Factor.”

Table 2. Meter Factor Multipliers

8300 Flowtubes				8000A-W and 9300A Flowtubes				
Line Size (in)	M.S. Code	M.S. Code	Multiply by Factor	Line Size (in)	M.S. Code	M.S. Code	M.S. Code	Multiply by Factor
				0.062	801SA		931SA	1.0034
				0.125	801EA		931EA	1.0033
				0.25	801QA		931QA	1.0011
0.5	830H		0.9938	0.5	800HA	800H	930HA	1.0032
1	8301		0.9967	1	8001A	8001	9301A	1.0011
1.5	831H		0.9960	1.5	801HA	801H	931HA	0.9976
2	8302		0.9964	2	8002A	8002	9302A	0.9985
3	8303		0.9974	3	8003A	8003	9303A	0.9996
4	8304		0.9961	4	8004A	8004	9304A	0.9981
6	8306	8006	0.9947	6	8006A	8006	9306A	1.0001
8	8308	8008	0.9946					
10	8310	8010	0.9941					
12	8312	8012	0.9948					
14	8314		0.9945					
16	8316		0.9943					
18	8318		0.9950					
20	8320		0.9954					
24	8324		0.9962					

Example:

A (3-inch) 8303-... tube with only “Cal Factor” listed:

i.e., CAL FACTOR = 7.2911

8303 “Multiply By Factor” = 0.9974

Meter Factor = 7.2911 * 0.9974 = 7.2721

— NOTE —

Flowtube models 9100A, 9200A, and 9308 through 9316 have “IMT25 Cal Fact” on the flowtube data label. Therefore, no multiplication factor is required.

If you are using a 2800 Series “60 Hz” Flowtube (without an “IMT25 Cal Factor” on the data label) with your IMT25 Transmitter, you can use the nominal factor shown in Table 3. If you need a greater accuracy than this factor provides or if you have a 2800 Series “50 Hz” Flowtube, contact Invensys Foxboro.

Table 3. Nominal Meter Factors for IMT25 Transmitter used with 2800 Flowtube

Nominal Line Size	Flowtube Type*	Nominal Factor	Nominal Line Size	Flowtube Type	Nominal Factor
1/10	T	1200	8	T	0.254
1/4	T	454	8	A	0.285

Table 3. Nominal Meter Factors for IMT25 Transmitter used with 2800 Flowtube (Continued)

Nominal Line Size	Flowtube Type*	Nominal Factor	Nominal Line Size	Flowtube Type	Nominal Factor
1/2	T	63.2	10	T	0.226
1	T	25.6	10	A	0.252
1 1/2	T	11.7	12	T	0.136
2	T	7.6	12	A	0.143
2	A	10.7	14	A,N,T	0.097
3	T	3.6	16	A,N,T	0.057
3	A	3.8	18	A,N,T	0.043
4	T	1.93	20	A,N,T	0.029
4	A	2.5	24	A,N,T	0.016
6	T	0.546	30	A,N,T	0.007
6	A	0.630	36	A,N,T	0.004

* A= Polyurethane; T = Teflon; N = Neoprene

3. Operation

Operation from Keypad/Display Panel

For local operation, configuration, and calibration, all operator entries are made through a 5-button keypad and all data is presented on a 2-line x 16 character LCD display. The keypad/display of the IMT25 Transmitter is shown in Figure 1. Information on various types of display is shown in Figure 2.

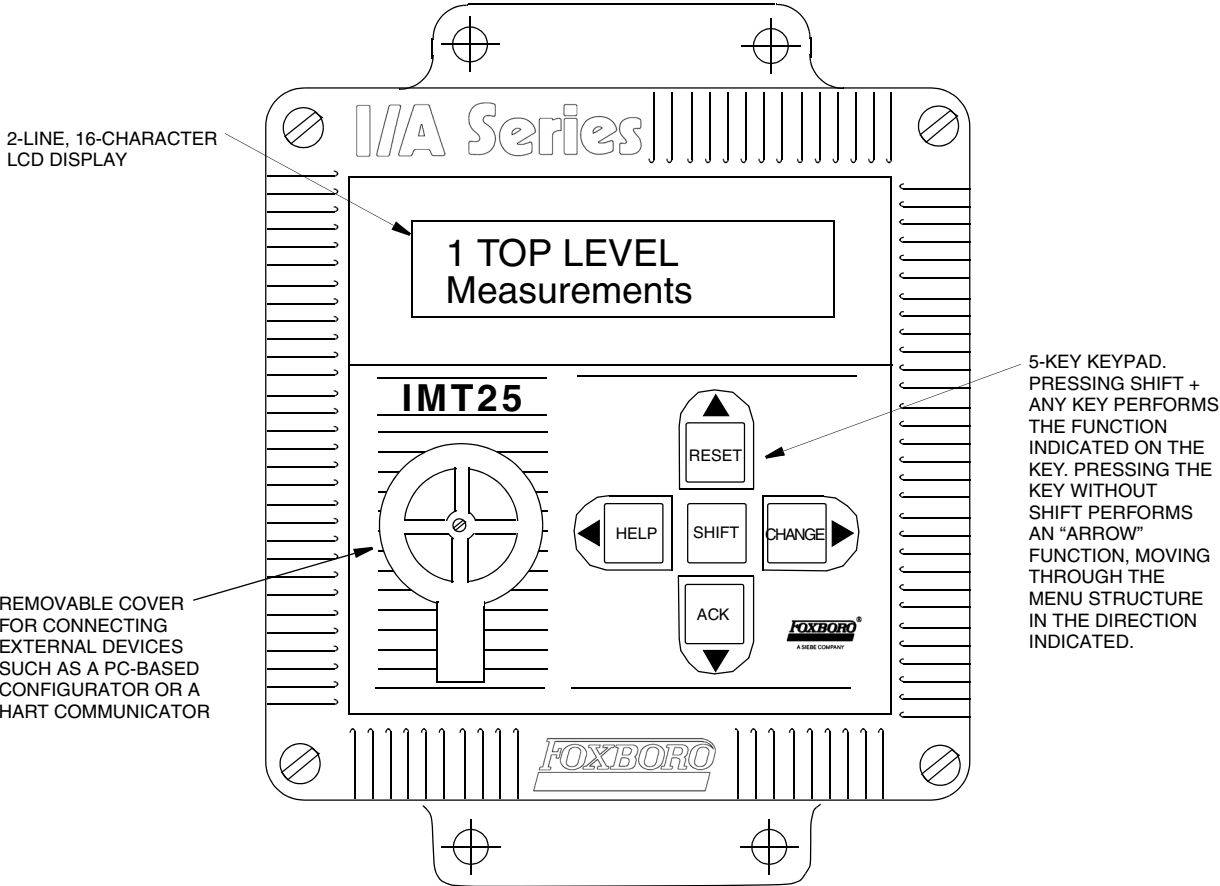


Figure 1. IMT25 Magnetic Flow Transmitter — Keypad/Display

All required functions are accomplished by using the four arrow keys alone and in combination with the Shift key. Table 4 explains the function of each key.

Table 4. Functions of Keys

Key	Function
Δ	Move up in the product structure. Scroll up in menu, list of characters, or on-line Help message.
SHIFT + RESET	Reset totals and empty pipe count.
∇	Move down in the product structure. Scroll down in menu, list of characters, or on-line Help message.
SHIFT + ACK	Acknowledge alarm or diagnostic messages.
◁	Move to the left in the product structure. Cancel parameter selection or data entry.
SHIFT + HELP	Access on-line Help.
▷	Move to the right in the product structure . Enter parameter selection or data entry.
SHIFT + CHANGE	Access Edit mode.
RESET + ACK	Change language (English/German) (Press and hold for 10 seconds)

DISPLAY TYPESALARM OR
DIAGNOSTICALARM 223
ALARMHIGHFLOW

- ICON INDICATES ALARM OR DIAGNOSTIC CONDITION

LONG DISPLAYS

TUBE MS CODE
T25-PADBM-ACG-X

- ICON INDICATES ADDITIONAL CHARACTERS. PRESS ARROW KEYS TO SCROLL LEFT/RIGHT

EDITABLE DATA

TAG NUMBER
{FT154A_____}

- CURLY BRACKETS INDICATE THAT DATA IS EDITABLE

DATA ENTRY

TAG NUMBER
[FT154A_____]

- PLAIN BRACKETS INDICATE YOU ARE IN EDIT MODE.
- TO ENTER A CHANGE, MOVE CURSOR TO RIGHT BRACKET AND PRESS RIGHT ARROW KEY.
- TO CANCEL, MOVE CURSOR TO LEFT BRACKET AND PRESS LEFT ARROW KEY.

ON-LINE HELP

This is a typical Help
Message. Press the

- PRESS UP/DOWN ARROW KEY TO VIEW ADDITIONAL INFORMATION.

Figure 2. IMT25 Magnetic Flow Transmitter — Displays

Top Level Menu

The Top Level menu displays the following modes – Measurements, Status, Identity, Quick Start (in FoxCom and HART transmitters), Test Mode, and Setup. You can switch from one to another in sequence by using the Up/Down arrow keys. To enter the second level menu from a particular top level screen, press the Right arrow key. To return to the top level from a second level menu item, press the Left arrow key. The level of the first, second, third, and fourth level menus is indicated by the digit appearing as the first character in Line 1 of the display; a 1 indicates Level 1 (Top Level), a 2 indicates Level 2, and a 3 indicates Level 3, etc.

The top level menu is shown in Figure 3. For a complete presentation of all menu structures, refer to Appendix A.

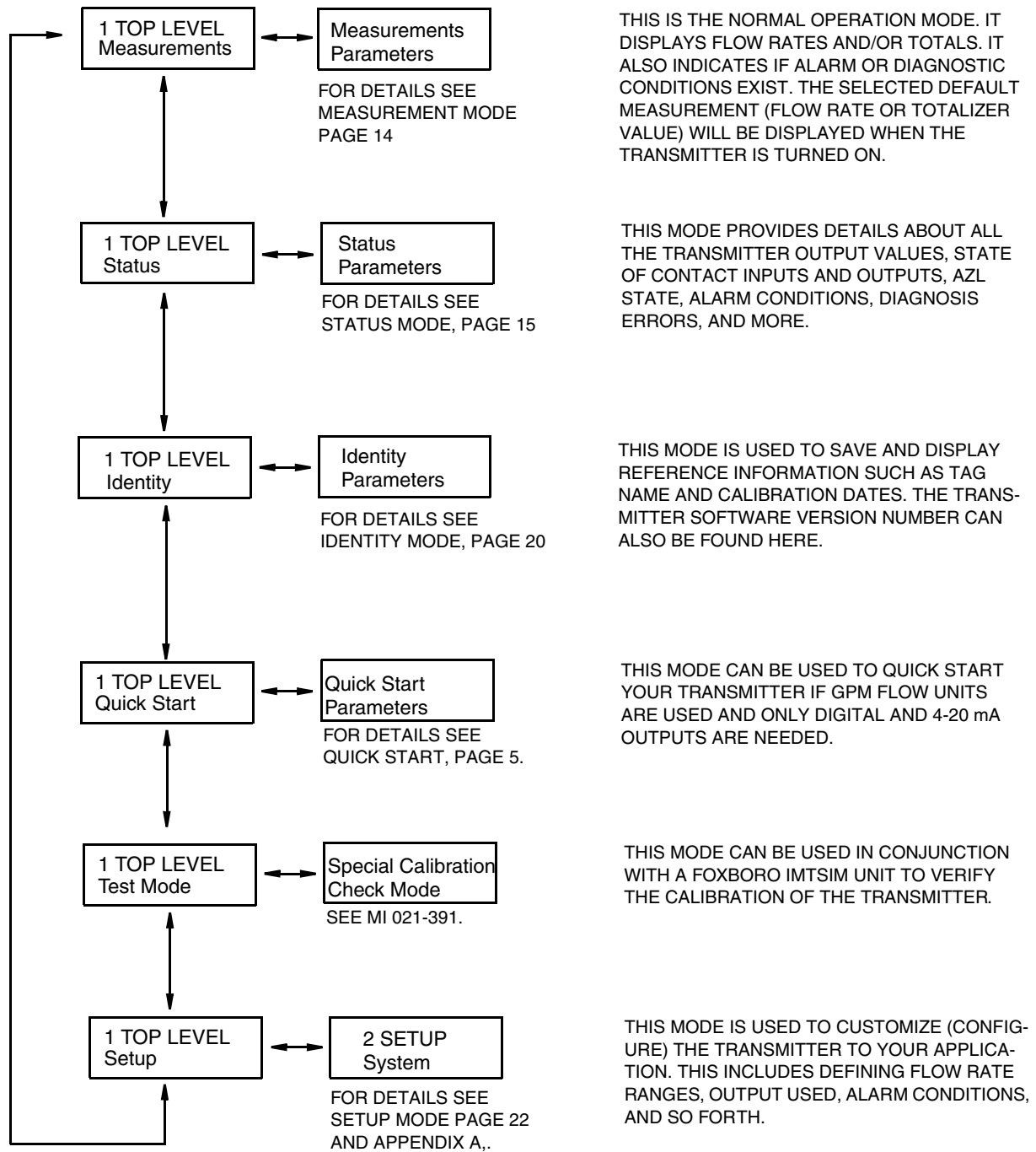


Figure 3. Transmitter Modes and Their Basic Functions

Measurements Mode

The Measurements mode, which is your main operating mode, is displayed upon startup. Depending on the transmitter configuration, it has up to seven displays, any of which may be set as the startup default. All screens can be scrolled with the Up/Down arrow keys.

- ◆ **Rate (EGU)** — Shows current flow rate (forward or reverse) in the selected engineering units.
- ◆ **Rate (% Range)** — Shows current flow rate (forward or reverse) as a percentage of full scale URV.
- ◆ **Fwd Tot** — Shows current value of the forward totalized flow in engineering units. Use the **Net Tot** display to reset.
- ◆ **Rev Tot** — Shows current value of the reverse totalized flow in engineering units. Use the **Net Tot** display to reset.
- ◆ **Net Tot** — Shows current value of the net totalized flow (forward total - reverse total) in selected engineering units. Press **Shift + Reset** to reset the displayed total to zero. Resetting **Net Tot** also resets **Fwd Tot** and **Rev Tot**. It does not reset **Gr Tot**. If Reset Totals is passcode protected, the message **Enter Passcode** appears.
- ◆ **Grand Tot** — Shows current value of the grand total flow in engineering units. Press **Shift + Reset** to reset the displayed total to zero. Resetting **Gr Tot** does not reset **Fwd Tot**, **Rev Tot**, and **Net Tot**. If Reset Totals is passcode protected, the message **Enter Passcode** appears.

If the Dual Display feature is configured **On**, a combination of two of these parameters can be displayed at once. A typical dual display, in which Line 1 shows flow rate and Line 2 shows the present forward total, is shown below. Units may not be displayed or may be truncated.

+35.67 +12345.8

You may step through the displays of each of these parameters with the Up and Down arrow keys. However, unless you specifically do so, the display defaults to that configured in Setup mode. The engineering units and formats used in the displays are also configured in Setup mode.

Measurements Menu Structure

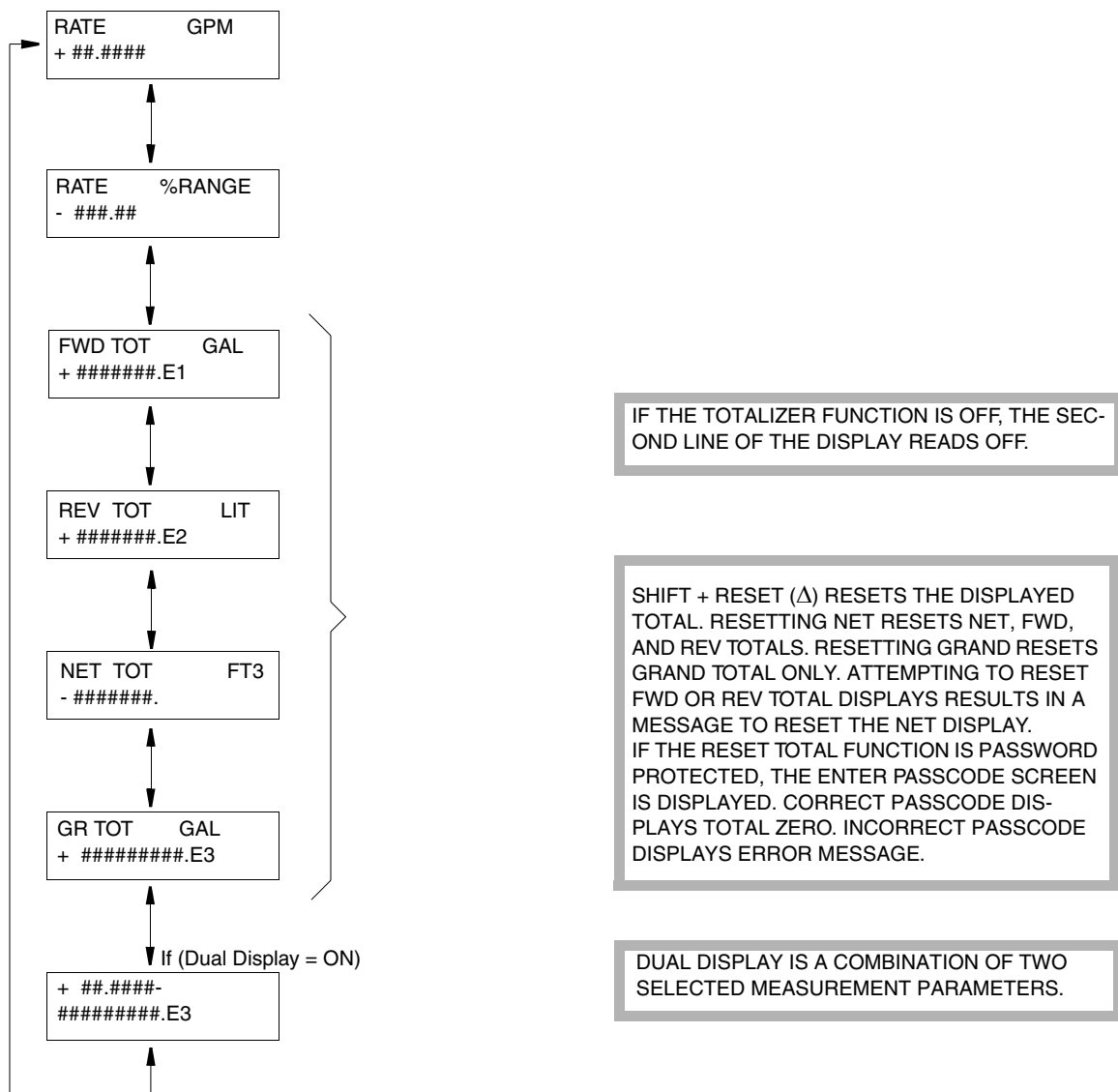


Figure 4. Structure Diagram – Measurements Menu

Status Mode

The Status mode enables you to view fourteen system parameters and thus assess the performance of the loop. You may not edit them in this mode. To step through the displays of the following parameters, use the up/down arrow keys:

- ◆ **Mode** — Shows the present operating mode: **On-Line**, **Off-Line**, **Override**, or **Calibrate**. This will normally display **On-Line**. The other modes will only be displayed if someone else has changed the mode with an I/A Series Workstation, PC-Based Configurator, HART Communicator, or fieldbus host. **Off-Line** means that it has been taken off-line; **Override**, that the measurements cannot be relied

upon because one or more of the outputs is at a preset value; and **Calibrate**, that the transmitter is in Calibration mode.

- ◆ **Alarm** — Shows the most current active alarm. If there are no active alarms but something is in the history buffer, the display reads **Alarms In Buffer**. If there are no active alarms and nothing in the buffer, display reads **No Alarms**.
- ◆ **Diagnostics** — Shows **No Diag**, **Diag Existed**, or **Diag Exists**. If a diagnostic problem exists, the second line identifies the problem. Help is available with the **Shift + Help** keys. An active diagnostic problem cannot be cleared; the problem must be corrected. **Diag Existed** means a diagnostic error did occur, but the condition has cleared and the transmitter is working correctly. However, the Diag icon will remain on the display until the diagnostic has been acknowledged. To clear, the transmitter must be in the Status mode with the diag window displayed. Then use the **Shift + Ack** keys.
- ◆ **Digital Output** — If the transmitter output is in Digital Output mode, the display shows whether the transmitter is configured for Unidirectional or BiDirectional flow. If the transmitter is not in Digital Output mode, the screen is not displayed.

— **NOTE** —

Digital and Analog Output are mutually exclusive. Only one of the two are displayed at any one time.

- ◆ **Analog Output** — If the transmitter output is in Analog Output mode, the display shows whether the transmitter is configured for **U** (unidirectional), **U/M1** (unidirectional multirange-range 1), **U/M2** (unidirectional multirange-range 2), **U/M3** (unidirectional multirange-range 3), **B/D** (bidirectional dual range), or **B/S** (bidirectional split range). If the transmitter is not in Analog Output mode, the screen is not displayed.

— **NOTE** —

Digital and Analog Output are mutually exclusive. Only one of the two are displayed at any one time.

Table 5. Analog Output Configuration

Display	Interpretation
U	UniDirectional Flow Single Range
U/M1	UniDirectional Flow Multi-Range Range 1 Active
U/M2	UniDirectional Flow Multi-Range Range 2 Active
U/M3	UniDirectional Flow Multi-Range Range 3 Active
B/D	BiDirectional Flow Dual Range
B/S	BiDirectional Flow Split Range (mA reading less than 12 indicates reverse flow, greater than 12, positive flow)

Table 5. Analog Output Configuration (Continued)

Display	Interpretation
UNKNOWN	Multi-Range is configured, but both contact inputs used to select the active range are in inactive state

- ◆ **Pulse Output** — Shows **Off** or the state of the pulse output shown in Table 6.

Table 6. Pulse Output States

Display Pulse Output Off	Interpretation
Pulse Rate #### Hz	Pulse Output set to create a frequency signal proportional to flow. Second line shows current output Hz.
Pulse Total ##.## %	Pulse Output set to generate pulses scaled to equal a volume of fluid; i.e., gallons. Second line shows the percent of the next pulse in the buffer. When the buffer fills to 100%, it issues the next pulse.

- ◆ **Contact In 1 and Contact In 2** — Shows the current state of the Contact Inputs. The possible states are as shown in Table 7.

Table 7. Contact Input Status

Display	Interpretation
Off	Contact Input configured Off.
Inactive	There are no Ack Alarm, Reset Totals, or Signal Lock actions taking place.
Invalid	Multi-Range is configured for one contact input and not the other, or both contacts are off.
Ack Alarm	Contact is acknowledging an alarm.
Reset Net Tot	Contact is resetting Fwd Tot, Rev Tot, and Net Tot.
Reset Gr Tot	Contact is resetting Gr Tot.
Reset All Tot	Contact is resetting All Totals
Signal Lock	Contact has “locked” the outputs (fully downscale)
Multi-Range	Contact is configured to switch ranges.

- ◆ **Relay Out 1 and Relay Out 2** — Shows the current function of Relay Output 1. The possible functions are shown in Table 8.

Table 8. Relay Output Status

Display	Interpretation
Off	Relay Output configured Off.
Inactive	No alarm or diagnostic conditions are activating the Relay Output.
Forward Dir	Flow in forward direction.
Reverse Dir	Flow in reverse direction.
High Rate Alm	High Rate Alm has activated the Relay Output.
Low Rate Alm	Low Rate Alm has activated the Relay Output.
High Tot 1 Alm	High Tot 1 Alm has activated the Relay Output.
High Tot 2 Alm	High Tot 2 Alm has activated the Relay Output.
Empty Pipe Alm	Empty Pipe Alm has activated the Relay Output.
Diagnostics	One of the diagnostics has activated the Relay Output.
Test Mode	Transmitter is in the Test Mode.

- ◆ **AZL Detect (Empty Pipe Det)** — The intent of the AutoZeroLock Detection (Empty Pipe Detection) feature is explained in “AutoZeroLock (Empty Pipe)” on page 43.

If the AutoZeroLock (Empty Pipe) detector is configured **On**, the display shows:

EPD Inactive, EPD Active, or EPD Needs Setpnt (FoxCom)

AZL Inactive, AZL Active, or AZL Needs Setpnt (HART)

Inactive, Active, or AZL Needs Cal (Fieldbus).

When AZL (EPD) is active, the outputs are locked at zero. If AZL (EPD) is configured **Off**, the status display shows **Off**.

— **! 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 (Empty Pipe Detection) indication.

- ◆ **AZL Count (Empty Pipe Cnt)** — Shows the cumulative count (maximum of 255) of AZL (empty pipe) conditions that have occurred since the last reset. To reset the count to zero, press **Shift + Reset**. Note that in some cases several counts may occur for one emptying of the pipeline.
- ◆ **Noise Reduction** — Shows whether the noise reduction function is configured **On** or **Off**.
- ◆ **Write Protection** — Shows whether the Write Protection dip switch is in the On position so that **no** Setup (configuration) changes may be made. This feature is usually only used in custody transfer applications or for another reason that you want to assure that the configuration is not changed. For the procedure to change the setting of this switch, see MI 021-387.

Status Menu Structure

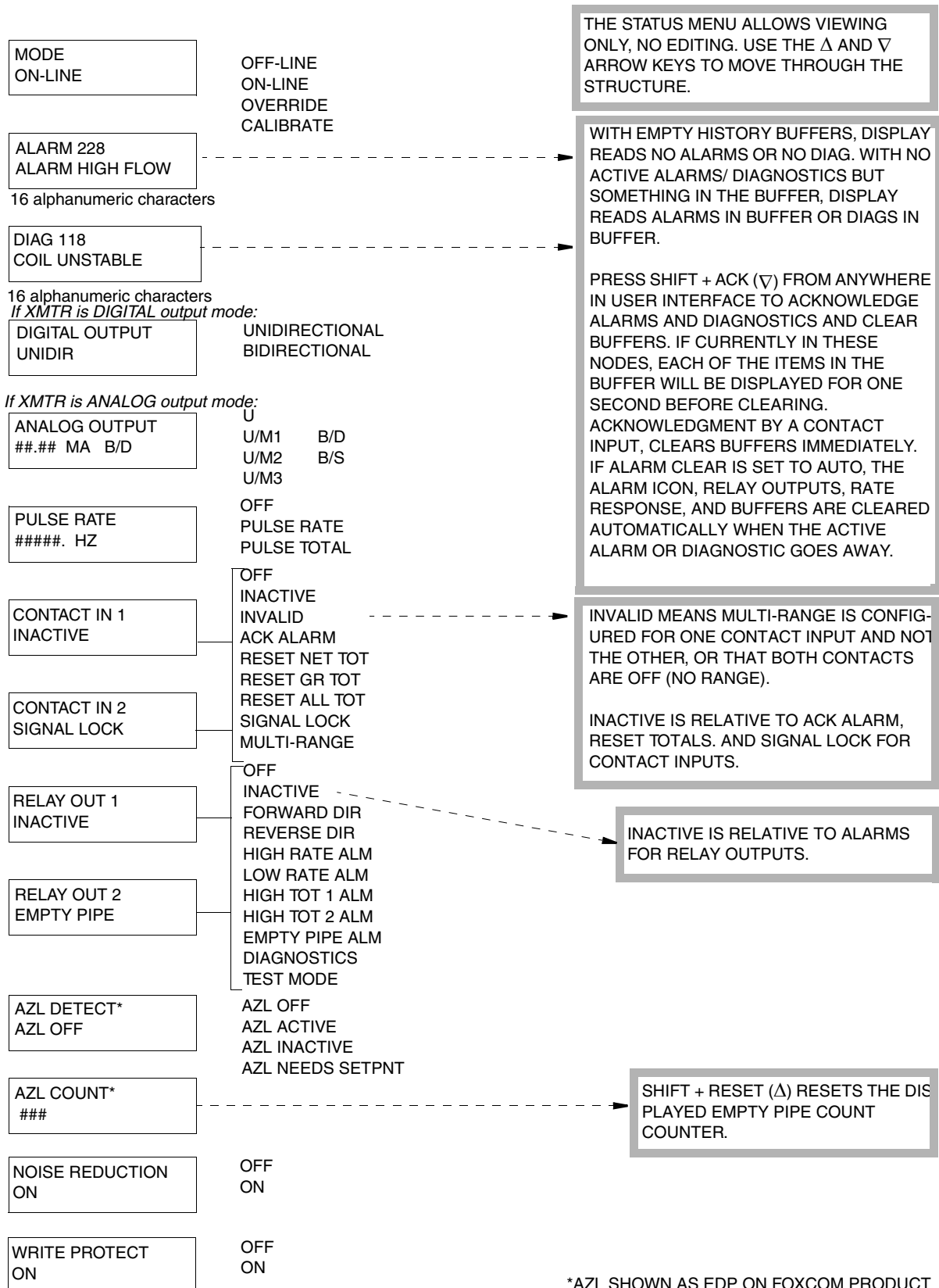


Figure 5. Structure Diagram – Status Menu

Identity Mode

The Identity mode enables you to view the identity parameters. Setup mode can be used to edit these parameters except for those indicated with an asterisk (*) which are factory set. To step through the list of the following parameters, use the Up and Down arrow keys.

TAG NUMBER (FoxCom and Fieldbus only)
 LOCATION (FoxCom and Fieldbus only)
 TAG NAME (displayed only if in Digital Output mode)
 DEVICE NAME (displayed only if in Digital Output mode)
 HART TAG (HART only)
 HART DESCRIPTION (HART only)
 HART MESSAGE (HART only)
 VERIFY SIM DATE (HART only)
 VERIFY SIM NAME (HART only)
 XMTR MS CODE (transmitter model code)*
 XMTR SERIAL NUM (transmitter serial number)*
 TUBE MS CODE (flowtube model code)
 TUBE SERIAL NUM (flowtube serial number)
 SOFTWARE VER (software version)*

On strings over 16 characters, left and right arrow icons indicate that there are off screen characters. Use the Left and Right arrow keys to view these characters.

TUBE MS CODE 8302-SATA-TSJ-GF	▶
----------------------------------	---

Identity Menu Structure

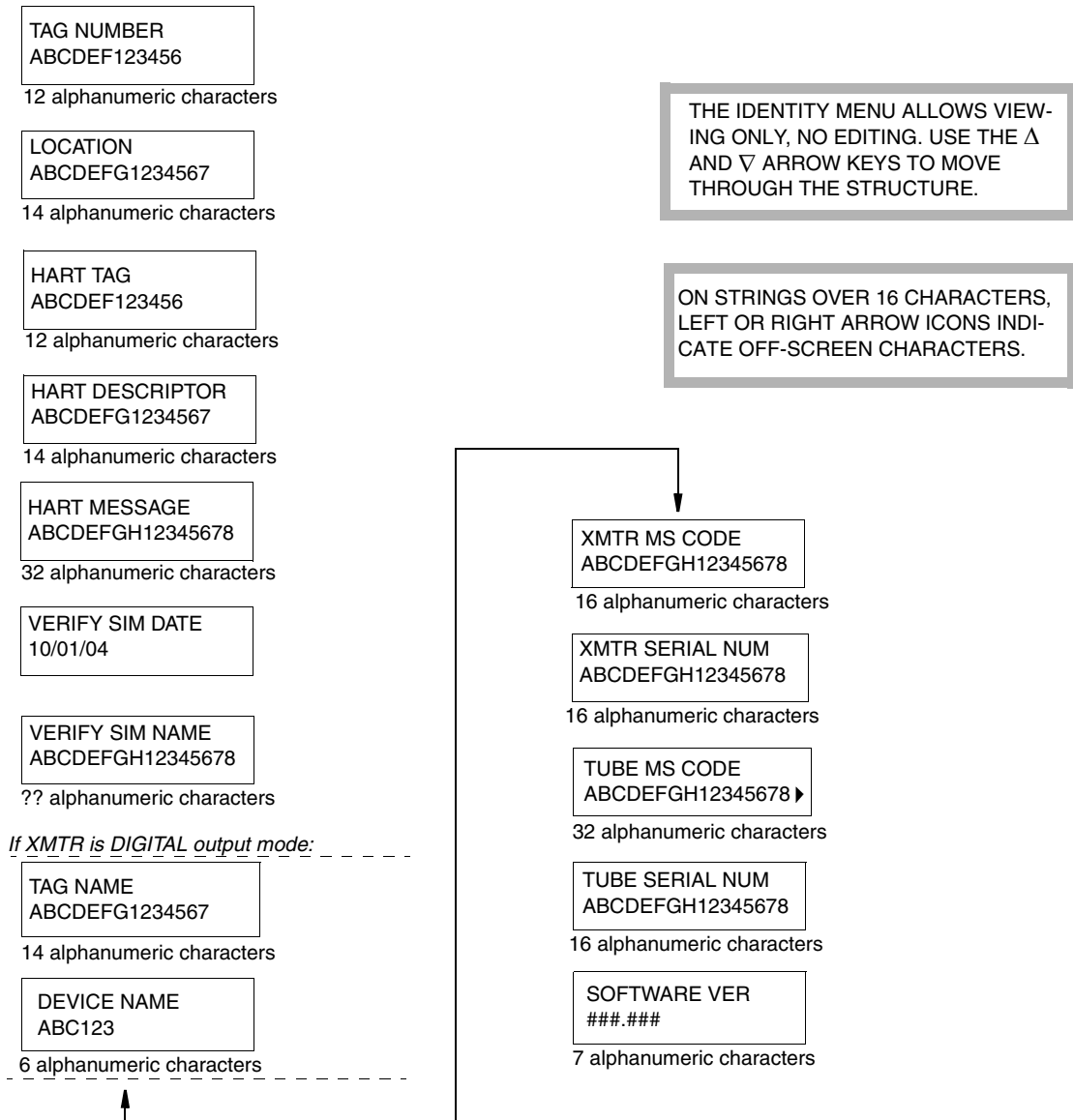


Figure 6. Structure Diagram – Identity Menu

Quick Start Mode (FoxCom and HART)

The Quick Start mode is a simplified setup (configuration) menu. For many applications it is all that is needed to setup the transmitter to provide accurate flow measurements. Quick Start can be used for applications requiring **only**:

- ◆ A 4-20 mA output based on a flow rate in (US) GPM
- ◆ The transmitter display to show a flow rate in (US) GPM
- ◆ A FoxCom digital or HART flow rate signal.

For details, see “Quick Start” on page 5.

Use Setup Mode for a full configuration of your transmitter.

Test Mode

The Test mode provides a way to check the operation and calibration of the transmitter. Details of using this function are covered in System Maintenance Instruction, MI 021-391.

To use Test mode, you must have an IMTSIM flowtube simulator to connect to the transmitter in place of the flowtube. Test mode provides three choices:

- ◆ OFF returns the transmitter to normal operation
- ◆ Test Mode A (See test description below)
- ◆ Test Mode B (See test description below)

In both test modes, the display initially shows the word “Testing” for about a minute while it performs internal checks. It then displays a mV/Amp value that should equal the dial setting on the IMTSIM. When this value stops flashing, it has stabilized and is ready to read.

The differences between Modes A and B relate to the 4 to 20 mA and pulse rate outputs. Mode B sets the outputs to 100% for the maximum IMTSIM setting, which is 8 mA. This makes it easy to compute the correct output percentages for the other dial settings. Since Mode A does not alter the ranging of the transmitter, the dial settings must be calculated using the flowtube factor and URV settings. When the transmitter exits from Test mode and returns to normal operation, the configuration that existed before testing is restored.

Setup Mode

The Setup mode enables you to configure your system, output, alarm, diagnostic, identity, passcode, transmitter, and calibration parameters. You can enter this menu while the transmitter is on-line to review parameter settings. The transmitter output is not disturbed without ample warning. If you press **Shift + Change** you are warned that you are going off-line and are asked if you want to do so. Indicate your reply with the left or right arrow keys.

Go Off-Line? ◀ No Yes ▶

This can also be a passcode protected mode. So after the initial configuration, you may need a password to enter this mode.

— NOTE —

If you lose your passcode, call Invensys Foxboro for assistance.

For detailed instructions on how to configure your transmitter, see “Configuration” on page 29. The structural diagrams of the Setup menu begins with Figure A-2 of Appendix A on page 52.

— CAUTION —


With a FOUNDATION Fieldbus transmitter, if you make any changes in some Transducer Block parameters from the local keypad/display, you **must** also make corresponding changes in the corresponding Analog Input Blocks from the fieldbus host before you attempt to place the transmitter in service. Failure to do so causes a mismatch error.

Alarm Actions

Conditions That Can Be Alarmed

- ◆ High Rate of Flow
- ◆ Low Rate of Flow
- ◆ High Forward Total 1
- ◆ High Forward Total 2
- ◆ AutoZeroLock (Empty Pipe Detect)

Actions of Transmitter During Alarm Conditions

Display — When an alarm condition is present, there is a triangular icon in the top position of the top line []. Optionally, the entire display can be configured to blink.

— **NOTE**

A diagnostic condition also causes the triangular icon to be displayed.

Outputs — Alarms can be configured to have no effect on the outputs or can force them to go fully upscale or downscale.

Relay Contact Outputs — Contact output relays can be configured to respond to a specific alarm or any alarm. (Refer to “Suppress Feature” below).

Status Mode — When an alarm condition occurs, the Status mode can provide an definition of the cause of the alarm, if the alarm condition still exists, or what the alarm was if the condition passed. Alarm conditions are defined as either **No Alarms** or a definition of the alarm, such as **Alarm High Flow**. If the alarms are configured for Manual Clear, the message **Alarms in Buffer** appears if an alarm condition that no longer exists and has not been acknowledged. If an alarm is acknowledged when the **Alarms in Buffer** message is displayed, the alarm condition is displayed briefly before it is cleared.

Clearing Alarms — The alarm clear function can be configured as Auto or Manual. In Auto, all evidence of the alarm clears when the alarm condition no longer exists. In Manual, the definition of the alarm condition changes to **Alarms in Buffer** when the alarm condition no longer exists. The alarm must be acknowledged to clear it from the buffer.

Acknowledging an Alarm — Three methods are available to acknowledge alarms when they are configured for manual clear. These methods are only effective after the condition that caused the alarm no longer exists. The methods are:

- ◆ Pressing the **Ack** key while the **Shift** key is depressed.
- ◆ Using a HART Communicator.
- ◆ Using an external contact if one of the contact inputs was configured to acknowledge alarms.

— **NOTE**

A power cycle or an off-line/on-line cycle (as in Setup mode) also clears the alarms that are in the buffer.

While the alarm condition continues to exist, acknowledging the alarms has the following effect:

- ◆ Does not affect the display action.
- ◆ Does not restore the outputs if they were configured to go high or low.
- ◆ Returns the Relay Output to the normal operation condition, but only if the Relay Output was also configured to allow the suppression feature.

When the condition that caused the alarm is corrected, the following will happen:

- ◆ The display icon and/or flashing stops if the alarms are configured to Auto Clear. If set for Manual Clear, the alarm has to be acknowledged to clear the display action.
- ◆ The Flow Rate Outputs return to normal without acknowledgment in either Auto or Manual Clear modes.
- ◆ The Relay Output returns to normal if alarms are set to Auto Clear. If set for Manual Clear, the alarm has to be acknowledged to return the Relay Output to the normal operation state.

Suppress Feature — The suppress feature can cause an output relay to revert to the inactive state when an alarm is acknowledged and the alarm condition still exists. For example, you can have a relay output that is configured for High Rate Alarm 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.

Diagnostic Actions

The transmitter performs diagnostic tests in the background while it is computing flow. The tests cover:

- ◆ Process conditions which preclude a valid measurement
- ◆ Hardware failure (transmitter, flowtube, wiring, etc.)
- ◆ Invalid configuration.

If a Diag error exists, the transmitter cannot reliably compute flowrate. Therefore, the transmitter flowrate outputs go upscale or downscale depending on the transmitter configuration. The display will show the Diag icon in the upper right corner and the display will flash if configured to do so.

The Status mode can be helpful in identifying the problem. The Diag window in Status gives a brief description of the error and provides on-line Help with the **Shift + Help** keys. If the Diag message is **Diags Exist**, the problem still exists and cannot be cleared, the problem must be fixed to restore flow measurement. If the Status message is **Diags Existed**, the condition no longer exists and the transmitter is working normally, However, the Diag must be acknowledged to restore the display and Relay Output (if used) to normal.

Acknowledging Diagnostics

The best way to acknowledge a Diag is to use the **Shift + Ack** keys while the display shows the Diag window in the Status mode. Another way to clear the Diag is to cycle power off and on. The advantage of using the Status mode method is that the second line of the display shows what problem existed. With a HART transmitter, a HART Communicator can also be used to clear diagnostic messages.

Write Protect Switch

The write protection DIP switch, located on the printed wiring board (refer to Figure 7) attached to the transmitter cover, allows or prevents anyone from changing the configuration of the transmitter or resetting the totalizer. This feature is usually only used in custody transfer applications or for another reason the user wants to ensure that the configuration and or totals will not be changed. Therefore, the switch is usually placed in the “disable” position (factory default position). Placing the switch in the “enable” position, engages the protection.

— **NOTE** —

A change in the write protect switch position does not take effect until power is turned off and on again.

—  **CAUTION** —

Do **not** touch the Foxboro service switch. It is for use by Foxboro service personnel only. The transmitter will not operate correctly if this switch is in the enable position. If this switch has been moved to the enable position, return it to the disable position and turn power off and on.

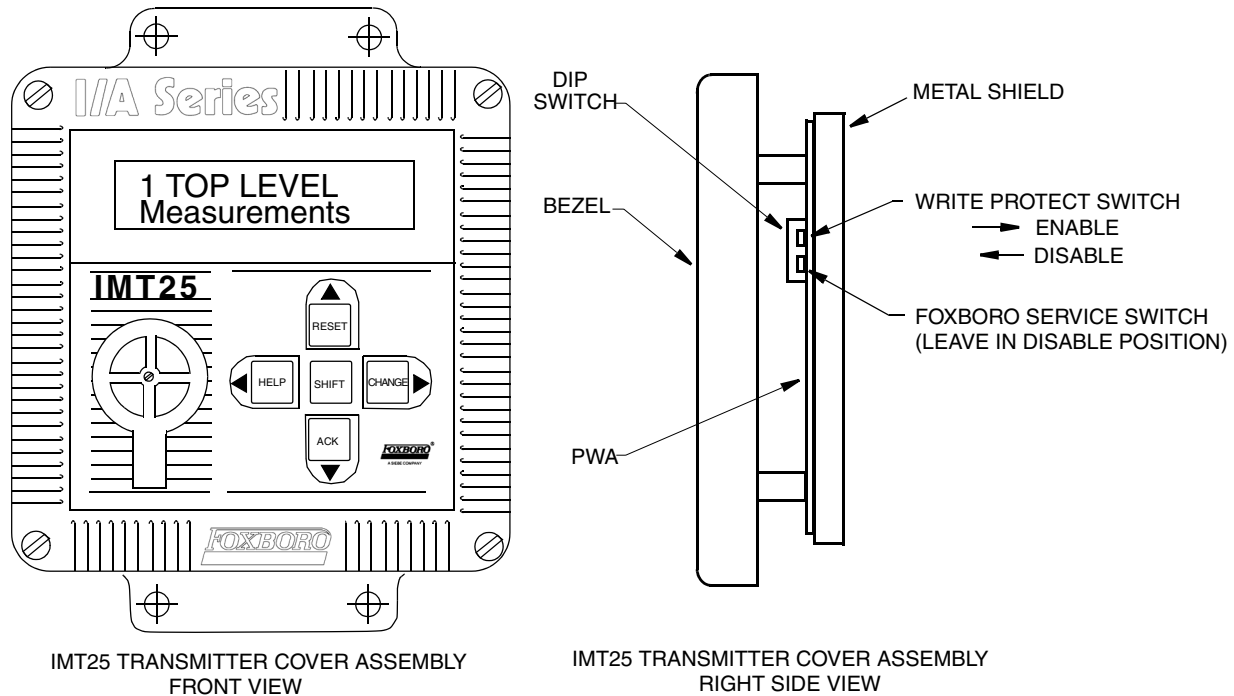


Figure 7. Write Protection Switch

Totalizer Operation

The Totalizer displays four totals which are stored in a nonvolatile memory.

- ◆ Forward (flow direction) Total
- ◆ Reverse (flow direction) Total
- ◆ Net Total (Forward Total minus Reverse Total)
- ◆ Grand Total (Forward Total minus Reverse Total since last reset of Grand Total)

You can specify the units of the pulse (for example, gallons) and the format of the display (for example, xxxxxx.x). This example given shows tenths of a gallon. The units selected apply to all four totals but the format of the Grand Total can be different than the other totals to display larger values.

The totalizer and alarm functions can be combined to drive the relay outputs. These relays can be used for remote alarm of totals or to close valves.

Resetting Totals

Forward, Reverse, and Net Totals are reset as a group. Grand Total is reset separately.

Totals can be reset with the keypad/display, an external contact, a PC-Based Configurator, a HART Communicator, or a fieldbus host. To reset with the keypad/display, use the following procedures:

- ◆ To reset **Fwd Tot** (forward total), **Rev Tot** (reverse total), and **Net Tot** (net total) to zero, go to **Net Tot** in Measurements mode and press **Shift + Reset**. If Reset Totals is

- passcode protected, the message **Enter Passcode** appears. To proceed, enter the passcode.
- ◆ To reset **Gr Tot** (grand total) to zero, go to **Gr Tot** in Measurements mode and press **Shift + Reset**. If Reset Totals is passcode protected, the message **Enter Passcode** appears. To proceed, enter the passcode.
 - ◆ If write protection is enabled, you cannot reset any totals. You must move the Write Protect switch to the disable position and then turn power off and on to disable write protection.
 - ◆ To reset Empty Pipe Count, go to **Empty Pipe Cnt** in Status mode and press/hold **Shift + Reset**.

Totalizer Overflow

Totalizer overflow (rollover) is indicated if **Alarm Clear** was configured as **Manual**. If so configured, rollover will cause the alarm icon to be displayed and the status mode will show **Alarms in Buffer**. When the alarm is acknowledged, the display will flash **Total Rollover** once for every rollover (maximum of 10 times).

Resetting AZL (EDP) Count

To reset AZL (EDP) Count, go to the **AZL Count (EDP Count)** display in Status mode and press/hold **Shift + Reset**.

On-Line Help

Context-sensitive on-line help messages can be displayed by pressing **Shift + Help** key. The message displayed pertains directly to the parameter currently displayed on the screen. A typical Help screen is shown below.

This is a typical HELP
message ▼

The down arrow icon indicates that more information is available. Press the Down arrow key to display the additional information. Similarly, an up arrow icon indicates more information can be displayed by pressing the Up arrow key. To exit from the On-Line Help mode, press either the Left or Right arrow keys. Press the **Shift + Help** key while in On-Line Help to get help on the On-Line Help function.

Output Owner Priority Structure

The IMT25 can provide digital measurement values, an analog 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 analog and pulse outputs to be forced to the configured “failure” setting.

In addition, the analog and pulse outputs are forced to the Zero flow condition when the transmitter is taken off-line for configuration using the optional keypad/display. Also, the analog 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 (analog output only)
- ◆ Signal Lock or AutoZeroLock (all outputs)
- ◆ Manual Presets (all outputs)
- ◆ Off-Line condition (analog and pulse outputs)
- ◆ Diagnostic conditions (analog and pulse outputs)
- ◆ Alarm conditions (analog and pulse outputs)
- ◆ Live process conditions (all outputs)

4. Configuration

Preparing Your Transmitter for Configuration

Your transmitter can be configured before or after it is connected to a flowtube. If it is connected to a flowtube, you can proceed directly to configuration. If the transmitter is not connected to a flowtube or IMTSIM Simulator, it is necessary to put a jumper wire between terminals Coil 1 and Coil 2. It is also necessary to provide power to the transmitter.

— **NOTE** —

If the pipe is full, it does not matter whether or not the fluid is flowing. If the pipe is empty, there is a slight chance you will have diagnostic interruptions during configuration. If this is a problem, fill the pipe or use jumper wires to connect signal terminals B, SG, and W together.

Getting Started

There are four basic steps to changing the configuration of your transmitter in Setup mode to the requirements of your application using the keypad/display.

1. Determine what parameters have to be changed using the information in Table 9.
2. Enter the Setup (configuration) mode.

Press the Left arrow key until the top line of the display shows **1 TOP LEVEL**. Then use the Up or Down arrow key until the second line shows Setup. Press the Right arrow key to enter this mode.

3. Change the parameter values.

The example in “Viewing and Changing Data” on page 32 illustrates the mechanics of changing the configured settings and values.

4. Exit the Setup mode.

This step transfers the values you changed from a volatile memory used by Setup to the transmitter nonvolatile operating memory. The changes made in Setup are not enacted until the Setup exit procedure is complete. If the power is turned off before exiting Setup, the changes are lost.

To exit the Setup mode, use the Left arrow key to move to the left in the menu structure until the display asks **Go On-Line?** A Yes reply (Right arrow) to this question completes the exiting of the Setup mode and returns the transmitter to the Measurements mode.

— **NOTE** —

There are some places in the Setup menu that do not respond to the Left arrow key. If there is no response to the Left arrow key, use the Right arrow key until you get to a location where the Left arrow key works.

Configuration Tools

Several tools exist to help you configure your transmitter using the keypad/display. They are:

- ◆ The configuration guide chart (see Table 9) — this guide shows what parameters must be checked or set.
- ◆ Appendix A — This shows how to get to the parameter location using the arrow keys and what parameter choices are available.
- ◆ Appendix B — This is a worksheet showing all the parameters, with the available choices or limits for each parameter, the factory default selections, and a space provided for you to write in the settings for your application.
- ◆ Configuration Checker and Display Help Messages — these features are part of the transmitter program. Pressing the **Shift + Help** keys brings parameter-specific help messages to the display. This help is available at any time during setup.

It is possible during the configuration process to choose conflicting parameters or not to provide all the settings necessary for the transmitter. If this happens, the triangular diagnostic icon will show in the upper right corner of the display when you return to the measurement mode. If the icon is there, press the Right arrow key. The display will read **Setup Needed/Config Error** or **1 TOP LEVEL/Measurements**. If the **Set Needed** message appears, use **Shift + Help** to display details of the problem. If **1 TOP LEVEL** is displayed, proceed to the Status mode and check the reason for the icon (see “Status Mode” on page 15).

Configuration Guide — How to Use

The first four columns of the configuration guide show specifically which parameters must be configured correctly to set up the particular transmitter outputs you want. The fifth identifies the optional and reference (Identity) features that can be configured.

The sixth column lists the page numbers of this instruction that contain a brief written description of the parameter. The seventh column refers to the figure number in Appendix A of the related software structure diagram for that parameter. This reference is helpful in finding the correct pages in Appendices A and B.

Table 9. Configuration Guide

Required for 4-20 mA Output	Required. for pulse Rate Output	Required. for Pulse Total Output	Required. for Digital Output	Optional Features	For description, see heading on page listed	For menu structure diagram, see figure listed	Description
Req	Req	Req	Req		49	A-14	Flowtube Factor (Meter Factor)
Req	Req	Req	Req		34	A-3	Flow Rate Units (EGUs)
Req	Req	Req	Req		46	A-12	Line Frequency (50 or 60 Hz)

Table 9. Configuration Guide (Continued)

Required for 4-20 mA Output	Required. for pulse Rate Output	Required. for Pulse Total Output	Required. for Digital Output	Optional Features	For description, see heading on page listed	For menu structure diagram, see figure listed	Description
Req	Req	Req	Req		37	A-5	Output Mode (Analog or Digital)
Req	Req	Req			37	A-5	Analog Flow Mode (Uni- or Bi-directional Flow)
			Req		37	A-5	Digital Flow Mode (Uni- or Bi-directional Flow)
Req	Req				39	A-5	Upper Range Flow Rates (URVs for all ranges)
Req	Req	Req	Req		46	A-12	Flow Direction
	Req	Req			40	A-6	Pulse Output (Off, Rate, or Total)
	Req				40	A-6	Pulse Rate, Values for URV and Hz at URV
		Req		Opt	35	A-4	Totalizer (Totalizer must be ON to use Pulse Total Output)
		Req		Opt	36	A-4	Total EGU (Used for Totalizer and Pulse Total Output)
				Opt	36	A-4	Totalizer Format (affects max. value that can be displayed)
				Opt	34	A-3	Flow Rate Display Setup
Opt	Opt		Opt		41	A-6	Damping of Rate Output Signals (also affects Noise Reduction)
Opt	Opt		Opt		48	A-13	Noise Reduction (works in conjunction with Rate Output Damping)
				Opt	35	A-3	Rate Display Damping (only affects transmitter display)
				Opt	43	A-8	Alarm Setup
				Opt	41	A-7	Output Relay Setup (Alarms, Flow Direction, Diagnostics, etc.)
				Opt	44	A-9	Diagnostics (Fail-safe setup)
				Ref	45	A-10	Identity (Tag Number, Tube ID, etc.)
				Opt	45	A-11	Passcodes (protect setup and/or totals)
Opt	Opt			Opt	47	A-12	Contact Inputs (acknowledge alarms, reset totals, multi-range, and signal lock)
Opt	Opt	Opt	Opt	Opt	48	A-13	AutoZeroLock detection (for alarm and/or auto signal lock)

Viewing and Changing Data

In Setup (configuration) mode, you will need to move through a structure of parameters (using the arrow keys) to view and/or change the value or status of a particular parameter. The Up- and Down-arrow keys will also enable you to scroll through a menu in either direction. Structure diagrams, located in Appendix A, will aid you in doing this.

Any parameter shown in { } brackets can be edited. For details, refer to Figure 2 on page 12.

The following example will show you how to use the keys in moving through the structure and in editing several parameters. For the example, we will configure the transmitter for a pulse rate URV of 150 GPM at a rate maximum frequency of 5000 Hz. In following this procedure, refer to Figure 8. We will begin at the Level 3 Output menu.

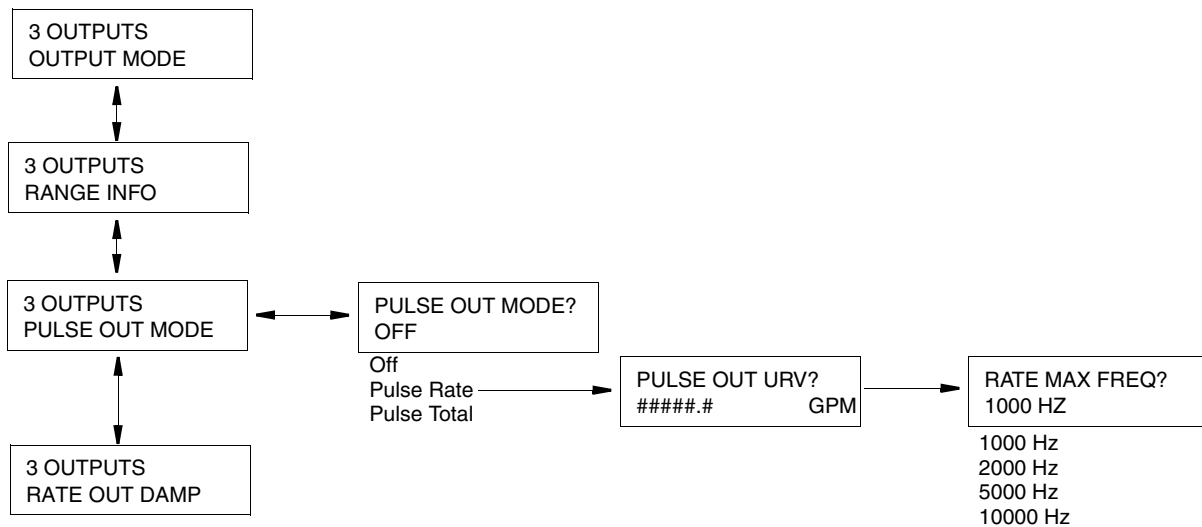


Figure 8. Example of Structure Diagram

1. Use the Down arrow key to move from **Output Mode** to **Range Info** to **Pulse Out Mode**.
2. Use the Right arrow key to move to **Pulse Out Mode? {Off}**. The curly brackets indicate that the Off status is editable.
3. Press the **Shift + Change** keys to enter Edit mode. If you are not already Off-Line, the display will ask **Go Off-Line?** Reply yes by pressing the Right arrow key. The display will show **Pulse Out Mode? [Off]**. The plain brackets indicate that you are in Edit mode.
4. Use the Down arrow key to scroll through the menu. Stop at Pulse Rate. Press the Right arrow key to enter this selection. The display will show **Pulse Out URV? {#####.# } GPM**.
5. Press the **Shift + Change** keys to enter Edit mode. The display will show **Pulse Out URV? [#####.#]GPM**. The cursor will be under the left bracket.
6. Use the Right arrow key to move the cursor under the first digit. Use the Down arrow key to scroll the character list until the **0** appears. Use the Right arrow to move the

- cursor under the second digit. Scroll the list to find the **0**. Select the **1**, **5**, **0**, and **0** in a like manner. The display now reads the pulse out URV required in our example.
7. Using the Right arrow key, move the cursor under the right bracket and press the key twice to enter the pulse out URV and move to the next parameter. The display will change to **{00150.0} GPM** and then to **Rate Max Freq? {2000 Hz}**.
 8. Press the **Shift + Change** keys to enter Edit mode. The display will show **Rate Max Freq? [2000 Hz]**.
 9. Use the Down arrow key to scroll the menu until **5000 Hz** appears. Press the Right arrow key once to enter our selection and a second time to return to Pulse Out Mode. Use the arrow keys to go to the next parameter to be changed.

Setup of System Parameters

The structural diagram of the System menu is located on Figure A-3 and Figure A-4 beginning on page 53.

Default Screen

The first item to be considered in setting up your system is to decide what display you want your system to default to in Measurements mode. Your choices are:

- Rate EGU** (Rate in engineering units)
- Rate % Range** (Rate in percent of range)
- Fwd Total** (Forward Total)
- Rev Total** (Reverse Total)
- Net Total**
- Grand Total**
- Dual Display** (a display of any two of the above if **Dual Display** is configured **On** (see next section)).

The default setting is **Rate EGU**.

Dual Display

In configuring this parameter, first you need to decide whether you want to use the dual display mentioned immediately above. If you selected the **Dual Display** as your Default Screen, you **must** configure this parameter **On**. If you want to scroll to a Dual Display sometimes in Measurement mode, you should also configure it **On**. If you never intend to use it, configure it **Off**. The default setting is **Off**.

If you configure the **Dual Display** as **On**, you must select the display for Line 1 and for Line 2. You may pick these from the first six choices that were available for the Default Screen. The default setting for both Line 1 and Line 2 is **Rate EGU**.

Rate Display

Rate EGU

In the Rate EGU parameter specify the engineering units in which you want your flowrate to be displayed. You may pick from a menu of:

GPM (gallons per minute)

GPH (gallons per hour)

GPD (gallons per day)

LPM (liters per minute)

LPH (liters per hour)

LPD (liters per day)

Custom Units

The default setting is **GPM**.

— NOTE —

Fieldbus transmitters have additional selections but do not have Custom Units.

If you select **Custom Units** you must enter the custom units you desire in up to six alphanumeric characters. The characters that may be used are listed in Table 10.

Table 10. Alphanumeric Characters

Characters
0 through 9
A through Z
a through z
. (period)
+
–
*
/
(space)

You must also enter the conversion factor from gallons per minute to the custom units under **Custom Slope**. The slope for some frequently used units are given in Table 11. The slope may be from $1.0e^{-30}$ to $1.0e^{+30}$. Enter it in the form `#####e+##`

Table 11. Custom Slope

Unit	Slope
ft ³ /min	1.3368e-01
m ³ /min	3.7850e-03
m ³ /h	2.2710e-01
bbl/min*	2.3810e-02
ImpGal/min	8.3267e-01
MGD	1.4400e-03

Slope is the quantity of the custom unit that equals one gallon per minute; i.e., 0.003785 m³/min = 1 GPM. Therefore, 0.003785 is the slope.

* 42 gallon barrel

— **NOTE**

To convert to units/hour, multiply the factor in the table by 60. To convert to units/day, multiply the factor in the table by 1440.

Rate Format

In Rate Format, from the eight choices in the menu, select the format of your rate from rounding to the nearest thousand to the nearest ten thousandth of a unit.

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. The default setting is #####.#.

— **NOTE**

Changing this parameter can affect other parameters such as Range URV and Alarm Setpt. For example, if **Rate Format** was configured as ####.## and the **Hi Setpoint** as **1234.56** but then the **Rate Format** was changed to ###.###. When you access **Hi Setpoint** again, you will find the display reading **999.999**, meaning that the Hi Alm Setpt exceeded the maximum legal limit. The displayed value is the maximum allowable value, **not** the currently configured value.

Rate Damping

In Rate Damping, specify the damping response time for the local display only. It is used to minimize flickering of the less significant digits. Choices are from 00.0 to 99.9 seconds. 00.0 is no damping. The default value is 3.0 seconds.

Totalizer

The totalizer provides an indication of the volume of flow that has accumulated since the last time that the totalizer was reset. Separate indications of the quantity of forward flow and reverse flow are available as are computed values for the Net Total (Forward flow minus Reverse flow) and the Grand Total (Forward flow minus Reverse flow since last reset of Grand Total). The totalizer is nonvolatile; that is, the accumulated values are retained over power cycles. If you are going to use the Totalizer or Pulse Total features, configure the **Totalizer** to **On**; if not, configure it **Off**. The default setting is **Off**.

If you configure it **On**, specify the engineering units of the totals (**Tots EGU**), the format of Forward, Reverse, and Net Total (**Tot/Net Format**), and the format of Grand Total (**Gr Tot Format**). **Tots EGU** also defines the units for a pulse from the pulse total output, if used.

Tots EGU

Specify the engineering units as gallons (**Gal**), liters (**Lit**), or **Custom Units**. The default setting is **Gal**.

— **NOTE**

Fieldbus transmitters have additional selections but do not have Custom Units.

If you selected **Custom Units**, specify the **Custom Units** and **Custom Slope** as you did in **Rate EGU**. The slope for some frequently used units are given in Table 11. The slope may be from $1.0e^{-10}$ to $1.0e^{+10}$. Enter it in the form **#####e+##**.

— **NOTE**

Changing the totalizer EGU rescales all totals to the new engineering units. Changing this parameter can change the total to zero if the total exceeds the limit of the new format. For example, if **Tot Net Format** is **#####.##** and the present total is **50000.00**, changing **Tots EGU** from **Gal** to **Lit** will cause the rescaled total to exceed the maximum displayable value and it will be reset to zero.

Table 12. Custom Slope

Unit	Slope
ft ³	1.3368e-01
m ³	3.7850e-03
barrel	2.3810e-02
Imp Gal	8.3267e-01

Slope is the quantity of the custom unit that equals one gallon; i.e., $0.003875 \text{ m}^3 = 1 \text{ Gallon}$. Therefore, 0.003875 is the slope.

* 42 gallon barrel

Tot/Net Format

In **Tot/Net Format**, from the eight choices in the menu, select the format of your forward, reverse, and net total from **####.###** to **#####.e4**. The default setting is **#####**.

— **NOTE**

1. Changing this parameter can change the total to zero if the total exceeds the limit of the new format. For example, if **Tot/Net Format** was configured as **#####.#** and present total was **123456.7** but then the **Tot/Net Format** was changed to **#####.##**, the totalizer would reset to zero.
 2. If you plan to use the output pulse in Totalizer mode, the size of each pulse will be the equivalent of 1 digit in the rightmost decimal position of the displayed total.
-

Gr Tot Format

In **Gr Tot Format**, from the eight choices in the menu, select the format of your grand total from #####.### to #####.e4. The default setting is #####.

— NOTE

Changing this parameter can change the total to zero if the total exceeds the limit of the new format. For example, if **Gr Tot Format** was configured as #####.# and present total was **12345678.9** but then the **Gr Tot Format** was changed to #####.##, the totalizer would reset to zero.

Reset Totals

This Setup parameter offers the opportunity to reset the totalizers to zero. To reset the totalizers, answer yes to the question **Reset All Tots?**

Setup of Outputs

The structural diagram of the Outputs menu is located on Figure A-5 through Figure A-7 beginning on page 55.

Output Mode

With FoxCom transmitters, specify your output as **Digital** or **Analog**. Specify **Analog** if you want an analog 4 to 20 mA signal. In this mode, a 600 baud digital signal is superimposed over the 4 to 20 mA signal for communication with a PC-Based Configurator. Specify **Digital** if you want to have a 4800 baud digital signal for I/A Series system communication.

If you selected **Digital** on your FoxCom transmitter or with a fieldbus transmitter, specify Unidirectional (**UniDir**) or BiDirectional (**BiDir**) flow. If you want a pulse output, you must specify Unidirectional. The default setting is **UniDir**.

If you selected **Analog** on your FoxCom transmitter or with a HART transmitter, specify one of the following:

- ◆ **UniDir** (unidirectional), which specifies unidirectional flow with a single upper range value (Forward URV).
- ◆ **Uni Multi-Rang** (unidirectional multi-range), which specifies unidirectional flow with multiple URVs selected by the Contact Inputs.
- ◆ **BiDir Dual Rng** (bidirectional dual range), which specifies two-way flow with 4 to 20 mA indicating the rate and an optional Relay Output indicating flow direction. The upper range value for forward flow is parameter Forward URV. The upper range value for reverse flow is parameter Reverse URV. The relationship between the milliamper output and the flow rate in BiDirectional Dual Range mode is illustrated in Figure 9.

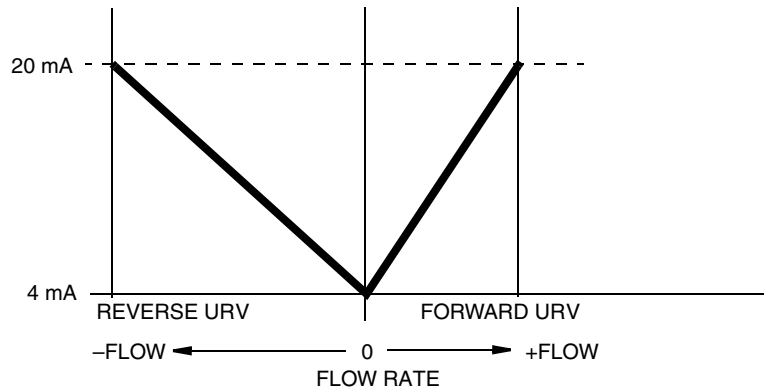


Figure 9. *BiDirectional Dual Range Milliampere Output*

- ◆ **BiDir SplitRng** (bidirectional split range), which specifies two-way flow with 4 to 12 mA for reverse flow (Reverse URV to 0) and 12 to 20 mA for forward flow (0 to Forward URV). An optional Relay Output can be used to indicate flow direction. 4 mA indicates reverse flow at the Reverse URV rate, 12 mA is zero flow, and 20 mA indicates forward flow at the Forward URV rate. The relationship between the milliampere output and the flow rate in BiDirectional Split Range mode is illustrated in Figure 10.

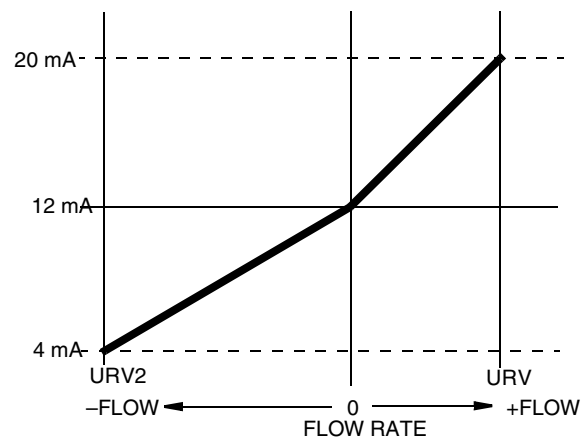


Figure 10. *BiDirectional Split Range Milliampere Output*

The default setting is **UniDir** (unidirectional single range).

The output mode must agree with flowtube direction. For example, if you pick **UniDir** or **Uni Multi-Rang** for **Output Mode**, you must pick **Positive** or **Reverse** for **Flowtube Direction**.

If you pick **Uni Multi-Rang** for **Output Mode**, you must supply two Contact Inputs to the transmitter, and program both CI1 and CI2 for Multi-Range. You must also program values for Range 1, 2, and 3 URVs. 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 Multi-Range** diagnostic condition and the outputs are set to the configured upscale or downscale failure condition. The active URV is determined by the states of the Contact Inputs as shown in Table 13.

Table 13. URV Selection in UniDirectional Multi-Range Flow Mode

Contact Input 1	Contact Input 2	Active URV
Active	Inactive	Range 1
Inactive	Active	Range 2
Active	Active	Range 3
Inactive	Inactive	INVALID

If you select **BiDir Dual Rng** or **BiDir SplitRng** for **Output Mode**, you should not enable the Pulse Output since the Pulse Output is unidirectional.

If you select **BiDir Dual Rng** for **Output Mode**, you can program a Relay Output for flow direction. This is the only way to indicate remotely whether the analog output represents forward (positive) or reverse flow in this mode.

— **NOTE** —

In all of the above modes, a contact output can be configured to indicate actual flow direction.

Range

The selections in this parameter relate to your choice of Output Mode:

- ◆ For Digital Output and Unidirectional mode, specify the Forward URV.
- ◆ For Digital Output and BiDirectional mode, specify the Forward URV and the Reverse URV.
- ◆ For Analog Output and Unidirectional mode, specify the Forward URV.
- ◆ For Analog Output and Unidirectional Multi-Range mode, specify the URV for each of three ranges.
- ◆ For Analog Output and BiDirectional Dual Range mode, specify the Forward URV and the Reverse URV.
- ◆ For Analog Output and BiDirectional Split Range mode, specify the Forward URV and the Reverse URV.

— **NOTE** —

1. In each case, the URV must be within the minimum and maximum URV limits of the flowtube (see appropriate flowtube Master Instruction in “Reference Documents” on page 2).
 2. The largest number that can be entered is limited by the **Rate Format** selection. The units for the URVs are defined by the Rate Display/Rate EGU selection.
-

Pulse Out

The **Pulse Out Mode** parameter can be configured to provide 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 selection for this parameter are **Off**, **Pulse Rate**, and **Pulse Total**. The default setting is **Off**.

In this parameter, specify the **Pulse Output** as **Off**, **Pulse Rate**, or **Pulse Total**.

— **NOTE** —

1. The Pulse Output is only unidirectional. Therefore it should be configured **Off** if you have specified BiDirectional flow.
 2. The normal pulse output value can be overridden by Presets, Signal Lock, Alarms, Diagnostics, and AutoZeroLock (Empty Pipe Detect), in both the **Pulse Rate** and **Pulse Total** modes.
-

Pulse Rate

To use the Pulse Rate output feature, set the **Pulse Out Mode** to **Pulse Rate**; then set **Pulse Out URV** to the flow rate value in EGUs that generates the full-scale pulse rate frequency. The default value is 100.

— **NOTE** —

The engineering units of the **Pulse Out URV** parameter are established by “Rate EGU” on page 34.

Next, configure the full-scale frequency for the Pulse Rate output via the **Rate Max Freq** parameter. The available selections are **1000 Hz**, **2000 Hz**, **5000 Hz**, and **10000 Hz**. The default setting is **2000 Hz**.

— **NOTE** —

Changing **Rate Max Freq** can affect the **Pulse Preset** in the Calibration Menu; for example, if the **Rate Max Freq** was configured as **5000** and the **Pulse Preset** as **4000**, but then the **Rate Max Freq** was changed to **1000**, when you access **Pulse Preset** again, you are warned that the preset value exceeds the maximum. The display shows a value of **1000.0**, the maximum allowable value.

The Pulse Rate output is damped in accordance with the **Rate Out Damp** parameter (see page 41) and the **Noise Reduction** parameter (see page 48) settings.

Pulse Total

To use the Pulse Total output feature, the **Totalizer** must have been configured **On**, the desired totalizer units specified in **Tots EGU**, and the quantity per pulse indicated via the **Tot/Net Format** configuration. See “Totalizer” on page 35.

Then, set the **Pulse Out Mode** to **Pulse Total** and configure the **Tot Max Freq** parameter to indicate the maximum frequency at which the Pulse Total output can generate pulses. The choices are **10 Hz** or **100 Hz**. This setting also determines the on-time for the Pulse Total output, which is 50 milliseconds for the 10 Hz and 5 ms for the 100 Hz setting. The default setting is **100 Hz**.

— NOTE

The Pulse Total output never generates pulses faster than the Tot Max Freq rate. However, the transmitter can keep track of a limited number of “pending” pulses. This occurs when the flow rate temporarily increments the totalizer faster than the Tot Max Freq rate. In this situation, the transmitter displays the message **Pulses Lag Total**. The accumulated pulses are sent to the pulse output when the flow rate returns to a lower value.

Rate Out Damp

This parameter specifies the damping time that is applied to the analog output and the pulse rate outputs. It is the time required to go from zero to 90% of a change. It can be set from 0.0 to 99.9 seconds. The default value is 3.0 seconds.

— NOTE

If the Noise Reduction parameter is enabled, it also affects the digital output indirectly since the rate output damping determines the timing of the noise reduction algorithm.

Relay Outputs

The transmitter provides two Relay Outputs (RO1 and RO2) that can be configured to indicate certain status conditions. To use this feature, configure the Function, Operation, and Suppress parameters for each relay.

RO1 Function and RO2 Function — This parameter enables you to turn this feature off or to specify one of several status conditions to be indicated. The selections are:

- ◆ **Off** (the relay output is not in use)
- ◆ **Alarm** (the relay becomes active when any configured alarm occurs)
- ◆ **Alarm + Diag** (the relay becomes active when a diagnostic condition or the configured alarm occurs)
- ◆ **Diagnostics** (the relay becomes active when a diagnostic condition occurs)
- ◆ **Flow Direction** (the relay becomes active when the flow rate is negative)
- ◆ **Test Mode** (the relay becomes active when the transmitter is in Test mode)

The default setting for these parameters is **Off**.

If you select **Alarm** or **Alarm + Diag**, you must specify in **RO n Alarm** a particular alarm condition that activates the Relay Output or indicate that any alarm should activate the Relay Output. The following selections are available:

- ◆ **High Rate**
- ◆ **Low Rate**
- ◆ **High Fwd Total 1**
- ◆ **High Fwd Total 2**
- ◆ **AutoZeroLock (Empty Pipe)**
- ◆ **Any Alarm**

The default for **RO 1 Alarm** is **High Rate** and for **RO 2 Alarm** is **Low Rate**.

— **NOTE** —

The alarm that you specify must also be enabled in “Setup of Alarms” on page 43.

If you select **AutoZeroLock (Empty Pipe)**, ensure that the AutoZeroLock (Empty Pipe) detector is enabled and calibrated. Also ensure that the **AZL Alarms (EPD Alarms)** parameter is set to **On**.

RO1 Operation and RO2 Operation — To use the Relay Output function, you must 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**. The default setting for both parameters is **Normally Open**.

RO1 Suppress and RO2 Suppress — If you select **Alarm** or **Alarm + Diag**, you can specify the Suppress function as **Yes** or **No**. If Suppress is **Yes**, an Alarm Acknowledge that is performed when the alarm condition still exists resets the Relay Output to the inactive state. Reassertion 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 keypad/display, a HART Communicator, or a contact input. The Suppress feature is separately configurable for each Relay Output. Specify either **Yes** or **No** for the **RO1 Suppress** and **RO2 Suppress** parameters. The default setting for both parameters is **No**.

HART Output

Poll Address

This parameter specifies the polling address of the unit, which is used in identifying the unit to another HART device. The address can be set to any value from 00 to 15. However, this parameter should always be set to 00 unless the unit is being operated in a multi-drop environment (more than one HART device present on the same current loop).

If the parameter is set to any nonzero 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 value is 00.

Number of Request Preambles

This parameter indicates the number of preamble characters that the transmitter sends at the start of each HART response message. Depending on the characteristics of the communication link, changing this parameter could disrupt communications. For this reason, this parameter is not configurable with the HART Communicator.

Setup of Alarms

The structural diagram of the Alarms menu is located on Figure A-8 on page 58.

The alarm feature allows you to specify process conditions of interest (such as high flow rate) and actions that the transmitter should take when the condition occurs (such as closing a relay output). To configure this feature, first specify **Alarms** as **On** or **Off**. The default setting is **Off**.

— NOTE —

Shutting alarms Off does not acknowledge existing alarms.

If **On**, proceed to configure the following alarm parameters:

High Rate and Low Rate

Set each of these alarms as **On** or **Off**. If **On**, specify the set point and the amount of deadband between 0 and 999999 in the **Rate EGU** units previously configured. The default values are:

Hi Setpoint:	100
Hi Deadband:	1.0
Lo Setpoint:	1.0
Lo Deadband:	0.5

— NOTE —

Alarm rates are absolute values so use care in applying them to bidirectional flow.

High Fwd Tot 1 and High Fwd Tot 2

The forward total alarms trigger an alarm when the forward total value exceeds the configured setpoint. Two forward total alarms are available. Each can be configured separately.

Configure **Tot 1 Alm** and **Tot 2 Alm** as **On** or **Off**. The default setting is **Off**. If **On**, specify **Tot 1 Setpoint** and **Tot 2 Setpoint** between 0 and 9999999 in the **Tots EGU** units previously configured. The default value for **Tot 1 Setpoint** is 100,000. that for **Tot 2 Setpoint** is 1,000,000.

AutoZeroLock (Empty Pipe)

AutoZeroLock (Empty Pipe) triggers an alarm when the AutoZeroLock (Empty Pipe) circuitry detects high electrode impedance. To use this alarm, the AZL Detect (Empty Pipe Det) parameter must be enabled and calibrated. See “AutoZeroLock (Empty Pipe)” on page 43.

Configure **AZL Alarm (EDP Alarm)** as **On** or **Off**. The default setting is **Off**.

— 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 (Empty Pipe) indication.

Rate Response

The alarm feature can be configured to drive the analog and pulse rate outputs fully downscale or upscale or to have no effect on these outputs. Analog output limits are 3.6 mA and 22.0 mA (12.0 mA and 22.0 mA, in Split Range). Pulse rate limits are 0 Hz and 110% of the configured maximum pulse rate.

Configure **Rate Response** as **GoDownscale**, **Go Upscale**, or **No Effect**. The default setting is **GoDownscale**.

— NOTE —

There is a hierarchy of precedence in driving the output up or down scale. The Signal Lock takes precedence over Diagnostics which takes precedence over Alarms. Therefore, if an alarm condition has caused the output to be driven upscale, a diagnostic condition could override the first action and drive the output downscale.

Display Response

The display can be configured to blink or not blink when an alarm condition occurs. Regardless of this setting, an active alarm causes an icon to be illuminated on the transmitter display panel.

Configure **Display Respon** as **Blink** or **Don't Blink**. The default setting is **Don't Blink**.

Alarm Clear

The alarm feature can be configured to clear an alarm automatically when the alarm condition no longer exists, or to require a manual clear. Once an alarm condition is no longer present, and has been cleared (either automatically or manually), all outputs return to their normal conditions.

— NOTE —

A contact input can also be configured to clear alarms.

Configure **Alarm Clear** as **Manual** or **Auto**. The default setting is **Auto**.

Setup of Diagnostics

The structural diagram of the Diagnostics menu is located on Figure A-9 on page 59.

Rate Response

The diagnostics **Rate Response** parameter determines if the analog and pulse rate outputs are driven fully downscale or upscale if a diagnostic condition is detected. Analog output limits are 3.8 mA and 22.0 mA (12.0 mA and 22.0 mA in Split Range). Pulse rate limits are 0 Hz and 110% of the configured maximum pulse rate.

Configure **Rate Response** as **GoDownscale** or **Go Upscale**. The default setting is **GoDownscale**.

— NOTE —

There is a hierarchy of precedence in driving the output up or down scale. The Signal Lock takes precedence over Diagnostics which takes precedence over Alarms. Therefore, if an alarm condition has caused the output to be driven upscale, a diagnostic condition could override the first action and drive the output downscale.

Display Response

The display can be configured to blink or not blink when an diagnostic condition occurs. Regardless of this setting, an active alarm causes an icon to be illuminated on the transmitter display panel.

Configure **Display Respon** as **Blink** or **Don't Blink**. The default setting is **Don't Blink**.

Setup of Identity

The structural diagram of the Identity menu is located on Figure A-10 on page 60.

Identify the following with the maximum number of alphanumeric characters listed. Use the characters listed in Table 10.

Tag Number	12 Characters	FoxCom and Fieldbus only
Location	14 Characters	FoxCom and Fieldbus only
Tag Name*	14 Characters	Only in Digital Output mode
Device Name*	6 Characters	Only in Digital Output mode
HART Tag	8 Characters	HART only
HART Description	16 Characters	HART only
HART Message	32 Characters	HART only
Tube MS Code	32 Characters	All versions
Tube Serial Num	16 Characters	All versions

Setup of Passcodes

The structural diagram of the Passcodes menu is located on Figure A-11 on page 61.

Passcodes can be configured to prohibit unauthorized personnel from performing certain functions on the transmitter. Passcodes can be configured **On** or **Off**. If you specify **Off**, there is no passcode protection. The default setting is **Off**.

If you specify **On**, you can configure each of two passcodes to protect one of the following functions or combination of functions:

- ◆ Setup (setup functions protected)
- ◆ Totals Reset (ability to reset totals protected)
- ◆ Setup and Totals (both setup and reset functions protected).
- ◆ Test Mode (TM) (Test mode functions protected)
- ◆ Test Mode and Setup (Test mode and setup functions protected)
- ◆ Test Mode and Reset (Test mode and reset functions protected)
- ◆ TM, Setup, and Reset (Test mode, setup, and reset functions protected)

An example of how this can be used is that one passcode could be given to some operators to enable them to reset totals but not change the configuration of the transmitter or perform test mode functions. Other operators could be given another passcode to enable them to reset totals, change the configuration, and perform test mode functions.

The sequence of this setup procedure is to specify the function of Passcode 1 and then its passcode. The passcode can be any four digit number between 0000 and 9998. When you have entered it, the display asks you, **Are You Sure?** Use the Right arrow key to accept the new passcode and the Left arrow key to cancel it. After you have completed the procedure for configuring Passcode 1, repeat it for Passcode 2. The default setting for specifying the functions protected of both passcodes is **Setup**.

Setup of Transmitter

The structural diagram of the Transmitter menu is located on Figure A-12 and Figure A-13 beginning on page 62.

Xmtr Mode

This parameter enables you to specify if you want the transmitter to be **On-line** or **Off-line**. This parameter could read **Calibrate** or **Override** if someone has changed the mode with a HART Communicator, PC-Based Configurator, I/A Series Workstation, or FOUNDATION Fieldbus Host. However, there is no need to set this parameter to anything other than **On-line** or **Off-line**. The default setting is **On-line**.

Line Frequency

The **Line Frequency** parameter specifies the local ac power frequency. Configure this parameter with the local ac power frequency to ensure optimum performance even if you are using a dc powered transmitter. The available selections are **50 Hz** and **60 Hz**. The default setting is **60 Hz**.

Flow Direction

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. This parameter ensures that the Flow Direction configured in the transmitter matches the installation. It indicates the direction of positive flow whether flow is UniDirectional or BiDirectional. Specify the flow direction as shown in Table 14.

You must make a **BiDir** selection if, and only if, you selected a BiDir flow mode in the Output section of Setup.

Make one of the **Positive** selections if the forward flow direction agrees with the flow direction arrow on the tube. Make one of the **Reverse** selections if the forward flow direction is opposite from the flow arrow.

The default setting is **Positive**.

Table 14. Flow Direction

Direction	Description
Positive	Forward flow is in direction of arrow on flowtube and unidirection flow mode was selected in the output section of setup.
Reverse	Forward flow is opposite the direction of arrow on flowtube and unidirection flow mode was selected in the output section of setup.
BiDir Positive	Forward flow is in direction of arrow on flowtube and bidirectional flow mode was selected in the output section of setup.
BiDir Reverse	Forward flow is opposite the direction of arrow on flowtube and bidirectional flow mode was selected in the output section of setup.

— 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 acceptable. But you must select **Positive** or **BiDir Positive** for **Flow Direction**. Refer to MI 021-387 for details on flowtube wiring.

Contact Inputs

The Contact Input parameters specify the function and operation of the two contact inputs. Each input is configured separately. **CI1 Function** and **CI2 Function** specify the function performed by the contact inputs when the contact enters the active state. **CI1 Operation** and **CI2 Operation** specify the inactive state (normally open or normally closed) of the contact inputs.

To configure **CI1 Function** and **CI2 Function**, specify one of the choices shown in Table 15.

If you have specified Unidirectional Multi-Range output, you **must** select **Multi-Range** for both CI1 and CI2. The external connections to these contacts must be so arranged that at least one of them is always in the active state; it is considered an error condition for both inputs to be in the off state. If you have **not** specified Unidirectional Multi-Range output, you should **not** select Multi-Range as the function of either of the contact inputs.

Table 15. Contact Input Functions

Function	Description
Off	Contact Input function not enabled.
Ack Alarm	Acknowledges an alarm, eliminates the need to do this manually.
Reset Net Tot	Resets the Forward, Reverse, and Net Totals.
Reset Grand Tot	Resets the Grand Total.
Reset All Tot	Resets all totals.
Multi-Range	Switches the range in a Multi-Range configuration.
Signal Lock	Drives the outputs to the zero flow condition.

The default setting of **CI1 Function** and **CI2 Function** is **Off**.

To configure the **CI1 Operation** and **CI2 Operation**, specify **Normally Open** or **Normally Closed**. The default setting is **Normally Open**, indicating that each contact is inactive when open and active when closed.

Noise Reduction

The noise reduction feature slows the initial output response to a change. See Figure 11. Noise reduction was designed to quiet the output flow signals with minimum impact on the transmitter ability to respond to rapid flow rate changes. Specify the **Noise Reduction** parameter as **On** or **Off**, and use the **Rate Out Damp** parameter to control the amount of noise reduction action.

If the **Noise Reduction** parameter is enabled (**On**), it also affects the digital output indirectly since the Rate Out Damp time determines the timing of the noise reduction algorithm. Thus, Noise Reduction applies to the analog, pulse rate, display, and digital outputs.

The default setting for the **Noise Reduction** parameter is **On**. This is recommended for most applications. If you want to increase the transmitter speed of response, leave the **Noise Reduction** parameter **On** and reduce the **Rate Out Damp** value.

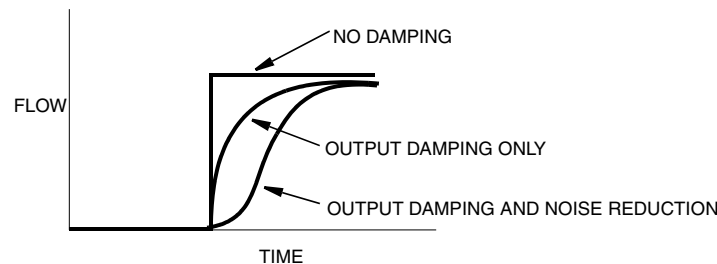


Figure 11. Noise Reduction

AutoZeroLock (Empty Pipe) Detection

The AutoZeroLock (Empty Pipe) Detector function can be configured to trigger when an increase in electrode impedance is detected, such as can occur when a pipe is empty. It can further be configured to force all outputs to the zero flow condition, generate an alarm condition, or both if triggered.

The intent of AutoZeroLock (Empty Pipe) Detection 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 and the output could drift. With this feature, the empty pipe detection circuit prevents output drift by monitoring the conductivity between electrodes and forcing the output to zero if the conductivity falls below a predetermined level. The 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 could cause a false empty pipe condition and coating of the electrodes with a viscous fluid could cause a significant lag before an empty pipe condition is recognized.

! 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 Empty Pipe Detection indication.

Configure the **AZL Setup (EPD Setup)** parameter as **On** or **Off**. The default setting is **Off**. Next, configure the **AZL Out Effect (EPD Rate Effect)** parameter as **No Effect** or **Auto Sig Lock**. The **No Effect** choice means that the AutoZeroLock (Empty Pipe) detect feature does not affect any of the outputs, but can still activate an alarm and contact output. The **Auto Sig Lock** choice means that AutoZeroLock (Empty Pipe) Detect forces all outputs to the zero condition when triggered. The default setting is **No Effect**.

! WARNING

Due to the possibility of false empty readings, do **not** use Empty Pipe Detection configured to **Auto Sig Lock** in critical flow loops.

Lastly, follow the calibration procedure (**Calculate Setpt** as shown in the Structure Diagram on page 63).

NOTE

AutoZeroLock (Empty Pipe) detect can also be calibrated via a HART Communicator, PC-Based Configurator, I/A Series Workstation, or FOUNDATION Fieldbus Host.

Setup of Calibration

The structure diagram of the Calibration menu is located on Figure A-14 on page 64.

Meter Factor

The Meter Factor is a property of the flowtube that must be entered into the transmitter configuration database.

Before entering the Meter Factor, you have the opportunity to confirm or change the **MFactor Format**. The default is **###.#####**. It only needs to be changed if the meter factor can not be entered into the format displayed.

The default value of the **Meter Factor** is **12.00**. To determine the proper value, find the “Cal Factor” or “IMT25 Cal Fact” that is stamped on the flowtube data label. If the data label shows the “IMT25 Cal Fact,” use that as your Meter Factor. If the data label does not have that exact label, refer to “Determining the Meter Factor” on page 8 to determine the meter factor.

Analog Out Cal

NOTE

1. This parameter only appears if the transmitter is in Analog Output mode.

2. The factory calibration of your transmitter is accurate. Therefore, it is not necessary to use the Analog Out Cal procedure unless there is a plant requirement to make the lower and upper calibration values exactly match readings on certain plant calibration equipment and there is a small but unacceptable difference between the transmitter mA output and the test equipment mA readout values.
 3. Once this procedure is used, the factory calibration is lost, but an accurate milliammeter can be used to restore an accurate calibration.
-

The **Analog Out Cal** parameter allows you to tune the 4 mA and 20 mA output values. The procedure is as follows:

1. Connect a precision milliammeter in the output loop.
2. With **4 mA Adjust** on the first line of the display, use the Up and Down keys to select an adjustment step size of **0.5**, **0.05**, or **0.005** mA. Then, use the Left or Right arrow keys to execute the adjustment in the lower or higher direction respectively.
3. Repeat Step 2 until your milliammeter reads **4 mA**. Then using the Up and Down arrow keys, go to **Done** and press either the Left or Right arrow key.
4. Repeat Steps 2 and 3 for 20 mA.

Preset Outputs

The Preset Outputs parameter allows you to override the normal outputs with particular output values. These values can then be used to verify that the output loops are connected and calibrated correctly. You can preset these values and configure them **Off** until you are ready to use them. Once you exit the Preset Output menu, the transmitter returns to normal operation.

If your transmitter is in Analog mode: In **Analog Preset**, you can configure the analog output between 3.8 and 21.0 mA.

If your transmitter is in Digital mode: In **Rate Preset**, you can configure the digital output in Rate Units configured in “Rate EGU” on page 34. The value can be between 0 and the maximum value that fits into the Rate Format configured in “Rate Format” on page 35.

If your transmitter is configured in Pulse Rate mode: In **Pulse Preset**, you configured the pulse rate to a value between 0 and the Rate Max Freq selected in the configuration of “Pulse Rate” on page 40.

If your transmitter is configured in Pulse Total mode: In **Pulse Preset**, you can configure the pulse count to a value between 0 and 65535.

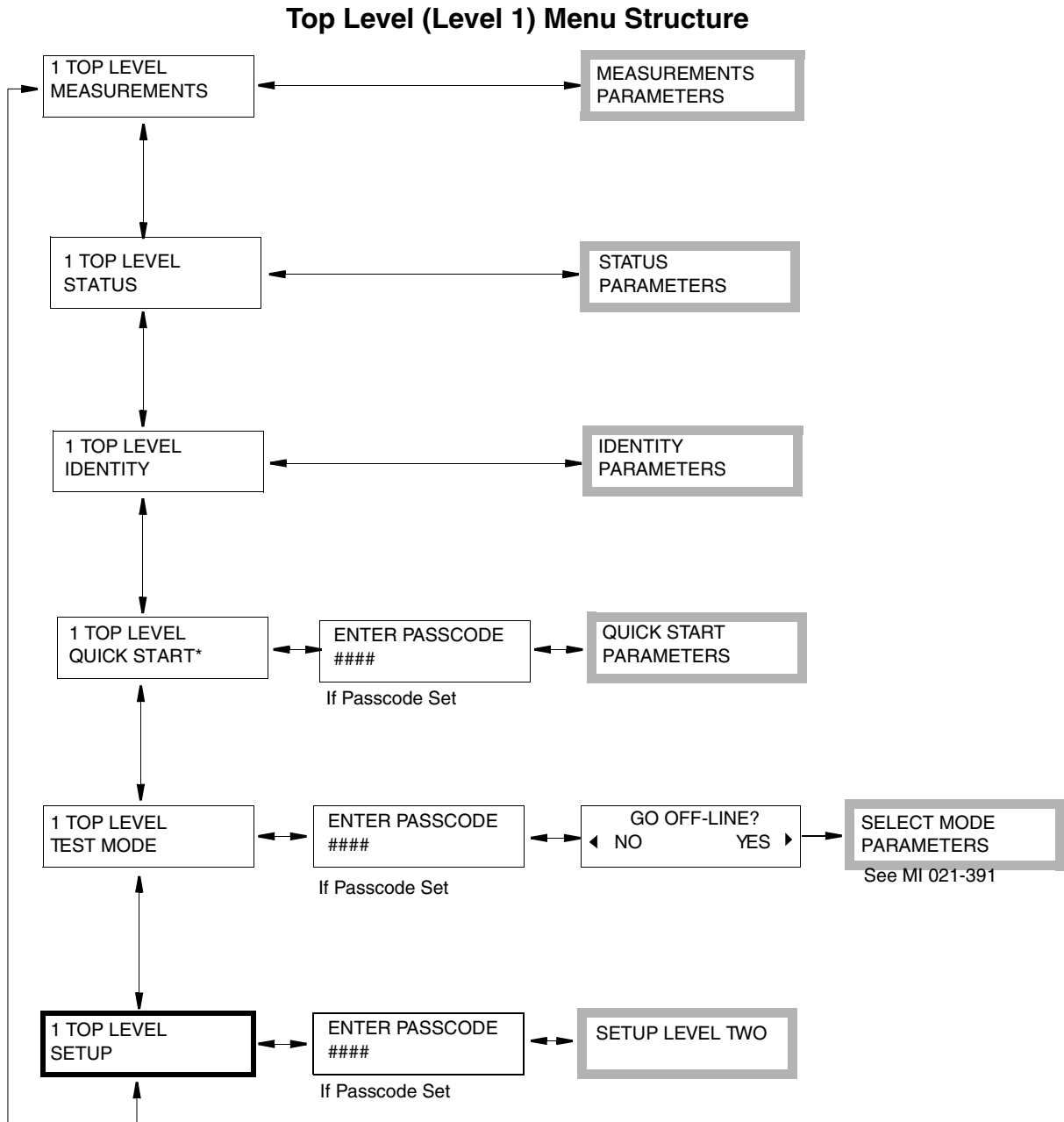
You can preset this value and configure it **Off** until you are ready to use it. You may change the configuration to **On** at the appropriate time.

— NOTE —

Presets have a lower priority than Signal Lock, Diagnostics, and Alarms. If the transmitter is in Signal Lock or an alarm or diagnostic is active and the output action for the active condition is anything other than No Effect, the preset will not actually control the output until the overriding condition goes away.

Appendix A. Setup Diagrams

This appendix contains structure diagrams that illustrate the Setup menu structure of the IMT25 Transmitter and show how you can use the keypad/display to get from one point to another in the structure. These diagrams and the configuration worksheets included in Appendix B can be invaluable tools in configuring and troubleshooting your transmitter.



*Quickstart is not present with FOUNDATION fieldbus transmitters

Figure A-1. Structure Diagram – Top Level Menu

Level 2 Setup Menu Structure

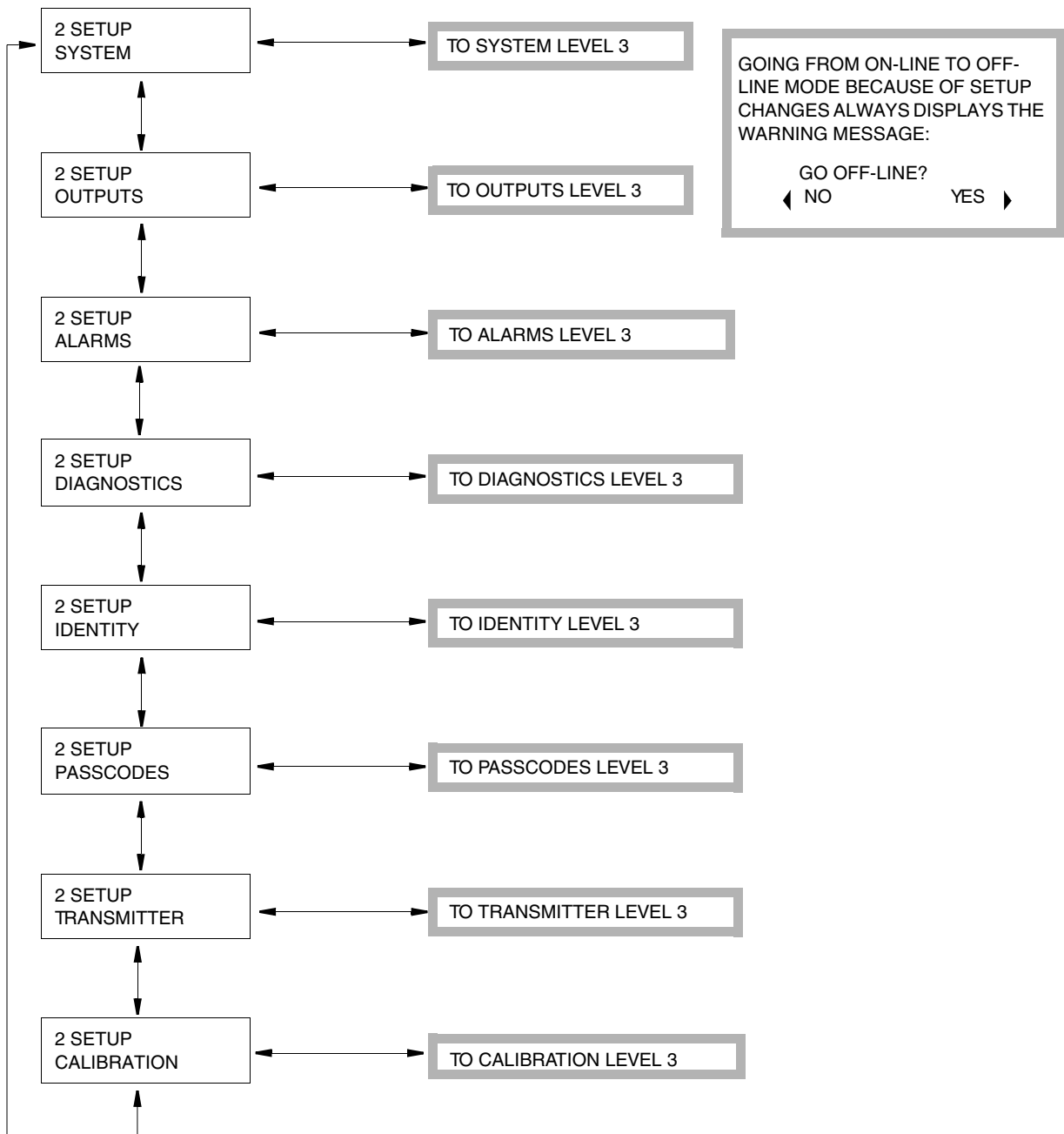
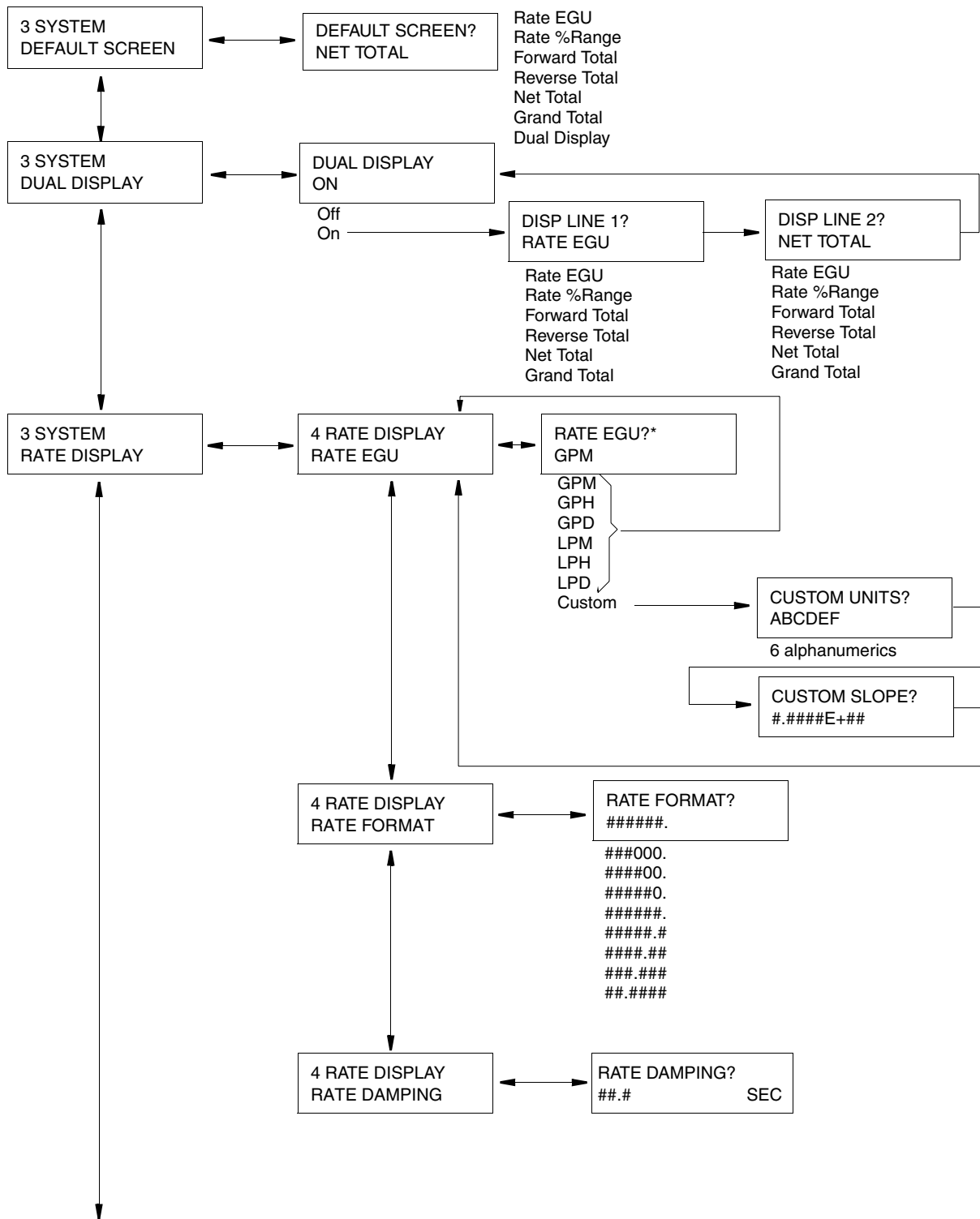


Figure A-2. Structure Diagram – Setup Menu

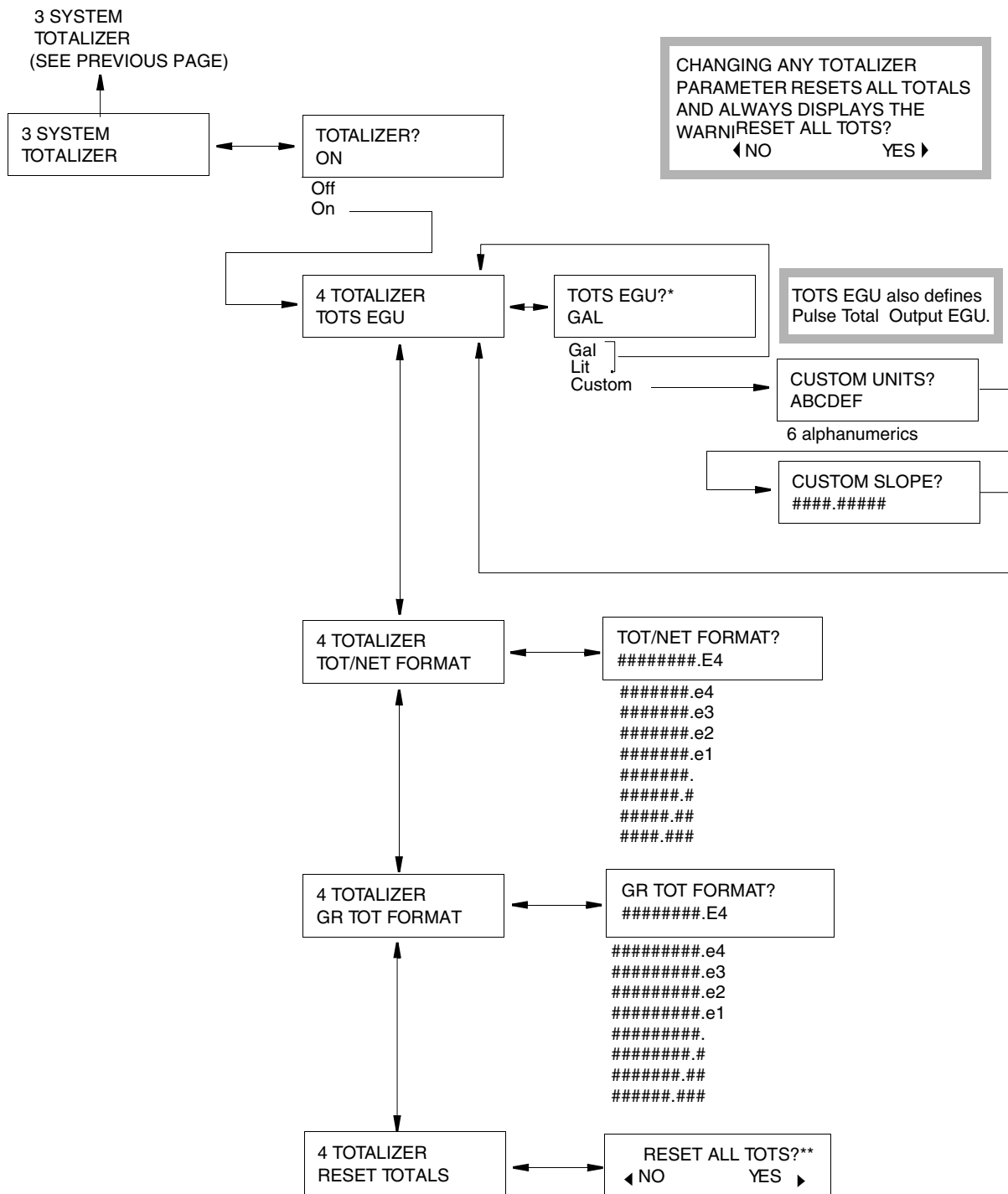
Level 3 System Menu Structure



*Fieldbus transmitters have additional unit selections but do not have Custom Units.

Figure A-3. Structure Diagram – System Menu

Level 3 System Menu Structure (Cont.)



*Fieldbus transmitters have additional unit selections but do not have Custom Units.

**Fieldbus transmitters have 4 Reset Total choices: Not Executed, Reset Net.Rev/Fwd, Reset Grand Total, and Reset All Totals

Figure A-4. Structure Diagram – System Menu (Cont.)

Level 3 OUTPUTS Menu Structure

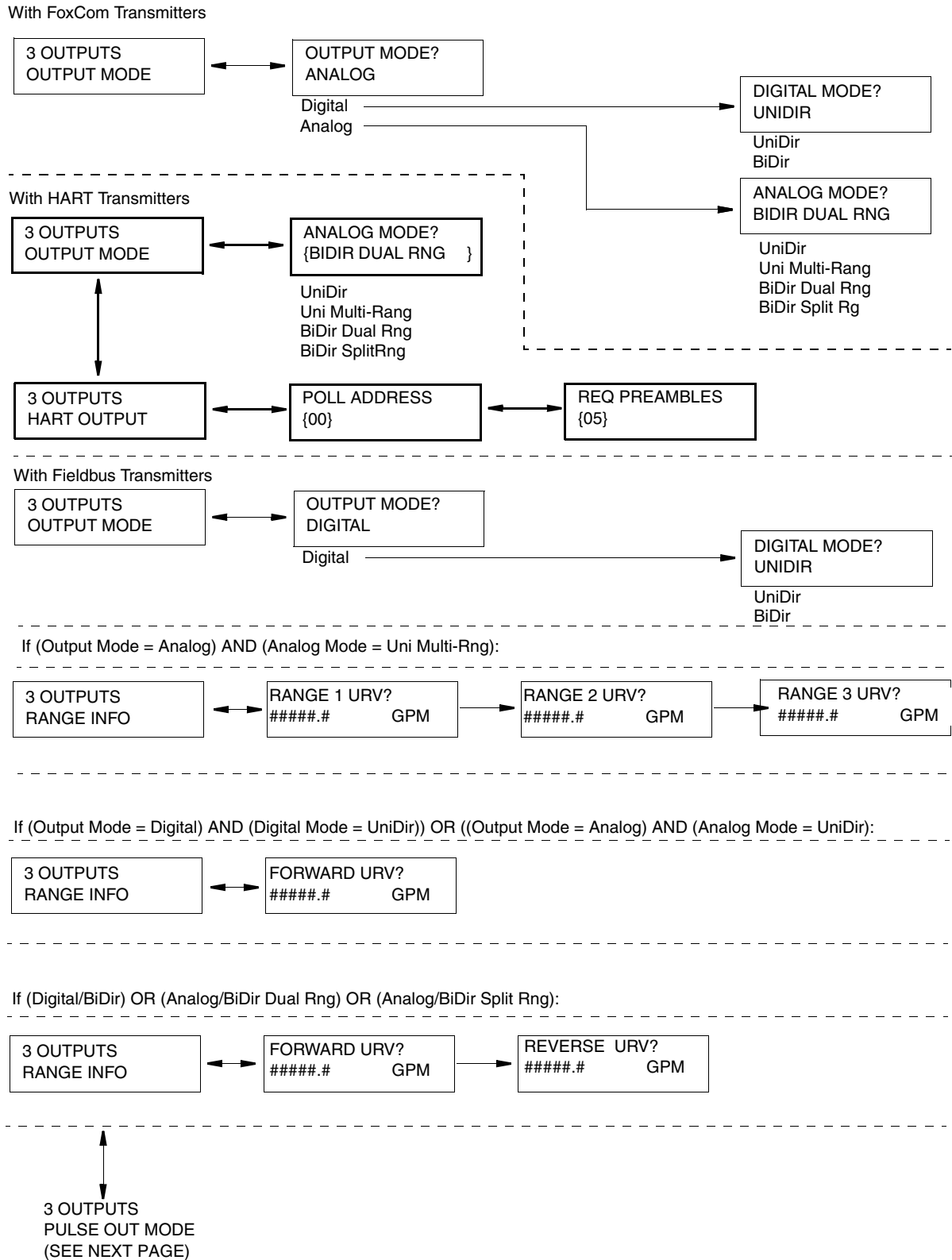


Figure A-5. Structure Diagram – Outputs Menu

Level 3 OUTPUTS Menu Structure (Cont.)

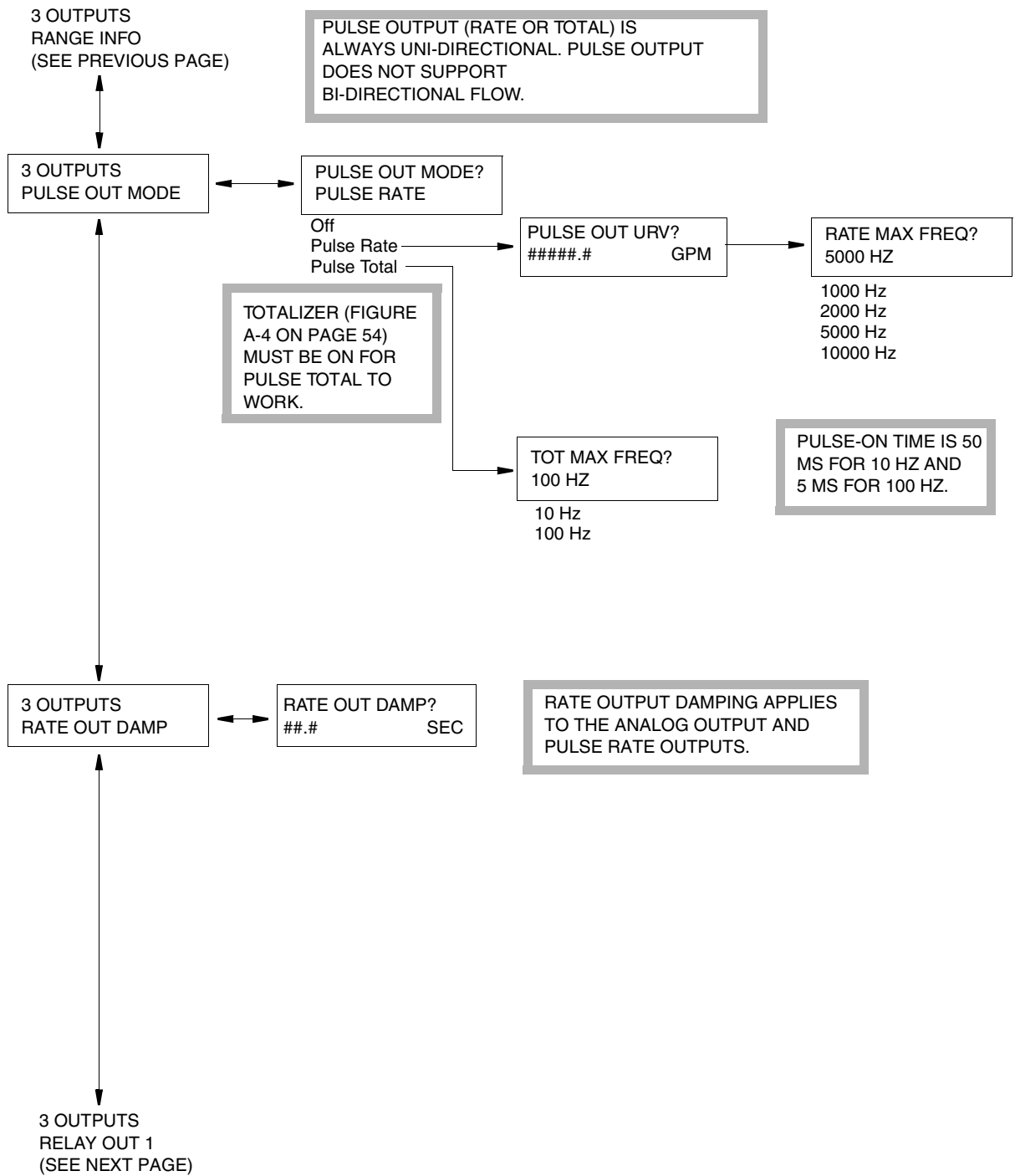


Figure A-6. Structure Diagram – Outputs Menu (Cont.)

Level 3 OUTPUTS Menu Structure (Cont.)

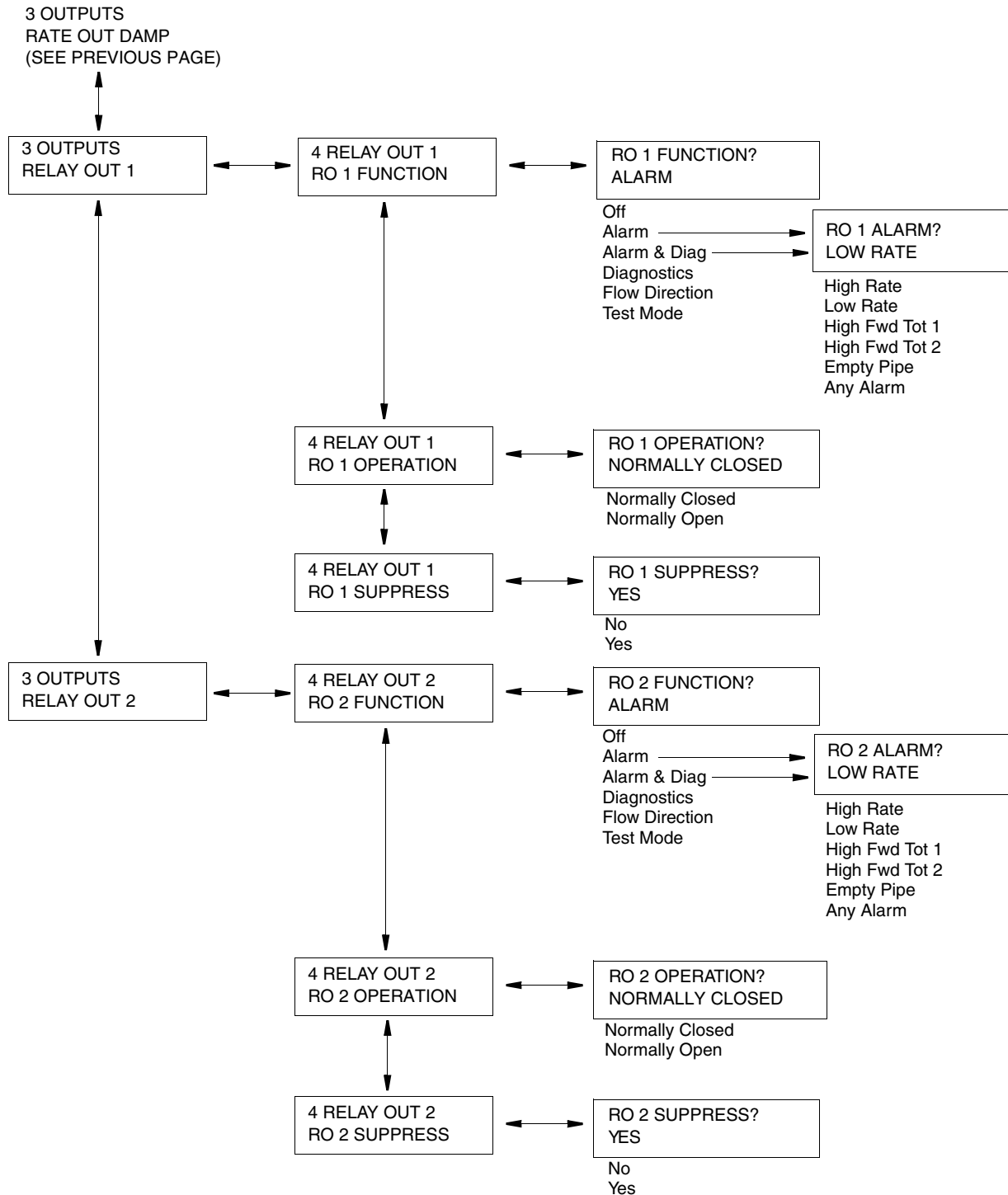


Figure A-7. Structure Diagram – Outputs Menu (Cont.)

Level 3 ALARMS Menu Structure

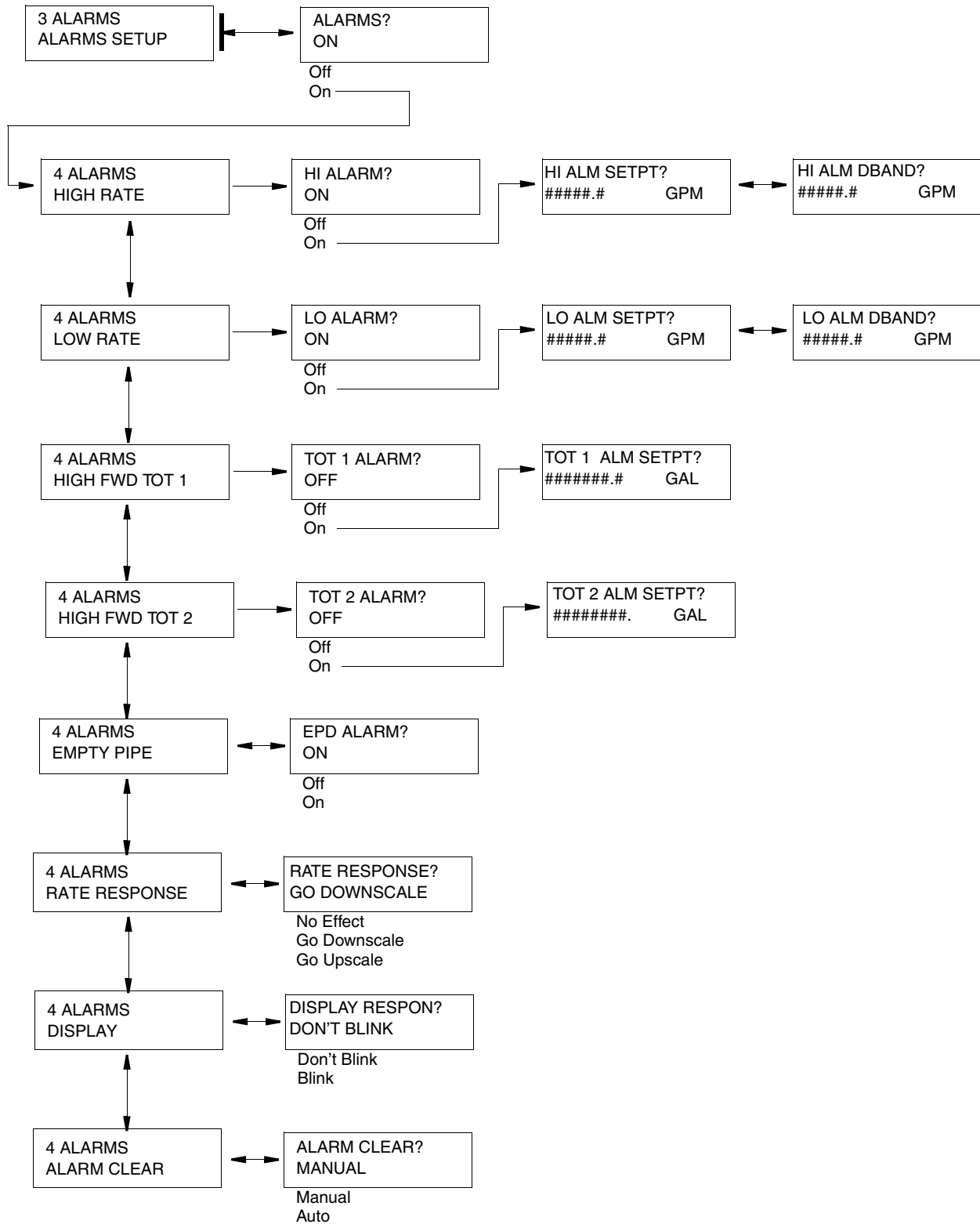


Figure A-8. Structure Diagram – Alarms Menu

Level 3 DIAGNOSTICS Menu Structure

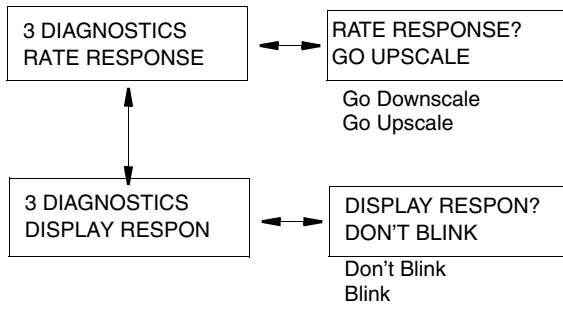
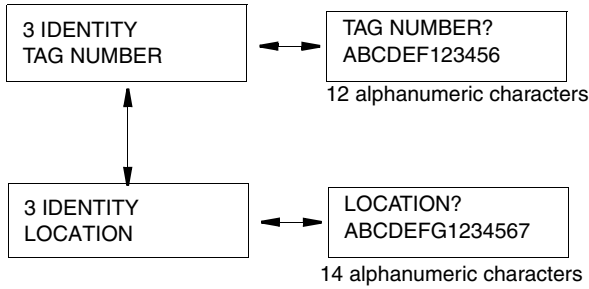


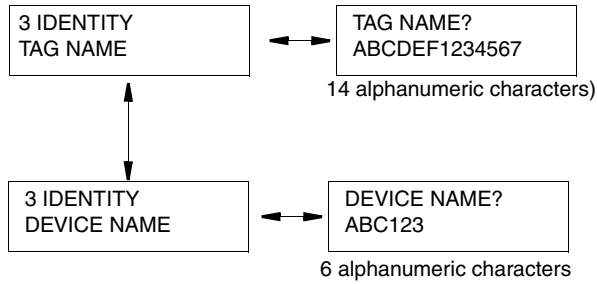
Figure A-9. Structure Diagram – Diagnostics Menu

Level 3 IDENTITY Menu Structure

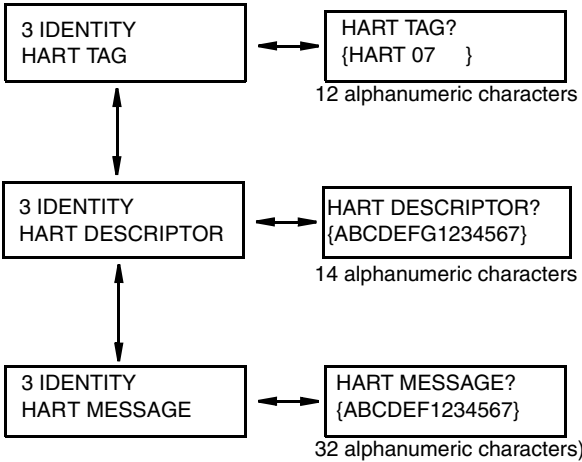
With FoxCom and Fieldbus Transmitters



If Output Mode = Digital



With HART Transmitters



With All Transmitters

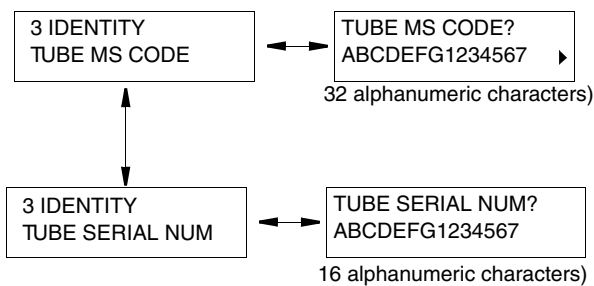


Figure A-10. Structure Diagram – Identity Menu

Level 3 PASSCODES Menu Structure

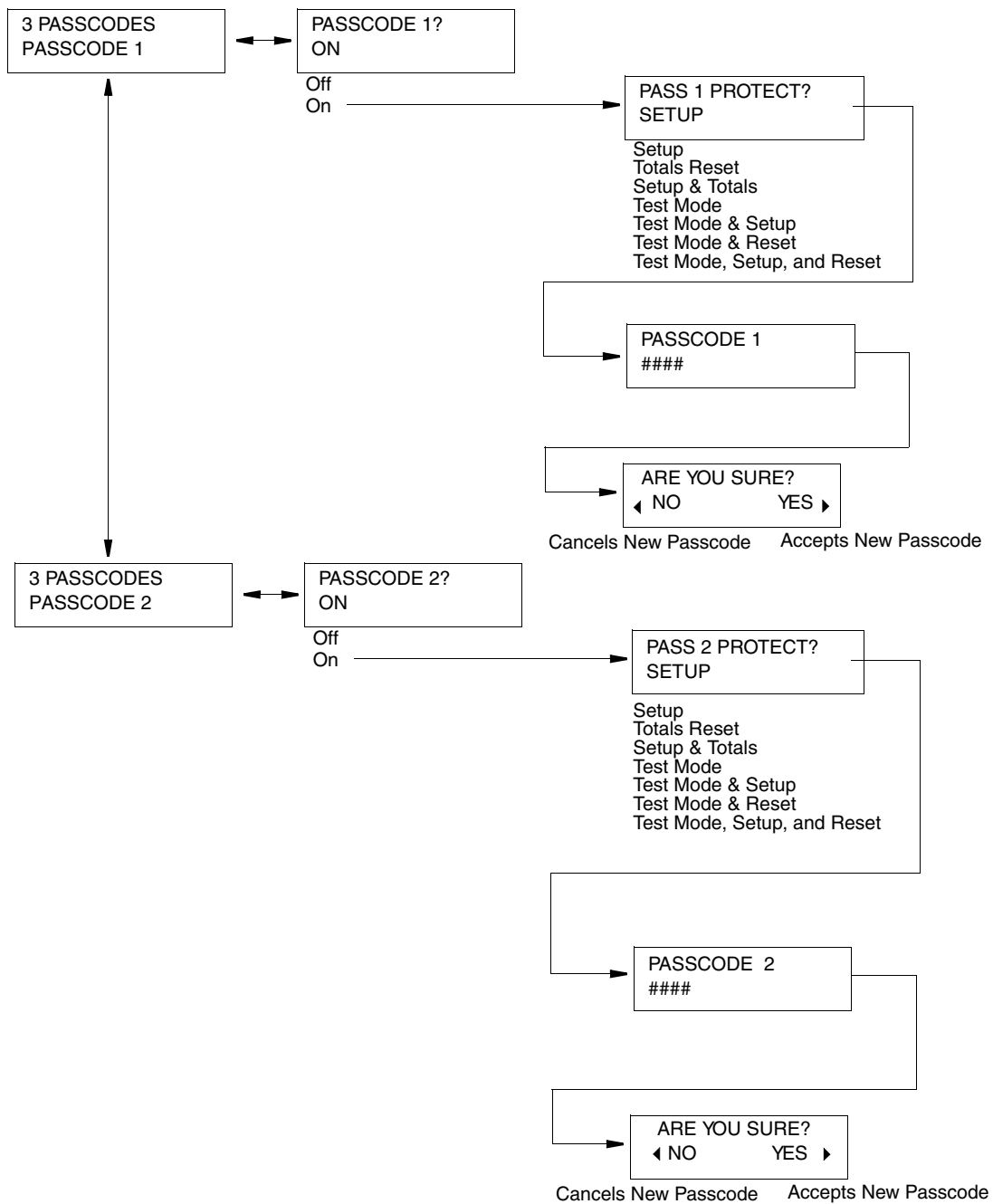


Figure A-11. Structure Diagram – Passcodes Menu

Level 3 TRANSMITTER Menu Structure

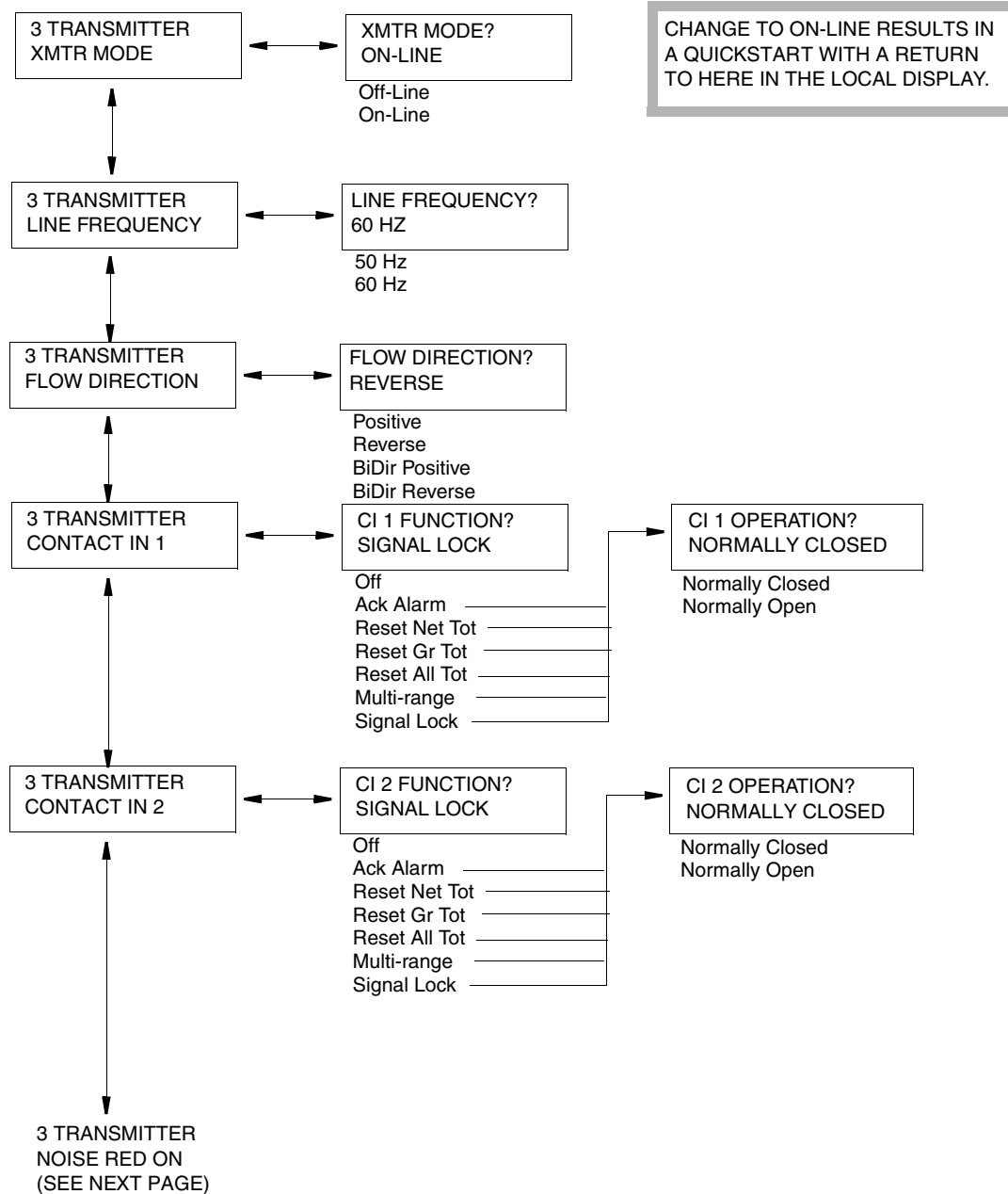
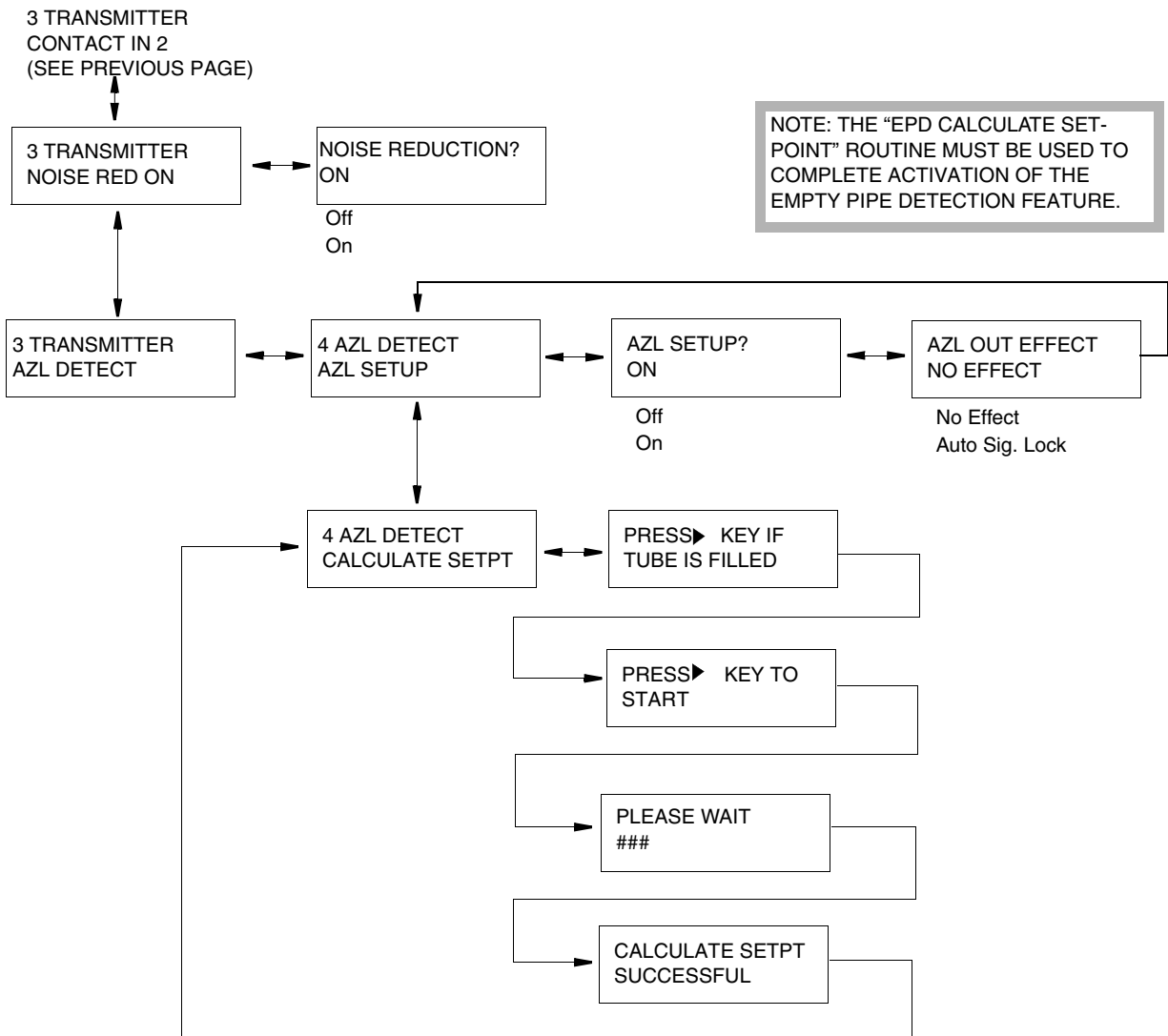


Figure A-12. Structure Diagram – Transmitter Menu

Level 3 TRANSMITTER Menu Structure (Cont.)



NOTE: On FoxCom Transmitters, AZL DETECT is shown as EDP PIPE DET
 AZL SETUP as EPD SETUP
 AZL OUT EFFECT as EDP RATE EFFECT

Figure A-13. Structure Diagram – Transmitter Menu (Cont.)

Level 3 CALIBRATION Menu Structure

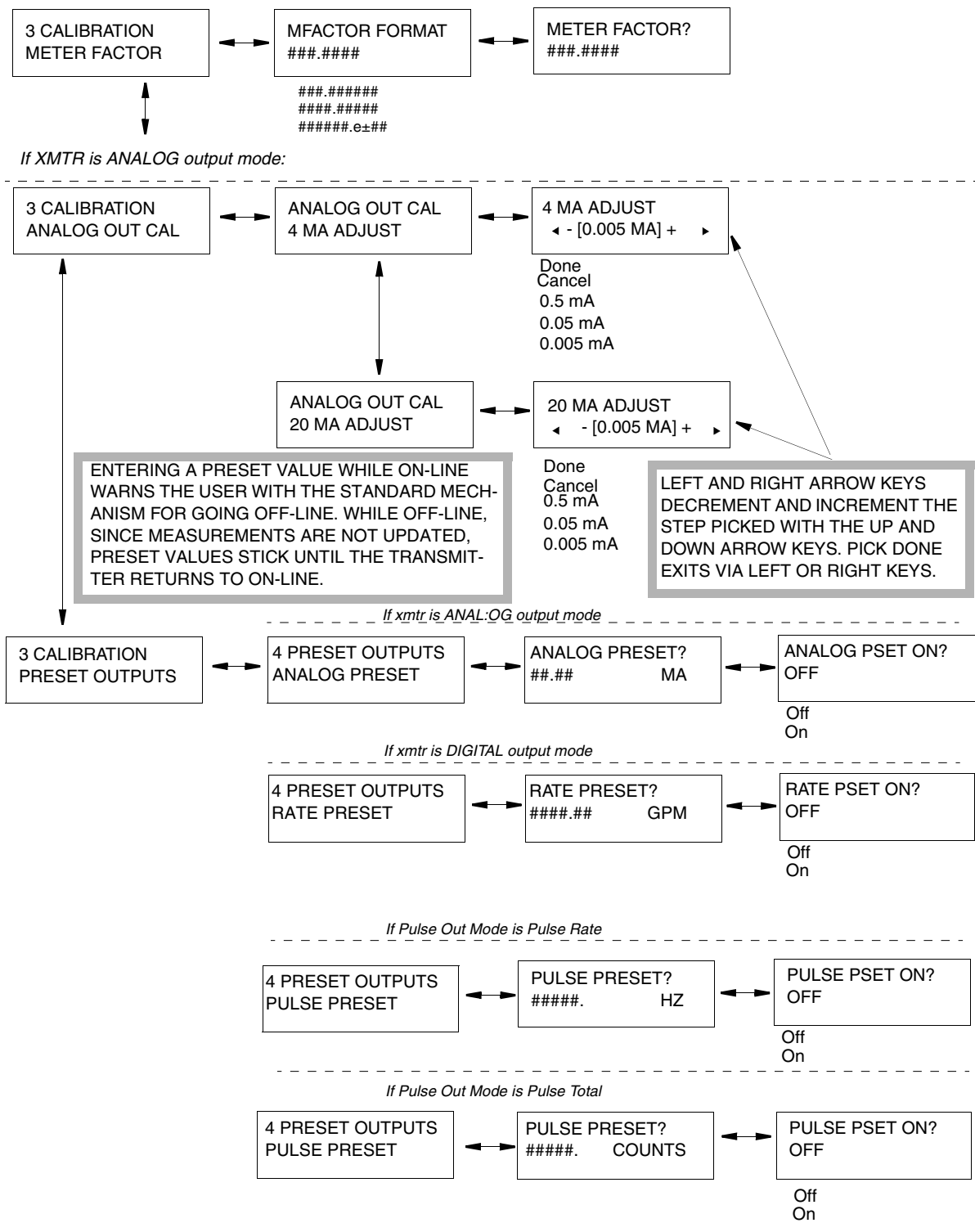


Figure A-14. Structure Diagram – Calibration Menu

Appendix B. Configuration Worksheets

This appendix contains information that will help you configure your IMT25 Transmitter. This page defines the content of the worksheets. Subsequent pages contain the actual configuration worksheets.

Structure Diagram	Prompt/Parameter	Options or Parameter Limits	Default Factory Configuration	User Configuration	Remarks and Notes

— NOTE —
 Shaded areas in configuration worksheets indicate options that are available only if the preceding option has been selected.

Structure Diagram	Prompt/Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
3 SYSTEM					
A-3	DEFAULT SCREEN				
	Default Screen	Rate EGU, Rate %Range, Forward Total, Reverse Total, Net Total, Grand Total, Dual Display	Rate EGU		
	Dual Display?	On, Off	Off		
	If On:				
	Disp Line 1?	Rate EGU, Rate %Range, Forward Total, Reverse Total, Net Total, Grand Total	Rate EGU		
	Disp Line 2?	Rate EGU, Rate %Range, Forward Total, Reverse Total, Net Total, Grand Total	Rate EGU		
	Rate Display	GPM, GPH, GPD, LPM, LPH, LPD, Custom Others (fieldbus)	GPM		
	If Custom:				
	Custom Units	Enter up to 6 alphanumerics	---		
	Custom Slope	Enter up to 9 digits	1		
	Rate Format	###000. ####00. #####0. #####.# ####.## ###.### ##.####	#####.#		
Rate Damping	0.0 to 99.9 seconds	3.0			

Structure Diagram	Prompt/Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-4	TOTALIZER				
	Totalizer On?	Off, On	Off		Changing any totalizer parameter resets all totals and causes warning message to appear.
	If On:	---	---		
	Tots EGU:	Gal, Lit, Custom	Gal		
	If Custom:	---	---		
	Tots Cust Units	Enter up to 6 alphanumerics:	---		
	Tots Cust Slope	Enter up to 9 digits from 1.0e-10 to 1.0e+10	1		
	Tot/net Format	Select 1 of 8 formats	#####.		
	Gr Tot Format	Select 1 of 8 formats	#####.		

Structure Diagram	Prompt/Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-5	3 OUTPUTS				
	Output Mode?	Digital, Analog	Per Model Code		
	If Digital:	---	---		
	Output Mode?	UniDir, BiDir	UniDir		
	If Analog:	---	---		
	Output Mode?	UniDir, Uni Multi-Rng, BiDir Dual Rng, BiDir Split Rg	UniDir		
	If Analog and Uni Multi Rng:	---	---		
	Range Info:	---	---		
	Multi-Rang URV1	Flowtube Min URV to 999999	100		
	Multi-Rang URV2	Flowtube Min URV to 999999	200		Must match value below marked **
	Multi-Rang URV3	Flowtube Min URV to 999999	300		
	If digital and UniDir or Analog and UniDir:	---	---		
	Range Info:	---	---		
	Forward URV	Flowtube Min URV to 999999	100		
	If Digital and BiDir or Analog and BiDir Dual Rng or Analog and BiDir Split Rg	---	---		
	Range Info:	---	---		
	Forward URV	Flowtube Min URV to 999999	100		
	Reverse URV	Flowtube Min URV to 999999	200		** Must match value of Multi-Range URV2 above
	HART Output	(HART only)			
	Poll Address	0 through 15	0		
Req Preambles					

Structure Diagram	Prompt/Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-6	3 OUTPUTS (cont.)				
	Pulse Out Mode	Off, Pulse Rate, Pulse Total	Off		Pulse output (rate or total) is always unidirectional.
	If Pulse Rate:	- - -	- - -		
	Pulse Out URV	Flowtube Min URV to 999999	100		
	Rate Max Freq	1000, 2000, 5000, or 10000 Hz	2000 Hz		
	If Pulse Total	- - -	- - -		
	Tot Max Freq	10 Hz, 100 Hz	100 Hz		
	Rate Out Damp	0 to 99.9 seconds	3.0 seconds		Rate output damping applies to analog and pulse rate outputs. It also controls the noise reduction action.

Structure Diagram	Prompt/Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-7	Relay Out 1	---	---		
	RO1 Function:	Off, Alarm, Alarm & Diag, Diagnostics, Flow Direction, Test Mode	Off		
	If Alarm or Alarm & Diag	---	---		
	RO1 Alarm?	High Rate, Low Rate, High Fwd Tot 1 High Fwd Tot 2 Empty Pipe Any Alarm	High Rate		
	RO1 Operation:	Normally Closed, Normally Open	Normally Open		
	RO1 Suppress:	No, Yes	No		
	Relay Out 2	---	---		
	RO2 Function:	Off, Alarm, Alarm & Diag, Diagnostics, Flow Direction, Test Mode	Off		
	If Alarm or Alarm & Diag	---	---		
	RO2 Alarm?	High Rate, Low Rate, High Fwd Tot 1 High Fwd Tot 2 Empty Pipe Any Alarm	Low Rate		
	RO2 Operation:	Normally Closed, Normally Open	Normally Open		
	RO2 Suppress:	No, Yes	No		

Structure Diagram	Prompt/ Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-8	3 ALARMS				
	Alarms On?	Off, On	Off		
	If On:		---		
	High Rate:	---	---		
	Hi Alarm On?	Off, On	Off		
	If On:	---	---		
	Hi Alm Setpt	0 to 999999	100		
	Hi Alm Dband	0 to 999999	1.0		
	Low Rate:	---	---		
	Low Alarm On?	Off, On	Off		
	If On:	---	---		
	Low Alm Setpt	0 to 999999	1.0		
	Low Alm Dband	0 to 999999	0.5		
	High Fwd Tot 1:	---	---		
	Tot 1 Alarm On:	Off, On	Off		
	Tot 1 Alm Setpt	0 to 9999999	100000		
	High Fwd Tot 2:	---	---		
	Tot 2 Alarm On:	Off, On	Off		
	Tot 2 Alm Setpt	0 to 9999999	1000000		
	AutoZeroLock	---	---		
AZL Alarm?	Off, On	Off			
Rate Response?	No Effect Go Downscale Go Upscale	Go Downscale			
Display Response?	Don't Blink Blink	Don't Blink			
Alarm Clear?	Manual Auto	Auto			
A-9	3 DIAGNOSTICS				
	Rate Response?	Go Downscale Go Upscale	Go Downscale		
	Display Respon?	Don't Blink, Blink	Blink		

Structure Diagram	Prompt/Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-10	3 IDENTITY				
	With FoxCom and Fieldbus Transmitters				
	Tag Number	Enter up to 12 alphanumeric characters	Tagnumber		
	Location	Enter up to 14 alphanumeric characters	Location		
	If Transmitter is in Digital Output Mode:				
	Tag Name	Enter up to 14 alphanumeric characters	Tagname		
	Device Name	Enter up to 6 alphanumeric characters	Devicename		
	With HART Transmitters				
	HART Tag	Enter up to 12 alphanumeric characters	(spaces)		
	HART Descriptor	Enter up to 14 alphanumeric characters	(spaces)		
	HART Message	Enter up to 32 alphanumeric characters	(spaces)		
	With all transmitters				
	Tube MS Code	Enter up to 32 alphanumeric characters	Tube MS		
	Tube Serial Num	Enter up to 16 alphanumeric characters	Tube S/N		

Structure Diagram	Prompt/Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-11	3 PASSCODES				
	Passcode 1	Off, On	Off		
	If On:	- - -	- - -		
	Pass 1 Protect?	Setup; Totals Reset; Setup Totals; Test Mode; Test Mode & Setup; Test Mode & Reset; Test Mode, Setup, and Reset	Setup		
	Passcode 1	0000 to 9998	- - -		Following entry, confirmation screen appears. Press “Left” to cancel, “Right” to accept.
	Passcode 2	Off, On	Off		
	If On:	- - -	- - -		
	Pass 2 Protect?	Setup; Totals Reset; Setup Totals; Test Mode; Test Mode & Setup; Test Mode & Reset; Test Mode, Setup, and Reset	Setup		
	Passcode 2	0000 to 9998	- - -		Following entry, confirmation screen appears. Press “Left” to cancel, “Right” to accept.

Structure Diagram	Prompt/ Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-12	3 TRANSMITTER				
	Xmtr Mode?	Off-Line, On-Line	On-Line		A change to On-Line causes a quickstart with return to here in the local display.
	Line Frequency?	50 Hz, 60 Hz	60 Hz		
	Flow Direction?	Positive, Reverse, BiDir Positive, BiDir Reverse	Positive		
	CI 1 Function?	Off, Ack Alarm, Reset Net Tot, Reset Gr Tot, Reset All Tot, Multi-Range, Signal Lock	Off		
	If NOT Off:	---	---		
	CI 1 Operation?	Normally Closed, Normally Open	Normally Open		
	CI 2 Function?	Off, Ack Alarm, Reset Net Tot, Reset Gr Tot, Reset All Tot, Multi-Range, Signal Lock	Off		
	If NOT Off:	---	---		
	CI 2 Operation?	Normally Closed, Normally Open	Normally Open		
A-13	Noise Red On?	Off, On	On		
	AZL Detect				
	AZL Setup	Off, On	Off		
	Calculate Setpt	Press→ if tube is filled. Press→ to start.	---		Completion indicated by Successful or Fail message.

Structure Diagram	Prompt/Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-14l	3 CALIBRATION				
	Mfactor Format	Forms ###.##### ####.##### #.#####e+##	###.#####		
	Meter Factor	From Flowtube	012.000000		
	If Xmtr is Analog Output Mode:				
	Analog Out Cal	---	---		
	4 mA Adjust	Done, 0.5 mA, 0.05 mA, 0.005 mA	Done		Left and right arrow keys decrement and increment the step size picked with the Up and Down arrow keys.
	20 mA Adjust	Done, 0.5 mA, 0.05 mA, 0.005 mA	Done		Left and right arrow keys decrement and increment the step size picked with the Up and Down arrow keys.
	Preset Outputs	---	---		
	Analog Preset	3.80 to 21.00 mA in form ##.##	---		
	Analog Preset On	Off, On	Off		
	If Xmtr is Digital Output Mode:	---	---		
	Rate Preset	0 to value limited by Rate Format	---		
	Rate Preset On	Off, On	Off		
	If Pulse Out Mode is Pulse Rate	---	---		
	Pulse Preset:	0 to Max Rate Freq	---		
	Pulse Preset On	Off, On	Off		
	If Pulse Out Mode is Pulse Total	---	---		
	Pulse Preset:	0 to 65535	---		
	Pulse Preset On	Off, On	Off		

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DEC 1997
APR 2002
APR 2005
APR 2009
AUG 2010

Vertical lines to the right of text or illustrations indicate areas changed at last issue date.

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