Instruction

MI 021-403
August 2009

I/A Series® MagEXPERT Flow Transmitter Model IMT96

with Integral Keypad and Display

Local Operation, Configuration, and Calibration

FOXBORO

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1. Introduction

Description

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

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

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

NOTE

For availability of remote communication software, contact Invensys Process Systems (IPS).

This document describes local operation and configuration of an IMT96 Transmitter supplied with local keypad and display.

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 concerned with configuration, read the entire manual, with special emphasis on the chapter titled “Configuration”,the structure diagrams in Appendix A, and the configuration worksheets in Appendix B. If you are concerned with calibration, read the “Introduction” and the section in the “Configuration” chapter on “Setup of Calibration”.

Summary of IMT96 Features

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

- UniDirectional or BiDirectional flow measurement capability with up to three independent upper range values that are selectable via Contact Inputs during operation
- Analog (4 to 20 mA) output proportional to the flow rate
- Pulse Output that is configurable as a scaled totalizer value or as a frequency that is proportional to the flow rate
- Nonvolatile Totalizer that maintains Forward Total and Reverse Total values in the user-specified volume units
- HART or FoxCom communications protocol (as specified).
- Quickstart on HART transmitter.
- AutoZero Lock (empty pipe detection) on HART transmitter.

- Digital measurement values accessible via the FoxCom or HART communications protocol. The following process measurement values are provided: flow rate in user-specified engineering units, flow rate as a percent of upper range value (URV), the present analog and pulse output settings, and separate totalizer values for the forward flow and reverse flow. Net Total (forward flow minus reverse flow) and Grand Total values are also provided, along with transmitter status information
- Configurable Noise Reduction algorithm that reduces variability in noise generating applications without the need for high damping values
- Alarms that can be configured to indicate that the flow rate is above or below a configurable alarm level or that the Totalizer has reached a specified count
- Two Contact Inputs that can be programmed to acknowledge alarms, reset the Totalizer values or select the active URV
- Two Relay Outputs that can be programmed to provide remote indication of alarm or diagnostic conditions, or flow direction
- Write Protect switch that allows you to prevent undesired modification of the configuration parameters and Totalizer values
- Optional 2-line x 16-character backlighted LCD display with keypad.

Functions

Using the IMT96 front panel keypad/display, the functions you can perform are:

Operating Functions

- Display measurement information

  (The current value of Flow Rate in engineering units (EGU), Flow Rate in % of upper range value (URV), Forward Total, Reverse Total, Net Total, and Grand Total)

- Display current status or values of transmitter parameters

  (Operating mode, outputs, contact inputs, relay outputs, AZL [on HART transmitter], noise reduction, and write protection)

- Display identity information

  (Transmitter, flowtube, and software identification data plus
  Tag number, location, tag name, and device name if FoxCom Protocol
  HART Tag, Descriptor, and Message if HART Protocol)

- Acknowledge alarms
- Reset totals (if authorized by passcode assignment).

Calibration Functions

— NOTE

These functions can be passcode protected.

- Adjust the 4 and 20 mA output signal (requires additional equipment)

- Preset outputs to calibrate the control loop
- Set the flowmeter system zero under actual zero flow conditions.

Configuration Functions

NOTE

These functions can be passcode protected.

- Read 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 installation, maintenance, and other details of the flowmeter, refer to the applicable documents listed in Table 1.

Table 1. Reference Documents

Document	Description
DP 021-367	IMT96 I/A Series MagEXPERT Flow Transmitter - Dimensions
MI 021-402	IMT96 I/A Series MagEXPERT Flow Transmitter with 2800 Series Flanged Flowtubes - Installation
MI 021-404	IMT96 I/A Series MagEXPERT Flow Transmitter - System Maintenance
MI 021-412	Retrofit Instructions for a 2800 Series Flowtube For Use with IMT96 Transmitter When Previously Connected to an E96 Transmitter
MI 021-415	Model IMT96 - Operation, Configuration and Calibration using a HART Communicator
PL 008-747	IMT96 I/A Series MagEXPERT Flow Transmitter - Parts List
TI 27-71f	Magnetic Flowtubes Material Selection Guide
TI 027-072	Electrical Conductivity of Process Liquids

2. Quick Start

FoxCom Protocol

Your IMT96 Transmitter with FoxCom communications protocol can be configured with a PC-Based Configurator or the local keypad/display option.

With the keypad/display, there are four basic steps to changing the configuration of the transmitter to the requirements of your application.

1. Determine what parameters must be changed.
   To configure a basic transmitter for single range, flowrate output, unidirectional flow, with 4 to 20 mA and digital output usually only requires entering your Upper Range Value (URV) and the flowtube calibration factor.
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 configured selections and values.
   The following example illustrates the mechanics of changing the configured selections and values.
4. Exit the Setup mode.
   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 Operating mode.

— NOTE

The IMT96 transmitter can be configured without being connected to a flowtube. However, a diagnostic error condition (low coil current) will exist. This can cause an interruption of the setup process if there is a 30 second delay between key strokes. After the setup procedure gets to the offline condition, the interruption does not occur.

Example of How to Change Configured Selections and Values:

The requirements of the application for this example are:

- Engineering units (EGUs) in GPM
- An analog output
- Forward direction of flow
- Flow range 0 to 150 GPM
- Flowmeter factor of 25.22.

The procedure for meeting these requirements is as follows:

1. First, enter your URV (150 GPM in the example). To do this, use the arrow keys to move the display to location 1 in Figure 1. The curly brackets around the URV **{####.##}** indicate that the value is editable. Notice the rate units and the rate format (number of places to the left and right of the decimal point). To change the units, go to location 1A. To change the format, go to location 1B. If both of these settings are acceptable, enter the URV as follows:

   a. Press the **SHIFT** + **CHANGE** keys to enter Edit mode. You are asked **Go Off-Line?** Reply yes by pressing the Right arrow key. The curly brackets around the URV change to plain brackets **[####.##]**. The plain brackets show that you are now in Edit mode.

— NOTE

When the transmitter goes Off-Line, the outputs go to zero.

   b. 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 **FORWARD URV?/[00150.0] GPM**.

   c. Using the right arrow key, move the cursor under the right bracket and press the key again to enter the URV into the working memory. The display reads **FORWARD URV? {150.0} GPM**.

   d. Press the right arrow key again. **3 OUTPUTS/Range Info** is displayed. (If the display asks for another URV value, the Output mode is not unidirectional single range.)

2. Next, check the **Output Mode** setting (**Analog** or **Digital**) shown in location 2 of Figure 1. Change if necessary.

3. If the **Output Mode** is configured as **Analog**, it can be helpful to enter a unique **Tag Number**. This puts a digital identifier on the mA loop which provides a means of positive identification at locations remote to the transmitter. Do this at Location 3 of Figure 1.
   If the **Output Mode** is configured as **Digital**, the transmitter **Device Name** is used for identity. It must match the letterbug used in your I/A Series system. It is case sensitive. Use correct upper/lower case letters.

4. Next, enter the meter factor. To do this, use the arrow keys to move the display to location 4 in Figure 1. Determine the meter factor by looking for an "IMT96 Cal Fact" number on the flowtube data plate. Use this number as the meter factor. If "IMT96 Cal Fact" does not appear on your flowtube, refer to MI 021-412 for information on converting any other factor on the data plate to a factor suitable for the IMT96 transmitter.
   Use the same **SHIFT** + **CHANGE** method used above to edit the factor. When you are finished, be sure move the cursor under the right bracket and press the key again to enter the meter factor.

5. Now that all changes have been made, you must exit the Setup mode. To do this, 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.

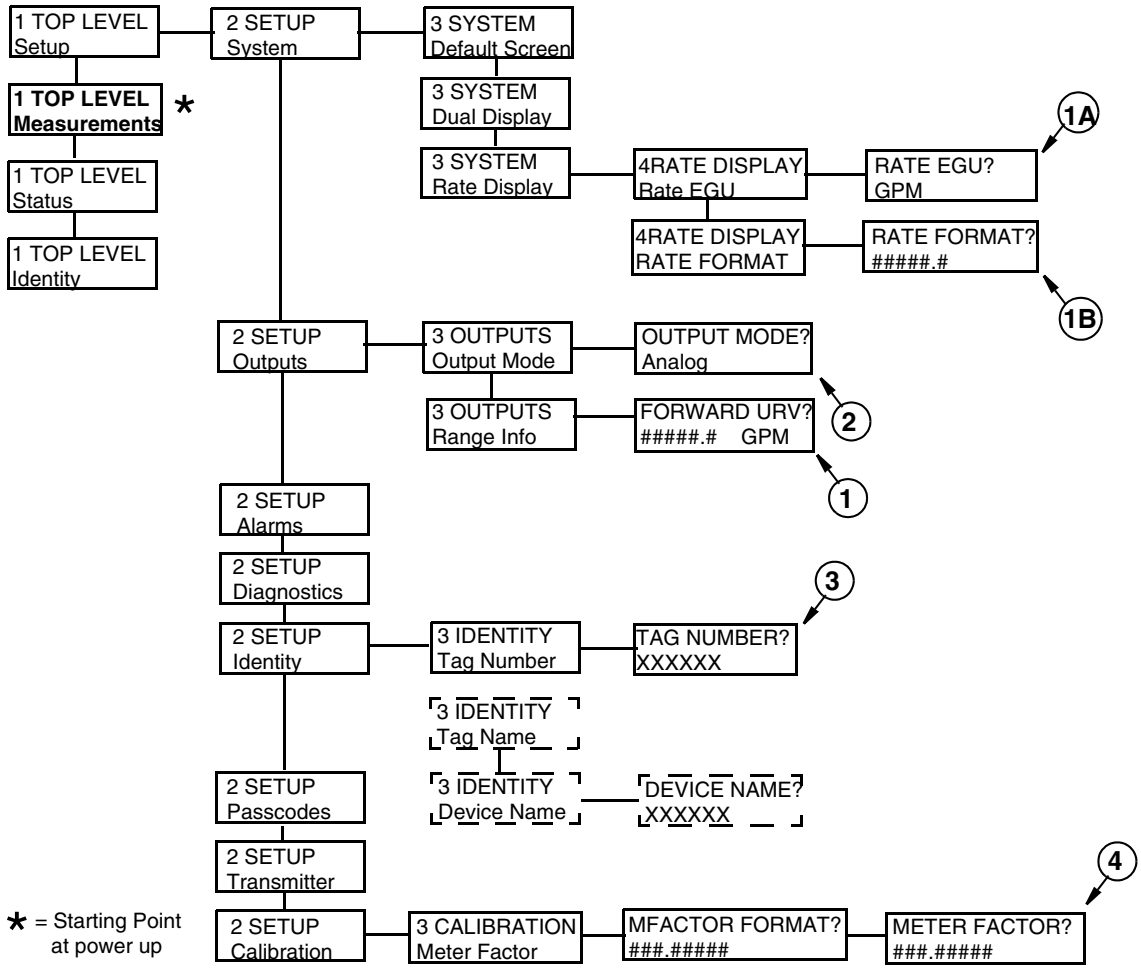


Figure 1. Example of Changing Configured Selections and Values

HART Protocol

Your IMT96 Transmitter with HART communications protocol can be configured with a HART Communicator, PC-Based Configurator, or the local 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 with transmitters that have been previously configured for your application or with new transmitters 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
- Totalizer capability in (US) Gallons

With new transmitters, use Setup mode that is fully described in “Configuration” on page 23, for applications involving:

- Transmitters powered from 50 Hz sources
- Pulse and frequency outputs

- Totalizer functions with other than default values
- 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 x)
- 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 {025.000000}). 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 x.

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}**. Press the Right arrow key again.

5. The display reads **TOTALIZER? {xxx}** (Default {Off}). Press **Shift + Change** to enter Edit Mode. Then use the up/down arrow keys to select **On** or **Off**. When you reach the selection you want, press the Right arrow key.
6. The display reads **Check Wiring?**
   a. To have the transmitter self check the signal wiring, reply Yes by pressing the Right arrow key. The display then prompts you to press the Right arrow key if the tube is full.

— NOTE

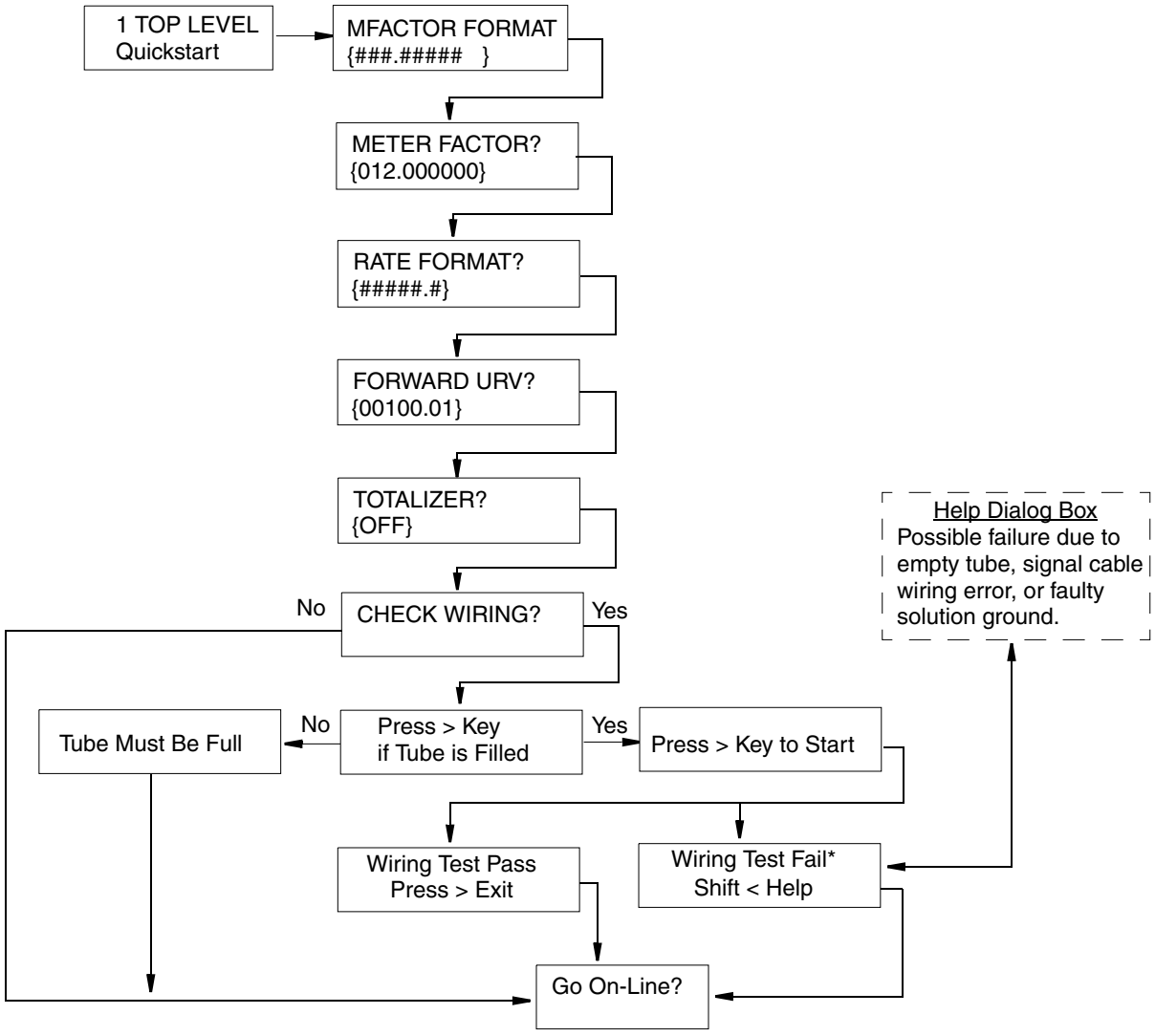
If the tube is not full, press the Left arrow key. The message **Tube Must Be Full** is displayed momentarily and then **Go On-Line?** The tube must be full to perform the wiring check.

Then press the Right arrow key again to start the wiring check.

If the test was successful, the display reads **Wiring Test Pass** and then **Go On-Line?**

If the test was not successful, the display reads **Wiring Test Fail**. Press Shift plus the Left arrow key to display a help dialog box which lists potential causes of the failed test. Pressing the Right arrow key takes you to **Go On-Line?**.

   b. If you do not want the transmitter to self check the wiring, reply No by pressing the Left arrow key. The display reads **Go On-Line?**
7. Reply Yes to **Go On-Line?** by pressing the Right arrow key. Press the Right arrow key again to begin displaying flow measurements.



*Low conductivity or long cable length may cause a false Wiring Test Fail message.

Figure 2. Menu of Quickstart Mode (HART Protocol)

3. Operation

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 IMT96 Transmitter is shown in Figure 3. Information on various types of display is shown in Figure 4.

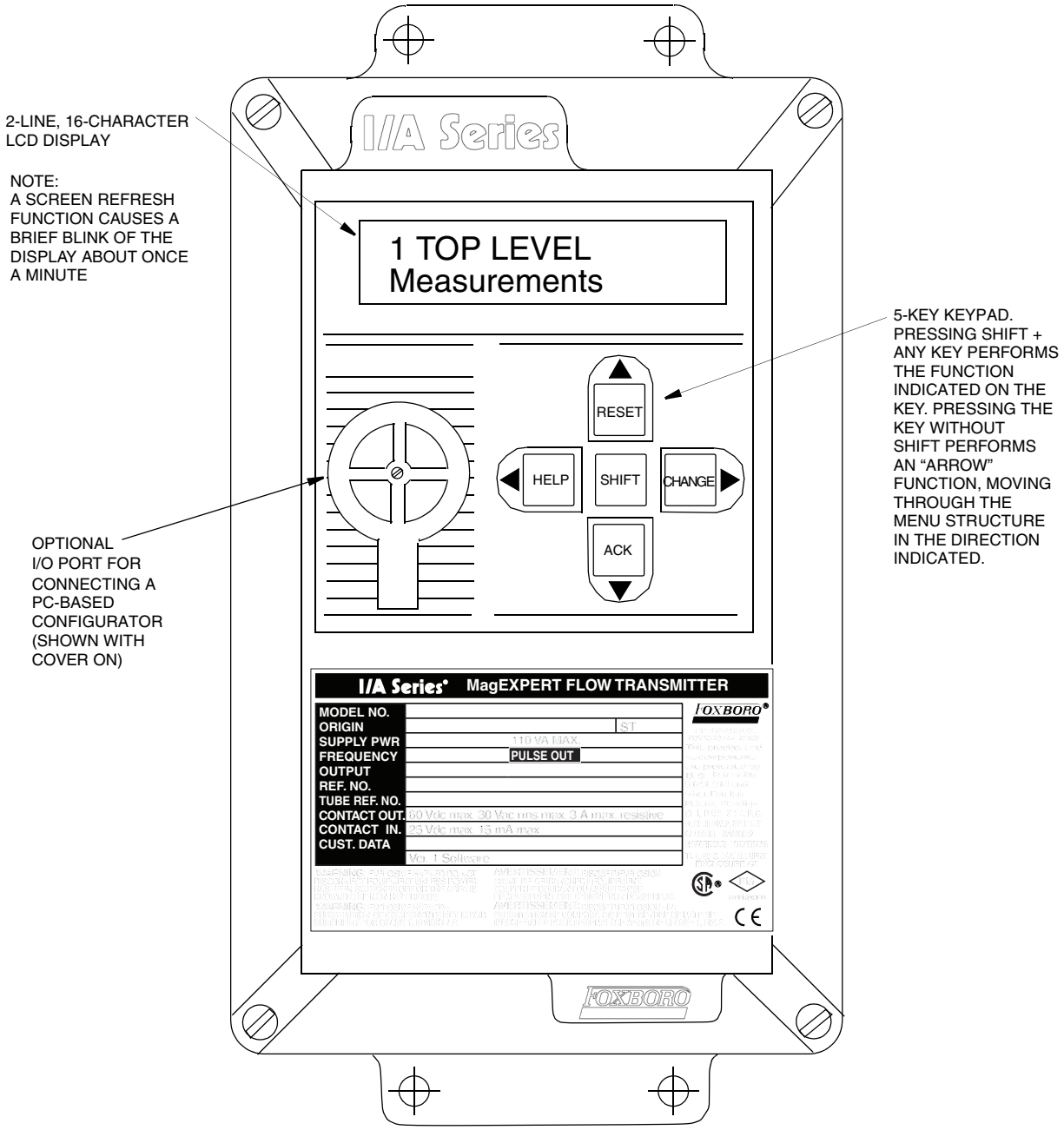


Figure 3. IMT96 Magnetic Flow Transmitter — Keypad/Display

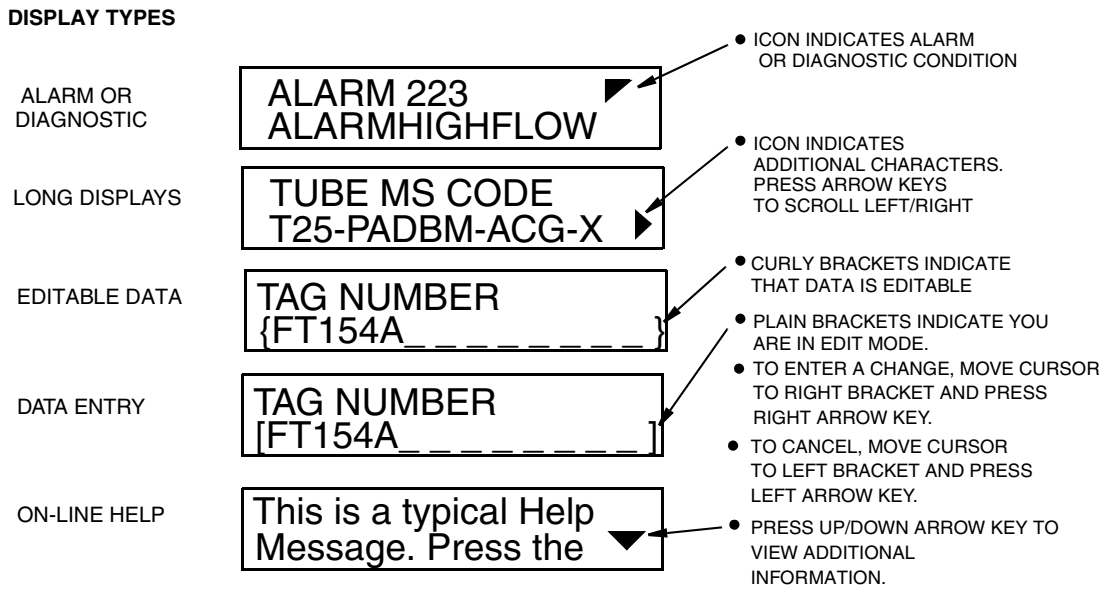
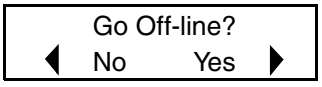


Figure 4. IMT96 Magnetic Flow Transmitter — Displays

All required functions including changing the display, acknowledging alarms, resetting totals, configuring the transmitter, or getting help messages are accomplished by using the four arrow keys alone and in combination with the Shift key. Table 2 explains the function of each key.

It is safe to use the keys even if the output of the transmitter is being used for control. Use of the keys changes what is being displayed but does not disturb the output of the transmitter without first showing the following message and receiving a “Yes” answer (Right Arrow key). A “No” response is achieved by pressing the Left arrow key.



If the totalizer function is being used, the totals can be reset with the keys without disturbing the transmitter rate outputs. Refer to “Resetting Totals” on page 15.

Table 2. Functions of Keys

Key	Function
Up Arrow	Move up in the product structure. Scroll up in menu, list of characters, or on-line Help message.
SHIFT + RESET	Reset totals.
Down Arrow	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.
Left Arrow	Move to the left in the product structure. Answer No to a prompt. Cancel parameter selection or data entry.

Table 2. Functions of Keys (Continued)

Key	Function
SHIFT + HELP	Access on-line Help.
Right Arrow	Move to the right in the product structure. Answer Yes to a prompt. Enter parameter selection or data entry.
SHIFT + CHANGE	Access Edit mode.

Alarm Actions

Depending on its configuration, the IMT96 does the following if a preset alarm condition is exceeded:

- Simply displays the alarm icon [◤]
- Displays the alarm icon and causes the display to flash
- Has no effect on the outputs or causes them to go high or low
- Activates a contact output relay.

When an alarm condition occurs, the Status mode can provide an explanation of the cause of the alarm, if the alarm condition still exists, or what the alarm was if the condition passed. The Status can also be used to review the current state of the transmitter outputs.

The alarm display window in Status mode shows **ALARM** followed by a brief description of the alarm, **ALARMS IN BUFFER**, or **NO ALARMS**. If you are viewing the alarm window when you press **SHIFT** + **ACK**, the display shows the last alarm for a few seconds.

Acknowledging an Alarm

An alarm can be acknowledged either with the key pad (**SHIFT** + **ACK**) or a remote contact connected to either of the two transmitter Contact Inputs.

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.
- Does return the Relay Output to the normal operation condition, but only if the relay output was also configured to allow suppression.

When the condition that caused the alarm is corrected, the following happens:

- The display icon and/or flashing stops if the alarms are configured to **ALARM CLEAR/Auto**. If set for **ALARM CLEAR/Manual**, the alarm must be acknowledged to clear the display action.
- The flow rate outputs return to normal without acknowledgment in either **ALARM CLEAR/Auto** or **ALARM CLEAR/Manual** modes.
- The Relay Output returns to normal if alarms are set to **ALARM CLEAR/Auto**. If set for **ALARM CLEAR/Manual**, the alarm must be acknowledged to return the Relay Output to the normal operation state.

Diagnostic Actions

The IMT96 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, and so forth)
- Invalid configuration.

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

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

Acknowledging Diagnostics

The best way to acknowledge a Diagnostic message is to use the **SHIFT** + **ACK** keys while the display shows the **DIAG** window in the Status mode. The only other way to clear the Diagnostic message 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.

Write Protect Switch

The write protect DIP switch (refer to Figure 5 for location) 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 are not 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.

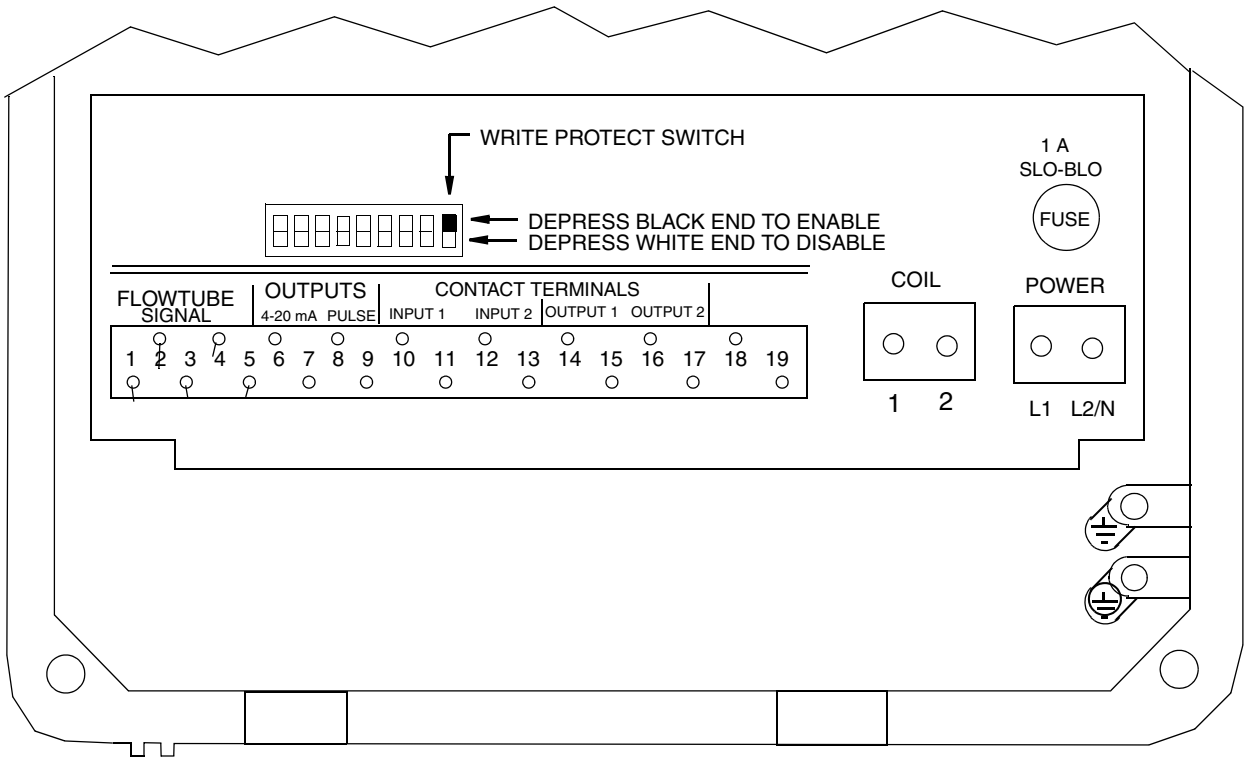


Figure 5. Write Protect Switch Location

Resetting Totals

Totals can be reset with the keypad, an external contact, a PC-Based Configurator, or I/A Series Workstation. To reset with the keypad, 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.

On-Line Help

Context-sensitive on-line Help messages can be displayed by pressing **SHIFT** + **HELP**. 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 ▼

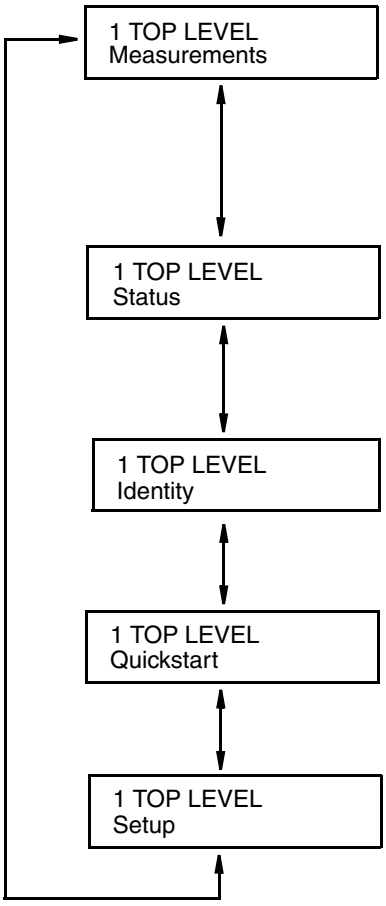
The Down arrow icon indicates that more information is available. Press the Down arrow key to display the additional information. Similarly, an Up arrow icon indicates more information can

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 **SHIFT** + **HELP** while in on-line Help to get help on the function itself.

Transmitter Modes

The top level menu displays the following modes – Measurements, Status, Identity, 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, and so forth.

The top level menu is shown in Figure 6. For a complete presentation of all menu structures, refer to Appendix A.



This is the normal operation mode. It displays flow rates and/or totals. It also indicates if alarm or diagnostic conditions exist. The selected default measurement (flow rate and totalizer value) is displayed when the transmitter is turned on. For details, see "Measurements Mode" below and Figure A-2 on page 49.

This mode provides details about the transmitter output values, state of contact inputs and outputs, alarm conditions, diagnostic errors, and so forth. For details, see "Status Mode" on page 17 and Figure A-3 on page 50.

This mode is used to save and display reference information such as tag name, software version number, and calibration dates. For details, see "Identity Mode" on page 20 and Figure A-4 on page 51.

For **HART protocol only**, this mode can be used to customize (configure) the transmitter in most basic applications. For details, see the procedure on page 7 and Figure 2.

This mode is used to customize (configure) the transmitter to your application. This includes defining flow rate ranges, output used, alarm conditions, and so forth. For details, see "Setup Mode" on page 21 and Figure A-5 on page 52.

Figure 6. Top Level Menu Summary

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 can 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 (**Fwd Tot** - **Rev Tot**) in selected engineering units. If the Reset Totals function is **not** passcode protected, 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. If the Reset Totals function is not passcode protected, 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 **Dual Display** 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. When the totalizer values get very large, the units label is truncated.

+35.67	GPM
+12345.8	GAL

You can 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.

The structural diagram of the Measurements menu is located on Figure A-2 of Appendix A on page 49.

Status Mode

The Status mode enables you to view eleven system parameters and thus assess the performance of the loop. You cannot 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 normally displays **On-Line**. The other modes are only displayed if someone else has changed the mode with a PC-based Configurator, HART Communicator, or I/A Series Workstation. **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.

— NOTE

Override and Calibrate apply only in transmitters with FoxCom protocol.

- **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 remains 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 a FoxCom transmitter output is set to Digital Output mode, the display shows whether the transmitter is configured for **UniDir** (unidirectional flow) or **BiDir** (bidirectional flow). If Digital output mode is not selected, the screen is not displayed.

— NOTE

1. 1. Digital Output only applies to a transmitter with FoxCom communications protocol.
2. 2. Digital and Analog Output are mutually exclusive. Only one of the two is displayed at any one time.

- **Analog Output** — If a FoxCom transmitter output is set to Analog Output mode or if using a HART transmitter, the display shows whether the transmitter is configured for **U** (unidirectional flow, single range), **U/M1** (unidirectional flow, multirange-range 1 active), **U/M2** (unidirectional flow multirange-range 2 active), **U/M3** (unidirectional flow, multirange-range 3 active), **B/D** (bidirectional flow, dual range), or **B/S** (bidirectional flow, split range). If Analog Output mode is not selected, the screen is not displayed.

— NOTE

1. Digital and Analog Output are mutually exclusive. Only one of the two is displayed at the same time.
2. For definition of direction and range, see “Output Mode” on page 32.

- **Pulse Output** — Shows **OFF** or the state of the pulse output shown in Table 3.

Table 3. Pulse Output States

Display	Interpretation
Pulse Rate #### Hz	Pulse Output set to create a frequency signal proportional to flow. Second line shows current output Hz.

Table 3. Pulse Output States

Display	Interpretation
Pulse Total ##.## %	Pulse Output set to generate pulses scaled to equal a volume of fluid; i.e., gallons. Second line shows the % of the next pulse in the buffer.

- **Contact In 1** and **Contact In 2** — Shows the current state of the Contact Inputs. The possible states are as shown in Table 5.

Table 4. 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 the Relay Outputs. The possible functions are shown in Table 5.

Table 5. 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.
AZL Alm	AZL Alm has activated the Relay Output (HART Transmitter only)
Diagnostics	One of the diagnostics has activated the Relay Output.

- **AZL Detect** — (HART Transmitter only) The intent of the AutoZeroLock Detection (Empty Pipe Detection) feature is explained in "AutoZeroLock (Empty Pipe) (HART Only)" on page 38.
  If the AutoZeroLock detector is configured **On**, the display shows:

  AZL Inactive, AZL Active, or **AZL Needs Setpnt**.

When AZL is active, the outputs are locked at zero. If AZL 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 indication.

- **AZL Count** — (HART Transmitter only) Shows the cumulative count (maximum of 255) of AZL 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 Protect dip switch is in the enable position so that no Setup (configuration) changes can be made. This feature is usually used only in custody transfer applications or for another reason that the user wants to assure that the configuration is not changed. For procedure to change the setting of this switch, see "Write Protect Switch" on page 14 and Figure 5 on page 15 in this document. Additional information is available in MI 021-402.

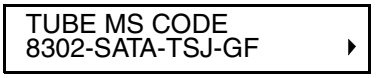
The structural diagram of the Status menu is located on Figure A-3 of Appendix A on page 50.

Identity Mode

The Identity mode enables you to view the identity parameters. You cannot edit them in this mode. They can be edited in Setup mode except for those with an asterisk (*) which are factory set. To step through the list of the following parameters, use the Up and Down arrow keys. The parameters are:

TAG NUMBER (FoxCom only)
LOCATION (FoxCom 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)
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)*

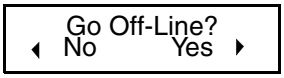
On strings over 16 characters, Left and Right arrow icons indicate that there are off screen characters. Use the Left and Right arrow keys to view these characters.



The structural diagram of the Identity menu is located on Figure A-4 of Appendix A on page 51.

Setup Mode

The Setup mode enables you to configure your system, output, alarm, diagnostic, identity, passcode, transmitter, and calibration parameters. This is an off-line mode. Outputs are driven fully downscale. Upon attempts to enter this mode, 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.



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, contact the IPS Global Client Support Center at one of the phone numbers listed on the last page of this document or at http://support.ips.invensys.com for assistance.

For detailed instructions on how to configure your transmitter, see “Configuration” on page 23. The structural diagram of the Setup menu begins with Figure A-5 of Appendix A on page 52.

4. Configuration

There are four basic steps to changing the configuration of the transmitter to the requirements of your application.

1. Determine what parameters must be changed.
   The "Configuration Guide" on page 24 shows which parameters must be checked and can be reconfigured. It also references the pages that describe each parameter and the structure diagram that is applicable to each. A list of the factory settings as shipped is given in Appendix B.
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 25 illustrates the mechanics of changing the configured values.
4. Exit the Setup mode.
   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 Operating mode.

— NOTE

The IMT96 transmitter can be configured without being connected to a flowtube. However, a diagnostic error condition (low coil current) will exist. This can cause an interruption of the setup process if there is a 30 second delay between key strokes. After the setup procedure gets to the offline condition, the interruption does not occur.

Configuration Tools

Several tools exist to help you configure the IMT96 using the key pad and display option. They are:

- The configuration guide chart (see Table 6) — 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 shows 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 reads **SETUP NEEDED/CONFIG ERROR** or **1 TOP LEVEL/Measurements**. If the **SETUP 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 17).

Configuration Guide

The first five columns of the configuration guide below show specifically which parameters must be configured correctly to set up the particular transmitter outputs you want. It also 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 of the related software structure diagram for that parameter in Appendix A. This reference is helpful in finding the correct pages in Appendixes A and B.

Table 6. 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		43	A-17	Flowtube Factor (Meter Factor)
Req	Req	Req	Req		28	A-6	Flow Rate Units (EGUs)
Req	Req	Req	Req		32	A-8	Output Mode (Analog or Digital)
Req	Req	Req			32	A-8	Analog Flow Mode (Uni- or Bi-Directional Flow)
			Req		32	A-8	Digital Flow Mode (Uni- or Bi-Directional Flow)
Req	Req				34	A-8	Upper Range Flow Rates (URVs for all ranges)
Req	Req	Req	Req		41	A-15	Flow Direction
	Req	Req			35	A-9	Pulse Output (Off, Rate, or Total)
	Req				35	A-9	Pulse Rate, Values for URV and Hz at URV
		Req		Opt	29	A-7	Totalizer (Totalizer must be ON to use Pulse Total Output)
		Req		Opt	30	A-7	Total EGU (Used for Totalizer and Pulse Total Output)

Table 6. 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
				Opt	30	A-6	Totalizer Format (Affects maximum value that can be displayed)
				Opt	28	A-6	Flow Rate Display Setup
Opt	Opt		Opt		36	A-9	Damping of Rate Output Signals (also affects Noise Reduction)
Opt	Opt		Opt		42	A-15	Noise Reduction (works in conjunction with Rate Output Damping)
				Opt	29	A-6	Rate Display Damping (only affects display)
				Opt	37	A-11	Alarm Setup
				Opt	36	A-10	Output Relay Setup (Alarms, Flow Direction, Diagnostics, etc.)
				Opt	39	A-12	Diagnostics (Fail-safe setup)
				Ref	39	A-13	Identity (Tag Number, Tube ID, etc.)
				Opt	40	A-14	Passcodes (protect setup and/or totals)
Opt	Opt			Opt	41	A-15	Contact Inputs (acknowledge alarms, reset totals, multi-range, and signal lock)

Preparing the Transmitter for Configuration

The IMT96 can be configured before or after it is connected to a flowtube. If connected to a flowtube and the pipe is full, it does not matter whether or not the fluid is flowing. If not connected to a flowtube or if connected and the pipe is empty, a diagnostic error condition (low coil current) exists. This can cause an interruption of the setup process if there is a 30 second delay between key strokes. After the setup procedure gets to the offline condition, the interruption does not occur.

Viewing and Changing Data

In Setup (configuration) mode, you 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 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 4 on page 12.

The following example shows 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 7.

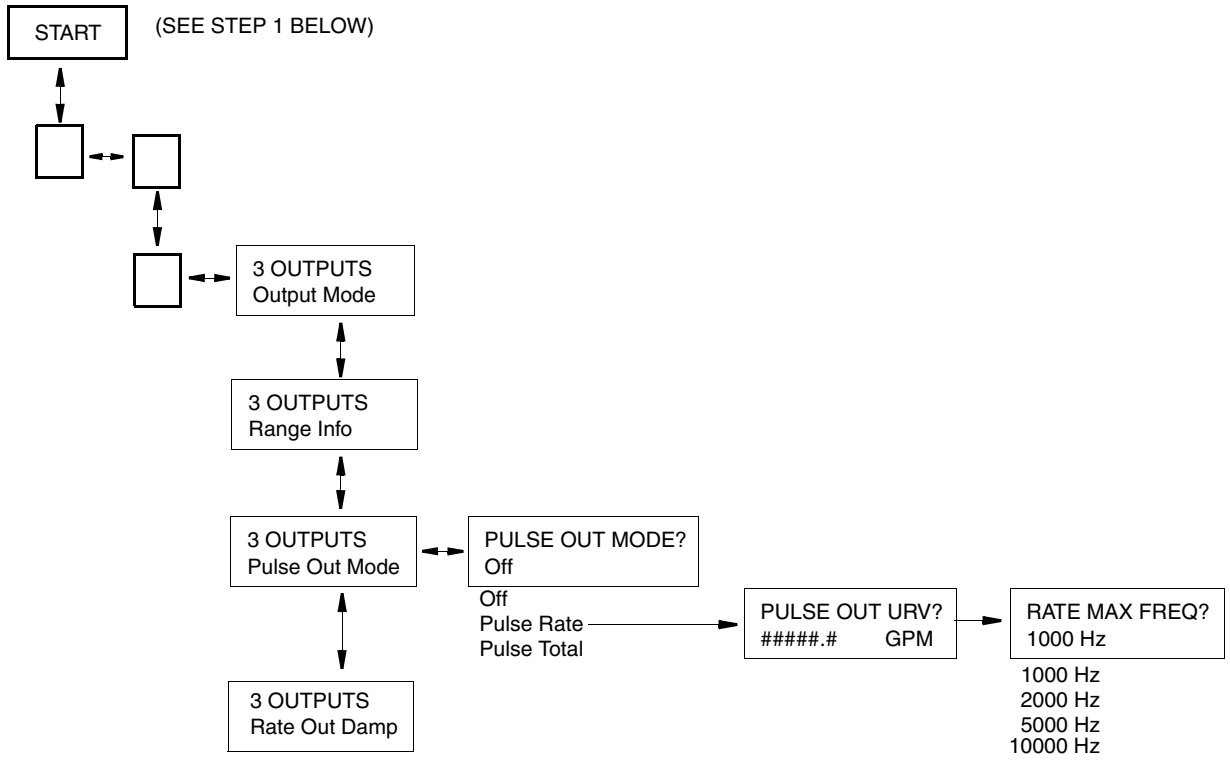


Figure 7. Example of Structure Diagram

1. The initial display after powering the transmitter is **1 TOP LEVEL/Measurements**. Use the Down arrow key to move to **1 TOP LEVEL/Setup**, then the Right arrow key to move to move to **2 SETUP/System**, then the Down arrow key to move to **2 SETUP/Outputs**, and then the Right arrow key to move to **3 OUTPUTS/Output Mode**.
2. Use the Down arrow key to move from **3 OUTPUTS/Output Mode** to **3 OUTPUTS/Range Info** to **3 OUTPUTS/Pulse Out Mode**.
3. Use the Right arrow key to move to **Pulse Out Mode?/{Off}**. The curly brackets indicate that the Off status is editable.
4. Press the **SHIFT** + **CHANGE** keys to enter Edit mode. If you are not already Off-Line, the display asks **Go Off-Line?** Reply Yes by pressing the Right arrow key. The display shows **PULSE OUT MODE?/[Off]**. The plain brackets indicate that you are in Edit mode.

— NOTE

When the transmitter goes Off-Line, the outputs go to zero.

5. 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 shows **PULSE OUT URV?/ {#####.# } GPM**.

6. Press the **SHIFT + CHANGE** keys to enter Edit mode. The display shows **PULSE OUT URV?/[#####.#]GPM**. The cursor is under the left bracket.
7. 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 the example.
8. 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 changes to **PULSE OUT URV?/{00150.0} GPM** and then to **RATE MAX FREQ? {2000 Hz}**.
9. Press the **SHIFT** + **CHANGE** keys to enter Edit mode. The display shows **RATE MAX FREQ? [2000 Hz]**.
10. 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.
11. When all the changes have been made, you must exit the Setup mode. To do this, 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.

System Setup

The structural diagram of the System menu is located on Figure A-6 and Figure A-7 on page 54.

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)
Forward 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**.

If you configure the Dual Display **On**, you must select the display for Line 1 and for Line 2. You can 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 flow rate to be displayed. You can 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 (Custom Units).

The default setting is **GPM**.

If you select **Custom**, you must enter the custom units you desire in up to six alphanumeric characters. The characters that can be used are listed in Table 7:

Table 7. Allowable Characters

0 through 9	@ (at sign)	% (percent sign)	: (colon)
A through Z	/ (forward slash)	& (ampersand)	; (semicolon)
^ (carat)	‘ (single quotation mark)	* (asterisk)	< (less than)
_ (underscore)	“ (single quotation mark)	, (comma)	= (equal)
. (period)	((left parentheses)	- (dash/minus sign)	> (greater than)
! (exclamation point)	) (right parentheses)	+ (plus sign)	? (question mark)
(space)	$ (dollar sign)	# (number sign)	

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 is given in Table 9. The slope can be from $1.0e^{-30}$ to $1.0e^{+30}$. Enter it in the form #.####e+##.

Table 8. Rate EGU Custom Slope

Unit	Slope
ft^3/min	1.3368e-01
m^3/min	3.7900e-03
bbl/min*	2.3810e-02
ImpGal/min	8.3267e-01

* 42 gallon barrel

Slope is the quantity of the custom unit that equals one gallon per minute; for example, 0.00379 m^3/min = 1 GPM. Therefore, 0.00379 is the slope for the unit m^3/min.

— 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

The engineering units for the flow rate value are determined by the **Rate EGU** parameter. The format of the values displayed are determined by the **Rate Format** parameter. The available options for this parameter are:

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

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

— NOTE

Changing this parameter can affect other parameters such as a Range URV or an alarm set point. For example, if **Rate Format** was configured as **xxxx.xx** and the **Hi Alm Setpt** as **1234.56** but then the **Rate Format** was changed to **xxx.xxx**, when you access **Hi Alm Setpt** again, the display will read **999.999**. This means that the high alarm set point 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 setting 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 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

The engineering units associated with the totalizer are configured via the **Tots EGU** parameter. Specify the engineering units as gallons (**Gal**), liters (**Lit**), or custom units (**Custom**). The default setting is **GAL**.

If you selected **Custom** in **Tots EGU**, specify the **Custom Units** and **Custom Slope** as you did in **Rate EGU**. The slope for some frequently used units is given in Table 9. The slope can be from $1.0e^{-10}$ to $1.0e^{+10}$. Enter it in the form #.####e+##.

— NOTE

Changing **Tots 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 **xxxxx.xx** and the present total is **50000.00**, changing **Tots EGU** from **Gal** to **Lit** causes the rescaled total to exceed the maximum displayable value and be reset to zero.

Table 9. Tots EGU Custom Slope

Unit	Slope
ft^3	1.3368e-01
m^3	3.7900e-03
barrel	2.3810e-02
Imp Gal	8.3267e-01

* 42 gallon barrel

Slope is the quantity of the custom unit that equals one gallon; for example, 0.00379 m^3 = 1 Gallon. Therefore, 0.00379 is the slope for the unit m^3.

Tot/Net Format

The **Tot/Net Format** parameter determines the resolution of the displayed values of Forward Total, Reverse Total, and Net Total. It also determines the volumetric quantity that causes a total pulse to be generated at the Pulse Total output if the transmitter is configured to generate this output. A total pulse is generated whenever the least significant digit in the configured format is incremented. Thus, if you specify **Tot/Net Format** in tenths of a gallon (**######.#**) and **Tots EGU** in gallons (**Gal**), one total pulse is generated for each tenth of a gallon.

The following options for this parameter are listed below:

- **#######.e4** (totalize in ten-thousands of units)
- **#######.e3** (totalize in thousands of units)
- **#######.e2** (totalize in hundreds of units)
- **#######.e1** (totalize in tens of units)
- **######.** (totalize in single units)
- **#####.#** (totalize in tenths of units)
- **####.##** (totalize in hundredth of units)
- **###.###** (totalize in thousandths of units).

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 **xxxxxx.x** and present total was **123456.7** but then the **Rate Format** was changed to **xxxxx.xx**, the totalizer would reset to zero.
2. If you plan to use the output pulse in Totalizer mode, the size of each pulse is the equivalent of 1 digit in the right-most decimal position of the displayed total.

Gr Tot Format

The **Gr Tot Format** parameter determines the resolution of the displayed value for the Grand Total. The following options for this parameter are listed below:

- **#########.e4** (totalize in ten-thousands of units)
- **#########.e3** (totalize in thousands of units)
- **#########.e2** (totalize in hundreds of units)
- **#########.e1** (totalize in tens of units)
- **#########.** (totalize in single units)
- **########.#** (totalize in tenths of units)
- **#######.##** (totalize in hundredth of units)
- **######.###** (totalize in thousandths of units).

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 **xxxxxx.x** and present total was **123456.7** but then the **Gr Tot Format** was changed to **xxxxx.xx**, 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-8 through Figure A-10 of Appendix A.

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, specify Unidirectional (**UniDir**) or BiDirectional (**BiDir**) flow. If you want a pulse output, you must specify Unidirectional. The default setting is **UniDir**.

- **UniDirectional** specifies unidirectional flow with a single upper range value (Forward URV).
- **BiDirectional** specifies two-way flow with a forward upper range value (Forward URV) and a reverse upper range value (Reverse URV).

If you selected **Analog** on your FoxCom transmitter or with a HART transmitter, specify Unidirectional (**UniDir**), Unidirectional Multi-Range (**Uni Multi-Rang**), BiDirectional Dual Range (**BiDir Dual Rng**), or Bidirectional Split Range (**BiDir Split Rng**). The default setting is **UniDir**.

- **UniDirectional** specifies unidirectional flow with a single upper range value (Forward URV).
- **UniDirectional Multi-Range** specifies unidirectional flow with multiple URVs selected by the Contact Inputs. The output is 4 mA at zero flow and 20 mA at the URV.

  You must also supply two Contact Inputs to the transmitter, and program both **CI1** and **CI2** for **Multi-Range**. You must also program values for **Range 1 URV**, **Range 2 URV**, and **Range 3 URV**. 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 10.

Table 10. URV Selection in UniDirectional Multi-Range Flow Mode

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

Table 10. URV Selection in UniDirectional Multi-Range Flow Mode

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

BiDirectional Dual Range specifies two-way flow with 4 to 20 mA indicating the rate. You can program a Relay Output to indicate Flow Direction. This is the only way to indicate remotely whether the analog output represents forward (positive) or reverse flow in this mode.

The upper range value for forward flow is parameter **Forward URV**. The upper range value for reverse flow is parameter **Reverse URV**.

The transmitter outputs a 4 to 20 mA current based on the URV for either forward or reverse flow, as appropriate, and uses a contact output to indicate flow direction. The output is 4 mA at zero flow and 20 mA at the URV. The relationship between the milliampere output and the flow rate is illustrated in Figure 8.

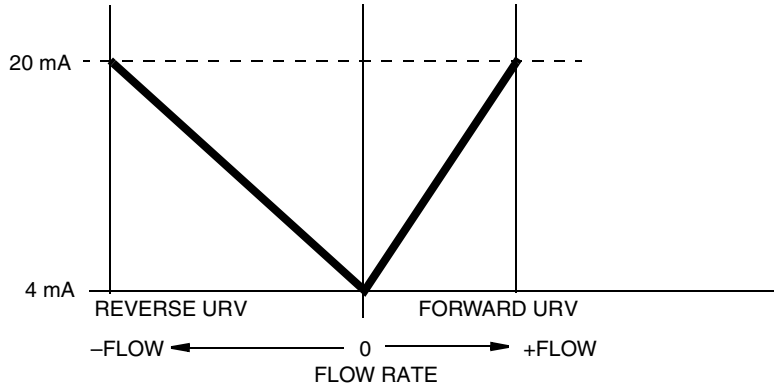


Figure 8. BiDirectional Dual Range Milliampere Output

BiDirectional Split Range 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 9.

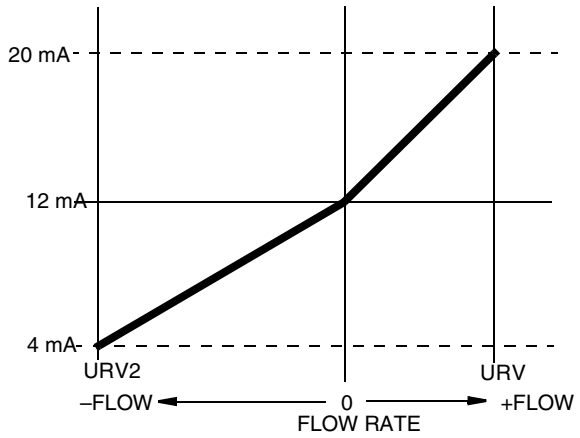


Figure 9. BiDirectional Split Range Milliampere Output

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

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

— NOTE

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

Range Info

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

Digital Output and Unidirectional mode: Specify the **Forward URV**.

Digital Output and BiDirectional mode: Specify the **Forward URV** and the **Reverse URV**.

Analog Output and Unidirectional mode: Specify the **Forward URV**.

Analog Output and Unidirectional Multi-Range mode: Specify the **URV** for each of three ranges.

Analog Output and BiDirectional Dual Range mode: Specify the **Forward URV** and the **Reverse URV**.

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.
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.
3. When more than one URV is specified, the largest must be no more than eight times the smallest.

Pulse Out Mode

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 selections for this parameter are **Off**, **Pulse Rate**, and **Pulse Total**. The default setting is **Off**.

— NOTE

The Pulse Output is only unidirectional. Therefore **Pulse Out Mode** should be configured **Off** if you have specified BiDirectional flow.

Pulse Rate

If you selected **Pulse Rate**, set **Pulse Out URV** to the flow rate value that generates the full-scale pulse rate frequency in the units previously configured in "Rate EGU" on page 28. The default setting is 100.

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 **Rate Max Freq** was configured as **5000** and Pulse Preset as **4000** but then the **Rate Max Freq** was changed to **1000**, when you access **Pulse Preset** again, you will be warned that the preset value exceeded the maximum. The display would show a value of **1000.0**, the maximum allowable value.

Pulse Total

If you specify **Pulse Total**, 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 ms for the **10 Hz** and 5 ms for the **100 Hz** setting. The default setting is 100 Hz.

— NOTE

1. 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 29.
2. 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

In this parameter, specify the damping rate for the Analog Output and the Pulse Rate Output. 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 setting is 3.0 seconds.

— NOTE

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

Relay Out 1 and Relay Out 2

The IMT96 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.

RO 1 and RO 2 Function

In this parameter, specify the function of each of the output relays from the menu. Choices are shown in Table 11.

Table 11. Function of Output Relays

Function	Description
Off	Relay not used.
Alarm	Relay activates upon alarm as configured.
Alarm & Diag	Relay activates upon configured alarms or any diagnostic condition.
Diagnostics	Relay activates upon any diagnostic condition.
Flow Direction	Relay activates upon change in flow direction.

The default setting is **Off**.

If you specified **Alarm** or **Alarm & Diag**, ensure that the Alarming parameter is enabled and at least one alarm is enabled (see “Setup of Alarms” on page 37). Also specify the alarm from the menu as **High Rate**, **Low Rate**, **High Fwd Tot 1**, **High Fwd Tot 2**, **AutoZeroLock** (HART Transmitter only) or **Any Alarm**. The default setting is **High Rate** for **RO1** and **Low Rate** for **RO2**.

RO 1 and RO 2 Operation

In this parameter, 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 is **Normally Open**.

RO 1 and RO 2 Suppress

If you selected **Alarms** or **Alarm & Diag**, specify the **RO 1 and RO 2 Suppress** 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 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. The default setting is **No**.

Setup of Alarms

The structural diagram of the Alarms menu is located on Figure A-11 on page 58 of Appendix A.

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 On** or **Off**. The default setting is **Off**.

— NOTE

Configuring **Alarms** to **Off** does not acknowledge existing alarms.

If **Alarms** is configured **On**, proceed to configure the alarm parameters described in the following sections.

High Rate

High Rate triggers an alarm when the flow rate exceeds the high alarm setpoint value. Once it is triggered, the alarm condition continues to exist until the flow rate falls below the high alarm set point minus the high alarm deadband.

Configure **Hi Alarm** as **On** or **Off**. The default setting is **Off**. If **On**, specify the **Hi Alm Setpt** between 0 and 999999 in the **Rate EGU** units previously configured. The default value is 100. Then specify the **Hi Alm Dband** between 0 and 999999. The default value is 1.0.

— NOTE

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

Low Rate

Low Rate triggers an alarm when the flow rate falls below the low alarm set-point value. Once it is triggered, the alarm condition continues to exist until the flow rate rises above the low alarm set point plus the low alarm deadband.

Configure **Lo Alarm** as **On** or **Off**. The default setting is **Off**. If **On**, specify the **Lo Alm Setpt** between 0 and 999999 in the **Rate EGU** units previously configured. The default value is 1.0. Then specify the **Lo Alm Dband** between 0 and 999999. The default value is 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 set point. 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 Alm Setpt** and **Tot 2 Alm Setpt** between 0 and 999999 in the **Tots EGU** units previously configured. The default value for **Tot 1 Alm Setpt** is 100,000; that for **Tot 2 Alm Setpt** is 1,000,000.

AutoZeroLock (Empty Pipe) (HART Only)

AutoZeroLock triggers an alarm when the AutoZeroLock circuitry detects high electrode impedance. To use this alarm, the AZL Detect parameter must be enabled and calibrated.

Configure **AZL 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 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 **Go Downscale**, **Go Upscale**, or **No Effect**. The default setting is **Go Downscale**.

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.

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-12 on page 59 of Appendix A.

Rate Response

The diagnostics feature can be configured to drive the analog and pulse rate outputs fully downscale or upscale if a diagnostic condition is detected. 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 **Go Downscale** or **Go Upscale**. The default setting is **Go Downscale**.

— 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 **Blink**.

Setup of Identity

The structural diagram of the Identity menu is located on Figure A-13 of Appendix A on page 60.

Identify the following with the maximum number of alphanumeric characters listed. Use the characters listed on page 28.

Tag Number	12 Characters	FoxCom only
Location	14 Characters	FoxCom 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-14 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:

- **Setup** (setup functions protected, ability to reset totals not protected)
- **Totals Reset** (ability to reset totals protected, ability to change setup functions not protected)
- **Setup and Totals** (both 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 setup (configuration) of the transmitter. Other operators could be given another passcode to enable them to reset totals and change the setup (configuration).

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 **Passcode 1**, repeat it for **Passcode 2**. The default setting for both passcodes is **Setup**.

Setup of Transmitter

The structural diagram of the Transmitter menu is located on Figure A-15 on page 62 in Appendix A.

Xmtr Mode

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

Line Frequency

This parameter specifies the local ac power frequency. The available selections are **50 Hz** or **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 **Flow Direction** as shown in Table 12.

Table 12. Flow Direction

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

The default setting is **Positive**.

The **Flow Direction** setting must agree with the **Output Mode** setting (see "Output Mode" on page 32). For example, if you selected **UniDir** or **Uni Multi-Rng** for **Output Mode**, you must pick **Positive** or **Reverse** for **Flow Direction**. Alternately, if you selected **BiDir Dual Rang** or **BiDir Split Rg** for **Output Mode,** you must pick **BiDir Positive** or **BiDir Reverse** for **Flow Direction**.

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 021-402 for details on flowtube wiring.

Contact Input 1 and Contact Input 2

The Contact Input parameters (**CI 1** and **CI 2**) specify the function and operation of the two Contact Inputs. Each Input is configured separately.

CI 1 and CI 2 Function

This parameter specifies the function performed by the contact input when the contact enters the active state. Specify the Function as one of the choices shown in Table 13.

If you have specified **Uni Multi-Rang** for **Output Mode** (see "Output Mode" on page 32), you **must** select **Multi-Range** for both **CI 1** and **CI 2.** 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 **Uni Multi-Rang**, you

should **not** select **Multi-Range** as the function of either of the contact inputs. The default setting is **Off**.

Table 13. Contact Input Functions

Function	Description
Off	Contact Input not used.
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 zero.

CI 1 and CI 2 Operation

This parameter specifies the inactive state of the contact inputs. Specify as **Normally Closed** or **Normally Open**. The default setting is **Normally Open**.

Noise Reduction

The **Noise Reduction** feature slows the initial output response to a change. See Figure 10. 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** feature as **On** or **Off**, and use the **Rate Out Damp** selection (described on page 36) 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 **Noise Reduction On** and reduce the **Rate Out Damp** value.

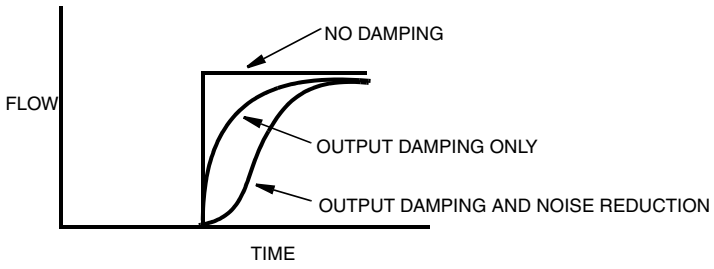


Figure 10. Noise Reduction

AutoZeroLock (Empty Pipe) Detection (HART Only)

The AutoZeroLock 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 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. 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. Also, the AZL feature may give a false failure response in certain low conductivity or long cable length applications.

⚠ 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** parameter as **On** or **Off**. The default setting is **Off**. Next, configure the **AZL Out Effect** parameter as **No Effect** or **Auto Sig Lock**. The **No Effect** choice means that the AutoZeroLock 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 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 can also be calibrated via a HART Communicator, PC-Based Configurator, or I/A Series Workstation.

Setup of Calibration

The structure diagram of the Calibration menu is located on Figure A-17 on page 64 in Appendix A.

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 can be changed to **####.#####** if the meter factor can not be entered into the default format. A scientific notation is also provided, but should be needed only in special cases.

If the data plate on the flowtube has a line with the label IMT96 CAL FACT, the value on that line is the **Meter Factor**. If the data label does not have that exact label, refer to MI 021-412 to determine the meter factor. The default value of the **Meter Factor** is 025.000000.

Zero Flow

In most applications, the zero flow signal is not a problem and zeroing is not required. But in applications operating at low flow velocities (<4 fps) or low fluid conductivity (<20 mS/cm), this calibration can improve the measurement accuracy.

To perform a zero flow calibration, the flowtube must be full and the flow rate must be zero. Under these conditions, the indicated flow rate should be less than 0.1 fps [in GPM, that is <0.25 (DIA^2) if the flowtube diameter is in inches]. Zero flow indications greater than 0.1 fps are not normal; Check that the correct meter factor has been entered and refer to the "Fault Location" section of MI 021-404 for corrective action before proceeding. If the indicated flow rate is less than 0.1 fps and stable, proceed by following the display prompts.

You can also restore the factory zero setting in this section of the menu structure.

Analog Output Calibration

As your device was accurately calibrated at the factory, the **Analog Out Cal** function is not normally required. This procedure should only be performed if the mA value displayed on your transmitter does not agree with the value measured by an accurate mA meter installed in the loop wiring.

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 arrow 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.

— NOTE

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

Preset Outputs

The **Preset Outputs** parameter allows you to manually set the analog, digital, and pulse 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 **Output Mode** is **Analog,** you can configure **Analog Preset** between 3.8 and 22.0 mA.

If **Output Mode** is **Digital**, you can configure **Rate Preset** between 0 and 999999 in the units established in "Rate EGU" on page 28.

If **Pulse Out Mode** is **Pulse Rate**, you can configure **Pulse Preset** between 0 and the maximum Rate Max Freq configured in "Pulse Rate" on page 35.

If **Pulse Out Mode** is **Pulse Total**, you can configure **Pulse Preset** between 0 and the maximum pulse count (65535).

— 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 does not actually control the output until the overriding condition goes away.

Appendix A. Structure Diagrams

This appendix contains structure diagrams that illustrate the menu structure of the IMT96 Transmitter and show how you can use the local display and keypad 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.

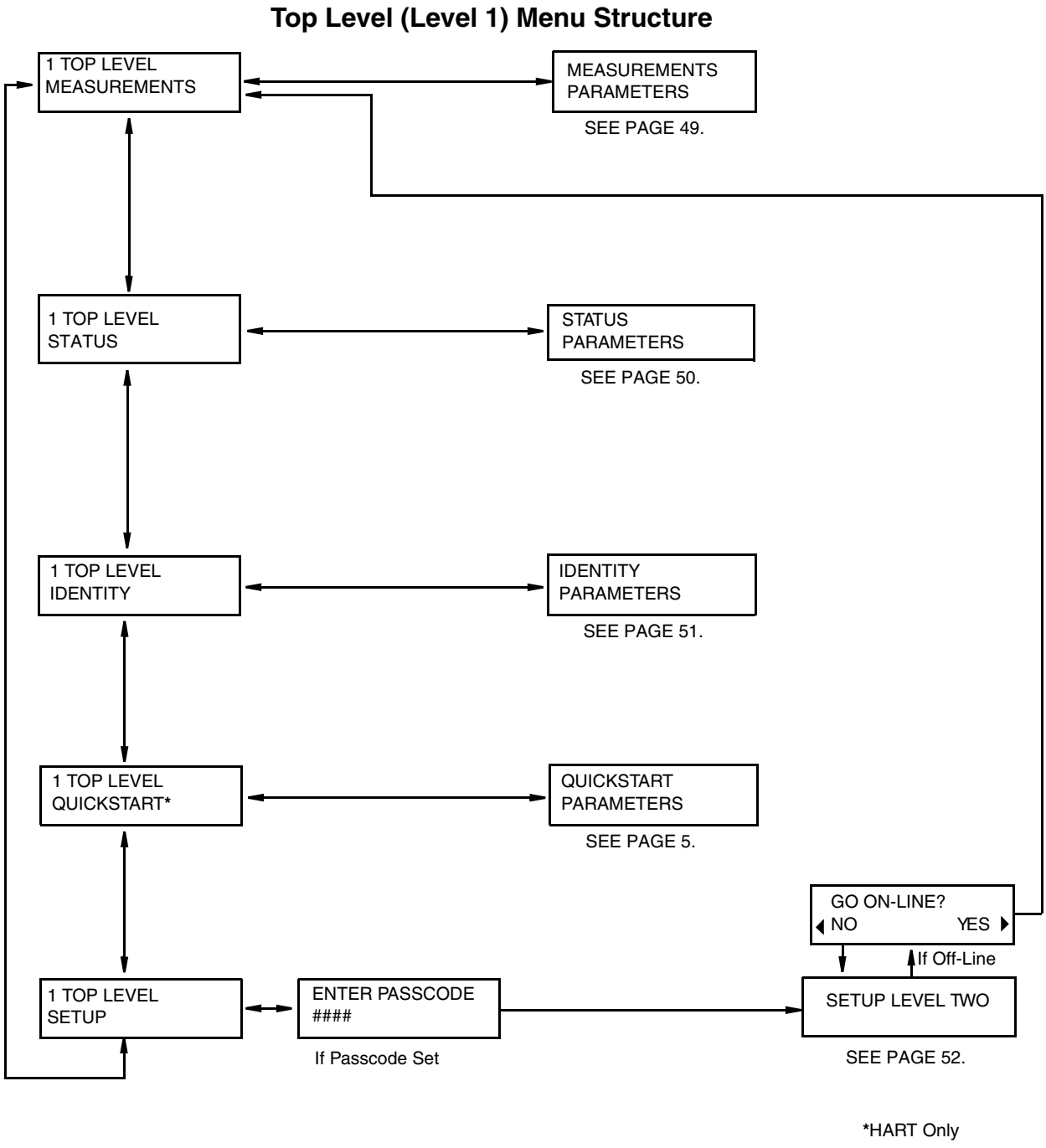


Figure A-1. Structure Diagram – Top Level Menu

Measurements Menu Structure

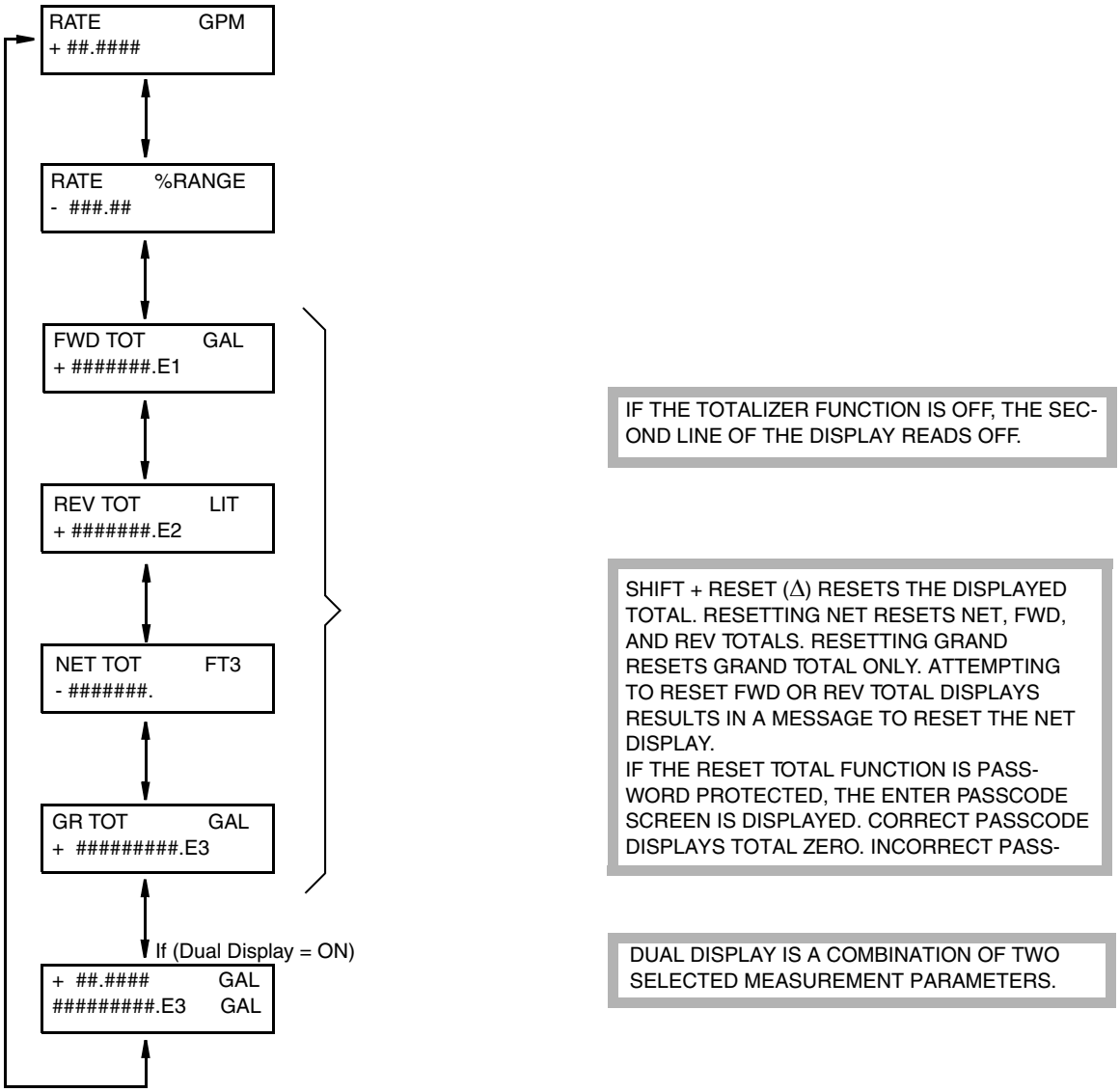


Figure A-2. Structure Diagram – Measurements Menu

Status Menu Structure

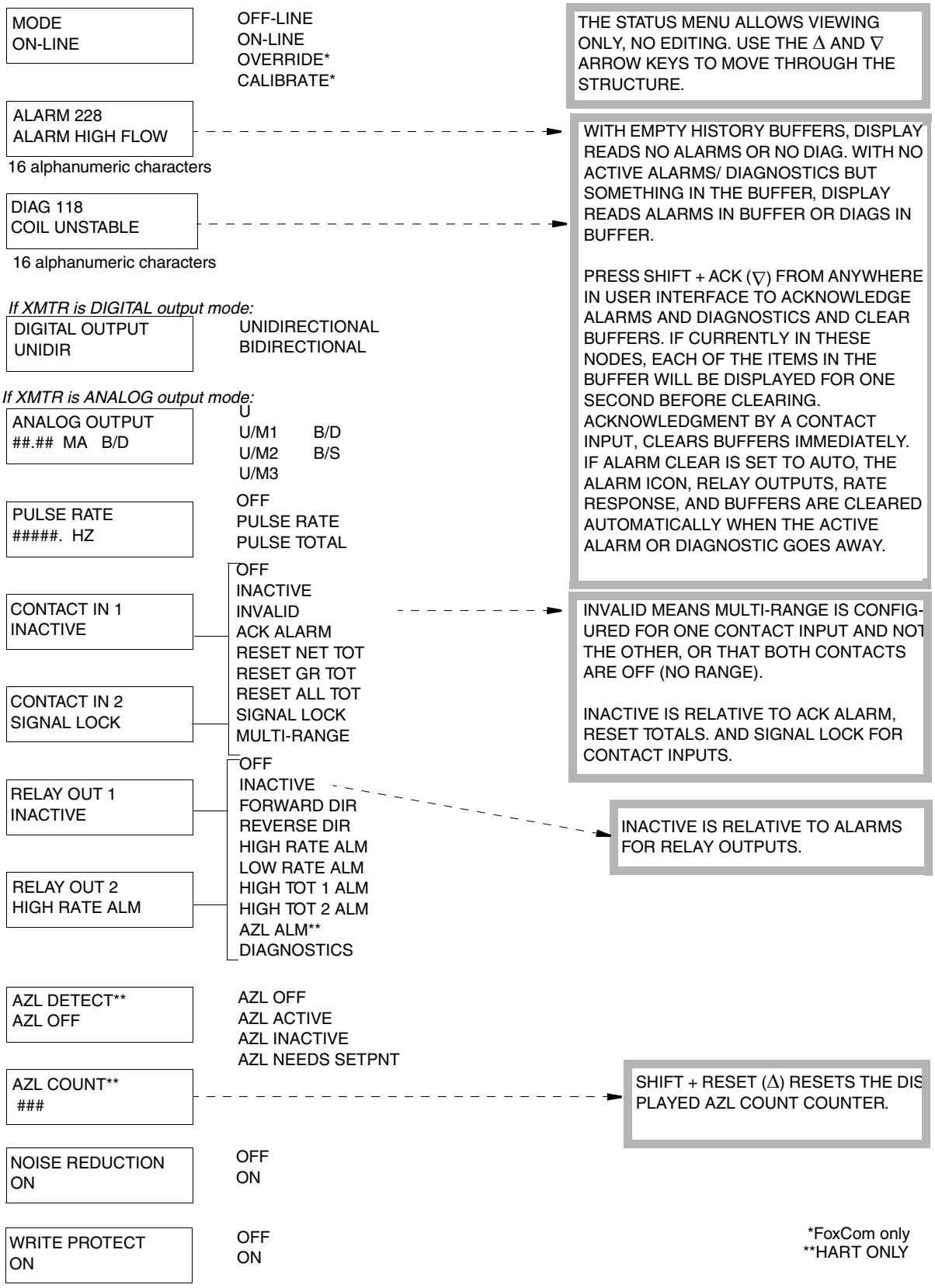


Figure A-3. Structure Diagram – Status Menu

Identity Menu Structure

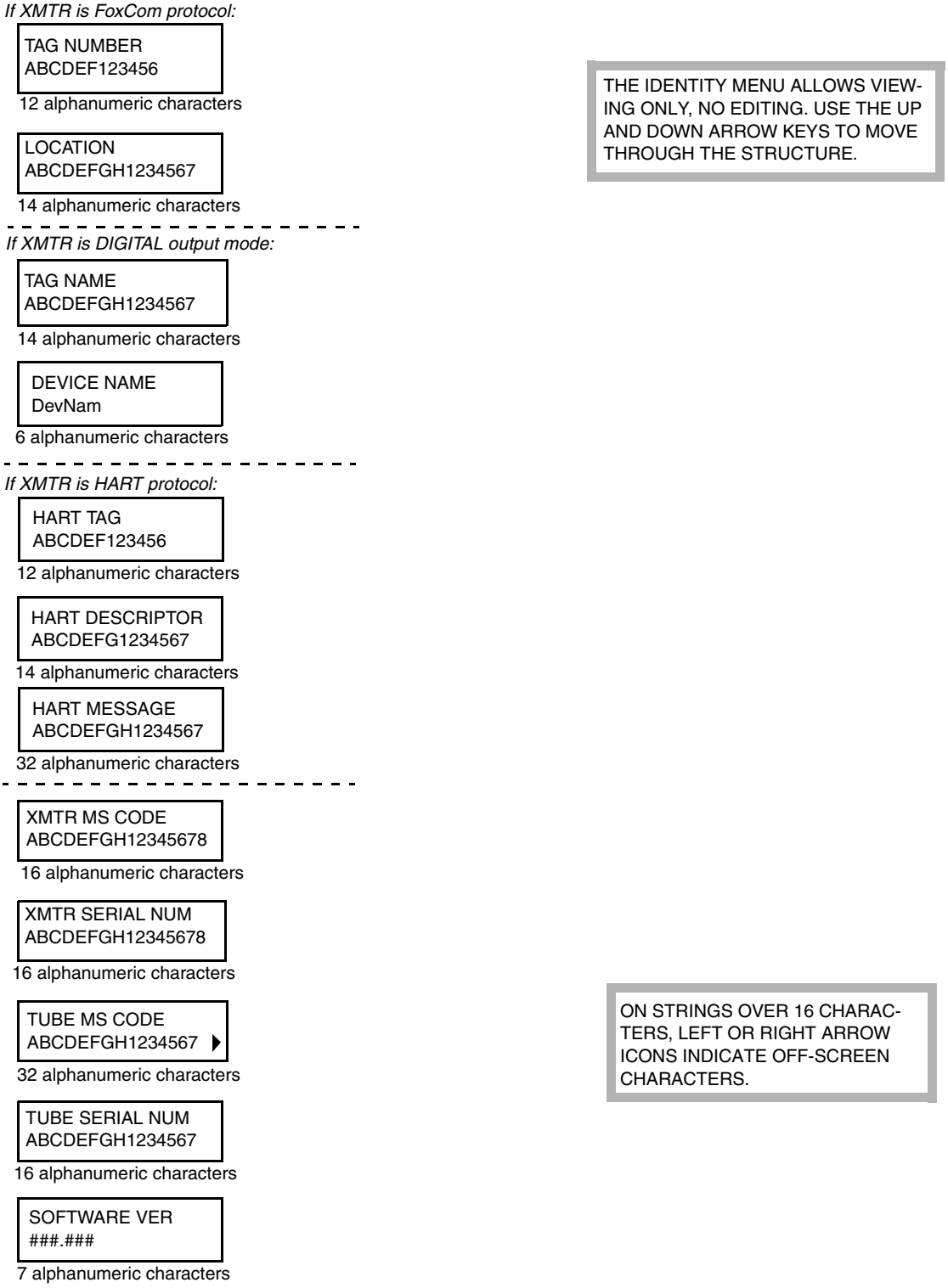


Figure A-4. Structure Diagram – Identity Menu

Level 2 Setup Menu Structure

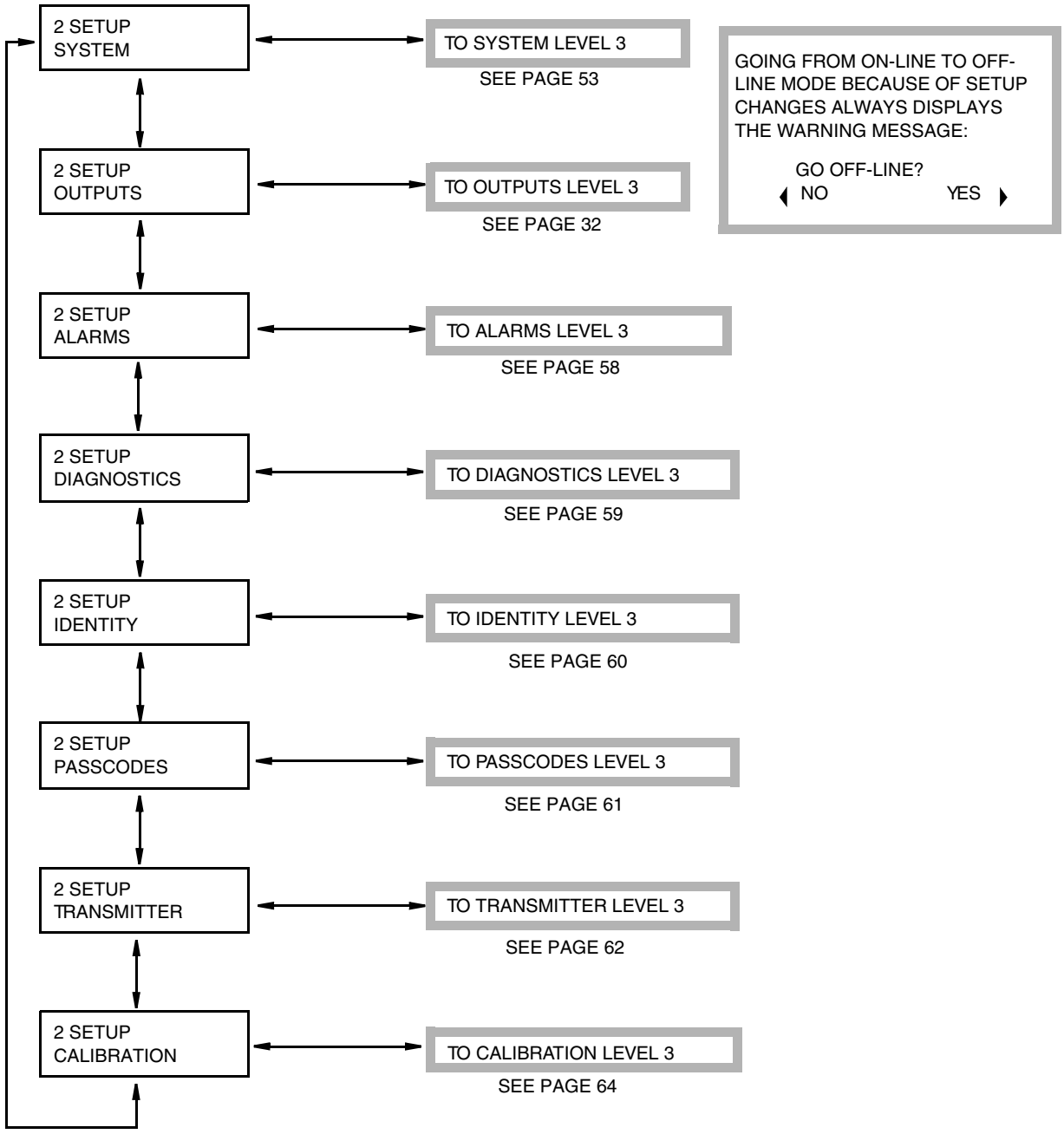


Figure A-5. Structure Diagram – Setup Menu

Level 3 System Menu Structure

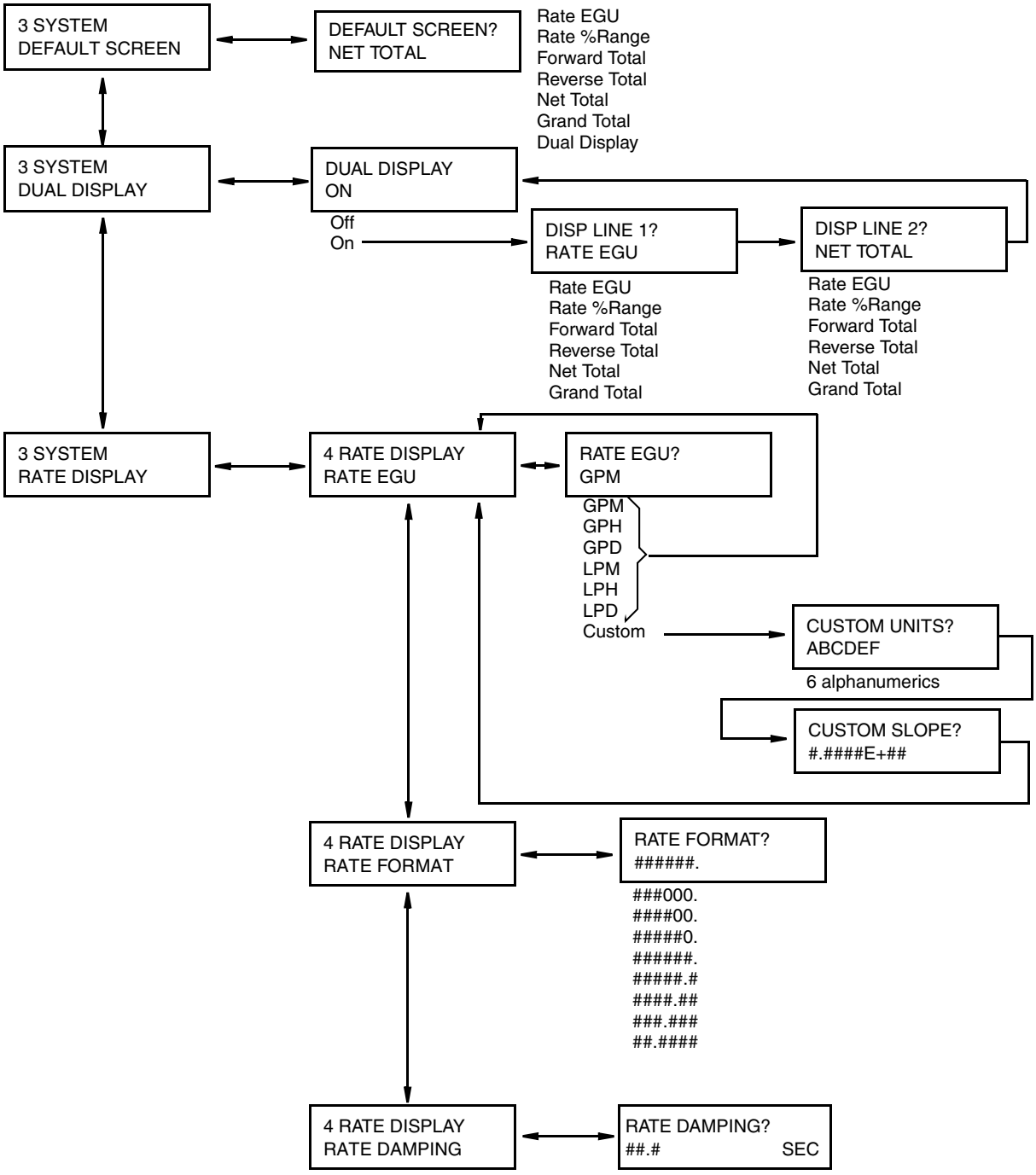


Figure A-6. Structure Diagram – System Menu

Level 3 System Menu Structure (Cont.)

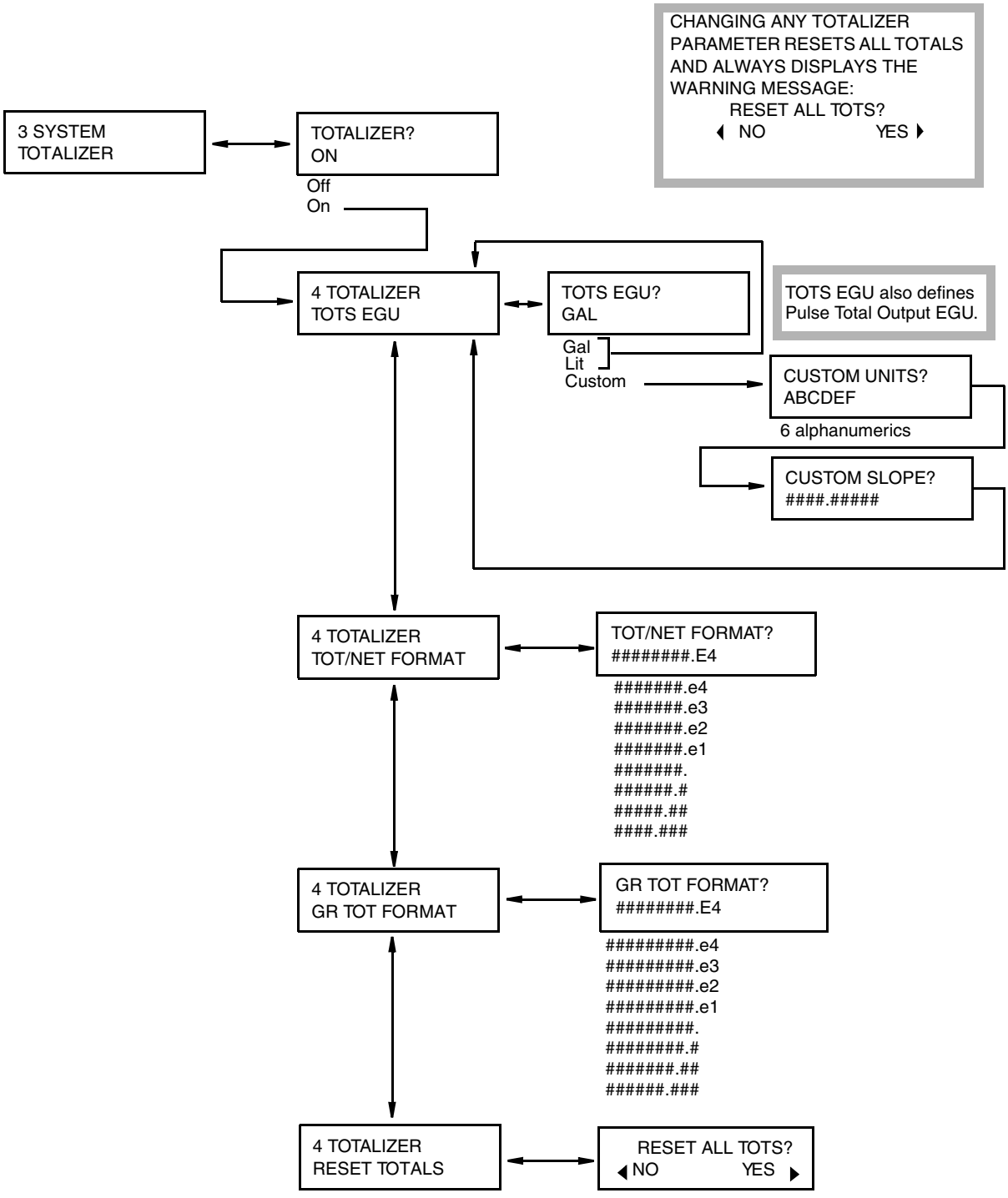


Figure A-7. Structure Diagram – System Menu (Cont.)

Level 3 OUTPUTS Menu Structure

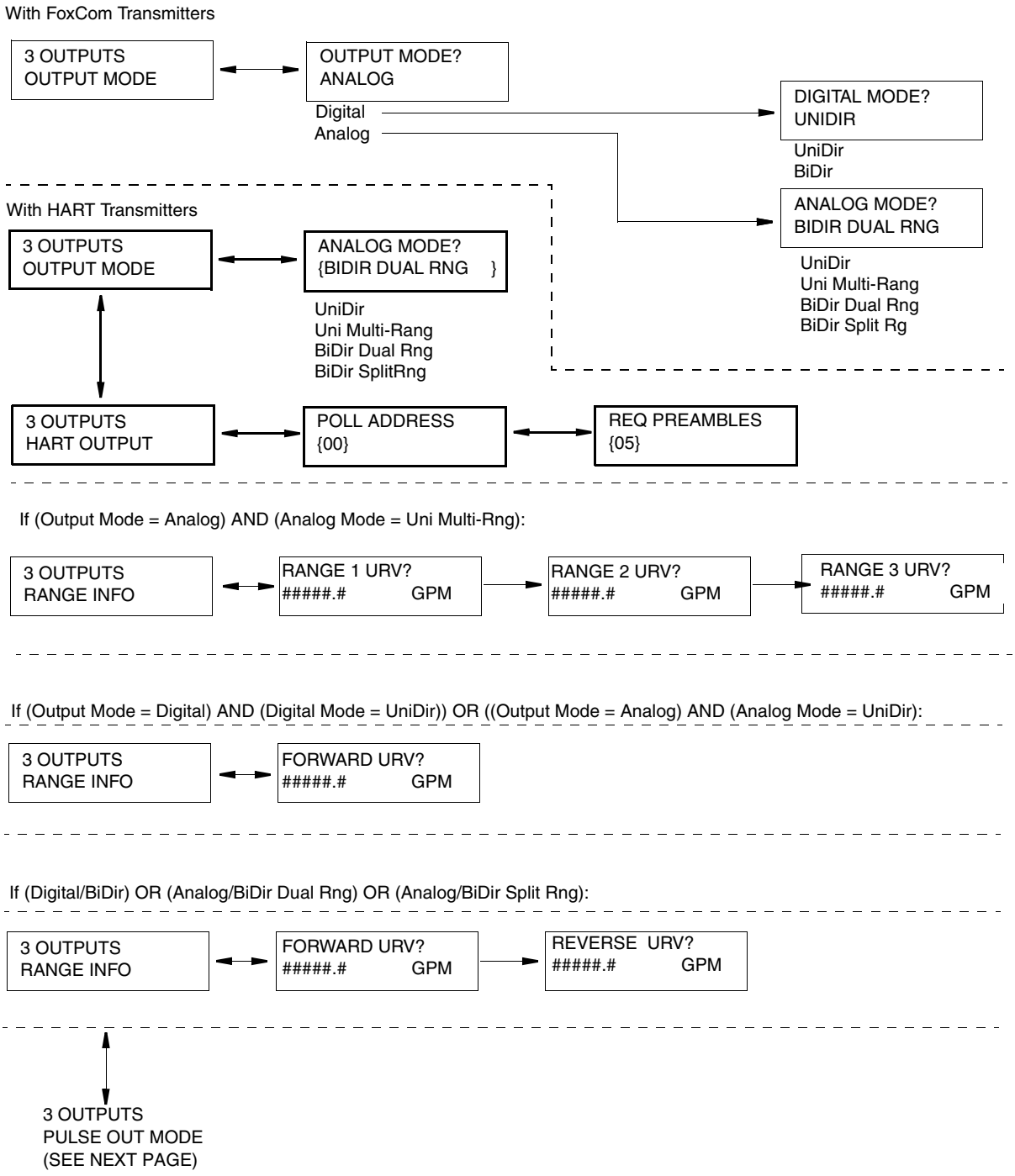


Figure A-8. Structure Diagram – Outputs Menu

Level 3 OUTPUTS Menu Structure (Cont.)

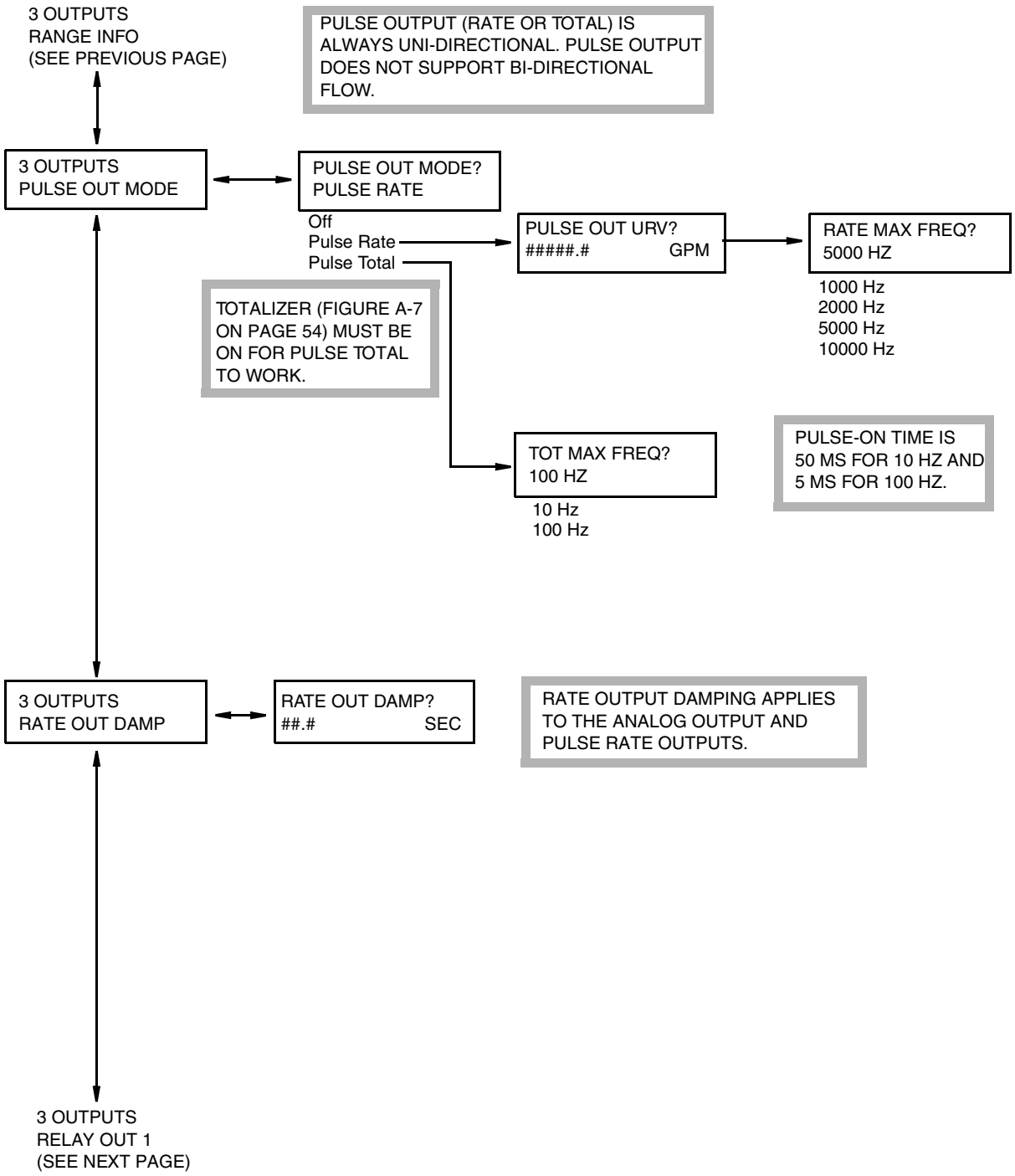


Figure A-9. Structure Diagram – Outputs Menu (Cont.)

Level 3 OUTPUTS Menu Structure (Cont.)

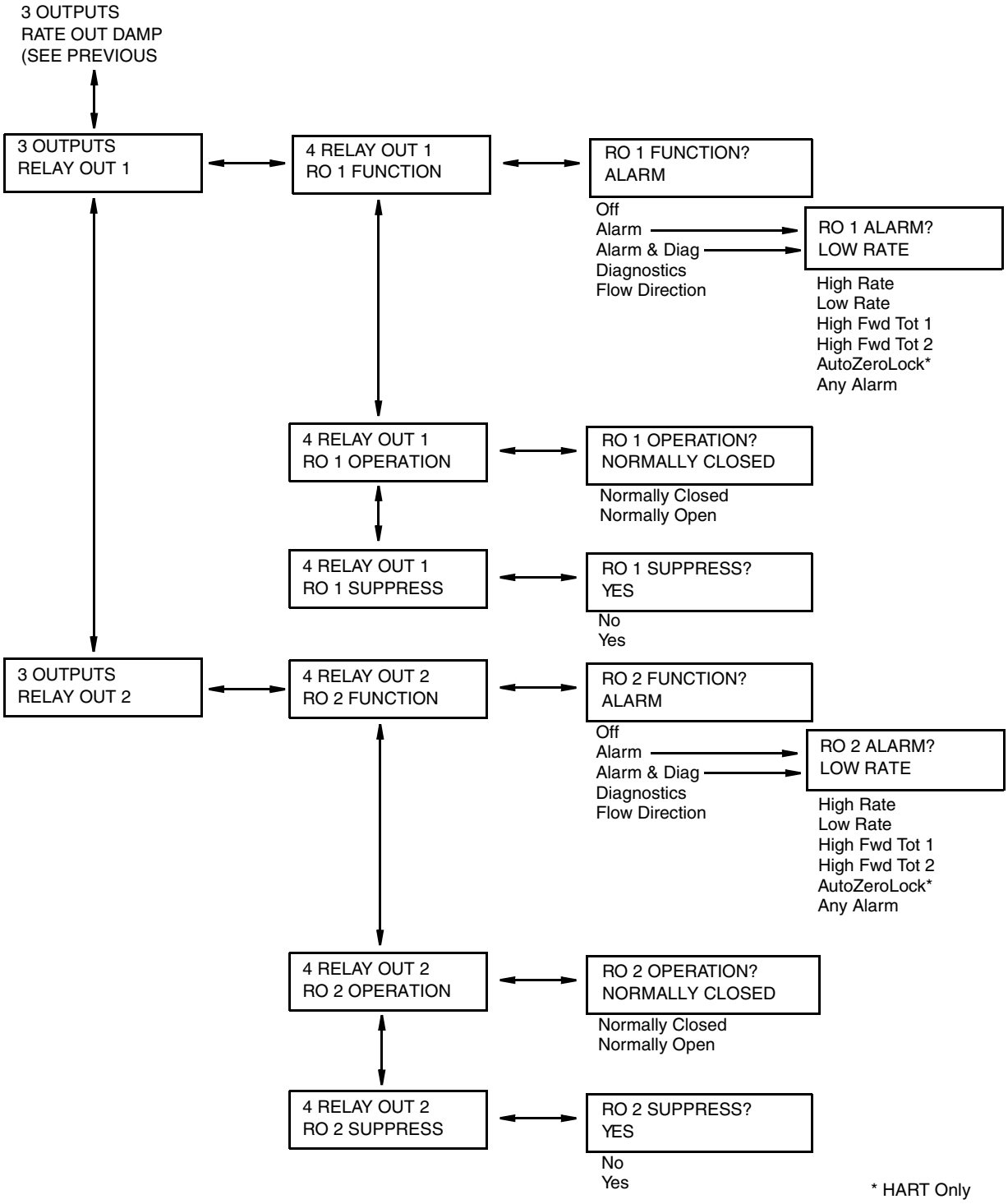


Figure A-10. Structure Diagram – Outputs Menu (Cont.)

Level 3 ALARMS Menu Structure

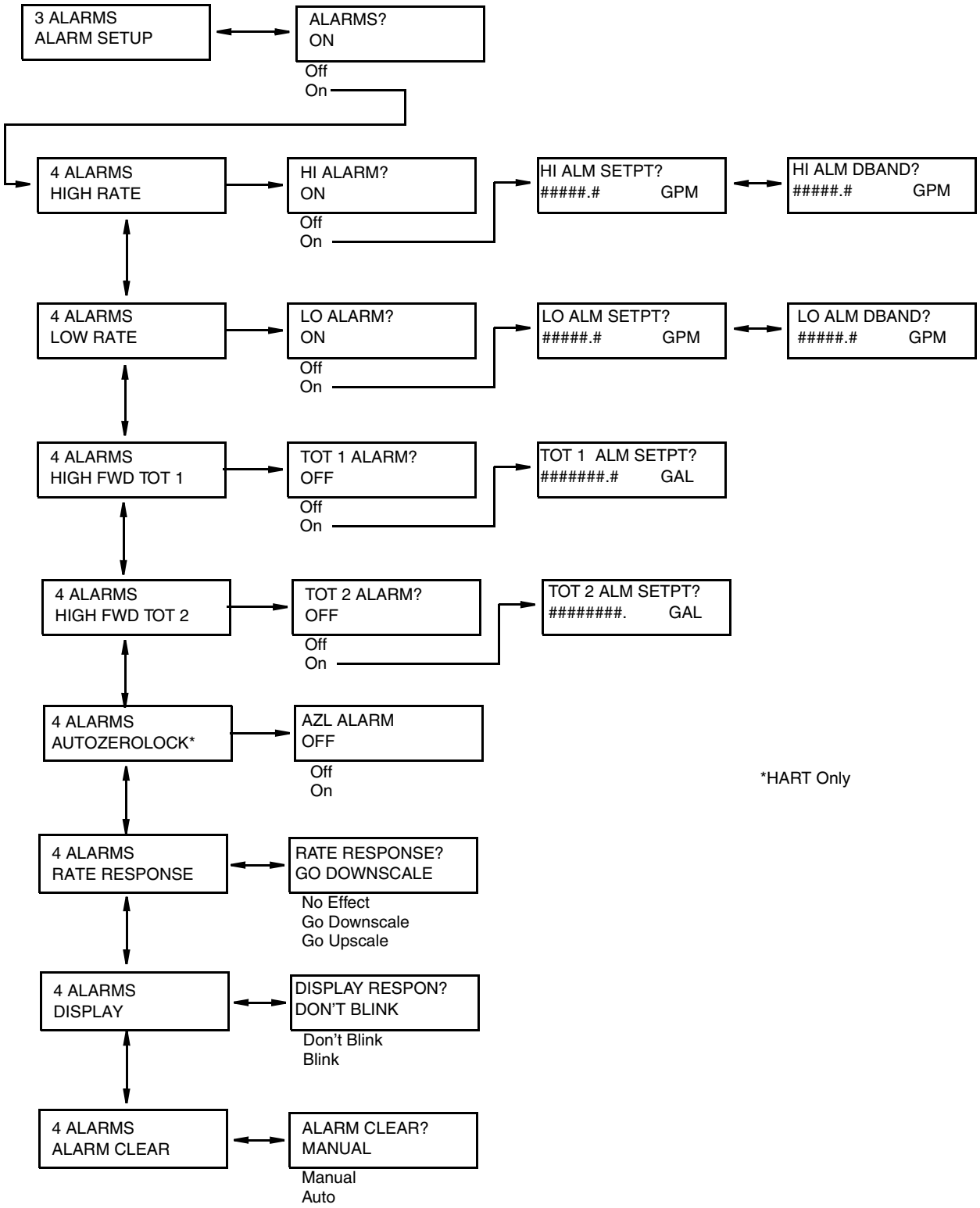


Figure A-11. Structure Diagram – Alarms Menu

Level 3 DIAGNOSTICS Menu Structure

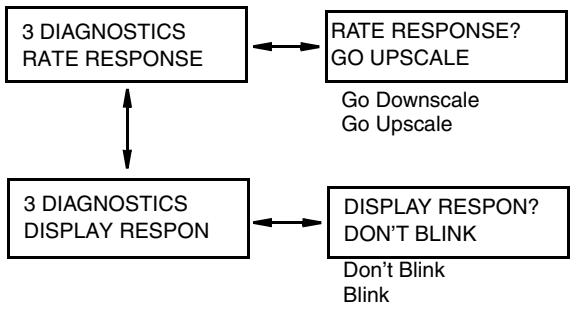


Figure A-12. Structure Diagram – Diagnostics Menu

Level 3 IDENTITY Menu Structure

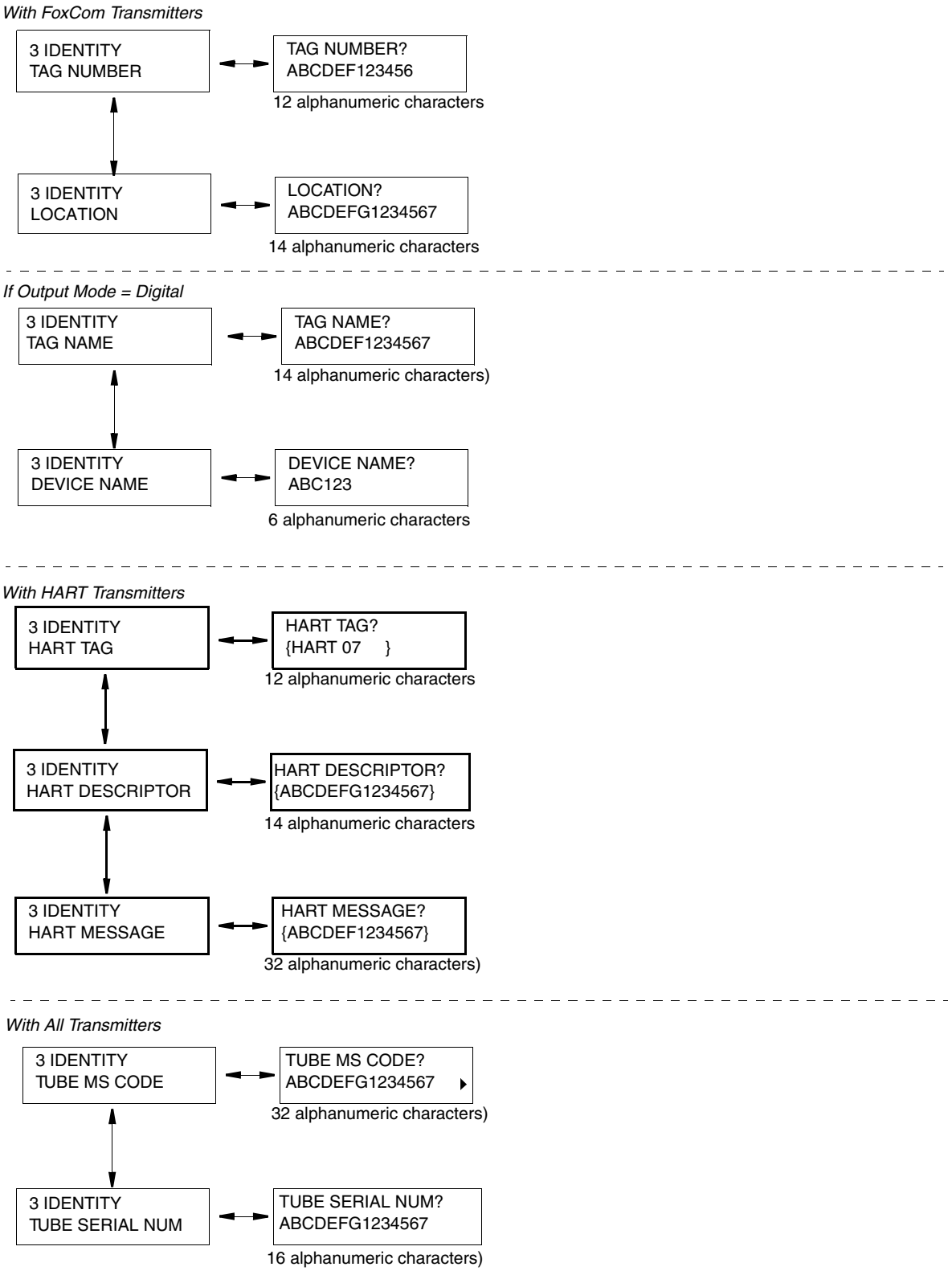


Figure A-13. Structure Diagram – Identity Menu

Level 3 PASSCODES Menu Structure

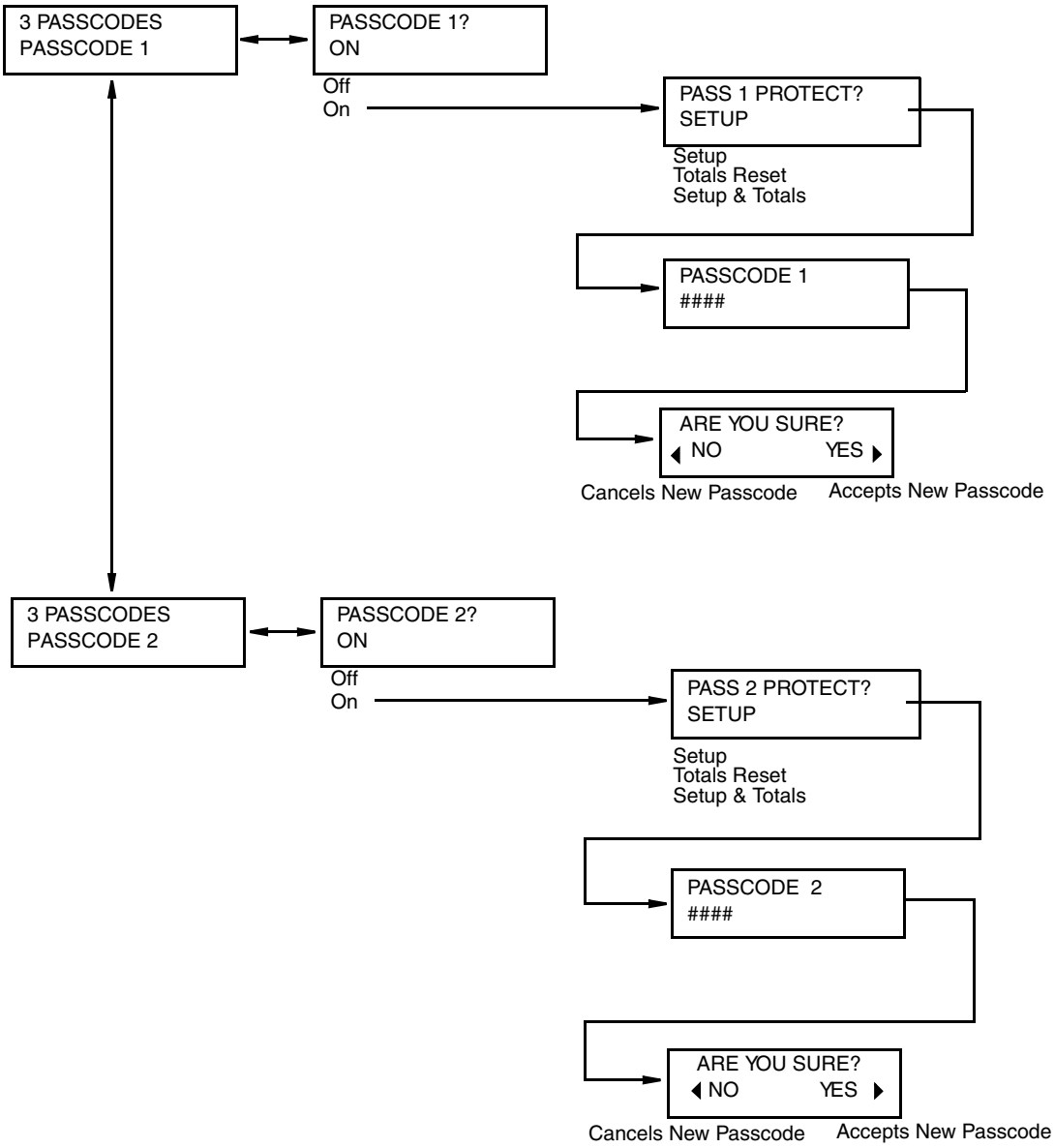


Figure A-14. Structure Diagram – Passcodes Menu

Level 3 TRANSMITTER Menu Structure

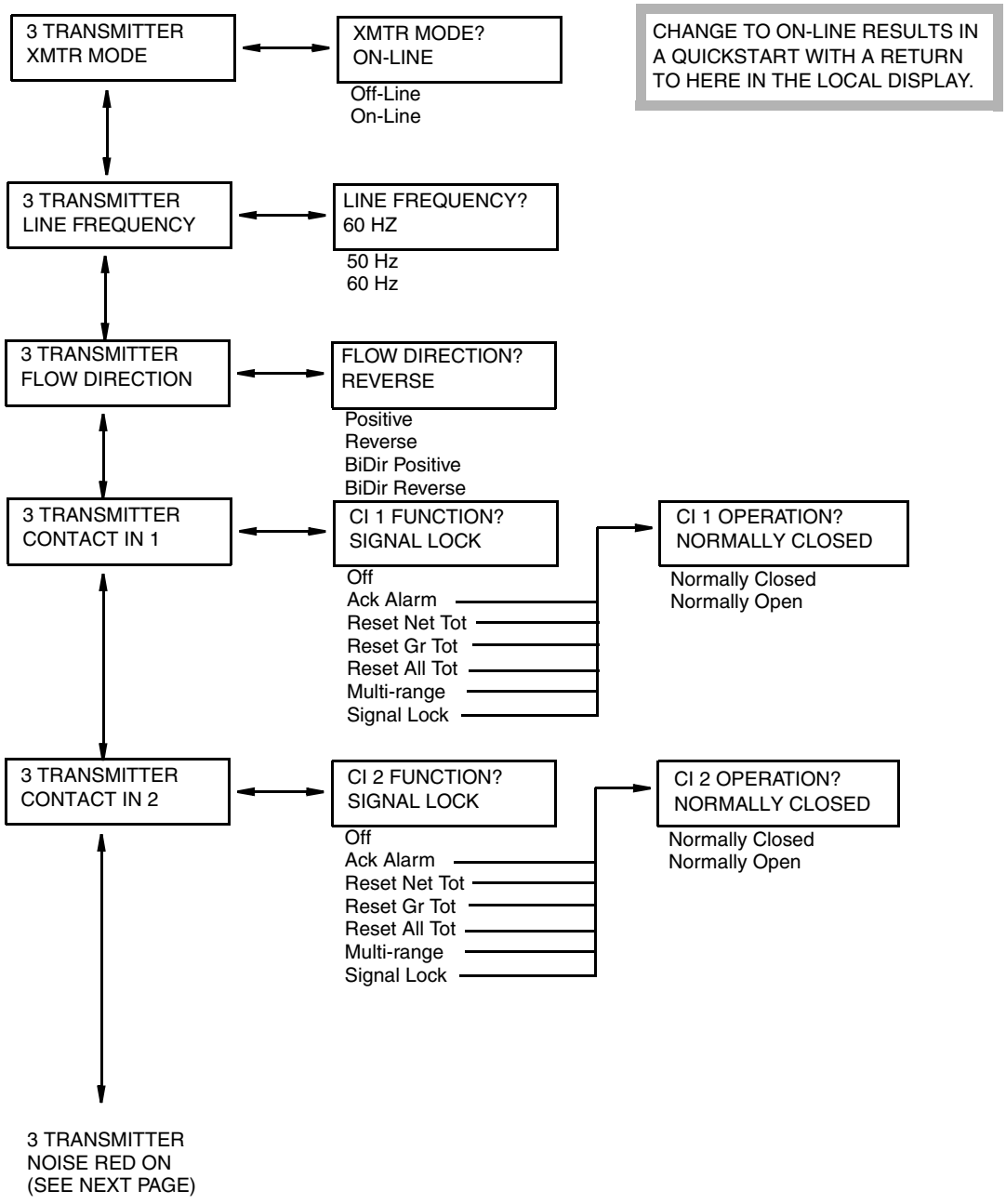


Figure A-15. Structure Diagram – Transmitter Menu

Level 3 TRANSMITTER Menu Structure (Cont.)

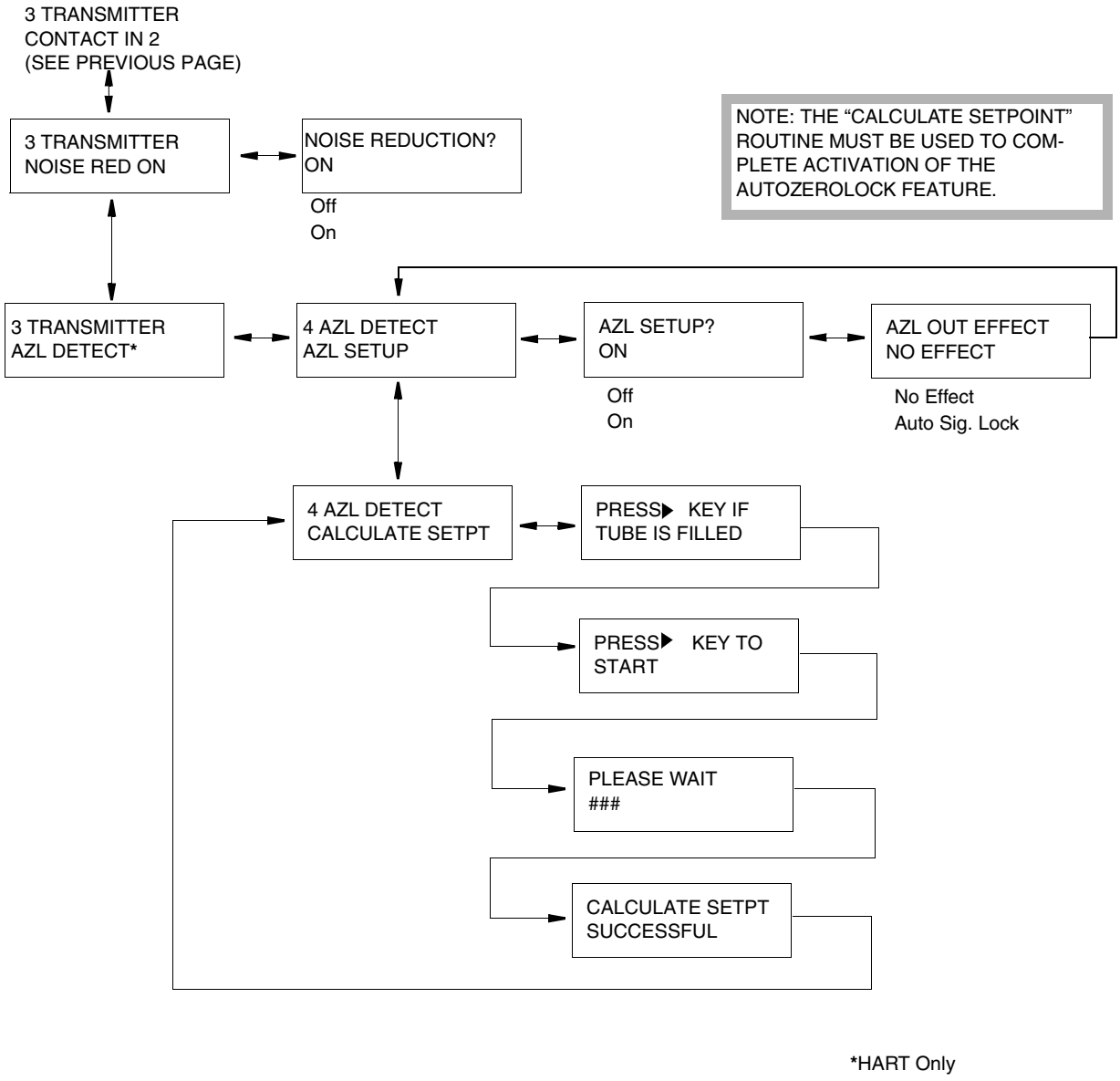


Figure A-16. Structure Diagram – Transmitter Menu (Cont.)

Level 3 CALIBRATION Menu Structure

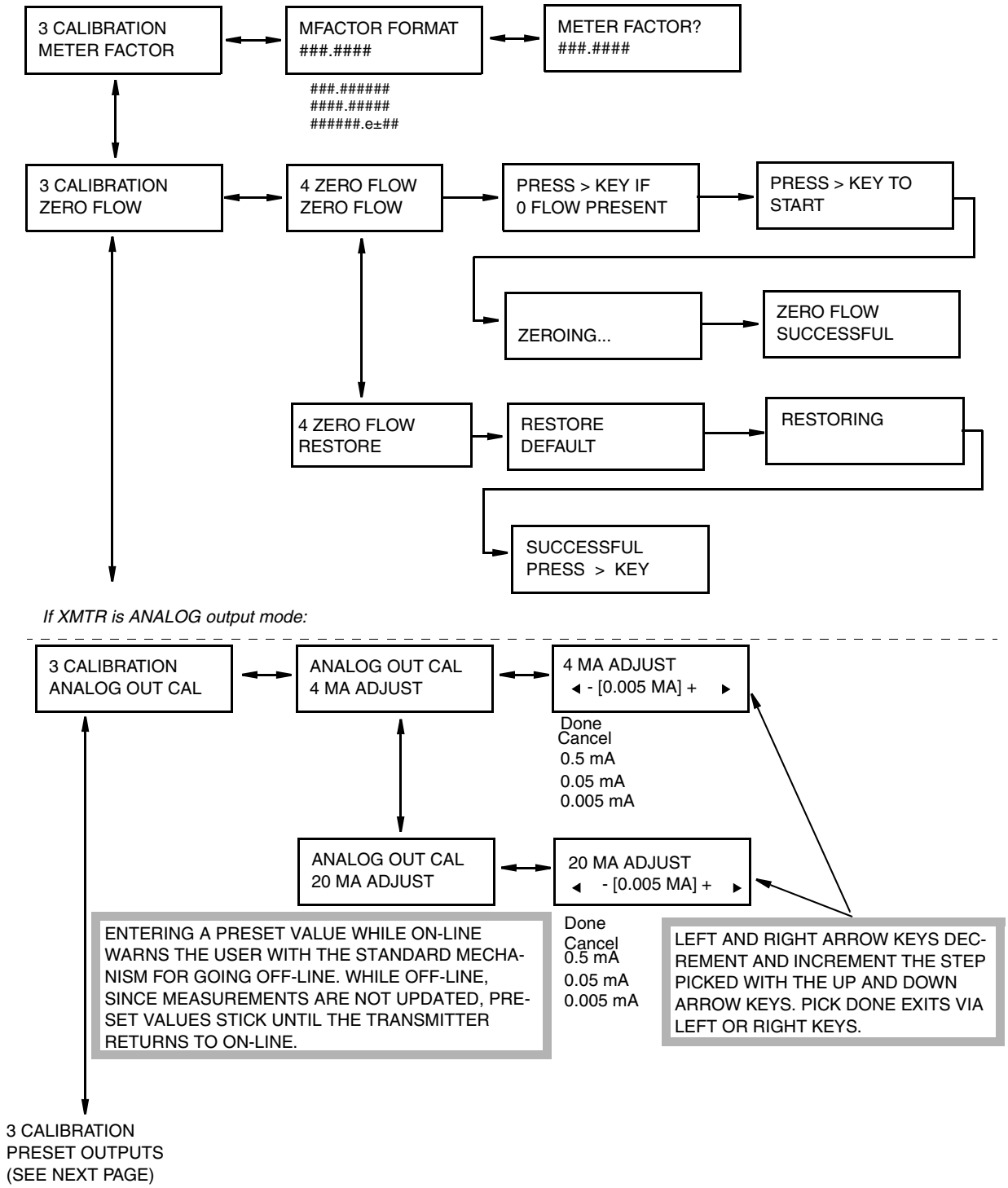


Figure A-17. Structure Diagram – Calibration Menu

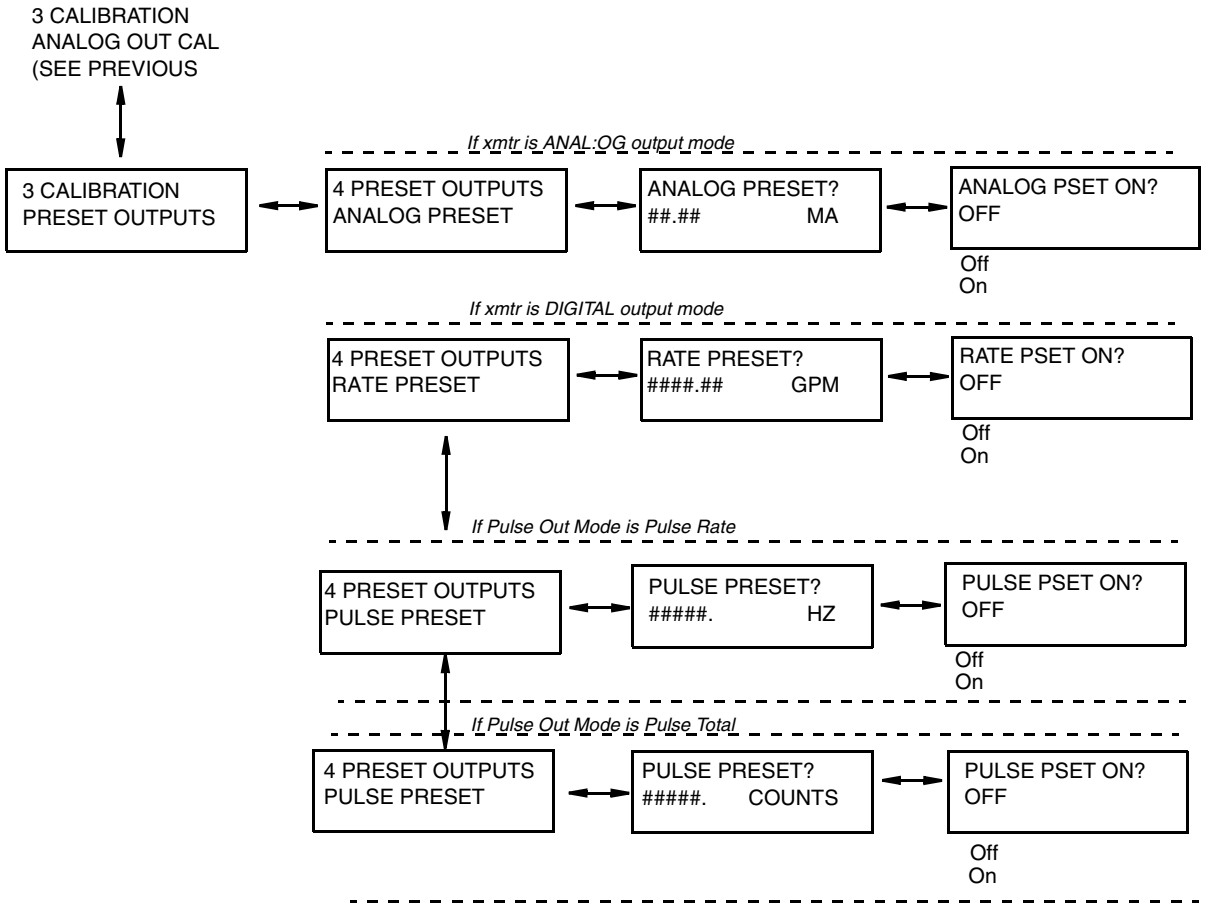


Figure A-18. Structure Diagram – Calibration Menu (Cont.)

Appendix B. Configuration Worksheets

This appendix contains information that will help you configure your IMT96 Transmitter. This page defines the content of the worksheets. Subsequent pages contain the actual configuration worksheets.

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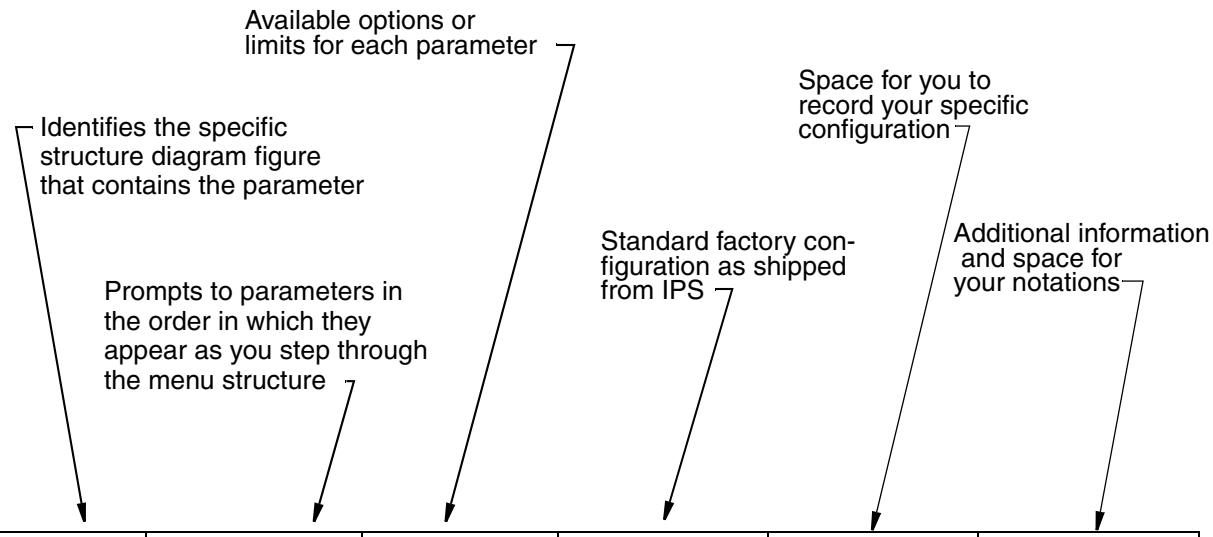

Structure Diagram	Prompt/ Parameter	Options or Parameter Limits	Default Factory Configuration	User Configuration	Remarks and Notes

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-6	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	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-7	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-8	3 OUTPUTS				
	Output Mode?	Digital, Analog	Per Model Code		
	If Digital:	- - -	- - -		
	Output Mode?	UniDir, BiDir	UniDir		
	If Analog:	- - -	- - -		
	Output Mode?	UniDir, Uni Multi-Rang, BiDir Dual Rng, BiDir Split Rg	UniDir		
	If Analog/Uni Multi Rang:	- - -	- - -		
	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/UniDir OR Analog /UniDir:	- - -	- - -		
	Range Info:	- - -	- - -		
	Forward URV	Flowtube Min URV to 999999	100		
	If Digital/BiDir OR Analog/ BiDir Dual Rng OR Analog/ 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-9	3 OUTPUTS (continued)				
	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-10	3 OUTPUTS (continued)				
	RO1 Function:	Off, Alarm, Alarm & Diag, Diagnostics, Flow Direction	Off		
	If Alarm or Alarm & Diag	- - -	- - -		
	RO1 Alarm?	High Rate, Low Rate, High Fwd Tot 1, High Fwd Tot 2, 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	Off		
	If Alarm or Alarm & Diag	- - -	- - -		
	RO2 Alarm?	High Rate, Low Rate, High Fwd Tot 1, High Fwd Tot 2, 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-11	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	1.00		
	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		
	AZL Alarm	Off, On	Off		
	Rate Response?	Go Downscale Go Upscale	Go Downscale		
	Display Response?	Don't Blink, Blink	Don't Blink		
	Alarm Clear?	Manual Auto	Auto		
A-12	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-13	3 IDENTITY				
	If XMTR is FoxCom				
	Tag Number	Enter up to 12 alphanumeric characters	Tag Number		
	Location	Enter up to 14 alphanumeric characters	Location		
	If XMTR is Digital Output Mode:				
	Tag Name	Enter up to 14 alphanumeric characters	Tag Name		
	Device Name	Enter up to 6 alphanumeric characters	DevNam		
	If XMTR is HART				
	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)		
	All Versions				
	Tube MS Code	Enter up to 32 alphanumeric characters	Tube MS		
	Tube Serial Num	Enter up to16 alphanumeric characters	Tube S/N		

Structure Diagram	Prompt/ Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-14	3 PASSCODES				
	Passcode 1	Off, On	Off		
	If On:	- - -	- - -		
	Pass 1 Protect?	Setup, Totals Reset, Setup Totals	Setup		
	Passcode 1	0000 to 9998	- - -		Following entry, confirmation screen appears. Press Left arrow key to cancel, Right to accept.
	Passcode 2	Off, On	Off		
	If On:	- - -	- - -		
	Pass 2 Protect?	Setup, Totals Reset, Setup Totals	Setup		
	Passcode 2	0000 to 9998	- - -		Following entry, confirmation screen appears. Press Left arrow key to cancel, Right to accept.

Structure Diagram	Prompt/ Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-15	3 TRANSMITTER				
	Xmtr Mode?	Off-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-16	3 TRANSMITTER (continued) (HART Only)				
	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-17	3 CALIBRATION				
	Mfactor Format	Forms ###.###### ####.##### #.#####e+##	###.######		
	Meter Factor	From Flowtube	025.000000		
	Zero flow	- - -	- - -		If zero flow present
	Restore Default	No, Yes	- - -		
	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.

Structure Diagram	Prompt/ Parameter	Options or Parameter Limits	Factory Default Configuration	User Entry or Selection	Remarks/Notes
A-18	CALIBRATION (continued)				
	Preset Outputs	- - -	- - -		
	Analog Preset	3.80 to 22.00 mA in form ##.##	- - -		
	Analog Preset On	Off, On	Off		
	If Xmtr is Digital Output Mode:	- - -	- - -		
	Rate Preset	0 to 999999	- - -		
	Rate Preset On	Off, On	Off		
	If Pulse Out Mode is Pulse Rate	- - -	- - -		
	Pulse Preset:	0 to 10000 Hz	- - -		
	Pulse Preset On	Off, On	Off		
	If Pulse Out Mode is Pulse Total	- - -	- - -		
	Pulse Preset:	0 to 10000 Hz	- - -		
	Pulse Preset On	Off, On	Off		

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