Instruction

MI 019-132
May 2010

I/A Series® Digital Coriolis Mass Flow Transmitter With HART Communication Model CFT50

Installation, Startup, Configuration, and Maintenance

Contents

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1. Introduction

Overview

The CFT50 Digital Coriolis Mass Flow Transmitter, when used with a CFS10 or CFS20 Mass Flowtube, measures fluid mass flow rate directly. It uses digital signal processing technology in conjunction with the Coriolis principle. The transmitter provides frequency, scaled pulse, 4 to 20 mA current, alarm, and contact outputs. It also supports nonvolatile totalization of the output.

The transmitter with HART communications protocol allows direct analog connection to common receivers while still providing full intelligent digital communications using a HART communication interface. Local communication is also available using the local display.

Reference Documents

In addition to this instruction, there is other user documentation supporting the CFT50 Transmitter, as listed in Table 1.

Table 1. Reference Documents

Document Number	Document Description
DP 019-182	Dimensional Print – CFS10 Style B Flowtubes (1/4 through 2 inch)
DP 019-183	Dimensional Print – CFS20 Style B Flowtubes (11/2 and 3 inch)
DP 019-366	Dimensional Print – CFS10 Style B Flowtubes (1/8 inch)
DP 019-375	Dimensional Print – CFT50 Transmitter
MI 019-120	Instruction – CFS10 and CFS20 Mass Flowtubes
MI 019-133	Instruction – CFT50 Safety Connection Diagrams (FM, CSA)
MI 019-179	Instruction – Flow Products Safety Information (only available on website www.foxboro.com/instrumentation/tools/safety/flow)
PL 008-704	Parts List – CFT50 Transmitter
PL 008-733	Parts List – CFS10 Style B Flowtubes
PL 008-735	Parts List – CFS20 Style B Flowtubes

Transmitter Identification

A data plate fastened to the side of the housing provides model number and other information as described in Figure 1. The software version of your device can be found in View mode as **2 SW Rev**.

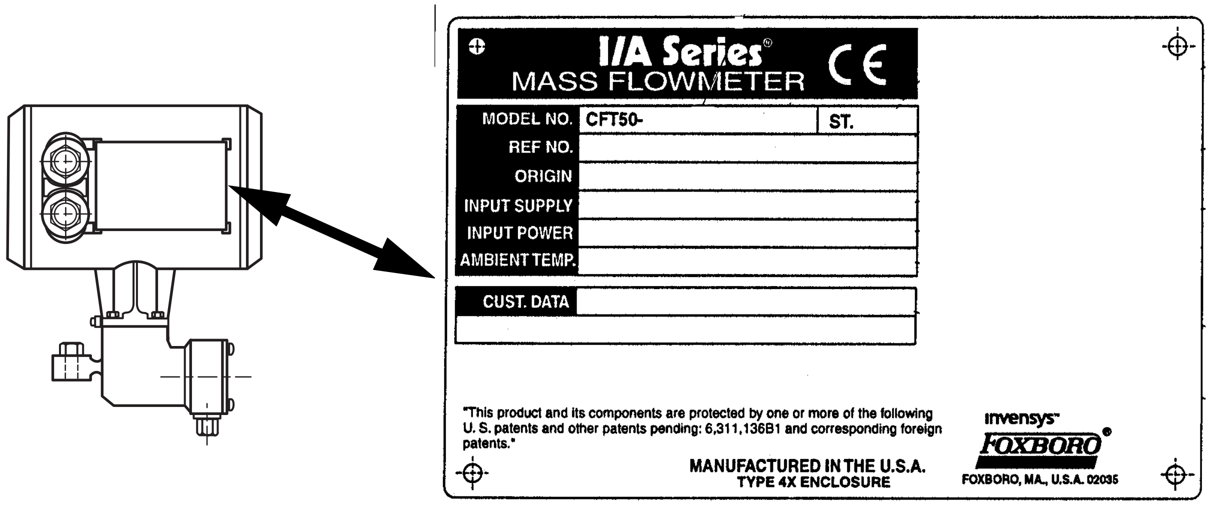


Figure 1. Transmitter Identification

Standard Specifications

Table 2. Standard Specifications

Item	Specification
Ambient Temperature Normal Operating Condition Limits	 –20 and +60°C (–4 and +140°F)
Relative Humidity Limits	5 and 100% (with transmitter covers installed)
Power Supply (ac)	120/240 V ac ±10% 50 or 60 Hz ±5%
Power Supply (dc)	10 - 36 V dc 10 W typical; 15 W maximum 3 A startup current

Current Output Limits
  Supply Voltage
  Load
 	
  Current
	
	24 V dc ±10% (External Power Supply)
	0 and 683 Ω (250 and 683 Ω with Current Output 1 when HART Communicator or PC-Based Configurator is used)
	22 mA maximum, 3.9 mA minimum

Pulse Output Limits
  Supply Voltage
  Current
	
	24 V dc ±10% (External Power Supply)
	80 mA maximum

Contact Input
  Supply Voltage
  Current
	
	24 V dc ±10% (External Power Supply)
	15 mA maximum

Contact Output Limits
  Supply Voltage
  Current
	
	24 V dc ±10% (External Power Supply)
	100 mA maximum

Vibration Limits	5 m/s^2 (0.5 “g”) from 5 to 500 Hz

Electromagnetic Compatibility (EMC) Specifications

The CFT50 Transmitter complies with international and European Union standards listed in Table 3.

Table 3. International and European Union Standards

Parameter	IEC Standard	EN Standard
Radiated RFI Immunity	10 V per IEC 61000-4-3	10 V per EN 61000-4-3
Conducted RFI Immunity	10 V per IEC 61000-4-6	10 V per EN 61000-4-6
RFI Radiated and Conducted Emissions	CISPR Class A	EN 55011 Class A
ESD Immunity	6 kV contact discharge per IEC 61000-4-2	6 kV contact discharge per IEC 61000-4-2
Electrical Fast Transients/Burst Immunity	2 kV per IEC 61000-4-4	2 kV per EN 61000-4-4
Surge Immunity	4 kV per IEC 61000-4-5	4 kV per EN 61000-4-5
Power Dips and Interruptions	IEC 61000-4-11	EN 61000-4-11

Electrical Safety Specifications

Table 4. Electrical Safety Specifications

Agency	Type of Protection and Code	Permitted Use	Temp. Code	Electrical Safety Design Code
CSA	Nonincendive, with nonincendive flowtube connections; NI	Class I, Division 2, Groups A, B, C, D. Suitable for use in Class II, Division 1, Groups E, F, G.	T4	S
FM	Nonincendive with intrinsically safe flowtube connections; NI	Class I, Division 2, Groups A, B, C, D. Suitable for use in Class II and III, Division 2, Groups F and G.	T4	K
FM	Nonincendive, with nonincendive flowtube connections; NI	Class I, Division 2, Groups A, B, C, D. Suitable for use in Class II and III, Division 2, Groups F and G.	T4	R
FM	Explosionproof with intrinsically safe flowtube connections; XP	Class I, Division 1, Groups A, B, C, D; Class II and III, Division 1, Groups E, F, G.	T6	N
KEMA (ATEX)	Nonsparking with nonsparking flowtube connections II 3 G EEx nA [L] IIC	Zone 2	T4	T
KEMA (ATEX)	Nonsparking with intrinsically safe flowtube connections II 3(2) G EEx nA [L] [ib] IIB	Zone 2	T4	M
KEMA (ATEX)	Nonsparking with intrinsically safe flowtube connections II 2 G EEx de [ib] IIB	Zone 1	T6	Q

— NOTE

These transmitters have been designed to meet the electrical safety descriptions listed in the table above. For detailed information or status of testing laboratory approvals/certifications, contact Invensys Foxboro.

2. Installation

Mounting

The CFT50 Transmitter housing is supported by a mounting bracket which can be attached to a surface or nominal DN 80 or 3-in vertical pipe. Mount the bracket to a surface using four (user supplied) 0.375 inch or M10 bolts or to a pipe using the two U-bolts (included). See Figure 2.

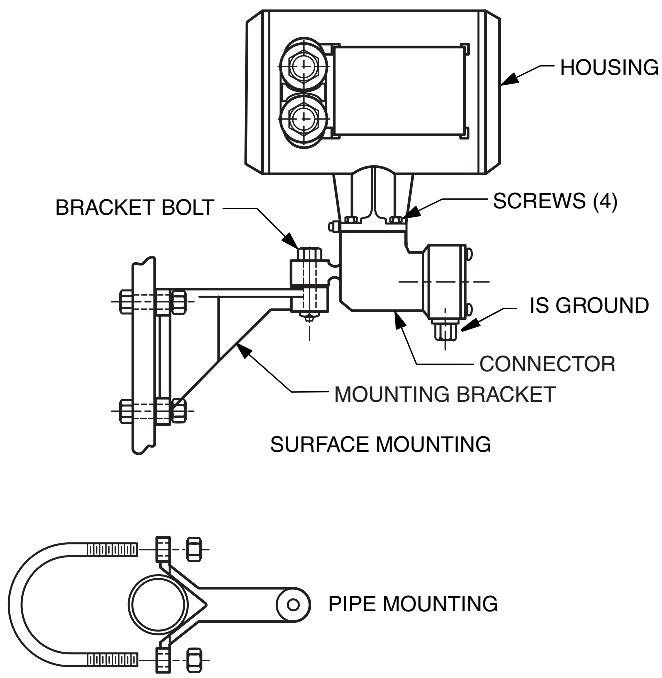


Figure 2. Transmitter Mounting

Positioning the Housing

The housing can be positioned at almost any angle in a horizontal plane by loosening the bracket bolt and turning the housing with respect to the mounting bracket. See Figure 2.

Cover Locks

Electronic housing cover locks, shown in Figure 3, are provided as part of the Custody Transfer Lock and Seal option. To lock the transmitter housing covers, insert the seal wire through the holes in both covers and crimp the seal. To lock the covers on the transmitter junction box and flowtube junction box, slide the seal wire through the holes in the three elongated cover screws and crimp the seal.

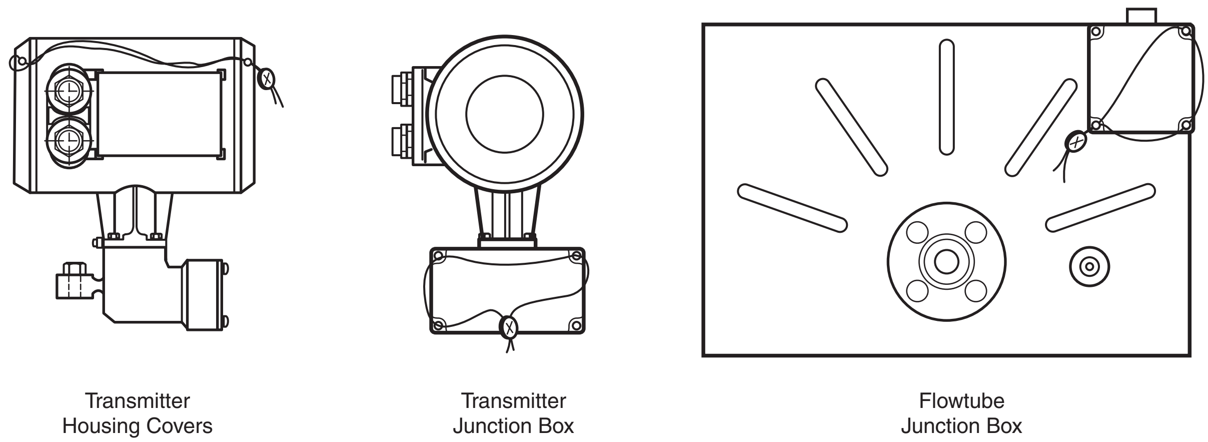


Figure 3. Cover Locks

Wiring

The installation and wiring of your transmitter must conform to local code requirements.

Field Wiring

To access the transmitter field terminals, remove the field terminal compartment cover by turning it counterclockwise using the cover tool provided. The field terminal compartment cover is the one closest to the conduit openings. When replacing the cover, tighten it until the cover meets the housing metal-to-metal.

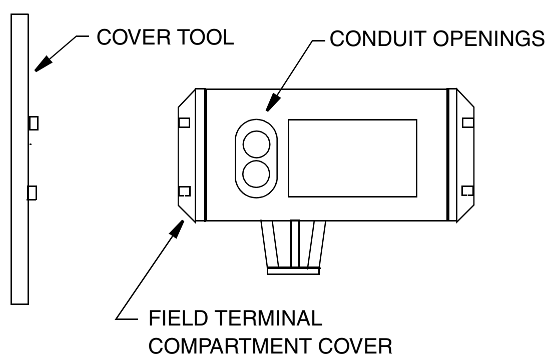


Figure 4. Accessing Field Terminals

Wire entrance is per two PG20 conduit openings as shown in Figure 4. The top entrance is for power; the bottom, for inputs and outputs. Optional 1/2 NPT and 3/4 NPT cable glands are available for use with these conduit openings.

The field wiring terminal board is shown in Figure 5.

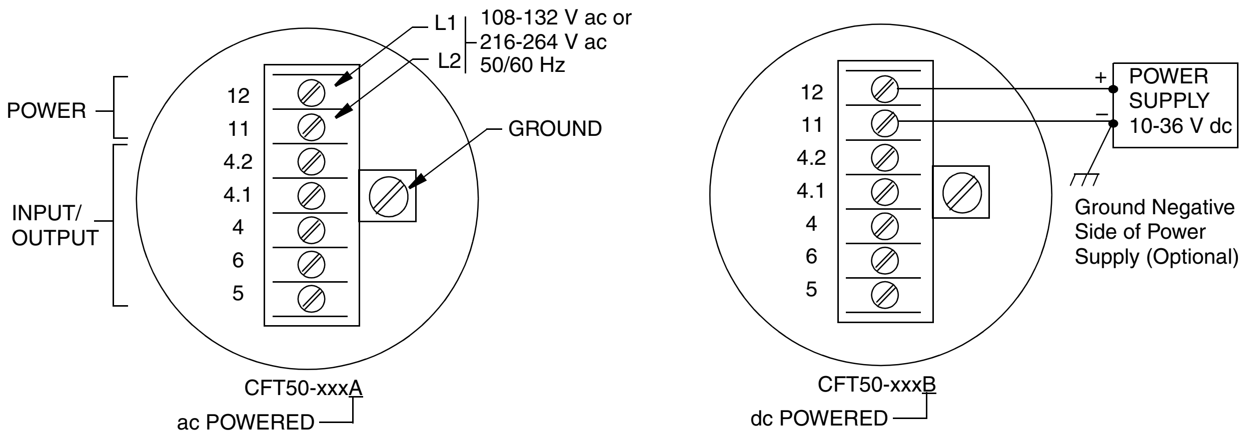


Figure 5. Field Wiring Terminal Board

Power Wiring

Connect the power wiring to the field wiring terminal board as shown in Figure 5.

Input/Output Wiring

The maximum length of signal wires for HART communication is 3050 m (10,000 ft). It is 1525 m (5000 ft) in multidrop mode.

Input/output connections depend on the output signals that were specified for your particular transmitter. The output signals available for your transmitter can be determined from the model number on your transmitter data plate as follows:

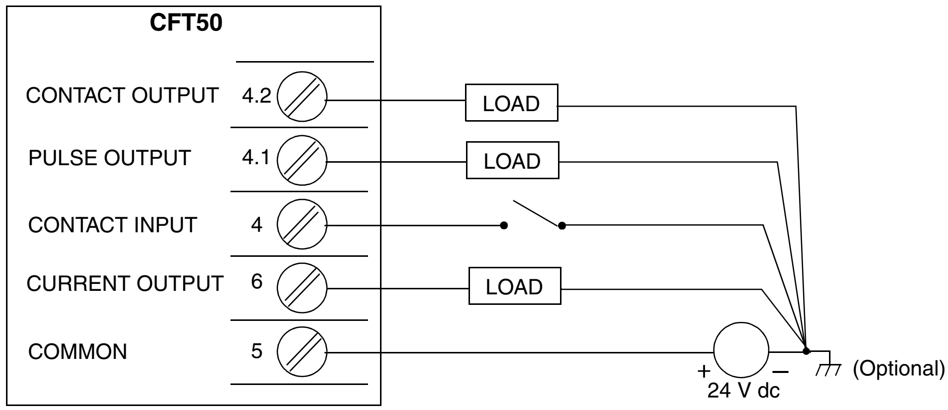
CFT50-B1EA#BK
Output Signal Code

Table 5. Input/Output Wiring Connections

Output Signal Code	Terminal 5	Terminal 6	Terminal 4	Terminal 4.1	Terminal 4.2
1	Positive Power Input	Current Output 1	Contact Input	Pulse Output	Contact Output
2			Contact Input	Current Output 2	Contact Output
C			Current Output 2	Contact Input	Pulse Output
D			Current Output 2	Current Output 3	Pulse Output
E			Current Output 2	Current Output 3	Contact Input
F			Current Output 2	Current Output 3	Contact Output

— NOTE

The CFT50 Transmitter output circuits are externally powered and are connected to the positive power input. See Figure 6.



NOTE: Avoid common wiring on load returns to prevent cross-talk on outputs.

Figure 6. Typical Wiring Diagram (Output Signal Code 1)

Current Outputs

A wiring diagram for a Current Output is shown in Figure 7.

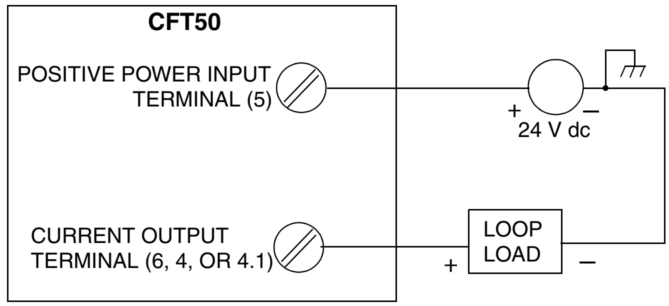


Figure 7. Current Output

The loop load can be a value from 0 to 683 Ω. To determine your loop load resistance, add the series resistance of each component in the loop, excluding the transmitter.

> **— NOTE**
> Current Output 1 must have a minimum loop load of 250 Ω when a HART Communicator or a PC-Based Configurator is used.

Contact Input

A wiring diagram for a Contact Input is shown in Figure 8.

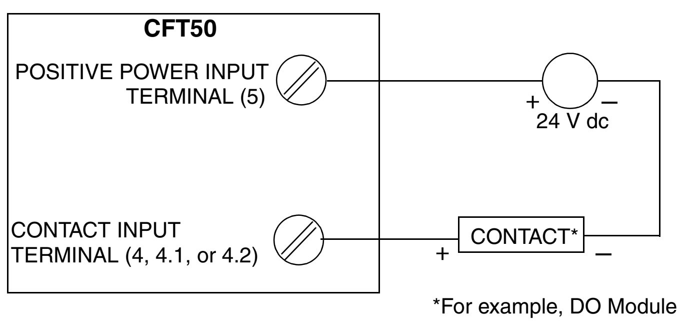


Figure 8. Contact Input

The voltage requirement for a contact input is 24 V dc ±10%. The maximum current is 15 mA.

Contact Output

A wiring diagram for a Contact Output is shown in Figure 9.

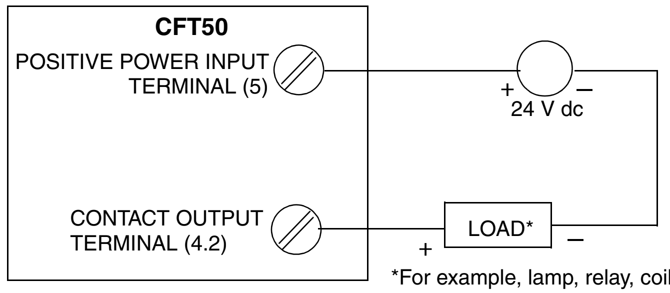


Figure 9. Contact Output

The voltage requirement for contact output is 24 V dc ±10%. The load requirement is limited to producing a maximum current of 100 mA.

Pulse Output

The pulse output signal is typically used with a receiver such as an external totalizer or control system. The pulse output is a high side switch or sourcing output. If the receiver requires a sourcing input and is internally current limited, it can be connected as shown in Figure 10.

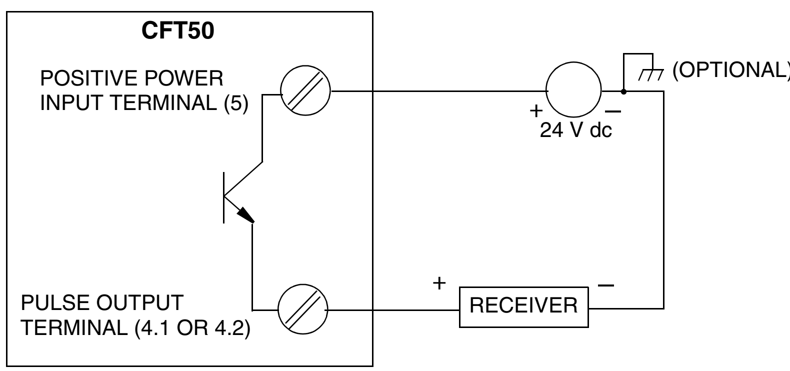


Figure 10. Pulse Output with a Sourcing Input Receiver (with Internal Current Limiting)

For receivers requiring a sourcing input but without internal current limiting, a resistor is required to limit the current to that specified by the receiver as shown in Figure 11. The pulse output current is limited to 80 mA maximum.

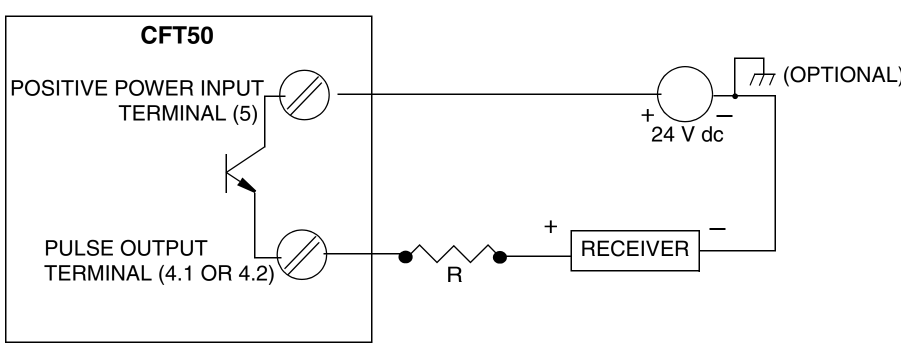


Figure 11. Pulse Output with a Sourcing Input Receiver (without Internal Current Limiting)

If the receiver requires a current sinking input (such as a contact closure or transistor switch), a resistor is required across the receiver terminals as shown in Figure 12. The resistor should be sized to limit the on-state current in the pulse output to 80 mA maximum.

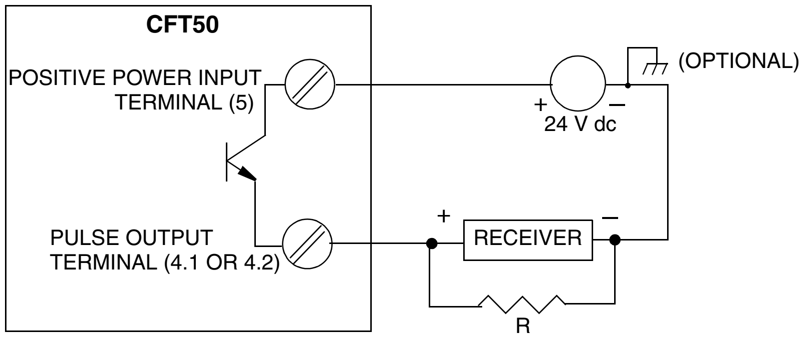


Figure 12. Pulse Output with a Receiver Requiring a Sinking Input

Because of the internal bias currents produced by some receivers requiring sinking inputs, a resistor divider may be necessary to ensure that the ‘low’ input threshold requirement of the receiver is met. This configuration is shown in Figure 13. R1 and R2 must limit the pulse output on-state current to 80 mA maximum.

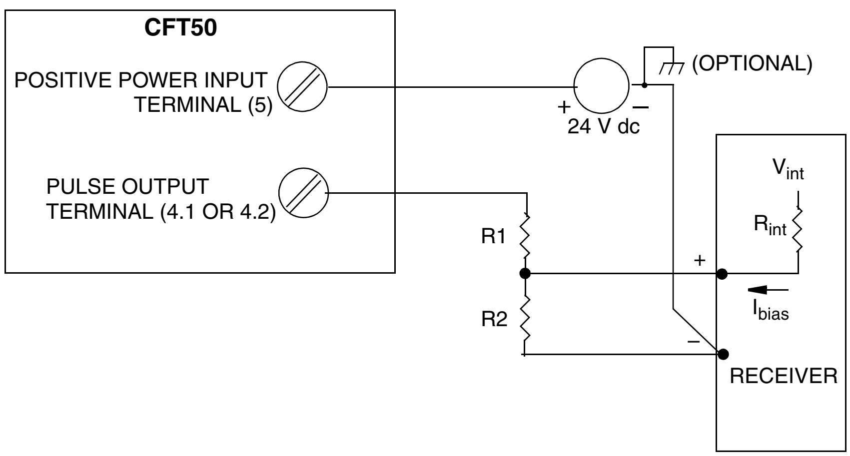


Figure 13. Pulse Output with a Sinking Input Receiver Using a Divider Network

Multidrop Communication

“Multidropping” refers to the connection of several transmitters to a single communications transmission line. Communications between the host computer and the transmitters takes place digitally with the analog output of the transmitter deactivated. With the HART communications protocol, up to 15 transmitters can be connected on a single twisted pair of wires or over leased telephone lines.

The application of a multidrop installation requires consideration of the update rate necessary from each transmitter, the combination of transmitter models, and the length of the transmission line. Communication with the transmitters can be accomplished with any HART compatible modem and a host implementing the HART protocol. Each transmitter is identified by a unique address (1-15) and responds to the commands defined in the HART protocol.

Figure 14 shows a typical multidrop network. Do **not** use this figure as an installation diagram. Contact the HART Communications Foundation, (512) 794-0369, with specific requirements for multidrop applications.

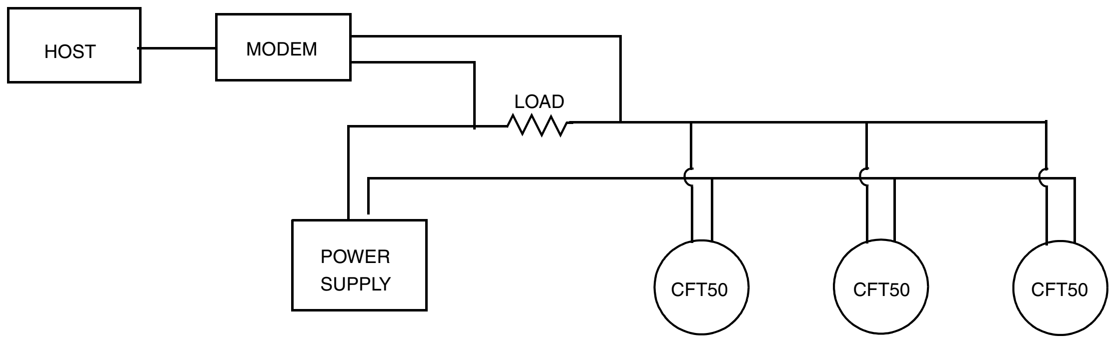


Figure 14. Typical Multidrop Network

The HART Communicator can operate, configure, and calibrate CFT50 Transmitters with HART communication protocol in the same way as it can in a standard point-to-point installation.

— NOTE

CFT50 transmitters with HART communication protocol are set to poll address 0 at the factory, allowing them to operate in the standard point-to-point manner with a 4 to 20 mA output signal. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15. Each transmitter must be assigned a unique number on each multidrop network. This change deactivates the 4 to 20 mA analog output for Current Output 1.

Flowtube Wiring Connections

Connect the wiring from the flowtube to the transmitter junction box per Figure 15 and Table 6. Distance between the flowtube and transmitter can be up to 305 m (1000 ft).

Invensys Foxboro cable (Model KFS1for PVC insulated cable or Model KFS2 for FEP insulated cable) from the flowtube is dressed and ready for connection to the transmitter. However, to facilitate wire identification, ensure that the proper wire pairs remain twisted as the black wires are not common.

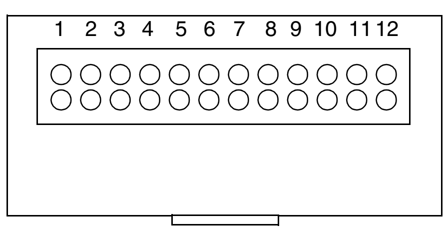


Figure 15. Junction Box Wiring

Table 6. Junction Box Wiring

Terminal	Wire Color	Signal
1	Black	RTD
2	Blue	
3	Black	RTD
4	Green	
5	Red	Sensor B
6	Black	
7	Black, Shield	Sensor A
8	Yellow	
9	Black	Driver 2
10	Brown	
11	Black	Driver 1
12	White	

Write Protect Jumper

The write protection jumper, located on the printed wiring board shown in Figure 16, allows or prevents anyone from changing the configuration of the transmitter or resetting the totalizer. This feature is usually used in custody transfer applications or when you want, for another reason, to ensure that the configuration and or totals are not changed. Therefore, the jumper is usually placed in the “disable” position (factory default position). Placing the jumper 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, the write protect jumper moved, and power turned on again.

If write protection is enabled and someone tries to enter Quick Start mode or Setup mode or to reset the totals, the display reads **WPROT/LOCKED**.

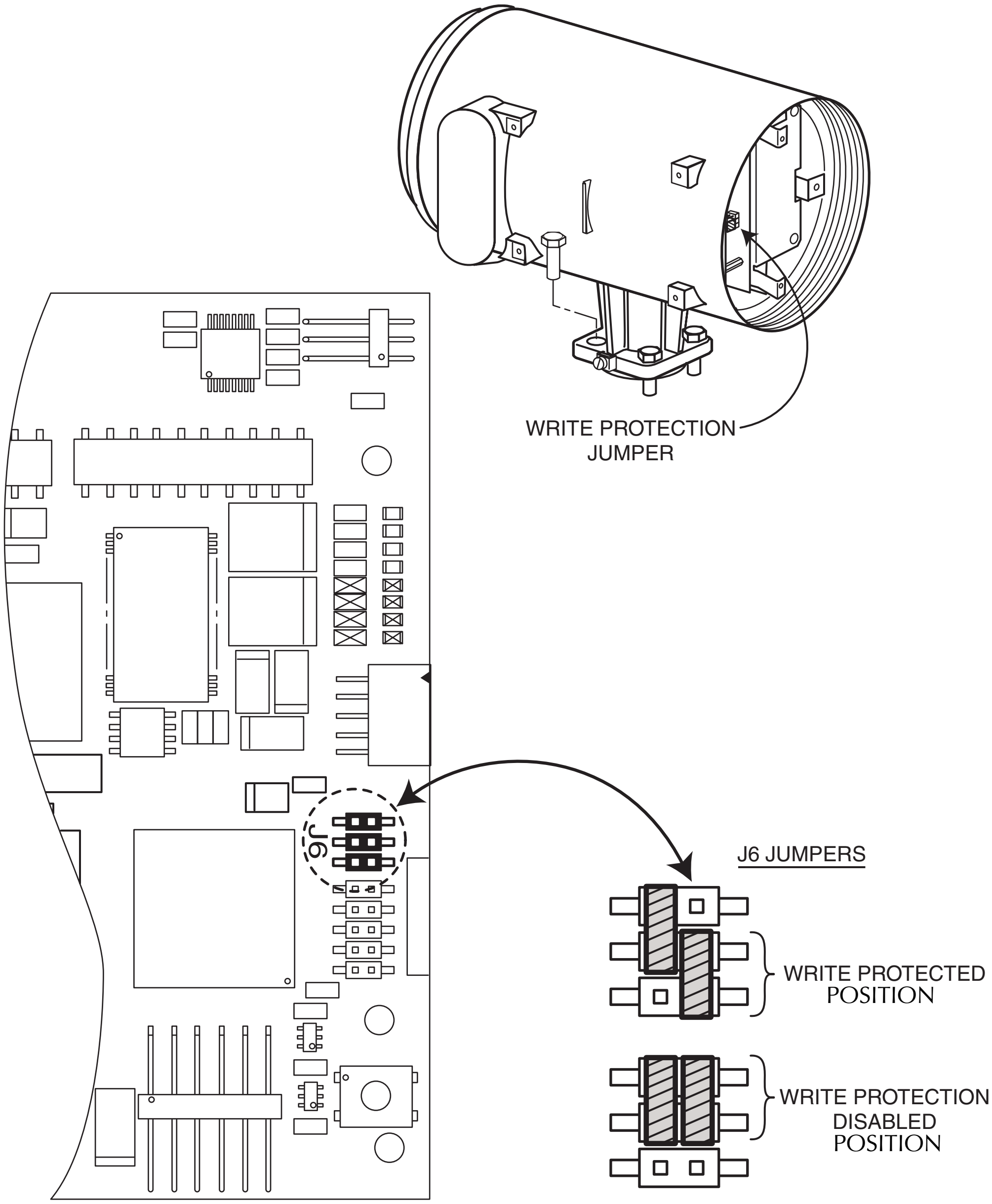


Figure 16. Write Protect Switch Location

3. Quick Start

The CFT50 Transmitter can be configured with a HART Communicator or with the keypad/display option. With either option, two configuration menus exist, Quick Start and Setup. Most basic applications can be configured in Quick Start mode; other applications require using Setup mode.

— NOTE

If write protection is enabled, the display reads **WPROT/LOCKED** and you cannot enter Quick Start mode. To disable write protection, you must first turn power off, move the write protect jumper to the disable position, and then turn power back on. See "Write Protect Jumper" on page 13.

When to Use Quick Start Mode

Quick Start mode can be used for applications requiring only:

- Flow measurement in current units (factory default is mass flow in lb/min)
- Current output
- Positive flow direction.

Use Setup mode that is fully described in "Setup" on page 35, for applications involving:

- Volume flow or density measurements
- Mass flow units other than the current units
- Pulse or Contact Output
- Alarm or Totalizer functions
- Reverse or bidirectional flow.

Steps Required

1. Obtain the flowtube constants from the calibration sheet shipped with the flowtube (or from the flowtube data label).
2. Obtain the flowtube size from the model code on the flowtube data label; for example:

CFS10-##
└── FLOWTUBE SIZE

02 = 1/8 IN (3 mm)	08 = 3/4 IN (20 mm)	15 = 1.5 IN (40 mm)
03 = 1/4 IN (6 mm)	10 = 1 IN (25 mm)	20 = 2 IN (50 mm)
05 = 1/2 IN (15 mm)		

3. Obtain the flowtube material from the model code on the flowtube data label:
   CFS10-..S = Model CFS10 Flowtube with AISI Type 316L wetted material
   CFS10-..H = Model CFS10 Flowtube with Hastelloy C wetted material
   CFS10-..C = Model CFS10 Sanitary Flowtube with AISI Type 316L wetted material
   CFS20-..S = Model CFS20 Flowtube with AISI Type 316L wetted material
   CFS20-..H = Model CFS20 Flowtube with Hastelloy C wetted material
   CFS20-..C = Model CFS20 Sanitary Flowtube with AISI Type 316L wetted material

4. Mount the flowtube (see MI 019-120) and transmitter (see “Mounting” on page 5).
5. Install wiring: power to transmitter, flowtube to transmitter, transmitter input/output wiring (see “Wiring” on page 6).
6. Enter the model size and material, flow constant FC2, and density constants DC2 and DC4 into the transmitter using the Quick Start menu (see Figure 17 or 18).
7. Apply flow for 5 to 10 minutes.
8. Create zero flow by closing block valves to ensure no fluid movement.
9. Zero the flowmeter using the Quick Start menu.
10. Enter upper and lower range values into the transmitter using the Quick Start menu.
11. Flowmeter is up and running.

Procedure Using Keypad/Display

Operation is accomplished via four multi-function keys. They operate as shown in Table 7.

Table 7. Operation of Function Keys

Key	Function
Left Arrow (**ESC**)	Moves left in the menu structure. Moves the cursor to the left in a data entry field. Escapes from changes in a picklist menu or data entry.* Answers No.
Right Arrow (**ENTER**)	Moves right in the menu structure. Used to access the data entry edit mode of a parameter. Moves the cursor to the right in a data entry field. Enters and saves the changed menu picklist choices or data entry.* Answers Yes.
Up Arrow (**BACK**)	Moves upward in the menu structure or a picklist menu.
Down Arrow (**NEXT**)	Moves downward in the menu structure or a picklist menu.

*On data entry, repeatedly press the key until the cursor reaches the end of the display.

The Keypad/Display Quick Start menu is shown in Figure 17.

1. Press the Left arrow key until the display reads **1 MEASURE** and follow the menu using the keys as explained in Table 7.
2. Go to **1 QSTART-->2 MODEL-->3 SIZE** and select the flowtube size code. Then go to **4 MATL** and select the flowtube material code.
3. Go to **2FLOWCON-->3 FC1**, then to **3 FC2** and enter flow constant FC2. Flow constants FC1 and FC3 are calculated by the transmitter.
4. Go to **2DENSCON-->3 DC1**, then to **3 DC2** and enter density constant DC2. Then go to **3 DC4** and enter the density constant DC4. Density constants DC1 and DC3 are calculated by the transmitter.
5. Apply flow to your flowmeter for 5 to 10 minutes.

6. Create zero flow by closing block valves to ensure no fluid movement.
7. Go to **3CALZERO**. Press the Enter key to start the zeroing process. The display reads **BUSY** until the process is finished and then reads **DONE**.

— NOTE

The transmitter is zeroed at the primary zero (1). To use the secondary zero (2), you must use Setup mode.

Press the Down arrow key to display **3 VALUE**, the amount of offset that is necessary to make the transmitter read zero at zero flow conditions. You can then manually change this value if necessary (for example, if the flowmeter cannot be blocked in at no-flow condition) using the Left/Right and Up/Down arrow keys as explained in Table 7. Lastly, you can press the Down arrow key to display **3RESTORE**. Pressing the Enter key at this point changes the manually entered value back to the last **CALZERO** offset value.

8. Go to **2 UNITS** to view the current units.
9. Go to **2 MA URV** and enter your upper range value in the current units.
10. Go to **2 MA LRV** and enter your lower range value in the current units.
11. Go to **2 FLOWCON**. Press the Left arrow key to go to **ONLINE?**. Pressing the Enter key to answer Yes takes you to **1 QSTART**. Press the Up arrow key to go to **1 MEASURE** and the Left arrow key to return to Measure mode.

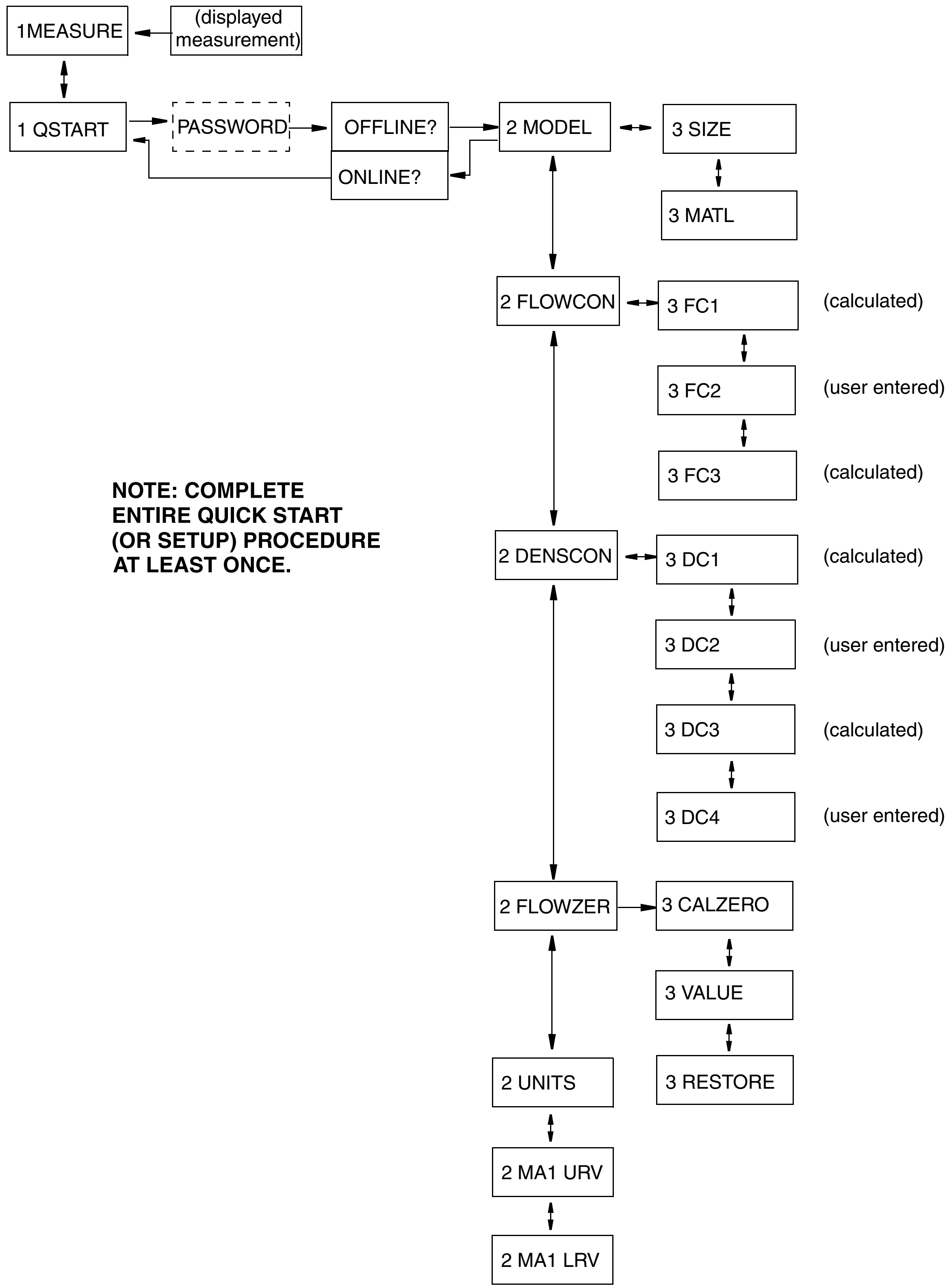


Figure 17. Keypad/Display Quick Start Menu

Procedure Using the HART Communicator

The HART Communicator Quick Start Menu is shown in Figure 18.

1. Go to **2 Online**.
2. Go to **2 Quick Start.**
3. Go to **1 Model** and select your flowtube size code and then material code.
4. Go to **2 Flow Constants** and enter flow constant FC2. Flow constants FC1 and FC3 are calculated by the transmitter.
5. Go to **3 Density Constants** and enter density constants DC2 and DC4. Density constants DC1 and DC3 are calculated by the transmitter.
6. Apply flow to your flowmeter for 5 to 10 minutes.
7. Create zero flow by closing block valves to ensure no fluid movement.
8. Go to **4 Flow Zero** and zero your flowmeter.
9. Go to **5 URV** and enter your upper range value.
10. Go to **6 LRV** and enter your lower range value.

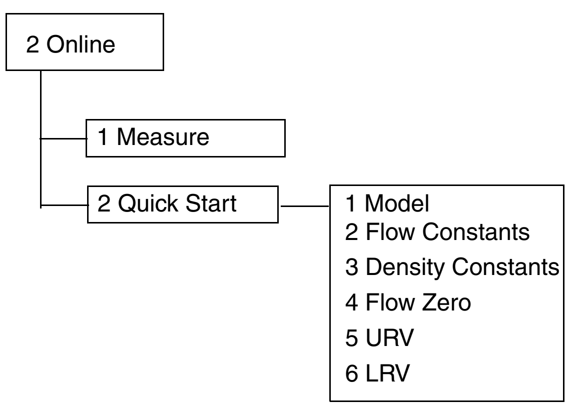


Figure 18. HART Communicator Quick Start Menu

4. Operation

Using the Local Display

A local display, as shown in Figure 19 provides local indication of measurement, status, and identification parameters. The display also provides a means of performing quick start, configuration, calibration, and self-test. Operation is accomplished via four multi-function keys.

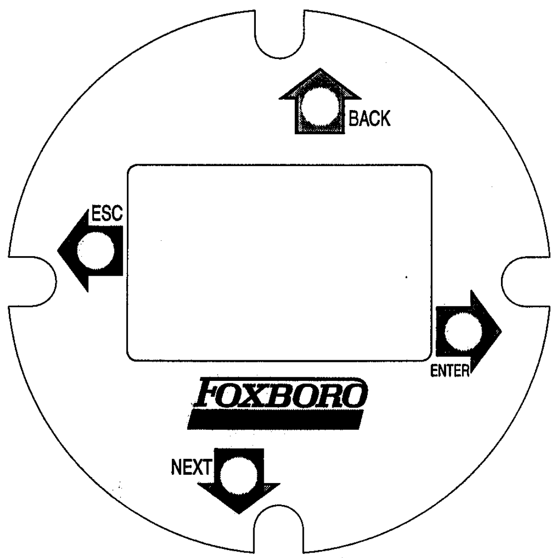


Figure 19. Local Display

Table 8. Operation of Function Keys

Key	Function
Left Arrow (**ESC**)	Moves left in the menu structure. Moves the cursor to the left in a data entry field. Escapes from changes in a picklist menu or data entry.* Answers No.
Right Arrow (**ENTER**)	Moves right in the menu structure. Used to access the data entry edit mode of a parameter. Moves the cursor to the right in a data entry field. Enters and saves the changed menu picklist choices or data entry.* Answers Yes.
Up Arrow (**BACK**)	Moves upward in the menu structure or a picklist menu.
Down Arrow (**NEXT**)	Moves downward in the menu structure or a picklist menu.

*On data entry, repeatedly press the key until the cursor reaches the end of the display.

Top Level Menu

The Top Level menu displays five modes – Measure, Quick Start, Status, View, 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 display, 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 20.

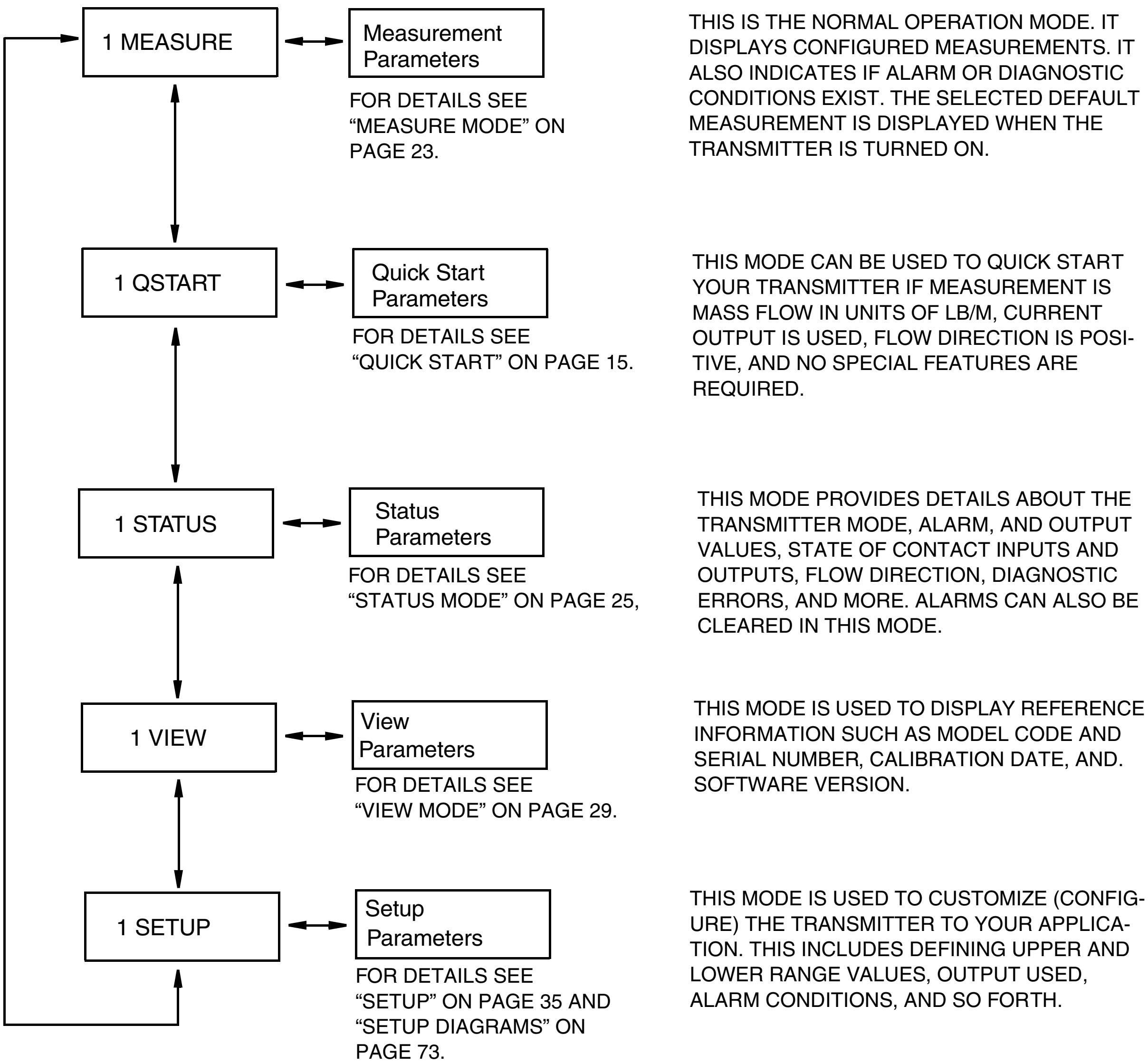


Figure 20. Top Level Modes and Their Basic Functions

— NOTE —

Certain parameters may be missing as you step through the menus described in this chapter depending on the output signals specified for your transmitter and the configuration of your instrument.

Measure Mode

The Measure mode, which is your main operating mode, is displayed upon startup. Depending on the transmitter configuration, it has up to 13 displays, any/all of which can be configured for viewing. See “Display” on page 51. All such displays can be configured to be scrolled with the Up/Down arrow keys or they can also be configured to cycle automatically from one to the other.

- **Mass Flow** — Shows current mass flow rate (forward or reverse) in the selected engineering units.
- **Volume Flow** — Shows current volume flow rate (forward or reverse) in the selected engineering units.
- **Density** — Shows current density in the selected engineering units.
- **Concentration** — Shows current percent concentration.
- **Temperature** — Shows current process temperature in the selected engineering units.
- **Totals 1, 2, 3, and 4** — Shows current totals in the selected engineering units.

— NOTE
If the totalizer measurement exceeds the configured format, the display will alternate the message **ROLLOVER** with the current rollover value.

- Component A and B Measurements — Shows current mass or volume flow rate (forward or reverse) in the selected engineering units.

The transmitter can also be configured so that the readings on the measurement display blink when an alarm and/or diagnostic condition is present. An arrow symbol also appears in the lower right corner of the display when an alarm occurs. An Up arrow indicates a high alarm; a Down arrow indicates a low alarm.

The transmitter has a feature which can produce compensated measurements in 2-phase applications for greater accuracy. The symbol 2Φ appears in the lower right corner of the display if 2-phase flow is present. This symbol does not indicate that the 2-phase feature is configured ‘on’. To activate the 2-phase feature, refer to “2 Phase” on page 57.

Resetting Totals

Totals 1, 2, 3, 4, and Pulse Total can also be turned on, off, or cleared in the Measure mode. A password is required if passwords are employed. The high level password is required to clear the grand total. Either (high or low level) password can be used to clear the net total.
To perform this function:
1. Press the Right arrow key during any measurement display.
2. Enter the password.
3. Use the Down arrow key to select the desired total.
4. Select **off**, **on**, or **clear** and press Enter.

Total 1, Total 2, Total 3, and Total 4 can be individually cleared by an external contact. An external contact can also be used to clear all net totals or all grand totals.

Totals can also be cleared using the HART Communicator.

— **NOTE**

If write protection is enabled, the display reads **WPROT/LOCKED** and you cannot reset any totals. To disable write protection, you must first turn power off, move the Write Protect jumper to the disable position, and then turn power back on. See "Write Protect Jumper" on page 13.

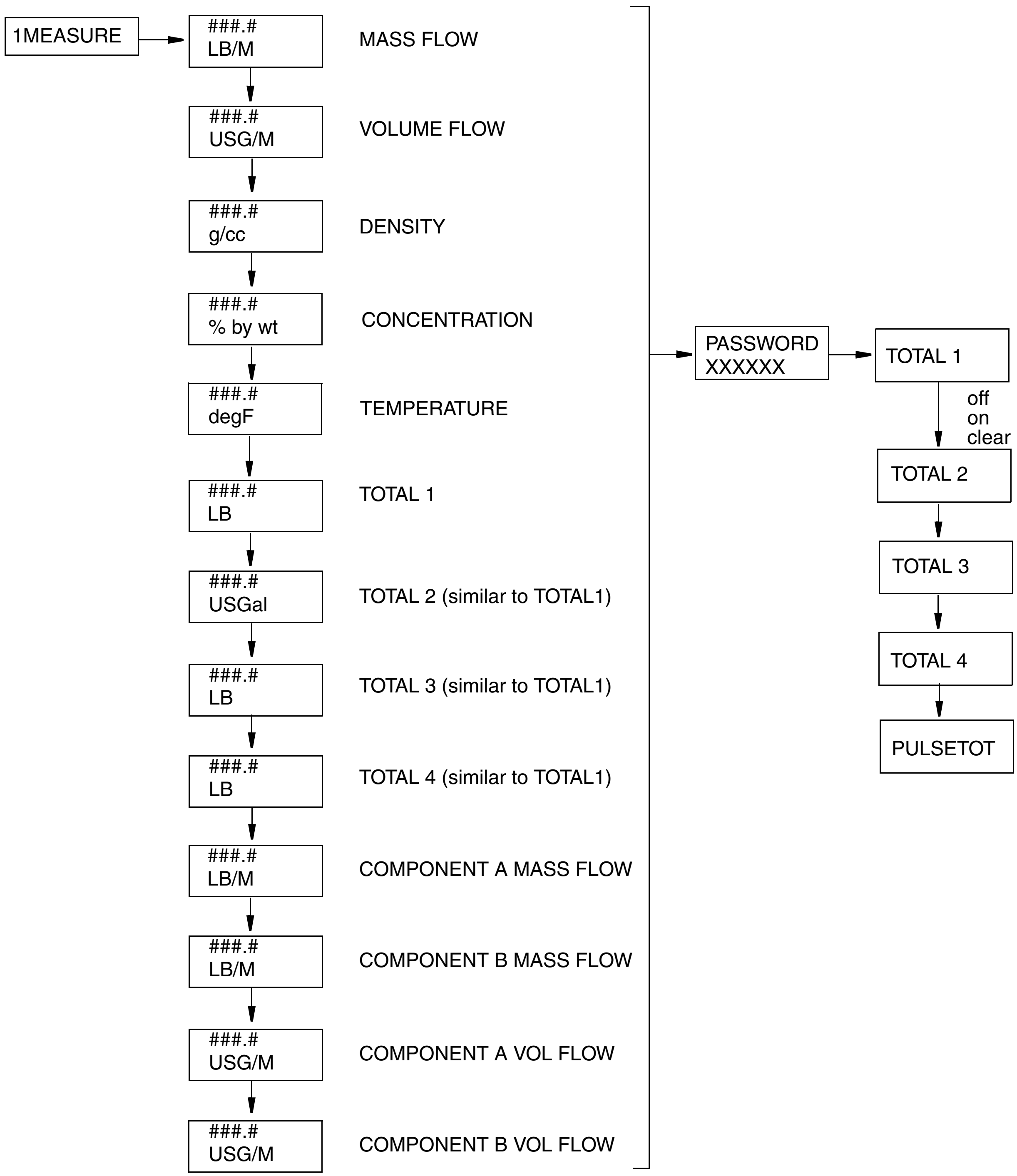


Figure 21. Measure Mode Structure Diagram

Quick Start Mode

Refer to "Quick Start" on page 15.

Status Mode

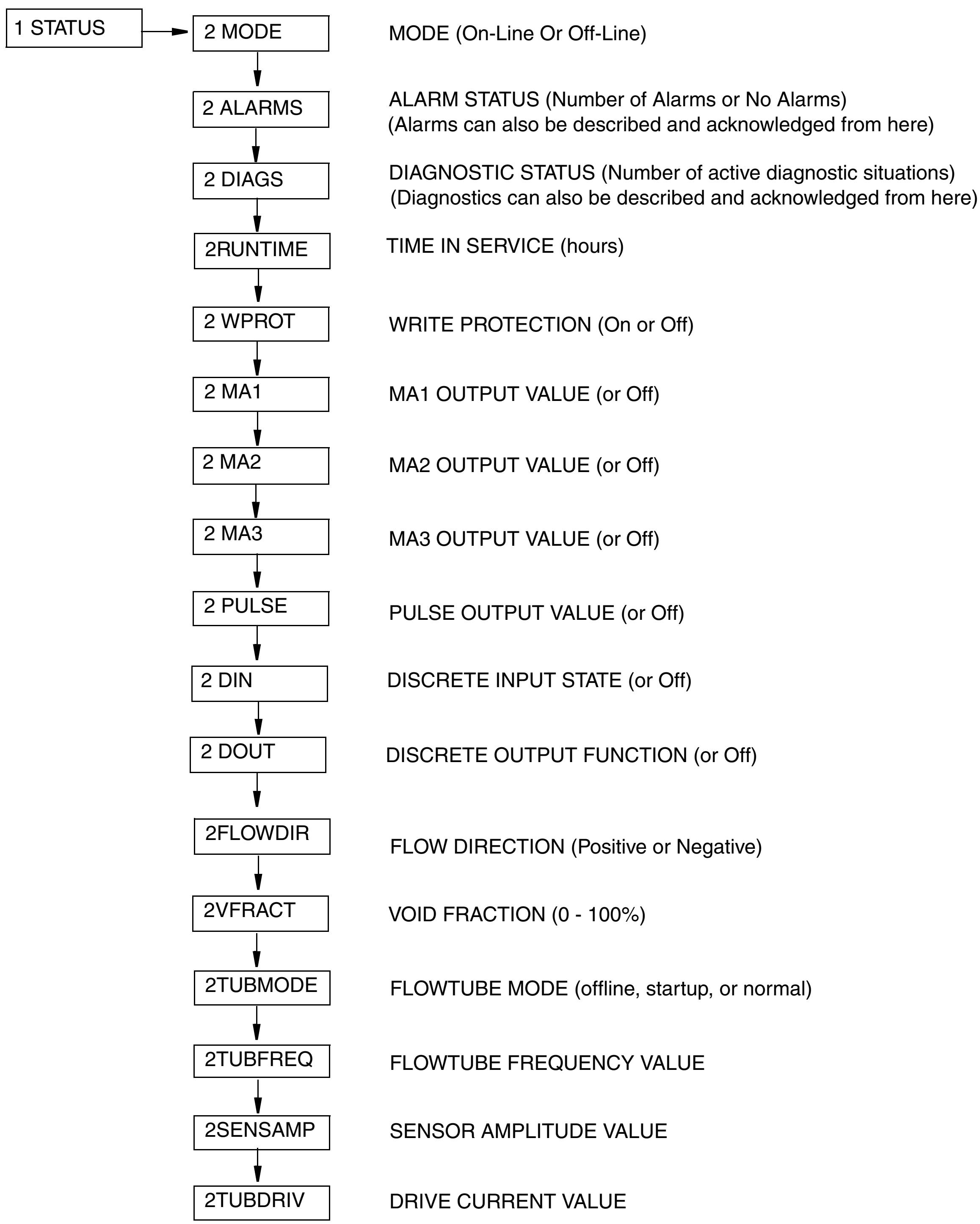
The Status mode enables you to view a number of system parameters and thus assess the performance of the loop. You can not edit them in this mode. To step through the displays of the parameters, use the Up/Down arrow keys. The Status mode structure diagram is shown in Figure 22.

In Alarm status, you can determine the number of alarms and a brief description of each. You can also clear all alarms manually. In viewing the parameter **2 ALARMS**, the display reads **no alrms** or **# alarms**. If it reads **# alarms**, pressing the Right arrow key displays a brief description of the first alarm condition. Using the Down arrow key, you can step through the list to view each alarm. Press the Left arrow key to return to **# alarms**. The alarms are not acknowledged. Press the Right arrow key to obtain the message **ACK ALARMS?**. Press the Right arrow key again to acknowledge all the alarms.

In Diagnostic status, you can view the diagnostic history of 10 diagnostic conditions. You can also acknowledge the active diagnostic manually. In viewing the parameter **2 DIAGS**, the display reads **0 active** or **1 active**. If **1 active**, press the Right arrow key to display the active diagnostic condition code. Press it again to display the time the diagnostic condition occurred. This is presented as the total number of hours the transmitter has been powered. Continue to use the Down arrow key to step through the history of up to 10 diagnostic conditions. Press the Left arrow key to return to **# active**. The diagnostic conditions are not acknowledged. Press the Right arrow key to obtain the message **ACK DIAGS?**. Press the Right arrow key again to acknowledge the active diagnostic condition.

— NOTE

A new diagnostic condition only appears after a diagnostic is detected while in Measure mode.



NOTE: SOME PARAMETERS MAY NOT BE DISPLAYED DEPENDING ON TRANSMITTER CONFIGURATION.

Figure 22. Status Mode Structure Diagram

Alarm Actions

Conditions That Can Be Alarmed

The high setpoint and low setpoint of mass flow, volume flow, density, concentration, temperature, and component measurements as configured. Also the high setpoint of each total measurement as configured.

Actions of Transmitter During Alarm Conditions

Display — The display can be configured to respond or not respond to a specific alarm. The display can be configured to blink or not blink in response to an alarm condition. An arrow symbol also appears in the lower right corner of the display when an alarm occurs. An Up arrow indicates a high alarm; a Down arrow indicates a low alarm.

Milliampere Outputs — Alarms can be configured to force the milliampere output associated with the alarm to go fully upscale, fully downscale or be held at the last value.

Relay Contact Outputs — Contact output relays can be configured to respond or not respond to a specific alarm.

Status Mode — Alarm conditions are defined in the status mode. Either **Alarm** or **No Alrm** is displayed.

Acknowledging Alarms — The alarm acknowledge function can be configured as Auto or Manual. In Auto, all evidence of the alarm clears when the alarm condition no longer exists. In Manual, the alarm must be acknowledged manually.

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

- Using the local keypad in Status mode. See “Status Mode” on page 25 for details.
- Using the HART Communicator.
- Using an external contact if the contact input was configured to acknowledge alarms and diagnostics.

— NOTE
A power cycle or an off-line/on-line cycle (as in Setup mode) also acknowledges the alarms.

Diagnostic Actions

Conditions That Can Be Diagnosed

- Process conditions which preclude a valid measurement
- Hardware failure (transmitter, flowtube, wiring, and so forth)
- Invalid configuration

Actions of Transmitter During Diagnostic Conditions

Display — When a diagnostic condition is present, the entire display can be configured to blink or not blink.

Outputs — If a diagnostic condition exists, the transmitter can not reliably compute flowrate. Therefore, the transmitter flowrate outputs go fully upscale, fully downscale, or are held at the last value depending on the configuration.

Status Mode — The Status mode can be helpful in identifying a diagnostic condition. The **Diag** window in Status mode gives an error code and the runtime the diagnostic condition occurred. This time is presented as the total number of hours the transmitter has been powered. A history is given for up to 10 conditions. Once the limit of 10 is reached, the oldest diagnostic is dropped and the new one added. The interpretation of this code and possible corrective actions is given “Error Codes” on page 65.

> **— NOTE**
> A new diagnostic condition only appears after a diagnostic is detected while in Measure mode.

Acknowledging Diagnostics — The diagnostic acknowledge function can be configured as Auto or Manual. In Auto, all evidence of the diagnostic message clears when the diagnostic condition no longer exists. In Manual, the diagnostic message must be acknowledged manually.

Three methods are available to acknowledge diagnostics when they are configured for manual acknowledgement. These methods are only effective after the diagnostic condition no longer exists. The methods are:

- Using the local keypad in Status mode. See “Status Mode” on page 25 for details.
- Using the HART Communicator.
- Using an external contact if the contact input was configured to acknowledge alarms and diagnostics.

> **— NOTE**
> A power cycle or an off-line/on-line cycle (as in Setup mode) also acknowledges the diagnostic.

View Mode

The View mode enables you to view the identity parameters. You can not edit them in this mode. To step through the list of the following parameters, use the Up and Down arrow keys.

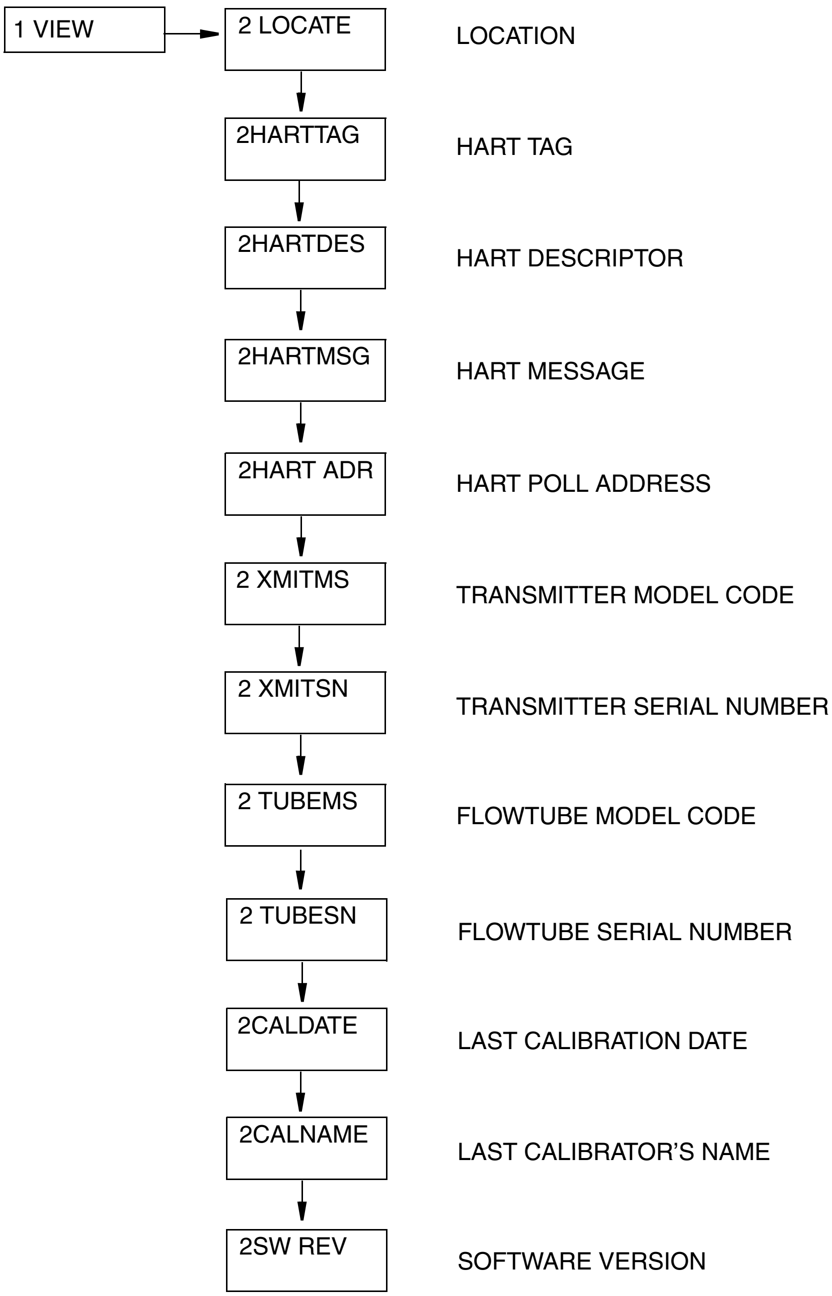


Figure 23. View Mode Structure Diagram

Setup Mode

Refer to "Setup" on page 35.

Using the HART Communicator

A HART Communicator can only be used with Current Output 1. Current Output 1 is always available on Terminals 5 and 6.

Connecting the HART Communicator

Connect your HART Communicator any place in the loop between the transmitter and the power supply per Figure 24. Note that a minimum of 250 Ω must separate the power supply from the HART Communicator.

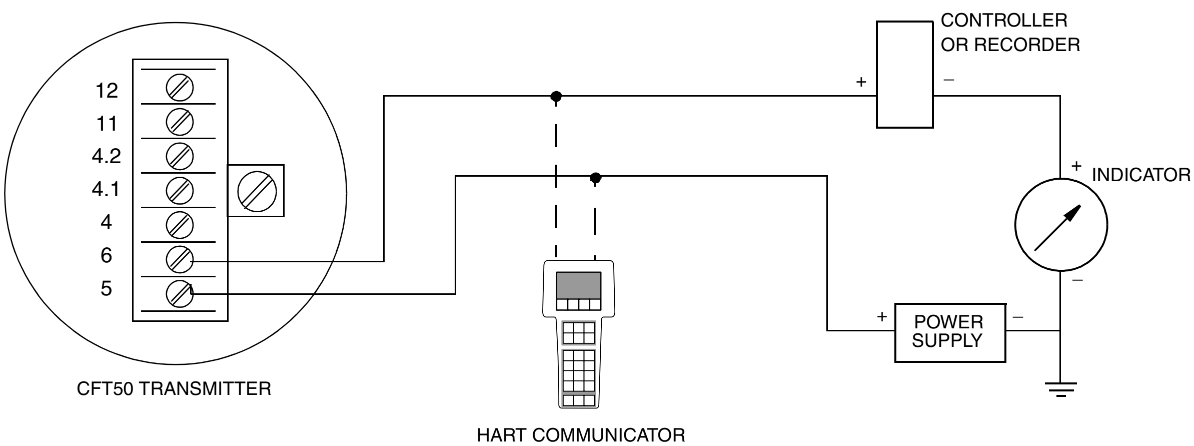


Figure 24. Connection of HART Communicator

Overview of Top Level Menus

Figure 25 shows the Main menu structure of the HART Communicator. Figure 26 and Figure 27 show the top level Offline and Online menus respectively for the CFT50 Transmitter.

1. Offline	Compile a set of configuration data for downloading to a device or simulate an online connection to a device without connecting to it.
2. Online	Configure, calibrate, or operate an online device.
4. Frequency Device	Display the frequency output and pressure output (if present)
5. Utility	Configure communicator parameters such as auto polling and adjusting contrast of communicator LCD.

Figure 25. HART Communicator Main Menu

1 New Configuration	Display the measurement (process variable) and related data.
2 Saved Configuration	Perform any of four calibration functions.

Figure 26. CFT50 Transmitter Top Level Offline Menu

1 Measurement	Display the measurement (process variable) and related data.
2 Quick Start	Perform configuration functions for simple applications
3 Status	Display status parameters
4 View	Display identification parameters
5 Setup	Perform configuration functions for all applications

Figure 27. CFT50 Transmitter Top Level Online Menu

Communicator Keyboard and Display

Refer to MAN 4250 supplied with the communicator.

Offline Configuration

The offline configuration feature is not available at this time.

Online Operation

Use Online mode to:

- Monitor **Measurement** values
- Perform a **Quick Start** procedure (for some applications)
- Display **Status** of various system parameters
- **View** various identity parameters
- Perform a **Setup** procedure (for any application).

Online Flowchart

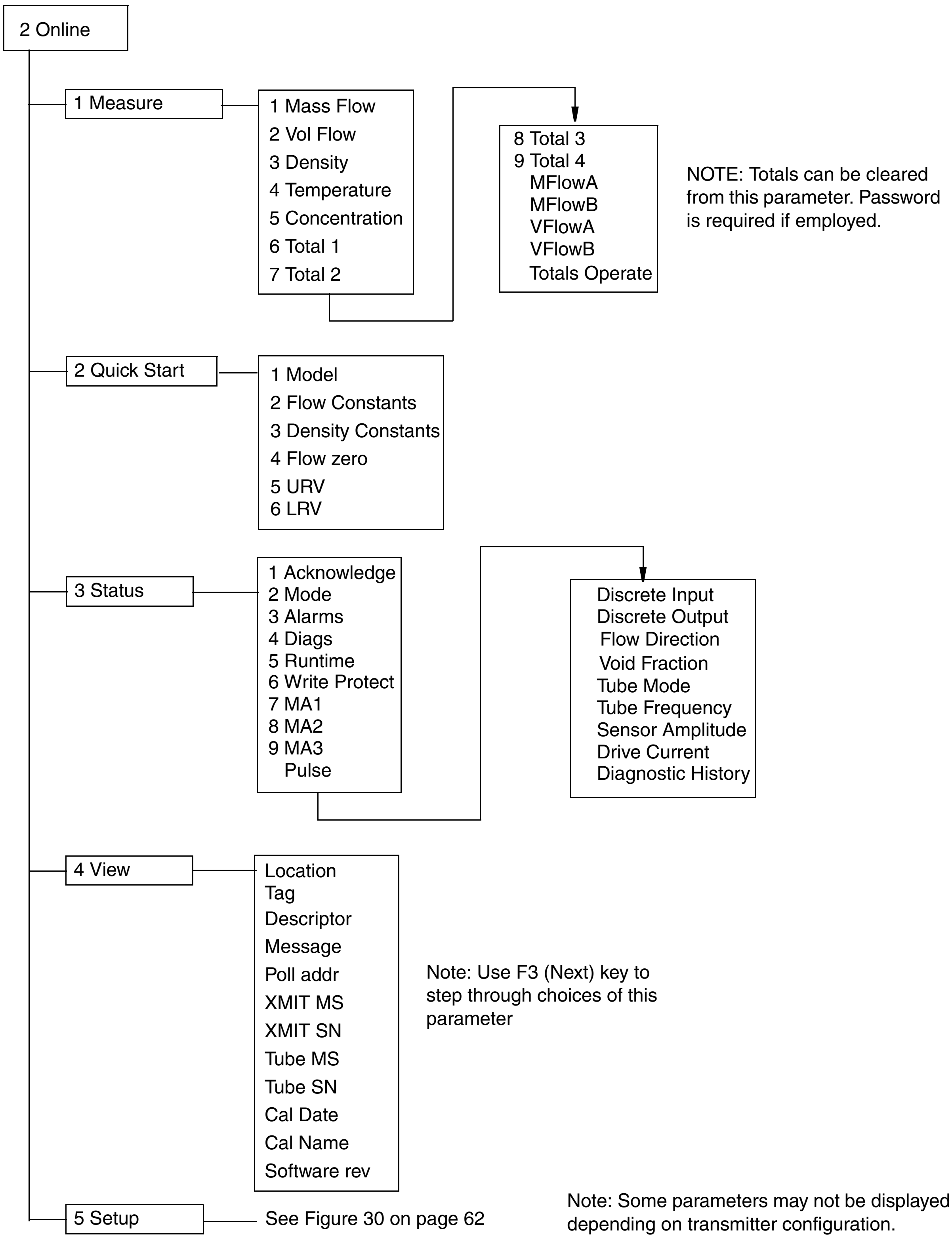


Figure 28. HART Online Flowchart

Explanation of Online Parameters

Parameter	Explanation
Measure Mode	
Mass Flow	Shows the value of mass flow
Vol Flow	Shows the value of volume flow
Density	Shows the value of density
Temperature	Shows the value of temperature
Concentration	Shows the value of concentration
Total 1, 2, 3, 4	Shows the value of total 1, 2, 3, 4
MFlow A, MFlow B, VFlow A, VFlow B	Shows the value of mass flow A, mass flow B, volume flow A, volume flow B
Totals Operate	Ability to start, stop, or reset the total selected
Quick Start Mode	
Model	Used to select the flowtube size and material
Flow Constant	Used to enter the flowtube flow constants
Density Constant	Used to enter the flowtube density constants
Flow zero	Used to zero the transmitter
URV	Used to set the upper range value
LRV	Used to set the lower range value
Status Mode	
Acknowledge[a]	Ability to acknowledge alarm and diagnostic conditions
Mode	Shows the mode as online or offline
Alarms	Shows the alarm status
Diags	Shows the diagnostic status
Runtime	Shows the time in service in hours
Write Protect	Shows if write protection is On or Off
MA1, 2, and/or 3	Shows the mA output values
Pulse	Shows the pulse output value
Flow Direction	Shows the flow direction (forward or reverse)

Discrete Input	Shows the contact in state
Discrete Output	Shows the contact out function
Tube Mode	Shows the flowtube mode (offline, startup, or normal)
Tube Frequency	Shows the flowtube frequency value
Sensor Amplitude	Shows the sensor amplitude value
Drive Current	Shows the drive current value
Void Fraction	Shows the void fraction in percent
Diagnostic History	Shows the diagnostic history (not available at this time)
View Mode	
Location	Shows location of the transmitter
Tag	Shows the tag (if any)
Descriptor	Shows the HART descriptor (if any)
Message	Shows the HART message (if any)
Poll Addr	Shows the polling address
XMIT MS	Shows the transmitter model number
XMIT SN	Shows the transmitter serial number
Tube MS	Shows the flowtube model number
Tube SN	Shows the flowtube serial number
Cal Date	Shows the date of the last calibration
Cal Name	Shows the name of the person who performed the last calibration
Software Version	Shows the software version

(a) Ignore the words ‘Unknown Enumerator’ if they appear.

— NOTE

Explanation of Setup parameters is located on page 63.

5. Setup

The CFT50 transmitter can be configured with a HART Communicator or with the optional keypad/display option. Two configuration menus exist. Some applications can be configured in Quick Start mode (see “Quick Start” on page 15). For applications requiring functions not covered by the Quick Start mode, use the Setup mode that is fully described in this chapter.

The structural diagrams for Setup from the local display and keypad are in “Setup Diagrams” on page 73. The diagram for Setup from a HART Communicator is in Figure 30.

— NOTE

1. As you step through the menus described in this chapter, available parameters depend on the output signals specified for your transmitter and shown in the model code.
2. If you pause in Setup mode for more than 10 minutes, the system times out and you may not be able to make more changes. If this happens, go to **1 SETUP** to reset the timer.
3. If write protection is enabled, the display reads **WPROT/LOCKED** and you cannot enter Setup mode to make changes. You can, however, bypass this message with the Enter key for viewing only. To disable write protection, you must first turn power off, move the write protect jumper to the disable position, and then turn power back on. See “Write Protect Jumper” on page 13.

Configurable Parameters

Table 9. Configurable Parameters

Parameter	Capability	Factory Default	Configurable with: Integral Indicator	Configurable with: HART Comm.	Application Requirement
Measure					
Mass Flow					
Units	Select from picklist	LB/M	Yes	Yes	
Format	Select from picklist	####.###	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Hi Deadband		0.0	Yes	Yes	
Lo Setpoint		0.0	Yes	Yes	
Lo Deadband		0.0	Yes	Yes	

Table 9. Configurable Parameters (Continued)

Parameter	Capability	Factory Default	Configurable with: Integral Indicator	Configurable with: HART Comm.	Application Requirement
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Volume Flow					
Units	Select from picklist	USG/M	Yes	Yes	
Format	Select from picklist	####.###	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Hi Deadband		0.0	Yes	Yes	
Lo Setpoint		0.0	Yes	Yes	
Lo Deadband		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Density					
Units	Select from picklist	g/cc	Yes	Yes	
Format	Select from picklist	###.####	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Hi Deadband		0.0	Yes	Yes	
Lo Setpoint		0.0	Yes	Yes	
Lo Deadband		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Concentration					
Units	% by wt, % by vol, Brix, Baume	% by wt	Yes	Yes	
Component	A or B	A	Yes	Yes	
Format	Select from picklist	####.###	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Hi Deadband		0.0	Yes	Yes	
Lo Setpoint		0.0	Yes	Yes	
Lo Deadband		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Temperature					
Units	degC or degF	degF	Yes	Yes	
Alarms					

Table 9. Configurable Parameters (Continued)

Parameter	Capability	Factory Default	Configurable with: Integral Indicator	Configurable with: HART Comm.	Application Requirement
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Hi Deadband		0.0	Yes	Yes	
Lo Setpoint		0.0	Yes	Yes	
Lo Deadband		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Total 1[a]					
Map	mass all, mflowA, mflowB, vol all, vflowA, vflowB	mass all	Yes	Yes	
Units	Select total units	LB	Yes	Yes	
Direction	Bidir, Forward, and Reverse	Forward	Yes	Yes	
Type (Protection)	Grand or Net (Batch)	Net	Yes	Yes	
Format	Select from picklist	xxxxxxxx	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Total 2[a]					
Map	mass all, mflowA, mflowB, vol all, vflowA, vflowB	vol all	Yes	Yes	
Units	Select total units	USGal	Yes	Yes	
Direction	Bidir, Forward, and Reverse	Forward	Yes	Yes	
Type (Protection)	Grand or Net (Batch)	Net	Yes	Yes	
Format	Select from picklist	xxxxxxxx	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Total 3[a]					
Map	mass all, mflowA, mflowB, vol all, vflowA, vflowB	mass all	Yes	Yes	
Units	Select total units	LB	Yes	Yes	
Direction	Bidir, Forward, and Reverse	Forward	Yes	Yes	
Type (Protection)	Grand or Net (Batch)	Net	Yes	Yes	
Format	Select from picklist	xxxxxxxx	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	

Table 9. Configurable Parameters (Continued)

Parameter	Capability	Factory Default	Configurable with: Integral Indicator	Configurable with: HART Comm.	Application Requirement
Hi Setpoint		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Total 4[(a)]					
Map	mass all, mflowA, mflowB, vol all, vflowA, vflowB	mass all	Yes	Yes	
Units	Select total units	LB	Yes	Yes	
Direction	Bidir, Forward, and Reverse	Forward	Yes	Yes	
Type (Protection)	Grand or Net (Batch)	Net	Yes	Yes	
Format	Select from picklist	xxxxxxxx	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Mass Flow Component A					
Units	Select from picklist	LB/M	Yes	Yes	
Format	Select from picklist	####.###	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Hi Deadband		0.0	Yes	Yes	
Lo Setpoint		0.0	Yes	Yes	
Lo Deadband		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Mass Flow Component B					
Units	Select from picklist	LB/M	Yes	Yes	
Format	Select from picklist	####.###	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Hi Deadband		0.0	Yes	Yes	
Lo Setpoint		0.0	Yes	Yes	
Lo Deadband		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Volume Flow Component A					
Units	Select from picklist	USG/M	Yes	Yes	
Format	Select from picklist	####.###	Yes	No	

Table 9. Configurable Parameters (Continued)

Parameter	Capability	Factory Default	Configurable with		Application Requirement
			Integral Indicator	HART Comm.	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Hi Deadband		0.0	Yes	Yes	
Lo Setpoint		0.0	Yes	Yes	
Lo Deadband		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Volume Flow Component B					
Units	Select from picklist	USG/M	Yes	Yes	
Format	Select from picklist	####.###	Yes	No	
Alarms					
Alarm Feature	Off, Hi Alm, Lo Alm, Both	Off	Yes	Yes	
Hi Setpoint		0.0	Yes	Yes	
Hi Deadband		0.0	Yes	Yes	
Lo Setpoint		0.0	Yes	Yes	
Lo Deadband		0.0	Yes	Yes	
Alm Output	Dig Output (yes or no) Display (yes or no)	No No	Yes	Yes	
Output					
mA1					
Map	mflow, vflow, density, concentration, temperature	mflow	Yes	Yes	
URV LRV		661.387 0	Yes	Yes	
Damping	00.0 to 99.9 seconds	0.5	Yes	Yes	
Alarm Response	Low, High, Last	High	Yes	Yes	
Diagnostic Response	Low, High, Last	High	Yes	Yes	
mA2					
Map	mflow, vflow, density, concentration, temperature	mflow	Yes	Yes	
URV LRV		661.387 0	Yes	Yes	
Damping	00.0 to 99.9 seconds	0.5	Yes	Yes	
Alarm Response	Low, High, Last	High	Yes	Yes	
Diagnostic Response	Low, High, Last	High	Yes	Yes	
mA3					
Map	mflow, vflow, density, concentration, temperature	mflow	Yes	Yes	

Table 9. Configurable Parameters (Continued)

Parameter	Capability	Factory Default	Configurable with		Application Requirement
			Integral Indicator	HART Comm.	
URV LRV		661.387 0	Yes	Yes	
Damping	00.0 to 99.9 seconds	0.5	Yes	Yes	
Alarm Response	Low, High, Last	High	Yes	Yes	
Diagnostic Response	Low, High, Last	High	Yes	Yes	
Pulse					
Pulse	Rate or Total	Rate	Yes	Yes	
Pulse (Rate)					
Map	mflow, vflow, density, concentration, temperature	mflow	Yes	Yes	
Fast Response	On or Off	Off	Yes		
Scaling	URV, U/Pulse, Pulses/U	U/Pulse	Yes		
URV LRV		661.387 0	Yes	Yes	
Min Freq Max Freq		1000 10000	Yes	Yes	
Damping	00.0 to 99.9 seconds	0.5	Yes	Yes	
Alarm Response	Low, High, Last	High	Yes	Yes	
Diagnostic Response	Low, High, Last	High	Yes	Yes	
Pulse (Total)					
Maximum Frequency	10 or 100 Hz	100 Hz	Yes	Yes	
Map	mass all, mflowA, mflowB, vol all, vflowA, vflowB	mass all	Yes	Yes	
Units	Select from picklist	kg	Yes	Yes	
Units per Pulse		1.0	Yes	Yes	
Direction	Bidir, Forward, and Reverse	forward	Yes	Yes	
Contact Output					
Function	Off, Any Alarm, Diag, Alarm/Diag	Off	Yes	Yes	
Operation	Normally Open or Closed	Closed	Yes	Yes	
Contact Input	Off, CalZero, SelZero, SigLock, AckAlrm, ClearTot1, ClearTot2, ClearTot3, ClearTot4, ClearNets, ClrTots	Off	Yes	Yes	
Display					
Show	Mflow, Vflow, Density, Temperature, Concentration, Total1, Total2, Total3, Total4, MFlowA, MFlowB, VflowA, VFlowB	Mflow, Density, Temperature, Total1	Yes	Yes	
Cycle	Auto or Manual	Manual	Yes	Yes	

Table 9. Configurable Parameters (Continued)

Parameter	Capability	Factory Default	Configurable with: Integral Indicator	Configurable with: HART Comm.	Application Requirement
Primary	Show items selected	Mflow	Yes	Yes	
Damping	00.0 to 99.9 seconds	1.0	Yes	Yes	
Alarm Resp	None or Blink	Blink	Yes	Yes	
Diag Resp	None or Blink	Blink	Yes	Yes	
HART Dynamic		fourth	Yes		
View					
Locate	14 characters	(spaces)	Yes	Yes	
Flowtube Model	32 characters	(spaces	Yes	Yes	
Flowtube Serial Number	16 characters	(spaces)	Yes	Yes	
HART Tag	8 characters	(spaces)	Yes	Yes	
HART Descriptor	16 characters	(spaces)	Yes	Yes	
HART Message	32 characters	(spaces)	Yes	Yes	
HART Poll Address	00 through 15	00	Yes	Yes	
Test					
Set mA1 Output			Yes	Yes	
Set mA2 Output			Yes	Yes	
Set mA3 Output			Yes	Yes	
Set Pulse Output			Yes	Yes	
Set Digital Output			Yes	Yes	
Calibration					
Model					
Size	02, 03, 05, 08, 10, 15, 20	02	Yes	Yes	
Matl	CFS10-S, CFS20-S, CFS10-H, CFS20-H CFS10-C, CFS20-C	CFS10-S	Yes	Yes	
Flow Constants					
FC1	(Calculated)		No	No	
FC2			Yes	Yes	
FC3	(Calculated)		No	No	
Density Constants					
DC1	(Calculated)		No	No	
DC2			Yes	Yes	
DC3	(Calculated)		No	No	
DC4			Yes	Yes	
DC Cal	(calculate new constants)		Yes	Yes	
KBias		1.0	Yes	Yes	
Flow Direction	uni pos, uni neg, bi pos, bi neg	bi pos	Yes	Yes	
Flow Zero					

Table 9. Configurable Parameters (Continued)

Parameter	Capability	Factory Default	Configurable with		Application Requirement
			Integral Indicator	HART Comm.	
Select Zero	1 or 2	1	Yes	Yes	
Cal Zero	(zero the transmitter)	0.0	Yes	Yes	
Low Flow Cut-Off	On or Off	Off	Yes	Yes	
Density Limit		0.0	Yes	Yes	
Fluid					
Component A					
Name		water	Yes	Yes	
Density		0.998254	Yes	Yes	
Temp Coefficient		-0.000113	Yes	Yes	
Reference Temperature		68 degF	Yes	Yes	
Component B					
Name		air	Yes	Yes	
Density		0.004101	Yes	Yes	
Temp Coefficient		-0.000008	Yes	Yes	
Reference Temperature		68 degF	Yes	Yes	
2 Phase					
Void Fraction Compensation					
MFlow	Yes (for mass flow & density)	No	Yes	Yes	
Density	Yes (for density only)	No	Yes	Yes	
Density		0.998254	Yes	Yes	
Temperature Coefficient		-0.000113	Yes	Yes	
Reference Temperature		68 degF	Yes	Yes	
Flowtube Mounting	Vertical or Horizontal	Vertical	Yes	Yes	
Milliampere Calibration					
mA1 Cal					
4 mA			Yes	Yes	
20 mA			Yes	Yes	
Factory Calibration			Yes	Yes	
mA2 Cal					
4 mA			Yes	Yes	
20 mA			Yes	Yes	
Factory Calibration			Yes	Yes	
mA3 Cal					
4 mA			Yes	Yes	
20 mA			Yes	Yes	
Factory Calibration			Yes	Yes	
Calibration Identification					
Calibration Date	MMDDYY		Yes	Yes	
Calibration Name	6 characters maximum		Yes	Yes	

Table 9. Configurable Parameters (Continued)

Parameter	Capability	Factory Default	Configurable with: Integral Indicator	Configurable with: HART Comm.	Application Requirement
System					
Password					
High Level Password		(6 spaces)	Yes	Yes	
Low Level Password		(6 spaces)	Yes	Yes	
Alarm Acknowledge	Auto or Manual	Auto	Yes	Yes	
Diagnostic Acknowledge	Auto or Manual	Auto	Yes	Yes	
Set Factory Configuration			Yes	Yes	
Preambles		5	Yes	Yes	

(a) Default is Off (set in Measure mode).

Using the Local Display

The Setup mode enables you to configure your measurement, output, view, test, calibration, and system parameters. Setup mode can be a passcode protected mode. So after the initial configuration, you may need a password to enter this mode. At the display **PASSWORD**, enter the correct password. If the entered password is incorrect, the display reads **PASSWORD/LOCKED** and you cannot enter Setup to make changes. You can, however, bypass this message with the Enter key for viewing only.

— NOTE
If you lose your password, call Invensys Foxboro for assistance.

If your transmitter is being configured by a HART Communicator at the time you try to enter Setup mode, the local display reads **REMOTE/LOCKED**. In this case, you cannot enter Setup mode to make changes. You can, however, bypass this message with the Enter key for viewing only.

This is also 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 asked if you want to do so. Indicate 'yes' with the Right arrow key.

The structural diagram of the Setup menu begins with Figure 31 in Appendix A.

Setting Measure Parameters

The structural diagram of the Measure Setup menus are located on Figure 32 and Figure 33 in Appendix A.

Mass Flow

Units

In the **3 MFLOW --> 4 UNITS** parameter, you can specify the mass flow units as:

G/S, G/M, G/H, G/D, (grams per unit time)
KG/S, KG/M, KG/H KG/D, (kilograms per unit time)
LB/S, LB/M, LB/H, LB/D, (pounds per unit time)
OZ/S, OZ/M, OZ/H, OZ/D, (ounces per unit time)
ST/S, ST/M, ST/H, ST/D, (short tons/unit time)
MT/M, MT/H, MT/D (metric tonnes per unit time)
or CUSTOM.

Custom

If you select **custom**, you must define your custom units in **4 CUSTOM**. First, enter a **name** for your custom units using up to eight alphanumeric characters. The characters that can be used are listed in Table 10. Then, enter any offset (**offset**) and a conversion factor (**slope**) from kilograms per second to the custom units.

Example: The slope for a custom unit of long tons per hour would be 3.5424 because 3.5424 LTon/hr = 1 kg/s.
A list of slopes for frequently used units is located in Appendix B.

Table 10. Alphanumeric Characters

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

Format

The format of the units on your display are determined in **4 FORMAT**. The available options for this parameter are:

- ########(display in single units)
- ######.# (display in tenths of units)
- #####.## (display in hundredths of units)
- ####.### (display in thousandths of units)
- ###.#### (display in ten thousandths of units)
- ##.##### (display in hundred thousandths of units).

Select a format that provides the desired precision without yielding excessive flickering of the less significant digits. The displayed value can also be damped. See "Display" on page 51.

Alarms

The configuration of mass flow alarms is determined in **4 ALARM**. This parameter has several subparameters:

- **5 ALARM** can be configured to set the alarm feature **off**, **hi alarm**, **lo alarm**, or **both**.
- **5HISETPT** and **5LOSETPT** is used to establish the high and low alarm set point values.
- **5DEADBND** is used to establish the alarm deadband value.
- **5ALRMOUT** is used to establish whether the alarm is to affect the digital output (**DOUT**) and/or the **DISPLAY**. You can answer **yes** or **no** to each.

Volume Flow

Units

In the **3 VFLOW --> 4 UNITS** parameter, you can specify the volume flow units as:

L/S, L/M, L/H, L/D,
USG/S, USG/M, USG/H, USG/D,
IMPG/S, IMPG/M, IMPG/H, IMPG/D,
BBL/S, BBL/M, BBL/H, BBL/D (42 gal barrel)
or CUSTOM.

Custom

If you select **custom**, you must define your custom units in **4 CUSTOM**. First, enter a **name** for your custom units using up to eight alphanumeric characters. The characters that can be used are listed in Table 10. Then, enter any offset (**offset**) and a conversion factor (**slope**) from liters per second to the custom units.

Example: The slope for a custom unit of ft^3/min would be 2.11888 because 2.11888 ft^3/min = 1 L/s.
A list of slopes for frequently used units is located in Appendix B.

Format

The configuration of volume flow format is determined in **4 FORMAT**. The details of this parameter are the same as explained in “Format” on page 45.

Alarms

The configuration of volume flow alarms is determined in **4 ALARM**. The details of this parameter are the same as explained in “Alarms” on page 45.

Density

Units

In the **3 DENSITY --> 4 UNITS** parameter, you can specify the density units as:

SG, KG/M3, KG/L, LB/G, LB/FT3, LB/IN3, G/ML, G/CC, G/L, ST/YD3, or CUSTOM.

Custom

If you select **custom**, you must define your custom units in **4 CUSTOM**. First, enter a **name** for your custom units using up to eight alphanumeric characters. The characters that can be used are listed in Table 10. Then, enter any offset (**offset**) and a conversion factor (**slope**) from kilograms per cubic meter to the custom units.

Example: The slope for a custom unit of oz/gal would be 7.48915 because 7.48915 oz/gal = 1 kg/m^3.
A list of slopes for frequently used units is located in Appendix B.

Format

The configuration of density format is determined in **4 FORMAT**. The details of this parameter are the same as explained in “Format” on page 45.

Alarms

The configuration of density alarms is determined in **4 ALARM**. The details of this parameter are the same as explained in “Alarms” on page 45.

Concentration

In the **3CONCENT --> 4 UNITS** parameter, you can specify the concentration units as **% by wt**, **% by volume**, **BRIX**, or **BAUME**.

If you selected **% by wt** or **% by volume**, the component to be measured is determined in **4 COMP**. The component can be specified as **A** or **B**. The definition of the components is established in “Fluid” on page 56.

— **NOTE**

1. When 2-phase compensation is turned on, Brix and Baume units for concentration measurement are not available. Conversely, if Brix or Baume concentration units have been specified, 2-phase compensation is not available.
2. For complete information on setting component measurement parameters, see “Setting Concentration Measurement Parameters” on page 59.

The configuration of concentration format is determined in **4 FORMAT**. The details of this parameter are the same as explained in “Format” on page 45.

The configuration of concentration alarms is determined in **4 ALARMS**. The details of this parameter are the same as explained in “Alarms” on page 45.

Temperature

In the **3 TEMP --> 4 UNITS** parameter, you can specify the temperature units as **degC** or **degF**.

The configuration of temperature alarms is determined in **4 ALARMS**. The details of this parameter are the same as explained in “Alarms” on page 45.

Totals

— **NOTE**

The following description refers to the **TOTAL1** parameter. It also applies to the **TOTAL2**, **TOTAL3**, and **TOTAL 4** parameters.

In the **3 TOTAL1 --> 4 MAP** parameter, you can specify the mode as **mass all**, **mflow A**, **mflow B**, **vol all, vflow A**, or **vflow B**.

Next, in the **4 UNITS** parameter, you can specify the totals units as follows:

- For mass: KG, G, LB, OZ, STON (short ton), MTON (metric tonne), or CUSTOM
- For volume: L, USG, IMPG, BBL (42 gal barrel), or CUSTOM.

If you select **custom**, you must define your custom units in **4 CUSTOM**. First, enter a **name** for your custom units using up to eight alphanumeric characters. The characters that can be used are listed in Table 10. Then, enter any offset (**offset**) and a conversion factor (**slope**) from kilograms (for mass units) or liters (for volume units) to the custom units.

Example: The slope for a custom unit of lb (troy) is 2.67921 because
2.67921 lb (troy) = 1 kg.
A list of slopes for frequently used units is located in Appendix B.

The direction of the flow is determined in **4DIRECTN**. The available options for this parameter are **bidir** (bidirectional), **forward**, and **reverse**.

— **NOTE**
Bidirectional functionality of totalizers is only possible if flow direction is configured to one of the bidirectional choices. See "Flow Direction" on page 55.

The type of total is determined in **4 TYPE**. The available options for this parameter are **grand** (Forward Total minus Reverse Total since last reset of Grand Total) and **net** (Forward Total minus Reverse Total).

The format of the units on your display are determined in **4 FORMAT**. The available options for this parameter are:

- ######## (display in single units)
- ######.# (display in tenths of units)
- #####.## (display in hundredths of units)
- ####.### (display in thousandths of units), and
- ###.#### (display in ten thousandths of units).
- ##.##### (display in hundred thousandths of units)
- #e5 (display in a number times a hundred thousand units)
- #e4 (display in a number times ten thousand units)
- #e3 (display in a number times a thousand units)
- #e2 (display in a number times a hundred units)
- #e1 (display in a number times ten units).

The configuration of total alarms is determined in **4 ALARM**. The details of this parameter are similar to the alarms explained in "Alarms" on page 45 except that there is no low setpoint and no deadband parameters.

Component A and B Mass Measurements

The setup for mflow A and mflow B is similar to that of "Mass Flow" on page 44.

— **NOTE**
The properties of each component must also be defined. See "Fluid" on page 56.

Component A and B Volume Measurements

The setup for vflow A and vflow B is similar to that of "Volume Flow" on page 45

— **NOTE**
The properties of each component must also be defined. See "Fluid" on page 56.

Setting Output Parameters

The structural diagram of the Output menus are located on Figure 34 and 35 in Appendix A.

Milliampere Output

— NOTE —
The following description refers to the MA1 parameter. It also applies to the MA2 and MA3 parameters.

In the **3 MA1 --> 4 MAP** parameter, you can map the output to **mflow** (mass flow), **vflow** (volume flow), **density**, **temp** (temperature), **concent** (concentration), **mflow A**, **mflow B**, **vflow A**, or **vflow B**.

In **4 URV** and **4 LRV**, set the upper range value and lower range value in the units specified in the Measure Setup parameters.

In **4DAMPING** specify the damping time that is applied to the analog 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 **4ALRMRSP** parameter allows you to drive the analog output fully downscale or upscale if an alarm condition occurs. You can also choose to hold the output at the last reading. Analog output limits are 3.6 mA and 21.0 mA. Configure this parameter as **low**, **high**, or **last**.

The **4DIAGRSP** parameter allows you to drive the analog output fully downscale or upscale if an diagnostic condition is detected. You can also choose to hold the output at the last reading. Analog output limits are 3.6 mA and 21.0 mA. Configure this parameter as **low**, **high**, or **last**.

Pulse Output

In the **3 PULSE --> 4 PULSE** parameter, you can set the type of pulse output as **rate** or **total**.

Rate

The **4 MAP** parameter allows you to map the output to **mflow** (mass flow), **vflow** (volume flow), **density**, **temp** (temperature), **concent** (concentration), **mflow A**, **mflow B**, **vflow A**, or **vflow B**.

The **4 FAST** parameter allows you to disable averaging of the raw measurement to achieve the fastest possible dynamic response. You can turn this feature **on** or **off**.

In **4 SCALING**, select **URV**, **U/PULSE**, or **PULSE/U**.

If you selected **URV**: In **4 URV** and **4 LRV**, set the upper range value and lower range value in the units specified in the Measure Setup parameters. Then in **4 MAXFRQ** and **4 MINFRQ**, set the frequency at the URV and LRV respectively.

— NOTE —
The slowest rate currently supported is 2 Hz.

If you selected **U/PULSE**, or **PULSE/U**, specify the units per pulse or the pulses per unit respectively. The in **4 MAXFRQ**, set the frequency at the URV. The LRV is 0.0 and the minimum frequency is 0 Hz.

In **4DAMPING**, specify the damping time that is applied to the analog 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 **4ALRMRSP** parameter allows you to drive the pulse output to zero (**low**) or to the maximum frequency value (**high**) if an alarm condition occurs. You can also choose to hold the pulse output at the **last** frequency. Configure this parameter as **low**, **high**, or **last**.

The **4DIAGRSP** parameter allows you to drive the pulse output to zero (**low**) or to the maximum frequency value (**high**) if an diagnostic condition is detected. You can also choose to hold the pulse output at the **last** frequency. Configure this parameter as **low**, **high**, or **last**.

Total

> **NOTE**
> When Total is selected, you can turn the pulse totalizer on or off or clear the pulse total in **1 MEASURE**.

In **4 MAXFRQ**, indicate the maximum frequency at which the pulse total output can generate pulses. The choices are **10 Hz** or **100 Hz**. This setting also determines the on-time for the pulse total output, which is 50 milliseconds for the 10 Hz and 5 ms for the 100 Hz setting.

In **4 MAP**, indicate the mode as **mass all**, **mflow A**, **mflow B**, **vol all**, **vflow A**, or **vflow B**.

In **4 UNITS**, select the units from the menu presented.

If you select **custom**, you must define your custom units in **4 CUSTOM**. First, enter a **name** for your custom units using up to eight alphanumeric characters. The characters that can be used are listed in Table 10. Then, enter any offset (**offset**) and a conversion factor (**slope**) from kilograms (for mass units) or liters (for volume units) to the custom units.

In **4U/PULSE**, specify the units per pulse.

In **4DIRECTN**, indicate the direction of flow as **forward**, **reverse**, or **bidir** (bidirectional).

Contact Output

The transmitter provides a relay output that can be configured to indicate certain alarm and/or diagnostic conditions.

> **NOTE**
> This function applies only to the alarms of those measurements that have been configured to affect the digital output.

To use this feature, configure its function and operation parameters in **3 DOUT**.

In **4 FUNCT**, specify one of the following:

- **off** (the relay output is not used)
- **alarm** (the relay becomes active when any configured alarm occurs)
- **diag** (the relay becomes active when a diagnostic condition occurs)
- **alm+diag** (the relay becomes active when a diagnostic condition or any configured alarm occurs).

In **4 OPERAT**, 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 **NormOpen** or **NormClosed**.

Contact Input

The Contact Input parameter specifies the function of the contact input.

In **3 DIN**, specify one of the following:

- **off** (contact input function not enabled)
- **cal zero** (initiates a zeroing of the transmitter)
- **sel zero** (selects zero):
  primary zero [1] = open contact; secondary zero [2] = closed contact)
- **siglock** (drives the outputs to the zero flow condition)
- **al/d ack** (acknowledges an alarm or diagnostic; eliminates the need to do this manually)
- **clr tot1** (resets Total1)
- **clr tot2** (resets Total2)
- **clr tot3** (resets Total 3)
- **clr tot4** (resets Total 4)
- **clr nets** (resets all net totals)
- **clr tots** (resets all totals).

Display

The Display parameters allow you to set all variable features of your display.

In **3 DISPLAY -->4 SHOW**, you can choose to display any or all of the following: **MFLOW**, **VFLOW**, **DENSITY**, **CONCENT**, **TEMP**, **TOTAL1**, **TOTAL2**, **TOTAL3, TOTAL4, MFLOW A, MFLOW B, VFLOW A, VFLOW B**. Specify each as **yes** or **no**.

In **4 CYCLE**, specify whether you want the display of the measurements selected above to cycle automatically from one to another (**auto**) or be able to be cycled manually (**manual**) with the Up and Down arrow keys.

In **4PRIMARY**, specify the display from the measurements selected above that you want as the default display.

In **4DAMPING**, you can damp the displayed value to minimize flickering of the less significant digits Specify the damping response time from 00.0 to 99.9 seconds. 00.0 is no damping.

In **4ALRMRSP**, specify if you want the display to blink if an alarm condition occurs. The selections are **none** and **blink**.

In **4DIAGRSP**, specify if you want the display to blink if a diagnostic condition occurs. The selections are **none** and **blink**.

HART Variable Assignment

Four variables can be monitored. Your transmitter has one to three milliampere outputs depending on the model ordered. HART gives preference to monitoring these outputs. Other available variables can be mapped to a measurement. For example, if your transmitter has two mA outputs, two variables can be assigned to measurements of your choice.

In **3 HARTDYN**, map each available HART variable to one of the following measurements: mass flow. volume flow, density, concentration, temperature, total 1, total 2, total 3, total 4, component A mass flow, component B mass flow, component A volume flow, or component B volume flow.

Setting View Parameters

The structural diagram of the View menus are located on Figure 36 in Appendix A.

Location

This parameter is available to document the location of the transmitter. This parameter performs no control function. In **3 LOCATE**, specify up to 14 alphanumeric characters.

Tube Model Code

The Tube Model Code is a reference identifier of the model code of the flowtube being used with your transmitter. It does not control the operation of the transmitter. Specify up to 32 alphanumeric characters.

Tube Serial Number

The Tube Serial Number is a reference identifier of the serial number of the flowtube being used with your transmitter. It does not control the operation of the transmitter. In **3 TUBESN**, specify up to 16 alphanumeric characters.

HART Tag

This parameter is used to identify the unit. In **3HARTTAG**, specify up to 8 alphanumeric characters.

HART Descriptor

This parameter is available for any desired purpose as a secondary description of the unit. This parameter performs no control function. In **3HARTDES**, specify up to 16 alphanumeric characters.

HART Message

This parameter is available for any desired purpose as a secondary description of the unit. This parameter performs no control function. In **3HARTMSG**, specify up to 32 alphanumeric characters.

HART Poll Address

This parameter specifies the polling address of the unit, which is used in identifying the unit to a HART Master Device such as the HART Communicator. In **3HARTADR**, you can set the address to any value from 00 to 15. However, this parameter should always be set to 00 unless the unit is being operated in a multi-drop environment (more than one HART device present on the same current loop).

If the parameter is set to any nonzero value (specifying multi-drop operation), the analog (milliampere) output of the device is constantly locked at 4.0 mA. Thus, the analog output no longer reflects process conditions or responds to diagnostics or alarms.

Setting Test Parameters

The structural diagram of the Test menus are located on Figure 36 in Appendix A.

The transmitter can be used as a signal source to check and/or calibrate other instruments in the control loop, such as indicators, controllers, and recorders. To do this, set the mA output (**3SET MA1, 3SET MA2, or 3SET MA3**), pulse output (**3SETPULS**), and digital output (**3SETDOUT**) signals to any value within the range limits of the transmitter.

— **NOTE**
If the pulse output is configured for **Total**, a maximum of 250 pulses can be sent.

Setting Calibration Parameters

The structural diagram of the Calibration menus are located on Figure 37 in Appendix A.

Model (Flowtube)

In **3 MODEL-->4 SIZE**, select the flowtube size code.

CFS10-##
FLOWTUBE SIZE

02 = 1/8 IN (3 mm)	08 = 3/4 IN (20 mm)	15 = 1.5 IN (40 mm)
03 = 1/4 IN (6 mm)	10 = 1 IN (25 mm)	20 = 2 IN (50 mm)
05 = 1/2 IN (15 mm)		

In **4 MATL**, select the flowtube material code.

CFS10-..S = Model CFS10 Flowtube with AISI Type 316L wetted material
CFS10-..H = Model CFS10 Flowtube with Hastelloy C wetted material
CFS10-..C = Model CFS10 Sanitary Flowtube with AISI Type 316L wetted material
CFS20-..S = Model CFS20 Flowtube with AISI Type 316L wetted material
CFS20-..H = Model CFS20 Flowtube with Hastelloy C wetted material
CFS20-..C = Model CFS20 Sanitary Flowtube with AISI Type 316L wetted material

From the size and material, the transmitter makes a number of calculations including the nominal capacity of the flowtube.

Flow Constants

In **4 FC2**, enter the flow constant 2 shown on the calibration sheet shipped with your flowtube (or your flowtube data plate). Flow constants FC1 and FC3 are calculated by the transmitter.

Density Constants

Standard Entry of Density Constants

In **3DENSCON -->4 DC2**, enter the density constant 2 shown on the calibration sheet shipped with your flowtube (or your flowtube data plate). In a similar fashion, enter the value for **4 DC4**. Density constants DC1 and DC3 are calculated by the transmitter.

Optional Density Calibration

Function

The CFT50 Transmitter provides an optional density calibration function that can be used to optimize the density accuracy for a specific process liquid. The factory calibration is done using water and air as the high and low calibration points respectively. The density calibration feature allows one point to be replaced with a specific process liquid calibration to provide the maximum accuracy.

If the specific gravity of the liquid (or the average of a range of liquids) is >0.2 but ≤0.5, you can replace the low calibration point. If it is >0.5, you can replace the high calibration point.

Procedure

First flow the process liquid to be used in the calibration through the flowtube until the flowtube is full of liquid (no vapor or gas voids) at a reasonably constant temperature.

In **4DENSCAL**, select whether the calibration is for the high or low density liquid and enter its desired density. From this and the temperature measurement, new values for DC1, DC2, DC3, and DC4 are calculated.

Referring to Figure 29, use the subsections of **4 DENSCAL** to do the following:

In **5 FLUID**, select high or low.
In **5DENSITY**, enter the desired known density of the process liquid.
Use **5 CAL DC** to calculate the new density flow constants
In **5 CALDC1** through **5 CALDC4**, you can view the new values.

In **5RESTORE**, you can revert to the last inputted values before the density calibration procedure was performed.

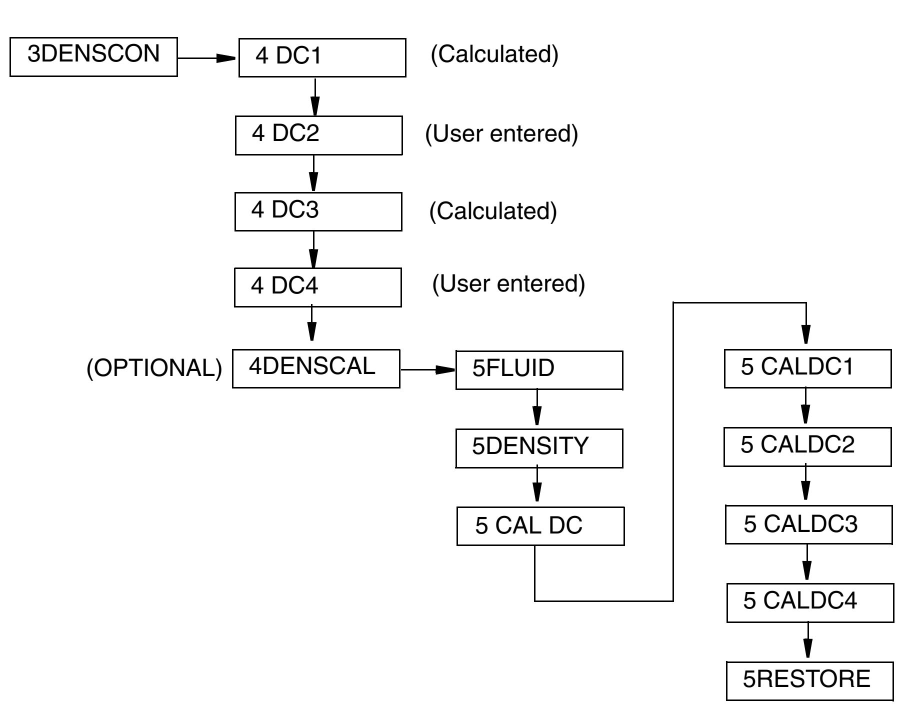


Figure 29. Density Constants Flowchart

K-Bias

K-Bias is used to calibrate or match the measurement of the transmitter to that of another measuring device. If your reading was one percent low, you would set your K-Bias to 1.01.

In **3 KBIAS --> 4 VALUE**, enter your K-Bias value.

Flow Direction

In **3FLOWDIR**, set the flow direction. Select **uni pos** to get only positive readings for unidirectional flow in the same direction as the arrow on the flowtube; Select **uni neg** to get only positive readings for unidirectional flow opposite the direction of the arrow on the flowtube; Select **bi pos** for bidirectional flow to get positive readings for flow in the same direction as the arrow on the flowtube; Select **bi neg** for bidirectional flow to get positive readings for flow opposite the direction of the arrow on the flowtube.

Zeroing the Transmitter

The CFT50 gives you the ability to have two independent zeros for two separate fluids. For example, you could use one for liquid and the other for gas. In **3FLOWZER -->4SELZERO**, select (1) or (2).

Then, using **4CALZERO,** rezero the selected zero. The display then changes to **4 VALUE/#.###,** showing the amount of offset that is necessary to make the transmitter read zero at zero flow conditions. You can then manually change this value if necessary (for example, if the flowmeter cannot be blocked in at no-flow condition).

Lastly, using **4RESTORE**, you can change the manually entered offset value back to the last **CALZERO** offset value. You can **not** restore a value that occurred before the last value calculated by **CALZERO.**

Low Flow Cut-Off

The low flow cut-off parameter allows you to set the level above which the transmitter begins to measure flow.

In **3LOWFLOW -->4 CUTOFF**, select **on** or **off**.

In **4 VALUE**, enter a value that provides no output under low flow conditions. The maximum low flow cut-off value is limited to 10% of the nominal capacity of the flowtube. Therefore, the size and material of the flowtube must be entered in "Model (Flowtube)" on page 53 before setting the low flow cut-off value. If this is not done, the low flow cut-off is 0.0.

— NOTE

The actual cutoff is at 90% of the value set. Measurement is resumed when the set value is again reached.

Density Limit

In **3DENS LIM --> 4DENSITY** you can set the density limit of the fluid below which the mass flow measurement is zero. When the density increases above the limit, measurement resumes.

Fluid

— NOTE

1. Fluid parameters are not required unless **% by wt** or **% by volume** units of concentration have been set in **1 SETUP --> 2 MEASURE --> 3CONCENT --> 4 UNITS**. See "Concentration" on page 46.
2. For complete information on setting component measurement parameters, see "Setting Concentration Measurement Parameters" on page 59.

In **3 FLUID --> 4COMP A** and **3 FLUID --> 4COMP B** you can establish the definition of component A and B. Component A is usually defined as the liquid component and Component B as the gaseous component.

In **5 NAME**, specify the name of the component in 8 alphanumeric characters or less.

In **5DENSITY**, specify the density of the component in units specified in "Density" on page 46.

In **5TEMPCO**, specify the temperature coefficient (change in density per unit temperature; for example: lb/ft3/°F) in the density units selected in"Density" on page 46 and the temperature units selected in "Temperature" on page 47.

In **5TEMPREF**, specify the reference temperature in units specified in "Temperature" on page 47.

2 Phase

Coriolis flowmeters require compensation for many types of 2-phase (gas/liquid) flows. The CTF50 Transmitter has built in compensation that provides greater accuracy for such flows. Contact Invensys Foxboro for guidance in using the built in compensation.

— NOTE

1. During 2-phase (gas/liquid) flow, density is the aggregate of the gas and liquid content.
2. When 2-phase compensation is turned on, Brix and Baume units for concentration measurement are not available. Conversely, if Brix or Baume concentration units have been specified, 2-phase compensation is not available.

In **3 2PHASE** you can activate a feature that produces compensated measurements in 2-phase applications for greater accuracy in many cases.

Under **4 VFCOMP** (void fraction compensation), you can enable this feature for both mass flow and density or for only density. To enable this feature for both mass flow and density, specify **5 MFLOW** as **on**; the next parameter, **5DENSITY** is automatically set to **on**. To enable this feature for only density, specify **5 MFLOW** as **off** and **5DENSITY** as **on**.

Under **4DENSITY**, enter the density of the liquid.

Under **4 TEMPCO**, enter the temperature coefficient.

Under **4REFTEMP**, enter the reference temperature.

Under **4 MOUNT**, specify the flowtube mounting as **VERT** (vertical) or **HORIZ** (horizontal). Vertical mounting of the flowtube is recommended when using the 2 Phase feature.

Milliampere Calibration

The milliampere calibration parameters allow the 4 to 20 mA output of the transmitter to be calibrated or matched to the calibration of the receiving device.

— NOTE

The transmitter has been accurately calibrated at the factory. Recalibration of the output is normally **not** required, unless it is being adjusted to match the calibration of the receiving device.

In **3 MACALS --> 4 MA1CAL --> 5CAL 4 mA**, enter the mA output at the low end. Then, in **5CAL20mA**, enter the mA output at the high end. If you make changes and then decide you want to return to the factory calibration, go to **5FAC CAL.** You are asked **Factory Config?** You can then reply yes or no by pressing the Enter or ESC key respectively.

In a similar fashion, enter the values for **4 MA2CAL**, and **4 MA3CAL**.

Calibration Identification

In **3 CAL ID --> 4CALDATE**, enter the date of the calibration in the form MMDDYY.

Then, in **4CALNAME**, enter the name of the calibrator in 6 alphanumeric characters or less.

Setting System Parameters

The structural diagram of the System menus are located on Figure 39 in Appendix A.

Password

Your CFT50 Transmitter employs two levels of password. Both consist of six alphanumeric characters. The passwords are established and changed in **3PASSWRD**.

The lower level password enables the operator to clear the net totals in Measure mode. The higher level password enables entering the QuickStart and Setup modes as well as clearing all totals in Measure mode.

To change a password, do the following:

1. In **3PASSWRD --> 4 HI PWD --> 5 OLD PWD**, enter the old (high level) password.

— NOTE
For initial entry of password, press Enter six times.

2. Press the Enter key to display **5 NEW PWD**.
3. Enter the new (high level) password and press Enter. The display reads **HIGH PWD CHANGED**.

— NOTE
To change a password to ‘no password’, enter six spaces. Changing a high level password to ‘no password’ automatically changes the low level password to ‘no password’.

4. Press Enter again to go back to **3PASSWRD.**
5. Go to **4 HI PWD** and then to **4 LO PWD --> 5 NEW PWD**.
6. Enter the new (low level) password and press Enter. The display reads **LOW PWD CHANGED**.

Alarm Acknowledge

In **3ALRMACK**, the alarm acknowledge function can be configured as **auto** or **manual**. In **auto**, all evidence of the alarm clears when the alarm condition no longer exists. In **manual**, the alarm must be acknowledged manually.

Diagnostic Acknowledge

In **3DIAGACK**, the diagnostic acknowledge function can be configured as **auto** or **manual**. In **auto**, all evidence of the diagnostic message clears when the diagnostic condition no longer exists. In **manual**, the diagnostic message must be acknowledged manually.

Set Factory Configuration

If your transmitter database becomes corrupted, this function enables you to rewrite all calibration (except the **CALZERO** value) and configuration values with factory default values (shown in Table 9). Therefore, it should **not** be used if your transmitter is functioning properly.

The factory default is accessed in **3SET DEF**. You are asked **Factory Config?** You can then reply yes or no by pressing the **Enter** or **ESC** key respectively.

Preambles

This parameter indicates the number of preamble characters that the transmitter sends at the start of each HART response message. Depending on the characteristics of the communication link, changing this parameter could disrupt communications. For this reason, this parameter is not configurable with the HART Communicator. You can set the number of preamble characters in **3 PREAMB**.

Setting Alarm Parameters

Setting alarm parameters must be done in both **1Setup > 2Measure** and **1Setup > 2Output**.

1. In **1Setup > 2Measure**, under each type of measurement affected, configure
   - Whether alarm is hi alarm, lo alarm, or both
   - The high and low setpoint and deadband values
   - Whether the alarm is to affect the digital output (see note below)
   - Whether the alarm is to affect the display.
2. In **1Setup > 2Output** > **3 MA1** (and/or **3 MA2**, **3 MA3**, **3 PULSE**)
   - Link the output (**4 MAP**) to the mass flow, volume flow, density, concentration, temperature, or component measurement.

— NOTE

The alarm must have been configured to affect the digital output in **1Setup > 2Measure** above.

   - Set the output response in case of an alarm condition (**4ALRMRSP**) to the highest output, lowest output or the output of the last reading.

Setting Concentration Measurement Parameters

Steps Required

1. Specify the units of concentration.
2. Specify the component to be measured as **A** or **B** (if applicable).
3. Configure any concentration alarms.
4. Configure the format of your local display for concentration measurement.
5. If required, define the component specified in Step 2.

Procedure

1. In the **1 SETUP --> 2 MEASURE --> 3CONCENT --> 4 UNITS** parameter specify the concentration units as **% by wt**, **% by volume**, **BRIX**, or **BAUME**.

2. If you selected **% by wt** or **% by volume**, the component to be measured is determined in **4 COMP**. The component can be specified as **A** or **B**. Component A is usually defined as the liquid component and Component B as the gaseous component. The definition of the components is established in Step5.
3. The configuration of concentration format is determined in **4 FORMAT**. Select a format that provides the desired precision without yielding excessive flickering of the less significant digits. The displayed value can also be damped. See “Display” on page 51.
4. The configuration of concentration alarms is determined in **4 ALARMS**. This parameter has several subparameters:
   - **5 ALARM** can be configured to set the alarm feature **off**, **hi alarm**, **lo alarm**, or **both**.
   - **5HISETPT** and **5LOSETPT** is used to establish the high and low alarm set point values.
   - **5DEADBND** is used to establish the alarm deadband value.
   - **5ALRMOUT** is used to establish whether the alarm is to affect the digital output (**DOUT**) and/or the **DISPLAY**. You can answer **yes** or **no** to each.
5. If you specified your component as **A** or **B** in Step 2, you must now define the component. To do so, go to **1 SETUP --> 2 CALIB --> 3 FLUID --> 4 COMP (A or B)**. This parameter has several subparameters:
   - In **5 NAME**, specify the name of the component in 8 alphanumeric characters or less.
   - In **5DENSITY**, specify the density of the component in units specified in “Density” on page 46.
   - In **5TEMPCO**, specify the temperature coefficient (change in density per unit temperature; for example: lb/ft3/°F) in the density units selected in“Density” on page 46 and the temperature units selected in “Temperature” on page 47.
   - In **5TEMPREF**, specify the reference temperature in units specified in “Temperature” on page 47.

Using the HART Communicator

The Setup mode enables you to configure your measurement, output, identifier, test, calibration, and system parameters. Setup mode can be a passcode protected mode. So after the initial configuration, you may need a password to enter this mode. This is also 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 asked if you want to do so. Indicate 'yes' with the Enter key.

— NOTE

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

The Setup Flowchart is shown in Figure 30.

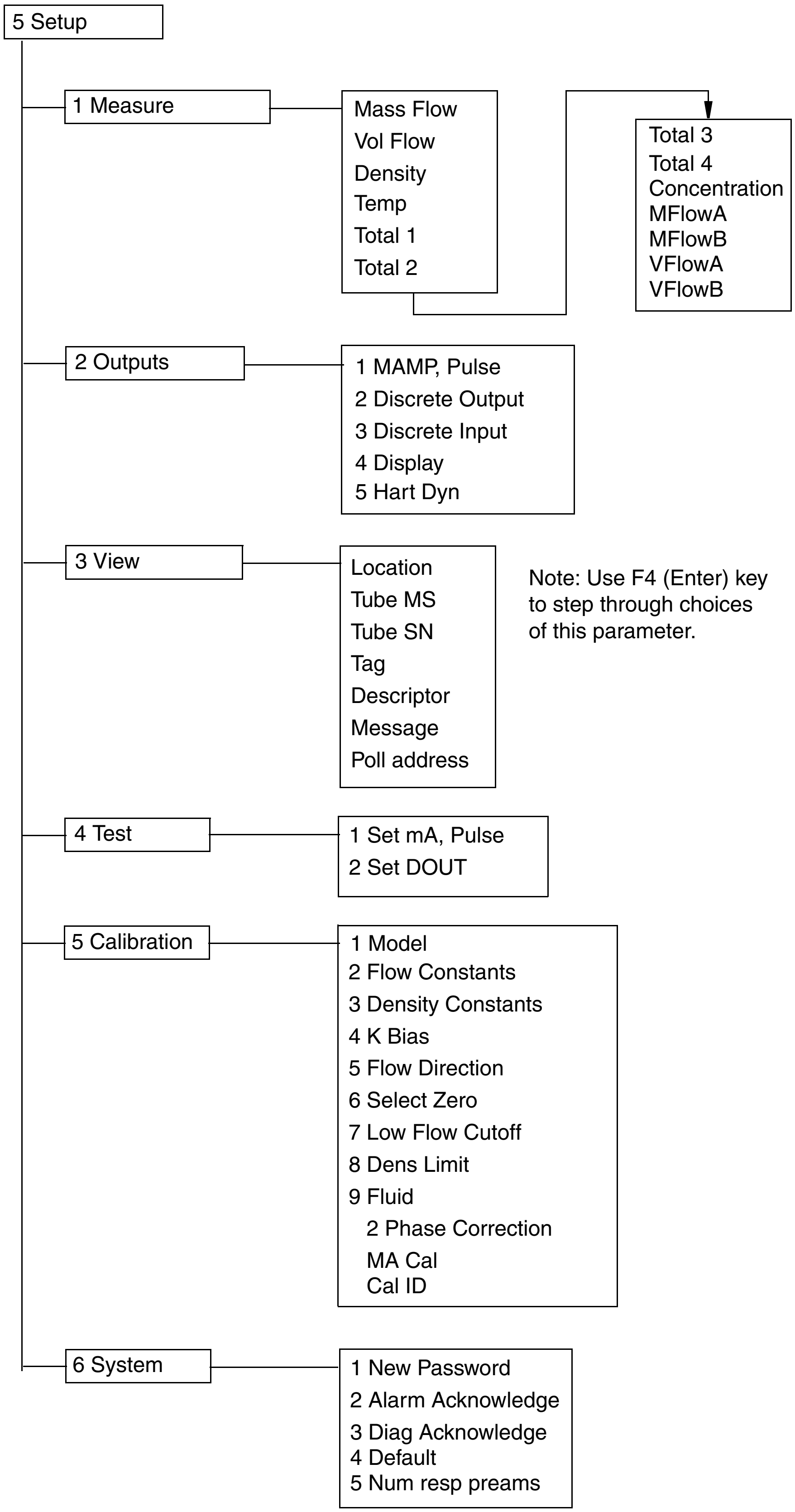


Figure 30. Setup Flowchart

Explanation of Setup Parameters

Parameter	Explanation
Setup Measure	
Mass Flow	Used to configure the mass flow parameters
Vol Flow	Used to configure the volume flow parameters
Density	Used to configure the density parameters
Temp	Used to configure the temperature parameters
Total 1, Total 2, Total 3, Total 4	Used to configure the total 1, total 2, total 3, and total 4 parameters
Concentration	Used to configure the concentration parameters (including naming Component A and B)
MFlowA, MFlowB, VFlowA, VFlowB	Used to configure the MFlowA, MFlowB, VFlowA, and VFlowB parameters
Setup Outputs	
MAMP, Pulse	Used to configure the mA and pulse output parameters
Discrete Output	Used to configure the parameters of the contact output
Discrete Input	Used to configure the function of the contact input
Display	Used to configure the transmitter display parameters
Hart Dyn	Used to configure the HART Dynamic parameter.
Setup Identifiers	
Location	Used to specify the location
Tube MS	Used to specify the tube model number
Tube SN	Used to specify the tube serial number
Tag	Used to specify the tag identifier
Descriptor	Used to specify the HART descriptor
Message	Used to specify the HART message
Poll Address	Used to specify the polling address
Setup Test	
Set mA, Pulse	Used to set transmitter output to calibrate other instruments in the control loop
Set DOUT	Used to set transmitter output to calibrate other instruments in the control loop
Setup Calibrations	
Model	Used to select the flowtube size and material
Flow Constants	Used to enter the flowtube flow constants
Dens Constants	Used to enter the flowtube density constants
K Bias	Used to set the K-Bias
Flow Direction	Used to specify positive or negative readings in relation to the direction of flow through the flowtube
Select Zero	Used to select the primary or secondary zero and zero the transmitter

Parameter	Explanation
Low Flow	Used to set the low flow cut-off
Dens Limit	Used to set the density limit below which mass flow measurement is zero.
Fluid	Used to establish the definition of component A and B.
2 Phase Compensation	Used to produce flow compensation in 2-phase applications for greater accuracy in many cases
mA Cal	Used to trim the mA output of the transmitter to match the calibration of a receiving device if necessary
Cal ID	Used to enter the date of the last calibration and the calibrator's name
Setup System	
New Password	Used to initially enter or change passwords
Alarm Acknowledge	Used to establish alarm acknowledge as auto or manual
Diag Acknowledge	Used to establish diag acknowledge as auto or manual
Default	Used to rewrite all calibration and configuration values with factory default values
Num resp preams	Used to set the number of preamble characters that the transmitter sends at the start of each HART response message

— NOTE

If a reading is displayed in Setup with too many digits, the message 'exceeds precision' is displayed. If this happens, enter blanks for the blinking digit and any digit to its right. For example, if the number 0.0944387 is displayed with the 'exceeds precision' message and the 8 is blinking, enter blanks for the 8 and 7.

6. Troubleshooting

Error Codes

When a diagnostic condition exists, an error code is displayed in Status mode. Table 11 gives an explanation of these codes. For more information on Status mode, see “Status Mode” on page 25.

Table 11. Error Codes

Log Error Code	Displayed Diagnostic Message	Description
200	No Signal	Problem with first tube input sensor due to wiring or failure.
201	No Signal	Problem with second tube input sensor due to wiring or failure.
202	No Signal	Problem with first drive output due to wiring or failure.
203	No Signal	Problem with second drive output due to wiring or failure.
204	RTD Open	RTD resistance is out of range, there is a wiring error, or the electronics have failed.
205	Gain Exceeded	Flowtube cannot be controlled.
P#	Change Setup	A parameter is out of range. See Table 12.

Table 12. Parameter Number Error Codes

Error Code	Description
P128	Incorrect K-Bias

Also, if the display reads 9999999, the format needs correcting.

Fault Location

The fault conditions referenced in Tables 13 through 16 may be present with or without any diagnostic error message on the local display, HART Communicator, or PC-Based Configurator.

Table 13. No/Incorrect Flow Measurement

Symptom	Possible Cause	Items to Check	Possible Solution	Reference
No flow or incorrect mass flow measurement when flowing	Incorrect configuration data entered	Flow Constants (**FC1**, **FC2**, **FC3**) and flowtube model data (**MODEL**)	Make sure that **FC2** is the same as that found on flowtube data plate with special.attention to sign, exponent sign and value. If FC2 is correct but FC1 and FC3 are wrong, enter correct flowtube **MODEL** data.	"Flow Constants" on page 53
		K-Bias (**KBIAS**)	Nominal K-Bias is 1.0.	"K-Bias" on page 55
		Fluid Density in regards to fluid density limit (**DENS LIM**)	Enter a lower density limit.	"Density Limit" on page 56
		Flow in regards to Low Flow Cut-Off level (**LOWFLOW**)	Increase flow or lower low flow cut-off level.	"Low Flow Cut-Off" on page 56
	Incorrect temperature measurement	Transmitter junction box terminals 1-4 Flowtube terminal box wiring	Correct wiring problems (correct color wire on each terminal) (terminal clamped on insulation?).	"Flowtube Wiring Connections" on page 12 Also MI 019-120
	Flowtube drivers or sensors not working properly	**TUBFREQ**, **SENSAMP**, and **DRIVE 1** in Status mode	**TUBFREQ** = 50-110 Hz, **SENSAMP** ≠ 0, **DRIVE I** < 85 mA.	"Flowtube Wiring Connections" on page 12 Also MI 019-120.
	Existing flowtube calibrated for a CFT10 or CFT15 transmitter	Flow measurement off by <1%	Perform in situ calibration and adjust K-Bias.	"K-Bias" on page 55
	Improper flowtube mounting	Flowtube mounting or support not per recommendations	Correct mounting issues.	MI 019-120
	2-phase (gas/liquid) present	Is 2Φ symbol displayed	Configure 2-phase flow	"2 Phase" on page 57
Volume flow incorrect but mass flow correct	Incorrect density measurement	See "Incorrect density measurement" on page 67		
Volume flow incorrect but density correct	Incorrect mass flow measurement	See "No flow or incorrect mass flow measurement when flowing" on page 66		

Table 13. No/Incorrect Flow Measurement (Continued)

Symptom	Possible Cause	Items to Check	Possible Solution	Reference
Negative flow measurement with positive flow	Incorrect configuration	Flow direction (**FLOWDIR**)	Change **FLOWDIR** configuration.	“Flow Direction” on page 55
	Flowtube mounting	Arrow on flowtube points in correct direction	Install flowtube so arrow points in direction of positive flow.	MI 019-120
	Driver wiring incorrect	Transmitter junction box terminals 9-12 Flowtube terminal box wiring	Correct wiring problems (correct color wire on each terminal) (terminal clamped on insulation?)	“Flowtube Wiring Connections” on page 12 Also MI 019-120
Incorrect density measurement	Incorrect configuration	Density Constants (**DC1**, **DC2**, **DC3**, **DC4**) and model data (**MODEL**)	Make sure that **DC2** and **DC4** is the same as that found on flowtube data plate with special.attention to sign, exponent sign and value. If **DC2** and **DC4** are correct but **DC1** and **DC3** are wrong, enter correct flowtube **MODEL** data.	“Density Constants” on page 54
	Incorrect temperature measurement	Transmitter junction box terminals 1-4 Flowtube terminal box wiring	Correct wiring problems (correct color wire on each terminal) (terminal clamped on insulation?).	“Flowtube Wiring Connections” on page 12 Also MI 019-120
	Flowtube drivers or sensors not working properly	**TUBFREQ**, **SENSAMP**, and **DRIVE 1** in Status mode	**TUBFREQ** = 50-110 Hz, **SENSAMP** ≠ 0, **DRIVE 1** < 85 mA.	“Flowtube Wiring Connections” on page 12 Also MI 019-120
	2-phase (gas/liquid) present	Is 2Φ symbol displayed	Configure 2-phase flow	“2 Phase” on page 57

Table 13. No/Incorrect Flow Measurement (Continued)

Symptom	Possible Cause	Items to Check	Possible Solution	Reference
Flow measurement not zero at zero flow	Incorrect configuration	Transmitter not zeroed at zero flow condition	Zero the transmitter.	“Quick Start” on page 15
	Improper flowtube mounting	Flowtube mounting or support not per recommendations	Correct mounting issues.	MI 019-120
	Flowtube partially full at zero flow	Fluid Density in regards to fluid density limit (**DENS LIM**)	Configure density limit between displayed value and expected flowing density.	“Density Limit” on page 56
	Wrong zero selected	Is **SELZERO** primary (1) or secondary (2)	Select proper zero and rezero	“Zeroing the Transmitter” on page 55
Flowtube making a noise	Sensor wiring broken, disconnected, or connected incorrectly	Transmitter junction box terminals 5-8 Flowtube terminal box wiring	Correct wiring problems (correct color wire on each terminal) (terminal clamped on insulation?).	“Flowtube Wiring Connections” on page 12 Also MI 019-120
Display reads No Signal or RTD Open or Gain Exceeded	Incorrect wiring between the transmitter and flowtube	Error code displayed in Status mode	Correct wiring problems.	“Error Codes” on page 65; “Flowtube Wiring Connections” on page 12; Also MI 019-120

Table 14. Milliampere and Frequency Output Problems

Symptom	Possible Cause	Items to Check	Possible Solution	Reference
Output not responding to measurement	Output wiring incorrect	dc power is connected?	Provide external dc power at Terminal 5.	"Input/Output Wiring" on page 7
		Wiring matches output signal code?	Correct wiring issue.	"Input/Output Wiring" on page 7
	Improper configuration	Measurement mapping to output	Correct output configuration.	"Setting Output Parameters" on page 48
	An alarm or diagnostic condition exists	Current output stays at 3.6 or 21 mA? Pulse output stays at low, high, or last value? Contact output is active?	Correct alarm or diagnostic condition. Acknowledge condition (if configured for manual acknowledge).	"Status Mode" on page 25

Table 15. HART Communication Problems

Symptom	Possible Cause	Items to Check	Possible Solution	Reference
Communication Problems when using a HART Communicator or PC-Based Configurator	Not enough load in loop	Loop load	Increase loop load to 250 ohms minimum.	"Current Outputs" on page 9

Table 16. Display Problems

Symptom	Possible Cause	Items to Check	Possible Solution	Reference
Display reads all 9s	Incorrect configuration	Measured value exceeds configured format	Increase format to provide sufficient digits to the left of the decimal point to encompass the measurement range.	"Setting Measure Parameters" on page 43
Display blinking	Alarm or diagnostic condition	Status menu for alarm or diagnostic information	Correct alarm or diagnostic condition. Acknowledge condition (if configured for manual acknowledge).	"Status Mode" on page 25

7. Maintenance

It is not possible to do field repair of the electronics of the CFT50 other than replacing the display module. When it has been determined that the main electronics module of the transmitter has failed, service at the factory is required. Do **not** remove the electronics module from its housing. Disconnect the transmitter from the flowtube wiring and remove from its mounting bracket by removal of the bracket bolt. Contact the Invensys Foxboro Customer Service Center at 1-866-746-6477 or isp.csc@invensys.com.

Appendix A. Setup Diagrams

This appendix contains structure diagrams that illustrate the Setup menu structure of the CFT50 Transmitter with HART communications and show how you can use the local display and keypad to get from one point to another in the structure. These diagrams can be invaluable tools in configuring your transmitter.

NOTE
Certain parameters may be missing as you step through the menus depending on the output signals specified for your transmitter.

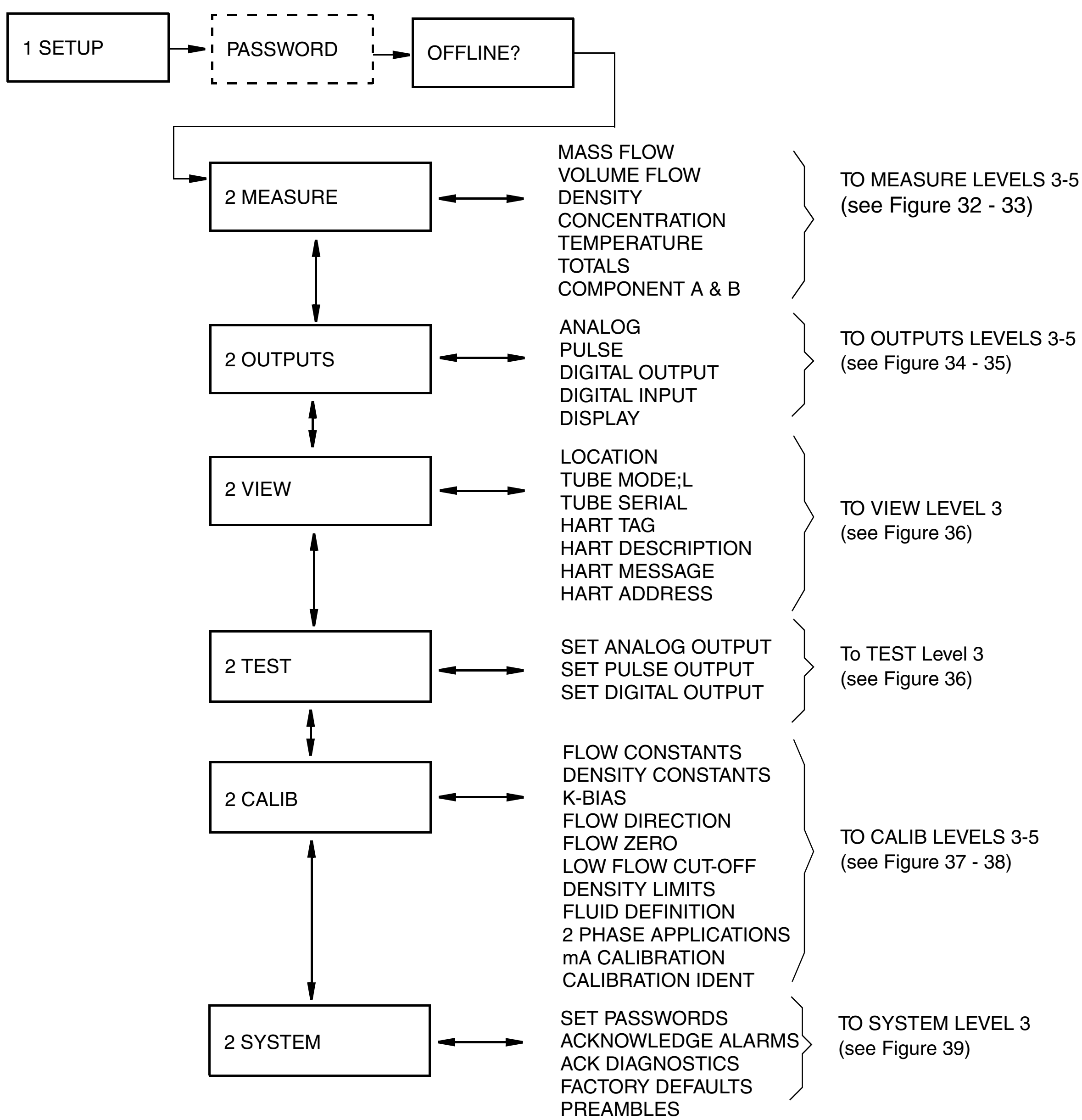


Figure 31. Level 2 Setup Menu Structure

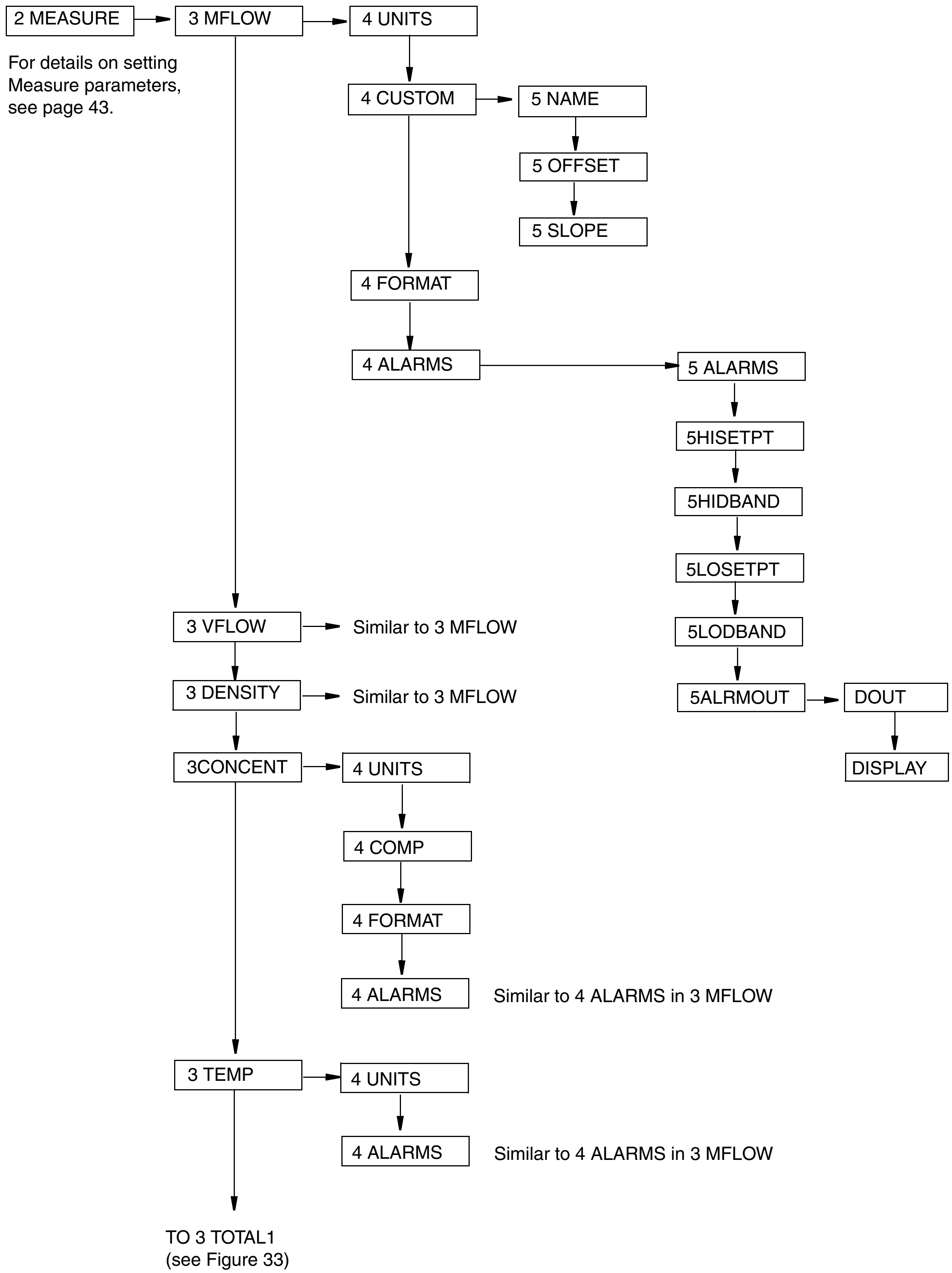


Figure 32. Level 3 Setup Measure Structure

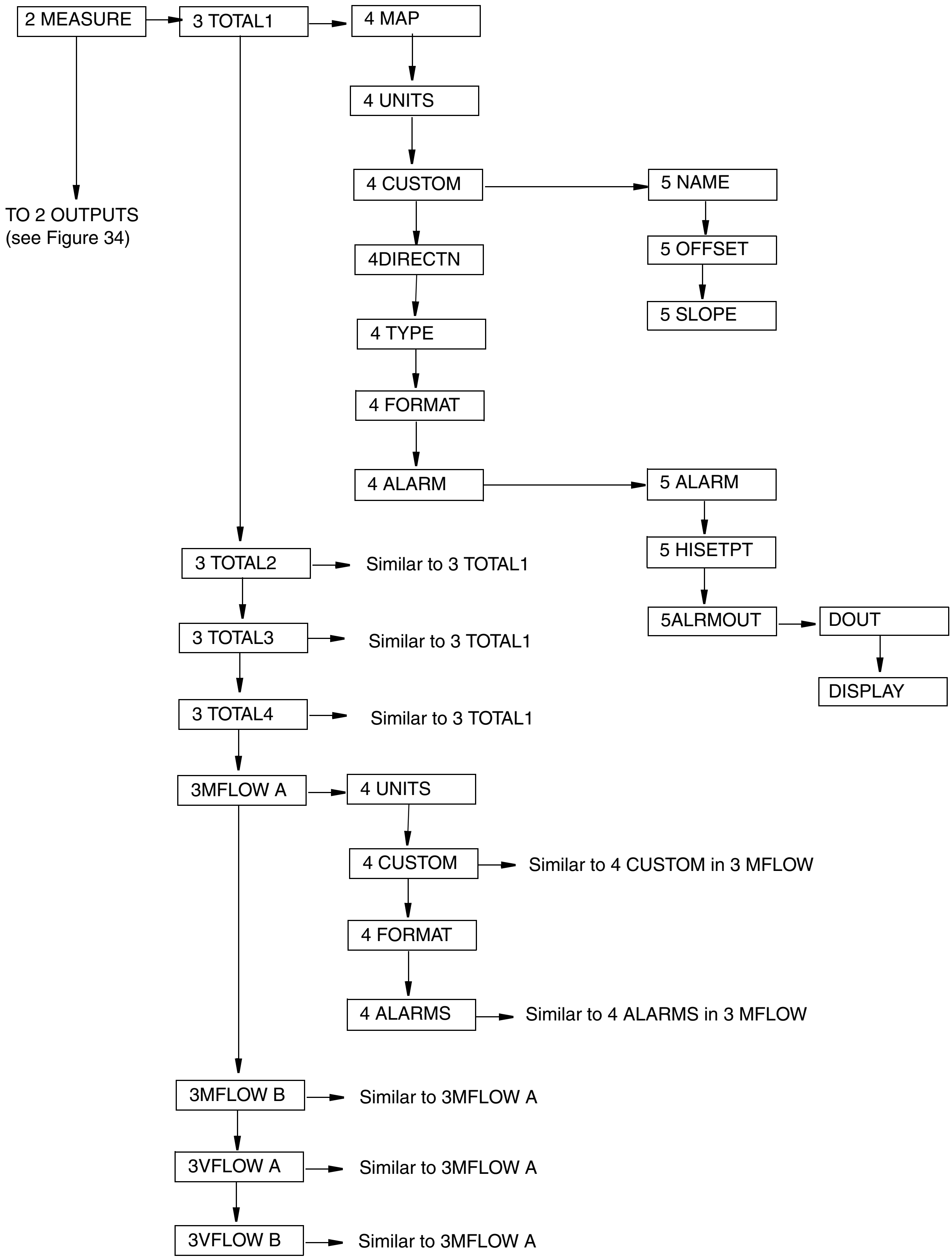


Figure 33. Level 3 Setup Measure Structure (Continued)

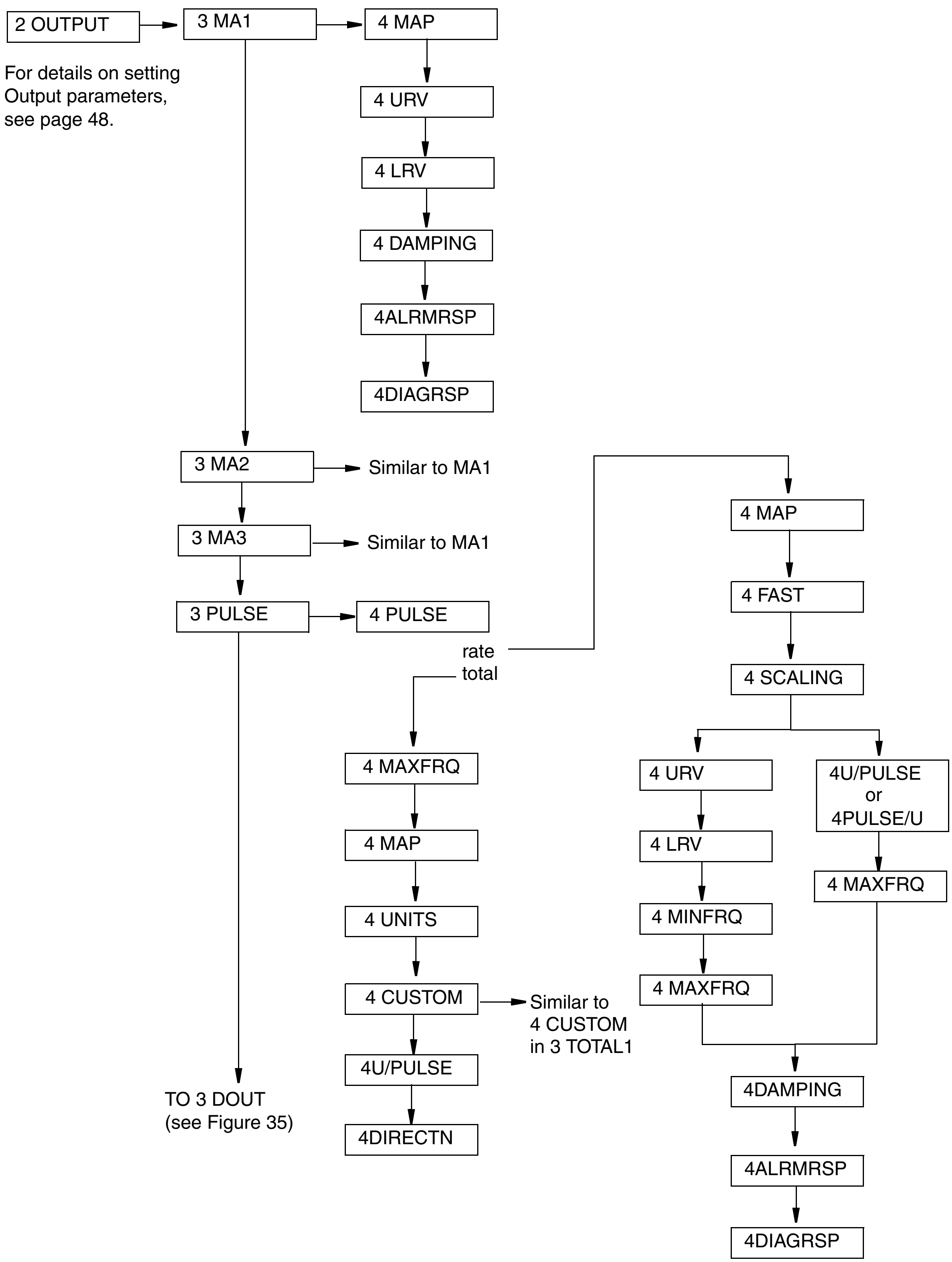


Figure 34. Level 3 Setup Output Structure

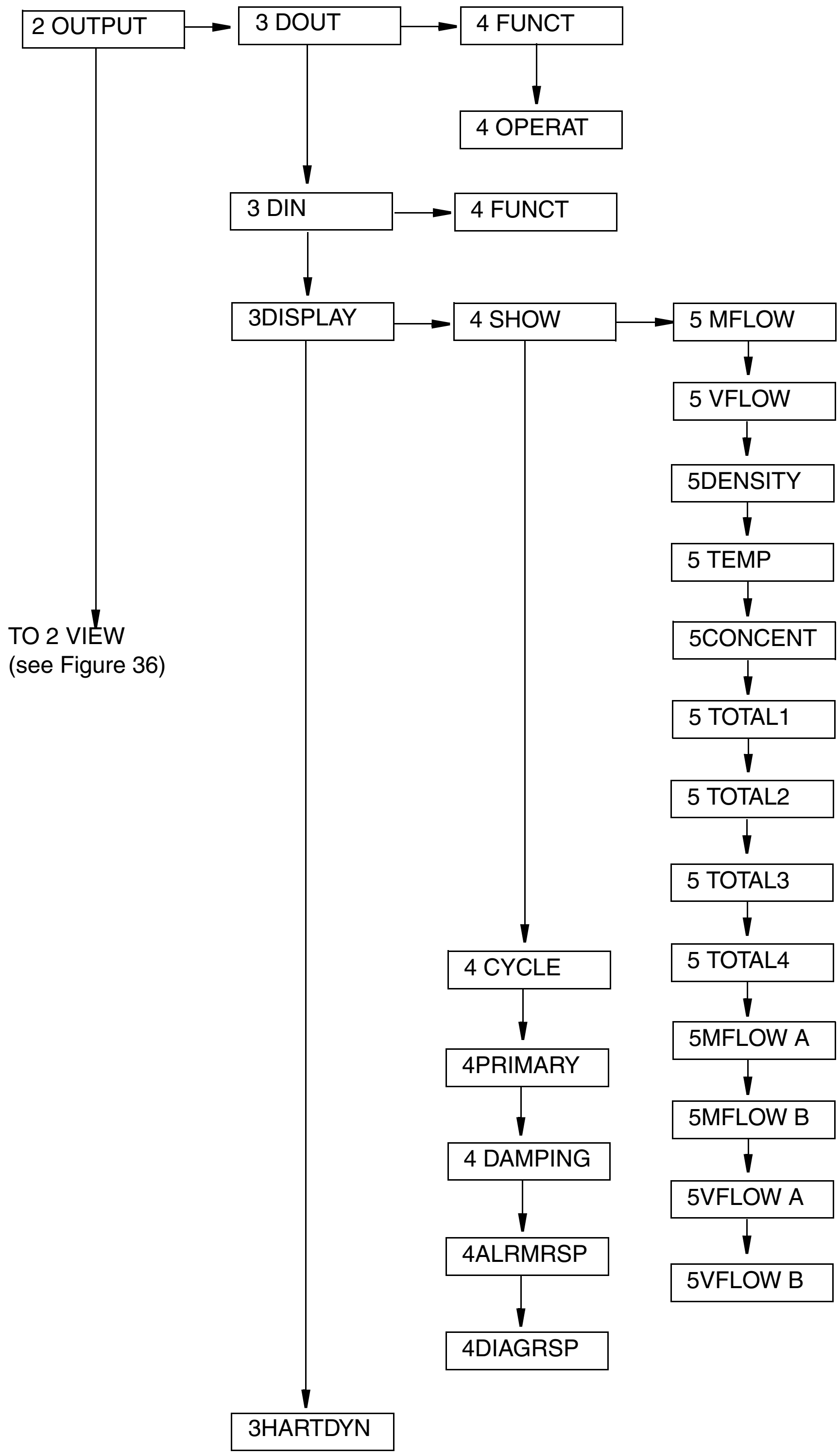
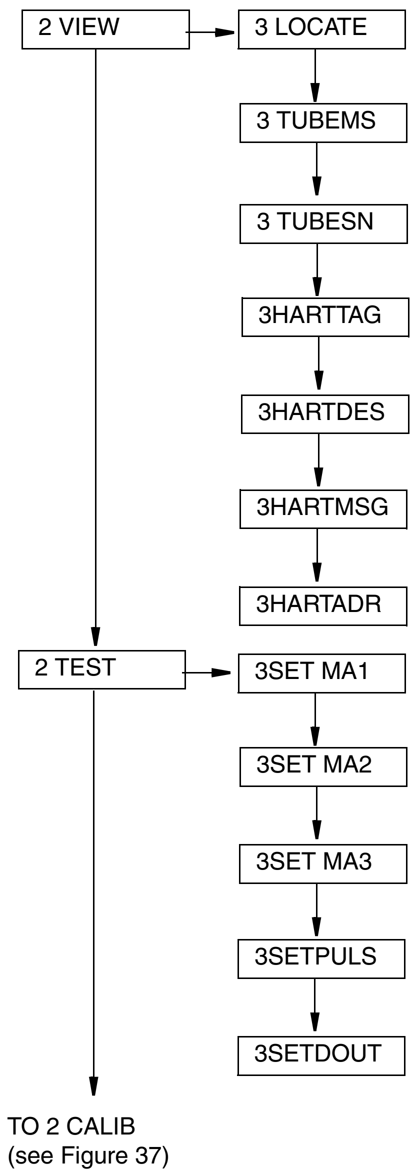


Figure 35. Level 3 Setup Output Structure (Continued)



For details on setting View parameters, see page 52.

For details on setting Test parameters, see page 53.

Figure 36. Level 3 View and Test Structure

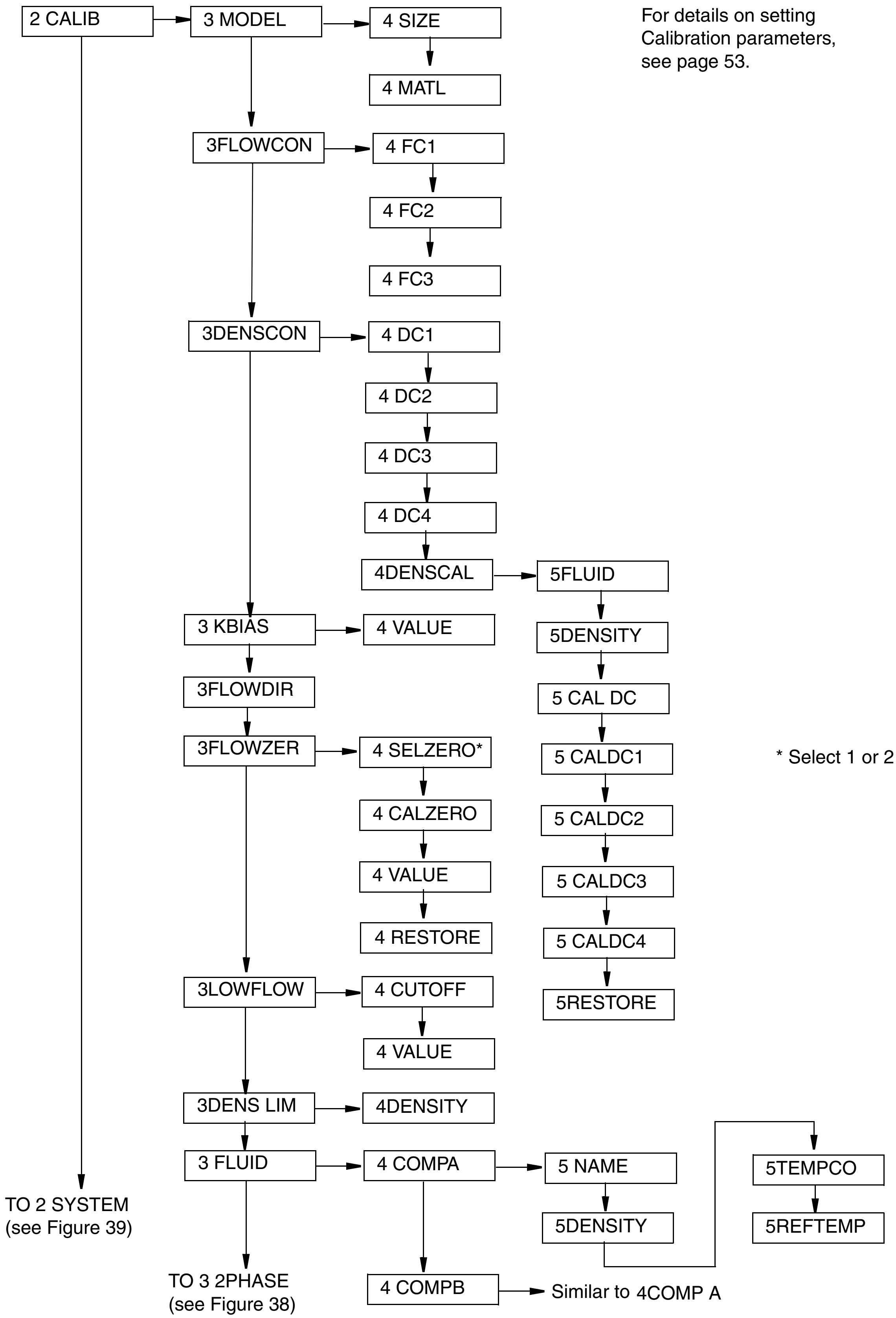


Figure 37. Level 3 Calibration Structure

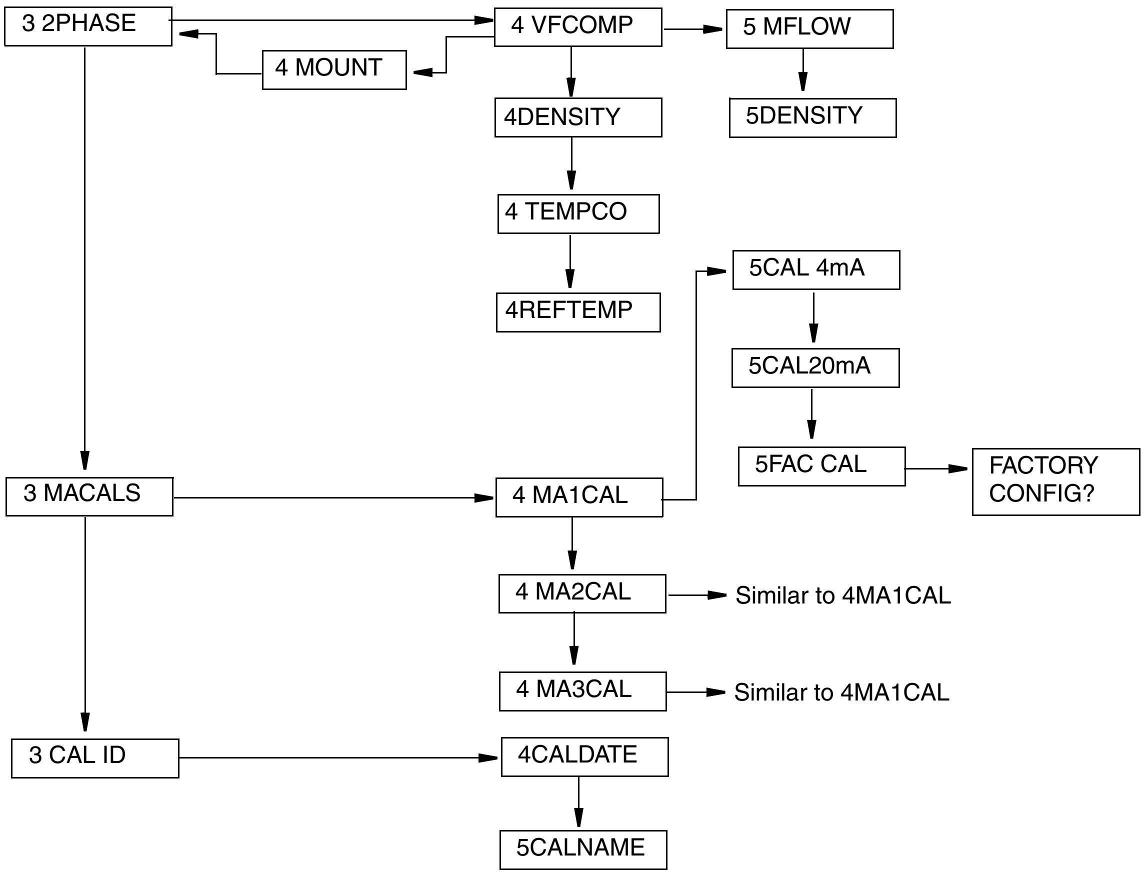


Figure 38. Level 3 Calibration Structure (Continued)

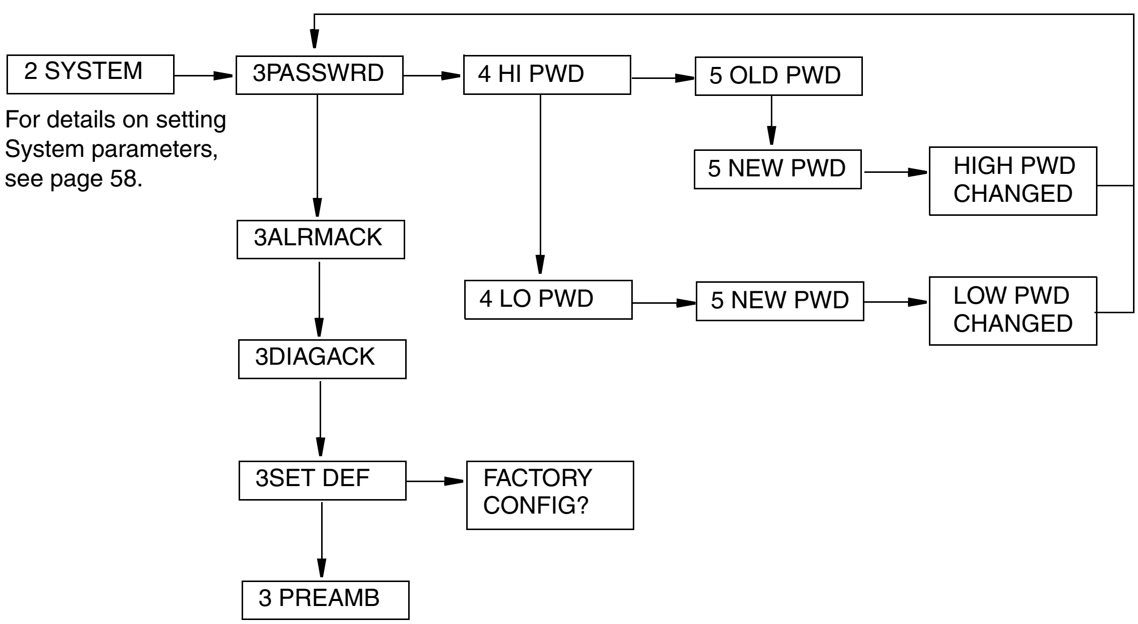


Figure 39. Level 3 System Structure

Appendix B. Custom Slopes

This appendix contains the custom slopes for frequently used units.

Mass Flow

Table 17. Mass Flow Custom Slope

Unit	Conversion	Slope
LTon/hr*	3.5424 LTon/hr = 1 kg/s	3.5424
Tonne/hr**	3.6 Tonne/hr = 1 kg/s	3.6

*Long Ton/hour
**Metric Ton/hour

Volume Flow

Table 18. Volume Flow Custom Slope

Unit	Conversion	Slope
ft^3/min	2.11888 ft^3/min = 1 L/s	2.11888
m^3/min	0.06 m^3/min = 1 L/s	0.06000
bbl/min*	0.37739 bbl/min = 1 L/s	0.37739

*42 gallon barrel

Density

Table 19. Density Custom Slope

Unit	Conversion	Slope
oz/gal	0.13352 oz/gal = 1 g/L	0.13352

Totals

Table 20. Totals Custom Slope

Unit	Conversion	Slope
lb (troy)	2.67921 lb (troy) = 1 kg	2.67921
bbl*	$6.2898x10^{-3}$ bbl = 1L	0.00629

*42 gallon barrel

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