

Instruction Manual

P/N 3300992, Rev. C

November 2003

Micro Motion[®] Series 3000

Detailed Setup Manual



Micro Motion[®]

Series 3000

Detailed Setup Manual

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1

Before You Begin

1.1 About this manual

This manual explains how to use the Series 3000 software to configure, operate, and maintain the Model 3300, 3350, 3500, and 3700 applications platforms.

This manual provides information about the following applications:

- Model 3500 or 3700 transmitter
- Discrete batch control
- Process and inventory totalizers
- Process monitor
- Process comparator
- Security for custody transfer

This manual does not provide information about the Series 3000 Net Oil Computer or the density application.

- For information about the Net Oil Computer, see the *Series 3000 Net Oil Computer Manual*.
- For information about the density application, see the *Series 3000 Density Application Manual*.

This manual does not explain installation or wiring. For information about installation and wiring, see the *Series 3000 Installation Manual*.

1.2 Organization

This manual is organized as follows:

Part 1: Introduction, includes Chapters 1 and 2.

- **This Chapter** outlines the contents of this manual.
- **Chapter 2** explains how to use the Person-Process Interface.

Part 2: Configuration, includes Chapters 3 through 9.

- **Chapter 3** explains how to configure system data.
- **Chapter 4** explains how to configure inputs.
- **Chapter 5** explains how to configure the discrete batch control application.
- **Chapter 6** explains how to configure measurement parameters.
- **Chapter 7** explains how to configure outputs.
- **Chapter 8** explains how to configure monitoring.
- **Chapter 9** explains how to configure digital communication.

Part 3: Security and Language, includes Chapters 10 and 11.

- **Chapter 10** explains how to configure security and select the language for Person-Process Interface displays.
- **Chapter 11** explains how to enable security for custody transfer.

Part 4: Operation and Diagnostics, includes Chapters 12 through 14.

- **Chapter 12** explains how to use the software in operation mode.
- **Chapter 13** explains how to use the diagnostic software.
- **Chapter 14** explains how to read inputs and set outputs.

Part 5: Maintenance, includes Chapters 15 through 18.

- **Chapter 15** explains how to use the active alarm log.
- **Chapter 16** explains how to monitor and reset totalizers.
- **Chapter 17** explains how to perform calibration and trim procedures.
- **Chapter 18** explains how to enter meter factors for proving applications.

1.1 Appendixes

Appendix A provides software diagrams for all software menus described in this manual.

Appendix B is the Series 3000 software configuration record. Use it to record parameters that will be configured as you follow the instructions in Chapters 3 through 9.

2

Person-Process Interface

2.1 About this chapter

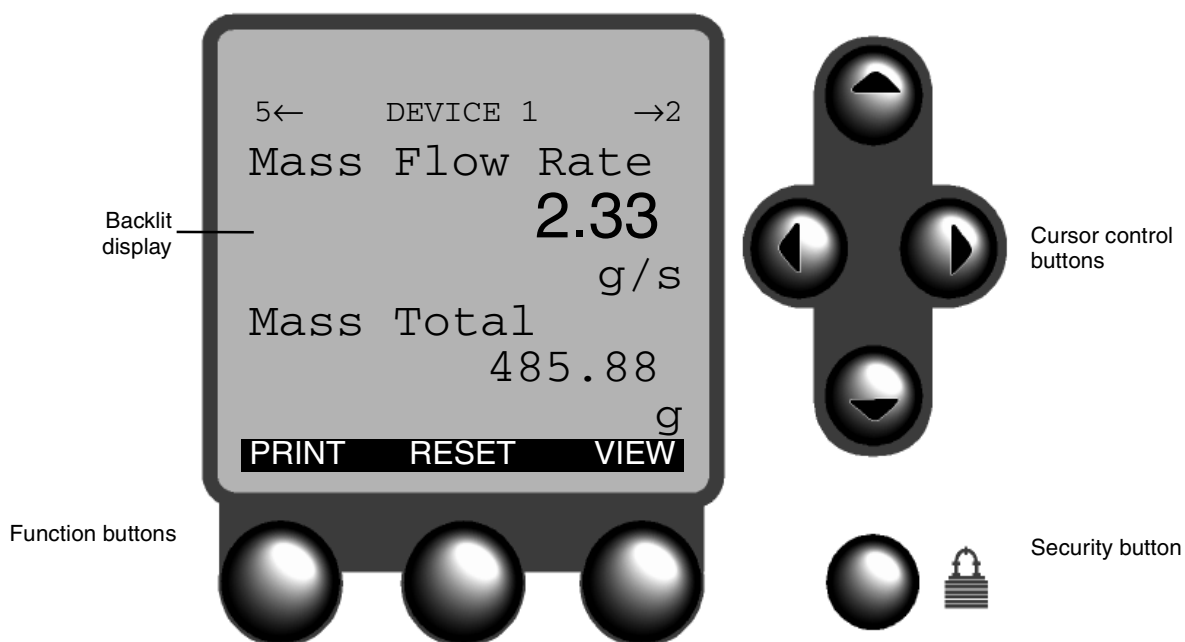
This chapter explains how to use the security button, function buttons, and cursor control buttons on the display face.

2.2 Person-Process Interface

Figure 2-1 shows the Person-Process Interface. Use the interface to:

- Configure the application
- Monitor and control the application
- Perform maintenance and diagnostic tasks

Figure 2-1. Person-Process Interface



Security button

The security button is in the lower right of the interface, marked by an icon of a padlock.

- If security is disabled, press the security button to access the main menu. See **Figure 2-2**. When you set up the application for the first time, security will be disabled.
- If security has been enabled, you will be prompted to enter a password. See **Figure 2-3**. To enable security, see pages 63-64.

You can use the security button to return to the main menu or password entry screen. Press the security button once to return to:

- The main menu, shown in **Figure 2-2**, if security is disabled
- The password entry screen, shown in **Figure 2-3**, if security is enabled

At the main menu or password entry screen, press EXIT to return to the operation screen.

Figure 2-2. Pressing security button, security disabled

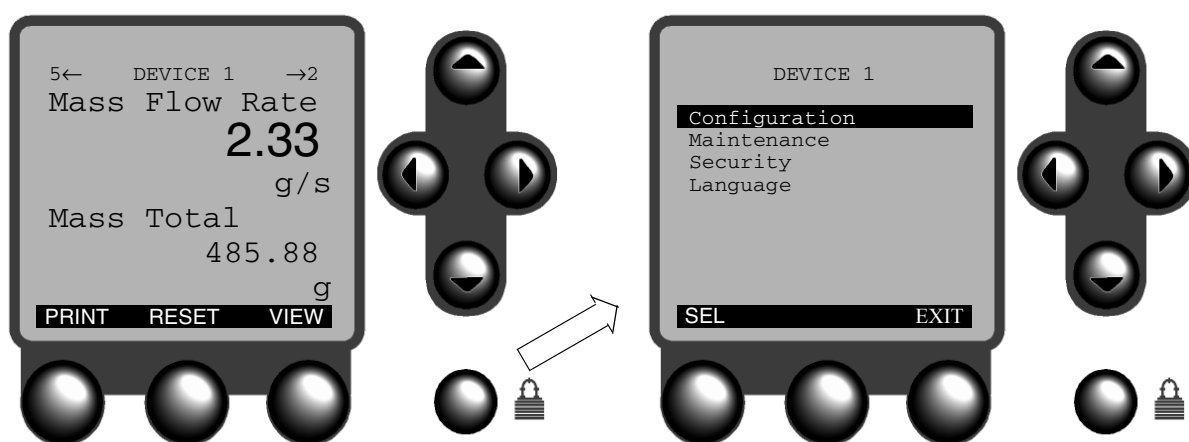
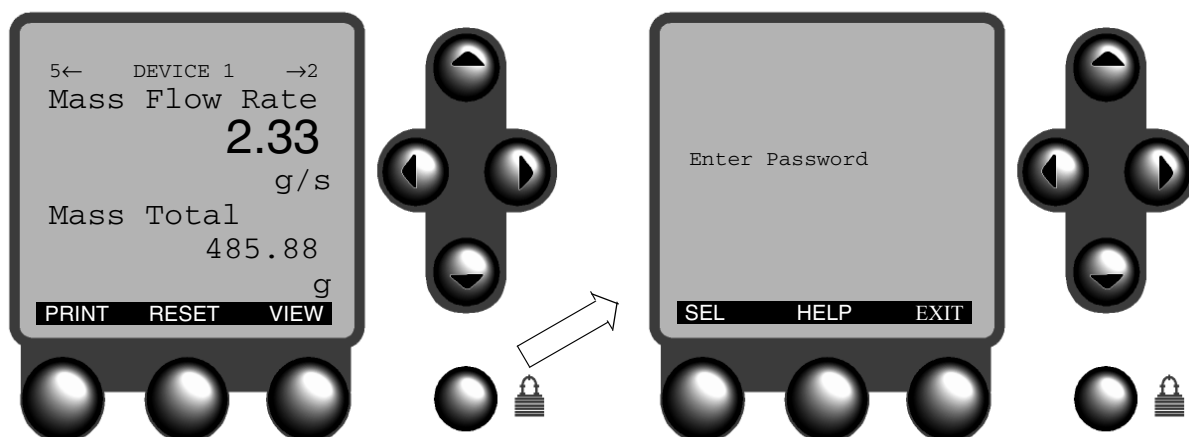


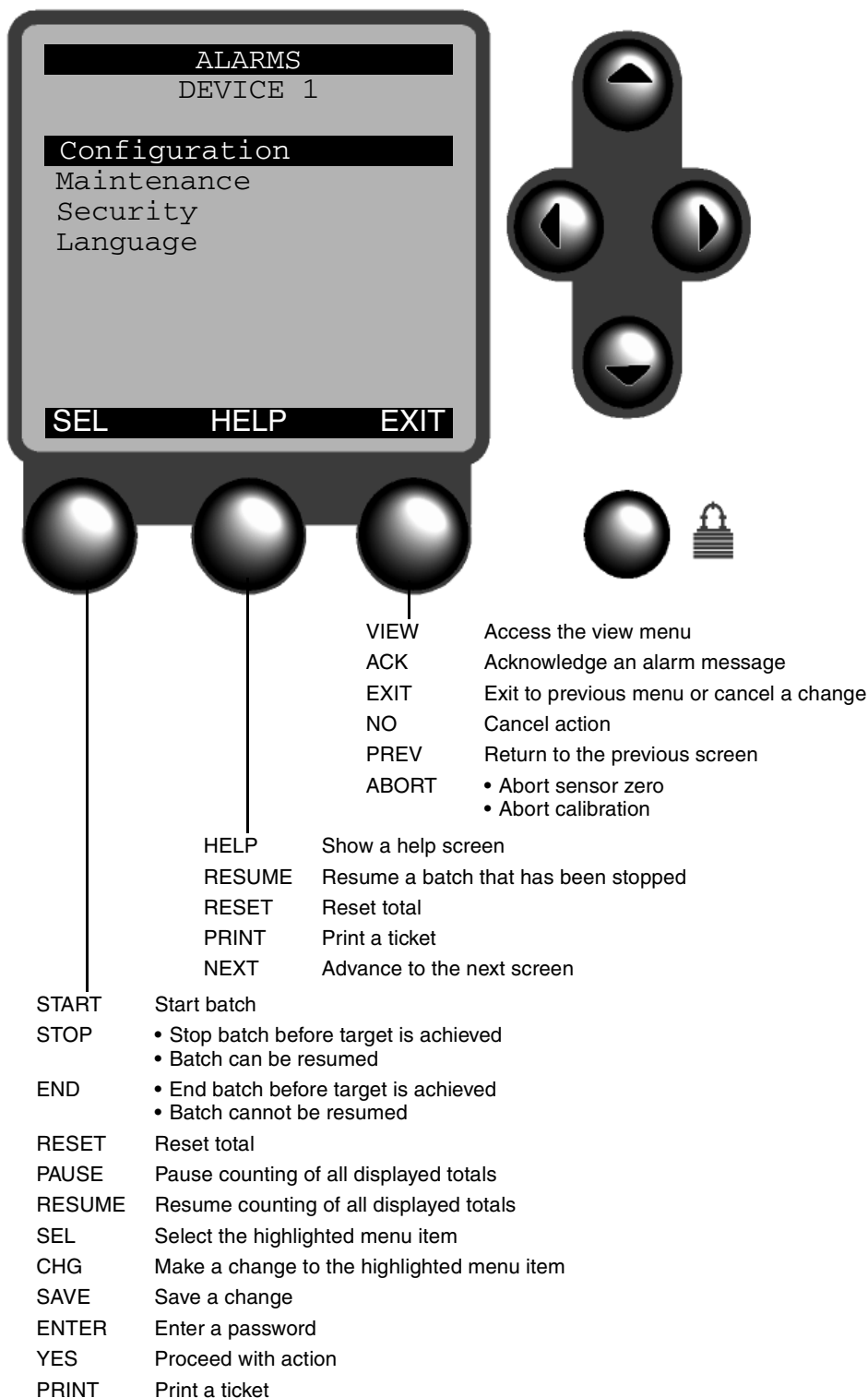
Figure 2-3. Pressing security button, security enabled



Function buttons

The pushbuttons below the display are the function buttons. The action each button performs appears above the button. See **Figure 2-4**.

Figure 2-4. Function buttons



Using cursor control buttons

The actions performed by the function buttons apply to the item at the cursor.

Figure 2-5, page 7, shows a typical configuration sequence involving both a menu item and a variable. Pressing HELP produces a screen that has help for the item at the cursor.

Menus

A menu is a list of items.

- The cursor is a reverse-video highlight bar.
- Use the up or down arrow buttons to locate the cursor at the menu item you want to select or change.
- After locating the cursor at the desired menu item, press CHG or the right arrow button to select the item.

Variables

After a menu item has been selected, the cursor enables you to enter or change a variable:

- The cursor appears as a line under a character.
- If the variable has a value of Yes or No, all arrows toggle between the two choices. Otherwise, press the up and down arrow buttons to increase or decrease the value of the character at the cursor.
- If the variable has more than one digit or character (like the slug low limit in the example), press the left and right arrow buttons to move the cursor to the next or previous character.
- When the variable is correct, press SAVE.
- If you wish to cancel the change, press EXIT before pressing SAVE. The interface will return to the previous screen without saving the changes.

Process monitor

In the process monitor, use the left and right arrows to scroll from one screen to the next or previous screen.

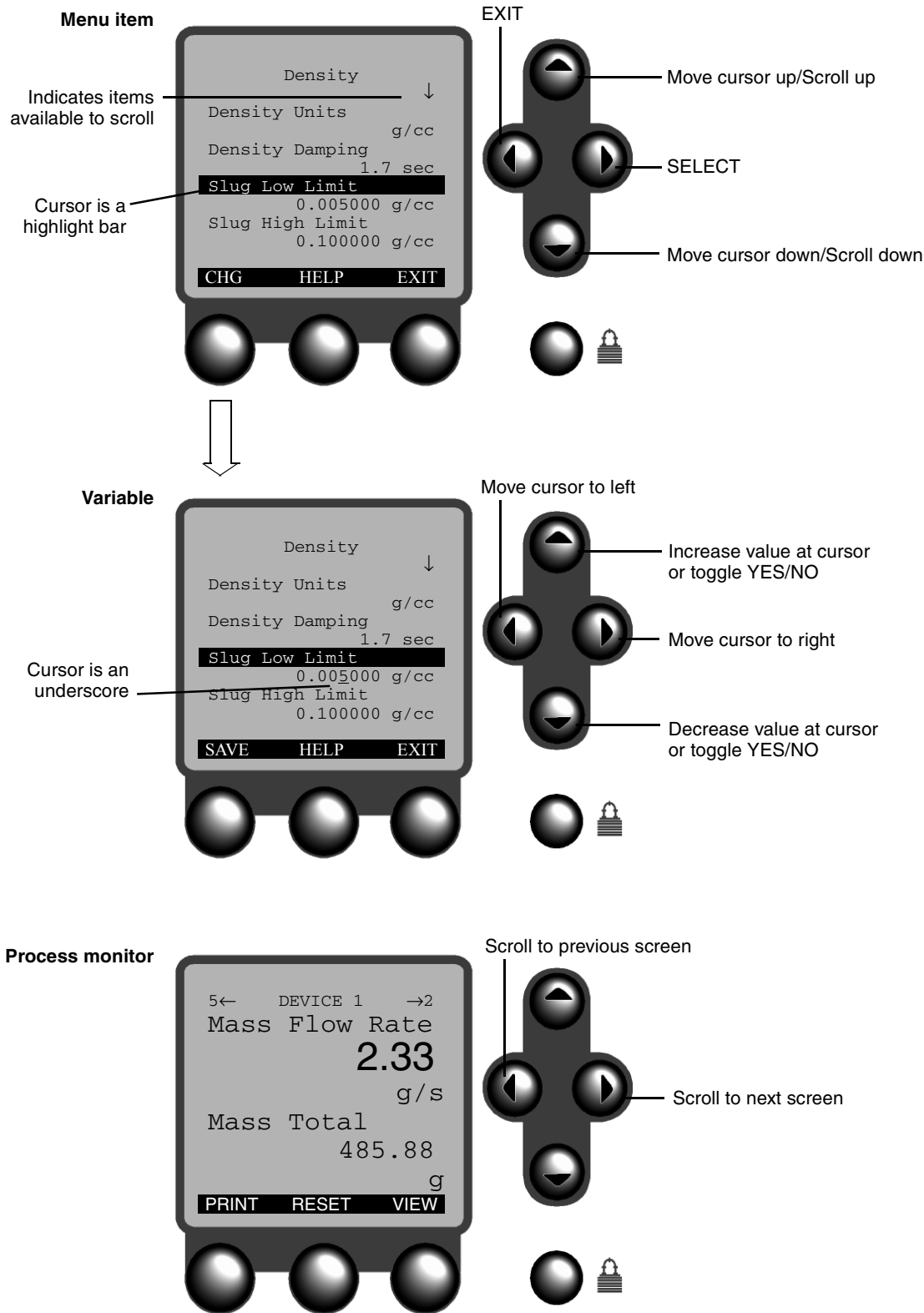
- Press the right arrow (→) to scroll to the next screen.
- Press the left arrow (←) to scroll to the previous screen.
- There are five screens.

To assign variables to each process monitor screen, see page 56.

2.3 Scientific notation

Scientific notation is used for displaying values that include 10 or more digits. For example, the value 123,400,000 would be displayed as 1.234+8.

Figure 2-5. Cursor control buttons



3

System Data

3.1 About this chapter

This chapter explains how to configure system data. System data include all the software parameters listed in **Figure 3-1**.

Failure to perform configuration tasks in the proper sequence could result in an incomplete configuration. Perform configuration tasks in the following sequence:

1. Configure system data.
2. Configure inputs (see **Chapter 4**).
3. Configure the discrete batch control application, if it is present (see **Chapter 5**).
4. Configure measurements (see **Chapter 6**).
5. Configure outputs (see **Chapter 7**).
6. Configure monitoring (see **Chapter 8**).
7. Configure digital communication (see **Chapter 9**).

⚠ CAUTION

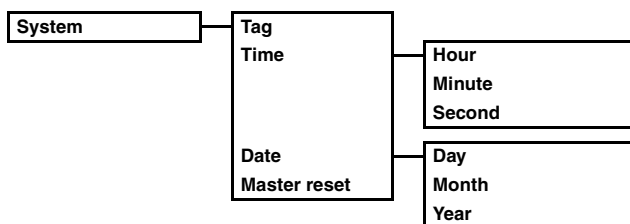
Selecting configuration will interrupt measurement and control functions. All outputs will go to their configured fault settings.

Set control devices for manual operation before accessing configuration menus.

3.2 Recording system data

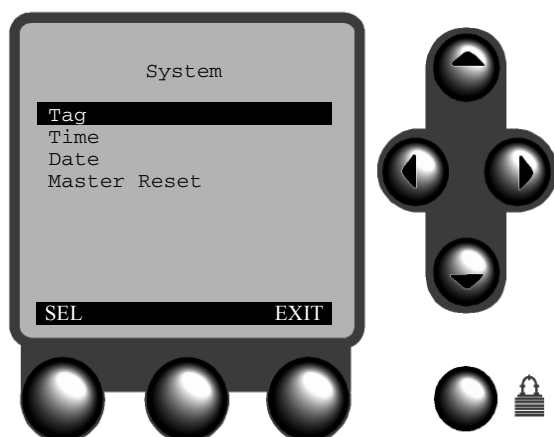
While you are configuring system data, record the data in the Series 3000 Series 3000 configuration record (**Appendix B**).

Figure 3-1. System menu



3.3 System data

Configuration
└ System



To configure system data:

1. Press the security button on the display face.
2. Select Configuration.
3. Select System.
4. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 3-1**.

Table 3-1. System parameters

Variable	Default	Description
Tag	Device 1	- Enter up to 8 digits and/or characters that uniquely identify this platform - The tag will appear on operation screens
Time	Current time	Enter 2 digits for hours, 2 digits for minutes, and 2 digits for seconds
Date	Current date	Enter 4 digits for the year, a character code for the month, and 2 digits for the day

4

Inputs

4.1 About this chapter

This chapter explains how to configure inputs. Inputs include all the software parameters listed in **Figure 4-1**, page 12.

Failure to perform configuration tasks in the proper sequence could result in an incomplete configuration. Perform configuration tasks in the following sequence:

1. Configure system data (see **Chapter 3**).
2. Configure inputs.
3. Configure the discrete batch control application, if it is present (see **Chapter 5**).
4. Configure measurements (see **Chapter 6**).
5. Configure outputs (see **Chapter 7**).
6. Configuring monitoring (see **Chapter 8**).
7. Configure digital communication (see **Chapter 9**).

CAUTION

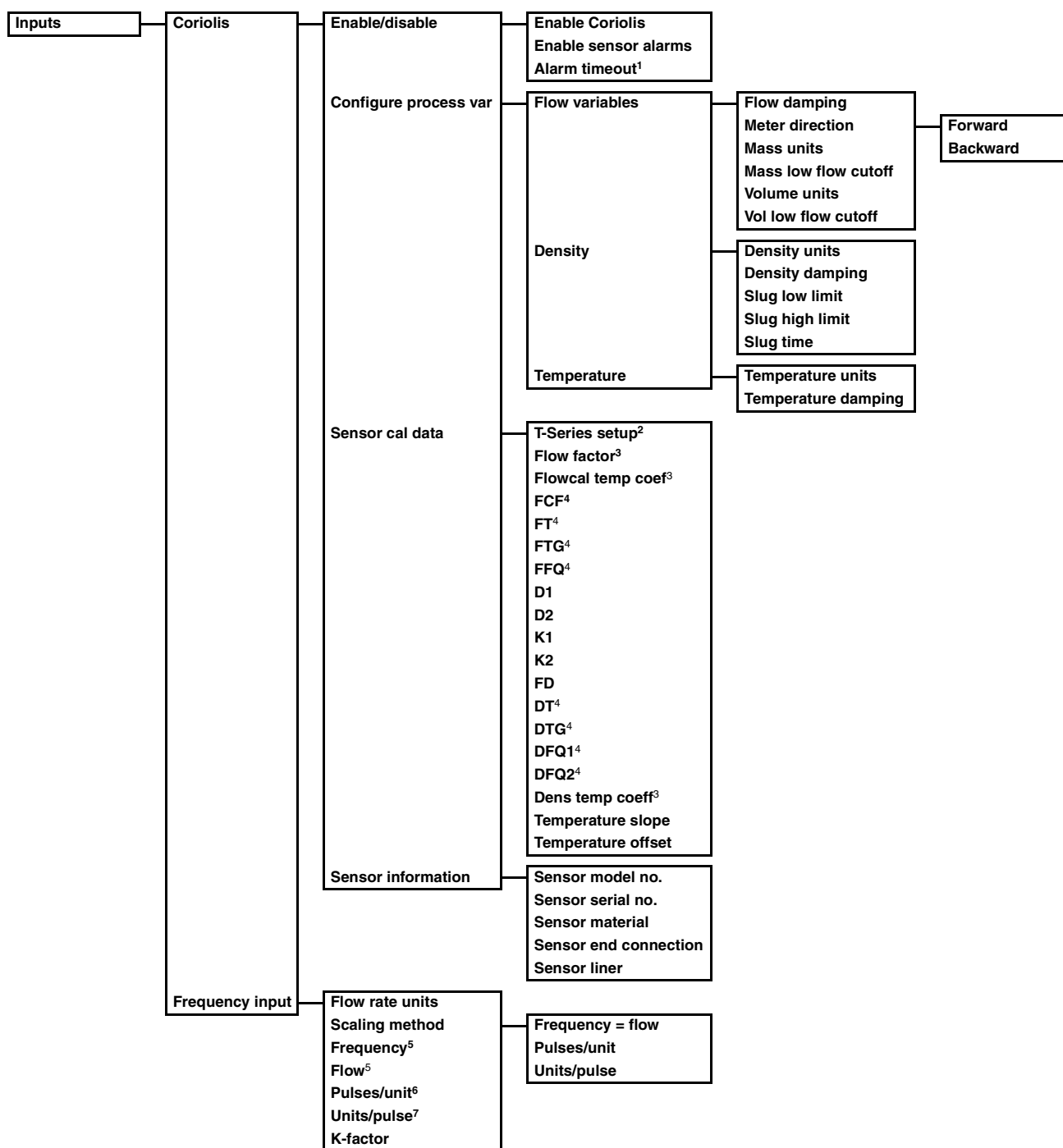
Selecting configuration will interrupt measurement and control functions. All outputs will go to their configured fault settings.

Set control devices for manual operation before accessing configuration menus.

4.2 Recording inputs

While you are configuring inputs, record them in the Series 3000 configuration record (**Appendix B**).

Figure 4-1. Inputs menu



¹If enable sensor alarms is set to NO.

²If a sensor is not connected.

³If an ELITE, BASIS, Model D, Model DL, or Model DT sensor is connected, or if T-Series setup is set to NO.

⁴If a T-Series sensor is connected or if T-Series setup is set to YES.

⁵If frequency = flow is selected.

⁶If pulses/unit is selected.

⁷If units/pulse is selected.

Inputs *continued***4.3 Disabling Coriolis inputs, Coriolis alarms, and sensor alarms**

Coriolis and sensor alarms are enabled as the default. By disabling Coriolis, you disable all Coriolis input signals and alarms. Disabling them might be desirable while you are connecting the sensor, or if you are using only the frequency input to measure flow. Disabling sensor alarms disables a subset of Coriolis alarms to prevent them from driving outputs to fault levels, stopping internal totalizers, and stopping a running batch.

To disable Coriolis inputs and Coriolis alarms, or to disable sensor alarms:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Inputs.
4. Select Coriolis.
5. Select Enable/Disable.
6. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 4-1**.

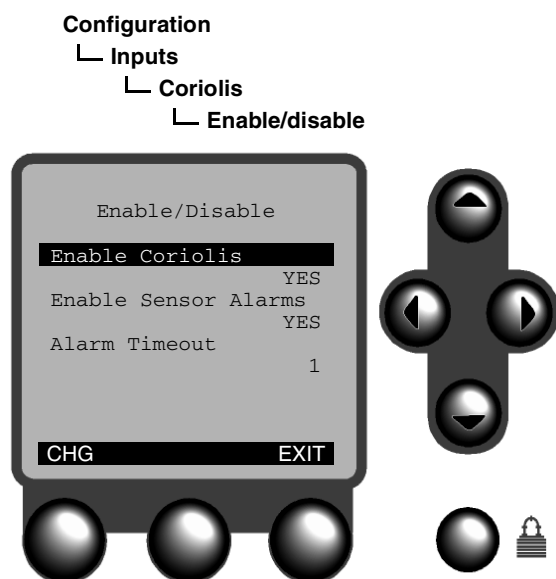


Table 4-1. Enabling or disabling inputs and alarms

Note

For more information about alarms, see **Chapter 13**.

Variable	Default	Description
Enable Coriolis	Yes	If set to NO: • The platform will not use input signals from the sensor to measure flow, density, or temperature • The platform will not produce the following alarms: warming up, cal in progress, drive overrange, temperature overrange, temperature failure, sensor failure, transmitter failure, density overrange, density failure, mass flow overrange, volume overrange, calibration failure, calibration complete, calibration aborted, RTD failure, charize required, slug flow, slug timeout
Enable sensor alarms	Yes	If set to NO, warming up, transmitter failure, density failure, and sensor failure alarms will be downgraded to informational alarms for the amount of time configured for the alarm timeout: • During alarm timeout, outputs will not go to fault levels • During alarm timeout, sensor alarms will not require acknowledgment • During alarm timeout, internal totalizers will not stop counting • During alarm timeout, batches in progress will not stop
Alarm timeout	1 minute	• If enable sensor alarms is set to NO, enter the number of minutes, from 1 to 20, for which sensor alarms will be disabled • Sensor alarms will revert to fault alarms after the alarm timeout has ended

4.4 Configure process variables

Process variables include flow variables, density, temperature, sensor calibration data, and sensor information.

Flow variables

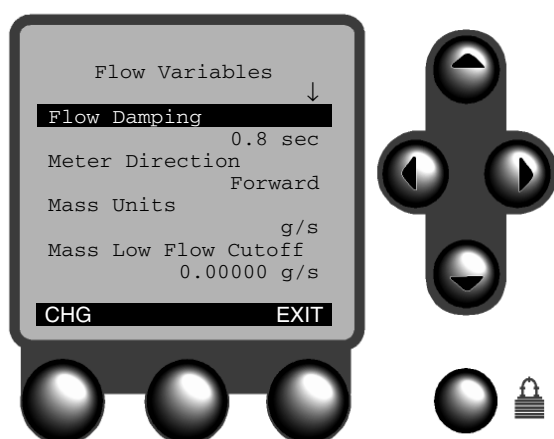
Configuration

└ Inputs

└ Coriolis

└ Config process var

└ Flow variables



To configure flow variables:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Inputs.
4. Select Coriolis.
5. Select Config Process Var.
6. Select Flow Variables.
7. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 4-2**.

Table 4-2. Flow variables

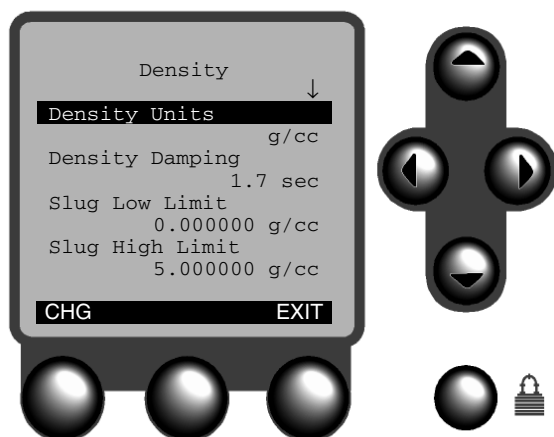
Variable	Default	Description
Flow damping	0.8 sec	• Damping filters out noise or the effects of rapid changes in the flow rate without affecting measurement accuracy • If the platform will operate with a Micro Motion T-Series sensor, the recommended flow damping value is 0.3 seconds • Milliamp outputs have their own damping
Meter direction	Forward	• Select the direction in which process fluid will flow through the sensor relative to the flow direction arrow on the sensor • The sensor can measure forward or backward flow • For the effect of flow direction on outputs and totalizers, see Table 4-3, page 15
Mass units	g/s	• Select the desired unit of mass flow (see Table 4-4, page 15) • Mass flow outputs and displays will indicate mass flow in the selected unit
Mass low flow cutoff	0.00000 g/s	• Enter the mass flow rate below which mass flow outputs and displays will indicate zero flow • Milliamp outputs have their own mass low flow cutoffs
Volume units	l/s	• Select the desired unit of volume flow (see Table 4-4, page 15) • Volume flow outputs and displays will indicate volume flow in the selected unit
Volume low flow cutoff	0.00000 l/s	• Enter the volume flow rate below which volume flow outputs and displays will indicate zero flow • Milliamp outputs have their own volume low flow cutoffs

Table 4-3. Effect of flow direction on outputs and totalizers

Fluid flow direction	Output or totalizer	Platform configuration for meter direction	
		Forward	Backward
Fluid flowing in <i>same direction</i> as flow arrow on sensor	4-20 mA output	Output increases as flow rate increases	Output goes to 2 mA
	Frequency output	Output increases as flow rate increases	Output remains at 0 Hz
	Totalizer configured for forward flow	Totals increase	Totals remain constant
	Totalizer configured for reverse flow	Totals remain constant	Totals increase
	Totalizer configured for absolute value forward/reverse	Totals increase	Totals increase
Fluid flowing in <i>opposite direction</i> from flow arrow on sensor	4-20 mA output	Output goes to 2 mA	Output increases as flow rate increases
	Frequency output	Output remains at 0 Hz	Output increases as flow rate increases
	Totalizer configured for forward flow	Totals remain constant	Totals increase
	Totalizer configured for reverse flow	Totals increase	Totals remain constant
	Totalizer configured for absolute value forward/reverse	Totals increase	Totals increase
	Totalizer configured for subtractive forward/reverse	Totals decrease	Totals increase

Table 4-4. Mass and volume flow units

Mass flow units		Volume flow units	
Unit	Software label	Unit	Software label
Grams/second	g/s	Cubic feet/second	cuft/s
Grams/minute	g/min	Cubic feet/minute	cuft/min
Grams/hour	g/hr	Cubic feet/hour	cuft/hr
Kilograms/second	kg/s	Cubic feet/day	cuft/day
Kilograms/minute	kg/min	Cubic meters/second	cu m/s
Kilograms/hour	kg/hr	Cubic meters/minute	cu m/min
Kilograms/day	kg/day	Cubic meters/hour	cu m/hr
Metric tons (1000 kg)/minute	t/min	Cubic meters/day	cu m/day
Metric tons (1000 kg)/hour	t/hr	U.S. gallons/second	USgps
Metric tons (1000 kg)/day	t/day	U.S. gallons/minute	USgpm
Pounds/second	lb/s	U.S. gallons/hour	USgph
Pounds/minute	lb/min	Imperial gallons/second	UKgps
Pounds/hour	lb/hr	Imperial gallons/minute	UKgpm
Pounds/day	lb/day	Imperial gallons/hour	UKgph
Short tons (2000 lb)/minute	STon/min	Imperial gallons/day	UKgpd
Short tons (2000 lb)/hour	STon/hr	Million gallons/day	MilGal/day
Short tons (2000 lb)/day	STon/day	Liters/second	l/sec
Long tons (2240 lb)/minute	LTon/min	Liters/minute	l/min
Long tons (2240 lb)/hour	LTon/hr	Liters/hour	l/hr
Long tons (2240 lb)/day	LTon/day	Milliliters/day	MillL/day
Ounces/second	oz/s	Barrels/second	bbl/s
Ounces/minute	oz/min	Barrels/minute	bbl/min
Ounces/hour	oz/hr	Barrels/hour	bbl/hr
		Barrels/day	bbl/day
		Fluid ounces/second	Floz/s
		Fluid ounces/minute	Floz/min
		Fluid ounces/hour	Floz/hr

Density inputs**Configuration**└ **Inputs**└ **Coriolis**└ **Config process var**└ **Density**

To configure density inputs:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Inputs.
4. Select Coriolis.
5. Select Config Process Var.
6. Select Density.
7. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 4-5**.

Table 4-5. Density inputs

Variable	Default	Description
Density units	g/cc	- Select the desired unit of density (see Table 4-6) - Density outputs and displays will indicate density in the selected unit
Density damping	1.7 sec	- Damping filters out noise or the effects of rapid changes in density without affecting measurement accuracy - If the platform will operate with a Micro Motion T-Series sensor, the recommended density damping value is 0.3 seconds - Milliamp outputs have their own damping
Slug low limit	0.000000 g/cc	- Enter the desired low limit, in g/cc, for the process density - The entered value is the density below which a slug flow alarm will be generated - For more information about slug flow, see page 98
Slug high limit	5.000000 g/cc	- Enter the desired high limit, in g/cc, for the process density - The entered value is the density above which a slug flow alarm will be generated - For more information about slug flow, see page 98
Slug time	1.0 sec	- Enter the number of seconds for which flow outputs will hold their last measured flow rate while density is outside the range specified by the slug low limit and slug high limit - The maximum slug time is 1200 seconds - If a value of 0.0 is entered, as soon as slug flow is detected, flow outputs will go to the level that indicates zero flow - For more information about slug time, see page 98

Table 4-6. Density units

Unit	Software label
Grams/cubic centimeter	g/cc
Kilograms/cubic meter	kg/cum
Pounds/gallon	lb/gal
Pounds/cubic foot	lb/cuft
Grams/milliliter	g/mL
Kilograms/liter	kg/L
Grams/liter	g/L
Pounds/cubic inch	lb/CuIn
Short tons (2000 lb)/cubic yard	STon/CuYd

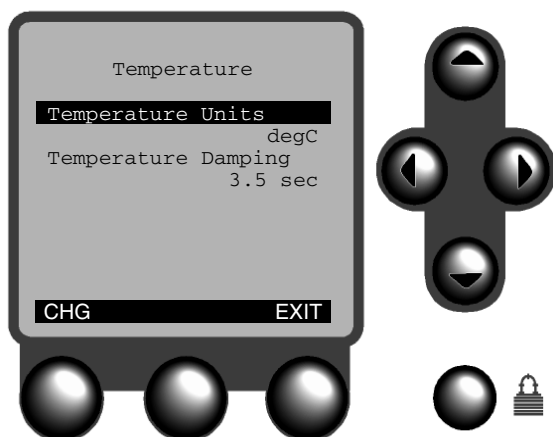
Temperature**Configuration**

└ Inputs

└ Coriolis

└ Config process var

└ Temperature



To configure temperature inputs:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Inputs.
4. Select Coriolis.
5. Select Config Process Var.
6. Select Temperature.
7. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 4-7**.

Table 4-7. Temperature inputs

Variable	Default	Description
Temperature units	degC	• Select °Celsius, °Fahrenheit, °Rankine, or Kelvin • Temperature outputs and displays will indicate temperature in the selected unit
Temperature damping	3.5 sec	• Damping filters out noise or the effects of rapid changes in temperature without affecting measurement accuracy • If the platform will operate with a Micro Motion T-Series sensor, the recommended temperature damping value is 0.0 seconds • Milliamp outputs have their own damping

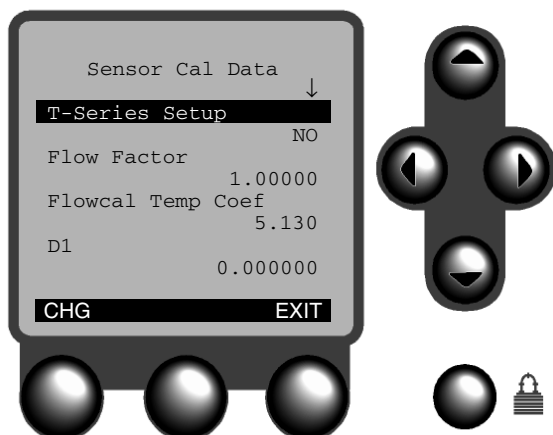
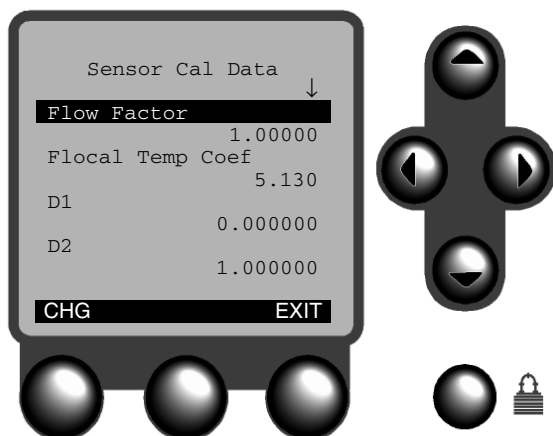
4.5 Sensor calibration data

Configuration

└ Inputs

└ Coriolis

└ Sensor cal data



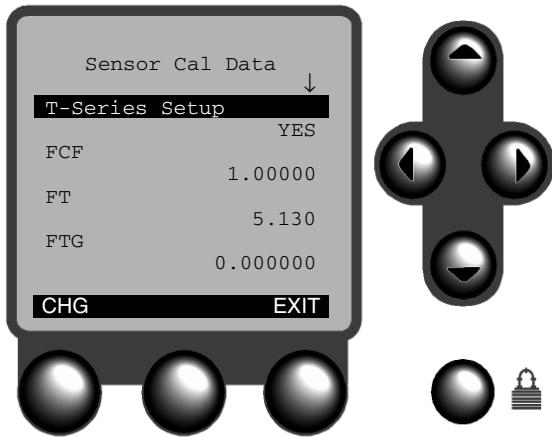
Sensor calibration data describe the sensor's sensitivity to flow, density, and temperature.

To configure sensor calibration data:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Inputs.
4. Select Coriolis.
5. Select Sensor Cal Data.

6. If the applications platform is connected to a sensor, skip to step 7. If the applications platform is not connected to a sensor, select T-Series Setup, then:
 - Select Yes to enter calibration data for a Micro Motion T-Series sensor (see page 19), or
 - Select No to enter calibration data for an ELITE, BASIS, Model D, Model DL, or Model DT sensor (see pages 20-26).
7. Use the function buttons and cursor control buttons to configure sensor calibration data.
 - Sensor cal data should be entered from the sensor serial number tag or factory calibration certificate.
 - Tags and certificates vary in appearance, depending on the sensor model number and manufacturing date.

Calibration data for Micro Motion T-Series sensors



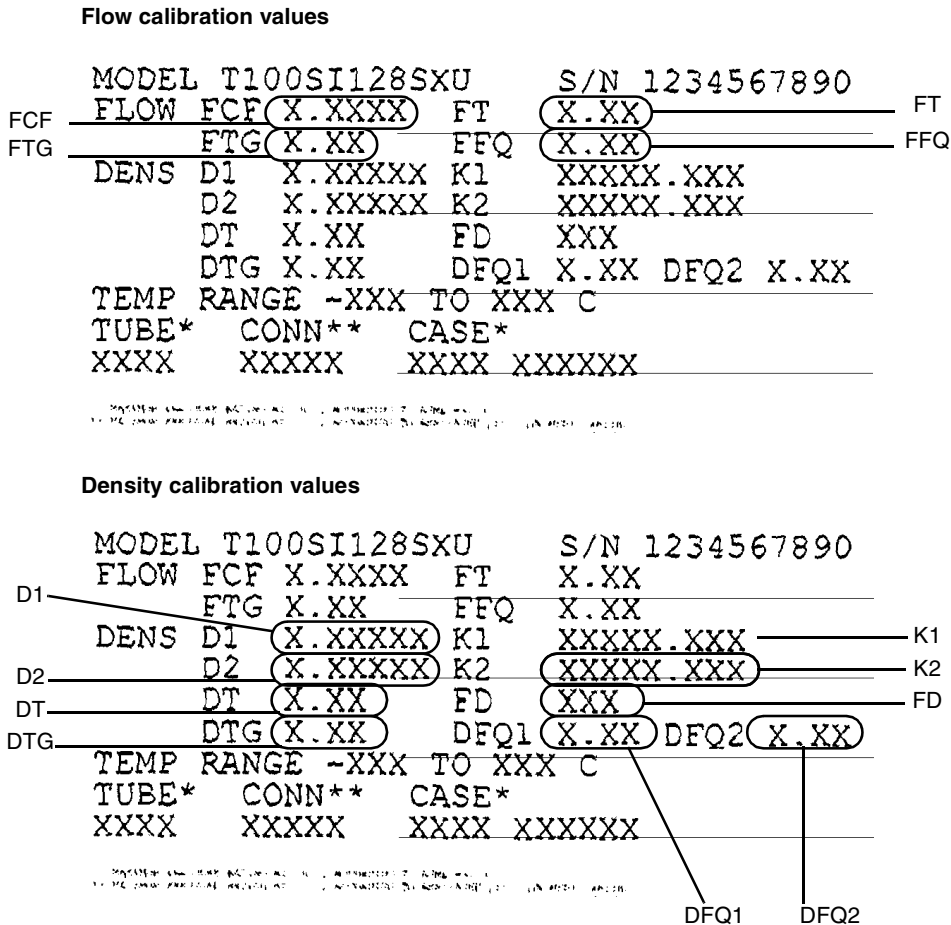
If the applications platform is connected to a Micro Motion T-Series sensor, or if YES was selected at step 6, page 18, the Person-Process Interface enables configuration of calibration data for a T-Series sensor.

Flow calibration values include the FCF, FT, FTG, and FFQ. Enter the flow calibration values that appear on the sensor tag. See **Figure 4-2**.

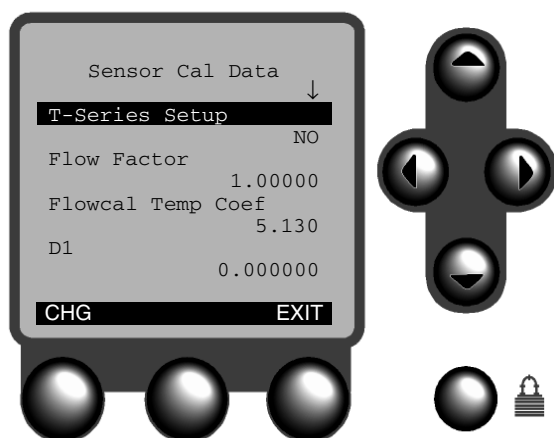
Density calibration values include D1, D2, K1, K2, FD, DT, DTG, DFQ1, and DFQ2. Enter the density calibration values that appear on the sensor tag. See **Figure 4-2**.

Temperature calibration values include the temperature slope and the temperature offset. To enter temperature calibration values, see page 26.

Figure 4-2. Sensor calibration data on Micro Motion T-Series sensor tag



Calibration data for ELITE®, BASIS®, Model D, Model DL, or Model DT sensors



If the applications platform is connected to an ELITE, BASIS, Model D, Model DL, or Model DT sensor, or if NO was selected at step 6, page 18, the Person-Process Interface enables configuration of calibration data for the appropriate sensor.

Flow calibration values include the flow factor and the flow calibration temperature coefficient. To configure flow calibration values, see page 20.

Density calibration values include D1 and D2 density values, K1 and K2 tube periods, the flowing density correction factor, and the density calibration temperature coefficient. To configure density calibration values, see pages 21-25.

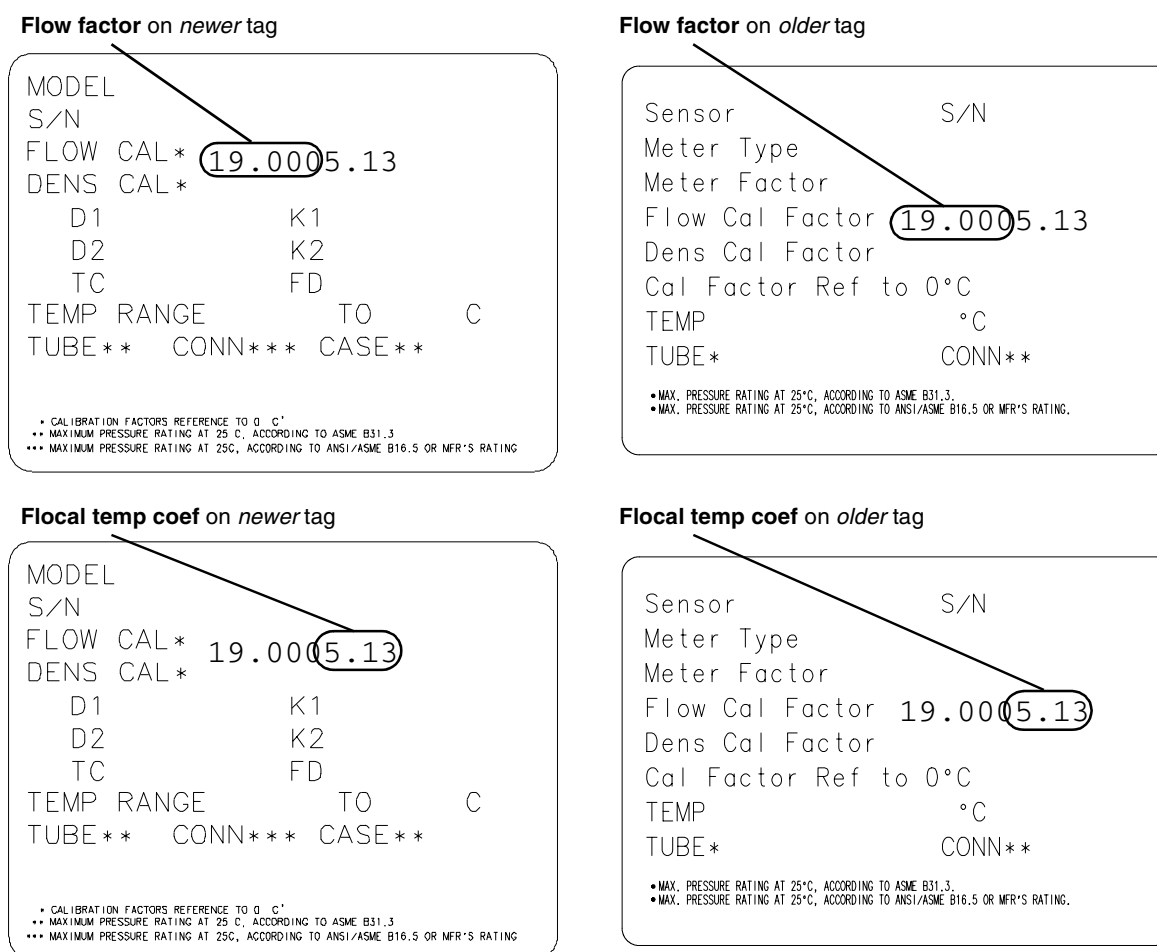
Temperature calibration values include the temperature slope and the temperature offset. To configure temperature calibration values, see page 26.

Flow calibration values

Flow calibration values include the flow factor and the flow calibration temperature coefficient (flowcal temp coef). To configure flow calibration values, see **Table 4-8** and **Figure 4-3**.

Table 4-8. Flow calibration values

Variable	Default	Description
Flow factor	1.00000 g/sec	- Enter the first 5 digits of the flow cal factor (see Figure 4-3) - The entered value is the flow rate, in g/sec, that generates 1 μsec of time shift between velocity signals from the sensor
Flowcal temp coef	5.130	- Enter the last 3 digits of the flow cal factor (see Figure 4-3) - The entered value represents the percent change in the measured flow rate per 100°C change in temperature

Figure 4-3. Flow calibration values on sensor serial number tag**Density calibration values**

Density calibration values include D1 and D2 density values, K1 and K2 tube periods, the flowing density correction factor (FD), and the density calibration temperature coefficient (dens temp coef).

- To configure D1 and D2, see **Table 4-9** and **Figure 4-4**, page 22.
- To configure K1 and K2, see **Table 4-10** and **Figure 4-5**, page 23.
- To configure FD and the dens temp coef, see **Table 4-11** and **Figure 4-6**, page 24.

Table 4-9. D1 and D2 density values

Variable	Default	Description
D1	0.000000 g/cc	• If the sensor tag shows a D1 value, enter the D1 value (see Figure 4-4) • If the sensor tag does not show a D1 value, enter the Dens A or D1 value from the calibration certificate • The entered value is the line-condition density of the low-density calibration fluid (Micro Motion uses air)
D2	1.000000 g/cc	• If the sensor tag shows a D2 value, enter the D2 value (see Figure 4-4) • If the sensor tag does not show a D2 value, enter the Dens B or D2 value from the calibration certificate • The entered value is the line-condition density of the high-density calibration fluid (Micro Motion uses water)

Figure 4-4. D1 and D2 on sensor serial number tag

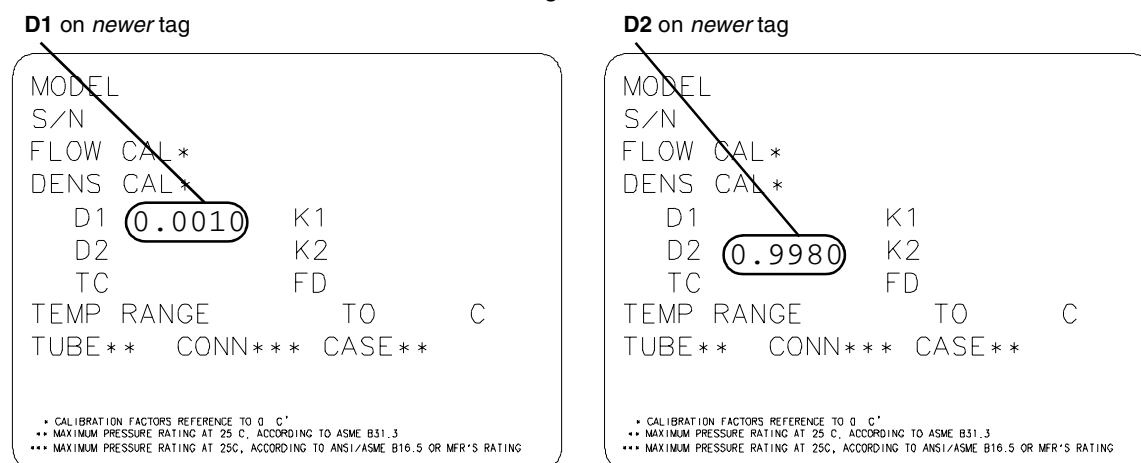


Table 4-10. K1 and K2 tube period values

Variable	Default	Description
K1	500.000	• If the sensor tag shows a K1 value, enter the K1 value (see Figure 4-5) • If the sensor tag does not show a K1 value, enter the first 5 digits of the density calibration factor (see Figure 4-5) • The entered value represents the sensor flow tube period associated with D1, adjusted to 0°C
K2	50000.000	• If the sensor tag shows a K2 value, enter the K2 value (see Figure 4-5) • If the sensor tag does not show a K2 value, enter the second 5 digits of the density calibration factor (see Figure 4-5) • The entered value represents the sensor flow tube period associated with D2, adjusted to 0°C

Inputs *continued***Figure 4-5. K1 and K2 on sensor serial number tag****K1 on newer tag**

MODEL
S/N
FLOW CAL *
DENS CAL * 12500142864.44
D1 K1 12502.000
D2 K2
TC FD
TEMP RANGE TO C
TUBE ** CONN *** CASE **

• CALIBRATION FACTORS REFERENCE TO 0 °C
• MAXIMUM PRESSURE RATING AT 25 °C, ACCORDING TO ASME B31.3
• MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ANSI/ASME B16.5 OR MFR'S RATING

K1 on older tag

Sensor S/N
Meter Type
Meter Factor
Flow Cal Factor
Dens Cal Factor 12500142864.44
Cal Factor Ref to 0°C
TEMP °C
TUBE * CONN **

• MAX. PRESSURE RATING AT 25°C, ACCORDING TO ASME B31.3.
• MAX. PRESSURE RATING AT 25°C, ACCORDING TO ANSI/ASME B16.5 OR MFR'S RATING.

K2 on newer tag

MODEL
S/N
FLOW CAL *
DENS CAL * 12500142864.44
D1 K1
D2 K2 14282.000
TC FD
TEMP RANGE TO C
TUBE ** CONN *** CASE **

• CALIBRATION FACTORS REFERENCE TO 0 °C
• MAXIMUM PRESSURE RATING AT 25 °C, ACCORDING TO ASME B31.3
• MAXIMUM PRESSURE RATING AT 25°C, ACCORDING TO ANSI/ASME B16.5 OR MFR'S RATING

K2 on older tag

Sensor S/N
Meter Type
Meter Factor
Flow Cal Factor
Dens Cal Factor 12500142864.44
Cal Factor Ref to 0°C
TEMP °C
TUBE * CONN **

• MAX. PRESSURE RATING AT 25°C, ACCORDING TO ASME B31.3.
• MAX. PRESSURE RATING AT 25°C, ACCORDING TO ANSI/ASME B16.5 OR MFR'S RATING.

Table 4-11. FD and dens temp coeff values

Variable	Default	Description
FD	0.0000	- If the sensor tag shows an FD value, enter the FD value (see Figure 4-6) - If the sensor tag does not show an FD value, enter the appropriate value from Table 4-12, page 25 - The entered value adjusts density calculations for the effect of high flow rates on measured density
Dens temp coeff	4.440000	- If the sensor tag shows a TC value, enter the TC value (see Figure 4-6) - If the sensor tag does not show a TC value, enter the last 3 digits of the density calibration factor (see Figure 4-6) - The entered value represents the percent change in the measured density per 100°C change in temperature

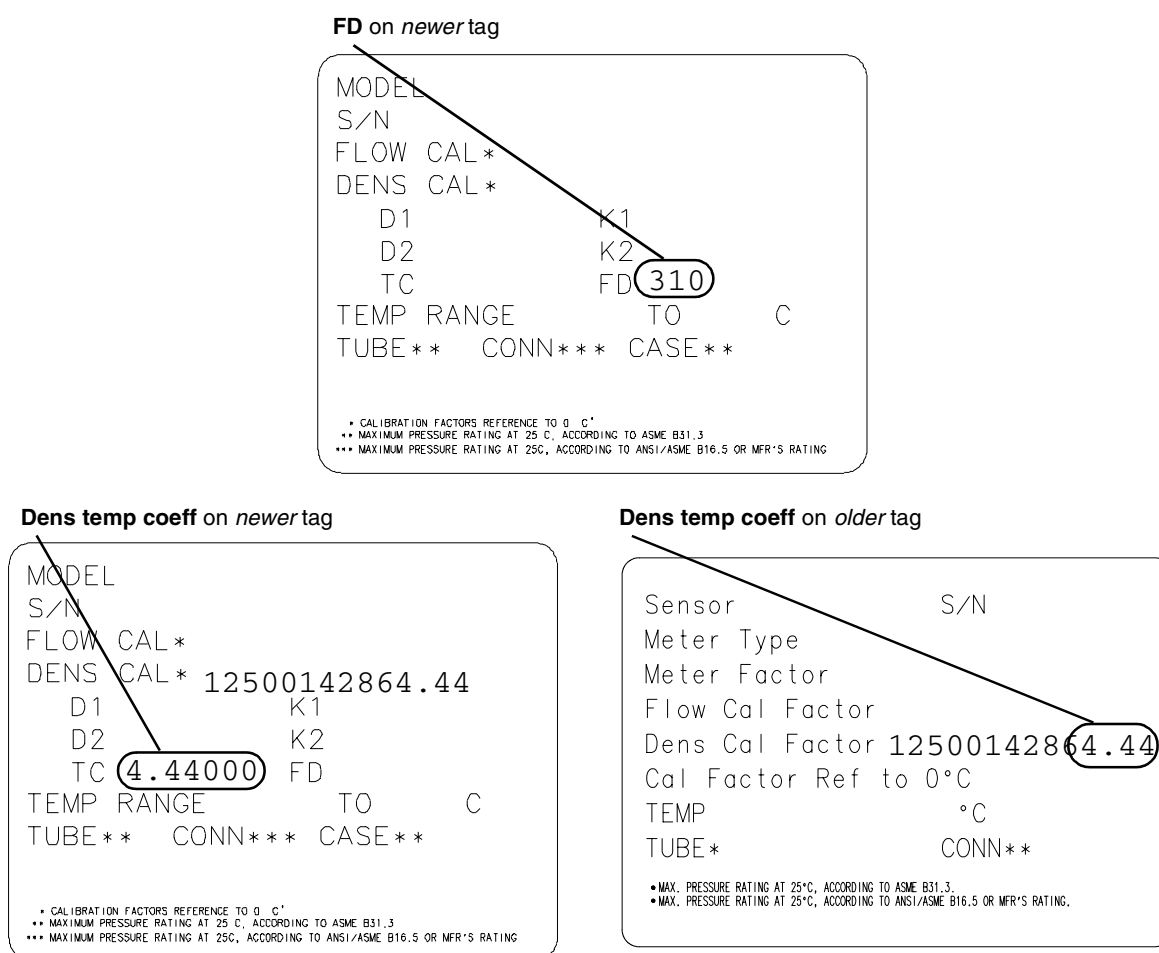
Figure 4-6. FD and dens temp coeff on sensor serial number tag

Table 4-12. Nominal FD values for sensors

	Sensor model	Flow tube material	Nominal FD value
ELITE®	CMF010 standard pressure	316L stainless steel	140
	CMF010 standard pressure	Inconel® 686	220
	CMF010 high pressure	Inconel 686	760
	CMF025 standard pressure	316L stainless steel or Hastelloy® C-22	450
	CMF050 standard pressure	316L stainless steel or Hastelloy C-22	430
	CMF100 standard pressure	316L stainless steel or Hastelloy C-22	230
	CMF200 standard pressure	316L stainless steel or Hastelloy C-22	320
	CMF300 standard pressure	316L stainless steel or Hastelloy C-22	280
	CMF400 standard pressure	316L stainless steel	608
BASIS®	F025S	316L stainless steel	0
	F050S	316L stainless steel	0
	F100S	316L stainless steel	0
	F200S	316L stainless steel	350
Model D	DS006 standard pressure	316L stainless steel or Hastelloy C-22	450
	DS012 standard pressure	316L stainless steel	900
	DS012 standard pressure	Hastelloy C-22	490
	DS025 standard pressure	316L stainless steel	110
	DS025 standard pressure	Hastelloy C-22	330
	DS040 standard pressure	316L stainless steel	220
	DS040 standard pressure	Hastelloy C-22	610
	DS065 standard pressure	316L stainless steel	310
	DS100 standard pressure	316L stainless steel or Hastelloy C-22	520
	DS150 standard pressure	316L stainless steel or Hastelloy C-22	480
	DS150 standard pressure	316L stainless steel with Tefzel® lining	640
	DS300 standard pressure	316L stainless steel or Hastelloy C-22	200
	DS300 standard pressure	316L stainless steel with Tefzel lining	260
	DS600 standard pressure	316L stainless steel	50
Model DH	DH006 high pressure	316L stainless steel	0
	DH012 high pressure	316L stainless steel	0
	DH025 high pressure	316L stainless steel	0
	DH038 high pressure	316L stainless steel	0
	DS100 high pressure	316L stainless steel	0
	DH150 high pressure	316L stainless steel	0
	DH300 high pressure	316L stainless steel	0
Model DL	DL065	316L stainless steel	210
	DL100	316L stainless steel	670
	DL200	316L stainless steel	150
Model DT	DT065	Hastelloy C-22	550
	DT100	Hastelloy C-22	380
	DT150	Hastelloy C-22	130

Temperature calibration values for all sensors

All Micro Motion sensors have the same temperature calibration values. They include the temperature slope and the temperature offset. To configure temperature calibration values, see **Table 4-13**.

Table 4-13. Temperature calibration values

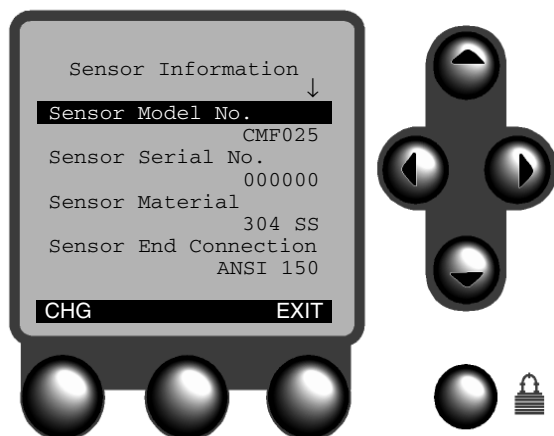
Variable	Default	Description
Temperature slope	1.000000	- Enter the slope provided by Micro Motion, or perform a temperature calibration - To perform a temperature calibration, see pages 133-134
Temperature offset	0.000000	- Enter the offset provided by Micro Motion, or perform a temperature calibration - To perform a temperature calibration, see pages 133-134

4.6 Sensor information**Configuration**

└ Inputs

└ Coriolis

└ Sensor information



Sensor information includes variables that serve as references without affecting calibration parameters, totalizers, or outputs.

To configure sensor information:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Inputs.
4. Select Coriolis.
5. Select Sensor Information.
6. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 4-14**.

Table 4-14. Sensor information variables

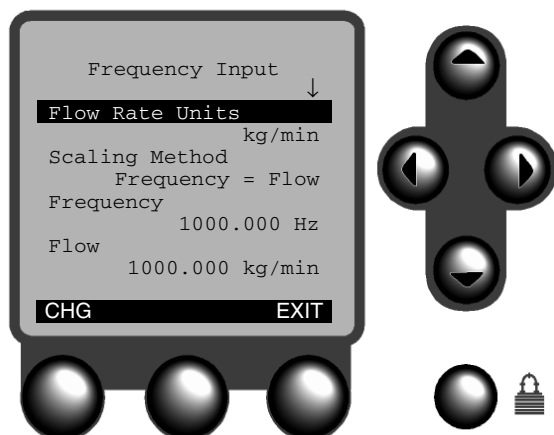
Variable	Default	Description
Sensor model no.	Uninitialized	Enter a description of the sensor model, such as "CMF025"
Sensor serial no.	000000	Enter the serial number that is on the sensor serial number tag
Sensor material	304 SS	Select the appropriate sensor flow tube material (304 SS, 316L SS, Hastelloy C, Inconel, or Tantalum)
Sensor end connection	ANSI 150	Select the appropriate flange, union fitting, sanitary fitting, or wafer fitting
Sensor liner	None	Select the appropriate liner material for the sensor flow tubes (Tefzel or none)

4.7 Frequency input

Configuration

└ Inputs

└ Frequency input



To configure the frequency input:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Inputs.
4. Select Frequency Input.
5. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 4-15**.

Table 4-15. Frequency input variables

Variable	Default	Description
Flow rate units	kg/min	• Select the desired unit of mass flow or volume flow (see Table 4-4, page 15) • If the frequency input will be used as the flow source for the density application, you must select a unit of mass flow. See the <i>Series 3000 Density Application Manual</i>
Scaling method	Frequency = flow	• Select frequency = flow, pulses/unit, or units/pulse • The frequency input has a range of 0 to 20,000 Hz
Frequency	1000.000 Hz	If frequency = flow is selected as the scaling method, enter the frequency (or pulse rate), in Hz, that represents the configured flow rate
Flow	1000.000 kg/min	If frequency = flow is selected as the scaling method, enter the flow rate that is represented by the configured frequency
Pulses	60.00 pulses	If pulses/unit is selected as the scaling method, enter the number of input pulses that represents one mass or volume unit
Units	0.017 kg	If units/pulse is selected as the scaling method, enter the number of mass or volume units that is represented by one input pulse
K-factor	1.0000	• Enter a value of 0.0001 to 2.0000 • The entered value serves as a scaling factor for flow rate outputs and displays. See the example on page 28 • The K-factor is used for proving a Model 3300 or 3350 application peripheral, for which meter factors are not available

Example:

A Model 3300 application peripheral indicates a flow rate of 5483 grams/minute. Calibration of the reference flow element reveals that the actual flow rate is 5482 grams/minute.

Use the following formula to calculate the K-factor:

$$K\text{-factor} = \frac{\text{Reference flow rate}}{\text{Indicated flow rate}}$$

$$K\text{-factor} = \frac{5482 \text{ g/min}}{5483 \text{ g/min}} = 0.9998$$

Enter a K-factor of 0.9998.

5

Discrete Batch

5.1 About this chapter

This chapter explains how to configure the discrete batch control application. The discrete batch control application includes all the software parameters listed in **Figure 5-1**, page 30.

Failure to perform configuration tasks in the proper sequence could result in an incomplete configuration. Perform configuration tasks in the following sequence:

1. Configure system data (see **Chapter 3**).
2. Configure inputs (see **Chapter 4**).
3. Configure the discrete batch control application.
4. Configure measurements (see **Chapter 6**).
5. Configure outputs (see **Chapter 7**).
6. Configure monitoring (see **Chapter 8**).
7. Configure digital communication (see **Chapter 9**).

CAUTION

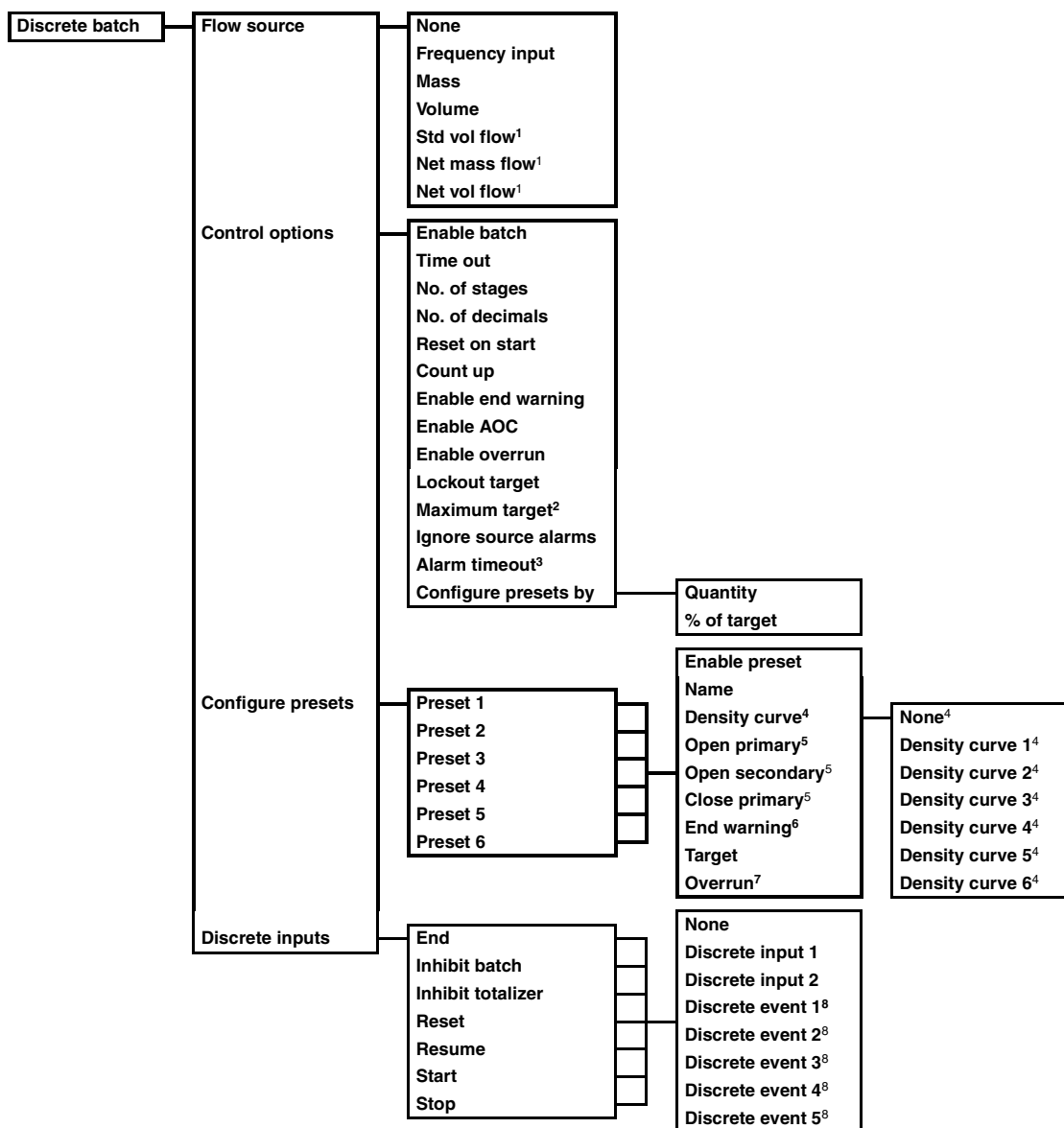
Selecting configuration will interrupt measurement and control functions. All outputs will go to their configured fault settings.

Set control devices for manual operation before accessing configuration menus.

5.2 Recording discrete batch parameters

While you are configuring discrete batch control parameters, record them in the Series 3000 configuration record (**Appendix B**).

Figure 5-1. Discrete batch menu



¹If density application software is installed and configured.

²If lockout target is set to NO.

³If Ignore source alarms is set to YES.

⁴If density application software is installed and configured.

⁵If no. of stages is set to 2.

⁶If enable end warning is set to YES.

⁷If enable overrun is set to YES.

⁸If discrete event has been configured under Measurements.

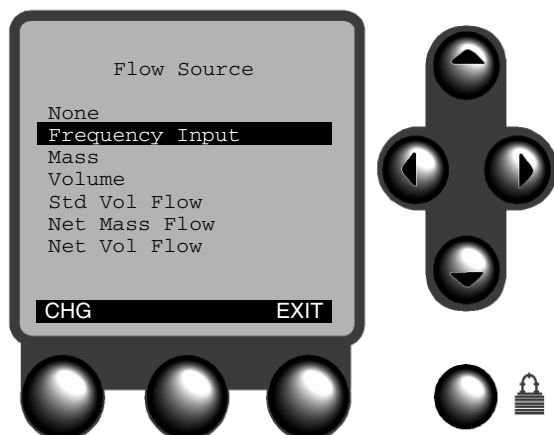
Discrete Batch *continued*

5.3 Flow source

Configuration

└ Discrete batch

└ Flow source



To configure the flow source:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Discrete Batch.
4. Select Flow Source.
5. Use the function buttons and cursor control buttons to select one of the flow sources listed in **Table 5-1**.

Table 5-1. Flow sources

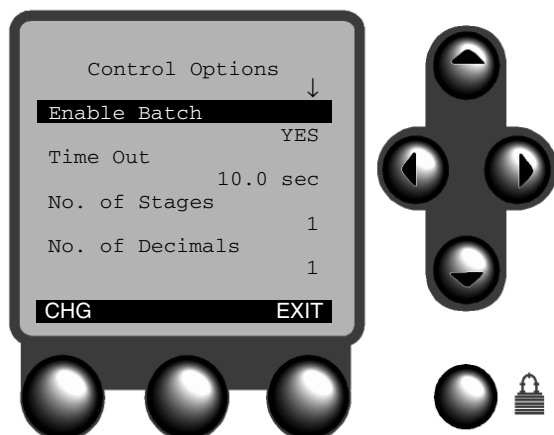
Flow source	Default	Description
None	None	- Batch controller is disabled - START button will not appear on display
Frequency input		- Frequency input from a Micro Motion® IFT9701 or RFT9739 transmitter - Frequency input from a pulse output device
Mass		Mass flow rate from Coriolis software in Model 3500 or 3700 transmitter
Volume		Volume flow rate from Coriolis software in Model 3500 or 3700 transmitter
Std vol flow		- Standard volume flow rate at reference temperature - Standard volume flow is available only if density application software is installed and configured to indicate standard volume flow (see the <i>Series 3000 Density Application Manual</i>)
Net mass flow		- Net mass flow rate - Net mass flow is available only if density application software is installed and configured to indicate net mass flow (see the <i>Series 3000 Density Application Manual</i>)
Net vol flow		- Net volume flow rate at reference temperature - Net volume flow is available only if density application software is installed and configured to indicate net volume flow (see the <i>Series 3000 Density Application Manual</i>)

5.4 Control options

Configuration

└ Discrete batch

└ Control options



To configure batch control options:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Discrete Batch.
4. Select Control Options.
5. Use the function buttons and cursor control buttons to configure the control options that are listed in **Table 5-2**, page 33.

Table 5-2. Control options**Note**

Control options apply to all batch presets. To configure presets, see pages 34-35

Setting	Default	Description
Enable batch	Yes	- Select YES to enable batch presets - Select NO to disable batch presets. The operation mode will default to the process monitor
Time out	10.0 sec	- Enter a value of 0.0 to 300.0 - The batch controller produces a time out alarm if flow stops for more than the number of seconds configured for the time out before the batch is completed - Time out can be assigned to a discrete output (see pages 49-50) - Time out is disabled if set to 0.0 seconds - For information about the time out alarm, see page 100
No. of stages	1	- Enter a value of 1 for 1-stage batch control - Enter a value of 2 for 2-stage batch control
No. of decimals	1	- Enter a value of 1 to 5 - The entered value is the number of digits to the right of the decimal point on the operation screen
Reset on start	No	- If set to YES, the batch totalizer resets when the operator starts the batch - If set to NO, the operator must press RESET before starting a new batch - Reset and start can be assigned to discrete inputs (see page 37)
Count up	Yes	- If set to YES, the actual total increases from zero - If set to NO, the actual total decreases from the target value
Enable end warning	No	- Select YES to enable the end warning - When end warning is enabled and an end warning value has been entered for the selected preset, a discrete output can be configured to indicate the end warning - End warning is a status indicator only, and does not affect valve operation - End warning will remain active until batch completion
Enable AOC	Yes	- Select YES to enable Automatic Overshoot Compensation (AOC) - The batch AOC compensates for valve closure time - When batch AOC is enabled, the batch controller measures overshoot on 2 to 10 trial batches, then compensates for the time required to close the valve - To calibrate the batch AOC, see page 132
Enable overrun	Yes	- Select YES to enable overrun indication - When overrun is enabled and an overrun value has been entered for the selected preset, the batch controller produces an overrun alarm when the batch total exceeds the target by more than the programmed overrun amount - Overrun can be assigned to a discrete output (see pages 49-50)
Lockout target	No	- If set to YES, batch targets cannot be changed by the operator - If set to NO, the operator can change the batch target when a batch is not running
Maximum target	999999999.0 kg	If lockout target is set to NO, enter the maximum target that the operator will be allowed to set in the batch operation mode
Ignore source alarms	No	- Select YES to ignore source alarms - If set to YES, the batch will not stop and a time out alarm will not be produced for the number of minutes configured for the alarm timeout - For information about the time out alarm, see page 100
Alarm timeout	1 minute	- If ignore source alarms is set to YES, enter the number of minutes, from 1 to 20, for which the time out alarm will be disabled - For information about the time out alarm, see page 100
Configure presets by	% of target	- If set to % of target, open primary, open secondary, close primary, and end warning values are each configured as a percent of target - If set to quantity, open primary and open secondary are each configured as a quantity at which the valve should open; close primary and end warning values are each configured as a quantity that is subtracted from the target - To configure open primary, open secondary, close primary, and end warning values, see pages 34-36

5.5 Configure presets

Configuration

└ Discrete batch

└ Configure presets

└ Preset 1

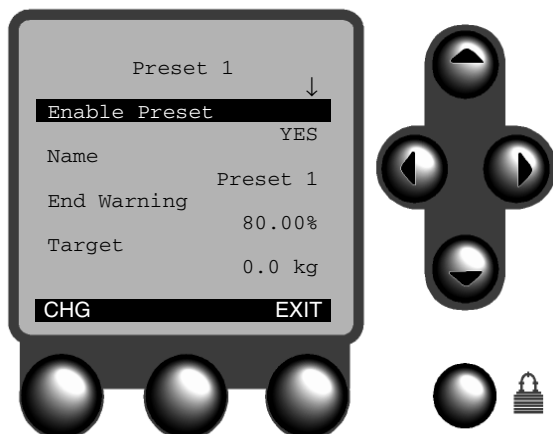
└ Preset 2

└ Preset 3

└ Preset 4

└ Preset 5

└ Preset 6



You can configure up to six batch presets. Preset 1 cannot be disabled.

To configure batch presets:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Discrete Batch.
4. Select Configure Presets.
5. Select Preset 1, Preset 2, Preset 3, Preset 4, Preset 5, or Preset 6.
6. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 5-3**, page 35.

To configure the primary valve open, secondary valve open, primary valve close, and end warning as a percent of target or as an amount, see the examples on page 36.

Table 5-3. Presets

Setting	Default	Description
Enable preset	• Yes for preset 1 • No for presets 2-6	• If set to YES, the batch preset can be selected in the view menu (see page 91) • If set to NO, the batch preset is disabled and cannot be selected • Preset 1 cannot be disabled
Name	• Preset 1 for preset 1 • Preset 2 for preset 2 • Preset 3 for preset 3 • Preset 4 for preset 4 • Preset 5 for preset 5 • Preset 6 for preset 6	Enter up to 21 alphanumeric characters for the name that will appear on operation screens and in preset selection menus
Density curves	None	• If density application software is installed and configured, you can select a density curve that will apply to this preset • If a density curve is selected, batch totals will be based on the derived variable that is selected during configuration of the density application (see the <i>Series 3000 Density Application Manual</i>)
Open primary	0.00% of target or 0.0 kg quantity	• If 2-stage batch is selected as a control option, enter the percent of the target, or quantity, at which the primary valve will open. See the examples on page 36 • Open primary and/or open secondary must be set to 0 • To enable 2-stage batch control, see pages 32-33 • The primary valve can be assigned to a discrete output (see pages 49-50)
Open secondary	0.00% of target or 0.0 kg quantity	• If 2-stage batch is selected as a control option, enter the percent of the target, or quantity, at which the secondary valve will open. See the examples on page 36 • Open primary and/or open secondary must be set to 0 • To enable 2-stage batch control, see pages 32-33 • The secondary valve can be assigned to a discrete output (see pages 49-50)
Close primary	80.00% of target or 0.0 kg quantity	• If 2-stage batch is selected as a control option, enter the percent of the target, or quantity subtracted from the target, at which the primary valve will close. See the examples on page 36 • The secondary valve always closes when the target is achieved • To enable 2-stage batch control, see pages 32-33 • The primary valve can be assigned to a discrete output (see pages 49-50)
End warning	80.00% of target or 0.0 kg quantity	• If end warning is enabled as a control option, enter the percent of the target, or quantity subtracted from the target, at which the end warning will occur. See the examples on page 36 • End warning can be assigned to a discrete output (see pages 49-50) • To enable the end warning, see pages 32-33
Target	0.0 kg	Enter the total at which the batch will be completed
Overrun	0.0 kg	• If overrun is enabled as a control option, enter the amount over the target value at which batch overrun will be indicated. For example, if the target is 250 kilograms and overrun should be indicated at 280 kilograms, enter 30 • Overrun can be assigned to a discrete output (see pages 49-50) • To enable overrun indication, see pages 32-33

Example 1:

Configure presets by quantity under the following conditions:

- The target is 200 kilograms
- The primary valve opens at the start of the batch and closes when 180 kilograms have been delivered
- The secondary valve opens when 100 kilograms have been delivered
- The end warning occurs when 160 kilograms have been delivered

$$\text{Close primary} = 200 \text{ kilograms} - 180 \text{ kilograms} = 20$$

$$\text{Open secondary} = 100 \text{ kilograms}$$

$$\text{End warning} = 200 \text{ kilograms} - 160 \text{ kilograms} = 40$$

Example 2:

Configure presets by percent of target under the following conditions:

- The target is 200 kilograms
- The primary valve opens at the start of the batch and closes when 180 kilograms have been delivered
- The secondary valve opens when 100 kilograms have been delivered
- The end warning occurs when 160 kilograms have been delivered

$$\text{Close primary} = \frac{180 \text{ kilograms}}{200 \text{ kilograms}} = 0.90$$

Since 0.90 equals 90%, enter a close primary value of 90.

$$\text{Open secondary} = \frac{100 \text{ kilograms}}{200 \text{ kilograms}} = 0.50$$

Since 0.50 equals 50%, enter an open secondary value of 50.

$$\text{End warning} = \frac{160 \text{ kilograms}}{200 \text{ kilograms}} = 0.80$$

Since 0.80 equals 80%, enter an end warning value of 80.

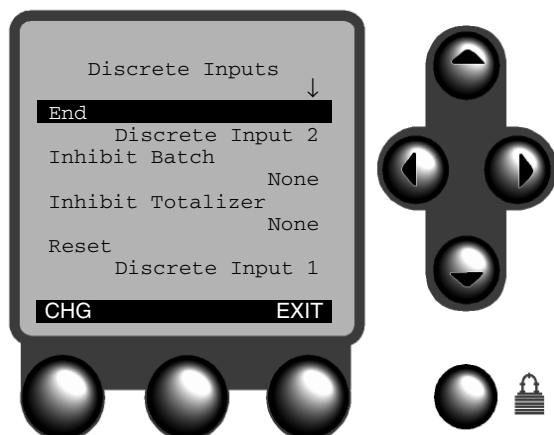
Discrete Batch *continued*

5.6 Discrete inputs or discrete events

Configuration

└ Discrete batch

└ Discrete inputs



The batch can be controlled by up to two discrete inputs and up to five discrete events.

To assign batch functions to discrete inputs or discrete events:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Discrete Batch.
4. Select Discrete Inputs.
5. Use the function buttons and cursor control buttons to assign the desired batch functions to a discrete input or discrete event. The discrete batch control application supports the discrete functions listed in **Table 5-4**.

Table 5-4. Discrete input or discrete event assignments

Notes

- A function cannot be assigned to a discrete event until the discrete event has been configured under Measurements
- To configure discrete events, see pages 42-45

Function	Default input or event	Description of ON state
End	None	• End the batch • The batch cannot be resumed • The batch totalizer must be reset for the next batch
Inhibit batch		• The batch is disabled • Inhibit batch is used for temporary lockout
Inhibit totalizer		• The batch is delivered but not totalized • Inhibit totalizer is used when process fluid is recirculated
Reset		• Reset batch total to zero • The batch controller can be configured to reset automatically on start • To configure reset on start, see pages 32-33
Resume		• Resume a batch that has been stopped • Counting resumes from the total at which the batch was stopped
Start		Start the batch by opening the flow control valve(s) and/or by starting the pump
Stop		• Stop the batch • The batch can be resumed • If lockout target is disabled as a control option, the operator can change the target before resuming • To enable or disable lockout target, see pages 32-33

6

Measurements

6.1 About this chapter

This chapter explains how to configure measurements. Measurements include all the software parameters listed in **Figure 6-1**, page 40.

Failure to perform configuration tasks in the proper sequence could result in an incomplete configuration. Perform configuration tasks in the following sequence:

1. Configure system data (see **Chapter 3**).
2. Configure inputs (see **Chapter 4**).
3. Configure the discrete batch control application, if it is present (see **Chapter 5**).
4. Configure measurements.
5. Configure outputs (see **Chapter 7**).
6. Configure monitoring (see **Chapter 8**).
7. Configure digital communication (see **Chapter 9**).

CAUTION

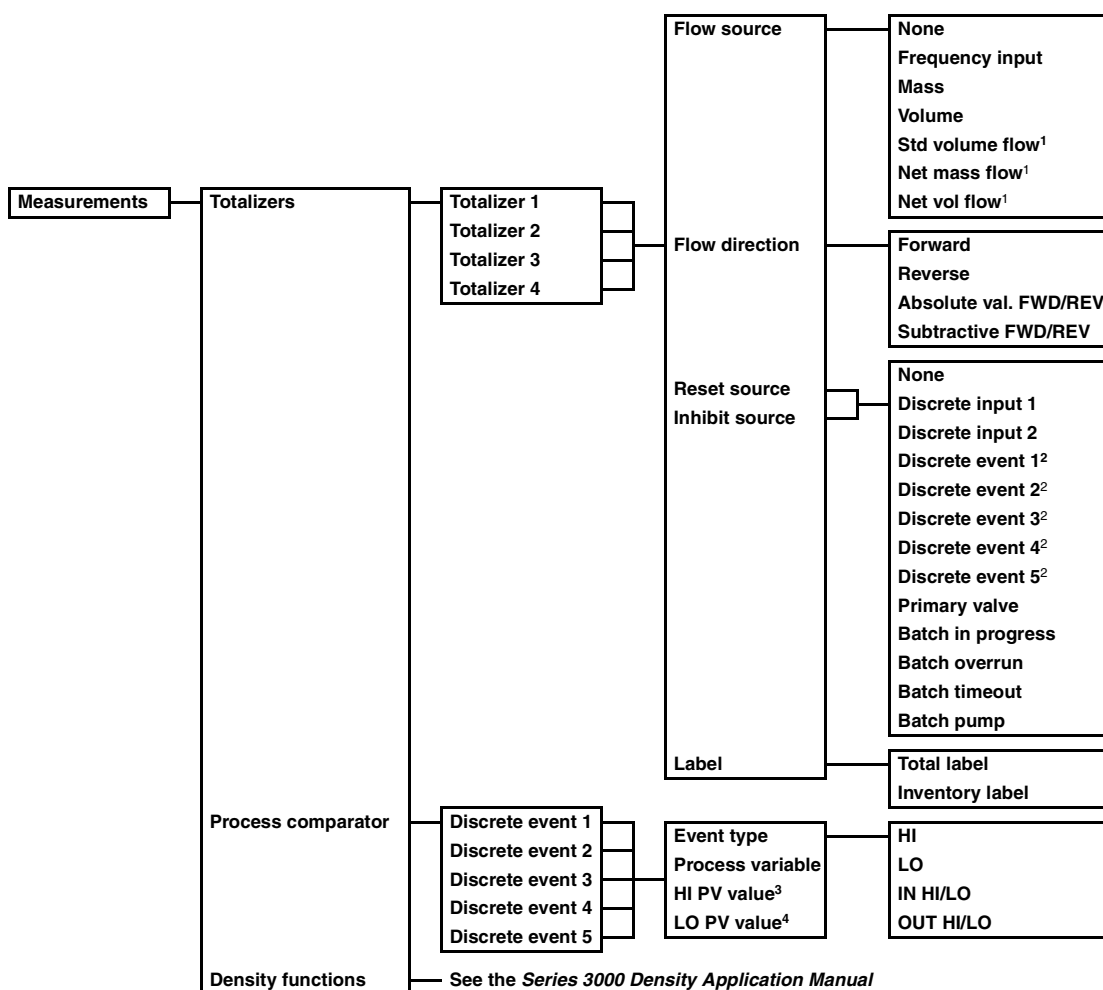
Selecting configuration will interrupt measurement and control functions. All outputs will go to their configured fault settings.

Set control devices for manual operation before accessing configuration menus.

6.2 Recording measurement parameters

While you are configuring measurement parameters, enter them in the Series 3000 configuration record (**Appendix B**).

Figure 6-1. Measurements menu



¹If density application software is installed and configured.

²If discrete event has been configured.

³If event type is HI, IN HI/LO, or OUT HI/LO.

⁴If event type is LO, IN HI/LO, or OUT HI/LO.

6.3 Totalizers

Configuration

└─ Measurements

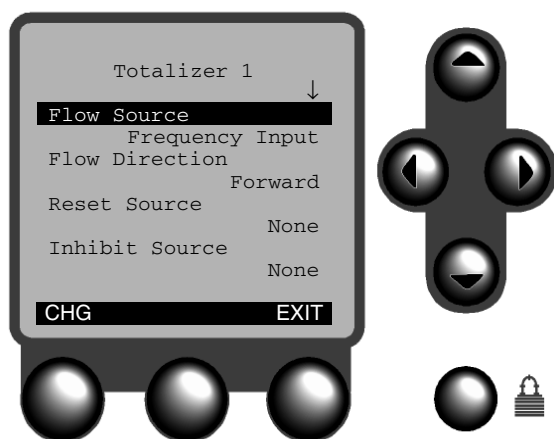
└─ Totalizers

└─ Totalizer 1

└─ Totalizer 2

└─ Totalizer 3

└─ Totalizer 4



To configure totalizers:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Measurements.
4. Select Totalizers.
5. Select Totalizer 1, Totalizer 2, Totalizer 3, or Totalizer 4.
6. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 6-1**, page 41.

Table 6-1. Totalizer parameters

Variable	Default	Description
Flow source	Totalizer 1: Frequency input Totalizer 2: Mass Totalizer 3: Volume Totalizer 4: None	• Frequency input: Totalizer will indicate accumulated total of the variable that is represented by the frequency input • Mass: Totalizer will indicate mass total • Volume: Totalizer will indicate volume total • Std vol flow (available only if density application software is installed and configured to indicate standard volume flow): Totalizer will indicate standard volume total at reference temperature • Net mass flow (available only if density application software is installed and configured to indicate net mass flow): Totalizer will indicate net mass total • Net vol flow (available only if density application software is installed and configured to indicate net volume flow): Totalizer will indicate net volume total at reference temperature
Flow direction	Forward	• Forward: Forward flow will be added to the total • Reverse: Reverse flow will be added to the total • Absolute Val. FWD/REV: Forward or reverse flow will be added to the total • Subtractive FWD/REV: Forward flow will be added to the total; reverse flow will be subtracted from the total
Reset source	None	Select the batch control option, valve, discrete input, or discrete event that will reset the totalizer
Inhibit source	None	• Select the batch control option, valve, discrete input, or discrete event that will inhibit the flow source • When the selected batch control option, valve, discrete input, or discrete event is active, the total and inventory will not change
Total label	Totalizer 1: Freq. input total Totalizer 2: Mass total Totalizer 3: Volume total Totalizer 4: Total 4	• Enter up to 16 alphanumeric characters that will identify this total • The label will identify this total in configuration and view menus
Inventory label	Totalizer 1: Freq. input inventory Totalizer 2: Mass inventory Totalizer 3: Volume inventory Totalizer 4: Inventory 4	• Enter up to 16 alphanumeric characters that will identify this inventory • The label will identify this inventory in configuration and view menus

6.4 Process comparator

The process comparator enables comparison of measured values of selected process variables with configured values of those variables. A discrete event occurs when the measured value of a selected process variable achieves a configured high or low value. The discrete event then can be used for controlling the process; for example, inhibiting a totalizer if the flow rate is outside a specified range.

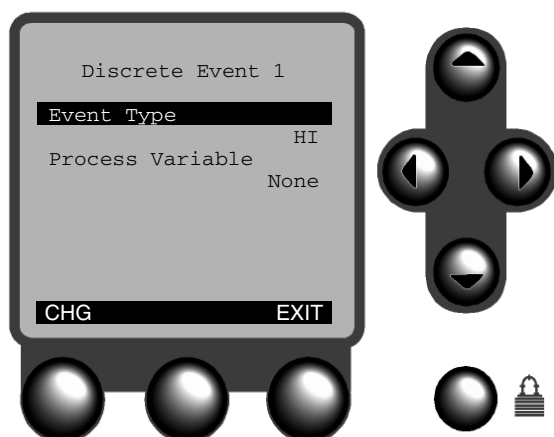
Configuring the process comparator includes the following procedures:

- Selecting the discrete event type
- Assigning a process variable to the event
- Configuring a high value, a low value, or high and low values at which the event will occur
- Assigning a batch control option, totalizer, or discrete output to the event

Event type

Configuration

- └─ Measurements
 - └─ Process comparator
 - └─ Discrete event 1
 - └─ Discrete event 2
 - └─ Discrete event 3
 - └─ Discrete event 4
 - └─ Discrete event 5



To configure the event type:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Measurements.
4. Select Process Comparator.
5. Select Discrete Event 1, Discrete Event 2, Discrete Event 3, Discrete Event 4, or Discrete Event 5.
6. Select Event Type.
7. Use the function buttons and cursor control buttons to select one of the event types listed in **Table 6-2**, page 43.

Measurements *continued***Table 6-2. Discrete event types****Notes**

- To assign a process variable to the discrete event, see below
- To set a high value, a low value, or high and low values at which the discrete event will occur, see page 44

Variable	Default	Description
None	None	Discrete event will be inactive
HI		Discrete event will occur if the assigned variable is above the high value
LO		Discrete event will occur if the assigned variable is below the low value
IN HI/LO		Discrete event will occur if the assigned variable is above the low value <i>and</i> below the high value
OUT HI/LO		Discrete event will occur if the assigned variable is below the low value <i>or</i> above the high value

Process variable**Configuration**

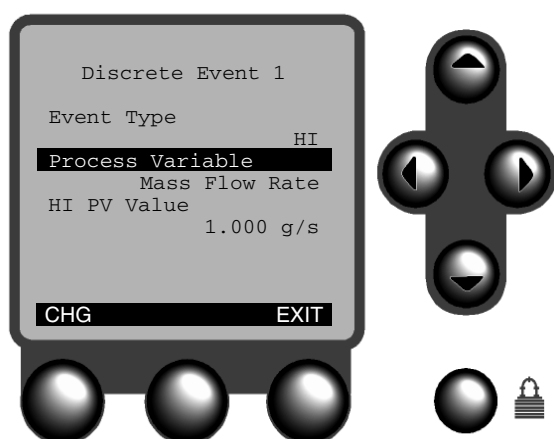
└─ Measurements

└─ Process comparator

- └─ Discrete event 1
- └─ Discrete event 2
- └─ Discrete event 3
- └─ Discrete event 4
- └─ Discrete event 5

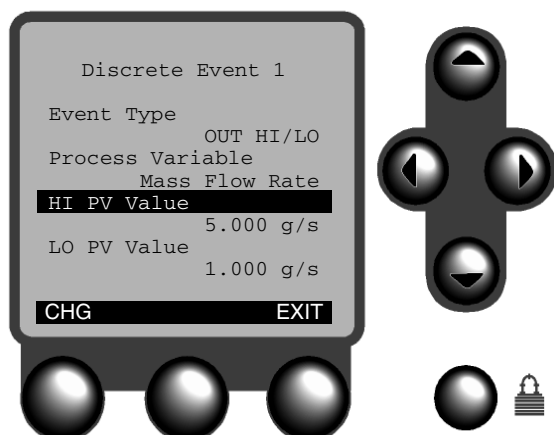
To select the process variable:

1. Select an event type (see page 42 and above).
2. Press EXIT to return to the Discrete Event 1, Discrete Event 2, Discrete Event 3, Discrete Event 4, or Discrete Event 5 screen.
3. Select Process Variable.
4. Use the function buttons and cursor control buttons to select a process variable.



High and low values**Configuration**└─ **Measurements**└─ **Process comparator**

- └─ Discrete event 1
- └─ Discrete event 2
- └─ Discrete event 3
- └─ Discrete event 4
- └─ Discrete event 5



To configure a high value, low value, or high and low values for the process variable:

1. Select an event type (see pages 42-43).
2. Select a process variable (see page 43).
3. Press EXIT to return to the Discrete Event 1, Discrete Event 2, Discrete Event 3, Discrete Event 4, or Discrete Event 5 screen.
4. Select HI PV Value or LO PV Value.
5. Use the function buttons and cursor control buttons to enter the appropriate value (or values) from **Table 6-3**.

Table 6-3. High and low values of process variables**Notes**

- To configure the event type as HI, LO, IN HI/LO or OUT HI/LO, see pages 42-43
- Values are exclusive. For example, if the event type is HI, the assigned process variable is mass flow, and the HI PV value is set for 100 lb/min, the event will occur when the mass flow rate *exceeds* 100 lb/min

Variable	Description
HI PV value	• If event type is HI or OUT HI/LO, enter the value above which the event will occur • If event type is IN HI/LO, enter the value below which the event will occur • If event type is OUT HI/LO or IN HI/LO, you must also enter a LO PV value
LO PV value	• If event type is LO or OUT HI/LO, enter the value below which the event will occur • If event type is IN HI/LO, enter the value above which the event will occur • If event type is OUT HI/LO or IN HI/LO, you must also enter a HI PV value

Assigning an event to a batch control function, totalizer, or output

To enable a discrete event to control the process, the event must be assigned to a batch control function, totalizer, or discrete output.

- To assign a discrete event to a batch control function, see page 37.
- To assign a discrete event to a totalizer, see page 41.
- To assign a discrete event to a discrete output, see pages 49-50.

Example:

Configure discrete event 1 so it will inhibit totalizer 1 when the mass flow rate in forward or backward direction is less than 2 pounds/minute.

1. Select lb/min as the mass unit (see page 14).
2. Configure totalizer 1 so the flow source is mass and the flow direction is subtractive forward/reverse (see page 41).
3. Configure discrete event 1 so the event type is IN HI/LO and the process variable is mass flow (see pages 42-43.)
4. Enter a value of 2 for the high process variable value and a value of -2 for the low process variable value (see **Table 6-3**, page 44).
5. Exit the process comparator menu.
6. Return to the totalizers menu, then configure totalizer 1 so the inhibit source is discrete event 1 (see page 41).

7

Outputs

7.1 About this chapter

This chapter explains how to configure outputs. Outputs include all the software parameters listed in **Figure 7-1**, page 48.

Failure to perform configuration tasks in the proper sequence could result in an incomplete configuration. Perform configuration tasks in the following sequence:

1. Configure system data (see **Chapter 3**).
2. Configure inputs (see **Chapter 4**).
3. Configure the discrete batch control application, if it is present (see **Chapter 5**).
4. Configure measurements (see **Chapter 6**).
5. Configure outputs.
6. Configure monitoring (see **Chapter 8**).
7. Configure digital communication (see **Chapter 9**).

CAUTION

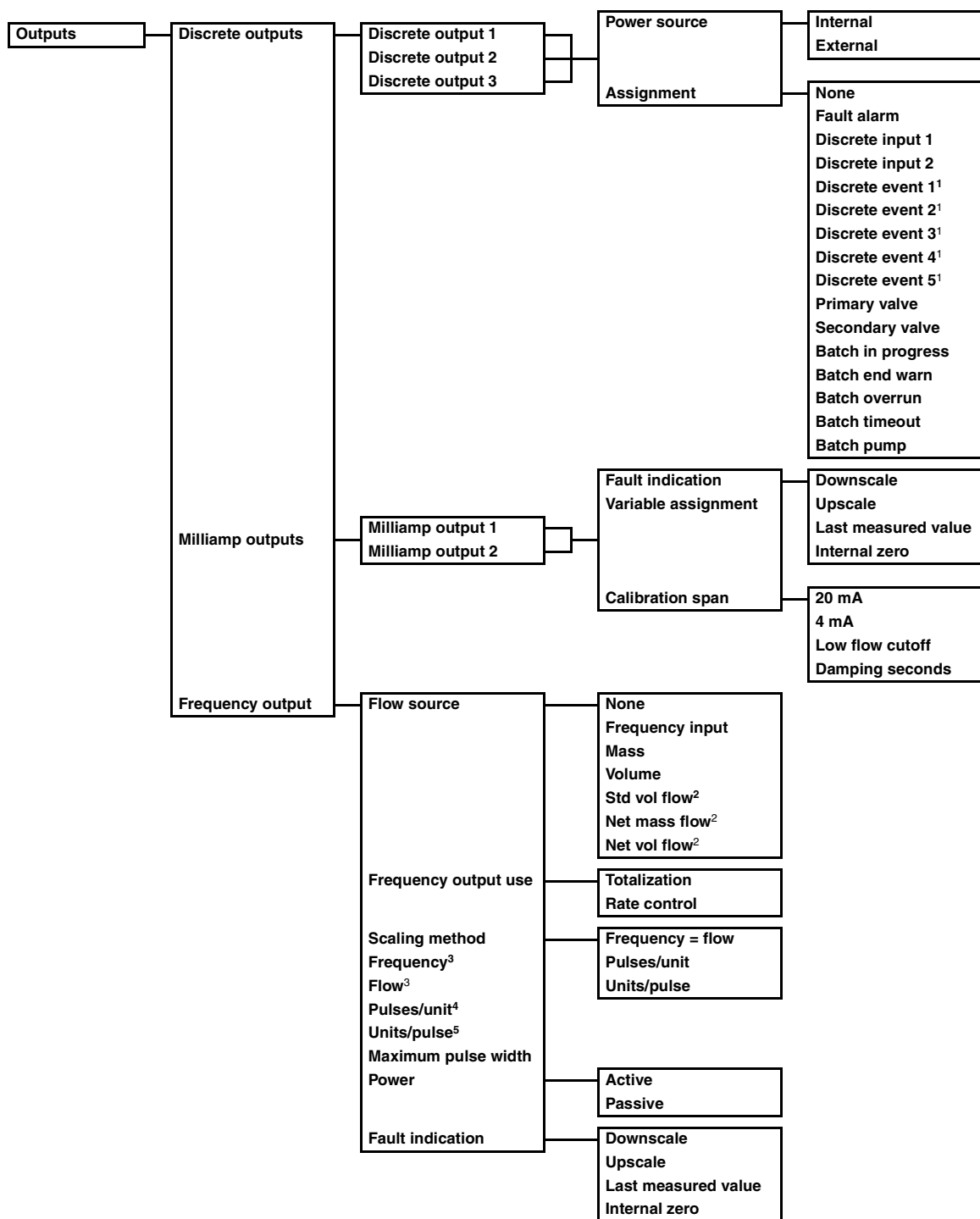
Selecting configuration will interrupt measurement and control functions. All outputs will go to their configured fault settings.

Set control devices for manual operation before accessing configuration menus.

7.2 Recording outputs

While you are configuring outputs, record them in the Series 3000 configuration record (**Appendix B**).

Figure 7-1. Outputs menu



¹If discrete event is configured under Measurements.

²If density application software is installed and configured.

³If frequency = flow is selected.

⁴If pulses/unit is selected.

⁵If units/pulse is selected.

Outputs *continued*

7.3 Discrete outputs

Configuration

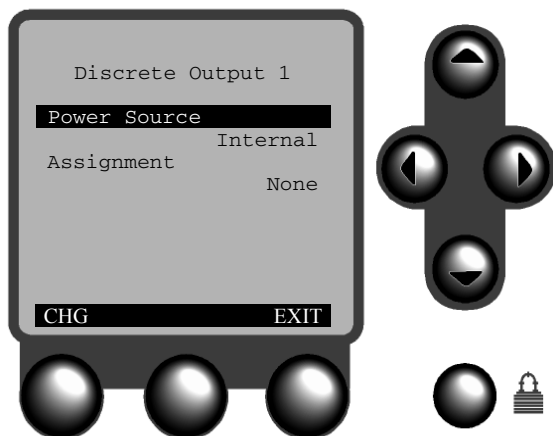
└─ Outputs

└─ Discrete outputs

└─ Discrete output 1

└─ Discrete output 2

└─ Discrete output 3



To configure discrete outputs:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Outputs.
4. Select Discrete Outputs.
5. Select Discrete Output 1, Discrete Output 2, or Discrete Output 3.
6. Use the function buttons and cursor control buttons to configure the power source and assignment for the selected discrete output.

Power source

- To select the appropriate power source, see **Table 7-1**, below.
- Discrete outputs can be connected to factory-supplied or user-supplied relays. For relay specifications and installation instructions, see the *Series 3000 Installation Manual*.

Assignment

Select the event or discrete input that will control the on/off states of the discrete output. See **Table 7-2**, page 50.

Table 7-1. Discrete output power sources

Note

For relay specifications and installation instructions, see the *Series 3000 Installation Manual*

Power source	Default	Description
Internal	Internal	• The circuit provides 24 volts when ON and 0 volts when OFF • The circuit is open when ON and closed when OFF
External		• The circuit provides 0 volts when ON and 24 volts when OFF • The circuit is open when OFF and closed when ON

⚠ CAUTION

If "batch in progress" is assigned to a discrete output, connecting the output to a system pump can cause batch overrun or a deadhead pump.

To avoid batch overrun or a deadhead pump, do not connect a discrete output to a pump if "batch in progress" is assigned to the output.

Table 7-2. Discrete output assignment variables**Notes**

- If control options are configured for 1-stage batch operation, primary valve or batch pump functions must be assigned to one of the discrete outputs
- If control options are configured for 2-stage batch operation, primary valve function must be assigned to one discrete output, and secondary valve function must be assigned to another discrete output
- To configure the batch controller for 1-stage or 2-stage operation, and to enable overrun and end warning, see pages 32-33
- To configure discrete inputs, valves, overrun, timeout, and the end warning, see page 37
- To configure discrete events, see pages 42-45

Variable	Default	Description
None	None	The discrete output is inactive
Fault alarm		• The discrete output will indicate any condition that produces a fault alarm • For information about fault alarms, see pages 104-109
Discrete input 1		The discrete output will be controlled by discrete input 1
Discrete input 2		The discrete output will be controlled by discrete input 2
Discrete event 1		The discrete output will be controlled by discrete event 1
Discrete event 2		The discrete output will be controlled by discrete event 2
Discrete event 3		The discrete output will be controlled by discrete event 3
Discrete event 4		The discrete output will be controlled by discrete event 4
Discrete event 5		The discrete output will be controlled by discrete event 5
Primary valve		• The discrete output will control the function of the primary valve • If control options are configured for 1-stage batch operation, primary valve function or batch pump function must be assigned to one of the discrete outputs • If control options are configured for 2-stage batch operation, primary valve function must be assigned to one discrete output, and secondary valve function must be assigned to another discrete output
Secondary valve		• The discrete output will control the function of the secondary valve • If control options are configured for 2-stage batch operation, primary valve function must be assigned to one discrete output, and secondary valve function must be assigned to another discrete output
Batch in progress		• The discrete output will indicate the batch is in progress • "Batch in progress" is a status indicator only • Because "batch in progress" remains active until batch completion, using "batch in progress" to control a pump can cause batch overrun or a deadhead pump
Batch end warn		The discrete output will indicate when the batch total has exceeded the percent of target or quantity subtracted from target that is configured for batch end warn
Batch overrun		The discrete output will indicate when the batch total has exceeded the amount configured for batch overrun
Batch timeout		At start of batch or at any time before batch completion, the discrete output will be active if no flow has been measured for the amount of time configured for time out
Batch pump		• The discrete output will control the function of the system pump • The pump remains on while the primary or secondary valve is open • If control options are configured for 1-stage batch operation, primary valve function or batch pump function must be assigned to one of the discrete outputs

Outputs *continued*

7.4 Milliamp outputs

Configuring milliamp outputs includes the following procedures:

- Configuring fault indication
- Assigning a process variable to the output
- Configuring the calibration span

Fault indication

Configuration

└ Outputs

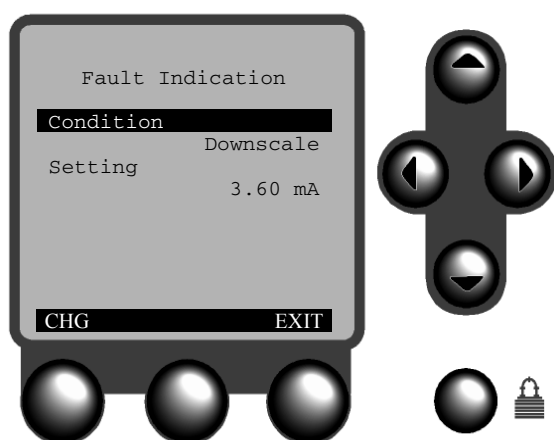
└ Milliamp outputs

└ Milliamp output 1

└ Fault indication

└ Milliamp output 2

└ Fault indication



To configure fault indication for milliamp outputs:

1. Press the security button on the display face.
2. Select Outputs.
3. Select Milliamp Outputs.
4. Select Milliamp Output 1 or Milliamp Output 2.
5. Select Fault Indication.
6. Use the function buttons and cursor control buttons to configure the condition and setting of fault indicators for the selected milliamp output.

Condition

Milliamp outputs can produce downscale, upscale, last measured value, or internal zero fault indicators. See **Table 7-3**. The default condition is downscale.

Setting

If downscale or upscale is selected as the fault condition, the setting determines the amount of current that indicates a fault. See **Table 7-3**.

⚠ CAUTION

Using last measured value or internal zero may hamper identification of fault outputs.

To make sure fault outputs can be identified, select downscale or upscale.

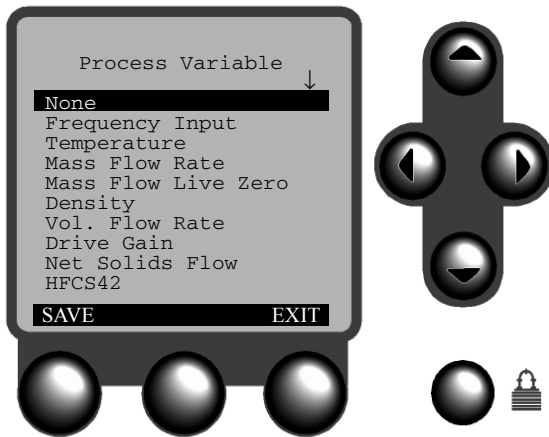
Table 7-3. Fault conditions and settings for milliamp outputs

Condition	Default condition	Description	Default setting
Downscale	Downscale	Can be configured from 1.0 to 3.6 mA	3.6 mA
Upscale		Can be configured from 21.0 to 24.0 mA	22.0 mA
Last measured value		• Holds at the mA value that represents the last measured value for the process variable before the fault occurred • Apparent lack of variation in the process variable could indicate a fault	Not applicable
Internal zero		• Goes to the mA value that represents a value of 0.0 for the process variable • An apparent value of 0.0 for the process variable could indicate a fault	

Process variable

Configuration

- └─ Outputs
 - └─ Milliamp outputs
 - └─ Milliamp output 1
 - └─ Variable assignment
 - └─ Milliamp output 2
 - └─ Variable assignment



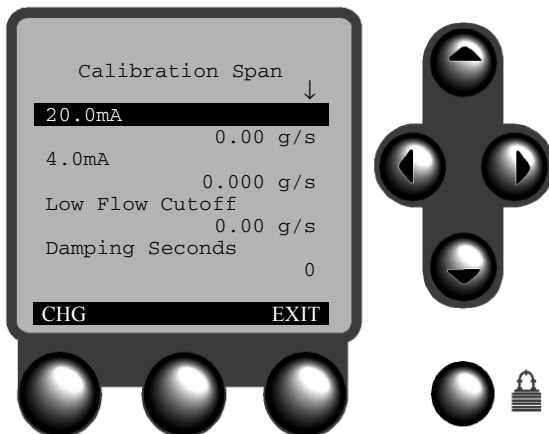
To assign process variables to milliamp outputs:

1. Press the security button on the display face.
2. Select Outputs.
3. Select Milliamp Outputs.
4. Select Milliamp Output 1 or Milliamp Output 2.
5. Select Variable Assignment.
6. Press CHG to access the process variable menu.
7. Use the function buttons and cursor control buttons to select a process variable.

Calibration span

Configuration

- └─ Outputs
 - └─ Milliamp outputs
 - └─ Milliamp output 1
 - └─ Calibration span
 - └─ Milliamp output 2
 - └─ Calibration span



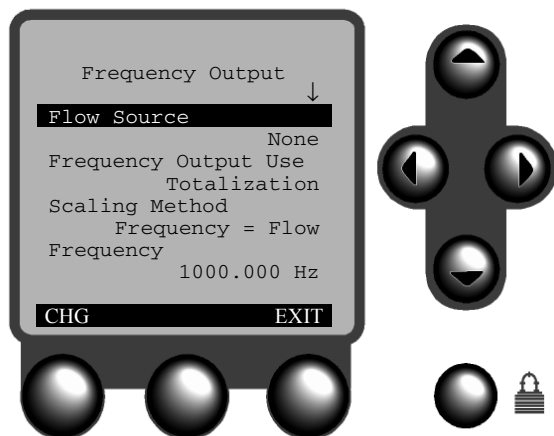
To configure the calibration span for milliamp outputs:

1. Press the security button on the display face.
2. Select Outputs.
3. Select Milliamp Outputs.
4. Select Milliamp Output 1 or Milliamp Output 2.
5. Select Calibration Span.
 - The calibration span menu item appears only after a process variable has been assigned to the output.
 - To assign process variables to milliamp outputs, see above.
6. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 7-4**, page 53.

Outputs *continued***Table 7-4. Calibration span variables****Notes**

- The calibration span menu item appears only after a process variable has been assigned to the output
- To assign process variables to milliamp outputs, see page 52
- Some values are dependent on sensor calibration data. To configure sensor calibration data, see pages 18-26

Variable	Default	Description
20 mA	0.0 for all process variables	• Enter the value the output will represent at 20.0 mA • The entered value must be greater than the 4.0 mA value
4 mA		• Enter the value the output will represent at 4.0 mA • The entered value must be less than the 20.0 mA value
Low flow cutoff	0.0 for all flow variables	• If a flow variable is assigned to the output, the low flow cutoff is the flow rate below which the output will indicate zero flow • The entered value must be greater than the mass or volume low flow cutoff that was configured as a flow variable (see page 14)
Damping seconds	0 sec	• Select the amount of added damping for the milliamp output • Damping is added to damping that has been configured for flow, density, or temperature (see pages 14-17)
4.0 mA minimum	Not applicable	The lowest value that can be represented by the output
20.0 mA maximum	(read-only)	The highest value that can be represented by the output
Minimum span		• The smallest allowable difference between the value represented at 4.0 mA and the value represented at 20.0 mA • The 20.0 mA value must be greater than the 4.0 mA value

7.5 Frequency output**Configuration**└─ **Outputs**└─ **Frequency output**

To configure the frequency output:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Outputs.
4. Select Frequency Output.
5. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 7-5**, page 54.

⚠ CAUTION

Using last measured value or internal zero may hamper identification of fault outputs.

To make sure fault outputs can be identified, select downscale or upscale.

Table 7-5. Frequency output variables

Variable	Default	Description
Flow source	None	- Frequency input: Output will indicate accumulated total of the variable that is represented by the frequency input - Mass: Output will indicate mass total - Volume: Output will indicate volume total - Std vol flow (available only if density application software is installed and configured to indicate standard volume flow): Output will indicate standard volume total at reference temperature - Net mass flow (available only if density application software is installed and configured to indicate net mass flow): Output will indicate net mass total - Net vol flow (available only if density application software is installed and configured to indicate net volume flow): Output will indicate net volume total at reference temperature
Frequency output use	Totalization	- Select totalization if the output will be used as or connected to a pulse counter - Select rate control if the output will be used for controlling the flow rate
Scaling method	Frequency = flow	- Select frequency = flow, pulses/unit, or units/pulse - The frequency output has a range of 0 to 12,500 Hz
Frequency	1000.000 Hz	If frequency = flow is selected as the scaling method, enter the frequency (or pulse rate), in Hz, that represents the configured flow rate
Flow	1000.000 kg/min	If frequency = flow is selected as the scaling method, enter the flow rate that is represented by the configured frequency
Pulses	60.00 pulses	If pulses/unit is selected as the scaling method, enter the number of output pulses that represents one mass or volume unit
Units	0.017 kg	If units/pulse is selected as the scaling method, enter the number of mass or volume units that is represented by one output pulse
Maximum pulse width	511 ms	- The pulse width can be configured for output frequencies below 500 Hz - Enter the desired pulse width in milliseconds
Power	Active	Select active or passive operation for the frequency output - Voltage is 24 VDC nominal for active operation, 20 VDC applied maximum for passive operation - Sourcing current is 10 mA at 3 VDC for active operation - Sinking current is 500 mA for active or passive operation
Fault indication	Downscale	- Downscale: Output goes to 0 Hz - Upscale: Output goes to 15,000 Hz - Last measured value: - Output holds at the frequency that represents the last measured flow rate before the fault occurred - Apparent lack of variation in the flow rate could indicate a fault - Internal zero: - Output goes to 0 Hz - An apparent no-flow condition could indicate a fault

8

Monitoring

8.1 About this chapter

This chapter explains how to configure monitoring. Monitoring includes all the software parameters listed in **Figure 8-1**.

Failure to perform configuration tasks in the proper sequence could result in an incomplete configuration. Perform configuration tasks in the following sequence:

1. Configure system data (see **Chapter 3**).
2. Configure inputs (see **Chapter 4**).
3. Configure the discrete batch control application, if it is present (see **Chapter 5**).
4. Configure measurements (see **Chapter 6**).
5. Configure outputs (see **Chapter 7**).
6. Configure monitoring.
7. Configure digital communication (see **Chapter 9**).

CAUTION

Selecting configuration will interrupt measurement and control functions. All outputs will go to their configured fault settings.

Set control devices for manual operation before accessing configuration menus.

8.2 Recording monitoring data

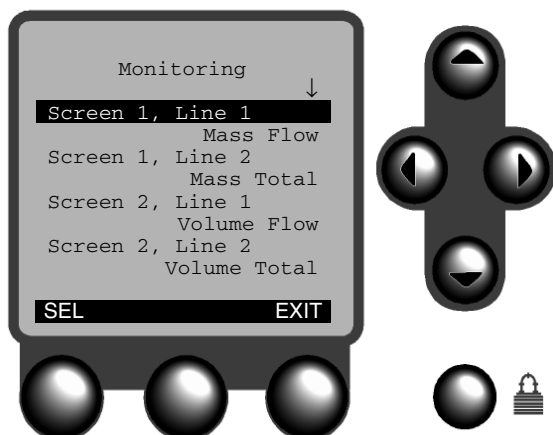
While you are configuring monitoring data, record the data in the Series 3000 configuration record (**Appendix B**).

Figure 8-1. Monitoring menu

Monitoring	
	Screen 1, line 1
	Screen 1, line 2
	Screen 2, line 1
	Screen 2, line 2
	Screen 3, line 1
	Screen 3, line 2
	Screen 4, line 1
	Screen 4, line 2
	Screen 5, line 1
	Screen 5, line 2
	Screen 5, line 3
	Screen 5, line 4

8.3 Process monitor

Configuration
└─ Monitoring



To configure monitoring:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Monitoring.
4. Use the function buttons and cursor control buttons to configure the parameters that are listed in **Table 8-1**.

For information about using the process monitor, see pages 84 and 91.

Table 8-1. Monitoring parameters

Variable	Default	Description
Screen 1, line 1	Mass flow rate	Select the process variable that will appear on screen 1, line 1
Screen 1, line 2	Mass total	Select the process variable that will appear on screen 1, line 2
Screen 2, line 1	Volume flow rate	Select the process variable that will appear on screen 2, line 1
Screen 2, line 2	Volume total	Select the process variable that will appear on screen 2, line 2
Screen 3, line 1	Density	Select the process variable that will appear on screen 3, line 1
Screen 3, line 2	Temperature	Select the process variable that will appear on screen 3, line 2
Screen 4, line 1	Density	Select the process variable that will appear on screen 4, line 1
Screen 4, line 2	Mass flow rate	Select the process variable that will appear on screen 4, line 2
Screen 5, line 1	Mass flow rate	Select the process variable that will appear on screen 5, line 1
Screen 5, line 2	Volume flow rate	Select the process variable that will appear on screen 5, line 2
Screen 5, line 3	Density	Select the process variable that will appear on screen 5, line 3
Screen 5, line 4	Temperature	Select the process variable that will appear on screen 5, line 4

9

Digital Communication

9.1 About this chapter

This chapter explains how to configure digital communication. Digital communication includes all the software parameters listed in **Figure 9-1**, page 58.

Failure to perform configuration tasks in the proper sequence could result in an incomplete configuration. Perform configuration tasks in the following sequence:

1. Configure system data (see **Chapter 3**).
2. Configure inputs (see **Chapter 4**).
3. Configure the discrete batch control application, if it is present (see **Chapter 5**).
4. Configure measurements (see **Chapter 6**).
5. Configure outputs (see **Chapter 7**).
6. Configure monitoring (see **Chapter 8**).
7. Configure digital communication.

CAUTION

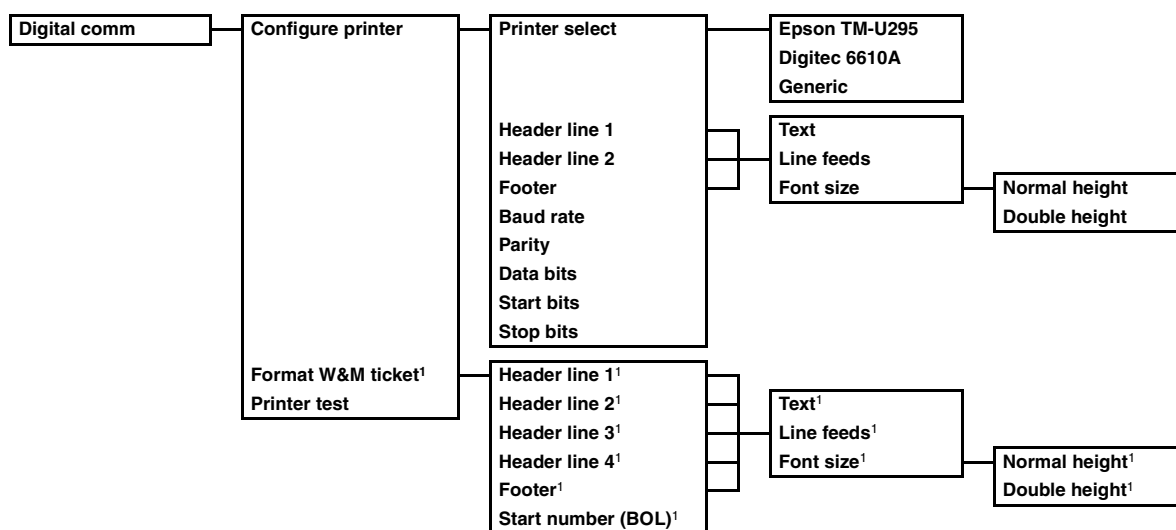
Selecting configuration will interrupt measurement and control functions. All outputs will go to their configured fault settings.

Set control devices for manual operation before accessing configuration menus.

9.2 Recording printer settings

While you are configuring printer settings, record them in the Series 3000 configuration record (**Appendix B**).

Figure 9-1. Digital communication menu



¹If custody transfer software and security switch are installed.

9.3 Configuring the printer setup

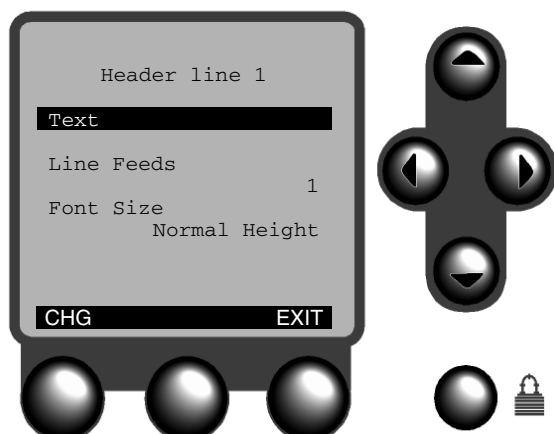
Configuring the printer setup includes the following procedures:

1. Configuring the headers and footer
2. Selecting the printer
3. Configuring the baud rate, parity, data bits, start bits, and stop bits

Headers and footer

Configuration

- └ Digital comm
 - └ Configure printer
 - └ Header line 1
 - └ Header line 2
 - └ Footer



To configure the headers and footer:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Digital Comm.
4. Select Configure Printer.
5. Select Header Line 1, Header Line 2, or Footer.
6. Use the function keys and cursor control buttons to configure the parameters that are listed in **Table 9-1**, page 59.

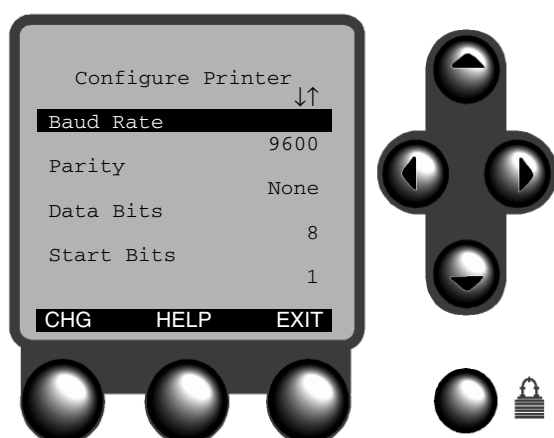
Table 9-1. Headers and footer for printer ticket

Variable	Default	Description
Text	Not applicable (no text)	Enter up to 21 characters of text for this line of the header or for the footer
Line feeds	1 line	- Enter 1 or 2 if the font size is normal height - Enter 2 if the font size is double height
Font size	Normal height	Select normal height or double height

Printer, baud rate, and bits**Configuration**

└ Digital comm

└ Configure printer



To configure the printer, baud rate, parity, data bits, start bits, and stop bits:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Digital Comm.
4. Select Configure Printer.
5. Use the function keys and cursor control buttons to configure the parameters that are listed in **Table 9-2**.

Typical tickets are illustrated in **Figure 9-2** and **Figure 9-3**, page 60.

- **Figure 9-2** illustrates a typical process monitor ticket.
- **Figure 9-3** illustrates a typical batch ticket.

Table 9-2. Printer setup variables

Variable	Default	Description
Printer select	Epson TM-U295	Select Epson TM-U295, Digitec 6610A, or generic
Baud rate	9600 bps	Select 1200, 2400, 4800, or 9600 bps to match baud rate for the selected printer
Parity	None	Select none, odd, or even to match parity bits for the selected printer
Data bits	8 bits	Enter 7 or 8 data bits to match data bits for the selected printer
Start bits	1 bit	This variable is fixed at 1 start bit and cannot be changed
Stop bits	1 bit	Enter 1 or 2 stop bits to match stop bits for the selected printer

Figure 9-2. Typical process monitor ticket

LINE 1	
LINE 2	
DEVICE 1	
2-JUN-1999	7:17:12
Mass Flow Rate	
Units: g/s	
Current value:	143.642
Mass Total	
Units: g	
Current value:	841.64
FOOTER	

Figure 9-3. Typical batch ticket

LINE 1	
LINE 2	
DEVICE 1	
2-JUN-1999	7:17:12
Preset 1	
Units: g	
Actual:	1000.1
Target:	1000.0
FOOTER	

9.4 Weights and measures ticket

The format weights and measures ticket menu appears only if the custody transfer software and security switch are installed.

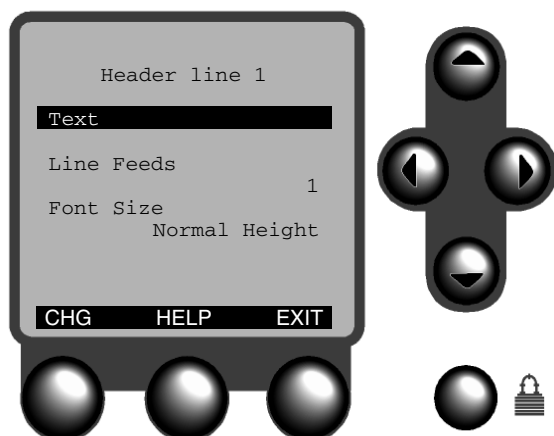
Configuring a weights and measures ticket includes the following procedures:

1. Configuring the headers and footer
2. Entering the start number for bills of lading

Headers and footer

Configuration

- └ Digital comm
 - └ Format W&M ticket
 - └ Header line 1
 - └ Header line 2
 - └ Header line 3
 - └ Header line 4
 - └ Footer



To configure the headers and footer:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Digital Comm.
4. Select Format W&M Ticket.
5. Select Header Line 1, Header Line 2, Header Line 3, Header Line 4, or Footer.
6. Use the function keys and cursor control buttons to configure the parameters that are listed in Table 9-3.

Table 9-3.

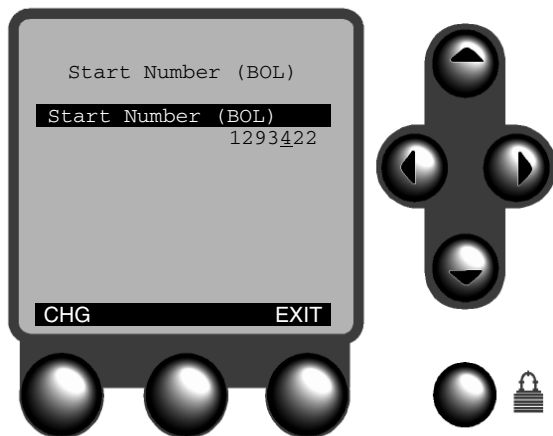
Table 9-3. Headers and footer for weights and measures ticket

Variable	Default	Description
Text	Not applicable (no text)	Enter up to 21 characters of text for this line of the header or for the footer
Line feeds	1 line	• Enter 1 or 2 if the font size is normal height • Enter 2 if the font size is double height
Font size	Normal height	Select normal height or double height

Start number for bills of lading

Configuration

- └ Digital comm
 - └ Format W&M ticket
 - └ Start number (BOL)



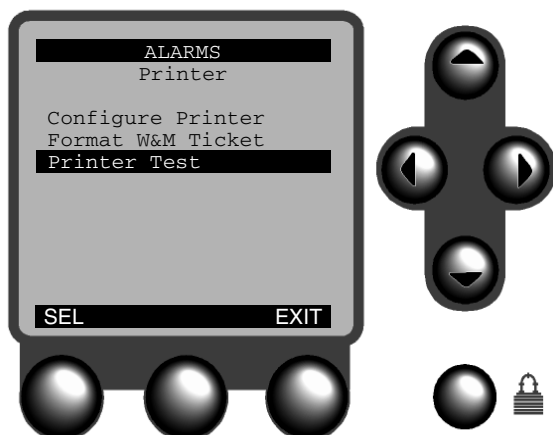
To enter the start number for bills of lading:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Digital Comm.
4. Select Format W&M Ticket.
5. Select Start Number (BOL).
6. Use the function keys and cursor control buttons to enter the desired start number for bills of lading.

9.5 Printer test

Configuration

- └ Digital comm
 - └ Printer test



To perform the printer test:

1. Press the security button on the display test.
2. Select Configuration.
3. Select Digital Comm.
4. Select Printer Test.

When the printer test is complete, the display reads, "Print Test Complete". If printing does not occur:

- Check RS-485 output wiring. See the *Series 3000 Installation Manual*.
- Make sure printer configuration settings are compatible with the selected printer. See the instructions for the selected printer.

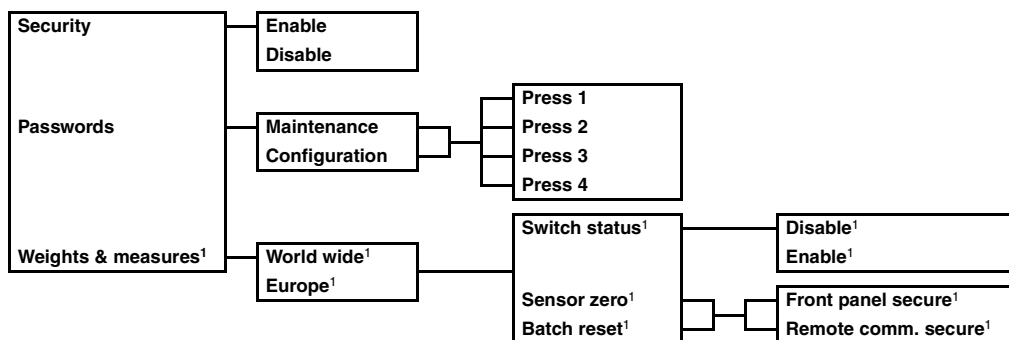
10 Passwords and Language

10.1 About this chapter

This chapter explains how to configure security and select the language for the Person-Process Interface.

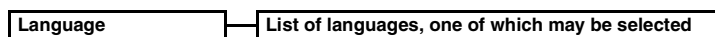
- Security includes all the software parameters listed in **Figure 10-1**.
- Language includes all the software parameters listed in **Figure 10-2**.

Figure 10-1. Security menu



¹If custody transfer software and security switch are installed.

Figure 10-2. Language menu



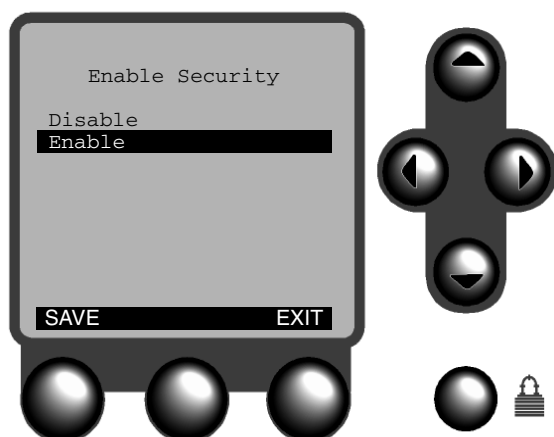
10.2 Security

Security enables limited access to configuration and maintenance menus. If security is enabled, you can set up a configuration password, a maintenance password, or configuration and maintenance passwords.

- The operator can access all software menus by entering the configuration password.
- The operator can access the maintenance menu by entering the maintenance password.

Enabling security

Security
└ Security

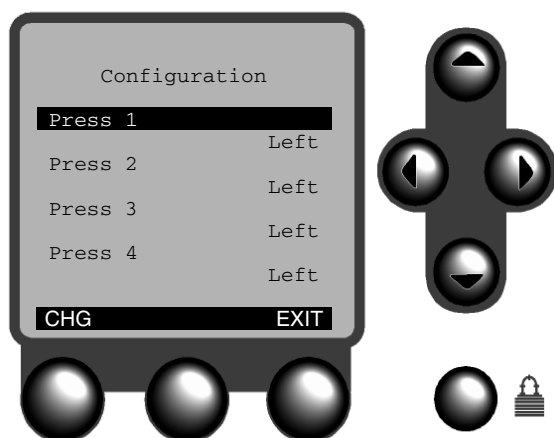


To enable security:

1. Press the security button on the display face.
2. At the main menu, select Security.
3. At the Security menu, again select Security.
4. Select Enable, then press SAVE.

Passwords

Security
└ Passwords
 └ Maintenance
 └ Configuration

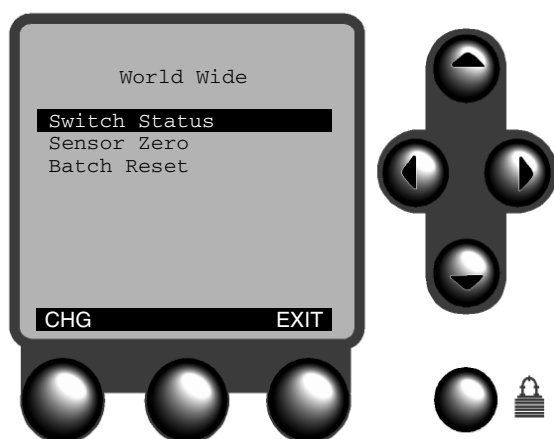


To set up passwords:

1. After enabling security as instructed above, press EXIT to return to the security menu.
2. Select Passwords.
3. Select the type of password that will be set up.
 - Select Maintenance to set up the maintenance password. The maintenance password allows access to the maintenance menu.
 - Select Configuration to set up the configuration password. The configuration password allows access to all software menus.
4. Select the cursor control button that will be pressed first, second, third, and fourth when the password is entered.

10.3 Security for weights and measures

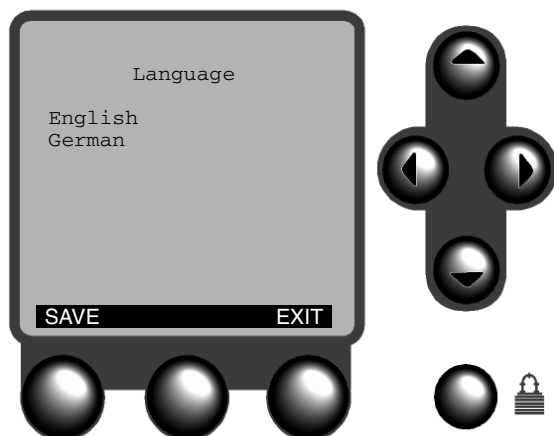
Security
 └ Weights & measures
 └ World Wide
 └ Europe



To configure security for weights and measures (custody transfer) applications, see **Chapter 11**.

10.4 Language

Language



The language menu enables you to select the language for all screens.

To select the language:

1. Press the security button on the display face.
2. Select Language.
3. Select the desired language, then press SAVE.

11

Custody Transfer

11.1 About this chapter

This chapter explains how to configure security for custody transfer.

11.2 Custody transfer configuration procedure

The procedure for configuring security for custody transfer includes the following steps:

1. Configuring the applications platform.
2. If the platform is a Model 3500 or 3700, performing a sensor zero.
3. Setting the security switch.
4. For custody transfer applications in Europe, securing software functions.
5. Installing the weights and measures seal.

Step 1 Configure the applications platform

To configure the applications platform, see **Chapters 3-10**.

Step 2 Perform a sensor zero (Model 3500 or 3700)

If the applications platform is a Model 3500 or 3700, perform a sensor zero. See pages 81-83.

Step 3 Set the security switch

Security for custody transfer will not take effect until the security switch has been set to ON.



CAUTION

Improper handling of transmitter components can damage the applications platform.

To prevent electrostatic discharge, wear an anti-static wrist strap while setting the security switch.

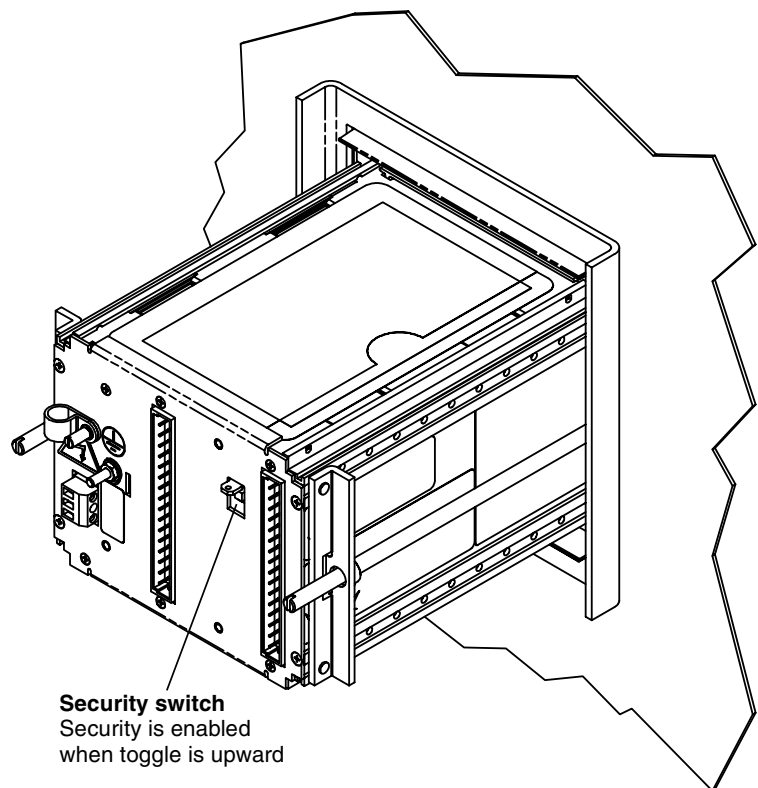
Setting the switch on the Model 3300 or 3500

Model 3300 or 3500 mounted in a panel

To set the security switch on a Model 3300 or 3500 mounted in a panel:

- Loosen the captive screws in the bracket that holds the screw-type wiring connectors or I/O cables in place on the back panel of the applications platform.
- Pull the bracket away from the back panel.
- The security switch is located on the back panel. Set the switch so the toggle is upward. See **Figure 11-1**.
- Plug the bracketed wiring connectors or I/O cables onto the terminal strips in the back panel.
- Tighten the captive screws to secure the bracket to the back panel.

Figure 11-1. Security switch on panel-mount Model 3300 or 3500



Model 3300 or 3500 mounted in a 19-inch (486.2 mm) DIN subrack

To set the security switch on a Model 3300 or 3500 mounted in a subrack:

- a. Loosen the captive screws that secure the front panel of the applications platform to the guide rails in the subrack.
- b. Slide the platform out of the subrack.
- c. The security switch is located on the back panel of the platform. Set the switch so the toggle is upward. See **Figure 11-2**.
- d. Align the platform with the guide rails in the subrack.
- e. Slide the platform into the subrack. Make sure the pins on the back panel make contact with the wiring connectors.
- f. Replace the top two or bottom two screws in the front panel of the platform with the supplied lockout screws. See **Figure 11-3**, page 70.
- g. Make sure all four front-panel screws are tightly secured to the guide rails in the subrack.

Figure 11-2. Security switch on rack-mount Model 3300 or 3500

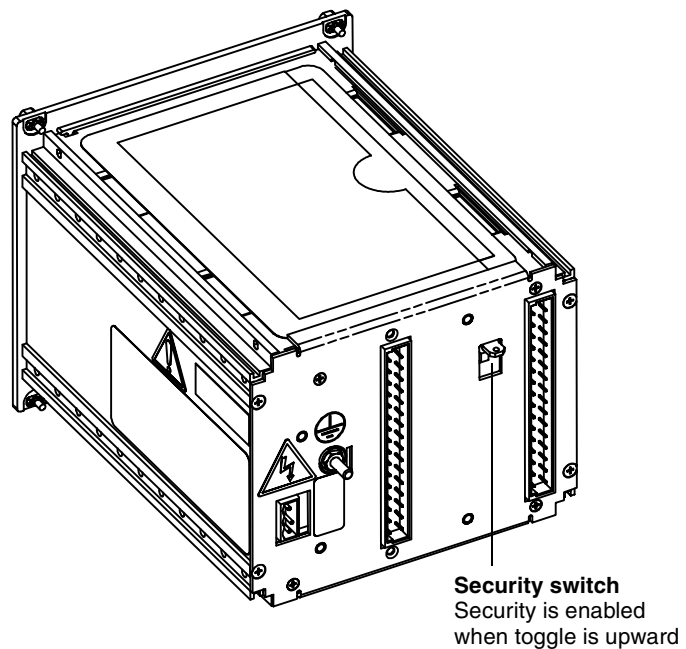
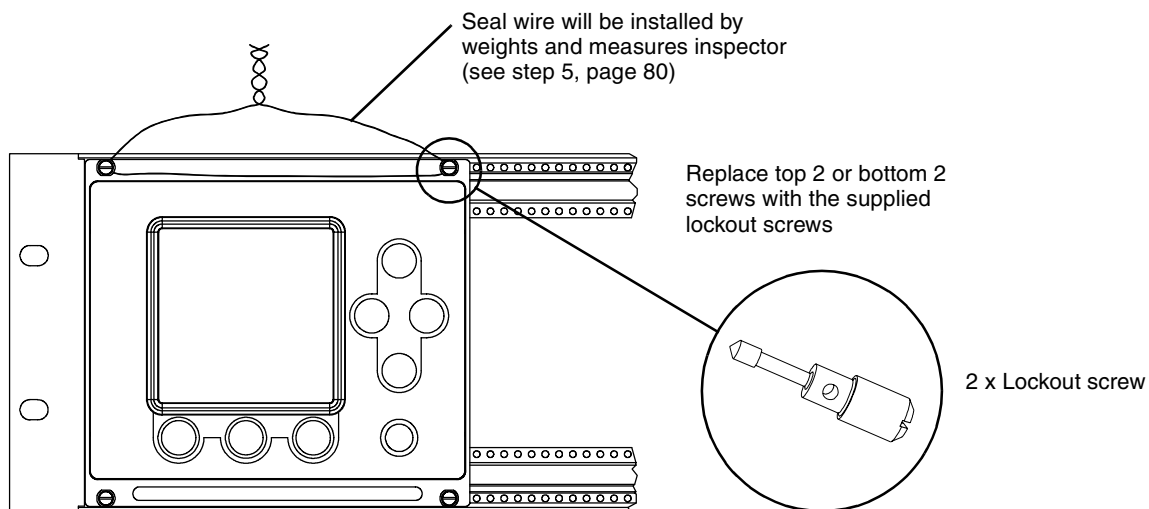


Figure 11-3. Installing lockout screws on rack-mount platform



Setting the switch on the Model 3350 or 3700

⚠ WARNING

Explosion hazard.

In an explosive atmosphere, do not remove the circuit board compartment cover within 2 minutes after power has been disconnected.

Figure 11-4 identifies the circuit board compartment.

⚠ CAUTION

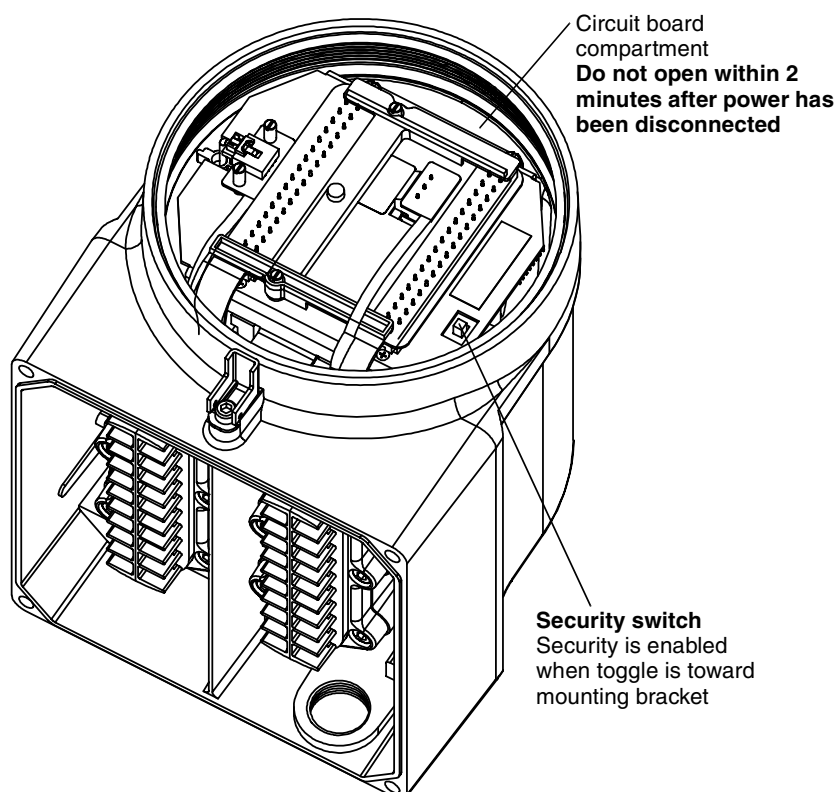
Improper handling of transmitter components can damage the applications platform.

If a breaker bar or other tool is used for loosening the cover of the circuit board compartment:

- Apply steady pressure to avoid chipping the paint. Chipped paint can result in corrosion of the housing. If the paint is chipped, repaint the housing.
- Do not apply excessive torque. Excessive torque can damage the pipeline or the platform.

To set the security switch on the Model 3350 or 3700:

- a. Unscrew the circuit board compartment cover.
- b. The security switch is located on the panel inside the circuit board compartment. Set the switch so the toggle is toward the mounting bracket for the applications platform. See **Figure 11-4**, page 71.
- c. Reinstall the cover. Tighten the cover to 12 ft-lb (16 Nm) torque.

Figure 11-4. Security switch for Model 3350 or 3700**Applicable conditions
when switch is on**

When the security switch is ON, the conditions listed in **Table 11-1** apply.

Table 11-1. Conditions in effect when security switch is on

Variable	Description
View menu functions	Parameters listed on page 73 are not secured
Configuration menu functions	- Parameters listed in bold type on pages 73-78 are secured - Parameters listed in gray type on pages 73-78 are <i>not</i> secured - Time can be changed to one hour earlier or one hour later than the current time to accommodate daylight savings time or standard time - Time cannot be changed to one hour earlier or one hour later twice in succession - Discrete batch flow source cannot be changed - Batch cannot be disabled - Batch totalizers count upward - Reset on start is not available as a batch control option - Number of decimal places in batch totals cannot be changed - Discrete inputs cannot be configured to inhibit batch or inhibit totalizer
Maintenance menu functions	- Parameters listed in bold type on pages 78-79 are secured - Parameters listed in gray type on pages 78-79 are <i>not</i> secured - Batch AOC can be calibrated
Security menu functions	- Parameters listed in bold type on page 80 are secured - Parameters listed in gray type on page 80 are <i>not</i> secured
Language menu functions	Language selection is secured

Step 4 Secure software functions (Europe)

For custody transfer security in Europe, you can secure individual software parameters.

To secure the software configuration:

- Press the security button on the display face.
- Select Security.
- Select Weights & Measures.
- Select Europe.
- Use the function buttons and cursor control buttons to secure the parameters listed in **Table 11-2**.

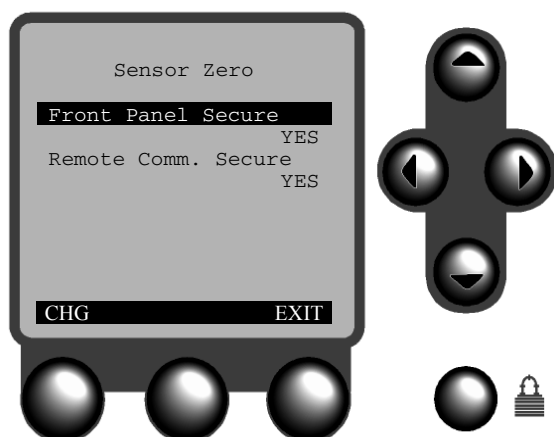
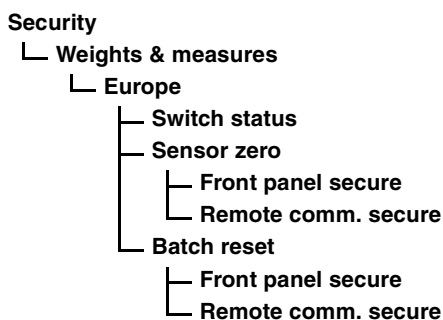


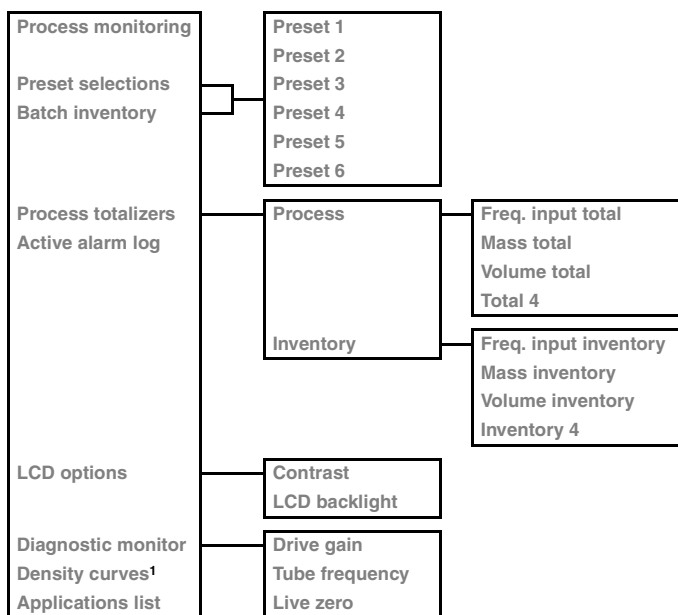
Table 11-2. Security for custody transfer in Europe

Note

The capability for performing a sensor zero or for resetting a batch using a discrete input or digital communication is not currently available, but will be available in a later Series 3000 release

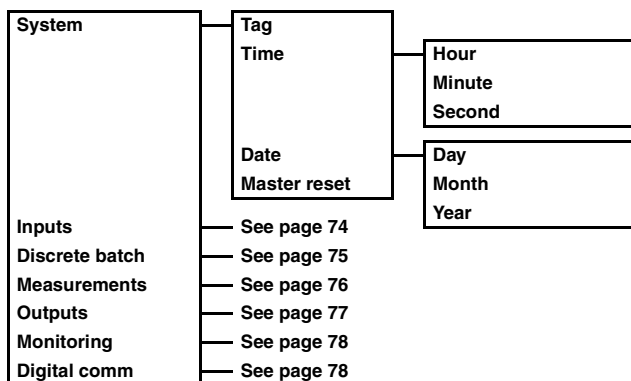
Variable	Default	Description
Switch status	- Enabled if security switch is ON - Disabled if security switch is OFF	- Set security switch to ON to enable security. If security is enabled: - Parameters in bold type on pages 73-80 are secured - Parameters in gray type on pages 73-80 are <i>not</i> secured - Set security switch to OFF to disable security. If security is disabled, all parameters listed on pages 73-80 are <i>not</i> secured
Sensor zero	- Front panel secure: YES - Remote comm. secure: YES	- If security switch is ON and front panel secure is set to YES, sensor zero cannot be performed using the display - If security switch is ON and remote comm. secure is set to YES, sensor zero cannot be performed using a discrete input or digital communication
Batch reset	- Front panel secure: YES - Remote comm. secure: YES	- If security switch is ON and front panel secure is set to YES, a running batch cannot be reset using the display - If security switch is ON and remote comm. secure is set to YES, a running batch cannot be reset using a discrete input or digital communication

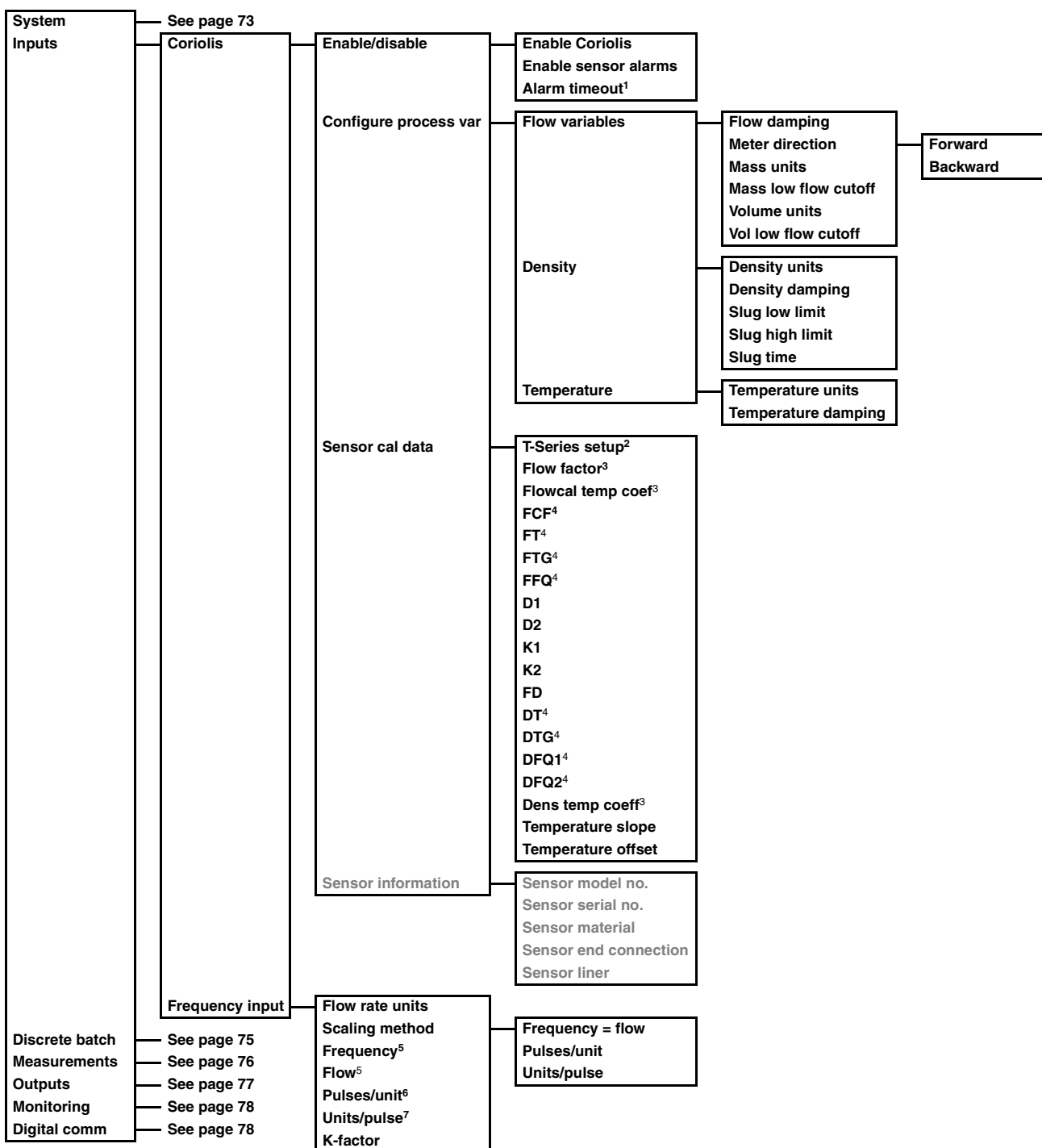
View menu

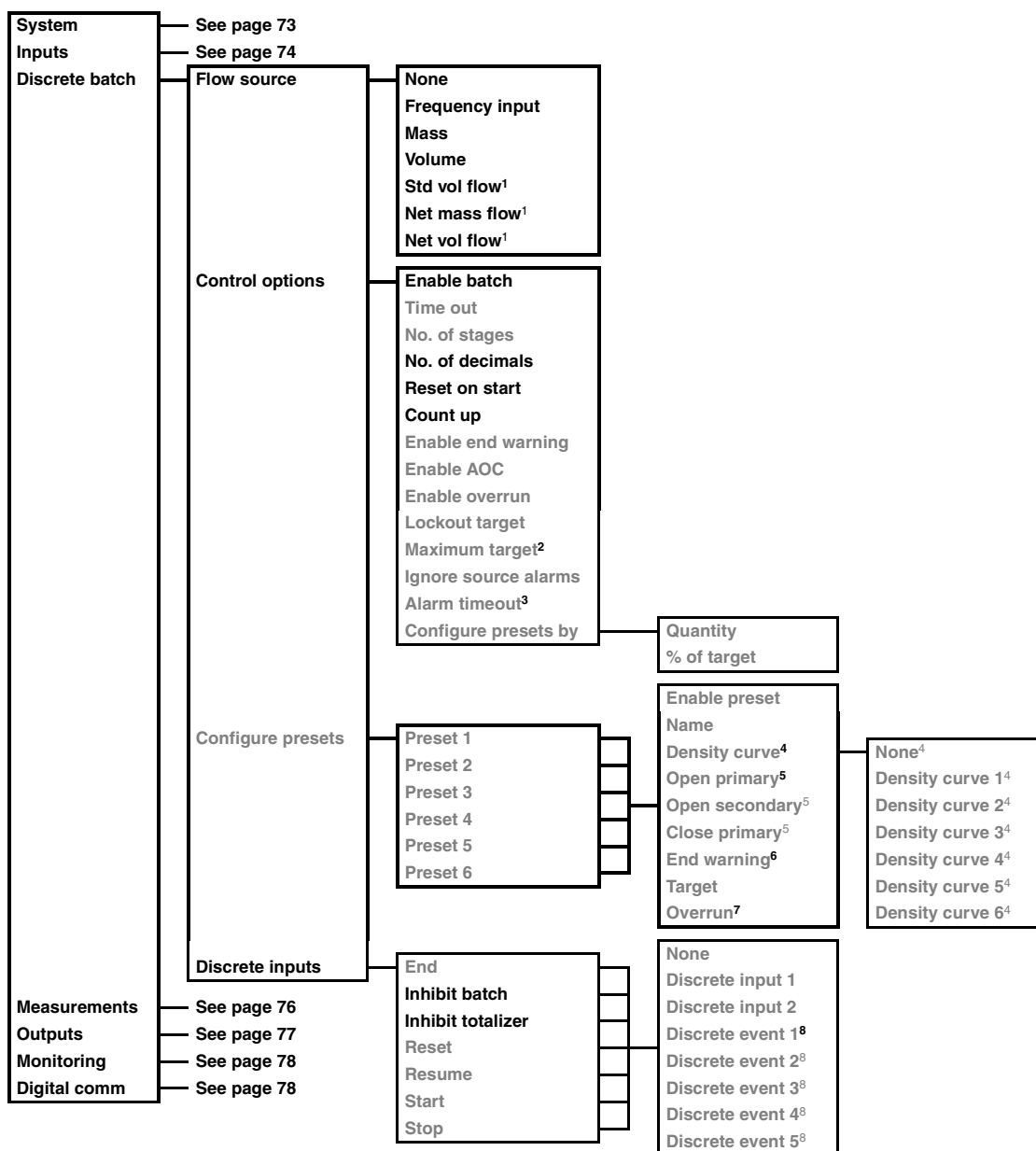


¹If density application software is installed and configured, and if density curves have not been assigned to batch presets under Discrete Batch.

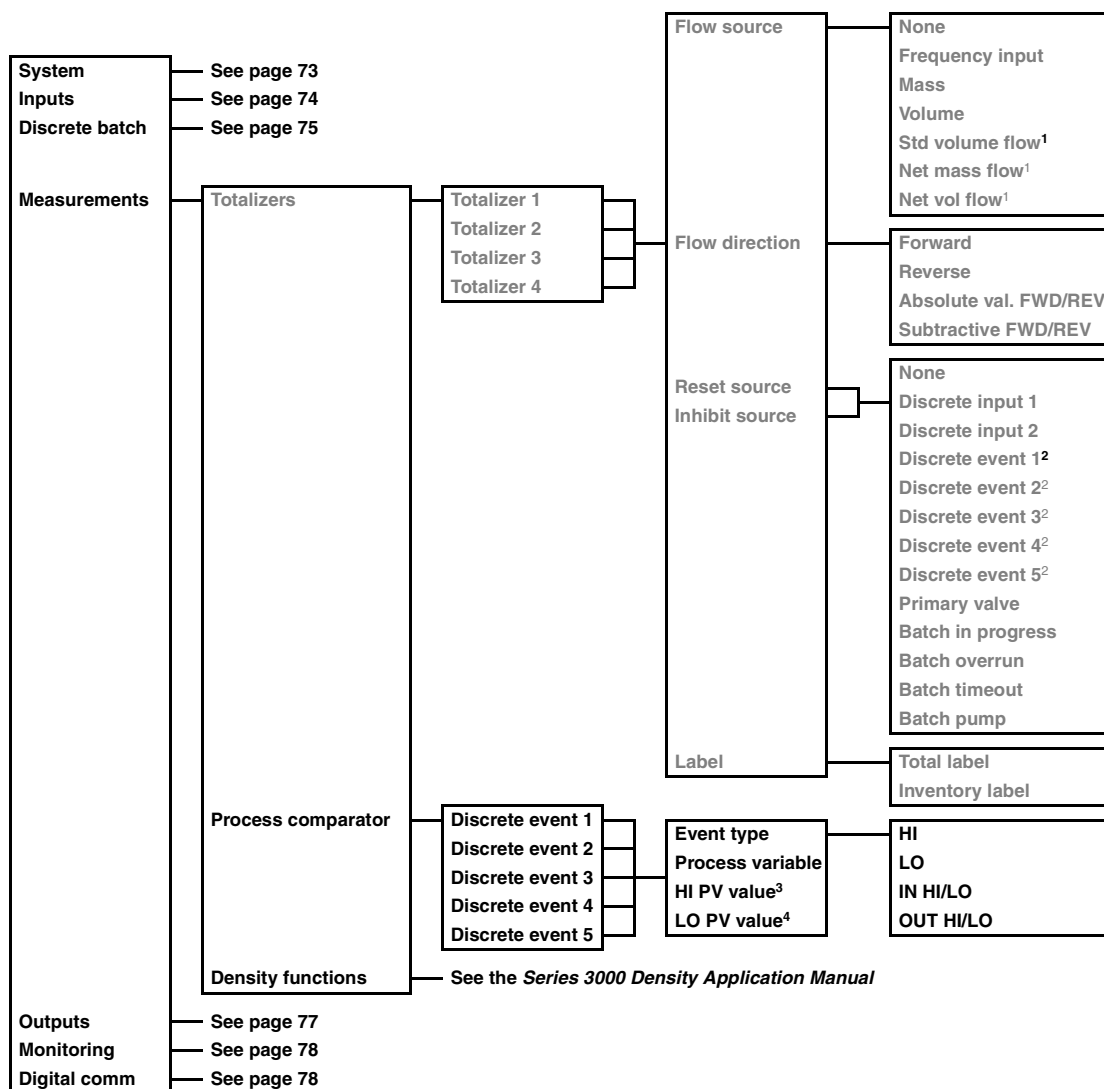
Configuration menu: System



Configuration menu: Inputs¹If enable sensor alarms is set to NO.²If a sensor is not connected.³If an ELITE, BASIS, Model D, Model DL, or Model DT sensor is connected, or if T-Series setup is set to NO.⁴If a T-Series sensor is connected or if T-Series setup is set to YES.⁵If frequency = flow is selected.⁶If pulses/unit is selected.⁷If units/pulse is selected.

Configuration menu: Discrete batch¹If density application software is installed and configured.²If lockout target is set to NO.³If Ignore source alarms is set to YES.⁴If density application software is installed and configured.⁵If no. of stages is set to 2.⁶If enable end warning is set to YES.⁷If enable overrun is set to YES.⁸If discrete event has been configured under Measurements.

Configuration menu: Measurements



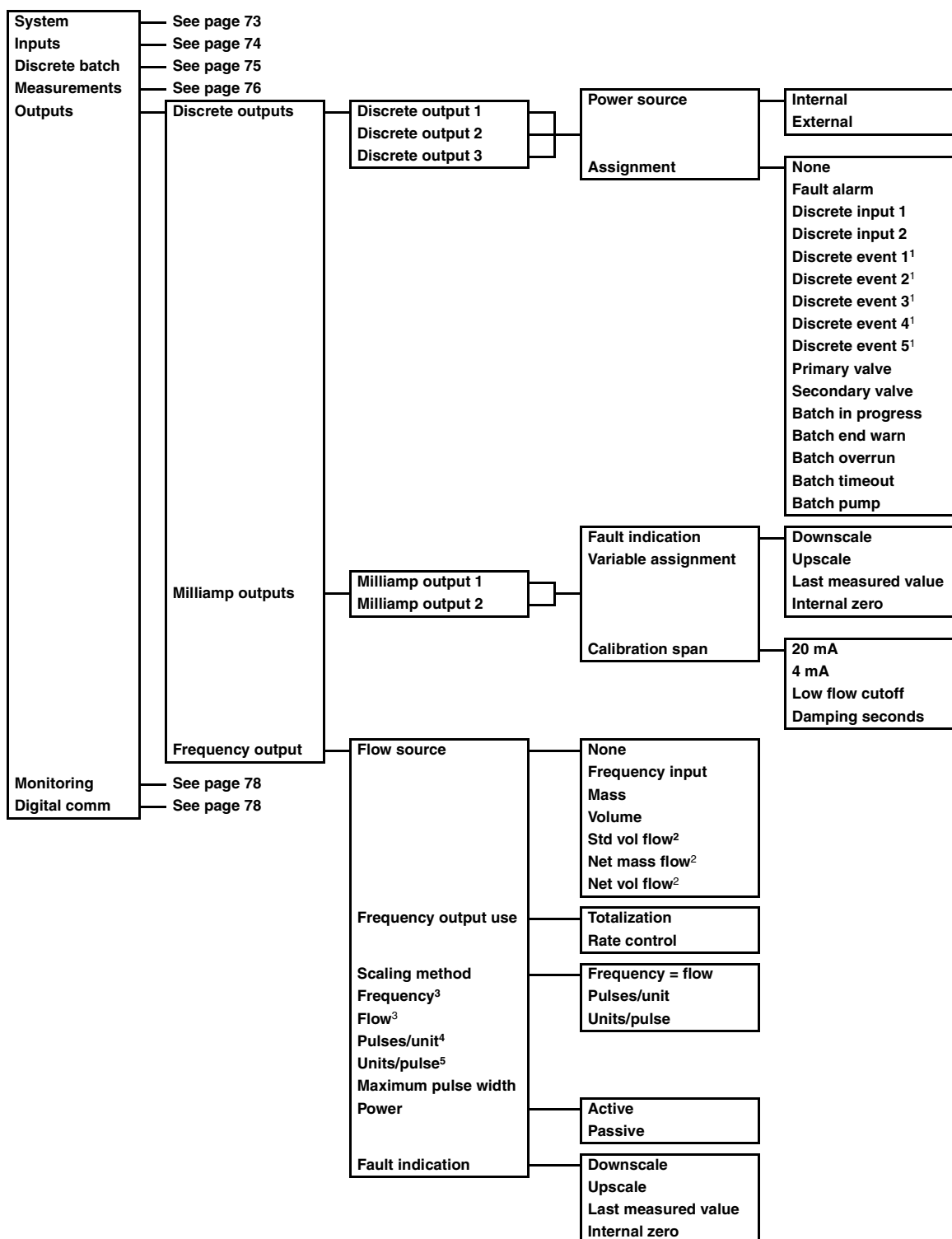
¹If density application software is installed and configured.

²If discrete event has been configured.

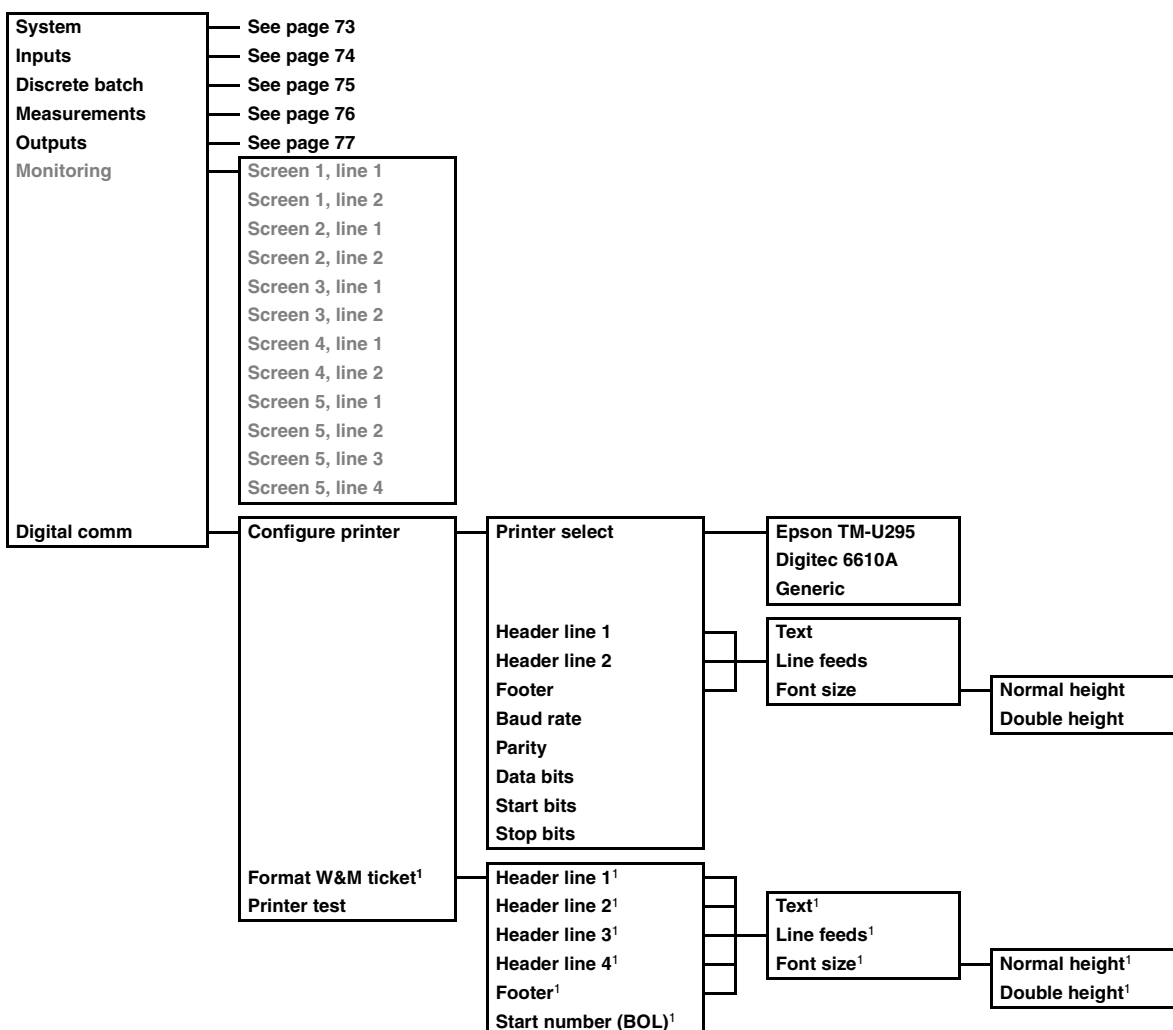
³If event type is HI, IN HI/LO, or OUT HI/LO.

⁴If event type is LO, IN HI/LO, or OUT HI/LO.

Configuration menu: Outputs

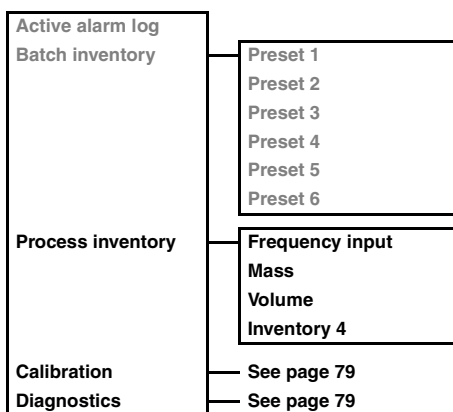
¹If discrete event is configured under Measurements.²If density application software is installed and configured.³If frequency = flow is selected.⁴If pulses/unit is selected.⁵If units/pulse is selected.

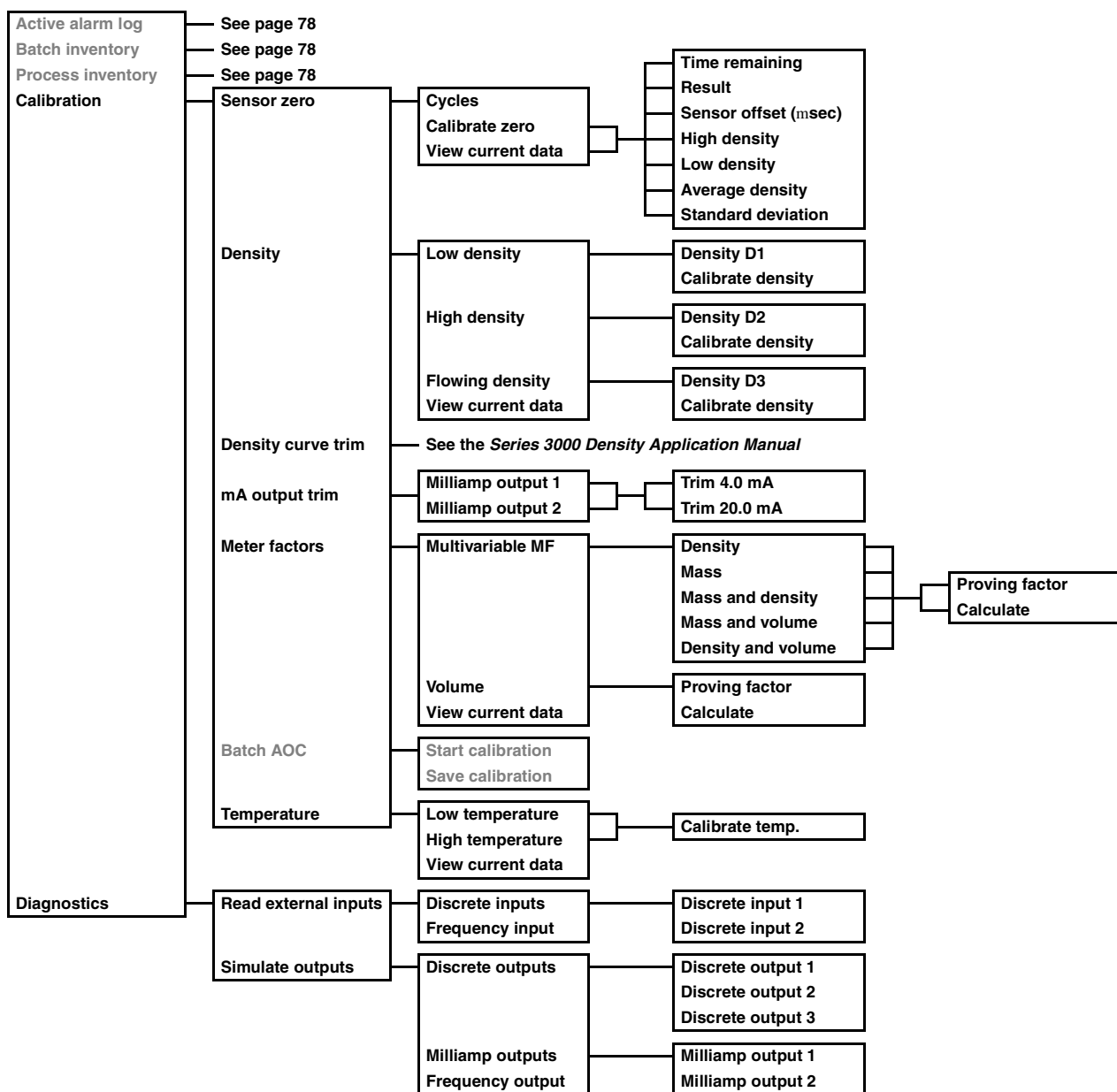
Configuration menu: Monitoring and digital communication



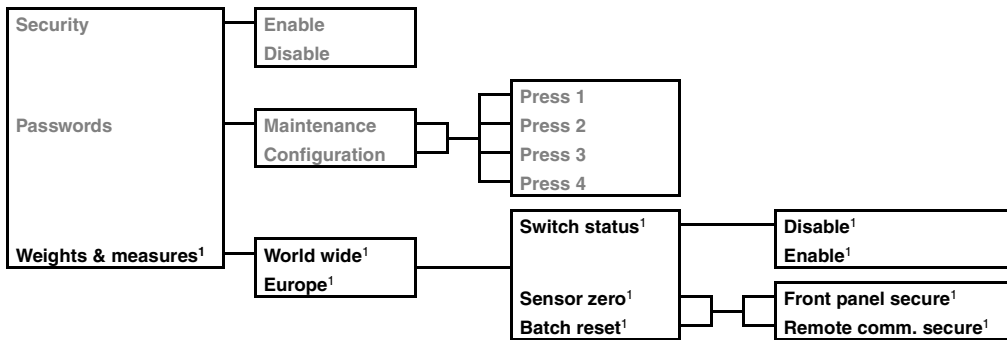
¹If custody transfer software and security switch are installed.

Maintenance menu: Active alarm log, batch inventory, and process inventory



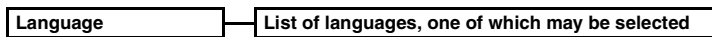
Maintenance menu: Calibration and diagnostics

Security menu



¹If custody transfer software and security switch are installed.

Language menu



Step 5 Install the weights and measures seal

The weights and measures inspector must install and secure the seal.

- On a Model 3300 or 3500 mounted in a panel, the inspector runs the wire seal through the hole in the tab protruding through the bracket that secures the wiring connectors to the back panel of the platform.
- On a Model 3300 or 3500 mounted in a subrack, the inspector runs the wire seal through the holes in the lockout screws on the front panel of the platform.
- On a Model 3350 or 3700, a hasp on the housing is located beside the circuit board compartment cover. The cover has four tabs. The inspector runs the wire seal through the hole in the hasp and the hole in the nearest tab.

11.3 Security breach

Security is breached if the security switch is set to OFF. A security breach brings about the following conditions:

- The alarm message "Security Breach" appears on the screen. The alarm, and the time and date when the breach occurred, are logged in the active alarm log.
- If the operator prints a ticket by pressing the function button labeled PRINT in the process monitor or discrete batch operation screen, a note on the ticket reads, "Not a legal receipt. Security breached."

The security breach remains in effect until the switch is set to ON.

12

Operation Mode

12.1 About this chapter

This chapter explains how to use the software in operation mode.

- The process monitor is the default operation mode unless a control function such as the discrete batch control application is present.
- If a control function is present, the control function is the default operation mode.

12.2 Startup and display test

At startup, the applications platform automatically tests its display. During display testing, the screen darkens for approximately five seconds. After the display test is completed:

1. The Micro Motion® logo appears.
2. An application list appears.
3. The platform enters the operation mode, as shown in **Figure 12-1**, page 84, and **Figure 12-2**, page 85.

12.3 Sensor zero

If the applications platform is a Model 3500 or 3700, a sensor zero must be performed at initial startup.

Sensor zero establishes flowmeter response to zero flow and sets a baseline for flow measurement.

Once the sensor zero is set, it remains part of the transmitter nonvolatile memory, and will not be affected by a power failure, brownout, or power cycle.



CAUTION

Failure to perform a sensor zero calibration at initial startup could cause the flowmeter to produce inaccurate signals.

To avoid inaccurate measurements, perform a sensor zero before putting the flowmeter into operation.

Preparing for sensor zero calibration

To prepare the flowmeter for sensor zero:

1. Install the sensor according to the appropriate sensor instruction manual.
2. Apply power to the platform, then allow it to warm up for at least 30 minutes.
3. Run the process fluid to be measured through the sensor until the sensor temperature approximates the normal process operating temperature.
4. Fill the sensor completely with process fluid under normal process conditions of temperature, density, pressure, etc., and ensure zero flow through the sensor.
5. Close the shutoff valve downstream from the sensor.
6. **Make sure flow through the sensor is completely stopped.**

⚠ CAUTION

Flow through the sensor during sensor zero will result in an inaccurate zero setting.

Make sure fluid flow through the sensor is **completely** stopped during sensor zero.

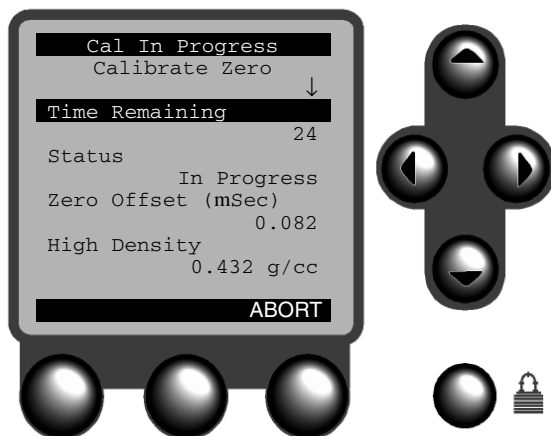
Performing the sensor zero calibration

Maintenance

└ Calibration

└ Sensor zero

└ Calibrate zero



To perform the sensor zero:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Calibration.
4. Select Sensor Zero.
5. Select Calibrate Zero, then press CHG.
 - During the sensor zero calibration, the time remaining counts down to zero seconds.
 - Sensor zero requires anywhere from 20 seconds to 2½ minutes, depending on the sensor model and the density of the fluid.

During sensor zero, the calibrate zero screen indicates the result, the zero offset in microseconds, the high density, and the low density.

If calibration is successful, when the time remaining is 0, the message "Calibration Complete" appears on the screen. Press ACK to acknowledge the message, then press EXIT to exit the calibrate zero screen.

If calibration is not successful, the message "Calibration Failure" appears on the screen. To diagnose the cause of the failure, see page 82.

Diagnosing sensor zero failure

If the calibrate zero screen reads "Calibration Failure," the sensor zero calibration was not successfully completed. "Calibration Failure" could indicate:

- Flow of fluid during the sensor zero calibration;
- Partially empty flow tubes; or
- An improperly mounted sensor.

To clear a sensor zero failure:

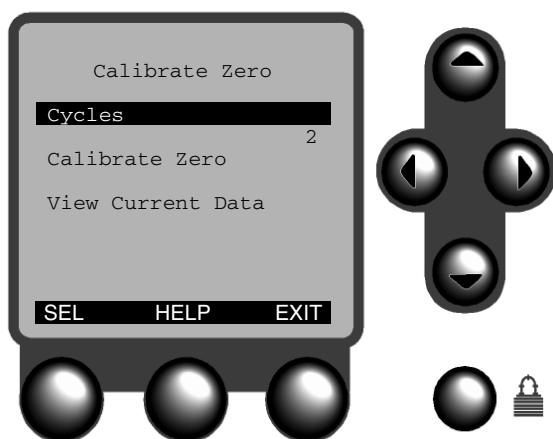
- Press ACK to acknowledge the "Calibration Failure" message, then re-zero after correcting the problem, or
- Abort the sensor zero procedure by cycling power to the platform.

Sensor zero cycles

Maintenance

└ Calibration

└ Sensor zero



Sensor zero cycles is the number of signal processing cycles required for sensor zero. The default sensor zero cycles is 2. Increasing the number of sensor zero cycles can improve sensor zero accuracy by enabling the platform to derive the offset of the flow signal from a larger number of flow signals.

12.4 Default operation mode

The process monitor, shown in **Figure 12-1**, is the default operation mode unless a control function such as the discrete batch application is present. If a control function is present:

- The control function is the default operating mode.
- Process variables can be monitored by accessing the process monitoring menu via the view menu. For more information about the view menu, see pages 90-93.

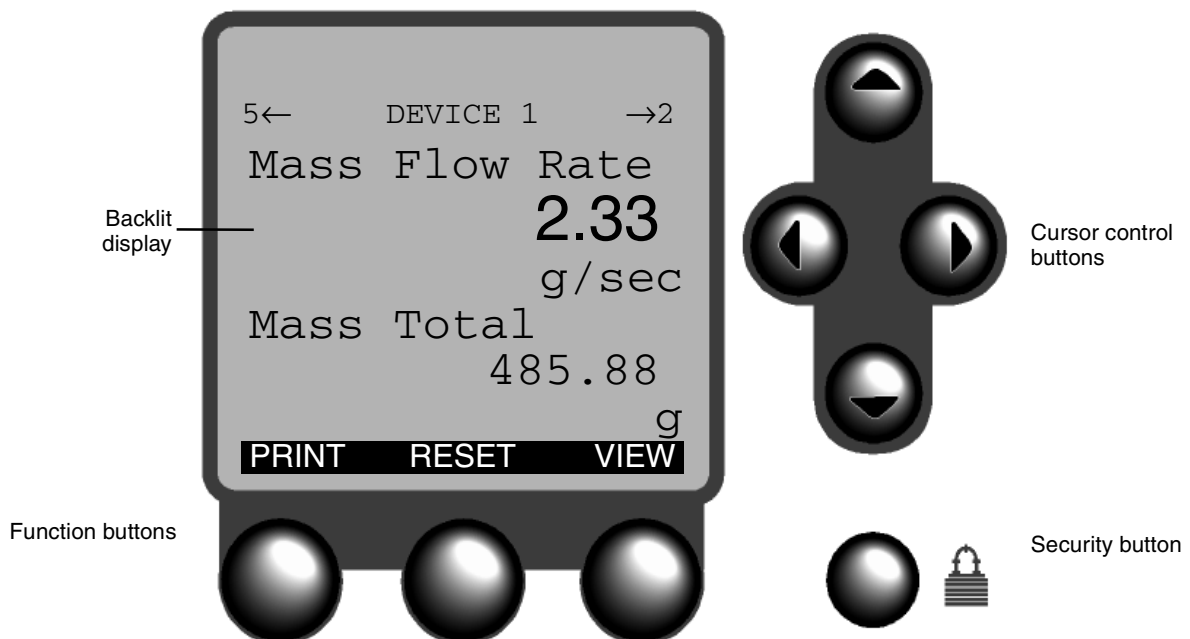
You can configure the process variables that will be displayed on each of the 5 screens of the process monitor. To configure the process monitor, see **Chapter 8**.

To scroll through the process monitor, press the left (←) or right (→) cursor control button. The number beside each arrow on the top line indicates the screen that will be displayed if the left or right cursor control button is pressed.

If a total appears on the screen, you can press RESET to reset it to 0. Pressing RESET will reset only the totals on the screen that is displayed.

Press PRINT to print a ticket that includes values of process variables on the screen that is displayed.

Figure 12-1. Person-Process Interface in default operation mode



Operation Mode *continued*

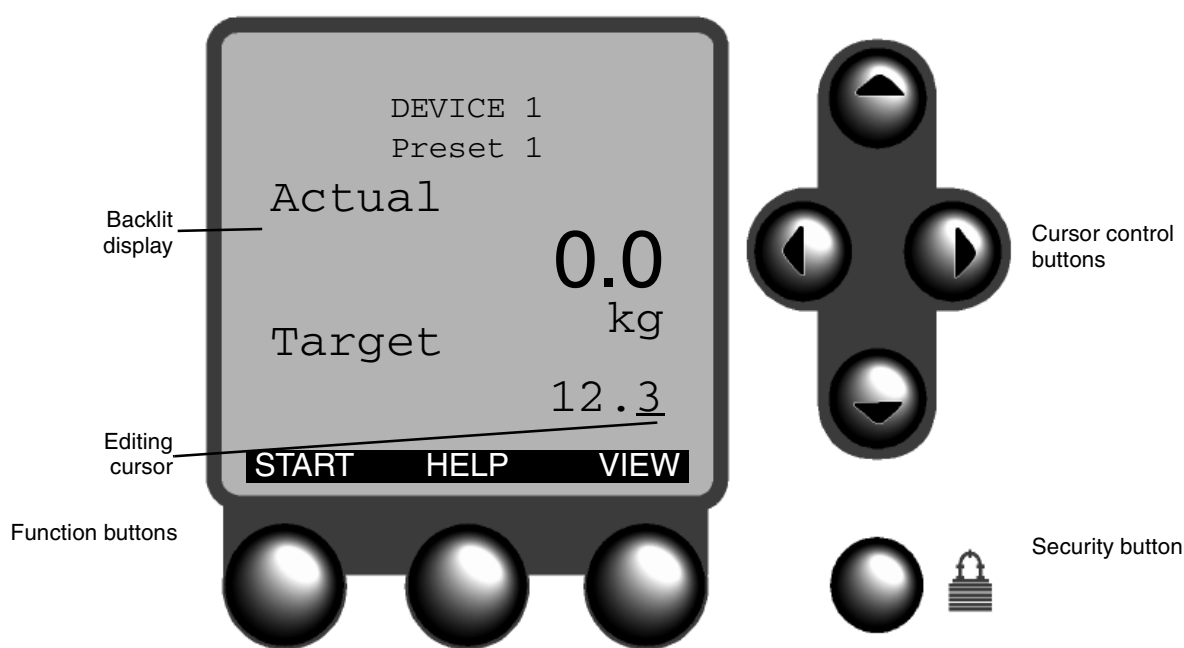
12.5 Operation mode for discrete batch control

Figure 12-2 shows the Person-Process Interface in batch operation mode, ready to start a batch. To select a batch preset, see page 91.

The display shows that there have been zero kilograms of actual delivery in this batch. When flow starts, the display continuously updates to show the actual amount that has been delivered.

The display can be set up to show either the amount that has been delivered (count up) or the amount left to be delivered (count down). To configure count up or count down, see pages 32-33.

Figure 12-2. Person-Process Interface in batch operation mode



If the batch controller is measuring standard volume, net volume, or net mass, actual and target values indicate net totals, rather than indicating gross totals

Function buttons

In **Figure 12-3**, the display shows that the batch target is 12.3 kg.

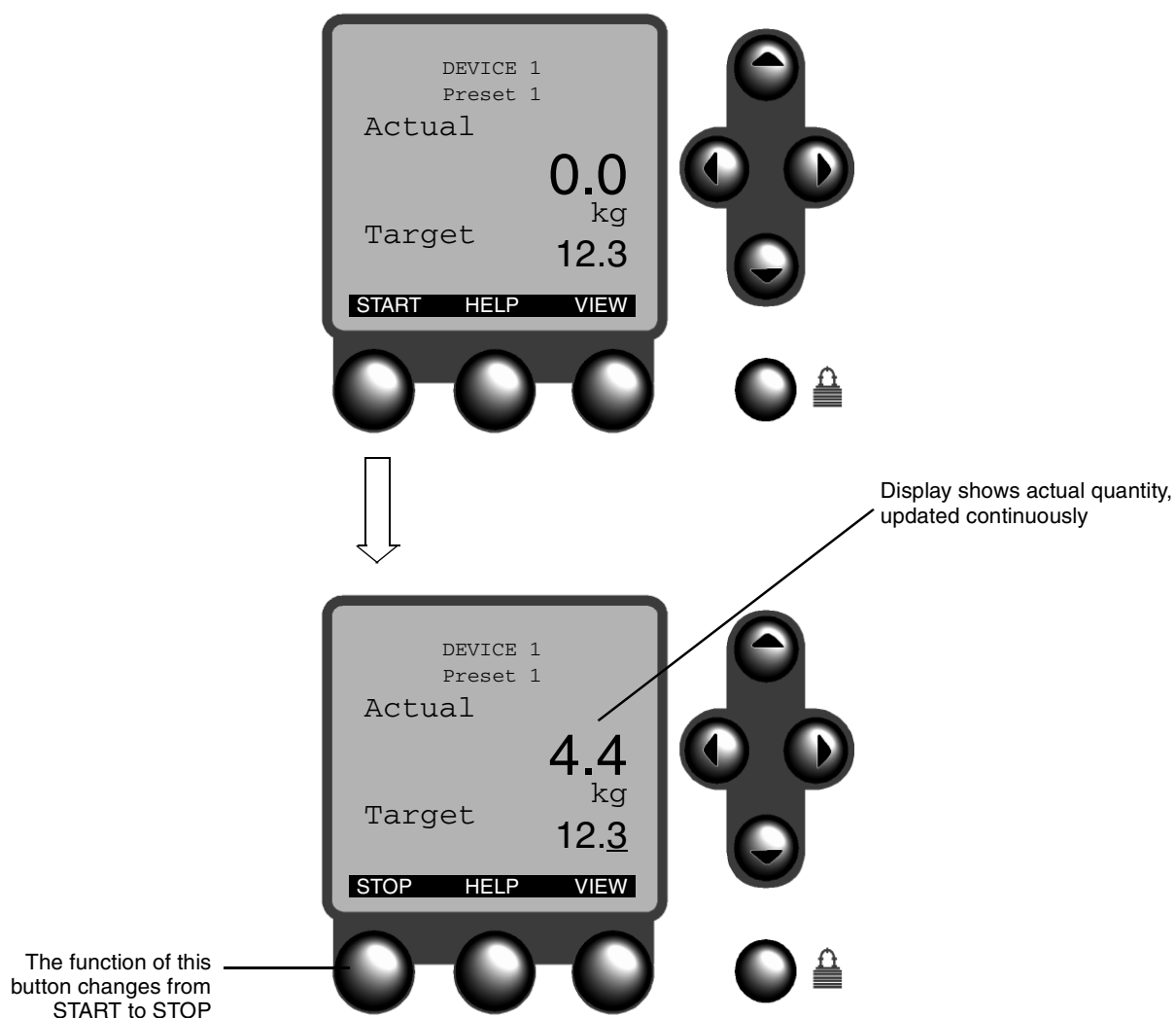
- When you press START, flow starts.
- When the target amount has passed through the flowmeter, flow automatically stops.

The words on the dark background at the bottom of the display tell you the actions you can perform by pressing the three function buttons.

To start the batch, press the button on the left, labeled START.

Figure 12-3 shows what happens.

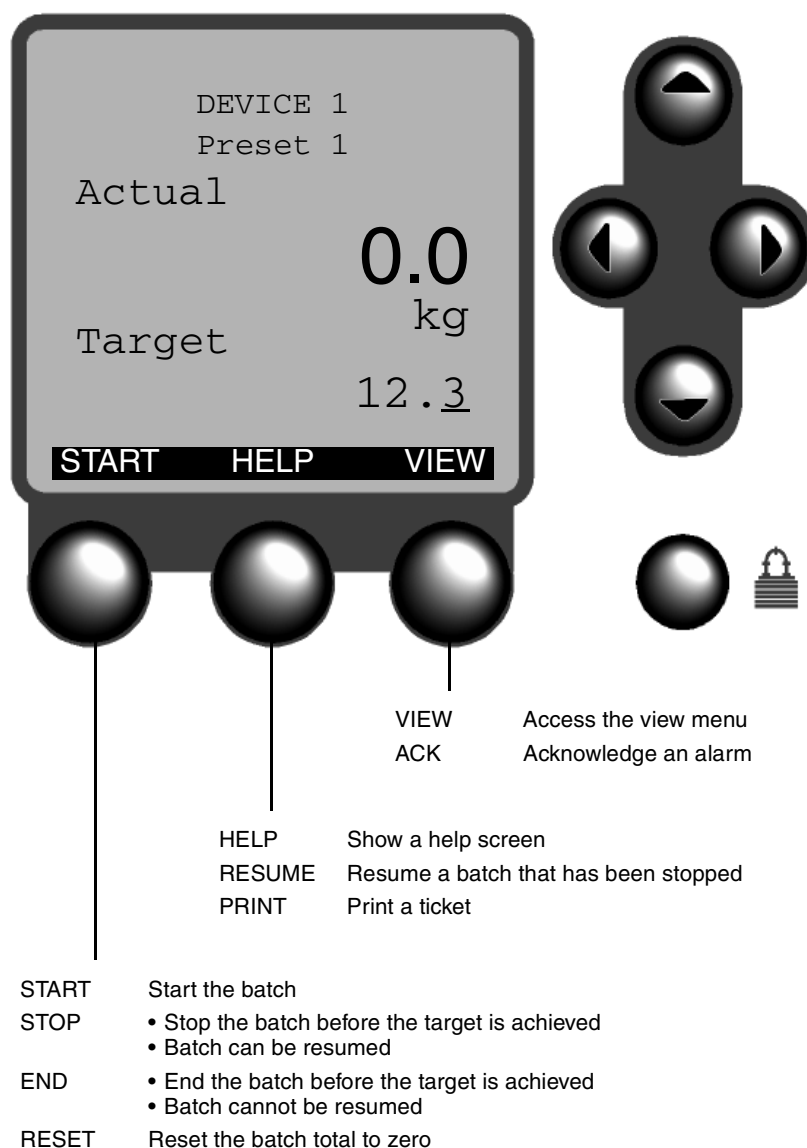
Figure 12-3.Using batch function buttons



Operation Mode *continued*

Figure 12-4 indicates the actions that are performed by the function buttons during batch operation. The batch control sequence is explained on page 89.

Figure 12-4.Function buttons in batch operation mode



Cursor control buttons

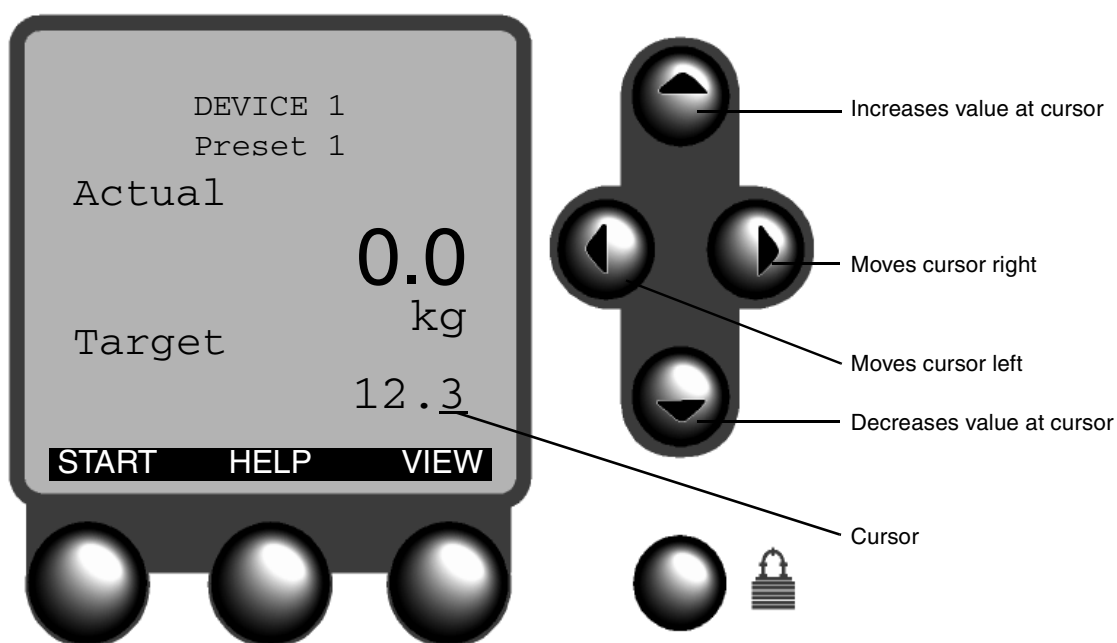
The discrete batch control application can be set up to allow the operator to change the target when the batch is not running. To enable target adjustment, see pages 32-33.

In **Figure 12-5**, the line beneath the farthest right digit of the target is the editing cursor.

- If the application has been set up to permit target adjustment, the cursor appears on the screen whenever the batch is stopped.
- Whenever the cursor appears on the screen, you can use the cursor control buttons to change the target.

Figure 12-5 shows how the cursor control buttons work when the editing cursor is displayed.

Figure 12-5. Adjusting the batch target



If the batch controller is measuring standard volume, net volume, or net mass, actual and target values indicate net totals, rather than indicating gross totals

Batch control sequence

After the discrete batch control application has been configured as described in **Chapter 5**, the batch control sequence is automatic. A batch can be controlled automatically from the moment you press the START button until the batch is complete. See **Table 12-1**.

If necessary, you can:

- Temporarily interrupt the batch by pressing STOP, then continue without resetting the batch totalizer by pressing RESUME.
- End the batch before it is complete by pressing END. After END has been pressed, the batch cannot be resumed.

Table 12-1. Batch events**Notes**

- To configure discrete batch control options, see pages 32-33
- To configure presets, see pages 34-35
- To assign a discrete input or discrete event to a batch event, see page 37
- To assign a batch event to a discrete output, see pages 49-50

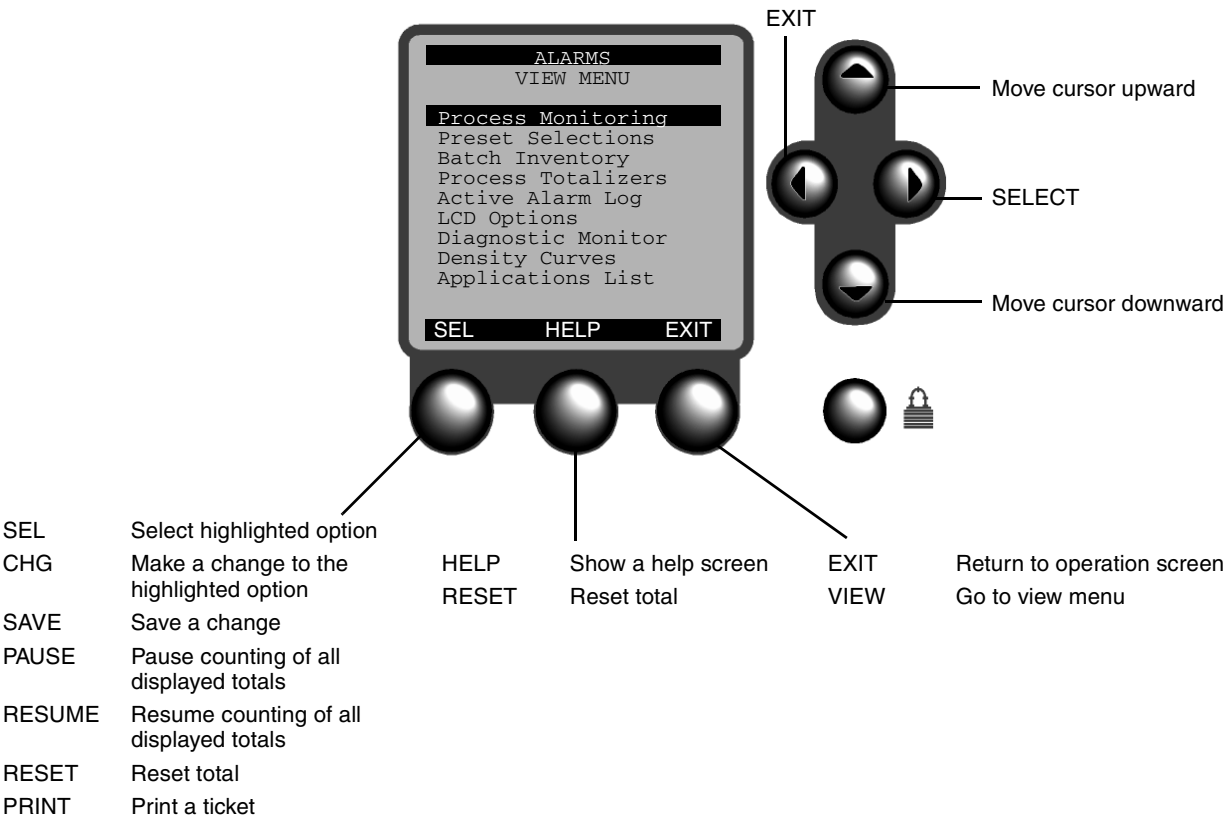
Event	Description
Batch in progress	• Batch is in progress • Batch in progress remains active until flow stops
Primary valve open/close, 1-stage batch	• If control options are configured for reset on start, pressing START resets the batch total to zero, opens the valve, and starts the batch • If control options are not configured for reset on start, pressing START opens the valve and starts the batch • The valve automatically closes when the target is achieved
Primary valve open/close, 2-stage batch	• If control options are configured for reset on start and the preset is configured so open primary is 0% of target or an amount of 0, pressing START resets the batch total to zero, opens the primary valve, and starts the batch • If control options are not configured for reset on start and the preset is configured so open primary is 0% of target or an amount of 0, pressing START opens the primary valve and starts the batch • If the preset is configured so open primary is a value other than 0% of target or an amount other than 0, the valve opens when the batch total achieves the open primary value • The primary valve closes when the batch total achieves the close primary value
Secondary valve open/close, 2-stage batch	• If control options are configured for reset on start and the preset is configured so open secondary is 0% of target or an amount of 0, pressing START resets the batch total, opens the secondary valve, and starts the batch • If control options are not configured for reset on start and the preset is configured so open secondary is 0% of target or an amount of 0, pressing START opens the secondary valve and starts the batch • If the preset is configured so open secondary is a value other than 0% of target or an amount other than 0, the secondary valve opens when the batch total achieves the open secondary value • The secondary valve closes when the target is achieved
End warning	• If end warning was enabled during configuration, the batch controller produces an alarm when the batch total achieves the programmed end warning value • The end warning remains active until batch completion
Overrun	• If overrun was enabled during configuration, the batch controller produces an alarm when the batch total exceeds the target by the programmed amount or percent of target • Overrun remains active until batch completion
Batch pump	• The system pump is operating • The pump remains on while the primary or secondary valve is open

12.6 Using the view menu

When you press VIEW at the operation screen, the view menu is displayed. **Figure 12-6** shows the functions performed by the function buttons and cursor control buttons in the view menu.

For more information about view menu functions, see pages 91-95.

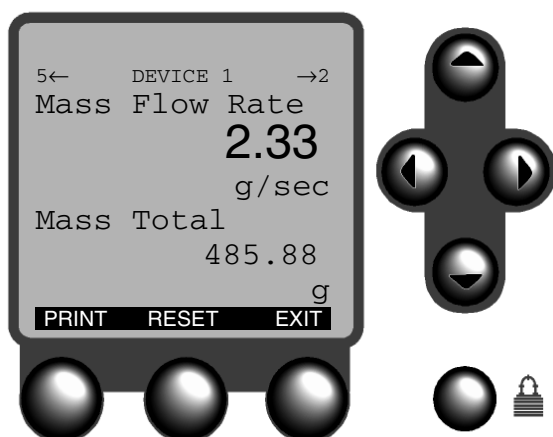
Figure 12-6. Working with the view menu



Process monitoring

View

└ Process monitoring



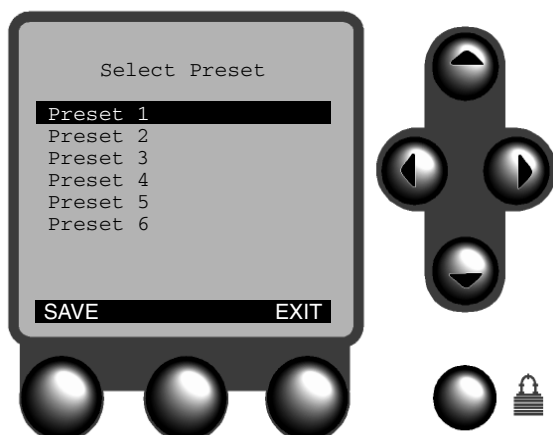
In the process monitor, process variables are displayed and continuously updated, in measurement units defined during configuration.

- You can configure the process variables that will be displayed on each of the 5 screens of the process monitor. To configure the process monitor, see **Chapter 8**.
- To scroll through the process monitor, press the left (←) or right (→) cursor control button. The number beside each arrow on the top line indicates the screen that will be displayed if the left or right cursor control button is pressed.
- If a total appears on the screen, you can press RESET to reset it to 0. Pressing RESET will reset only the totals on the screen that is displayed.
- Press PRINT to print a ticket that includes values of process variables on the screen that is displayed.

Preset selections

View

└ Preset selections



The discrete batch control application can be set up with as many as six different batch presets.

- Each preset has its own target.
- A preset may also have a descriptive name, which will appear on the selection menu.

To select a batch preset:

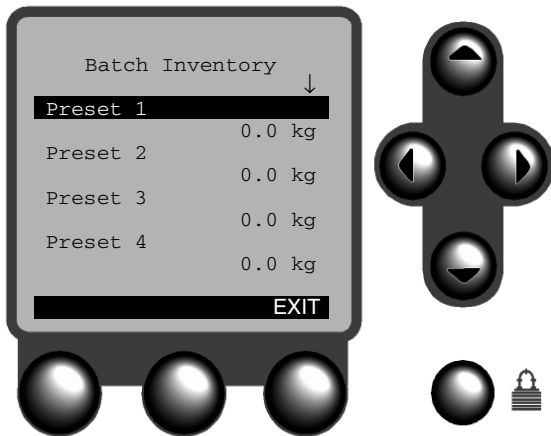
1. At the operation screen, press VIEW.
2. Select Preset Selections. Only presets that have been configured will be listed.
3. Select the desired preset, then press SAVE.
4. Press EXIT repeatedly to return to the operation screen.

If a density curve has been assigned to the selected preset, batch totals will be based on the derived variable that was selected during configuration of the density application. See the *Series 3000 Density Application Manual*.

Batch inventory

View

└ Batch inventory



Use the batch inventory menu to monitor inventory totals for batch presets.

To monitor a batch inventory total:

1. At the operation screen, press VIEW.
2. Select Batch Inventory.
3. Press EXIT repeatedly to return to the operation screen.

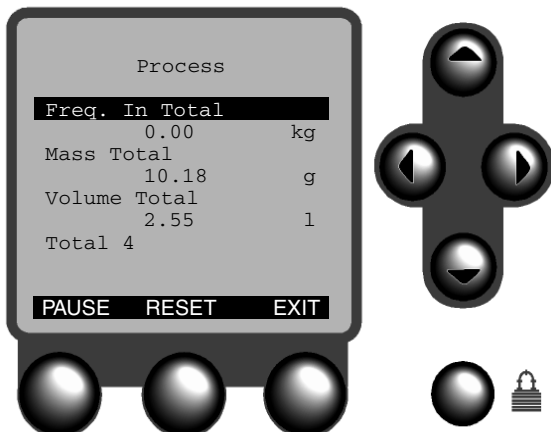
To reset batch inventory totals, see page 118.

Totalizers

View

└ Process totalizers

└ Process



The process totalizers menu allows you to:

- Monitor and reset process totals, and pause and resume counting of displayed totals
- Monitor inventory totals

Process totalizers

In the view menu, you can monitor or reset process totals, and pause and resume counting of displayed totals.

⚠ CAUTION

If counting has been paused, pressing RESET will cause the total to reset to a non-zero value.

To make sure the total resets to zero, press RESET before pressing PAUSE.

To reset a process totalizer, or to pause and resume counting of the displayed totals:

1. At the operation screen, press VIEW.
2. Select Process Totalizers.
3. Select Process.
4. Select the desired process totalizer.
 - To reset the selected totalizer, press RESET.
 - To pause counting of all displayed totals, press PAUSE.
 - To resume counting of all displayed totals, press RESUME.
5. Press EXIT repeatedly to return to the operation screen.

The value to which the process total resets depends on whether or not counting has been paused.

Operation Mode *continued*

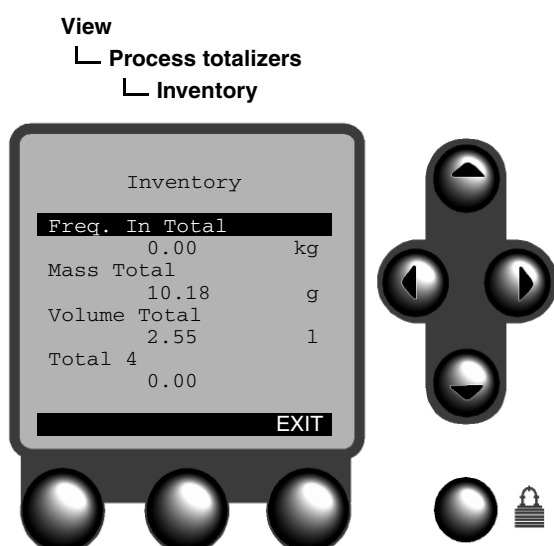
- If you press RESET without pressing PAUSE, the total resets to zero.
- If you press PAUSE, then press RESET, the total resets to the amount that accumulated from the time counting was paused to the time the total was reset. For example, if counting was paused at 500 grams, then 25 grams were counted before the total was reset, the total resets to 25 grams.

Inventory totalizers

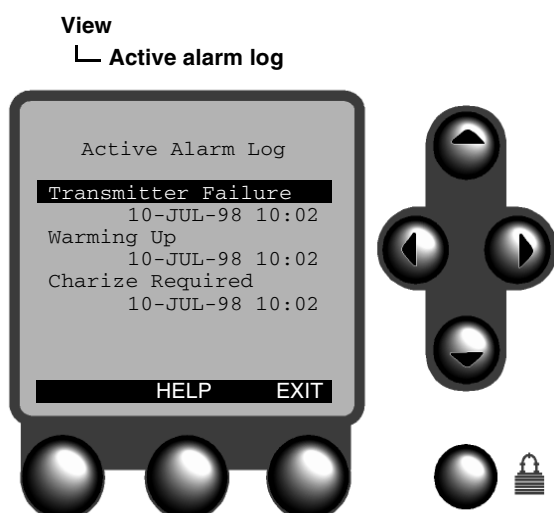
To monitor inventory totalizers:

1. At the operation screen, press VIEW.
2. Select Process Totalizers.
3. Select Inventory.
4. Press EXIT repeatedly to return to the operation screen.

To reset process inventory totalizers, see page 118.



Active alarm log



The platform performs self-diagnostics during operation. If the platform detects certain events or conditions, an alarm message appears in the highlight bar at the top of the screen.

If the condition that caused an alarm is active, the alarm is listed in the active alarm log.

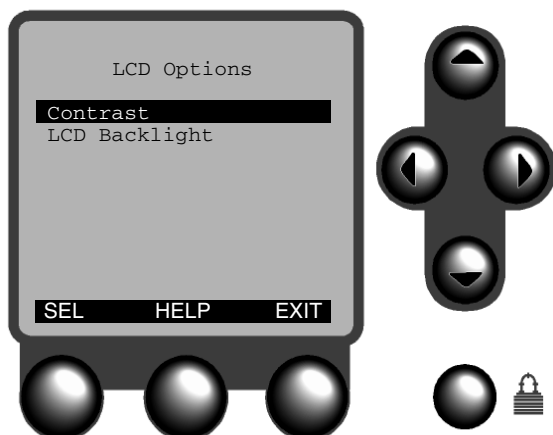
- Each alarm is time/date stamped.
- The first alarm listed is the most recent.

For information about responding to alarm messages, see **Chapter 13**.

LCD options

View

└ LCD options



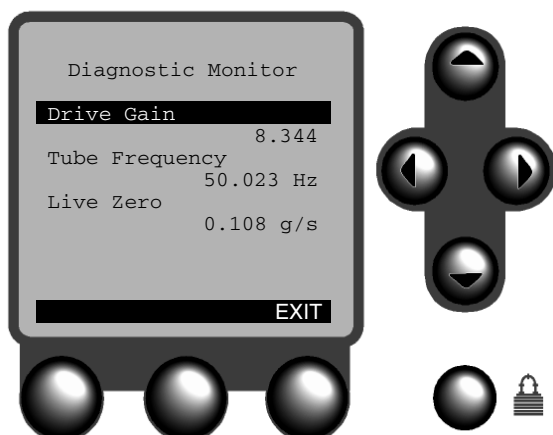
Display contrast can be adjusted for operator preference. After selecting LCD Options from the View menu:

- Select Contrast to adjust the screen contrast
- Select LCD Backlight to turn screen backlighting on or off.

Diagnostic monitor

View

└ Diagnostic monitor



The diagnostic monitor shows real-time values for drive gain, sensor flow tube frequency, and live zero.

Drive gain and sensor flow tube frequency values are useful for troubleshooting fault alarms. For information about troubleshooting fault alarms, see pages 107-109.

Live zero is useful for monitoring the flow rate when it drops below the mass low flow cutoff. To configure the mass low flow cutoff, see page 14.

Operation Mode *continued***Density curves**

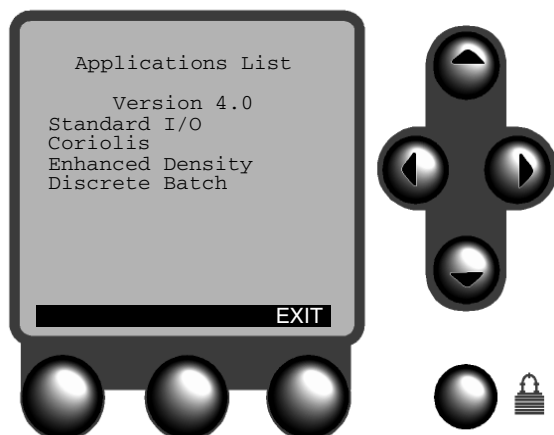
The density curves menu item is available only if:

- The density application software is installed and configured.
- Density curves have not been assigned to batch presets (see page 91).

To configure density curves, see the *Series 3000 Density Application Manual*.

Applications list**View**

└ Applications list



The applications list shows all applications that are installed and the software revision. Refer to this screen for the software revision number to report problems.

13 Alarms

13.1 About this chapter

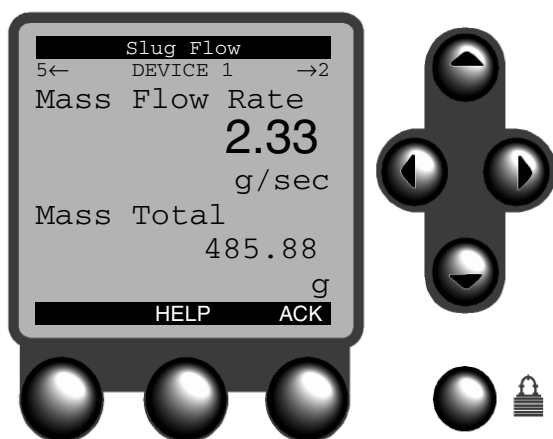
This chapter explains how to use the diagnostic software to troubleshoot alarm conditions. Diagnostic software includes:

- Alarm messages
- The diagnostic monitor
- The active alarm log

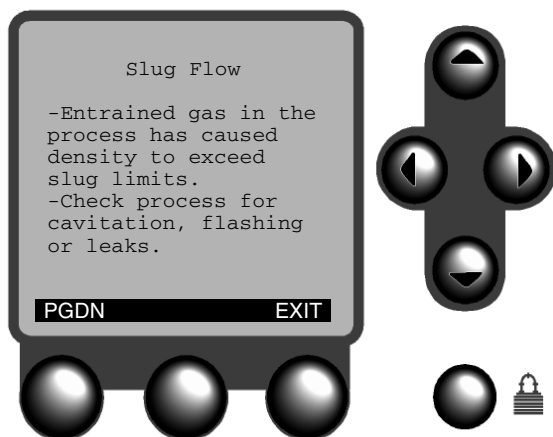
13.2 Alarm messages

The applications platform performs self-diagnostics during operation. If the platform detects certain events or conditions, an alarm message appears in the highlight bar at the top of the screen.

If the alarm must be acknowledged, press ACK.



Responding to alarms



To respond to an alarm, press HELP, then follow the instructions on the screen.

- The help screen explains what the alarm means.
- The help screen will tell you what to do. You may be advised to perform an action, as in the example, or to contact someone.
- If the help occupies more than one screen, you can read all the help screens by pressing PGDN (page down) or PGUP (page up).

Using alarm messages

The following types of alarms do not drive outputs to fault levels:

- Slug flow and output saturation alarms (see below and page 99)
- Batch and totalizer alarms (see page 100)
- Calibration and trim alarms (see page 101)
- Conditional status alarms (see page 102)
- Sensor information alarms (see page 103)

The following types of alarms, known as fault alarms, drive outputs to fault levels:

- Critical status fault alarms (see page 105)
- Platform failure fault alarms (see page 106)
- Sensor error fault alarms (see pages 106-109)

Alarms that do not generate fault outputs

Slug flow alarms

Conditions such as slug flow (gas bubbles in a liquid flow stream) adversely affect sensor performance by causing erratic vibration of the flow tubes, which in turn causes the applications platform to produce inaccurate flow signals. If you program slug limits, a slug flow condition causes the platform to produce slug flow alarms.

The "Slug Flow" alarm indicates slug flow has occurred for less than the amount of time that is configured for the slug time. Outputs indicating the flow rate remain at the last measured flow rate before the slug flow condition occurred.

The "Slug Timeout" alarm indicates slug flow has occurred for more than the amount of time that is configured for the slug time. If the "Slug Timeout" alarm occurs, outputs indicating the flow rate go to the level that represents zero flow.

- Outputs representing a process variable other than the flow rate continue to indicate the measured value for the process variable.
- The flowmeter resumes normal operation when density stabilizes within the programmed slug flow limits.
- Slug time can be up to 1200 seconds.
- If slug time is configured for 0.0 seconds, as soon as slug flow is detected, outputs indicating the flow rate will go to the level that represents zero flow.

Table 13-1 summarizes slug flow alarms and lists corrective actions.

Table 13-1. Using slug flow alarms

Notes

- To get help troubleshooting an alarm message, press HELP, then follow the instructions
- To acknowledge an alarm message, press ACK

Alarm message	Cause	Action
Slug Flow	• Gas bubbles are causing density to go below low slug flow limit • Solids are causing process density to exceed high slug flow limit	• Check process for cavitation, flashing, or leaks • Monitor density • If desired, enter new slug flow limits (see page 16) • If desired, increase slug time (see page 16)
Slug Timeout	Slug flow has occurred for more than amount of time configured for slug time	

Alarms *continued***Output saturation alarms**

If an output variable exceeds the upper range limit or goes below the lower range limit, the applications platform produces an output saturation alarm. The alarm can mean:

- The output variable is outside appropriate limits for the process
- The unit of flow needs to be changed
- Sensor flow tubes are not filled with process fluid
- Sensor flow tubes are plugged

Table 13-2 summarizes output saturation alarms and lists corrective actions.

Table 13-2. Using output saturation alarms**Notes**

- To get help troubleshooting an alarm message, press HELP, then follow the instructions
- To acknowledge an alarm message, press ACK

Alarm message	Cause	Action
Freq. Out Saturated	Frequency output has exceeded 12,500 Hz	• Alter fluid process • Change flow unit (see page 14) • Change frequency and flow values, pulses per unit, or units per pulse (see pages 53-54)
mA Out 1 High Sat	Milliamp output 1 has exceeded 20.5 mA	• Alter fluid process • Increase value of variable represented by milliamp output 1 at 20 mA (see pages 52-53)
mA Out 1 Low Sat	Milliamp output 1 has gone below 3.8 mA	• Alter fluid process • Decrease value of variable represented by milliamp output 1 at 4 mA (see pages 52-53)
mA Out 2 High Sat	Milliamp output 2 has exceeded 20.5 mA	• Alter fluid process • Increase value of variable represented by milliamp output 2 at 20 mA (see pages 52-53)
mA Out 2 Low Sat	Milliamp output 2 has gone below 3.8 mA	• Alter fluid process • Decrease value of variable represented by milliamp output 2 at 4 mA (see pages 52-53)
Drive Overrange	• Severely erratic or complete cessation of flow tube vibration • Plugged flow tube	• Fill sensor with process fluid • Bring flow rate within sensor limit • Purge flow tubes

Batch and totalizer alarms

If the batch controller or totalizers are operating, the applications platform produces batch and totalizer alarms. **Table 13-3** summarizes batch and totalizer alarms and lists corrective actions.

Table 13-3. Using batch and totalizer alarms**Notes**

- To get help troubleshooting an alarm message, press HELP, then follow the instructions
- To acknowledge an alarm message, press ACK

Alarm message	Cause	Action
Time Out	• No flow was detected for the number of seconds configured for time out • If ignore source alarms is set to YES, the platform produces a time out alarm after the number of minutes configured for the alarm timeout	• Check valves, piping, and pumps for proper operation or • Increase number of seconds for time out (see pages 32-33) • If ignore source alarms is set to YES, increase number of minutes for alarm timeout (see pages 32-33) • After cause has been diagnosed, press END to end batch or RESUME to resume batch
Overrun	Batch total has exceeded target: • Batch has not ended • Flow is still being measured	• Check wiring for discrete output indicating overrun • Check device connected to discrete output indicating overrun • Enable batch AOC (see pages 32-33) • After cause has been diagnosed, press RESET or START to start new batch
Start Without Reset	Operator attempted to start batch without pressing RESET	• Press RESET, then press START or • Set reset on start option to YES (see pages 32-33)
Start Not OK	Enable batch control option is set to NO	Set enable batch control option to YES (see pages 32-33)
	Batch flow source is not configured	Configure batch flow source (see page 31)
	Control functions have not been assigned to discrete outputs	Assign control functions such as primary valve, secondary valve, or pump to discrete outputs (see pages 49-50)
	An alarm is active	Clear all alarm messages
	Discrete input is configured to inhibit batch	Shut off discrete input
	Target value is zero	Change target value (see pages 34-35 and page 88)

Alarms *continued***Calibration and trim alarms**

Calibration and trim alarms indicate the following conditions:

- An output state or value has been set in the diagnostics menu
- Sensor zero, density calibration, temperature calibration, or milliamp output trim is in progress
- Sensor zero, density calibration, or temperature calibration was aborted by the operator
- Sensor zero, density calibration, or temperature calibration is complete

Table 13-4 summarizes calibration and trim alarms and lists corrective actions.

Table 13-4. Using calibration and trim alarms

Notes

- To get help troubleshooting an alarm message, press HELP, then follow the instructions
- To acknowledge an alarm message, press ACK

Alarm message	Cause	Action
mA Out 1 Fixed	Milliamp output 1 trim or simulation in progress	Exit diagnostics menu
mA Out 2 Fixed	Milliamp output 2 trim or simulation in progress	
Freq. Out Fixed	Frequency output trim or simulation in progress	
Cal In Progress	• Sensor zero in progress • Density calibration in progress • Temperature calibration in progress	• If "Calibration Complete" replaces "Cal In Progress", no action • If "Calibration Failure" replaces "Cal In Progress" and sensor zero was performed, rezero after: - Eliminating mechanical noise, if possible - Completely shutting off flow - Ensuring interior of sensor junction box is dry • If "Calibration Failure" replaces "Cal in Progress" and density or temperature calibration was performed, recalibrate for density or temperature
Calibration Complete	• Sensor zero calibration complete • Density calibration complete • Temperature calibration complete	Press ACK to acknowledge alarm
Calibration Aborted	• User aborted sensor zero calibration • User aborted density calibration • User aborted temperature calibration	• Re-initiate calibration procedure • Existing calibration values will remain unchanged

Conditional status alarms

Conditional status alarms occur in the following situations:

- During normal startup
- During normal operation
- After power to the applications platform has been cycled
- If the custody transfer security switch is set to OFF
- After a master reset has been performed

Table 13-5 summarizes conditional status alarms and lists corrective actions.

Table 13-5. Using conditional status alarms

Notes

- To get help troubleshooting an alarm message, press HELP, then follow the instructions
- To acknowledge an alarm message, press ACK

Alarm message	Cause	Action
Power Reset	• Power failure • Brownout • Power cycle	Check accuracy of totalizers
Security Breach	Custody transfer security switch is set to OFF	Reset custody transfer security switch to ON (see pages 68-71)
Master Reset	• Master reset has been performed • Software configuration contains default values	• Configure sensor calibration data (see pages 18-26) • Do not operate platform until configuration has been verified
EEPROM Initialized	• EEPROM has been cleared and software upgrade has been downloaded • Software configuration contains default values	
PPI Fault	Person-Process Interface failed	• Adjust screen contrast (see page 94) • If problem persists, phone Micro Motion Customer Service (see page 110 or the back cover for phone numbers)
EEPROM Corrupt	EEPROM has temporarily failed or been corrupted	If problem persists, phone Micro Motion Customer Service (see page 110 or the back cover for phone numbers)
EEPROM Error		

Alarms *continued***Sensor information alarms**

The platform produces sensor information alarms if sensor alarms have been disabled (see page 13) and an erratic flow rate or density is preventing the platform from calculating flow or density measurements within the accuracy and repeatability specifications for the flowmeter.

Sensor alarms revert to fault alarms if the flow rate or density remains erratic for the number of minutes that were configured for the alarm timeout.

- During the alarm timeout, outputs do not go to fault levels
- During the alarm timeout, sensor information alarms do not require acknowledgment
- During the alarm timeout, internal totalizers do not stop counting
- During the alarm timeout, a batch in progress does not stop

Table 13-6 summarizes sensor information alarms and lists corrective actions.

Table 13-6. Using sensor information alarms

- To get help troubleshooting an alarm message, press HELP, then follow the instructions
- To disable sensor alarms and configure the alarm timeout, see page 13

Alarm message	Cause	Action
Warming Up Info	Platform is self-calibrating	• Wait for flow rate or density to stabilize • Sensor alarms will revert to fault alarms if flow rate or density has not stabilized within the number of minutes configured for the alarm timeout
Sensor Info	• Platform cannot calculate flow or density within accuracy and repeatability specifications for the flowmeter • Sensor is recovering from effects of erratic flow rate or erratic density	
Density Info		
Transmitter Info		

Fault alarms

Fault alarms cause outputs to go to fault levels. Outputs also go to fault levels when you perform configuration, calibration, or diagnostic tasks. See **Table 13-7**.

The platform can be configured to produce downscale, upscale, last measured value, or internal zero fault outputs. See **Table 13-8**.

- To configure fault outputs, see **Chapter 7**.
- The default configuration for fault outputs is downscale.

Table 13-7. Fault output levels

Software mode	Output levels
Configuration	Fault level
Diagnostics	Active (outputs indicate measured values)
Calibration	Active (outputs indicate measured values)
Output simulation	Active (outputs indicate values at which they are set)

 CAUTION

Using last measured value or internal zero may hamper identification of fault outputs.

To make sure fault outputs can be identified, select downscale or upscale.

Table 13-8. Configurations for fault outputs**Note**

Discrete outputs do not have fault limits, but can be configured to indicate fault conditions. See pages 49-50

Fault limit	Fault value
Downscale	• Milliamp outputs can be configured from 1.0 to 3.6 mA; default is 3.6 mA • Frequency output goes to 0 Hz
Upscale	• Milliamp outputs can be configured from 21.0 to 24.0 mA; default is 22.0 mA • Frequency output goes to 15,000 Hz
Last measured value	Outputs hold at mA value or frequency that represents the last measured value for the process variable before the fault occurred
Internal zero	• Milliamp outputs go to mA value that represents 0.0 for the process variable • Frequency output goes to 0 Hz

Critical status fault alarms

Critical status fault alarms occur in the following situations:

- During normal startup
- After power to the applications platform has been cycled
- After a master reset has been performed
- If a sensor zero, density calibration, or temperature calibration has failed
- If an erratic flow rate or density is preventing the platform from calculating flow or density

Table 13-9 summarizes critical fault alarms and lists corrective actions.

Table 13-9. Using critical status fault alarms

Notes

- To get help troubleshooting an alarm message, press HELP, then follow the instructions
- To acknowledge an alarm message, press ACK

Alarm message	Cause	Action
Warming Up	• Platform is performing self-test; outputs remain at fault levels until self-test is complete • Erratic flow rate or density is preventing platform from calculating flow or density	• Press ACK to acknowledge alarm • If platform produces "Density Failure", "Sensor Failure", or "Transmitter Failure" alarm message, wait for flow rate or density to stabilize • If desired, disable sensor alarms (see page 13)
Calibration Failure	• Sensor zero failed • Density calibration failed • Temperature calibration failed • Outputs remain at fault levels until calibration has been successfully completed	• If sensor zero was performed, rezero after: - Eliminating mechanical noise, if possible - Completely shutting off flow - Ensuring interior of sensor junction box is dry • If density or temperature calibration was performed, recalibrate for density or temperature
Charize Required	• Master reset has been performed • Software configuration contains default values • Outputs remain at fault levels until platform has been configured	• Configure sensor calibration data (see pages 18-26) • Do not operate platform until configuration has been verified

Platform failure fault alarms

When a software or hardware failure occurs, the applications platform produces one of the fault alarms listed in **Table 13-10**.

If any of the fault alarm messages listed in **Table 13-10** appears on the screen, phone one of the Micro Motion Customer Service telephone numbers listed on page 110 and the back cover.

⚠ CAUTION

Platform failure fault alarms are critical, and could result in measurement error.

The applications platform does not have any parts that are serviceable by the user. If a platform failure is indicated, phone Micro Motion Customer Service. (See page 110 or the back cover for phone numbers.)

Table 13-10.Using platform failure fault alarms

Alarm message	Cause	Action
Hardware Failure	Hardware has failed	Phone Micro Motion Customer Service (see the title page of this manual for phone numbers)
Transmitter Failure	Transmitter core has failed	
EEPROM Failure	EEPROM has failed or been corrupted	

Fault alarms requiring troubleshooting

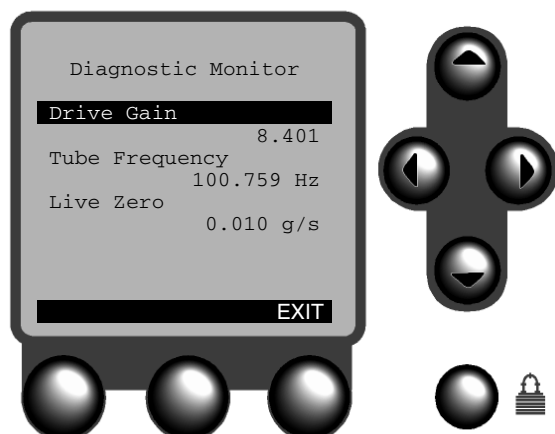
Some fault alarms require troubleshooting to isolate the problem that caused fault outputs to be produced. Fault alarms that require troubleshooting include:

- Sensor Failure
- Density Failure
- Temperature Failure
- Temperature Overrange
- RTD Failure

⚠ CAUTION

During troubleshooting the flowmeter could produce inaccurate output signals, resulting in measurement error.

Set control devices for manual operation before troubleshooting the flowmeter.

Alarms *continued*

If the applications platform produces fault outputs and any of the alarm messages listed at the top of this page appears on the screen, follow these steps to troubleshoot the problem:

1. Press ACK, repeatedly if necessary, to clear all the messages.
2. Press VIEW to access the view menu.
3. Select Diagnostic Monitor.
4. Read the drive gain:
 - a. If drive gain is unstable, see **Table 13-11**.
 - b. If drive gain is stable, go to step 5, page 108.

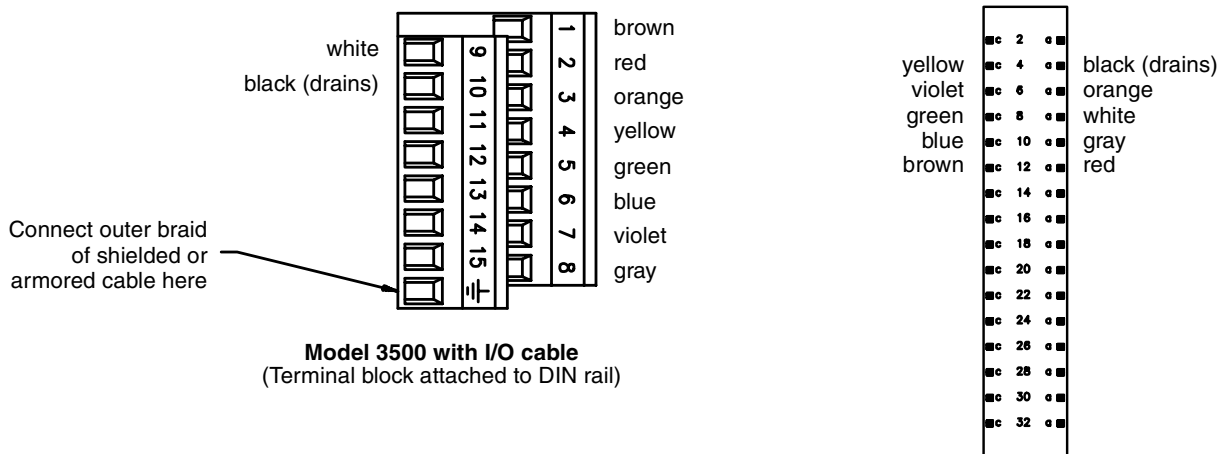
Table 13-11. Troubleshooting excessive drive gain

Symptom	Cause	Corrective action
Drive gain is unstable	Erratic process density (slug flow) has caused flow tubes to vibrate erratically or stop vibrating	• Monitor density • Change sensor orientation
	Plugged flow tube	Purge flow tubes
	Cavitation or flashing of process fluid	• If possible, increase inlet pressure and/or back pressure • If pump is mounted upstream from sensor, increase distance between pump and sensor
	• Drive board failure • Sensor imbalance	Phone Micro Motion Customer Service (see the title page of this manual for phone numbers)
	• Sensor failure	See step 5, page 108

5. Disconnect sensor cable from the sensor wiring terminals on the Model 3500 or 3700.

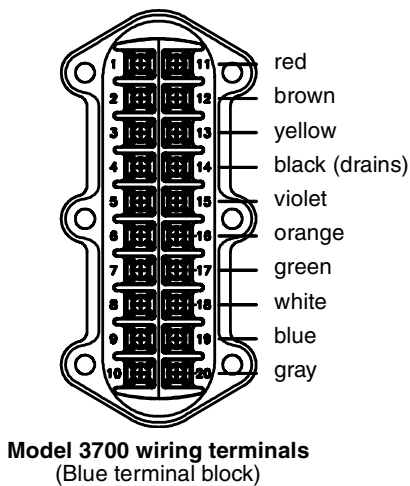
- **Figure 13-1** illustrates Model 3500 sensor wiring terminals.
- **Figure 13-2** illustrates Model 3700 sensor wiring terminals.

Figure 13-1. Model 3500 sensor wiring terminals



Model 3500 with screw-type or solder-tail wiring connectors
(Middle terminal block on back panel)

Figure 13-2. Model 3700 sensor wiring terminals



Alarms *continued*

6. Measure ohms of resistance between wire pairs at the sensor junction box.
 - a. If all measured resistance values are within the ranges listed in **Table 13-12**, the sensor cable is faulty or improperly connected. Repair or replace the cable, or reconnect it according to the *9-Wire Cable Preparation and Installation Instruction Manual*.
 - b. If open or short circuits are found, the sensor case or junction box contains moisture, or the sensor is damaged. See **Table 13-13**.

Table 13-12. Nominal resistance ranges for flowmeter circuits**Notes**

- Resistance values increase 0.38675 ohms per °C increase in temperature
- Nominal resistance values will vary 40% per 100°C. However, confirming an open coil or shorted coil is more important than any slight deviation from the resistance values presented below
- Resistance across blue and gray wires (right pickoff circuit) should be within 10% of resistance across green and white wires (left pickoff circuit)
- Actual resistance values depend on the sensor model and date of manufacture
- Readings across wire pairs should be stable. If they are unstable, see **Table 13-13**

Circuit	Wire colors	Sensor junction box wiring terminals	Nominal resistance range
Drive coil	Brown to red	1 to 2	8 to 2650 Ω
Left pickoff	Green to white	5 to 9	15.9 to 1000 Ω
Right pickoff	Blue to gray	6 to 8	15.9 to 1000 Ω
Resistance temperature detector	Yellow to violet	4 to 7	100 Ω at 0°C + 0.38675 Ω per °C
Lead length compensator ¹	Yellow to orange	4 to 3	100 Ω at 0°C + 0.38675 Ω per °C
Composite temperature ²	Yellow to orange	4 to 3	300 Ω at 0°C + 1.16025 Ω per °C

¹All currently manufactured sensors except T-Series sensors.

²T-Series sensors only.

Table 13-13. Troubleshooting sensor error fault alarms

Resistance at sensor junction box	Cause	Alarm message	Action
All resistance values are within the ranges listed in Table 13-12	• Sensor cable is faulty • Sensor cable is improperly connected	Sensor Failure Density Failure Temperature Failure RTD Failure Temperature Overrange	• Repair or replace cable • Reconnect cable according to the <i>9-Wire Cable Preparation and Installation Instruction Manual</i>
Open or short from green to white (terminal 5 to terminal 9)	• Moisture in sensor case or junction box • Open or short left pickoff	Sensor Failure Density Failure	• If sensor case or junction box contains moisture, check for leaking junction box, conduit, or conduit seals • If sensor case or junction box does not contain moisture, return sensor to Micro Motion
Open or short from blue to gray (terminal 6 to terminal 8)	• Moisture in sensor case or junction box • Open or short right pickoff		
Open or short from red to brown (terminal 2 to terminal 1)	• Moisture in sensor case or junction box • Open or short drive coil		
Open or short from yellow to orange (terminal 4 to terminal 3)	• Moisture in sensor case or junction box • Open or short lead length compensator or composite temperature circuit	Temperature Failure Temperature Overrange	
Open or short from yellow to violet (terminal 4 to terminal 7)	• Moisture in sensor case or junction box • Open or short RTD	RTD Failure Temperature Overrange	

13.3 Active alarm log



If the condition that caused an alarm is active, the alarm is listed in the active alarm log.

- Each alarm is time/date stamped.
- The first alarm listed is the most recent.

The active alarm log can be accessed from the maintenance menu or the view menu.

To access the log from the maintenance menu:

1. At the operation screen, press the security button.
2. Select Maintenance.
3. Select Active Alarm Log.

To access the log from the view menu:

1. At the operation screen, press VIEW.
2. Select Active Alarm Log.

13.4 Customer service

For Customer Service, phone the Micro Motion Customer Service Department. Telephone numbers are listed on the title page of this manual.

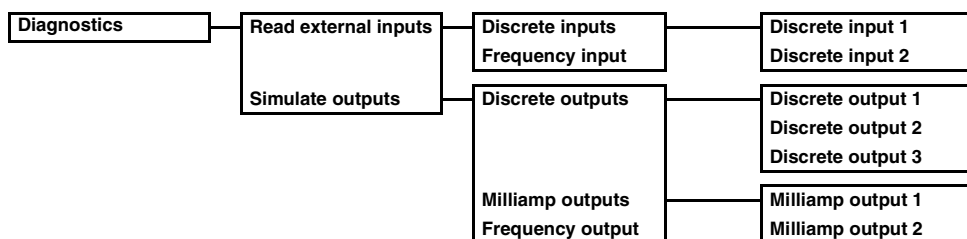
14

Diagnostics Menu

14.1 About this chapter

This chapter explains how to use the diagnostics menu to read inputs and set the states or values of outputs. The diagnostics menu includes all the software parameters listed in **Figure 14-1**.

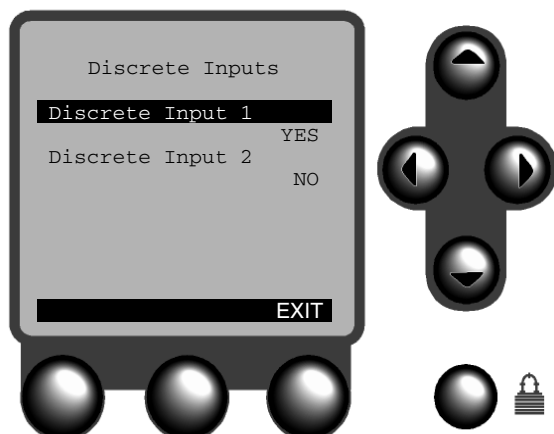
Figure 14-1.Diagnostics menu



14.2 Reading inputs

Reading discrete inputs

Maintenance
└─ Diagnostics
 └─ Read external inputs
 └─ Discrete inputs



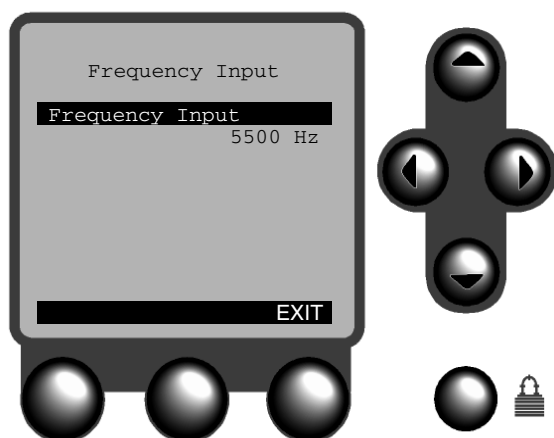
The software enables you to read the states of discrete inputs or the value of the frequency input.

To read the state of a discrete input:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Diagnostics.
4. Select Read External Inputs.
5. Select Discrete Inputs. The state of both discrete inputs is displayed.
 - YES indicates the discrete input is on.
 - NO indicates the discrete input is off.

Reading the frequency input

Maintenance
└─ Diagnostics
 └─ Read external inputs
 └─ Frequency input



To read the frequency input:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Diagnostics.
4. Select Read External Inputs.
5. Select Frequency Input. The frequency in Hertz is displayed.

14.3 Setting outputs

The software enables you to set the states of discrete outputs or the values of milliamp outputs or the frequency output.

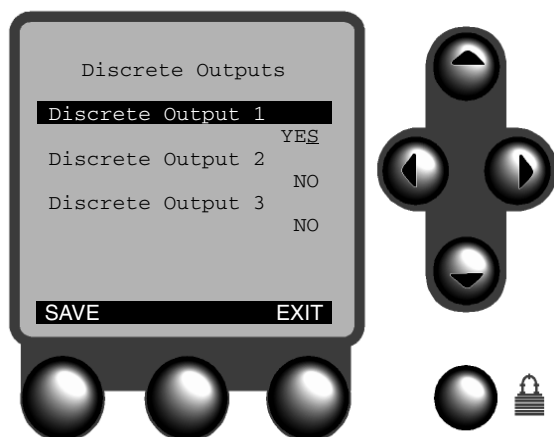
⚠ CAUTION

While diagnostic tasks are being performed, outputs go to values or states at which they are being set, resulting in measurement error.

Set control devices for manual operation before accessing the diagnostics menu.

Setting discrete outputs

Maintenance
└─ Diagnostics
 └─ Simulate outputs
 └─ Discrete outputs



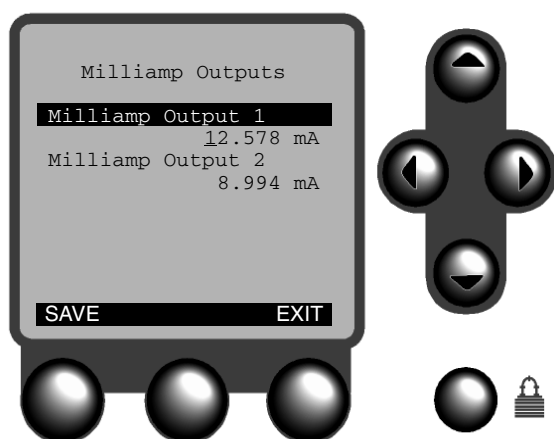
To set the state of a discrete output:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Diagnostics.
4. Select Simulate Outputs.
5. Select Discrete Outputs.
6. Select the discrete output to be set.
7. Press CHG.
8. Use the cursor control buttons to toggle the output on or off. The state of the output depends on the power source:
 - If the power source is internal, YES indicates the output is on.
 - If the power source is internal, NO indicates the output is off.
 - If the power source is external, NO indicates the output is on.
 - If the power source is external, YES indicates the output is off.
9. Press SAVE to set the state of the output.

When you return to the operation mode, the states of the outputs are released and are again controlled by the application.

Setting milliamp outputs

Maintenance
└─ Diagnostics
 └─ Simulate outputs
 └─ Milliamp outputs



To set the value of a milliamp output:

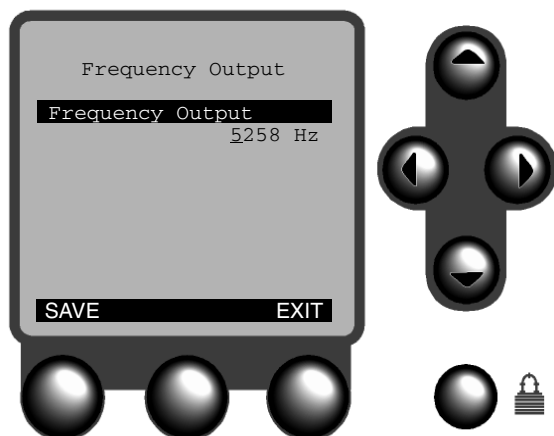
1. Press the security button on the display face.
2. Select Maintenance.
3. Select Diagnostics.
4. Select Simulate Outputs.
5. Select Milliamp Outputs.
6. Select the milliamp output to be set.
7. Press CHG.
8. Use the cursor control buttons to change the output value.
9. Press SAVE to set the value.

When you exit to the simulate outputs screen, the output returns to its configured fault setting.

When you return to the operation mode, the values of the outputs are released and are again controlled by the application.

Setting the frequency output

Maintenance
└─ Diagnostics
 └─ Simulate outputs
 └─ Frequency output



To set the value of the frequency output:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Diagnostics.
4. Select Simulate Outputs.
5. Select Frequency Output.
6. Press CHG.
7. Use the cursor control buttons to change the output value.
8. Press SAVE to set the value.

When you exit to the simulate outputs screen, the output returns to its configured fault setting.

When you return to the operation mode, the value of the output is released and is again controlled by the application.

15

Active Alarm Log

15.1 About this chapter

This chapter explains how to use the active alarm log, which is accessible from the view menu or the maintenance menu.

15.2 Active alarm log



If the condition that caused an alarm is active, the alarm is listed in the active alarm log.

- Each alarm is time/date stamped.
- The first alarm listed is the most recent.

To access the log from the maintenance menu:

1. At the operation screen, press the security button.
2. Select Maintenance.
3. Select Active Alarm Log.

To access the log from the view menu:

1. At the operation screen, press VIEW.
2. Select Active Alarm Log.

15.3 For more information about alarms

For information about responding to alarms, see **Chapter 13**.

16

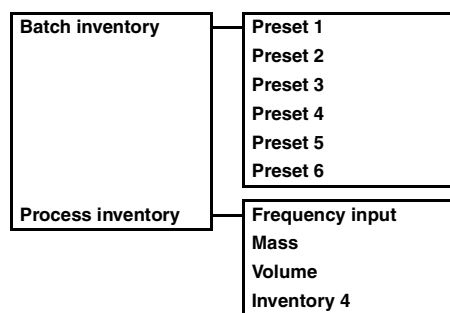
Totalizers

16.1 About this chapter

This chapter explains how to use the maintenance menu to monitor and reset batch inventory and process inventory totalizers.

- Totalizers are accessible from the view menu or the maintenance menu. All totalizer parameters in the maintenance menu are listed in **Figure 0-1**.
- To access totalizers from the view menu, see pages 92-93.

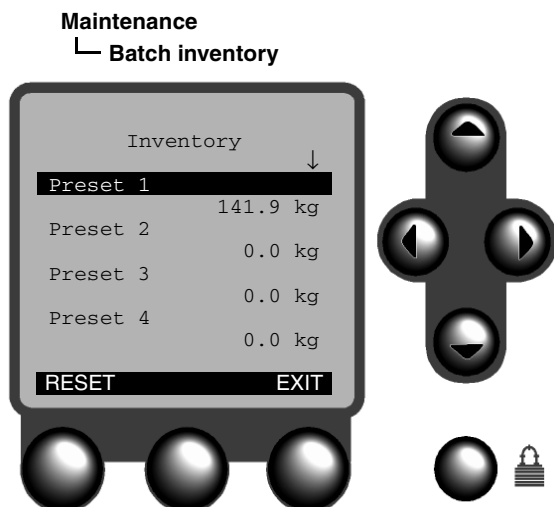
Figure 0-1. Totalizer menus



16.2 Configuring totalizers

- To configure batch inventory totalizers, see **Chapter 5**.
- To configure process totalizers, see page 39.

16.3 Batch inventory totalizers

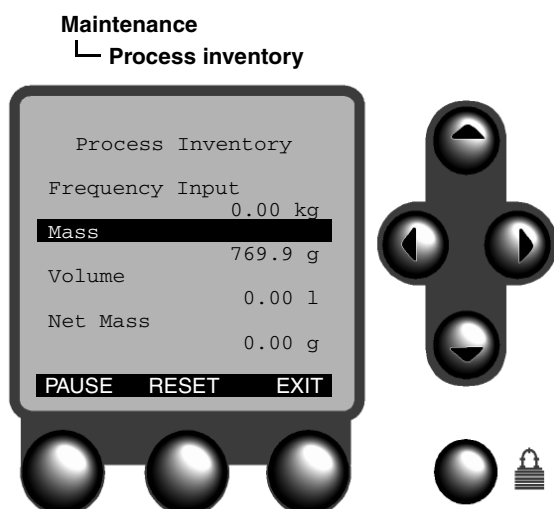


Use the batch inventory menu to monitor or reset inventory totals for batch presets.

To reset a batch inventory total:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Batch Inventory.
4. Select the desired preset, then press RESET.
 - Only batch inventories for presets that have been configured will be listed.
 - To configure presets, see page 34.
5. Press EXIT repeatedly to return to the operation screen.

16.4 Process inventory totalizers



The process inventory menu allows you to:

- Monitor and reset process inventory totals
- Pause and resume counting of displayed totals

CAUTION

If counting has been paused, pressing RESET will cause the total to reset to a non-zero value.

To make sure the total resets to zero, press RESET before pressing PAUSE.

To reset an inventory total, or to pause and resume counting of the displayed totals:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Process Inventory.
4. Select the desired inventory totalizer.
 - To reset the selected inventory totalizer, press RESET. Pressing RESET also resets the corresponding process totalizer (see page 92).
 - To pause counting of all displayed totals, press PAUSE.
 - To resume counting of all displayed totals, press RESUME.
5. Press EXIT repeatedly to return to the operation screen.

The value to which the inventory total resets depends on whether or not counting has been paused.

- If you press RESET without pressing PAUSE, the total resets to zero.
- If you press PAUSE, then press RESET, the total resets to the amount that accumulated from the time counting was paused to the time the totalizer was reset. For example, if counting was paused at 500 grams, then 25 grams were counted before the total was reset, the total resets to 25 grams.

17

Calibration and Trim

17.1 About this chapter

This chapter explains how to perform calibration and trim procedures.

Calibration and trim account for performance variations in individual sensors, transmitters, and peripheral devices. When a transmitter and a sensor are ordered together, they are factory calibrated to produce highly accurate measurements of mass flow, fluid density, and flow tube temperature.

The maintenance menu enables you to perform the calibration and trim procedures listed in **Figure 17-1**, page 122.

CAUTION

Selecting calibration will interrupt control functions. All control outputs will go to their configured idle settings.

Set control devices for manual operation before accessing calibration menus.

17.2 Necessary versus optional calibration and trim procedures

Some calibration and trim procedures must be performed; other procedures are optional, or must be performed only in some situations.

Necessary procedures

Sensor zero

If the applications platform is a Model 3500 or 3700, a sensor zero must be performed at initial startup. To perform a sensor zero, see page 82.

Batch AOC calibration

Calibrating the batch AOC is necessary if any of the following conditions apply:

- When the discrete batch application is installed
- If consistent overshooting or undershooting of the target is observed
- If equipment (valve or pump) is changed

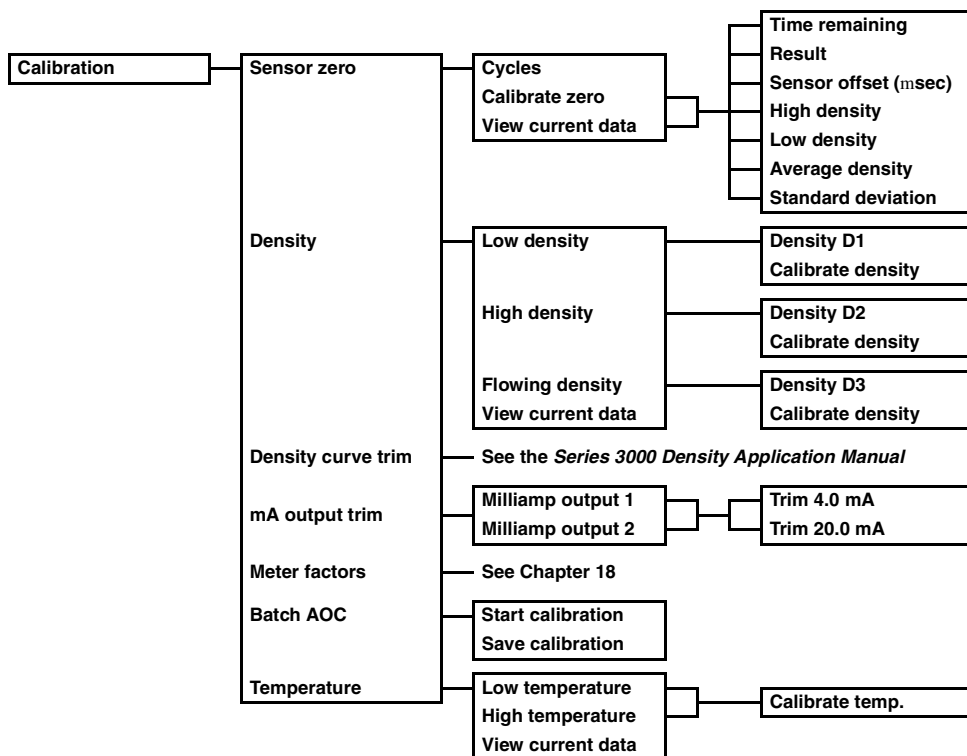
To calibrate the batch AOC, see page 134.

Optional procedures

The following calibration and trim procedures are not necessary, but may be performed to enhance measurement accuracy:

- Two-point density calibration (see pages 124-127).
- Flowing density calibration (see pages 128-129).
- Temperature calibration (see pages 133-134).
- Milliamp output trim (see pages 130-131).

Figure 17-1. Calibration menu



17.3 Sensor zero

A sensor zero must be performed at initial startup.

Sensor zero establishes flowmeter response to zero flow and sets a baseline for flow measurement.

To perform a sensor zero, see page 82.

CAUTION

Failure to perform a sensor zero calibration at initial startup could cause the flowmeter to produce inaccurate signals.

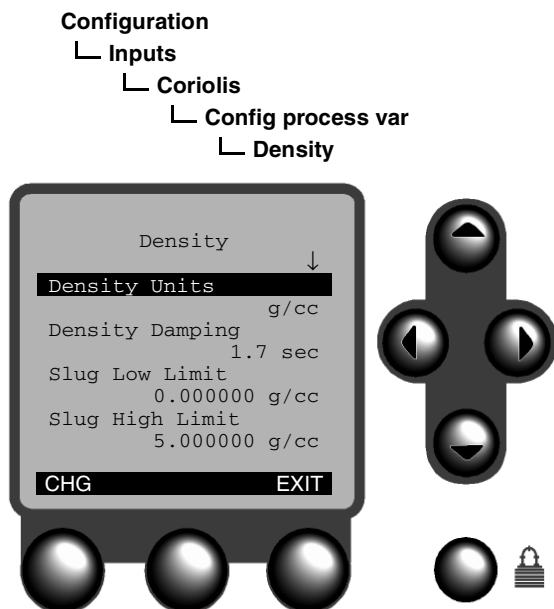
Perform a sensor zero before putting the flowmeter into operation.

17.4 Density calibration

The maintenance software supports two types of density calibration:

- Two-point density calibration, preferably performed under zero flow conditions, establishes the sensor's tube periods at low and high reference densities.
- Flowing density calibration, performed at or near the maximum flow rate for the sensor, accounts for the effects of flow on the tube period at high flow rates. Most applications do not require flowing density calibration, but it should be performed if the process often exceeds the appropriate flow rate listed in **Table 17-4**, page 128.

Density unit for calibration



Density calibration requires reading and entering density values in grams per cubic centimeter.

To change the density unit:

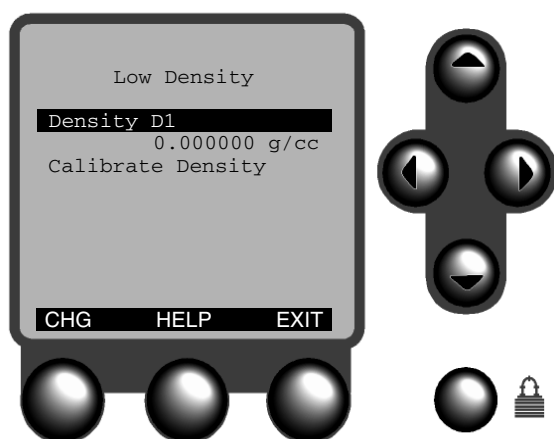
1. Press the security button on the display face.
2. Select Configuration.
3. Select Inputs.
4. Select Coriolis.
5. Select Config Process Var.
6. Select Density.
7. At the density menu:
 - a. Select Density Units.
 - b. Press CHG.
 - c. Select g/cc, then press SAVE.

Two-point density calibration

During 2-point density calibration, the operator commands the transmitter to measure the sensor tube period when the flow tubes contain a fluid with a reference low density (usually air) and when the flow tubes contain a fluid with a reference high density (usually water).

Two-point density calibration is preferably performed under zero flow conditions. The calibration procedure includes a low-density calibration and a high-density calibration.

Maintenance
 └ Calibration
 └ Density
 └ Low density



To perform the low-density calibration:

1. Fill the sensor with a low-density fluid, such as air.
2. If possible, shut off the flow. Otherwise, pump the fluid through the sensor at the lowest flow rate allowed by the process.
3. Use any established method to derive an accurate density, in grams per cubic centimeter, for the fluid at line conditions. If air is the low-density calibration fluid, a value from **Table 17-1** can be used for the density.
4. Press the security button on the display face.
5. Select Maintenance.
6. Select Calibration.
7. Select Density.
8. Select Low Density.
9. At the low density menu:
 - a. Select Density D1, then press CHG.
 - b. Enter the line-condition density **in grams per cubic centimeter**, then press SAVE.
 - c. Select Calibrate Density, then press CHG.
10. After calibration is complete, an alarm message appears at the top of the screen.
 - a. Press ACK to acknowledge the alarm.
 - b. If the alarm message reads "Calibration Failure", see page 105.
11. Press SAVE to save the calibration.
12. Perform the high-density calibration as instructed on pages 126-127.

Table 17-1. Density of air

Pressure in millibar (inches of mercury)	Temperature in °C and °F								
	10°C 50°F	15°C 59°F	20°C 68°F	25°C 77°F	30°C 86°F	35°C 95°F	40°C 104°F	45°C 113°F	50°C 122°F
850 (25.14)	.0010	.0010	.0010	.0010	.0010	.0010	.0009	.0009	.0009
900 (26.62)	.0011	.0011	.0011	.0010	.0010	.0010	.0010	.0010	.0009
950 (28.10)	.0012	.0011	.0011	.0011	.0011	.0011	.0010	.0010	.0010
1000 (29.57)	.0012	.0012	.0012	.0012	.0011	.0011	.0011	.0011	.0011
1050 (31.06)	.0013	.0013	.0012	.0012	.0012	.0012	.0012	.0011	.0011

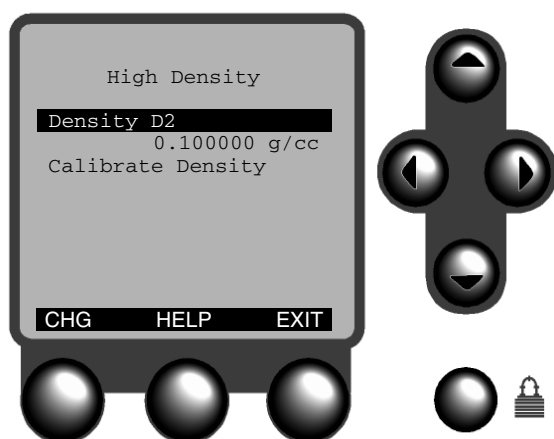
To perform the high-density calibration:

1. Perform the low-density calibration as instructed on page 125.
2. Press EXIT to return to the density menu.
3. Fill the sensor with a high-density fluid, such as water.
4. If possible, shut off the flow. Otherwise, pump the fluid through the sensor at the lowest flow rate allowed by the process. The flow rate should be less than the rate listed in **Table 17-2**.

Table 17-2. Maximum flow rates for high-density calibration

Sensor model		Maximum flow rate	
		lb/min	kg/h
ELITE®	CMF010	0.25	6.75
	CMF025	5	135
	CMF050	15	425
	CMF100	62	1700
	CMF200	200	5440
	CMF300	625	17,010
	CMF400	1250	34,090
T-Series	T075	31	850
	T100	68	1870
	T150	215	5960
BASIS®	F025	5	135
	F050	15	425
	F100	62	1700
	F200	200	5440
Model D	D6	0.125	3.25
	D12	0.25	8.25
	D25	1.5	42
	D40	2.75	76
	D65	18	510
	D100	50	1360
	D150	175	4760
	D300	435	11,905
Model DH	D600	1560	42,525
	DH6	0.125	3.25
	DH12	0.25	8.25
	DH25	1.5	42
	DH38	3	85
	DH100	50	1360
	DH150	175	4760
	DH300	435	11,905
Model DL	DL65	15	420
	DL100	50	1360
	DL200	215	5950
Model DT	DT65	18	510
	DT100	50	1360
	DT150	87	2380

Maintenance
 └ Calibration
 └ Density
 └ High density



5. To ensure stable density, make sure the fluid in the flow tubes remains **completely** free of gas bubbles during the calibration.
6. Use any established method to derive an accurate density, in grams per cubic centimeter, for the fluid at line conditions. If water is the high-density calibration fluid, a value from **Table 17-3** can be used for the density.
7. Select High Density.
8. At the high density menu:
 - a. Select Density D2, then press CHG.
 - b. Enter the line-condition density **in grams per cubic centimeter**, then press SAVE.
 - c. Select Calibrate Density, then press CHG.
9. After calibration is complete, an alarm message appears at the top of the screen.
 - a. Press ACK to acknowledge the alarm.
 - b. If the alarm message reads "Calibration Failure", see page 105.
10. Press SAVE to save the calibration.

Table 17-3. Density of water

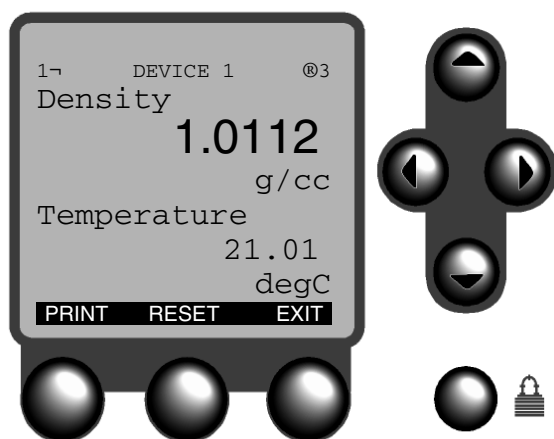
Temperature			Temperature		
°F	°C	Density in g/cc	°F	°C	Density in g/cc
32	0.0	0.9998	59	15.0	0.9991
33	0.6	0.9998	60	15.6	0.9991
34	1.1	0.9999	61	16.1	0.9989
35	1.7	0.9999	62	16.7	0.9989
36	2.2	0.9999	63	17.2	0.9988
37	2.8	0.9999	64	17.8	0.9987
38	3.3	0.9999	65	18.3	0.9986
39	3.9	1.0000	66	18.9	0.9984
40	4.4	1.0000	67	19.4	0.9983
41	5.0	0.9999	68	20.0	0.9982
42	5.6	0.9999	69	20.6	0.9981
43	6.1	0.9999	70	21.1	0.9980
44	6.7	0.9999	71	21.7	0.9980
45	7.2	0.9999	72	22.2	0.9979
46	7.8	0.9999	73	22.8	0.9977
47	8.3	0.9998	74	23.3	0.9975
48	8.9	0.9998	75	23.9	0.9973
49	9.4	0.9998	76	24.4	0.9972
50	10.0	0.9997	77	25.0	0.9970
51	10.6	0.9996	78	25.6	0.9969
52	11.1	0.9996	79	26.1	0.9968
53	11.7	0.9995	80	26.7	0.9966
54	12.2	0.9995	81	27.2	0.9964
55	12.8	0.9994	82	27.8	0.9963
56	13.3	0.9994	83	28.3	0.9961
57	13.9	0.9992	84	28.9	0.9960
58	14.4	0.9992	85	29.4	0.9958
			86	30.0	0.9956

Flowing density calibration

Flowing density calibration should be performed if the flow rate often exceeds the flow rate listed in **Table 17-4**.

Table 17-4. Minimum flow rates for flowing density calibration

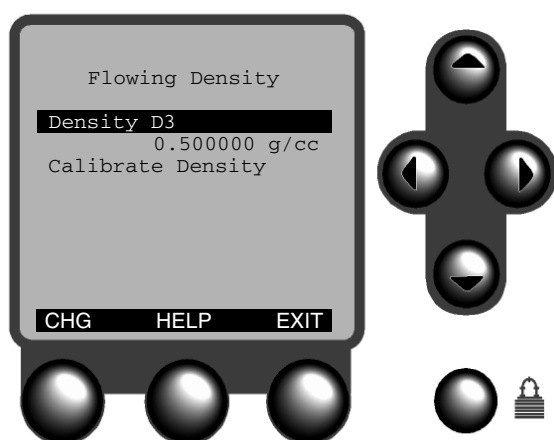
		Minimum flow rate	
		lb/min	kg/h
ELITE®	CMF010	2.5	69
	CMF025	27	720
	CMF050	86	2350
	CMF100	280	7575
	CMF200	1270	34,540
	CMF300	4390	119,600
	CMF400	15,000	409,000
T-Series	T075	500	13,630
	T100	1100	29,990
	T150	3500	95,430
BASIS®	F200	2315	63,045
	All other F sensors	Flowing density calibration not necessary	
Model D	D6	0.8	25
	D12	4.5	125
	D25	18	485
	D40 stainless steel	33	900
	D40 Hastelloy® C-22	52	1395
	D65	115	3060
	D100	405	11,010
	D150	1140	31,050
	D300	2705	73,660
	D600	9005	245,520
Model DH	All DH sensors	Flowing density calibration not necessary	
Model DL	DL65	115	3075
	DL100	325	8,780
	DL200	1210	32,950
Model DT	DT65	150	4040
	DT100	315	8460
	DT150	580	15,780

**Maintenance**

└─ Calibration

└─ Density

└─ Flowing density

**To perform the flowing density calibration:**

1. Make sure density factors (D1, D2, K1, K2, and Dens Temp Coeff) are correct.
 - Enter density factors from the sensor serial number tag (see pages 21-25) or
 - Perform a 2-point density calibration (see pages 125-127).
2. Compare the maximum flow rate for the process against the appropriate value from **Table 17-4**, page 128. If the maximum flow rate for the process is less than the value listed in **Table 17-4**, performing a flowing density calibration is unnecessary.
3. Fill the sensor with a process fluid that has a stable density.
4. With the process under no-flow or low-flow conditions, read the process density:
 - If the process monitor is the default operating mode, read density from the operation screen (see page 84).
 - If a control function is the default operating mode, read density by pressing VIEW, then selecting Process Monitoring (see page 90).
5. Take note of the process density for use at step 12.
6. Pump the fluid through the sensor at the highest flow rate allowed by the process. The flow rate must be greater than the appropriate value in **Table 17-4** or the calibration will be in error. To ensure stable density, make sure the fluid in the flow tubes remains **completely** free of gas bubbles during the calibration.
7. Press the security button on the display face.
8. Select Maintenance.
9. Select Calibration.
10. Select Density.
11. Select Flowing Density.
12. At the flowing density menu:
 - a. Select Density D3, then press CHG.
 - b. Enter the density **in grams per cubic centimeter** that was read at step 4, then press SAVE.
 - c. Select Calibrate Density, then press CHG.
13. After calibration is complete, an alarm message appears at the top of the screen.
 - a. Press ACK to acknowledge the alarm.
 - b. If the alarm message reads "Calibration Failure", see page 105.
14. Press SAVE to save the calibration.

To verify the accuracy of the flowing density calibration:

1. Monitor the process density.
 - If the process monitor is the default operating mode, read density from the operation screen (see page 84).
 - If a control function is the default operating mode, read density by pressing VIEW, then selecting Process Monitoring (see page 90).
2. If changes in density readings cannot be attributed to actual process density changes caused by changes in temperature, pressure, etc., the calibration should be performed again.

After density calibration is complete

Density calibration changes the density calibration values that appear in the sensor cal data menu. After a 2-point or flowing density calibration has been performed:

1. Follow the procedure on page 18 to read density calibration values.
2. Record the density calibration values in the configuration record (**Appendix B**).

17.5 Milliamp output trim

To perform a milliamp output trim:

1. Connect a digital multimeter (DMM) or other reference device to the primary or secondary milliamp wiring terminals. **Table 17-5** lists the terminals to which the reference device should be connected.

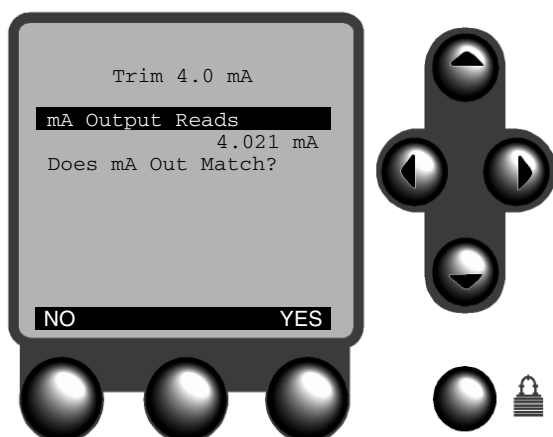
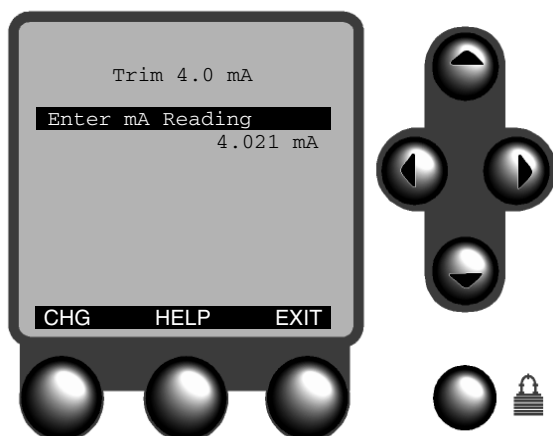
Table 17-5. Milliamp output wiring terminals**Note**

Reference device should be set to read milliamps and should be connected in series to wiring terminals

Terminal designation	Polarity	Terminal number		
		Model 3500 with screw-type or solder-tail terminals	Model 3500 with I/O cable	Model 3700
4-20 mA primary	+	c 2	1	2
	–	a 2	2	1
4-20 mA secondary	+	c 4	14	4
	–	a 4	15	3
Terminal block location:		Farthest right block on back panel	Attached to DIN rail	Gray terminal block

```

Maintenance
├─ Calibration
│   └─ mA output trim
│       ├── Milliamp output 1
│       │   ├── Trim 4.0 mA
│       │   └── Trim 20.0 mA
│       └── Milliamp output 2
│           ├── Trim 4.0 mA
│           └── Trim 20.0 mA
    
```



2. Press the security button on the display face.
3. Select Maintenance.
4. Select Calibration.
5. Select mA Output Trim.
6. Select Milliamp Output 1 or Milliamp Output 2.
7. Select the output level to be trimmed:
 - To trim at 4 mA, select Trim 4.0 mA
 - To trim at 20 mA, select Trim 20.0 mA
8. Press CHG, enter the amount of current indicated by the reference device, then press SAVE.

9. Compare the output level that is indicated by the reference device to the output level that appears in the display.
 - If the output level that appears in the display matches the output level that is indicated by the reference device, press YES.
 - If the output level that appears in the display does *not* match the output level that is indicated by the reference device, press NO, then repeat steps 8 and 9.

17.6 Batch AOC

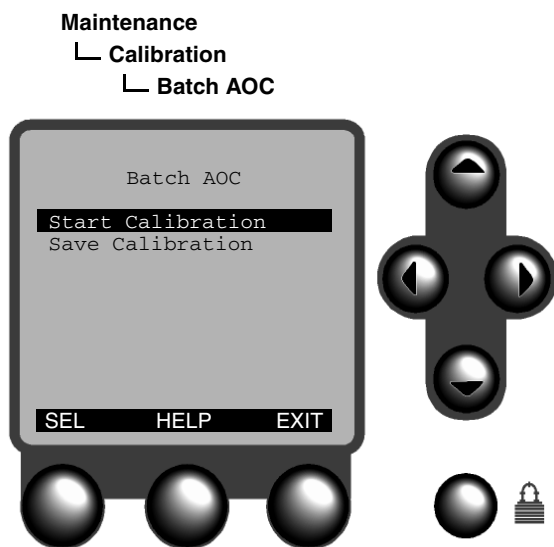
Batch AOC (Automatic Overshoot Compensation) keeps the actual quantity delivered as close as possible to the batch target, by minimizing the amount of overshoot. To enable the batch AOC, see pages 32-33.

The batch AOC must be calibrated:

- When the discrete batch application is installed
- If consistent overshooting or undershooting of the target is observed
- If equipment (valve or pump) is changed

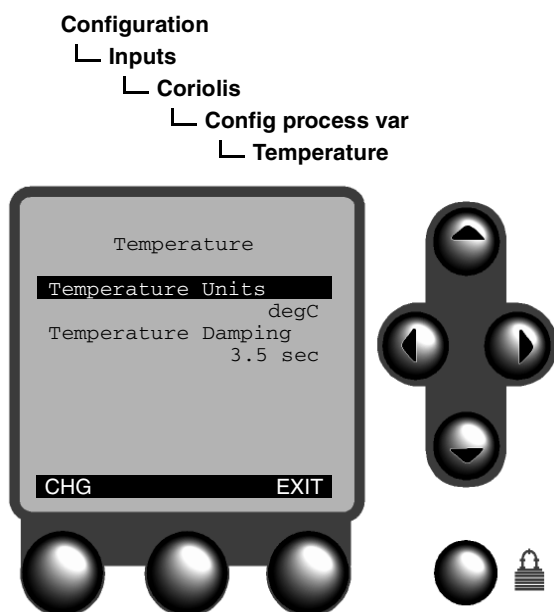
To calibrate the batch AOC:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Calibration.
4. Select Batch AOC.
5. Select Start Calibration.
6. Press EXIT repeatedly to return to the operation screen.
7. Run two to 10 batches.
8. When overshoot has been adequately minimized, repeat steps 1 through 4.
9. Select Save Calibration.



17.7 Temperature calibration

Temperature unit for calibration



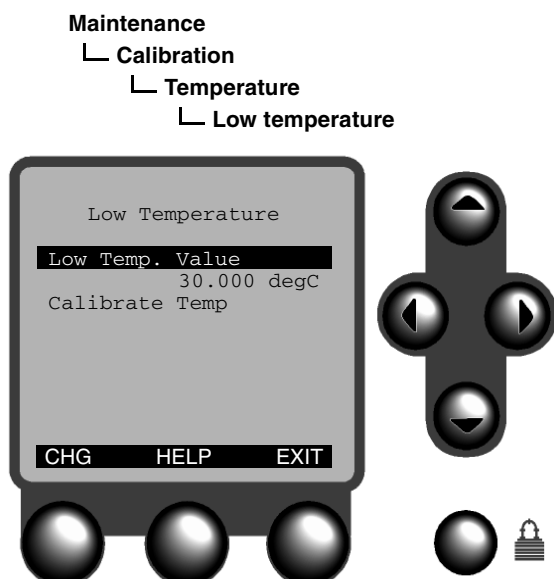
If a temperature calibration is performed, you must perform the temperature offset calibration and the temperature slope calibration.

Temperature calibration requires reading and entering temperature values in degrees Celsius.

To change the temperature unit:

1. Press the security button on the display face.
2. Select Configuration.
3. Select Inputs.
4. Select Coriolis.
5. Select Config Process Var.
6. Select Temperature.
7. At the temperature menu:
 - a. Select Temperature Units.
 - b. Press CHG.
 - c. Select degC, then press SAVE.

Temperature offset calibration

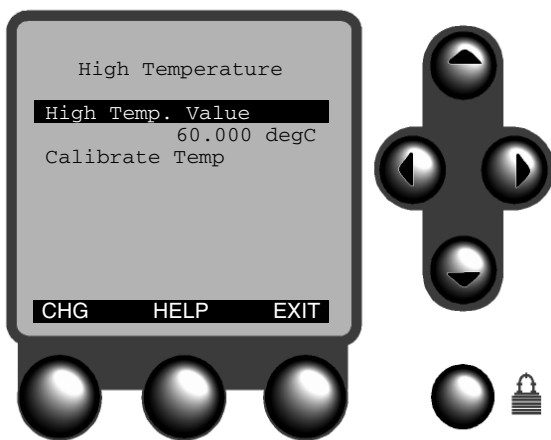


To perform the temperature offset calibration:

1. Fill the sensor with process fluid at the lowest temperature measured during the application.
2. Wait approximately 30 minutes for the flow tube temperature to stabilize.
3. Use a highly accurate thermometer, temperature sensor, RTD, or other device to measure the temperature of the process fluid.
4. Press the security button on the display face.
5. Select Maintenance.
6. Select Calibration.
7. Select Temperature.
8. Select Low Temperature.
9. At the low temperature menu:
 - a. Select Low Temp Value, then press CHG.
 - b. Enter the temperature that was measured at step 3, **in degrees Celsius**, then press SAVE.
 - c. Select Calibrate Temp, then press CHG.

Temperature slope calibration

Maintenance
└─ Calibration
 └─ Temperature
 └─ High temperature



After temperature calibration is complete

10. After calibration is complete, an alarm message appears at the top of the screen.
 - a. Press ACK to acknowledge the alarm.
 - b. If the alarm message reads "Calibration Failure", see page 105.
11. Press SAVE to save the calibration.
12. Perform the temperature slope calibration as instructed below.

To perform the temperature slope calibration:

1. Perform the temperature offset calibration as instructed above.
2. Press EXIT to return to the temperature menu.
3. Fill the sensor with process fluid at the highest temperature measured during the application.
4. Wait approximately 30 minutes for the flow tube temperature to stabilize.
5. Use the same reference device as the one that was used during the temperature offset calibration to measure the temperature of the process fluid.
6. Select High Temperature.
7. At the high temperature menu:
 - a. Select High Temp Value, then press CHG.
 - b. Enter the temperature that was measured at step 5, **in degrees Celsius**, then press SAVE.
 - c. Select Calibrate Temp, then press CHG.
8. After calibration is complete, an alarm message appears at the top of the screen.
 - a. Press ACK to acknowledge the alarm.
 - b. If the alarm message reads "Calibration Failure", see page 105.
9. Press SAVE to save the calibration.

After a temperature calibration has been performed:

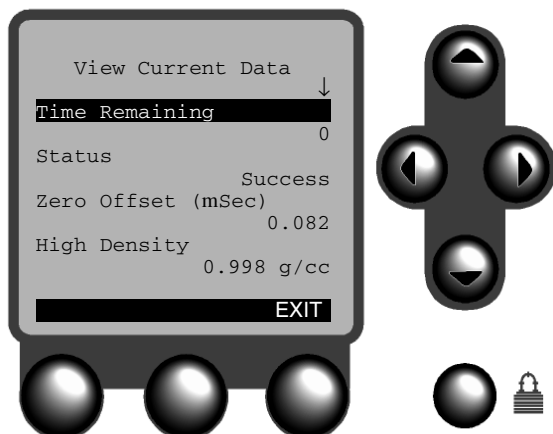
1. Follow the procedure on page 18 to read the temperature slope and temperature offset.
2. Record the slope and offset values in the configuration record (**Appendix B**).
3. If density application software is present, re-enter data for density measurement. See the *Series 3000 Density Application Manual*.

17.8 Viewing current data for calibrations

```

Maintenance
├─ Calibration
│   ├── Sensor zero
│   ├── Density
│   └── Temperature
│       └─ View current data

```



To view current data for sensor zero, density calibration, or temperature calibration:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Calibration.
4. Select the type of calibration for which current data will be viewed.
 - To view current data for the sensor zero, select Sensor Zero.
 - To view current data for the density calibration, select Density.
 - To view current data for the temperature calibration, select Temperature.
5. Select View Current Data to read calibration factors for the type of calibration that was selected at step 4.

18

Meter Factors

18.1 About this chapter

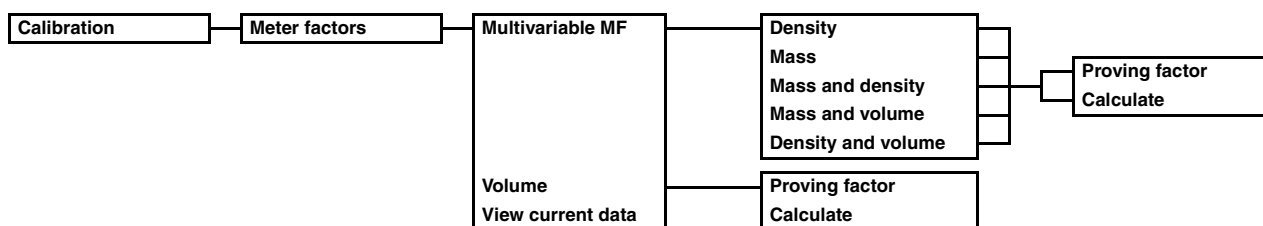
This chapter explains how to calculate and enter meter factors for proving applications. Meter factors include all the software parameters listed in **Figure 18-1**.

⚠ CAUTION

Selecting calibration will interrupt control functions. All control outputs will go to their configured idle settings.

Set control devices for manual operation before accessing calibration menus.

Figure 18-1. Meter factors menu



18.2 Meter factors and measurements

Meter factors adjust measurements without modifying calibration factors. Meter factors perform the following operation on measurements:

$$Density_{(corrected)} = Meter\ factor_{(density)} \times Density_{(uncorrected)}$$

$$Mass\ flow_{(corrected)} = Meter\ factor_{(mass\ flow)} \times Mass\ flow_{(uncorrected)}$$

$$Volume\ flow_{(corrected)} = Meter\ factor_{(volume)} \times \frac{Mass\ flow_{(uncorrected)}}{Density_{(uncorrected)}}$$

- Meter factors apply primarily to proving applications, in which the flowmeter measurement is checked against a calibrated reference.
- Meter factors are cumulative: Any time a meter factor is changed, the previous (old) meter factor is a factor in the equation that is used for calculating the new value.

18.3 Proving factors

Proving is done by comparing the value of the process variable as indicated by the transmitter against the value of the process variable as indicated by a reference device:

$$\text{Proving factor} = \frac{\text{Reference value}}{\text{Indicated value}}$$

18.4 Volume method

The volume method allows proving volume flow only.

Each time the flowmeter is proved for volume, a new meter factor for volume is derived from the following equation:

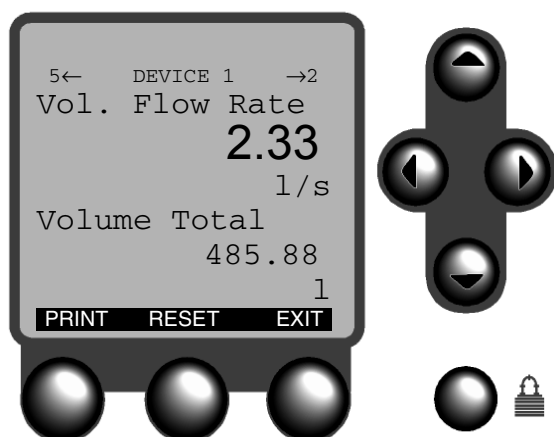
$$\text{Meter factor}_{(new)} = \text{Proving factor} \times \text{Meter factor}_{(old)}$$

When the volume method is used, mass and density meter factors always have a value of 1.0, regardless of the value of the volume meter factor.

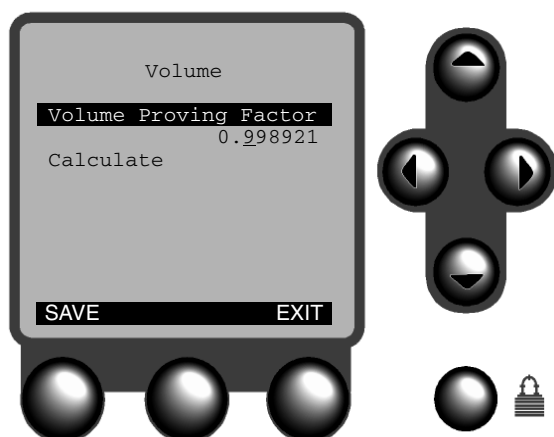
To calculate and enter a volume meter factor:

1. Run a batch of fluid.
2. Use a device such as a volumetric tank, prover, or volumetric flowmeter to measure the volume total for the batch.
3. Use the process monitor to read the volume total for the batch that is indicated by the transmitter.
 - If the process monitor is the operation mode, use the operation screen to read the total.
 - If a control application is the operation mode, press VIEW, select Process Monitoring, then press NEXT to read the total.
4. Calculate the volume proving factor according to the following formula:

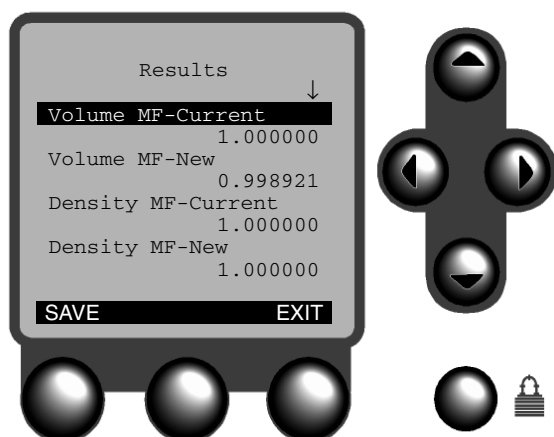
$$\text{Volume proving factor} = \frac{\text{Reference volume total}}{\text{Indicated volume total}}$$



Maintenance
 └ Calibration
 └ Meter factors
 └ Volume



Maintenance
 └ Calibration
 └ Meter factors
 └ Volume
 └ Calculate



5. Press the security button on the display face.
6. Select Maintenance.
7. Select Calibration.
8. Select Meter Factors.
9. Select Volume.
10. Select Volume Proving Factor:
 - a. Press CHG.
 - b. Enter the volume proving factor that was calculated at step 4.
 - c. Press SAVE.

11. Select Calculate. The results of the calculation will appear as shown at left.
 - The "current" meter factors are the factors that are currently being used for adjusting measurements.
 - The "new" meter factors are derived from the calculation that has just been made.
 - To replace the current meter factors with the new meter factors, you must save the calculation results.
12. Press SAVE. The new meter factors have now become the current meter factors. To view the current meter factors that have just been saved, see page 150.

18.5 Multivariable method

The multivariable method enables you to select the variables to be proved and gives you the option of proving one or two variables. If the multivariable method is used:

- Changing the value of one meter factor always affects the value of another meter factor.
- Changing the value of two meter factors always affects the value of a third meter factor.

New meter factor

Each time the flowmeter is proved for a given process variable, a new meter factor for that process variable is derived from the following equation:

$$\text{Meter factor}_{(new)} = \text{Proving factor} \times \text{Meter factor}_{(old)}$$

Dependent meter factor

A *dependent meter factor* is recalculated when you change the value of another meter factor using the multivariable method. The new value of a dependent meter factor is always recalculated from the previous (old) meter factor.

Table 18-1 lists all equations for recalculating meter factors when the multivariable method is used.

Table 18-1. Calculations for multivariable proving

Notes

- MF = Meter factor
- PF = Proving factor

Variable(s) to be proved	New meter factor _(MASS) =	New meter factor _(DENSITY) =	New meter factor _(VOLUME) =
Mass	$\text{PF}_{\text{MASS}} * \text{MF}_{\text{MASS(ol)}}_{\text{independent}}$	$\text{MF}_{\text{DENSITY(ol)}}_{\text{unaffected}}$	$\text{PF}_{\text{MASS}} * \text{MF}_{\text{VOLUME(ol)}}_{\text{dependent}}$
Density	$\text{MF}_{\text{MASS(ol)}}_{\text{unaffected}}$	$\text{PF}_{\text{DENSITY}} * \text{MF}_{\text{DENSITY(ol)}}_{\text{independent}}$	$\text{MF}_{\text{VOLUME(ol)}} \div \text{PF}_{\text{DENSITY}}_{\text{dependent}}$
Mass and density	$\text{PF}_{\text{MASS}} * \text{MF}_{\text{MASS(ol)}}_{\text{independent}}$	$\text{PF}_{\text{DENSITY}} * \text{MF}_{\text{DENSITY(ol)}}_{\text{independent}}$	$(\text{PF}_{\text{MASS}} \div \text{PF}_{\text{DENSITY}}) * \text{MF}_{\text{VOLUME(ol)}}_{\text{dependent}}$
Mass and volume	$\text{PF}_{\text{MASS}} * \text{MF}_{\text{MASS(ol)}}_{\text{independent}}$	$(\text{PF}_{\text{MASS}} \div \text{PF}_{\text{VOLUME}}) * \text{MF}_{\text{DENSITY(ol)}}_{\text{dependent}}$	$\text{PF}_{\text{VOLUME}} * \text{MF}_{\text{VOLUME(ol)}}_{\text{independent}}$
Density and volume	$\text{PF}_{\text{DENSITY}} * \text{PF}_{\text{VOLUME}} * \text{MF}_{\text{MASS(ol)}}_{\text{dependent}}$	$\text{PF}_{\text{DENSITY}} * \text{MF}_{\text{DENSITY(ol)}}_{\text{independent}}$	$\text{PF}_{\text{VOLUME}} * \text{MF}_{\text{VOLUME(ol)}}_{\text{independent}}$

Example:

The flowmeter is installed and proved. The flowmeter mass measurement is 250.27 pounds; the reference device measurement is 250 pounds. A mass proving factor is determined as follows:

$$\text{Mass proving factor} = \frac{250}{250.27} = 0.998921$$

The transmitter calculates a mass meter factor as follows:

$$\text{Mass meter factor} = 0.998921 \times 1.0 = 0.998921$$

A new volume meter factor is also determined:

$$\text{Volume meter factor} = 0.998921 \times 1.0 = 0.998921$$

One month later, the flowmeter is proved again. The flowmeter measurement is 250.07 pounds; the reference device measurement is 250.25 pounds. A mass proving factor is determined as follows:

$$\text{Mass proving factor} = \frac{250.25}{250.07} = 1.000072$$

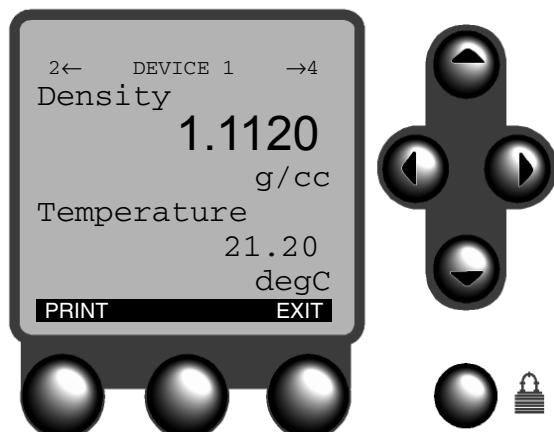
The new mass meter factor is determined as follows:

$$\text{Mass meter factor} = 1.000072 \times 0.998921 = 0.999640$$

Because the volume meter factor is dependent on the mass meter factor, a new volume meter factor is also determined:

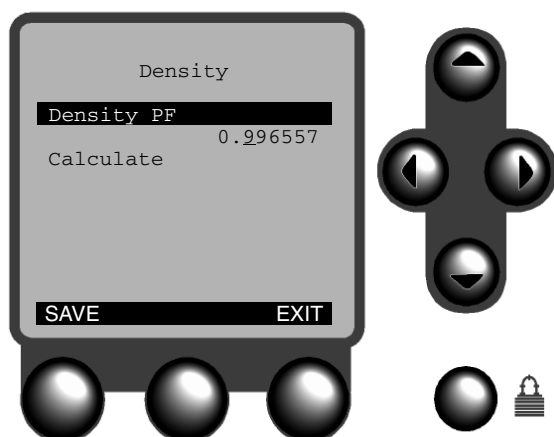
$$\text{Volume meter factor} = 1.000072 \times 0.998921 = 0.999640$$

Density



Maintenance

- └ Calibration
 - └ Meter factors
 - └ Multivariable MF
 - └ Density



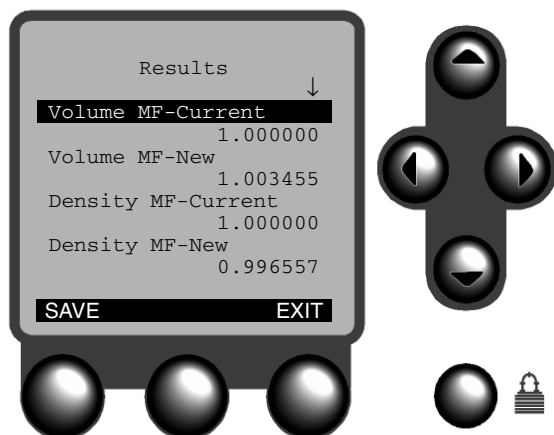
To calculate and enter a density meter factor:

1. Run a batch of fluid.
2. Use a reference densitometer or density sampling device such as a pycnometer to measure the process density.
3. Use the process monitor to read the process density that is indicated by the transmitter.
 - If the process monitor is the operation mode, use the operation screen to read the density.
 - If a control application is the operation mode, press VIEW, select Process Monitoring, then press NEXT repeatedly to read the density.
4. Calculate the density proving factor according to the following formula:

$$\text{Density proving factor} = \frac{\text{Reference density}}{\text{Indicated density}}$$

5. Press the security button on the display face.
6. Select Maintenance.
7. Select Calibration.
8. Select Meter Factors.
9. Select Multivariable MF.
10. Select Density.
11. Select Density PF:
 - a. Press CHG.
 - b. Enter the density proving factor that was calculated at step 4.
 - c. Press SAVE.

Maintenance
 └ Calibration
 └ Meter factors
 └ Multivariable MF
 └ Density
 └ Calculate

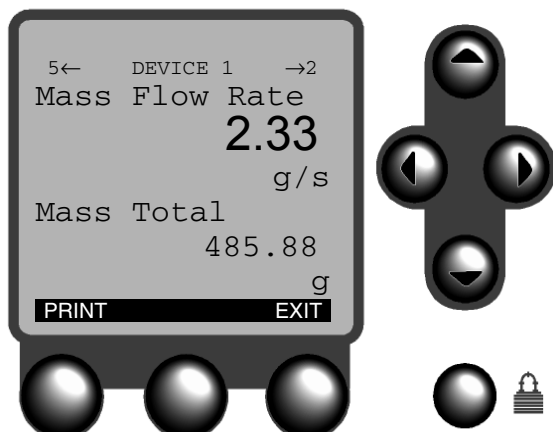


12. Select Calculate. The results of the calculation will appear as shown at left.

- The "current" meter factors are the factors that are currently being used for adjusting measurements.
- The "new" meter factors are derived from the calculation that has just been made. Note that the volume meter factor has also been recalculated because it is dependent on the density meter factor (see **Table 18-1**, page 140).
- To replace the current meter factors with the new meter factors, you must save the calculation results.

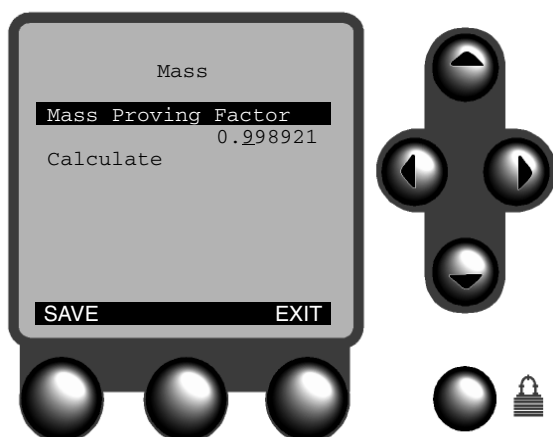
13. Press SAVE. The new meter factors have now become the current meter factors. To view the current meter factors that have just been saved, see page 150.

Mass



Maintenance

- └ Calibration
 - └ Meter factors
 - └ Multivariable MF
 - └ Mass



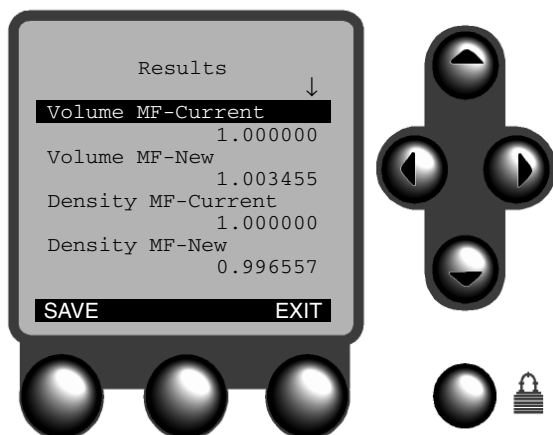
To calculate and enter a mass meter factor:

1. Run a batch of fluid.
2. Use a device such as a weigh scale, prover, or reference flowmeter to measure the mass total for the batch.
3. Use the process monitor to read the mass total for the batch that is indicated by the transmitter.
 - If the process monitor is the operation mode, use the operation screen to read the total.
 - If a control application is the operation mode, press VIEW, then select Process Monitoring to read the total.
4. Calculate the mass proving factor according to the following formula:

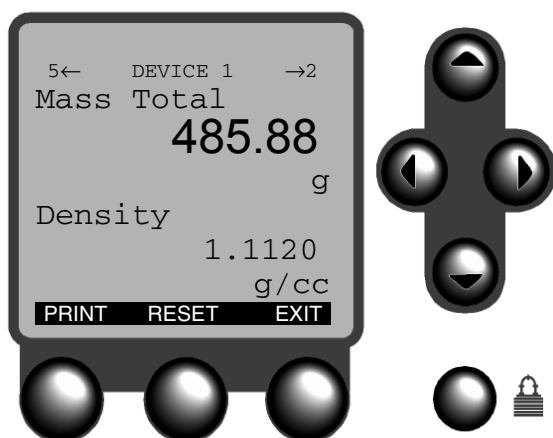
$$\text{Mass proving factor} = \frac{\text{Reference mass total}}{\text{Indicated mass total}}$$

5. Press the security button on the display face.
6. Select Maintenance.
7. Select Calibration.
8. Select Meter Factors.
9. Select Multivariable MF.
10. Select Mass.
11. Select Mass Proving Factor:
 - a. Press CHG.
 - b. Enter the mass proving factor that was calculated at step 4.
 - c. Press SAVE.

Maintenance
 └ Calibration
 └ Meter factors
 └ Multivariable MF
 └ Mass
 └ Calculate



Mass and density



12. Select Calculate. The results of the calculation will appear as shown at left.

- The "current" meter factors are the factors that are currently being used for adjusting measurements.
- The "new" meter factors are derived from the calculation that has just been made. Note that the volume meter factor has also been recalculated because it is dependent on the mass meter factor (see **Table 18-1**, page 140).
- To replace the current meter factors with the new meter factors, you must save the calculation results.

13. Press SAVE. The new meter factors have now become the current meter factors. To view the current meter factors that have just been saved, see page 150.

To calculate and enter mass and density meter factors:

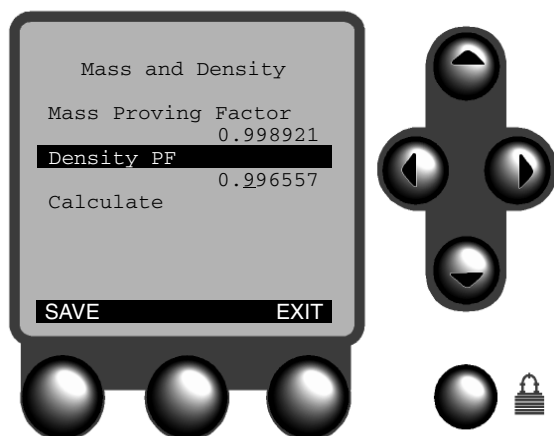
1. Run a batch of fluid.
2. Use a device such as a weigh scale, prover, or reference flowmeter to measure the mass total for the batch.
3. Use a reference densitometer or density sampling device such as a pycnometer to measure the process density.
4. Use the process monitor to read the mass total and density that are indicated by the transmitter.
 - If the process monitor is the operation mode, use the operation screen to read the mass total and density.
 - If a control application is the operation mode, press VIEW, then select Process Monitoring to read the mass total and density.
5. Calculate the mass proving factor according to the following formula:

$$\text{Mass proving factor} = \frac{\text{Reference mass total}}{\text{Indicated mass total}}$$

6. Calculate the density proving factor according to the following formula:

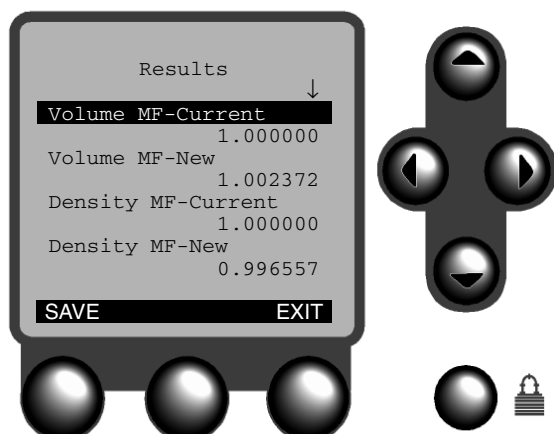
$$\text{Density proving factor} = \frac{\text{Reference density}}{\text{Indicated density}}$$

- Maintenance
 - └ Calibration
 - └ Meter factors
 - └ Multivariable MF
 - └ Mass and density



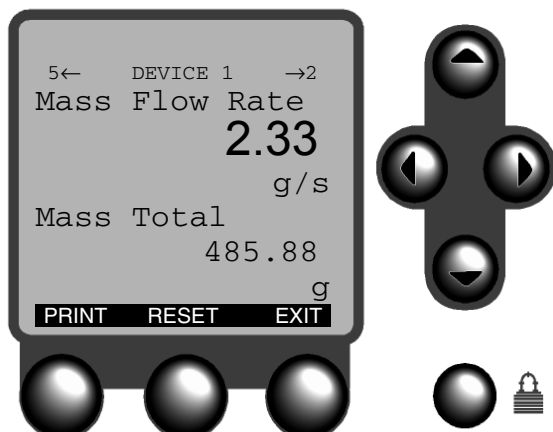
7. Press the security button on the display face.
8. Select Maintenance.
9. Select Calibration.
10. Select Meter Factors.
11. Select Multivariable MF.
12. Select Mass and Density:
 - a. Select Mass Proving Factor.
 - b. Press CHG.
 - c. Enter the mass proving factor that was calculated at step 5.
 - d. Press SAVE.
 - e. Select Density PF.
 - f. Press CHG.
 - g. Enter the density proving factor that was calculated at step 6.
 - h. Press SAVE.

- Maintenance
 - └ Calibration
 - └ Meter factors
 - └ Multivariable MF
 - └ Mass and density
 - └ Calculate



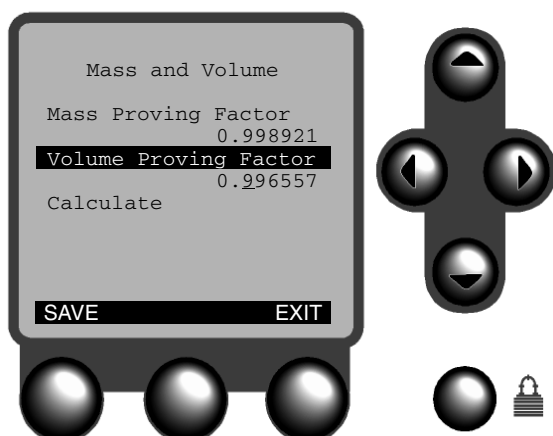
13. Select Calculate. The results of the calculation will appear as shown at left.
 - The "current" meter factors are the factors that are currently being used for adjusting measurements.
 - The "new" meter factors are derived from the calculation that has just been made. Note that the volume meter factor has also been recalculated because it is dependent on the mass and density meter factors (see **Table 18-1**, page 140).
 - To replace the current meter factors with the new meter factors, you must save the calculation results.
14. Press SAVE. The new meter factors have now become the current meter factors. To view the current meter factors that have just been saved, see page 150.

Mass and volume



Maintenance

- └ Calibration
 - └ Meter factors
 - └ Multivariable MF
 - └ Mass and volume



To calculate and enter mass and volume meter factors:

1. Run a batch of fluid.
2. Use a device such as a weigh scale, prover, or reference flowmeter to measure the mass total for the batch.
3. Use a device such as a volumetric tank, prover, or volumetric flowmeter to measure the volume total for the batch.
4. Use the process monitor to read the mass and volume totals that are indicated by the transmitter.
 - If the process monitor is the operation mode, use the operation screen to read the totals.
 - If a control application is the operation mode, press VIEW, then select Process Monitoring to read the totals.
5. Calculate the mass proving factor according to the following formula:

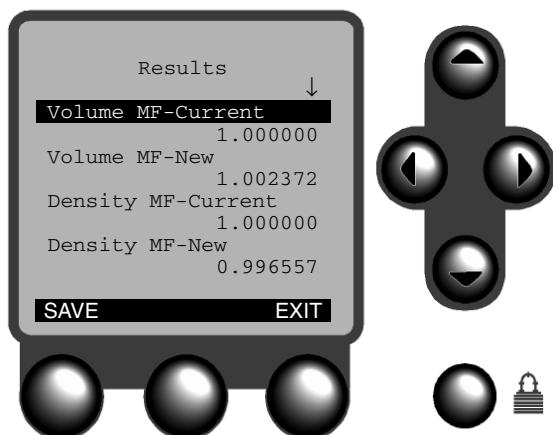
$$\text{Mass proving factor} = \frac{\text{Reference mass total}}{\text{Indicated mass total}}$$

6. Calculate the volume proving factor according to the following formula:

$$\text{Volume proving factor} = \frac{\text{Reference volume total}}{\text{Indicated volume total}}$$

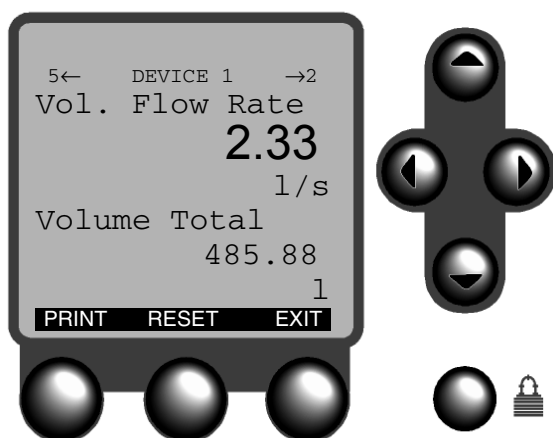
7. Press the security button on the display face.
8. Select Maintenance.
9. Select Calibration.
10. Select Meter Factors.
11. Select Multivariable MF.
12. Select Mass and Volume:
 - a. Select Mass Proving Factor.
 - b. Press CHG.
 - c. Enter the mass proving factor that was calculated at step 5.
 - d. Press SAVE.
 - e. Select Volume Proving Factor.
 - f. Press CHG.
 - g. Enter the volume proving factor that was calculated at step 6.
 - h. Press SAVE.

Maintenance
 └─ Calibration
 └─ Meter factors
 └─ Multivariable MF
 └─ Mass and volume
 └─ Calculate



13. Select Calculate. The results of the calculation will appear as shown at left.
 - The "current" meter factors are the factors that are currently being used for adjusting measurements.
 - The "new" meter factors are derived from the calculation that has just been made. Note that the density meter factor has also been recalculated because it is dependent on the mass and volume meter factors (see **Table 18-1**, page 140).
 - To replace the current meter factors with the new meter factors, you must save the calculation results.
14. Press SAVE. The new meter factors have now become the current meter factors. To view the current meter factors that have just been saved, see page 150.

Density and volume



To calculate and enter density and volume meter factors:

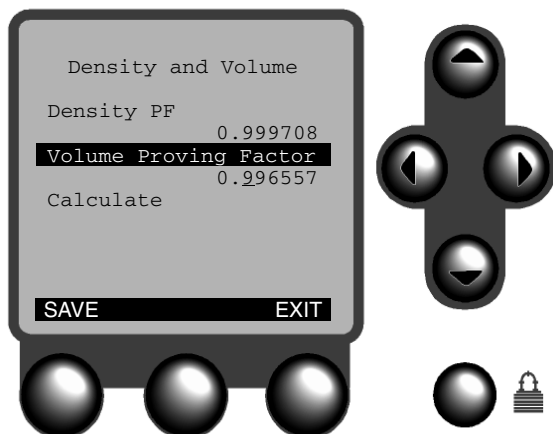
1. Run a batch of fluid.
2. Use a reference densitometer or density sampling device such as a pycnometer to measure the process density.
3. Use a device such as a volumetric tank, prover, or volumetric flowmeter to measure the volume total for the batch.
4. Use the process monitor to read the process density and volume total that are indicated by the transmitter.
 - If the process monitor is the operation mode, use the operation screen to read the density and volume total.
 - If a control application is the operation mode, press VIEW, then select Process Monitoring to read the density and volume total.
5. Calculate the density proving factor according to the following formula:

$$\text{Density proving factor} = \frac{\text{Reference density}}{\text{Indicated density}}$$

6. Calculate the volume proving factor according to the following formula:

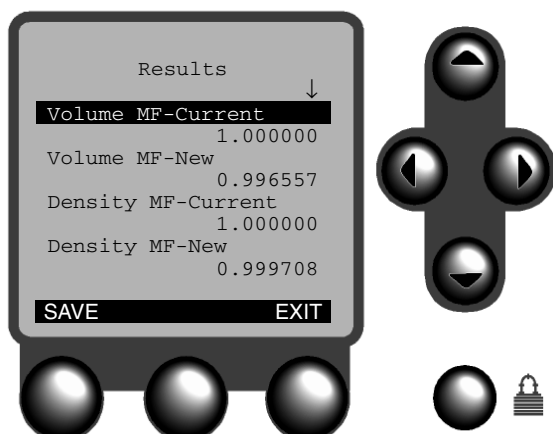
$$\text{Volume proving factor} = \frac{\text{Reference volume total}}{\text{Indicated volume total}}$$

- Maintenance
 - └ Calibration
 - └ Meter factors
 - └ Multivariable MF
 - └ Density and volume



7. Press the security button on the display face.
8. Select Maintenance.
9. Select Calibration.
10. Select Meter Factors.
11. Select Multivariable MF.
12. Select Density and Volume:
 - a. Select Density PF.
 - b. Press CHG.
 - c. Enter the density proving factor that was calculated at step 5.
 - d. Press SAVE.
 - e. Select Volume Proving Factor.
 - f. Press CHG.
 - g. Enter the volume proving factor that was calculated at step 6.
 - h. Press SAVE.

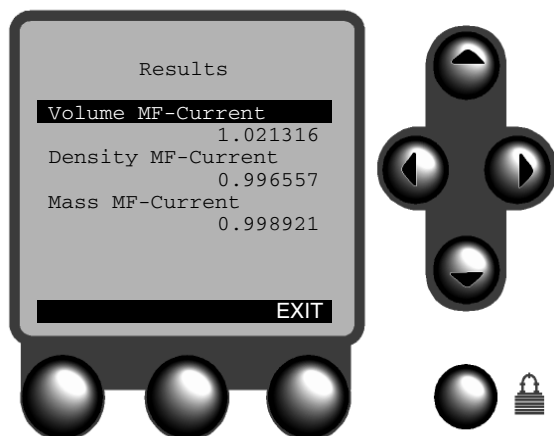
- Maintenance
 - └ Calibration
 - └ Meter factors
 - └ Multivariable MF
 - └ Density and volume
 - └ Calculate



13. Select Calculate. The results of the calculation will appear as shown at left.
 - The "current" meter factors are the factors that are currently being used for adjusting measurements.
 - The "new" meter factors are derived from the calculation that has just been made. Note that the mass meter factor has also been recalculated because it is dependent on the density and volume meter factors (see **Table 18-1**, page 140).
 - To replace the current meter factors with the new meter factors, you must save the calculation results.
14. Press SAVE. The new meter factors have now become the current meter factors. To view the current meter factors that have just been saved, see below.

18.6 Viewing current data for meter factors

Maintenance
└─ Calibration
 └─ Meter factors
 └─ View current data



To view current data for meter factors:

1. Press the security button on the display face.
2. Select Maintenance.
3. Select Calibration.
4. Select Meter Factors.
5. Select View Current Data.

18.7 Resetting meter factors and proving factors

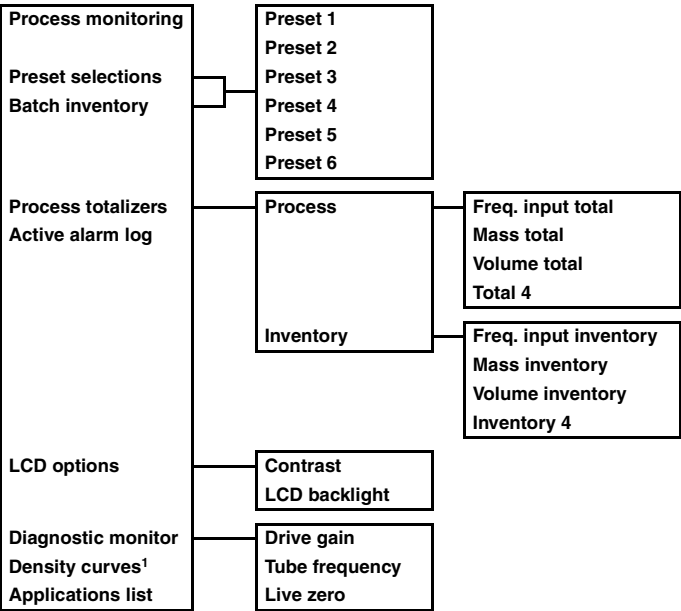
To reset meter factors and proving factors to a value of 1.0, you can:

- Perform a master reset in the system menu of the configuration software branch, or
- Prove for volume (see pages 138-139) and enter a proving factor of 1.0.

Appendix A

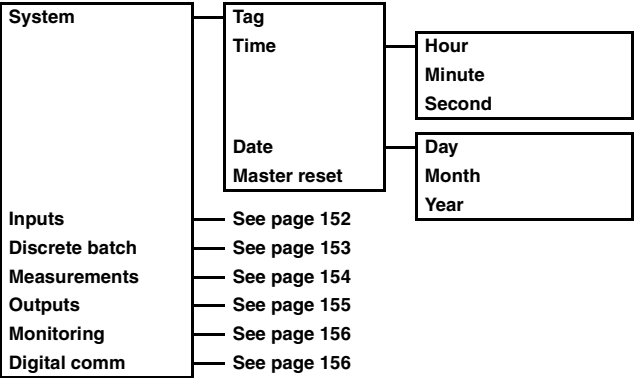
Software Diagrams

View menu

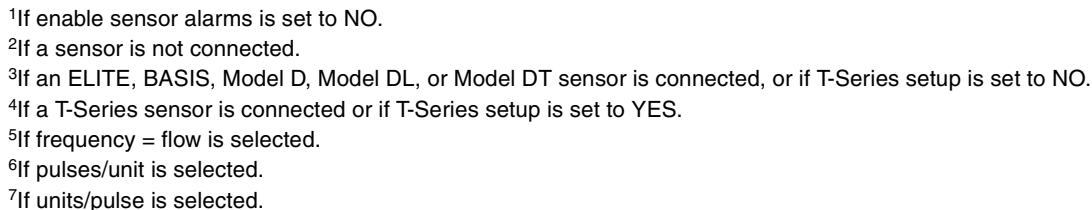


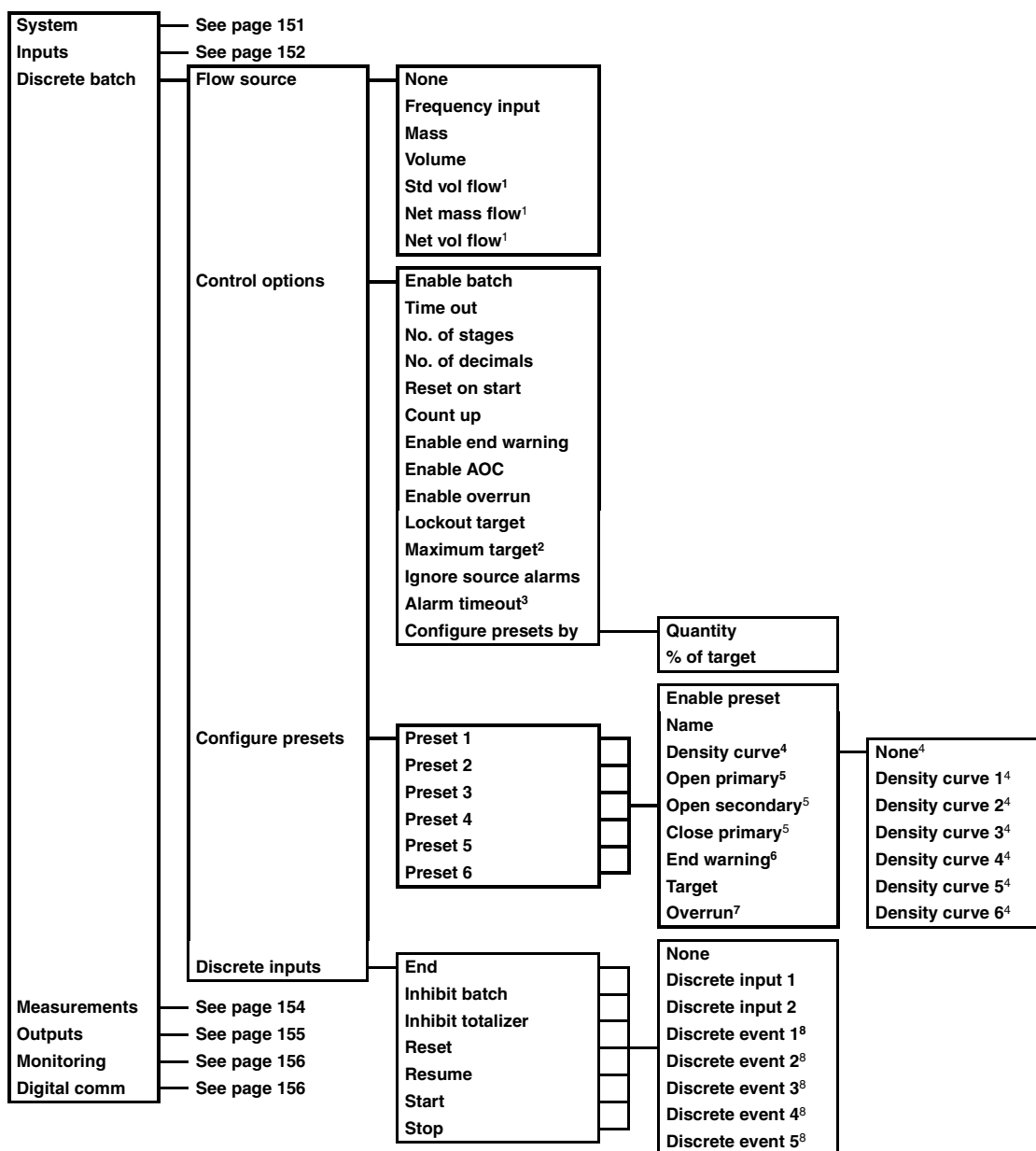
¹If density application software is installed and configured, and if density curves have not been assigned to batch presets under Discrete Batch.

Configuration menu: System



Series 3000 Detailed Setup Manual



Configuration menu: Discrete batch

¹If density application software is installed and configured.

²If lockout target is set to NO.

³If ignore source alarms is set to YES.

⁴If density application software is installed and configured.

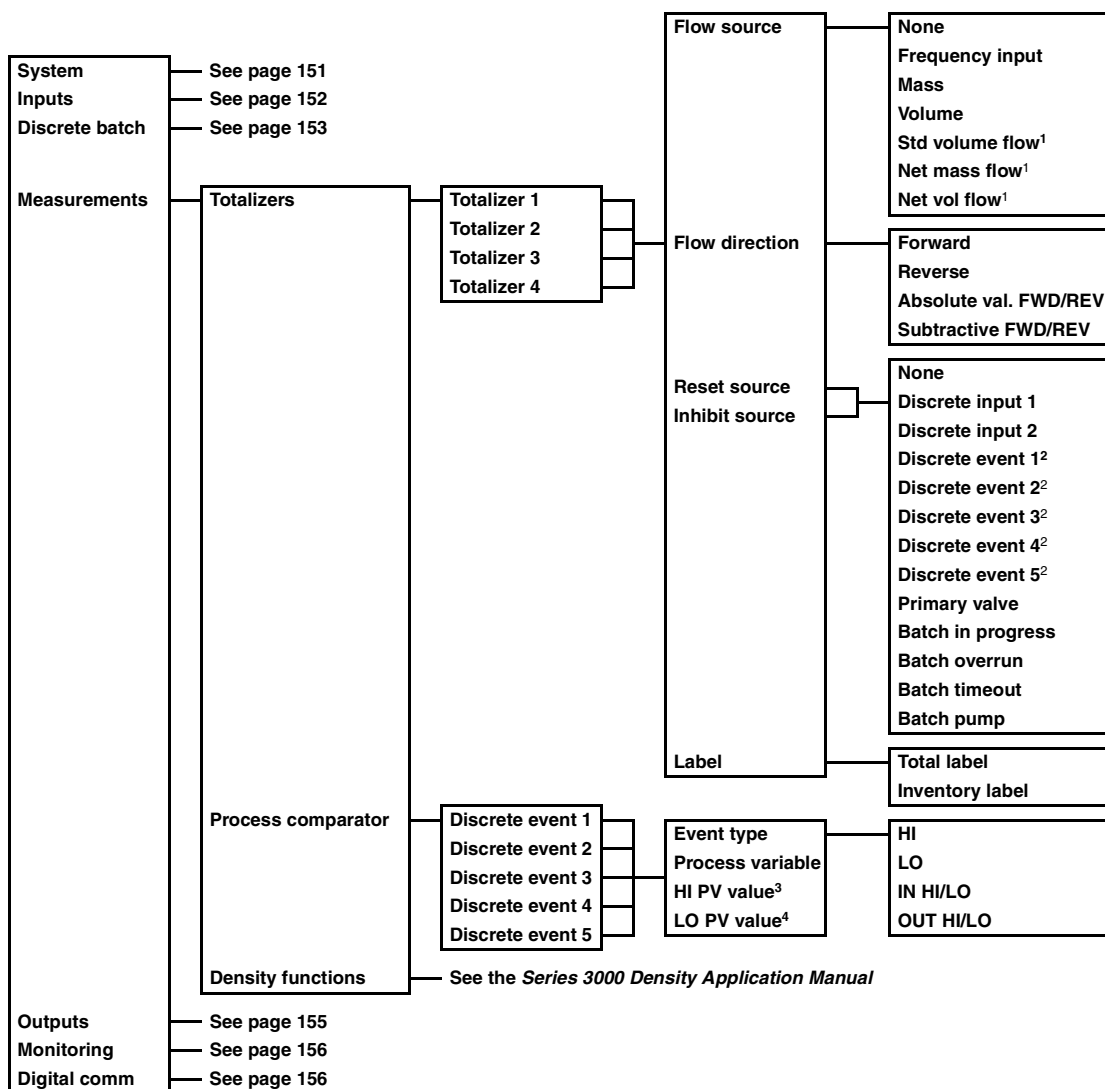
⁵If no. of stages is set to 2.

⁶If enable end warning is set to YES.

⁷If enable overrun is set to YES.

⁸If discrete event has been configured under Measurements.

Configuration menu: Measurements

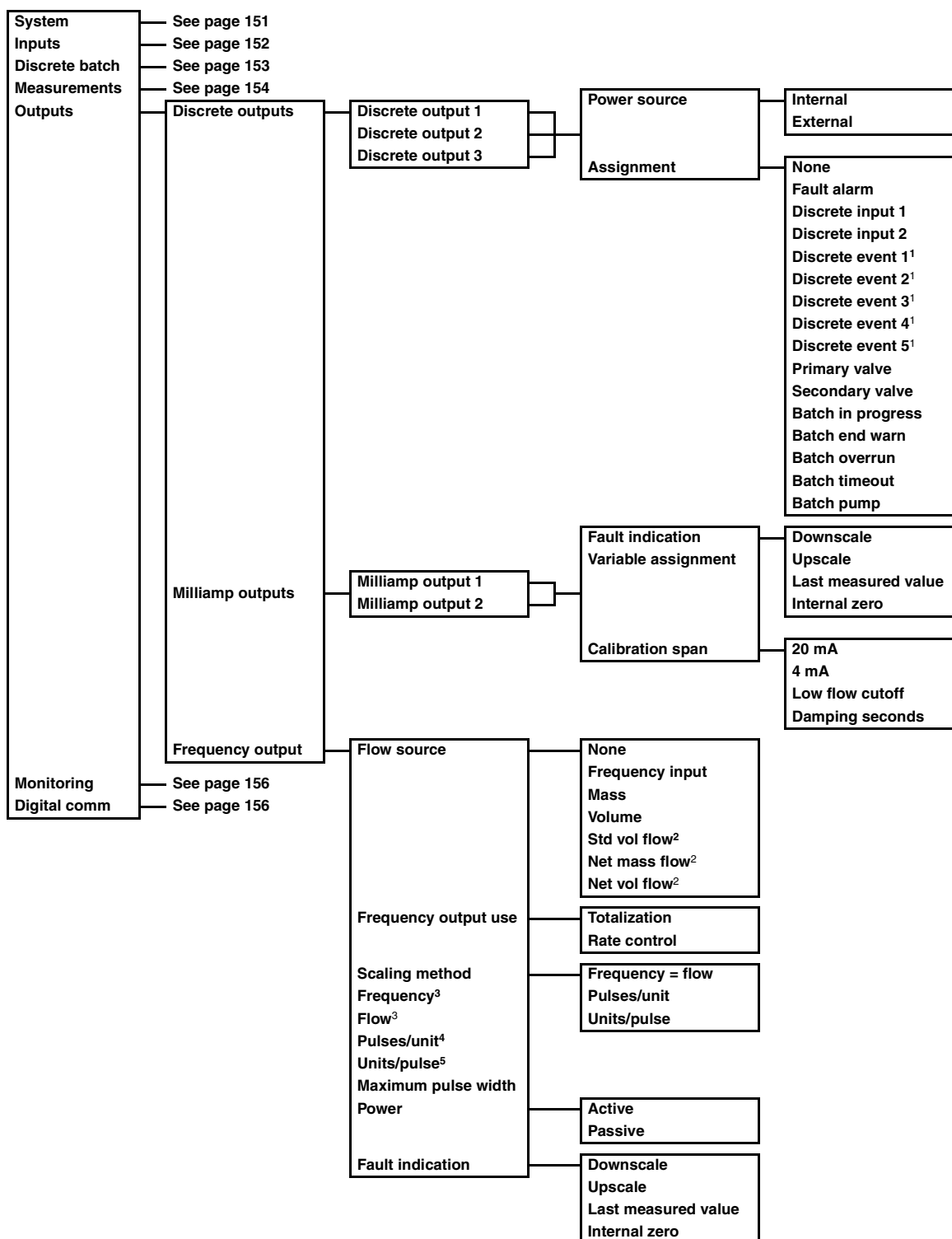


¹If density application software is installed and configured.

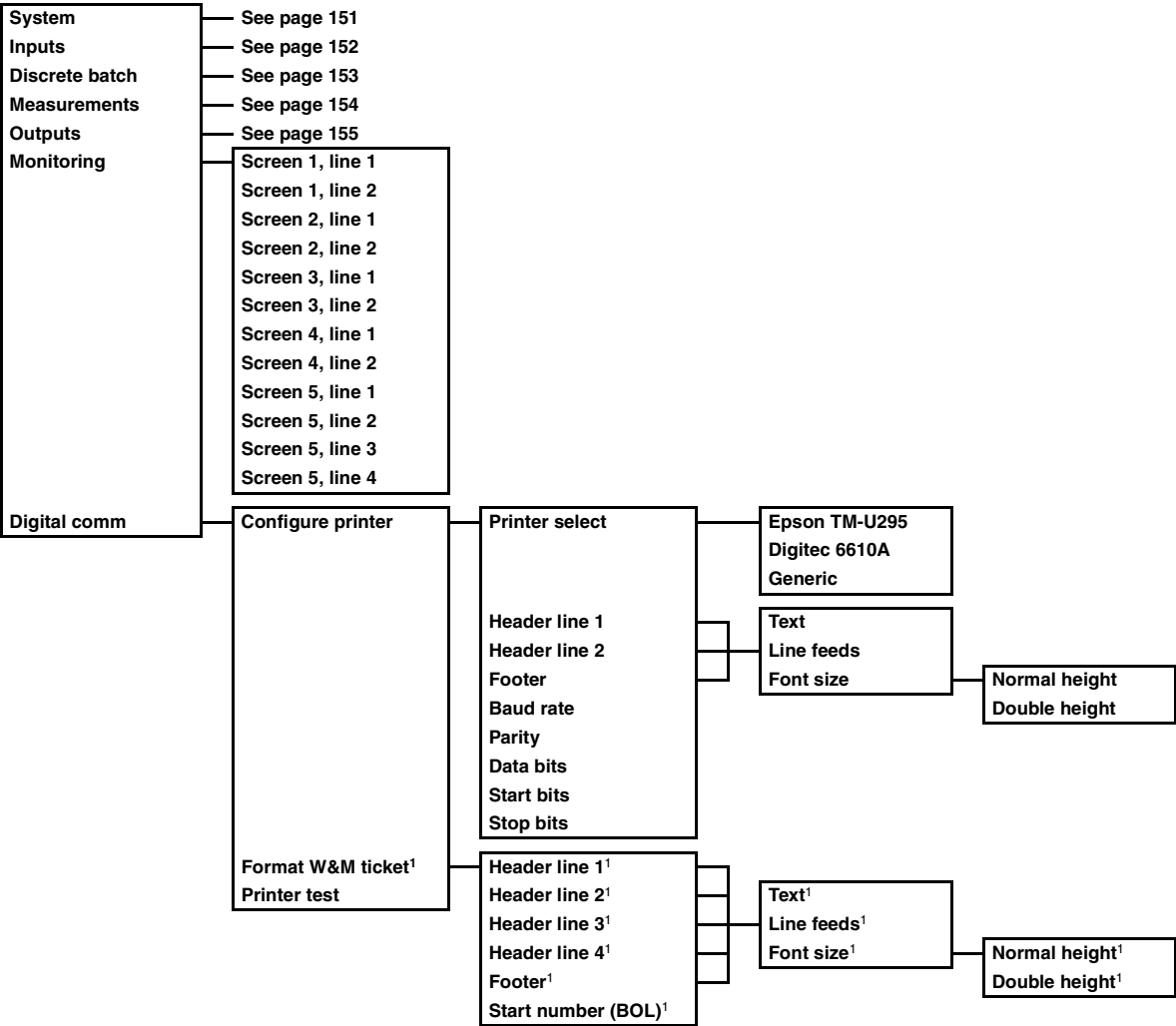
²If discrete event has been configured.

³If event type is HI, IN HI/LO, or OUT HI/LO.

⁴If event type is LO, IN HI/LO, or OUT HI/LO.

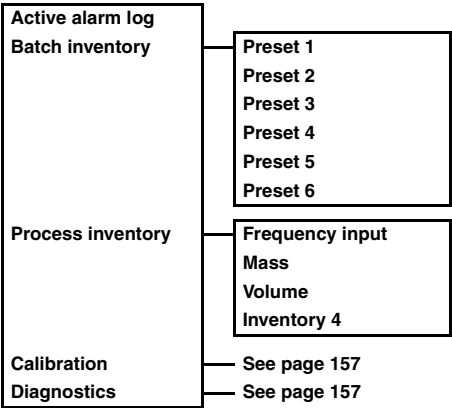
Configuration menu: Outputs¹If discrete event is configured under Measurements.²If density application software is installed and configured.³If frequency = flow is selected.⁴If pulses/unit is selected.⁵If units/pulse is selected.

Configuration menu: Monitoring and digital communication

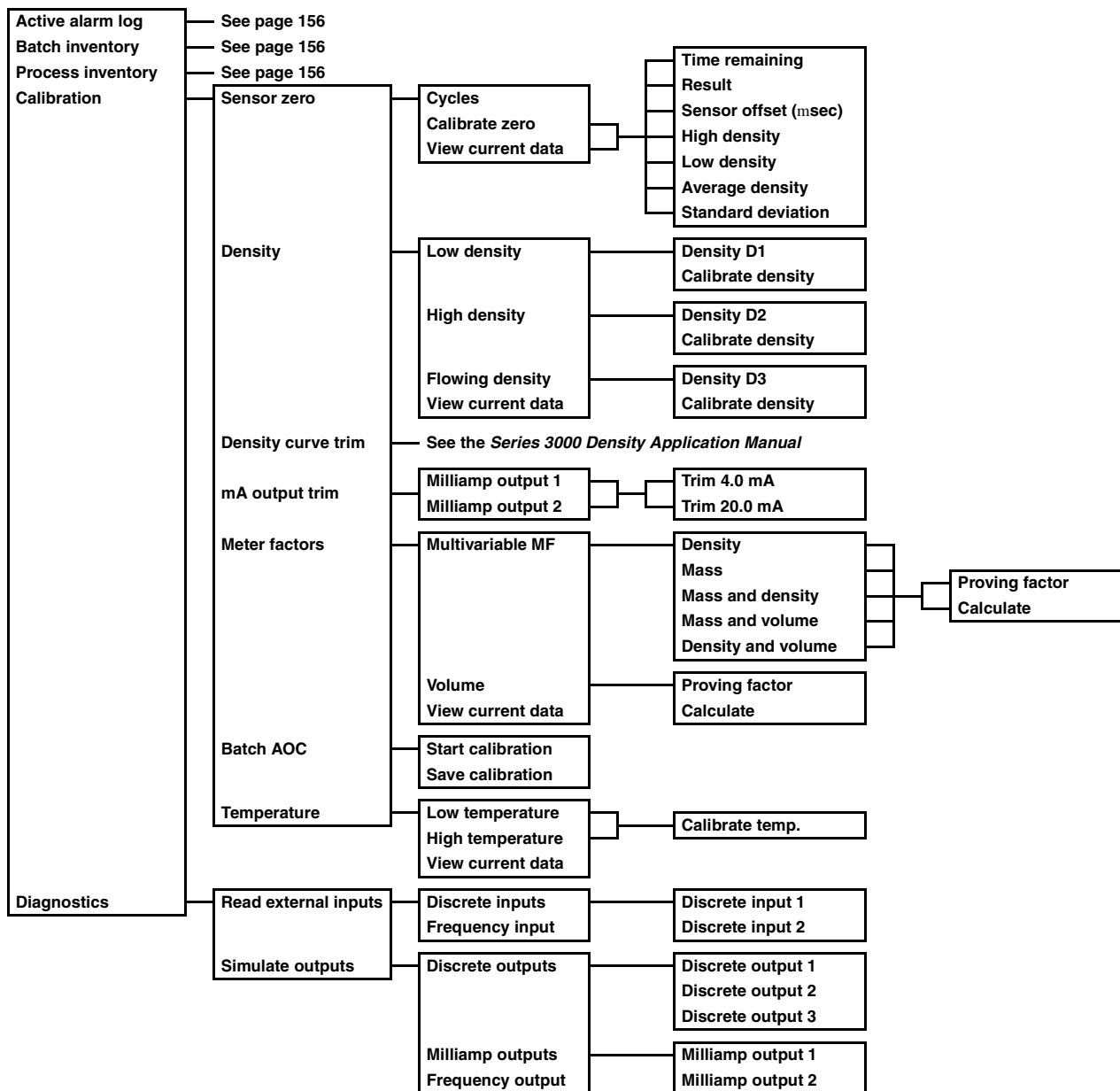


¹If custody transfer software and security switch are installed.

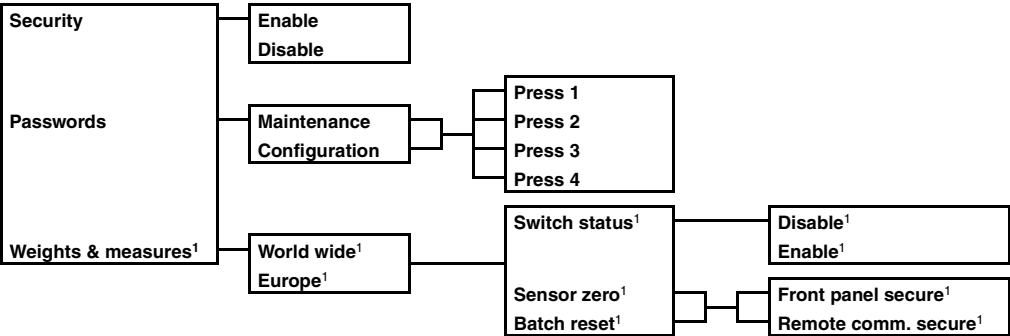
Maintenance menu: Active alarm log, batch inventory, and process inventory



Maintenance menu: Calibration and diagnostics

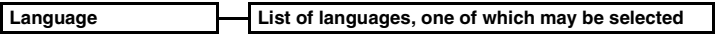


Security menu



¹If custody transfer software and security switch are installed.

Language menu



Appendix B

Series 3000 Software Configuration Record

System Tag _____ (8 characters maximum)		Date _____ (Day Month Year) Time _____ (Hour:Minute:Second)	Step 1: Configure system data
Enable/disable Coriolis Enable Coriolis ☐ Yes ☐ No Enable sensor alarms ☐ Yes ☐ No		Alarm timeout _____ minutes	Step 2: Configure inputs
Flow variables Flow damping _____ seconds Flow direction ☐ Forward ☐ Backward Mass unit _____		Mass low flow cutoff _____ Volume unit _____ Volume low flow cutoff _____	
Density inputs Density unit _____ Slug low limit _____ Slug time _____ seconds		Density damping _____ seconds Slug high limit _____	
Temperature Temperature unit _____		Temperature damping _____ seconds	

Sensor calibration data for ELITE®, BASIS®, Model D, Model DL, or Model DT sensors			
Flow factor _____		FD _____	
Flowcal temp coef _____		Dens temp coeff _____	
D1 _____	D2 _____	Temperature slope _____	
K1 _____	K2 _____	Temperature offset _____	
Sensor calibration data for Micro Motion T-Series sensors			
FCF _____	FT _____	FTG _____	FFQ _____
D1 _____	D2 _____	K1 _____	K2 _____
FD _____	DT _____	DTG _____	DFQ1 _____
DFQ2 _____	Temperature slope _____		Temperature offset _____
Sensor information			
Sensor model no. _____		Sensor serial no. _____	
Sensor material ☐ 304 SS ☐ 316L SS ☐ Hastelloy C ☐ Inconel ☐ Tantalum ☐ Titanium			
Sensor end connection _____		Sensor liner ☐ None ☐ Tefzel	
Frequency input			
Flow Rate Unit _____			
Scaling Method ☐ Frequency = Flow			
Frequency _____ Hz equal		Flow _____ units	
☐ Pulses/Unit		☐ Units/Pulse	
Pulses _____ / unit		Units _____ / pulse	

Flow source ☐ None ☐ Frequency input ☐ Mass ☐ Volume ☐ Std vol flow ☐ Net mass flow ☐ Net vol flow	Step 3: Configure discrete batch																		
Control options <table style="width: 100%;"> <tr> <td style="width: 50%;"> Enable batch ☐ Yes ☐ No Time out _____ seconds No. of stages ☐ 1 ☐ 2 No. of decimals ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Reset on start ☐ Yes ☐ No Count up ☐ Yes ☐ No Enable end warning ☐ Yes ☐ No </td> <td style="width: 50%;"> Enable batch AOC ☐ Yes ☐ No Enable overrun ☐ Yes ☐ No Lockout target ☐ Yes ☐ No Maximum target _____ Ignore source alarms ☐ Yes ☐ No Alarm timeout _____ minutes Configure presets by ☐ Quantity ☐ % of target </td> </tr> </table>		Enable batch ☐ Yes ☐ No Time out _____ seconds No. of stages ☐ 1 ☐ 2 No. of decimals ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Reset on start ☐ Yes ☐ No Count up ☐ Yes ☐ No Enable end warning ☐ Yes ☐ No	Enable batch AOC ☐ Yes ☐ No Enable overrun ☐ Yes ☐ No Lockout target ☐ Yes ☐ No Maximum target _____ Ignore source alarms ☐ Yes ☐ No Alarm timeout _____ minutes Configure presets by ☐ Quantity ☐ % of target																
Enable batch ☐ Yes ☐ No Time out _____ seconds No. of stages ☐ 1 ☐ 2 No. of decimals ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Reset on start ☐ Yes ☐ No Count up ☐ Yes ☐ No Enable end warning ☐ Yes ☐ No	Enable batch AOC ☐ Yes ☐ No Enable overrun ☐ Yes ☐ No Lockout target ☐ Yes ☐ No Maximum target _____ Ignore source alarms ☐ Yes ☐ No Alarm timeout _____ minutes Configure presets by ☐ Quantity ☐ % of target																		
Configure presets <table style="width: 100%;"> <tr> <td style="width: 15%;">Preset 1</td> <td style="width: 40%;"> Enable preset ☐ Yes Density curve _____ Open secondary _____ End warning _____ Overrun _____ </td> <td style="width: 45%;"> Name _____ Open primary _____ Close primary _____ Target _____ </td> </tr> <tr> <td>Preset 2</td> <td> Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____ </td> <td> Name _____ Open primary _____ Close primary _____ Target _____ </td> </tr> <tr> <td>Preset 3</td> <td> Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____ </td> <td> Name _____ Open primary _____ Close primary _____ Target _____ </td> </tr> <tr> <td>Preset 4</td> <td> Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____ </td> <td> Name _____ Open primary _____ Close primary _____ Target _____ </td> </tr> <tr> <td>Preset 5</td> <td> Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____ </td> <td> Name _____ Open primary _____ Close primary _____ Target _____ </td> </tr> <tr> <td>Preset 6</td> <td> Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____ </td> <td> Name _____ Open primary _____ Close primary _____ Target _____ </td> </tr> </table>		Preset 1	Enable preset ☐ Yes Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____	Preset 2	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____	Preset 3	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____	Preset 4	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____	Preset 5	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____	Preset 6	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____
Preset 1	Enable preset ☐ Yes Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____																	
Preset 2	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____																	
Preset 3	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____																	
Preset 4	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____																	
Preset 5	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____																	
Preset 6	Enable preset ☐ Yes ☐ No Density curve _____ Open secondary _____ End warning _____ Overrun _____	Name _____ Open primary _____ Close primary _____ Target _____																	

Discrete inputs and discrete events				
Discrete input 1	☐ End	☐ Inhibit batch	☐ Inhibit totalizer	
	☐ Reset	☐ Resume	☐ Start	☐ Stop
Discrete input 2	☐ End	☐ Inhibit batch	☐ Inhibit totalizer	
	☐ Reset	☐ Resume	☐ Start	☐ Stop
Discrete event 1	☐ End	☐ Inhibit batch	☐ Inhibit totalizer	
	☐ Reset	☐ Resume	☐ Start	☐ Stop
Discrete event 2	☐ End	☐ Inhibit batch	☐ Inhibit totalizer	
	☐ Reset	☐ Resume	☐ Start	☐ Stop
Discrete event 3	☐ End	☐ Inhibit batch	☐ Inhibit totalizer	
	☐ Reset	☐ Resume	☐ Start	☐ Stop
Discrete event 4	☐ End	☐ Inhibit batch	☐ Inhibit totalizer	
	☐ Reset	☐ Resume	☐ Start	☐ Stop
Discrete event 5	☐ End	☐ Inhibit batch	☐ Inhibit totalizer	
	☐ Reset	☐ Resume	☐ Start	☐ Stop

Totalizers				Step 4: Configure measurements
Totalizer 1	Flow source	☐ None ☐ Volume ☐ Net vol flow	☐ Frequency input ☐ Std vol flow	
	Flow direction	☐ Forward ☐ Absolute val. FWD/REV	☐ Reverse ☐ Subtractive FWD/REV	
	Reset source	☐ None ☐ Primary valve ☐ Batch end warn ☐ Batch pump ☐ Discrete event 3	☐ Discrete input 1 ☐ Secondary valve ☐ Batch overrun ☐ Discrete event 1 ☐ Discrete event 4	☐ Discrete input 2 ☐ Batch in progress ☐ Batch timeout ☐ Discrete event 2 ☐ Discrete event 5
	Inhibit source	☐ None ☐ Primary valve ☐ Batch end warn ☐ Batch pump ☐ Discrete event 3	☐ Discrete input 1 ☐ Secondary valve ☐ Batch overrun ☐ Discrete event 1 ☐ Discrete event 4	☐ Discrete input 2 ☐ Batch in progress ☐ Batch timeout ☐ Discrete event 2 ☐ Discrete event 5
	Total label			
	Inventory label			
Totalizer 2	Flow source	☐ None ☐ Volume ☐ Net vol flow	☐ Frequency input ☐ Std vol flow	☐ Mass ☐ Net mass flow
	Flow direction	☐ Forward ☐ Absolute val. FWD/REV	☐ Reverse ☐ Subtractive FWD/REV	
	Reset source	☐ None ☐ Primary valve ☐ Batch end warn ☐ Batch pump ☐ Discrete event 3	☐ Discrete input 1 ☐ Secondary valve ☐ Batch overrun ☐ Discrete event 1 ☐ Discrete event 4	☐ Discrete input 2 ☐ Batch in progress ☐ Batch timeout ☐ Discrete event 2 ☐ Discrete event 5
	Inhibit source	☐ None ☐ Primary valve ☐ Batch end warn ☐ Batch pump ☐ Discrete event 3	☐ Discrete input 1 ☐ Secondary valve ☐ Batch overrun ☐ Discrete event 1 ☐ Discrete event 4	☐ Discrete input 2 ☐ Batch in progress ☐ Batch timeout ☐ Discrete event 2 ☐ Discrete event 5
	Total label			
	Inventory label			

Totalizer 3	Flow source	☐ None	☐ Frequency input	☐ Mass
		☐ Volume	☐ Std vol flow	☐ Net mass flow
		☐ Net vol flow		
	Flow direction	☐ Forward		☐ Reverse
		☐ Absolute val. FWD/REV		☐ Subtractive FWD/REV
	Reset source	☐ None	☐ Discrete input 1	☐ Discrete input 2
		☐ Primary valve	☐ Secondary valve	☐ Batch in progress
		☐ Batch end warn	☐ Batch overrun	☐ Batch timeout
		☐ Batch pump	☐ Discrete event 1	☐ Discrete event 2
		☐ Discrete event 3	☐ Discrete event 4	☐ Discrete event 5
	Inhibit source	☐ None	☐ Discrete input 1	☐ Discrete input 2
		☐ Primary valve	☐ Secondary valve	☐ Batch in progress
		☐ Batch end warn	☐ Batch overrun	☐ Batch timeout
		☐ Batch pump	☐ Discrete event 1	☐ Discrete event 2
		☐ Discrete event 3	☐ Discrete event 4	☐ Discrete event 5
Total label				
Inventory label				
Totalizer 4	Flow source	☐ None	☐ Frequency input	☐ Mass
		☐ Volume	☐ Std vol flow	☐ Net mass flow
		☐ Net vol flow		
	Flow direction	☐ Forward		☐ Reverse
		☐ Absolute val. FWD/REV		☐ Subtractive FWD/REV
	Reset source	☐ None	☐ Discrete input 1	☐ Discrete input 2
		☐ Primary valve	☐ Secondary valve	☐ Batch in progress
		☐ Batch end warn	☐ Batch overrun	☐ Batch timeout
		☐ Batch pump	☐ Discrete event 1	☐ Discrete event 2
		☐ Discrete event 3	☐ Discrete event 4	☐ Discrete event 5
	Inhibit source	☐ None	☐ Discrete input 1	☐ Discrete input 2
		☐ Primary valve	☐ Secondary valve	☐ Batch in progress
		☐ Batch end warn	☐ Batch overrun	☐ Batch timeout
		☐ Batch pump	☐ Discrete event 1	☐ Discrete event 2
		☐ Discrete event 3	☐ Discrete event 4	☐ Discrete event 5
Total label				
Inventory label				

Process comparator				
Event 1	Event type	☐ None	☐ HI	☐ LO
		☐ IN HI/LO	☐ OUT HI/LO	
	Process variable	_____		
	PV high value	_____		
	PV low value	_____		
Event 2	Event type	☐ None	☐ HI	☐ LO
		☐ IN HI/LO	☐ OUT HI/LO	
	Process variable	_____		
	PV high value	_____		
	PV low value	_____		
Event 3	Event type	☐ None	☐ HI	☐ LO
		☐ IN HI/LO	☐ OUT HI/LO	
	Process variable	_____		
	PV high value	_____		
	PV low value	_____		
Event 4	Event type	☐ None	☐ HI	☐ LO
		☐ IN HI/LO	☐ OUT HI/LO	
	Process variable	_____		
	PV high value	_____		
	PV low value	_____		
Event 5	Event type	☐ None	☐ HI	☐ LO
		☐ IN HI/LO	☐ OUT HI/LO	
	Process variable	_____		
	PV high value	_____		
	PV low value	_____		

Discrete outputs <i>Power</i> Discrete output 1 ☐ Internal ☐ External <i>Assignment</i> _____ Discrete output 2 ☐ Internal ☐ External _____ Discrete output 3 ☐ Internal ☐ External _____		Step 5: Configure outputs
Milliamp outputs Milliamp output 1 <i>Fault Indication</i> <i>Process variable</i> ☐ Downscale _____ ☐ Upscale <i>Calibration span</i> ☐ Last Measured Value 4 mA _____ ☐ Internal Zero 20 mA _____ Setting Low flow cutoff _____ _____ mA Damping _____ seconds Milliamp output 2 <i>Fault Indication</i> <i>Process variable</i> ☐ Downscale _____ ☐ Upscale <i>Calibration span</i> ☐ Last Measured Value 4 mA _____ ☐ Internal Zero 20 mA _____ Setting Low flow cutoff _____ _____ mA Damping _____ seconds		
Frequency output Flow source ☐ None ☐ Frequency input ☐ Mass ☐ Volume ☐ Std vol flow ☐ Net mass flow ☐ Net vol flow Frequency output use ☐ Totalization ☐ Rate control Scaling method ☐ Frequency = Flow Frequency _____ Hz = Flow _____ units ☐ Pulses/Unit ☐ Units/Pulse Pulses _____ / unit Units _____ / pulse Pulse width _____ Power ☐ Active ☐ Passive Fault indication ☐ Downscale ☐ Upscale ☐ Last measured value ☐ Internal zero		
Monitoring Screen 1, line 1 _____ Screen 4, line 1 _____ Screen 1, line 2 _____ Screen 4, line 2 _____ Screen 2, line 1 _____ Screen 5, line 1 _____ Screen 2, line 2 _____ Screen 5, line 2 _____ Screen 3, line 1 _____ Screen 5, line 3 _____ Screen 3, line 2 _____ Screen 5, line 4 _____		Step 6: Configure monitoring

Printer setup					Step 7: Configure digital communication
Printer select	☐ Epson TM-U295 ☐ Digitec 6610A ☐ Generic				
Header line 1	Text _____				
	Line feeds	☐ 1 line	☐ 2 lines		
	Font	☐ Normal height	☐ Double height		
Header line 2	Text _____				
	Line feeds	☐ 1 line	☐ 2 lines		
	Font	☐ Normal height	☐ Double height		
Footer	Text _____				
	Line feeds	☐ 1 line	☐ 2 lines		
	Font	☐ Normal height	☐ Double height		
Baud rate	☐ 1200	☐ 2400	☐ 4800	☐ 9600	
Parity	☐ Odd	☐ Even	☐ None		
Data bits	☐ 7 data bits	☐ 8 data bits			
Stop bits	☐ 1 stop bit	☐ 2 stop bits			
Weights and measures ticket					
Header line 1	Text _____				
	Line feeds	☐ 1 line	☐ 2 lines		
	Font	☐ Normal height	☐ Double height		
Header line 2	Text _____				
	Line feeds	☐ 1 line	☐ 2 lines		
	Font	☐ Normal height	☐ Double height		
Header line 3	Text _____				
	Line feeds	☐ 1 line	☐ 2 lines		
	Font	☐ Normal height	☐ Double height		
Header line 4	Text _____				
	Line feeds	☐ 1 line	☐ 2 lines		
	Font	☐ Normal height	☐ Double height		
Footer	Text _____				
	Line feeds	☐ 1 line	☐ 2 lines		
	Font	☐ Normal height	☐ Double height		
Start number for bill of lading	_____				

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Micro Motion Inc. USA
Worldwide Headquarters

7070 Winchester Circle
Boulder, Colorado 80301
T (303) 530-8400
(800) 522-6277
F (303) 530-8459

Micro Motion Europe

Emerson Process Management
Wiltonstraat 30
3905 KW Veenendaal
The Netherlands
T +31 (0) 318 495 670
F +31 (0) 318 495 689

Micro Motion Asia

Emerson Process Management
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T (65) 6777-8211
F (65) 6770-8003

Micro Motion United Kingdom

Emerson Process Management Limited
Horsfield Way
Bredbury Industrial Estate
Stockport SK6 2SU U.K.
T 0800 966 180
F 0800 966 181

Micro Motion Japan

Emerson Process Management
Shinagawa NF Bldg. 5F
1-2-5, Higashi Shinagawa
Shinagawa-ku
Tokyo 140-0002 Japan
T (81) 3 5769-6803
F (81) 3 5769-6843

