KURZ INSTRUMENTS INC.™

Complex Technology Made Simple

Technical Reference

B-Series Flow Meter Operations Guide

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Preface

Before You Begin

Important ***The device warranty is void if the device is not installed in accordance with the specified installation requirements. Read and thoroughly understand the installation requirements before attempting to install the device. If you have any questions, contact your Kurz customer service representative before attempting installation.***

Using this Manual

Kurz Instruments, Inc., documentation includes manuals, product literature, Adobe Acrobat PDF files, and application online Help files. The Kurz Instruments CD contains all the available documentation files. To read PDF files, download the free Adobe Acrobat Reader from www.adobe.com.

The Kurz Instruments Web site provides additional information:

- **World Wide Web:** www.kurzinstruments.com
- **Email:** service@kurzinstruments.com
- Documentation links to the most current manuals and literature

You can access device support in the following ways:

- **Main:** 831-646-5911
- **Phone:** 800-424-7356
- **Fax:** 831-646-8901

Manual Conventions

The following table lists conventions used in the Kurz Instruments, Inc., documentation, and gives an example of how each convention is applied.

Table 1. Conventions used in this manual

Convention	For Example
Text type, click, or select (for example, field names, menus, and commands) are shown in bold.	Check the **Configuration File** checkbox.
Text appearing in a display or window is shown in courier.	`PRESS ENTER TO` `SET METER DATA`
An arrow (→) is used to separate a menu name from its menu command.	Select **Start→All Programs→Kurz Instruments→KzComm**.
Simplified directory structures and path names are used in examples. Your folder names may be different.	Programs Files\Kurz Instruments\KzComm.

System Requirements

The B-Series use the XMODEM communication protocol via USB port, or the MODBUS protocol via RS-485 port or MODBUS TCP/IP. The Kurz USB device driver or FTDI USB device driver must be installed before attempting to connect a computer with a B-Series device via a USB cable.

The B-Series devices require:

- A two-wire shielded cable for Modbus RTU.
- For the XMODEM protocol, a USB Type A-to-mini B cable.

  Note The Kurz USB device driver or FTDI USB device driver must be installed before attempting to connect a computer with a B-Series device via a USB cable.

- For the Modbus TCP/IP protocol, an Ethernet cable to a Modbus TCP/IP to RS-485 gateway.

Software Requirements

KzComm is supported on Windows XP, Windows Vista, Windows 7, and Windows 8.
All platforms require up-to-date service packs.

Note On Windows Vista, downloading the Trend Log has infrequently caused the operating system to freeze (no screen activity). Restart the computer as described in your computer hardware manual.

Basic computer knowledge is necessary for copying and moving files, navigating file structures, identifying file types, and installing applications. You will need a decompression utility to extract files from compressed file packages.

The Kurz USB device driver or FTDI USB device driver must be installed before attempting to connect a computer with a B-Series device via a USB cable. Both drivers are available during the KzComm installation, on the Kurz customer CD in the USB Device Driver folder, and on the Kurz website (kurzinstruments.com). The FTDI USB driver is a 64-bit virtual COM port (VCP) driver available from the FTDI Chip website (ftdichip.com).

Chapter 1

B-Series Flow Meter Modes & Menus

Overview

This section describes the user interface for the B-Series flow meter and provides the menu structure for each mode:

- Boot-Up mode
- Run Mode
- Display mode
- Program mode
- Log mode
- Extended Utilities mode

This chapter is intended for users accessing the flow meter menus using the local keypad and display. However, the menus and commands remain the same even if you are using KzComm or a terminal emulator with a blind device. Refer to the *KzComm User's Guide* for information about KzComm.

Flow Meter User Interface

To access the flow meter user interface, unscrew the enclosure lid.

The flow meter user interface (Figure 1-1) includes an display screen with two rows of 16 characters and a keypad with 20 keys (several of which have dual functions). You may need to use a small-tip pointing device to press the keys.

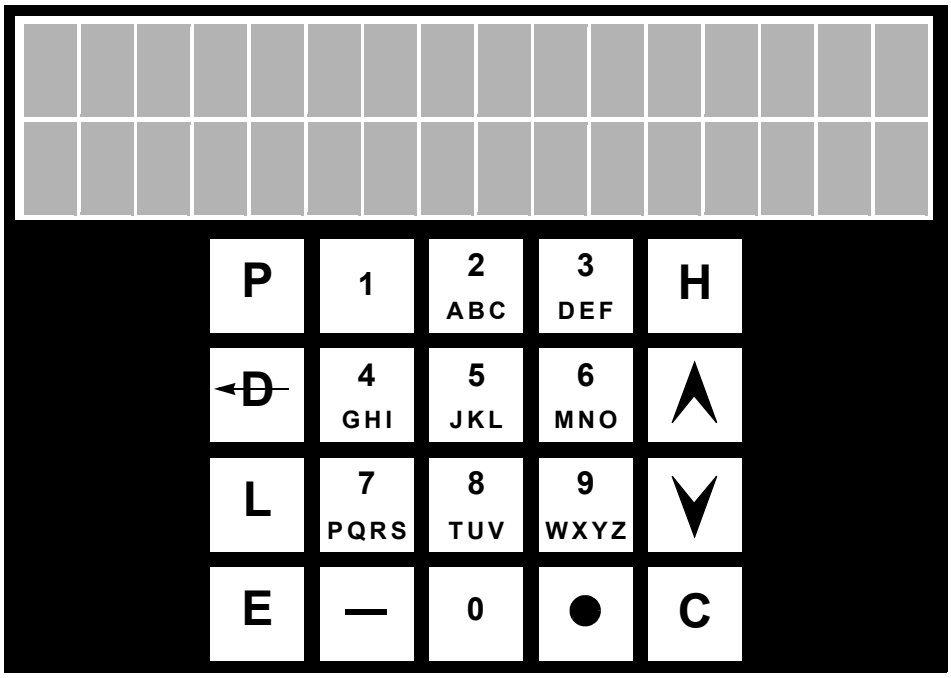

Figure 1-1. Flow meter user interface

There are six operating modes for the meter:

- Boot-up mode
  Occurs during a power cycle when the meter performs self-tests for diagnostics.
- Run mode
  An installed meter is normally in Run mode to show the flow and temperature of the processed gas.
- Display mode
  A view-only of the meter's configuration parameters.
- Program mode
  Allows you to make configuration and parameter changes to the meter.
- Log mode
  Allows you to send reports to the meter's serial port.
- Extended Utilities mode
  Allows access to advanced meter functions.

Meter Keypad

The large letter keys are used for:

- The **P** key accesses Program mode for making configuration changes to the meter. This is a password protected mode.
- The **D** key accesses Display mode for a view-only of the meter's configuration parameters. It can also be used as a backspace key.
- The **L** key accesses Log mode and sends reports to the meter's serial or USB port.
- The **E** key accesses Extended Utilities mode for the advanced features of the meter. This is a password protected mode. The **E** key is also used as an Enter key and to accept and save changes after entering data.
- The **H** key is the Home key used for backing out of any menu. Press **H** to back up one level or press it twice to return to Run mode.
- The **C** key is used to clear a data entry field.

The alphanumeric keys include numbers 0 through 9, with keys 2 through 9 also being used for letters A to Z. For data fields that accept alphabetic data, continue pressing the alphanumeric key to cycle through the letters. For example, if you wanted to enter the letter "R," you would press the 7 key, press again for "P," press again for "Q," and press again for "R." Press the **E** key to save the selection and move to the next field.

The symbol keys are:

- The up (⋀) and down (⋁) arrow keys are used to scroll through a menu. The scroll option is available when the symbol ^v appears.
- The bar key (—) is used for entering negative values.
- The dot key (●) is used for entering decimal places.
- The arrow key (←) overlaying the D key becomes a backspace key after you enter a mode and is used for deleting characters to the left.

Flow Meter Display Screen

Each user configurable mode provides menu options based on the access code you enter. For example, one code might only allow access to basic meter settings while another code allows access to all meter settings. Full meter access provides the option of scrolling through the list of available menu options or entering the number of a specific menu item.

- **Menu Scroll** allows you to go through all menu options for that mode.
- **Quick Jump** allows you to enter a menu number within the specified mode.

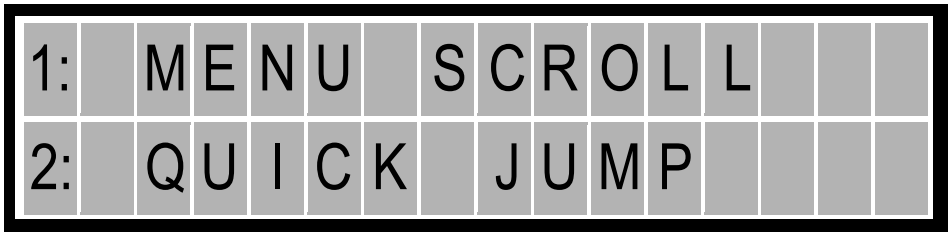

Figure 1-2. Flow meter display screen

When menu suboptions are available, up and down symbols appear at the end of the second line.

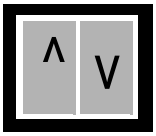

Figure 1-3. Menu suboption indicator

Boot Mode

The device boot test verifies that the configuration, sensor, and wiring are valid. The length of the boot-up time varies on whether the sensor is cold or hot when the power is applied.

Table 1-1. Nominal Boot-Up Times

Settling Time (1% Reading, Modbus, 4-20 mA, or Display)	Cold Sensor (Power Off)	Hot Sensor (Power Cycled)
1600 SFPM, velocity, filter TC = 0.5 seconds	15 seconds	17 seconds
1600 SFPM, temperature, filter TC = 0.5 seconds	10 seconds	13 seconds
Zero flow, velocity, filter TC = 0.5 seconds	15 seconds	60 seconds
Zero flow, temperature, filter TC = 0.5 seconds	10 seconds	55 seconds

The B-Series flow meter can boot-up and start responding to Modbus communications or updating the 4-20 mA output and display within one second of restarting/powering up. However, the boot sequence has to complete to guarantee the integrity of the data, and it is generally recommended to wait an additional 20 seconds before issuing any commands.

A near zero flow rate can cause a boot delay up to 2 minutes, during which time the velocity sensor must cool off so its resistance value can be checked to ensure there are no sensor faults. A high process velocity during boot-up reduces the delay because the hot sensor can cool down faster.

When the meter is turned on from a power-off state, the NE-43 alarm low (3.6 mA or less) is set until the sensor boot process starts. The flow and temperature will then increase to their proper values depending on the process velocity meter filter settings.

Note Firmware version 1.10 and later hold the NE-43 alarm until boot-up and sensor stabilization complete.

When you boot-up (power on) the flow meter, the display progresses through a series of initialization indicators:

```
KURZ INSTRUMENTS
DISP DRIVER V4.X
```

```
CHECKING TYPE OF
CONNECTED SENSOR
```

```
WAIT PERFORMING
SENSOR LEAK TEST
```

```
KURZ INSTRUMENTS
SERIES MFT-B
```

```
FIRMWARE VERSION
MFT-B VER 2.XX
```

Note If the device supports Hart communication, an **H** appears before the firmware version number.

Once boot testing completes, the flow meter automatically goes into Run mode.

An error message indicates the unit has failed boot-up testing due to a sensor mismatch, wiring, or other problem.

- The device will cycle through boot testing again until the issue is resolved.

  Note Downloading the Min/Max, Event, and Trend logs is not possible until boot testing completes successfully.

- You can force a boot exit by pressing the **C** key.

Once boot completes you can start downloading the Min/Max, Event, and Trend logs.

Run Mode

Run mode is the normal operational state of the meter after Boot-Up mode. The default information in Run mode is the flow meter's tag name and flow, as shown in the following example:

```
TAG NATURAL GAS1
FLOW 0.0000 SCFM
```

Firmware version 2.0 and higher allow you to determine how process variables appear in Run mode. Setting Run mode variables is available by selecting option 7 in Program mode with an advanced password. You can also access Run mode variables by selecting option 1 in Program mode with a basic password, although you must scroll through the entire basic setup. See "Program Mode" on page 1-11 for more information.

Static Variables

Static shows only one set of process variables.

- **Flow only**

  Line 1 is flow

  Line 2 is blank

```
FLOW 0.0000 SCFM
```

- **Flow and totalized flow**

  Line 1 is flow

  Line 2 is totalized flow

```
FLOW 0.0000 SCFM
FLTOT 183545.0
```

- **Flow and velocity**

  Line 1 is flow

  Line 2 is velocity

```
FLOW 0.0000 SCFM
VEL 0.00000 SFPM
```

- **Tag name and flow**

  Line 1 is tag name

  Line 2 is flow

```
TAG NATURAL GAS1
FLOW 0.0000 SCFM
```

- **Flow and temperature**

  Line 1 is flow

  Line 2 is temperature

```
FLOW 0.0000 SCFM
TEMP 82.52  DEGF
```

Scrolled Variables

Scrolled shows all or specific process variables. Each process variable provides the a label, a value, and the unit of measure. You also determine from 2 to 8 seconds that each process variable appears before showing the next variable.

- **Flow**

```
FLOW RATE
0.0000 SCFM
```

- **Temp**

```
TEMPERATURE
82.52  DEGF
```

- **Velocity**

```
VELOCITY
0.00000 SFPM
```

- **Totalized flow**

```
TOTAL FLOW
183545.0 SCF
```

- **Tag name**

```
TAG NAME
NATURAL GAS1
```

The scroll combinations are:

- Scroll all
- Flow only
- Flow and totalized flow
- Flow and velocity
- Tag name and flow
- Tag name, flow, and velocity
- Flow, totalized flow, and velocity
- Flow and temperature
- Flow, temperature, and velocity

Display Mode

Pressing the **D** key enters Display mode, which provides view-only access to the meter's configuration parameters. If you want to know basic configuration information, it can be much quicker by viewing one of the log files created in Log mode or using KzComm. See "Log Mode" and the *KzComm User's Guide* for more information. You can scroll through the menu or quick jump to any of the following options.

Note Functions with (♥) support Hart.

Table 1-2. Display Mode

Option #	Function	Description
1	BASIC SETUP	Basic meter setup
2	FLOW CUTOFF	Flow cutoff
3	FLOW CF/TC	Flow correction factor and time constant
4	RESET TOTAL	Flow totalizer reset setup
5	AOUT 1	Analog output #1 setup
6	AOUT 2	Analog output #2 setup
7	RUN DISPLAY	Run mode display setup
8	ASSIGN DOUT	Relay output setup
9	ALARM SETUP	Alarm setup
10	NE-43 ALRM	NE-43 alarm setup
11	PULSE OUT	Pulse output setup
12	PURGE TIMR	Sensor purge setup
13	CALIB DATA	Flow calibration parameters setup
14	CALIB AOUT	Calibrate outputs
15	VRMS DATA	Variable flow correction data
16	REMOTE CF	Remote correction factor data
17	CAL CURVE	Gas calibration curve selection
18	DATA LOG	Data logging setup
19	MODBUS COM	Modbus communication setup
20	EXT AINPUT	External input setup
21	PID SETUP	PID data setup
22	PID CONTRL	Manual PID adjustment
23	DRIFT CHCK	Drift check setup
24	CHANGE PW	Change user password
25	GET EEPROM	Update *from* EEPROM
26	BOOTUP DLY	Set bootup output delay

Table 1-2. Display Mode (continued)

Option #	Function	Description
27	WGF PARAM	WGF correction factors for process temperature and pressure
28-30	(reserved)	(reserved)
31	METR CONFG	Factory meter setup
32	SENS CONFG	Factory sensor setup
33	INCAL CONF	Calibration coefficients
34	PROD CONFG	Manufacturing data setup
35	SAV 2 EEPR	Save to EEPROM
36	BRIDGE PID	Bridge PID coefficients
37	AUTO SAVE	AutoSave status
38	CURSR HOME	Terminal home status
39	SETFACTORY	Extended factory meter setup
40	AO CALCOEF	Set analog output cal coefficient
41	EXT INP mA	External input current
42	FLOW DATA	Flow data
43	TEMP DATA	Temperature data
44	INPUT VOLT	Input voltage (♥)
45	SENSOR OUT	Sensor output (♥)
46	SENSOR CTL	Sensor control
47	ELEC TEMP	Electronics temperature
48	SENS LEAKG	Sensor leakage
49	EVENT CODE	Meter event code
50	FW VERSION	Firmware version

Program Mode

Program mode allows you to make configuration and parameter changes to the meter. This is a password protected mode. The password determines the amount of access you have in Program mode.

- The default **password for basic meter setup is 123456**. Basic meter setup (see“Program Mode — Basic Access” on page 2-3) is used to configure the essential flow meter parameters (option 1 only):
  - Meter tag name
  - Flow units
  - Flow area
  - Probe depth (for insertion meters)
  - Analog output range
  - Run mode display setup
- The default **password for advanced meter setup is 654321**. Advanced settings (see“Program Mode — Advanced Access” on page 2-7) are for options 2 through 26, which include an option for changing the default passwords.

Before making any configuration changes in Program mode, it is important to remember:

- Any configuration changes followed by the message “New value accepted” are automatically saved to EEPROM. There are no prompts to confirm changes.
- To back out of a series of menus, continue to press **H** for each level (manual exit).
- If there is no menu activity for 3 minutes, the display automatically exits to Run mode.
- The configuration is retained through flow meter reboots and power cycles.

Important ***You should not make any changes to the meter configuration without a complete understanding of the flow meter parameters. Changing a setting incorrectly can cause the flow meter to malfunction.***

To enter Program mode:

1> Press **P**.

2> Enter the advanced meter setup password.

3> Press **E**.

4> You can scroll through the menu or quick jump to any of the options shown in Table 1-3.

Note Not all parameters may appear based on your meter configuration.

Functions with (♥) support Hart.

Within a menu, press **E** to scroll through the menu options unless the up/down arrows appear.

In most cases, when you reach the end of the parameters for a menu, you are automatically presented the next option. In instances where you continue to cycle through the parameters, press **H** to exit the menu.

Table 1-3. Program Mode

Option #	Function	Parameters / Description	Purpose
1	BASIC SETUP	**Basic Meter Setup** Meter Type Is IN-LINE FLOW INSERTION FLOW Tag Name (♥) Meter Name Flow Units (♥) PPM SLPM SCFM PPH SCMH SCFH NLPM KGM NCMH KGH Duct Profile ROUND Inside Diameter RECTANGLE Duct Width Duct Height CUSTOM Flow area Flow Area (calculated from Duct Profile, but can override with manual entry) (♥) Probe Depth (for Insertion meters only) Analog Out 1 FLOW RATE VELOCITY TEMPERATURE (optional) PID (optional) AO1at 4mA (♥) AO1 at 20mA (♥) Analog Out 2 (optional) FLOW RATE VELOCITY TEMPERATURE PID AO2 at 4mA AO2 at 20mA	Basic Meter Setup allows you to use one location to change common parameters. You must scroll through each option to reach the next one in the list. There is no Quick Jump option within Basic Meter Setup. All Basic Meter Setup parameters are available as individual options, which you can access using Quick Jump. The purpose for each parameter in Basic Meter Setup is described with its option number.

Table 1-3. Program Mode (continued)

Option #	Function	Parameters / Description	Purpose
1 (con't)		Run Mode Display SCROLLED Scrolled Vars SCROLL ALL TAG+FLOW+VEL FLOW ONLY FLOW+TOT+VEL FLOW+TOT FLOW+TEMP FLOW+VEL FLOW+TEMP+VEL TAG+FLOW Scroll interval (seconds) STATIC Static Vars FLOW ONLY TAG+FLOW FLOW+TOT FLOW+TEMP FLOW+VEL	
2	FLOW CUTOFF	**Flow Cutoff** Flow Cutoff SW ON OFF Lo Flow Cutoff *Value in flow rate units*	Sets a value as the bottom point (zero) for cutoff. This eliminates drifting on the output.
3	FLOW CF/TC	**Flow Correction Factor and Time Constant** (♥) Sensor Blockage CF (for Insertion meters only) Field Calib CF Flow TC Sec	Applies a correction to an existing flow.
4	RESET TOTAL	**Flow Totalizer Reset Setup** (♥) Totalizer Reset MAN RESET Reset Flow Total YES NO AUTO RESET Total Reset Cnt Reset Flow Total YES NO	An accumulation of the flow going past the sensor. The Auto Reset allows to preset a value for returning to zero.
5	AOUT 1	**Analog Output #1 Setup** Analog Out 1 FLOW RATE VELOCITY TEMPERATURE PID AO1at 4mA (♥) AO1 at 20mA (♥)	The 4-20mA output range to the control room.

Table 1-3. Program Mode (continued)

Option #	Function	Parameters / Description	Purpose
6	AOUT 2	**Analog Output #2 Setup** (optional) Analog Out 2 FLOW RATE VELOCITY TEMPERATURE PID AO2 at 4mA AO2 at 20mA	The 4-20mA output range to the control room.
7	RUN DISPLAY	**Run Mode Display Setup** Run Mode Display SCROLLED Scrolled Vars SCROLL ALL TAG+FLOW+VEL FLOW ONLY FLOW+TOT+VEL FLOW+TOT FLOW+TEMP FLOW+VEL FLOW+TEMP+VEL TAG+FLOW STATIC Static Vars FLOW ONLY TAG+FLOW FLOW+TOT FLOW+TEMP FLOW+VEL	See Run Mode on page 1-7.
8	ASSIGN DOUT	**Relay Output Setup** Select Relay # Assign Relay To ALARM OUTPUT See Setup Alarm TOT PULSE OUT See Setup Pulse Output PURGE OUTPUT (optional) See Setup Sensor Purge	Opens or closes a contact on a preset setting.
9	ALARM SETUP	**Alarm Setup** Select Alarm # *Value x* Set Alarm *x* ON OFF Alarm *x* Trigger VELOCITY FLOW RATE TEMPERATURE GLOBAL EVENT	Triggers an alarm for an event. This is used in conjunction with the Relay Output Setup.

Table 1-3. Program Mode (continued)

Option #	Function	Parameters / Description	Purpose
9 (con't)		Alarm *x* Trip LOW SETPOINT LO Alarm Setpt HI SETPOINT HI Alarm Setpt LO AND HI SP LO Alarm Setpt HI Alarm Setpt Continue with Relay Setup YES NO If YES, Alarm x assigned to DO n Relay n State NORMALLY OPN NORMALLY CLS	
10	NE-43 ALRM	**NE-43 Alarm Setup** NE-43 Alarm Type LOW OUTPUT HIGH OUTPUT	
11	PULSE OUT	**Pulse Output Setup** Pulse Output ON OFF If ON, Pulse Output assigned to DO n Flow Volume per Pulse Pulse Width	Used in conjunction with the Relay Output Setup.
12	PURGE TIMR	**Sensor Purge Setup** (♥) Purge Timer ON OFF If ON, Purge Output assigned to DO n Purge Time msec Hold Time msec Purge Intv min	Used to send compressed air to clean the sensor. This option requires the Purge System.

Table 1-3. Program Mode (continued)

Option #	Function	Parameters / Description	Purpose
13	CALIB DATA	**Flow Calibration Parameters Setup** Sensor SN Cal Flow Unit SCFM SCMH SFPM SMPS Factory STP Ref User Ref Temp (♥) User Ref Press (♥) Cal Curve Type (optional) VELOCITY MAP MULTIPLE CAL VM Reference INTERNAL EXTERNAL Gas Mol Wt New Ref Density Gas Name # VM Data Sets (x) Flow Data for S1 # Data Pts At S1 (y) Raw Signal S1-1 Flow Data S1-1 Raw Signal S1-*x* Flow Data S1-*x* (Raw Signal and Flow Data repeat) Flow Data for S*x* (optional) # Data Pts at S*x* (*n*) Raw Signal S*x*-1 Flow Data S*x*-1 Raw Signal S*x*-*n* Flow Data S*x*-*n* (Raw Signal and Flow Data repeat)	This should only be changed with approval from Kurz. Used for calibrating the sensor data. Standard reference temperature is 25°C or 77°F. Standard reference pressure is 14.7 PSI. This is velocity temperature mapping.
14	CALIB AOUT	**Calibrate Analog Outputs** Set 4.000 mA to Out 1 (♥) Set 20.000 mA to Out 1 (♥) AO1 Calib Coeff A01 Slope A01 Offset Set 4.000 mA to Out 2 (optional) Set 20.000 mA to Out 2 (optional)	This allocates the 4-20 mA output to a specific terminal.

Table 1-3. Program Mode (continued)

Option #	Function	Parameters / Description	Purpose
14 (con't)		AO2 Calib Coeff (optional) A02 Slope A02 Offset Chk NE-43 Alarms YES NO If YES Low Alarm Check High Alarm Check Enter output mA mA and equivalent	
15	VRMS DATA	**Variable Flow Correction Data** (♥) Enter # of Flow Data Sets *n* Enter Flow Data Set # *x* Ref Value R*x* (Vrms-*x*) Test Data D*x* (VdsAve-*x*)	This should only be changed with approval from Kurz.
16	REMOTE CF	**Remote Correction Factor Data** Remote CF ON OFF Enter # of Remote CF Data Points n Enter ExtInput.RemCF-D1 Enter ExtInput.RemCF-X1 : Enter ExtInput.RemCF-Dn Enter ExtInput.RemCF-Xn	This allows you to correct the meter reading in reference to other data
17	CAL CURVE	**Gas Calibration Curve Selection** (optional) Curve Sel Mode MANUAL SELECT EXT INPUT LEV If MANUAL SELECT Cal Curve #	
18	DATA LOG	**Data Logging Setup** Enable Data Log ON OFF If ON Log Interval sec	Stores 200 recent events, top 20 min/ max, and 56 hours of trends in volatile memory.

Table 1-3. Program Mode (continued)

Option #	Function	Parameters / Description	Purpose
19	MODBUS COM	**Modbus Communication Setup** Dev Modbus Addr Modbus Mode MODBUS RTU MODBUS ASCII Modbus Baud Rate 9600 38400 14400 57600 19200 Register Order BYTE #12 34 BYTE #34 12	Allows you to setup up Modbus communications and specify either RTU or ASCII commands. The baud rate will typically be 9600.
20	EXT AINPUT	**External Input Setup** Ext Input Usage CAL DATA SW PID EXT. REF (optional) VM REFERENCE REMOTE CF PURGE COMMAND (optional) VM REFERENCE Scale Unit Inp Val At 4mA Inp Val At 20mA Filter TC	
21	PID SETUP	**PID Data Setup** (optional) PID State ON OFF PID Operation MANUAL AUTOMATIC PID Control To VELOCITY FLOW RATE PID Setpt Ref INTERNAL EXTERNAL PID Setpoint Prop Gain (KP) Integral TC Derivative TC PID Low Limit PID High Limit	
22	PID CONTRL	**Manual PID Adjustment** (optional) Manual PID Adjust	

Table 1-3. Program Mode (continued)

Option #	Function	Parameters / Description	Purpose
23	DRIFT CHCK	**Drift Check Setup** (♥) Auto Drift Check ON OFF If ON, Drift Chk Intrvl % FS at Zero Duration at Zero % FS at Mid Duration at Mid % FS at Span Duration at Span	
24	CHANGE PW	**Change User Password** Basic Setup Code Adv Setup Code	Allows you to change the basic and advanced passcodes (6 digits).
25	GET EEPROM	**Update From EEPROM** Load From EEPROM YES NO	
26	BOOTUP DLY	**Bootup Output Delay Setup** Bootup Out Delay *seconds*	
27	WGF PARAMS	**WGF Parameters Setup** WFG Tmax (estimated saturation temperature) DegF DegC WGF Press (line pressure) PSI kPA	Calculates the vapor pressure correction for the dry flow rate.

Log Mode

Pressing the **L** key puts the meter in Log mode and allows you to send reports to the meter's serial port. You must have a terminal emulator installed to accept the Log file output or use KzComm. You can scroll through the menu or quick jump to any of the options.

Table 1-4. Log Mode

Option #	Function	Description
1	EVENT	Event log
2	MIN/MAX	Min/max data
3	TREND	Trend log
4	CONFIG	System configuration
5	RUN DATA	Snapshot of flow meter data

Note Log files are comma-delimited files that can be opened using any spreadsheet application or basic word processing application (such as WordPad).

Event Log

The Event log contains up to 260 of the most recent events determined and reported by the flow meter. The output provides the runtime and an event code. Refer to *B-Series Troubleshooting* for error codes and a brief description of behavior and possible causes. In the table, x's represent leading zeros that do not appear, and the plus signs (+) represent any digits after the number that clarify the event.

Min/Max Log

The Min/Max log is used to determine the range of the flow rate, temperature, and electronics temperature for the process being measured by the Kurz flow meter. The output file contains up to 20 records for each of the following events:

- Minimum and maximum flow rate
- Minimum and maximum process temperature
- Minimum and maximum electronics temperature

Trend Log

The Trend log contains up to 20,416 records. Each record contains the runtime, flow rate, and process temperature data every 10 seconds for approximately 2.5 days. When the log file is full, the oldest data is replaced with the newest data. The data shows how the process being measured by the flow meter changes with time. The Trend log will show details if an unusual event occurs with the process. Downloading the Trend log can take several minutes.

Important ***The Trend log is stored in volatile memory. The data is lost when the flow meter power cycles.***

Config Log

The Config log provides the following information:

- Firmware version
- Runtime duration
- Meter number
- Analog output meter number
- Alarm output status (enabled or disabled)
- Pulse output status (enabled or disabled)
- Data log status (enabled or disabled)
- Modbus status (enabled or disabled)
- PID status (enabled or disabled)
- Multiple calibration curves status (enabled or disabled)
- Remote correction factor status (enabled or disabled)
- System unit language

Run Data Log

The Run Data log provides the following information:

- Device tag name
- Length of meter activity in seconds
- PPM flow rate
- Temperature in degrees Farenheit

Extended Utilities Mode

Extended Utilities mode allows access to advanced meter functions. This is a password protected mode. The password determines the amount of access you have in Extended Utilities mode. The default password is 654321.

Before making any configuration changes in Extended Utilities mode, it is important to remember:

- Any configuration changes followed by the message “New value accepted” are automatically saved to EEPROM. There are no prompts to confirm changes.
- To back out of a series of menus, continue to press H for each level (manual exit).
- If there is no menu activity for 3 minutes, the display automatically exits to Run mode.
- The configuration is retained through flow meter reboots and power cycles.

Important ***You should not make any changes to the meter configuration without a complete understanding of the flow meter parameters. Changing a setting incorrectly can cause the flow meter to malfunction.***

The **E** key is also used as an Enter key and to accept and save changes after entering data.

To enter Extended Utilities mode:

1> Press **E**.

2> Enter your password.

3> Press **E**.

4> You can scroll through the menu or quick jump to any of the options shown in Table 1-5.

Note Functions with (♥) support Hart.

Table 1-5. Extended Utility Mode

Option #	Function	Description / Parameters
1	ZERO DRIFT	**Drift Check at Zero** (♥) If YES, runs test and provides updated % Diff, VIN, and VOUT data. If NO, shows current % Diff, VIN, and VOUT data.
2	MIDSP DRIFT	**Drift Check at Mid-span** (♥) If YES, runs test and provides updated % Diff, VIN, and VOUT data. If NO, shows current % Diff, VIN, and VOUT data.
3	FULLSP DRFT	**Drift Check at Full-span** (♥) If YES, runs test and provides updated % Diff, VIN, and VOUT data. If NO, shows current % Diff, VIN, and VOUT data.
4	CYCLE DRIFT	**Drift Check Cycle (all tests)** (♥) If YES, runs test and provides updated % Diff, VIN, and VOUT data. If NO, shows current % Diff, VIN, and VOUT data.

Table 1-5. Extended Utility Mode (continued)

Option #	Function	Description / Parameters
5	RESET TOTAL	**Reset Flow Total** (♥) If YES, resets counters to zero. If NO, returns to the menu.
6	DEL EVENTS	**Reset Event Log Memory**
7	DEL MIN/MAX	**Reset Min/Max Records**
8	RESET RUNTM	**Reset Runtime Counter**
9	RP CIRCUIT	**RP Circuit Test**
10	RTC CIRC	**RTC Circuit Test**
11	IN CAL LO	**Input Cal Low Test**
12	IN CAL HI	**Input Cal High Test**
13	END IN CAL	**End Input Cal Test**
14	VLEAK HI	**VLeak Cal High**
15	VLEAK LO	**VLeak Cal Low**
16	VOLTG DRV	**Voltage Drive Test**
17	VOLTG RAMP	**Voltage Ramp Test**
18	BRIDGE PID	**Bridge PID Coefficients**
19	EVENT TEST	**Event Code Bit Test**
20	INPUT VOLT	**Display Input Voltages**
21	SENSOR OUT	**Display Sensor Output**
22	SENSOR CTL	**Display Sensor Control**
23	ELEC TEMP	**Display Electrical Temperature**
24	SENS LEAKG	**Sensor Leakage**

Quick Reference Card

You should have received a Quick Reference Card similar to the one shown in Figure 1-4. In the event the card is missing or you need extra cards, print the following Quick Reference Card.

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Kurz Instruments, Inc.
B–Series v2.0
Quick Reference Card

H	**Home Key** **Back out of menu system**
C	**Clears input in Program mode** **Acknowledge meter event**
P	**Program mode** **Page display**
D	**Display mode** **Delete (backspace) in Program mode**
E	**Enter key (accept user input)**

Function	Key Sequence
Basic setup	P-123456-E
Advanced setup (Menu Scroll)	P-654321-E-1
Advanced setup (Quick Jump)	P-654321-E-2

Basic Setup Menu Items	
Tag Name	4-20 mA AO #1 Setup
Flow Units	4-20 mA AO #2 Setup
Flow Area	Setup Run Mode Display
Probe Depth (insertion meter)	

www.kurzinstruments.com
800-424-7356

Function	Option #
Program Mode (Quick Jump)	
Basic Meter Setup	1
Flow Cutoff Setup	2
Flow CF and TC	3
Flow Totalizer Setup	4
4-20 mA AO #1 Setup	5
4-20 mA AO #2 Setup (optional)	6
Run Mode Display Setup	7
Relay Outputs Setup	8
Alarms Setup	9
Pulse Output Setup	11
Calibrate Analog Outputs	14
Drift Check Setup	23
Dry Flow Setup (WGF only)	27
Display Mode (Quick Jump)	
Sensor Serial Number	32
Model Number	34
Flow Meter Data	42
Input Voltage	44
Sensor Output	45
Event Code	49
Firmware Version	50

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Figure 1-4. User interface quick reference card

Chapter 2

B-Series Flow Meter Menu Applications

Overview

This section provides the steps for frequently requested topics and menu processes. It includes:

- Display Mode — Wet and Dry Flow Rates
- Program Mode — Basic Access
- Program Mode — Advanced Access
- Enabling Data Logging
- Setting Up Analog Output Channels
- Setting Relay Assignments
- Setting the Pulse Mode Totalizer Output
- Using the Built-In Zero-Mid-Span Drift Check Calibration
- Configuring the Built-In Flow Controller
- Changing the WGF Vapor Correction Factor
- Setting Flow Meter Modbus Connectivity
- Cleaning A Sensor

Display Mode — Wet and Dry Flow Rates

The wet and dry flow rates are available for the 454FTB-WGF flow meter.
To view the WGF Parameters information in Display mode:

1> Press **D**.

2> Press **2** to invoke the Quick Jump option.

3> Press **27** for the WGF Parameters menu, and then press **E**.

```
PROCESS TMAX
>0.00000000 DEGF
```

This is the estimated saturation temperature in the pipe.

4> Press **E**.

```
PROCESS PRESSURE
>14.7000000 PSI
```

This is the pressure in the line where the flow is being measured.

5> Press **E**.

```
VEL RATIO OF GAS
>1.50000000
```

This is the estimated velocity of the flow where the it is being measured.
This value is derived from the velocity ratio of gas-to-air or steam-to-air.
See “Changing the WGF Vapor Correction Factor” on page 2-44 to change these values.

To access the wet and dry flow rates information in Display mode:

1> Press **D**.

2> Press **2** to invoke the Quick Jump option.

3> Press **42** for the Flow Data menu, and then press **E**.

4> Press **P** until the Dry/Wet option appears.

```
DRY/WET       uuuu
dd.d    /     ww.w
```

where:

uuuu are the flow rate units
dd.d is the dry flow rate
ww.w is the wet flow rate

The flow rate can also be monitored through Modbus using function04, input register 0x43.

Program Mode — Basic Access

Basic flow meter options are configured in Program mode, which you access by pressing **P** and using the basic access code. All basic access options are available individually with an advanced access password. Refer to Chapter 1 for information about the flow meter user interface, default access code, and basic access menu options.

Before making any configuration changes in Program mode, it is important to remember:

Important ***You should not make any changes to the meter configuration without a complete understanding of the flow meter parameters. Changing a setting incorrectly can cause the flow meter to malfunction.***

- A flow meter used in a critical process or feedback control should be taken offline before making configuration changes in Program mode. The Basic Setup menu option temporarily suspends flow meter output at the last value before the menu option was invoked.

```
! WARNING !
OUTPUT WILL STOP
```

  If this prompt does not appear, the meter continues to operate normally.
- Press only **P** to continue to the next prompt without making changes.
- To back out of a menu, press **H** to force an exit.
- Any changes accompanied by the following message are automatically saved to EEPROM:

```
NEW VALUE
ACCEPTED
```

  There are no prompts to confirm that you want to make a change.
- If there is no menu activity for 3 minutes, the display automatically exits to Run mode.
- The configuration is retained through flow meter reboots and power cycles.
- The output automatically restarts when you exit the Basic Setup menu option.

```
OUTPUT UPDATE
IS RESUMED ......
```

Note If a parameter change affects the output, the output will restart as the new parameter is accepted or the output update is resumed.

To access the Basic Setup menu in Program mode:

1> Press **P**.

2> Enter your basic access password, and then press **E**.

```
! WARNING !
OUTPUT WILL STOP
```

The warning message appears followed by a general description of the meter type (either insertion or inline).

```
METER TYPE IS
INSERTION FLOW
```

3> Press **E**.

```
TAG NAME
>FLOW METER
```

The tag name is the flow meter name. The name can indicate the location, process, or company naming convention.

4> Press **E** to continue to the next option without making changes.

If you want to change the flow meter name, press **C** to clear the tag name field. Use the alphanumeric keys to enter letters and numbers. Press **E** to advance to the next character position. Press **E** to accept the new name and continue to the next option.

```
FLOW UNITS
>SCMH     ^v
```

The flow units determine the units that appear for velocity and temperature.
The flow rate options are NCMH, NLPM, SCFH, SCFM, SCMH, and SLMP.
The mass rate options are KGH, KGM, PPH, and PPM.

5> Use the arrow keys to select the flow units, and then press **E**.

```
DUCT PROFILE
>ROUND     ^v
```

The duct profile options are round, rectangle, and custom.

6> Use the arrow keys to select the duct profile, and then press **E**.

Depending on the duct profile selection, the duct width, inside diameter, or flow area prompt appears.

Rectangle

```
DUCT WIDTH
>36.25        IN
```

```
DUCT Height
>40.625        IN
```

Round

```
INSIDE DIAMETER
>15.325    IN
```

Custom

```
FLOW AREA
>10.525     SQFT
```

7> Use the number and decimal keys to enter the profile measurements. Press **E**.

```
FLOW AREA
>10.525     SQFT
```

The Flow Area is calculated from the height and width of a rectangular profile or the inside diameter of a circular profile.

> **Note:** If you selected a custom duct profile, the Flow Area option will not appear twice.

8> Use the number and decimal keys to enter the flow area measurements. Press **E**.

For insertion flow meters, the Probe Depth option appears.

```
PROBE DEPTH
>18.230     IN
```

9> Use the number and decimal keys to enter the probe depth. Press **E**.

```
ANALOG OUT
>FLOW RATE    ^v
```

The Analog Output options include flow rate, velocity, temperature, and PID. The availability of options is based on other settings.

10> Use the arrow keys to select an Analog Output option, and then press **E**.

```
AO1 at 4mA
>0.0000000 SCFM
```

The analog output 4mA prompt determines the minimum range value; that is, how low the flow unit value can go before triggering a signal to the analog output. The flow unit type was specified in a previous option.

11> Use the number and decimal keys to enter the 4mA value. Press **E**.

```
AO1 at 20mA
>15000.000 SCFM
```

The analog output 20mA prompt determines the maximum range value; that is, how high the flow unit value can go before triggering a signal to the analog output. The flow unit type was specified in a previous option.

12> Use the number and decimal keys to enter the 20mA value. Press **E**.

Note: If the flow meter was configured with a second analog output, prompts will appear for AO2 at 4mA and AO2 at 20mA.

```
RUN MODE DISPLAY
>STATIC       ^v
```

The Run Mode options are static variables and scrolled variables.

Refer to “Run Mode”on page 1-7 for a description of static and scrolled modes.

13> Use the arrow keys to select the Run Mode Display, and then press **E**.

Depending on the run mode selection, the static variable or scrolled variables prompt appears.

```
STATIC VARS
>FLOW+TEMP    ^v
```

```
SCROLLED VARS
>SCROLL ALL   ^v
```

Refer to “Run Mode” on page 1-7 for a description and examples of static and scrolled variables.

14> Use the arrow keys to select the variable, and then press **E**.

```
SCROLL INTERVAL
>2          SEC
```

The Scrolled Variable option also allows you to determine the length of time (between 2 and 8 seconds) that information appears on the display before changing to the next value.

15> Use the number keys to to choose between 2 and 8 seconds, and then press **E**.

Program Mode — Advanced Access

Advanced flow meter options are configured in Program mode, which you access by pressing **P** and using the advanced access code. Refer to Chapter 1 for information about the flow meter user interface, default access code, and advanced access menu options.

Before making any configuration changes in Program mode, it is important to remember:

Important ***You should not make any changes to the meter configuration without a complete understanding of the flow meter parameters. Changing a setting incorrectly can cause the flow meter to malfunction.***

- A flow meter used in a critical process or feedback control should be taken offline before making configuration changes in Program mode. Advanced setup temporarily suspends flow meter output at the last value before Program mode was invoked.

```
! WARNING !
OUTPUT WILL STOP
```

  If this prompt does not appear, the meter continues to operate normally.
- Press only **P** to continue to the next prompt without making changes.
- To back out of a menu, press **H** (possibly multiple times) to force an exit.
- Any changes accompanied by the following message are automatically saved to EEPROM:

```
NEW VALUE
ACCEPTED
```

  There are no prompts to confirm that you want to make a change.
- If there is no menu activity for 3 minutes, the display automatically exits to Run mode.
- The configuration is retained through flow meter reboots and power cycles.
- The output automatically restarts when you exit the Basic Setup menu option.

```
OUTPUT UPDATE
IS RESUMED ......
```

Note If a parameter change affects the output, the output will restart as the new parameter is accepted or the output update is resumed.

Enabling Data Logging

Data logging typically occurs for:

- Field calibration process
- Troubleshooting a process flow
- Troubleshooting meter readings

To access the Data Logging menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **18** for the Data Logging menu, and then press **E**.

The menu prompts you for enabling the data log.

```
ENABLE DATA LOG
>OFF          ^v
```

5> Use the arrow keys to select ON, and then press **E**.

The LOG INTERVAL prompt defines the frequency (in seconds) of data logged to the USB port. The interval can be between 1 second and 32,768 seconds (approximately 9.1 hours).

```
LOG INTERVAL SEC
>300
```

6> Enter the LOG INTERVAL value using the number keys, and then press **E**.

Totalizing Volume or Mass Flow

Flow applications frequently must totalize the flow to know the accumulated volume or mass going through the pipe or duct. The flow meter measures several process variables including the accumulation of the total flow in volume or mass.

- Volume uses standard cubic feet (SCF) or standard cubic meters (SCM)
- Mass uses pounds (lb) or kilograms (kg)

The volume and mass values can be monitored on the flow meter display, queried through the USB port, or through the Modbus register or HART. The flow meter also maintains the elapsed time in minutes since the last reset of the flow totalizer.

The flow totalizer can be manually reset from Program mode, through a Modbus command, or through a HART command. Additionally, it can be configured to automatically reset to zero when it reaches a predefined value.

Determining Accuracy Limits

Data for the flow totalizer is retained in less than eight digits. Round-off errors cause mistracking to occur when the data has been accumulating for extended periods (more than two years). To maintain mistracking below one percent, select an automatic roll-over value that occurs within two years as a point for resetting the flow totalizer. This value is independent of the flow rate. See “Resetting the Flow Totalizer Value” on page 2-10 for additional information.

For example, a typical flow rate of 100 SCFM that occurs for 10 hours per day results in a total flow per day of 100 x 10 x 60 = 60,000 CF. In one year this accumulates 60,000 x 365 = 21,900,000 or 21.9 MCF per year. Configuring the flow totalizer to automatically reset at 10 MCF would force it to reset about every 6 months.

Viewing the Totalized Flow

To access the Flow Totalizer in Display mode:

1> Press **D**.

2> Press **2** to invoke the Quick Jump option.

3> Press **42** for the Flow Data menu, and then press **E**.

4> Press **P** repeatedly until similar information appears:

Note The example uses standard cubic feet (SCF), although metric or mass can appear based on the meter configuration.

```
SCF =183747.5
ET 2036.256 MIN
```

5> Press **H** twice to return to Run mode.

The Run mode display can also be configured to continuously show and update the totalized flow, as shown in the following example:

```
FLOW 25730 SCFM
FLTOT 4.620E+06
```

Resetting the Flow Totalizer Value

You can manually reset the flow totalizer value and elapsed time to zero or configure it to reset when it reaches a specified value.

To access the Flow Totalizer Reset Setup menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **4** for the Flow Totalizer Reset Setup menu, and then press **E**.

The menu prompts you for a manual or automatic reset.

5> Use the arrow keys to select either MANUAL RESET or AUTOMATIC RESET, and then press **E**.

For **MANUAL RESET**:

```
TOTALIZER RESET
>MAN RESET ^v
```

a> Selecting **MANUAL RESET** will then prompt you to confirm resetting the totalizer.

```
RESET FLOW TOTAL
>YES ^v
```

b> Use the arrow keys to select **YES**, and then press **E**.
Press **P** to exit the prompt without changes.

The following information appears:

```
RESETTING FLOW
TOTALIZER...
```

```
TOTALIZER IS
RESET...
```

c> Press **E**, **C**, or **P** to return to the Program mode option menu.

For **AUTOMATIC RESET**:

```
TOTALIZER RESET
>AUTO RESET ^v
```

a> Selecting **AUTOMATIC RESET** will then prompt you for a reset count.

The reset count defines the maximum limit of the flow totalizer before it automatically resets to zero.

```
TOTAL RESET CNT
>1.000E+20 SCF
```

b> Enter the maximum limit using the number and decimal keys, and then press **E**.

A prompt appears to confirm resetting the totalizer.

```
RESET FLOW TOTAL
>YES ^v
```

c> Use the arrow keys to select **YES**, and then press **E**.
Press **P** to exit the prompt without changes.

The following information appears:

```
RESETTING FLOW
TOTALIZER...
```

```
TOTALIZER IS
RESET...
```

d> Press **E**, **C**, or **P** to return to the Program mode option menu.

Setting Up Alarms

A Kurz thermal flow meter can be factory configured with up to two alarms. The alarms can be monitored on the display, via ASCII or Modbus commands, or through the HART interface. Additionally, the alarms can be setup to send a control signal (energize a relay output) when an alarm event occurs.

Alarm Setup

Note It is recommended that you start with the **Relay Output Setup** (option **8**) to avoid assigning conflicting relays. See “Setting Up the Relay Output for an Alarm Function” on page 2-14 for information.

Note As the relays are solid state optically isolated, SSRs (SPST), their unpowered state is an open circuit and must be considered for fail-safe alarm logic configurations.

To access the Alarm Setup menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **9** for the Alarm Setup menu, and then press **E**.

The following information appears if the meter was not purchased with the alarm option:

```
ALARM FUNCTION
IS NOT INSTALLED
```

If you would like the Alarm function available, contact your Kurz representative.

If the meter is configured with the alarm option, you are prompted for an alarm number.

```
SET ALARM #
>1
```

5> Use the numeric keys to enter either **1** or **2** for the alarm number, and then press **E**.

You are prompted to turn the alarm ON or OFF.

```
SET ALARM 1
>ON
```

6> Use the arrow keys to select ON, then press **E**.

You are prompted to select an event that activates the alarm. The available events are:

FLOW RATE Limits check

VELOCITY Limits check

TEMPERATURE Limits check

GLOBAL EVENT

Select FLOW RATE, VELOCITY, or TEMPERATURE to monitor one of the meter's process variables with respect to a set point limit. Select GLOBAL EVENT if you want the alarm activated by any System Fault Event.

```
ALARM 1 TRIGGER
>FLOW RATE      ^v
```

7> Use the arrow keys to scroll through the list, and then press **E**.

If you select FLOW RATE, VELOCITY, or TEMPERATURE, the menu system prompts for the condition that activates the alarm. The condition can be LOW SETPOINT / HIGH SETPOINT / LO AND HI SP.

```
ALARM 1 TRIP
>LOW SETPOINT      ^v
```

8> Use the arrow keys to scroll through the list, and then press **E**.

Depending on the activation condition you selected, you could be prompted for the LOW and/or HIGH set points. The following examples show the prompting for the FLOW RATE low and high alarm set points.

```
LO ALARM SETPT
>0.0000000      SFPM
```

```
HI ALARM SETPT
>10000.0000     SFPM
```

9> Use the numeric and decimal keys to enter the set point value, and then press **E**.

If the alarm condition energizes a relay output, the following example shows setting up the relay output assigned to the alarm.

```
CONTINUE WITH
RELAY SETUP >YES
```

10> Press **H** to exit if the alarm will not energize a relay. Otherwise, use the arrows keys to select YES or NO, and then press **E**.

Setting Up the Relay Output for an Alarm Function

The Relay Output Setup is used to assign a relay to the alarm function. The Relay Output Setup menu automatically starts the Alarm Setup menu after a relay is assigned to the Alarm function.

To access the Relay Output Setup menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **8** for the Relay Output Setup menu, and then press **E**.

Before setting up the relay for the alarm, the system checks if the relay is assigned to another active function. If the relay is being used, the following prompt appears (where x is either 1 or 2):

```
DOx IS USED
CHANGE IT >NO
```

This prompt indicates that the relay is assigned to either the TOTALIZER PULSE OUTPUT or the PURGE OUTPUT function. If you do not want to make any changes, press **E** to accept the setting, **H** to back out of the prompt, or **P** to go to the main menu.

5> Use the arrow keys to change the selection to YES to proceed with the relay reassignment.

If the relay is currently assigned, a prompt similar to the following example appears:

```
ALARM x AT DO y
REASSIGN >NO
```

6> Use the arrow keys to change the selection to YES, and then press **E**.

Note If the relay is reassigned, the other alarm will still be active but it will no longer energize the reassigned relay.

A confirmation of the relay selection and alarm number assignment appears, similar to the following example:

```
ALARM #1
ASSIGNED TO DO1
```

7> Press **P** or **C** to advance to the next setup screen.

After the relay selection is confirmed, a prompt for the normal (unalarmed) state of the relay appears.

```
RELAY 1 STATE
NORMALLY OPN  ^v
```

Use the arrow keys to select between:

- NORMALLY OPN is used if the contact is closed when the alarm is triggered.
- NORMALLY CLS is used if the contact is opened when the alarm is triggered.

8> Press **E** to accept the selection and exit the Alarm Setup menu.

If the meter is configured for multiple alarms, the alarm setup can be repeated for the other alarms.

Setting Up Analog Output Channels

The flow meter supports up to two analog output (AO) channels. Each analog output channel (AO1 and AO2) can report flow rate, temperature, velocity, or be assigned to a PID flow controller. Both channels are active during the zero-mid-span drift check.

Note HART versions of the sensor control board only have one AO channel.

Table 2-1. 4-20 mA Output Functions

Analog Output Functions	Description
Flow rate	Process measurement.
Temperature	
Velocity	
PID flow controller	Control valve position, damper position, or motor controller speed.

The drift check and NE-43 alarms are temporary overrides to the analog output signals.

Table 2-2. Temporary 4-20 mA Process Measurement Override

	Drift Check	NE-43 Alarms
Trigger	Internal timer	Error event bits
Trigger	DI2 input	

Analog Output Setup Menu

The output and signal range for process variables are configured through the Analog Output Setup menu in Program Mode. The receiving device must be programmed for the same range.

To access the Analog Output Setup menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **5** for the Analog Out 1 menu or **6** for the Analog Out 2 menu, and then press **E**.

The following example uses the Analog Out 1 option with the flow rate feature.

```
ANALOG OUT 1 >
FLOW RATE ^v
```

5> Use the arrow keys to scroll through the list, then press **E**.

The prompt appears for assigning the minimum flow rate at 4 mA.

This is the value of the controlled variable (flow rate or velocity) when the valve or damper is fully closed or the fan is OFF; this value is usually zero.

```
AO1 at 4mA
>0.00000000 SCFM
```

6> Use the numeric and decimal keys to enter the minimum flow rate, and then press **E**.

The prompt appears for assigning the maximum flow rate at 20 mA.

This is the value of the controlled variable (flow rate or velocity) when the valve or damper is completely open or the fan is at full speed (controlled device).

```
AO1 at 20mA
>12000.0000 SCFM
```

7> Use the numeric and decimal keys to enter the maximum flow rate, and then press **E**.

The prompt returns to the Program mode main menu.

Repeat these steps if the meter has a second analog output channel.

PID Flow Control

An analog output can be part of an automatic flow controller. It can control a valve, damper, or motor controller. The flow meter can regulate the process flow based on an internal set point value stored in the flow meter's memory or an external analog input signal that specifies the desired flow rate. The internal set point for the PID control can be set manually at the keypad or through a Modbus command. The external analog input set point is read from the analog input channel, if this option is installed on the board. See "Setting Up the PID 4-20 mA Control Output" on page 2-37 for additional information.

Zero-Mid-Span Drift Check

The zero-mid-span drift check is an automatic calibration mode where both 4-20 mA Analog Output channels report standard zero, mid, and high values for checking the calibration of the device and its data recording signal chain. See "Built-In Zero-Mid-Span Drift Check Calibration" on page 2-27 for additional information.

NE-43 Alarms

The flow meter supports the NAMUR specification NE-43 for alarm support on the 4-20 mA signal. The analog output signal is clipped between 3.8 and 20.5 mA so any bit set in the meter event code triggers an NE-43 alarm. See "Setting Relay Assignments" on page 2-18 for additional information.

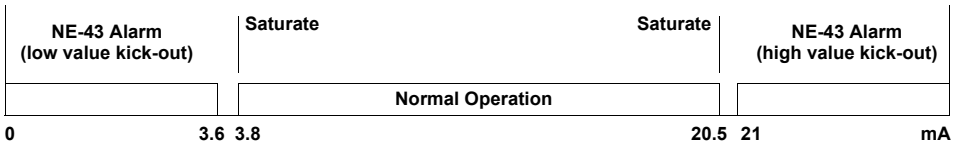


Figure 2-1. 4-20 mA operation with the NE-43 alarm

The following flow meter error events cause a NE-43 alarm:

- Unable to write configuration file to EEPROM
- Abnormal sensor node voltages
- Sensor type does not match configuration
- Sensor over-voltage crowbar engaged
- Sensor control drive stopped responding
- ADC failed to convert measurement
- High sensor or wire leakage
- Rps sensor lead open circuit
- Wire loop resistance above high limit
- Rtc resistance below low limit and above high limit
- Rp resistance below low limit and above high limit

To access the NE-43 Alarm Setup menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **10** for the Relay Output Setup menu, and then press **E**.

The NE-43 alarm type prompt appears.

— A LOW OUTPUT drives the 4-20 mA output to 3.6 mA when a meter fault occurs.

— A HIGH OUTPUT drives the 4-20 mA output to 21 mA when a meter fault occurs.

```
NE-43 ALARM TYPE
>HIGH OUTPUT ^v
```

5> Use the arrow keys to select LOW OUTPUT or HIGH OUTPUT, and then press **E**.

Setting Relay Assignments

The B-Series has two solid state relays rated for +/-30 VDC or 24 VAC up to 0.5 A RMS load; however, not all versions of the sensor control board support the relays. The relay functions are configurable, but each relay can only be assigned one function at a time. Table 2-3 shows the functions that can be assigned to each relay.

Table 2-3. Relay Functions

Relay # (DO#)	Alarms	Pulse Totalizer	Purge Valve
1	Yes	Yes	No
2	Yes	Yes	Yes

Note The sensor purge cleaning function can only use Relay #2 (or DO2).

To access the Relay Outputs Setup menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **8** for the Relay Outputs Setup menu, and then press **E**.

The menu prompts you for a relay number.

```
SELECT RELAY #
> 1
```

5> Press either **1** or **2**, and then press **E**.

The meter prompts you for a function to assign to the selected relay number. Relay #1 can be assigned to the ALARM OUTPUT and TOT PULSE OUT functions. Relay #2 can be assigned to the ALARM OUTPUT, TOT PULSE OUT, PURGE OUTPUT functions.

```
ASSIGN RELAY TO
>ALARM OUTPUT ^v
```

6> Use the arrow keys to scroll through the list, and then press **E**.

Once a function is configured for the selected relay number, the meter will advance to the setup menu for that function.

If the relay is being used by another active function the following prompt appears:

```
RELAY IS USED
CHANGE IT>NO
```

7> The relay can be reassigned to the new function by changing the response to YES by using the arrow keys, and then pressing **E**.

The meter will reassign the relay to the new function. The previously assigned function is now unassigned and turned off, when applicable.

— An example of when the function is turned off is if Relay #2 is assigned to the PURGE OUT function and then reassigned to the TOTALIZER PULSE OUTPUT *and* the PURGE TIMER is ON. The meter will turn OFF the PURGE TIMER when the relay is reassigned.

— An example of when the function is *not* turned off is when a relay is assigned to the ALARM OUTPUT function and then reassigned to another function, the alarm is not turned OFF. Only the actuation of the relay due to the triggered alarm is disabled, and the alarm will remain ON and continue to trigger as configured.

If the flow meter is configured with more than 1 relay output, the meter will repeat the sequence of prompts to configure the other relay output.

8> Press **H** to exit the Setup Relay Outputs menu.

Assigning an Alarm to a Relay

After a relay is configured to actuate an alarm, the menu advances to the Setup Alarms menu. A flow meter can have up to two alarms.

You are prompted to select an alarm number.

```
SELECT ALARM #
>1
```

1> Press either **1** or **2**, and then press **E**.

You are prompted to set the selected alarm ON or OFF.

```
SET ALARM 1
>ON
```

2> Use the arrow keys for your selection, and then press **E**.

A confirmation of your selections appears.

```
ALARM #1
ASSIGNED TO DO1
```

3> Press **P** or **C** to advance to the next prompt.

If the relay is currently assigned to the other alarm the following prompt appears.

```
ALARM 2 AT DO 1
REASSIGN>NO
```

4> The relay can be reassigned to the new function by changing the response to YES by using the arrow keys, and then pressing **E**.

If you reassign the relay, the other alarm is active but it will not activate any relay.

After confirming the relay selection, the meter prompts for the normal (unalarmed) state of the relay.

```
RELAY 1 STATE
>NORMALLY OPN    ^v
```

NORMALLY OPN is used if the contact is closed when the alarm is triggered.
NORMALLY CLS is used if the contact is opened when the alarm is triggered.

5> Use the arrow keys for your selection, and then press **E**.

You are prompted to select a trigger event that will activate the alarm.

```
ALARM 1 TRIGGER
>FLOW RATE       ^v
```

The available events are FLOW RATE, VELOCITY, TEMPERATURE, and GLOBAL EVENT.

- Selecting FLOW RATE, VELOCITY, or TEMPERATURE prompts you for a trip condition to activate the alarm. The trip condition can be LOW SETPOINT, HIGH SETPOINT, or LO AND HI SP.
- Select GLOBAL EVENT if the alarm will be triggered by any flow meter event.

6> Use the arrow keys for your selection, and then press **E**.

```
ALARM 1 TRIP
>LOW SETPOINT    ^v
```

The following examples show the prompts for the FLOW RATE low and high alarm set points.

```
LO ALARM SETPT
>0.0000000     SFPM
```

```
HI ALARM SETPT
>10000.0000    SFPM
```

7> Enter the set point value using the number and decimal keys, and then press **E**. Press **P** if you want to skip entering a value.

The Setup Relay Outputs menu appears.

Assigning a Pulse to a Relay

When a relay is configured to the Pulsed Output of Totalized Flow from the Setup Relay Outputs Menu (option 8), the meter advances to the Setup Pulsed Output menu.

The meter was not purchased with this option if the following prompt appears.

```
PULSE OUTPUT IS
NOT INSTALLED
```

You can perform a hardware check to see if this feature is available for your meter.

1> Press **E** to continue.

You are prompted to set the Totalizer Pulse Output function ON or OFF.

```
PULSE OUTPUT
>ON            ^v
```

2> Use the arrow keys to select ON, and then press **E**.

A prompt confirming the relay assignment appears.

```
PULSE OUTPUT #1
ASSIGNED TO DO1
```

3> Press **E** or **P** to continue.

A prompt for the Totalized Flow Per Pulse appears.

This value defines the accumulated flow per pulse, which is the units of volume or mass per pulse based on the system units. (The example uses English and standard cubic feet.)

```
SCF PER PULSE
>100000.000
```

4> Enter the value using the number and decimal keys, and then press **E**.

A prompt for the Pulse Width appears. This is the length of time to close the assigned relay after reaching the accumulated volume or mass.

```
PULSE WIDTH
>50          MSEC
```

5> Enter the number of milliseconds using the number keys, and then press **E**.
Press **P** if you want to skip entering a value.

The Setup Relay Outputs menu appears.

Assigning a Purge to a Relay

When a relay is configured to the Purge Output from the Setup Relay Outputs menu (option 8), the meter advances to the Setup Sensor Purge menu.

A prompt appears for the state of the PURGE TIMER.

```
PURGE TIMER
>ON            ^v
```

1> Use the arrow keys to select ON, and then press **E**.

A confirmation prompt for the relay assignment appears.

```
PURGE OUTPUT
ASSIGNED to DO2
```

2> Press **E** or **P** to continue.

A prompt for the PURGE TIME appears.

The PURGE TIME is the length of time the purge solenoid is held open.

```
PURGE TIME MSEC
>500
```

3> Enter the number of milliseconds using the number keys, and then press **E**.
A short blast generally works best.

The HOLD TIME prompt appears.

The HOLD TIME allows the sensor to recover from the purge by masking off the large flow spike following the purge. It can be a function of the purge gas temperature compared with the temperature of the process gas being measured. A longer HOLD TIME may be needed if there is a large temperature difference between these two variables. Lower flow rates typically need more recovery time than higher flow rates following a purge.

Note A cleaned sensor changes the flow readings following a purge regardless of the specified hold time. Additionally, the rate at which the shift occurs is filtered by the meter time constant setting.

The HOLD TIME applies to the update of the flow rate, velocity, and temperature values with respect to the 4-20mA output, Modbus output, and display.

The HOLD TIME is the total time for the entire purge cycle. For example, a HOLD TIME of 2000 milliseconds with a PURGE TIME of 500 milliseconds means that the Purge Relay will be pulsed for 500 milliseconds, followed by an additional 1500 milliseconds of idle time to allow for sensor recovery.

Note The HOLD TIME value must be greater than or equal to the PURGE TIME value.

```
HOLD TIME MSEC
>2000
```

4> Use the numeric keys and type in the number of milliseconds for the desired HOLD TIME, and then press **E**.

The PURGE INTERVAL prompt appears. The PURGE INTERVAL is used to set the frequency (in minutes) of the purge cycle when it is triggered by the internal timer. For example, a PURGE INTERVAL of 60 minutes will trigger one purge per hour.

If the internal timer and the external purge contact closure are used to start the purge, set the internal timer PURGE INTERVAL to a value higher than is specified by the external closure. This will prevent the internal timer from purging too soon after the last externally commanded purge.

```
PURGE INTV MIN
> 60
```

The PURGE INTERVAL can be from 1 to 1440 minutes.

5> Use the numeric keypad and type the number of minutes for the desired PURGE INTERVAL, and then press **E**.
Press **P** if you want to skip entering a value.

The Setup Relay Outputs menu appears.

Pulse Mode Totalizer Output

The totalized flow can be represented by a pulse output from one of the flow meter relay outputs. Once assigned to a relay output, each pulse will be an *X* millisecond contact closure (for example, 100 cubic feet per pulse or 1,000 pounds per pulse). The minimum pulse length is 50 ms and the maximum pulse rate is 8 Hz (8 pulses/second).

Note Pulse output cannot be used to measure rate because of the slow update rate (approximately every 50 milliseconds). Pulse rates require a changing frequency.

Assigning a Totalizer Pulse to a Relay

Before you can configure the totalizer pulse output, the function must be assigned to a relay.

To access the Relay Outputs Setup menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **8** for the Relay Outputs Setup menu, and then press **E**.

The menu prompts you for a relay number.

```
SELECT RELAY #
> 1
```

5> Press either **1** or **2**, and then press **E**.

The meter prompts you for a function to assign to the selected relay number. Relay #1 can be assigned to the ALARM OUTPUT and TOT PULSE OUT functions. Relay #2 can be assigned to the ALARM OUTPUT, TOT PULSE OUT, PURGE OUTPUT functions.

```
ASSIGN RELAY TO
>TOT PULSE OUT ^v
```

6> Use the arrow keys to select totalizer pulse output, and then press **E**.

Once a function is configured for the selected relay number, the meter will advance to the setup menu for that function.

The relay is being used by another active function if the following prompt appears:

```
RELAY IS USED
CHANGE IT>NO
```

7> The relay can be reassigned to the new function by changing the response to **YES** by using the arrow keys, and then pressing **E**.

The meter will reassign the relay to the new function. The previously assigned function is now unassigned and turned off, when applicable.

If the flow meter is configured with more than 1 relay output, the meter will repeat the sequence of prompts to configure the other relay output.

8> Press **H** to exit the Setup Relay Outputs menu.

The meter will advance to the Setup Pulsed Output menu.

Accessing the Totalizer Pulse Setup Menu

To access the Pulse Output Setup menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **11** for the Pulse Output Setup menu, and then press **E**.

The meter was not purchased with this option if the following prompt appears.

```
PULSE OUTPUT IS
NOT INSTALLED
```

You can perform a hardware check to see if this feature is available for your meter.

1> Press **E** to continue.

You are prompted to set the Totalizer Pulse Output function ON or OFF.

```
PULSE OUTPUT
>ON           ^v
```

2> Use the arrow keys to select **ON**, and then press **E**.

If the relay is being used, the following prompt appears (where x is either 1 or 2):

```
DO1 IS USED
CHANGE IT>NO
```

This prompt indicates that the relay is assigned to another function. If you do not want to make any changes, press **E** to accept the setting, **H** to back out of the prompt, or **P** to go to the main menu.

3> The relay can be reassigned to the new function by changing the response to **YES** by using the arrow keys, and then pressing **E**.

The meter will reassign the relay to the new function. The previously assigned function is now unassigned and turned off, when applicable.

Note If the relay is assigned to another function, you should go through the Relay Assignment menu so that a previous configuration is not inadvertently changed. See “Setting Relay Assignments” on page 2-18 for additional information.

When the pulse output is turned on, a prompt appears confirming the relay assignment.

```
PULSE OUTPUT #1
ASSIGNED TO DO1
```

4> Press **E** or **P** to continue.

A prompt for the Totalized Flow Per Pulse appears.

This value defines the accumulated flow per pulse, which is the units of volume or mass per pulse based on the system units. (In this example, each pulse represents 100,000 standard cubic feet.)

```
SCF PER PULSE
>100000.000
```

5> Enter the value using the number and decimal keys, and then press **E**.

A prompt for the Pulse Width appears. This is the length of time to close the assigned relay after reaching the accumulated volume or mass. The value of the pulse width can be between 50 to 2000 milliseconds.

```
PULSE WIDTH
>50          MSEC
```

6> Enter the number of milliseconds using the number keys, and then press **E**.
Press **P** if you want to skip entering a value.

Repeat the setup if there is a second pulse output.

Built-In Zero-Mid-Span Drift Check Calibration

Continuous Emissions Monitoring Systems (CEMS) require the verification of long-term stability. Most flow transmitter equipment is verified by calibrating a gas source substitute for the flue gas measured in the actual environment.

To report total lb/day or Kg/day of a particular pollutant, both the total flow and the concentration of the pollutant must be known. For the total process flow measurements, it is not practical to provide a 25% and 75% type flow signal simulation. The EPA accepted an electronics substitution signal representing a zero and span flow. This is performed as close to the front end of the flow meter as possible so the maximum amount of the signal processing chain can be checked for drift.

Configuring Independent Calibration for Drift Check

The B-Series has an independently calibrated voltage source that can be programmed from 0 to 3.3 V, which is used to drive the 4-20 mA output where 3.3 V is FS. This independent voltage source is programmable in its value for zero-mid-span check and for the duration of time spent holding at each value. The zero-mid-span function can be initiated as a sequence from an internal meter timer or an externally provided contact closure to one of the digital inputs. The meter also retains the recorded values from the previous test, which can be accessed through the meter's onboard menu system or through Modbus registers. The independent calibration is factory calibrated to better than 0.13% FS and can be used at any time to verify the proper calibration of the flow meter.

Important ***When the drift check is in-progress, the 4-20 mA output represents the percentage of full scale for which the drift check was configured, not the process flow reading or temperature.***

The amplitudes, duration, and trigger conditions are configured for the drift check feature. The configurable parameters are as follows:

- Auto drift check — ON or OFF of the internal timer only. No effect on Modbus or DI triggers.
- Interval time — xx hours (internal timer trigger only)
- Zero drift check value — % full scale (4-20 mA output current)
- Zero drift check duration — xx seconds
- Mid-span drift check value — % full scale (4-20 mA output current)
- Mid-span drift check duration — xx seconds
- Span drift check value — % full scale (4-20 mA output current)
- Span drift check duration — xx seconds

Setting Up Drift Check

This configuration is for the internal timer to initiate the Drift Check at a specified interval. It has no effect on triggering the Drift Check function from Modbus or the digital input.

To access the Drift Check Setup menu:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **23** for the Drift Check Setup menu, and then press **E**.

A prompt appears for setting automatic drift ON or OFF.

```
AUTO DRIFT
CHECK >ON ^v
```

5> Press the arrow keys to select ON or OFF, and then press **E**.

When AUTO DRIFT CHECK is ON, the prompt appears for the Drift Check Interval.

This parameter defines the periodic interval (in hours) that the drift check sequence will be initiated by the internal timer. The interval can be between 1 to 18000 hours. The factory default is 16 hours.

```
DRIFT CHK
INTRVL >16 HOUR
```

6> Use the numeric keys to enter a time value, and then press **E**.
Press **P** to skip to the prompt without making changes.

A series of prompts appear for each drift check test level (zero-mid-span) regarding the amplitude of the output signal and its duration.

The amplitude is given as a % of the FS of the independent voltage source (3.3V).
In the following example, 10.0% means that 0.33V (10% of 3.3V) will be applied to the 4-20 mA output for the drift check at zero.

```
% FS AT
ZERO >10.000
```

7> Use the numeric and decimal keys to enter the value, and then press **E**.

The prompt appears for specifying the duration. The duration is the time the 4-20 mA output is at the zero value before switching to the mid and span drift check prompts.

```
DURATION AT ZERO >60 SEC
```

8> Use the numeric to enter the time value, and then press **E**.
Press **P** to skip to the prompt without making changes.

The prompts repeat for the mid and span (full) drift checks.

```
% FS AT MID >50.000
DURATION AT MID >60 SEC
% FS AT SPAN >90.000
DURATION AT SPAN >60 SEC
```

9> Use the numeric and decimal keys to enter the % AT FS values, and then press **E**.

10> Use the numeric to enter the time value, and then press **E**.
Press **P** to skip to the prompt without making changes.

11> After completing all prompts, the main Program mode option entry prompt appears. Press **H** to return to Run mode.

Note The zero-mid-span drift check and sensor purge features can be configured to automatically trigger on a user-configured interval. If both features are ON and scheduled to run at the same time, the features will run consecutively, not concurrently.

Specifying Drift Check Triggers

There are four ways to initiate the zero-mid-span drift check.

- A specified time interval
- An external digital input
- A menu option in Extended Utilities mode
- A Modbus command

The duration of the individual zero, mid, or span checks are controlled by user-specified duration values.

Specified-Time Interval Drift Check

The zero-mid-span check can be triggered by the drift check interval time. To configure this option, turn ON the Auto Drift Check. When it is triggered, it will perform the zero, mid, and span sequence. Change the value of the drift check interval to change the frequency that the drift check starts. See step 6 under “Setting Up Drift Check” for information about setting up drift check.

External Digital Input

The external digital input trigger does not require that Auto Drift Check be turned ON. When the flow meter digital input (DI) channel #2 changes from high to low, the meter initiates the zero-mid-span drift check sequence. While the system is busy performing the drift check sequence, it will not accept another command via the digital input. After the drift check sequence completes, the meter monitors the DI channel for the next request to initiate a drift check.

If a specified time internal drift check is underway while an external drift check is triggered, the external drift check will start after the internal drift check completes.

Extended Utilities Mode Options

The Extended Utilities mode allows zero, mid, span, and all drift checks to be initiated using the flow meter user interface or from a remote terminal. You can also view the results from the last drift check test, which does not require that the Auto Drift Check be turned ON.

To access the drift options from the Extended Utility mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> The following table list the drift menu options. Use the number keys to make your selection, and then press **E**.

Table 2-4. Extended Utility Mode (Drift Options)

Option #	Function	Description
1	ZERO DRIFT	**Drift Check at Zero** (H) If YES, runs test and provides updated % Diff, VIN, and VOUT data. If NO, shows current % Diff, VIN, and VOUT data.
2	MIDSP DRIFT	**Drift Check at Mid-span** (H) If YES, runs test and provides updated % Diff, VIN, and VOUT data. If NO, shows current % Diff, VIN, and VOUT data.
3	FULLSP DRFT	**Drift Check at Full-span** (H) If YES, runs test and provides updated % Diff, VIN, and VOUT data. If NO, shows current % Diff, VIN, and VOUT data.
4	CYCLE DRIFT	**Drift Check Cycle (all tests)** (H) Consecutively performs the zero, mid, and span drift checks. If YES, runs test and provides updated % Diff, VIN, and VOUT data. If NO, shows current % Diff, VIN, and VOUT data.

The following example runs the zero drift check after entering Extended Utilities mode.

```
Enter UTL Option
1-5>1
```

1> Use the numeric keys to enter **1**, and then press **E**.

The prompt appears to confirm starting the drift check test.

```
ZERO DRIFT CHECK
START TEST> YES
```

2> Press the arrow keys to select **YES**, and then press **E**.

The display indicates that the test is running.

```
ZERO DRIFT CHECK
IS RUNNING...
```

When the test completes, the display shows the percent difference between the voltage input and voltage output for the zero drift check.

```
ZERO DRIFT CHECK
%DIFF = 1.091
```

After 3 seconds, the display shows the voltage input and output values used in the zero drift check.

```
Vin = 0.33000 V
Vout= 0.33360 V
```

Note If you select **NO** when prompted to start the drift check, the percent difference between voltage input/output and the voltage input/output values for the last drift check appear.

3> Press **E** or **C** to return to the Extended Utilities mode option prompt.

Modbus Protocol Write Coil Command

By writing a 1 to the specific Modbus coil, you can trigger a zero (#0), mid (#1), span (#2), and cycle all (#3, function code 05) drift check. Only one Modbus drift check start command can run at a time. This trigger does not require the Auto Drift Check to be ON. However, if the Auto Drift Check is ON and currently performing a drift check, the Modbus-triggered drift check will not start until the other drift check completes.

The following are the Modbus write coil commands:

- Modbus coil #0 — Triggers zero drift check
- Modbus coil #1 — Triggers mid drift check
- Modbus coil #2 — Triggers span drift check
- Modbus coil #3 — Triggers cycle all drift check (zero-mid-span sequence)
- Modbus coil #4 — Aborts any of the above states

Modbus Status Registers

Status registers are provided via Modbus (function code 01) to indicate whether zero, mid, and span checks are busy or idle.

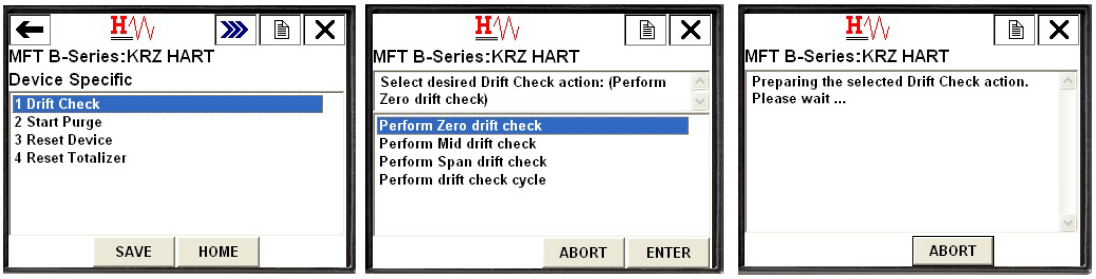
- Status register 0 — Status register for zero drift check, 0=idle or 1= busy
- Status register 1 — Status register for mid drift check, 0=idle or 1=busy
- Status register 2 — Status register for span drift check, 0=idle or 1=busy
- Status register 3 — Status register for cycle all check (zero-mid-span sequence) 0=idle or 1=busy
  While performing a cycle check, both the register 3 and the corresponding zero, mid, or span register are set to the current status (busy). When the cycle completes, the status returns to idle.

The status register bits are also used to report the diagnostic errors on the flow meter (function code 02). This permits fast status polling along with the principle variable polling.

A drift check triggered through Modbus is a bit or coil write command with status. The amplitude values (% 4-20 mA scale) and the duration (seconds) for each drift check are available as read and write registers. The results from a previous drift check (using volts measured from the 3.3 V programmable reference, not 4-20 mA range) and percentage change are also available as read registers.

HART Interface

Zero-mid-span drift checks can be initiated through the HART interface using a handheld communicator or a Windows-based HART host if the B-Series Device Descriptor (DD) is loaded into the HART host memory module. The following Drift Check menu examples are from an Emerson 475 handheld communicator.



Configuring the Built-In Flow Controller

The B-Series uses a manually configured, built-in flow controller based on a simple local flow control PID loop. This section describes setting up the flow control functions and information about feedback control systems.

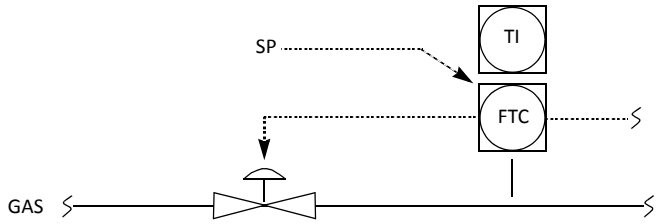
Table 2-5. Summary of flow controller capabilities

Capability	Description
Control output	4-20 mA positional signal. Fixed output position control for testing in program mode (% of AO range).
Set point register	Fix flow, menu programmed. Modbus write register.
Analog input set point	4-20 mA input, engineering units scaled.
Reference meter	Meter 1, flow rate.
PID	Manual gain setting. Normalized coefficients: P: gain I: time constant D: time constant

Setting Up the Flow Controller

A 4-20 mA output can be used as a position command signal for a control valve or motor drive RPM. To use the B-Series as an automatic flow controller, connect one of its 4-20 mA outputs to the control valve, damper, or motor controller. It will regulate the flow based on a fixed flow set point value or an analog input for the set point.

The following example has the B-Series flow meter actuating a valve based on an external set point of the flow rate. The second 4-20 mA output channel is sending the flow rate signal elsewhere, although temperature can be specified instead of flow rate. PID control of the process is manually configured. The control output can be controlled manually from the display to verify the range operation of the control loop or to manually set the output (control valve) at a fixed position.



Setting Up a PID

To setup a PID:

1> Mechanically mount all components, test for leaks, and check flow control actuator motion or motor controller action.

2> Electrically connect all components. Wire-in one of the 4-20 mA outputs. The default output of the FT device is for loop powered 4-20 mA. Refer to the device wiring diagram if you need it to be self-powered.

3> Configure the 4-20 mA output scale for the control device using velocity or flow rate units to determine the process flow units at the 4 mA output position and the 20 mA output position.

4> Configure the set point source for the:

- External analog input by configuring the 4-20 mA scale using appropriate engineering units.
- Internal set point using a flow rate or velocity value that will maintain the PID control variable (flow rate or velocity) at a fixed value. This set point can be changed at the meter keypad or using a Modbus command.

5> Tune the control loop for stable operation over the specified flow range.

Accessing the PID Data Menu

To set the PID in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **21** for the PID Data Setup menu, and then press **E**.

The following information appears if the feature was not purchased or was not available with the flow meter:

```
PID FUNCTION IS
NOT INSTALLED
```

You can perform a hardware check to see if this feature is available for your meter.

If the feature was included, a prompt appears to turn the PID function ON or OFF.

```
PID STATE
>ON            ^v
```

5> Press the arrow keys to change the response to YES, and then press **E**.

A prompt appears to make the PID mode of operation AUTOMATIC or MANUAL.

— AUTOMATIC is used for constant flow control that adjusts based on an external or internal set point.

— MANUAL is used for manual flow control using the PID Manual Control menu to set the PID control to a fixed position.

```
PID OPERATION
>MANUAL        ^v
```

6> Press the arrow keys to select the mode of operation, and then press **E**.

A prompt appears for the FLOW RATE or VELOCITY control variable.

— FLOW RATE is for volumetric and mass flow.

— VELOCITY is for flow velocity.

```
PID CONTROL TO
>FLOW RATE     ^v
```

7> Press the arrow keys to select the control variable, and then press **E**.

A prompt appears for the internal or external PID set point reference.

- INTERNAL is used when the PID variable is controlled with respect to an internal (internally stored in the meter's nonvolatile memory) set point value specified by the user.
- EXTERNAL is used when the PID variable is controlled with respect to a measured analog input.

```
PID SETPT REF
>INTERNAL      ^v
```

8> Press the arrow keys to select the PID set point reference, and then press **E**.

If you choose EXTERNAL, the external analog input channel must be assigned to the PID EXT. REF variable in option 20, External Input Setup, of Program mode.

If you choose INTERNAL, a prompt appears for the set point value. The PID SETPOINT uses the units specified in the PID CONTROL TO variable.

```
PID SETPOINT
>1234.5600   SCFM
```

9> Use the numeric and decimal keys to enter the PID set point value, and then press **E**.

The set point value can also be specified using Modbus command 0x06, register 44.

Prompts appear for the PID tuning parameters:

- Proportional gain
- Integral time constant
- Derivative time constant

The integral gain is the proportional gain divided by the integral time constant. The derivative gain is the proportional gain multiplied by the derivative time constant.

Linking the integral time constant with the proportional gain and linking the derivative time constant with the proportional gain makes it easier to manually tune the system.

```
PP GAIN (KP)
>0.300
```

```
INTEGRAL TC
>1.000        SEC
```

```
DERIVATIVE TC
>0.300        SEC
```

10> Use the numeric and decimal keys to enter the PID tuning parameters, and then press **E**. Press **P** to skip to the prompts without making changes.

A prompt appears for the PID low limit.

This output limit is the lowest flow rate or velocity (based on the CONTROL TO variable) set point that the meter will control. Refer to “Setting Up the PID 4-20 mA Control Output” for setting up the analog output. Output will saturate 10 percent below the specified value. The limit also prevents accumulation.

```
PID LOW LIMIT
>0.000        SCFM
```

11> Use the numeric and decimal keys to enter the PID low limit, and then press **E**. Press **P** to skip to the prompt without making changes.

A prompt appears for the PID high limit.

This output limit is the highest flow rate or velocity (based on the CONTROL TO variable) set point that the meter will control. Refer to “Setting Up the PID 4-20 mA Control Output”for setting up the analog output. Output will saturate 10 percent above the specified value. The limit also prevents accumulation.

```
PID HIGH LIMIT
>5000.00      SCFM
```

12> Use the numeric and decimal keys to enter the PID high limit, and then press **E**.

13> Press **E** or **P** to exit the PID Data Setup menu and return to the main Program mode prompt.

Setting Up the PID 4-20 mA Control Output

The PID control output is a 4-20 mA positional signal. It uses either one of the 4-20 mA analog outputs. An analog output (AO1 or AO2) must be configured to the PID output.

To set the analog output in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **5** for the Analog Output #1 Setup menu or **6** for the Analog Output #2 Setup menu, and then press **E**.

The following examples use Analog Output #2 as the PID output.

A prompt appears for selecting a function to assign to the analog output.

```
ANALOG OUT 2
>PID            ^v
```

5> Press the arrow keys to select PID, and then press **E**.

A prompt appears for setting the analog output signal at 4 mA.

This is the value of the controlled variable (flow rate or velocity) when the valve or damper is fully closed or the fan is OFF; this value is usually zero.

```
AO1 at 4mA
>0.00000000   SCFM
```

6> Use the numeric and decimal keys to enter the PID low limit, and then press **E**. Press **P** to skip to the prompt without making changes.

A prompt appears for setting the analog output signal at 20 mA.

This is the value of the controlled variable (flow rate or velocity) when the valve or damper is completely open or the fan is at full speed (controlled device).

```
AO1 at 20mA
>12345.678    SCFM
```

7> Use the numeric and decimal keys to enter the PID high limit, and then press **E**.

8> Press **E** or **P** to exit the Analog Output Setup menu and return to the main Program mode prompt.

Setting Up the External Input for PID Remote Reference

The PID is controlled from a set point reference that is defined as Internal or External. When the set point reference is Internal, the set point value you specify via the keypad or Modbus is stored in the flow meter. When the PID is controlled from an analog input (4-20 mA) signal, the PID set point reference is an External configuration.

To access the External Input Setup option in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **20** for the External Input Setup menu, and then press **E**.

The following information appears if the feature was not purchased or was not available with the flow meter:

```
EXTERNAL INPUT
IS NOT INSTALLED
```

You can perform a hardware check to see if this feature is available for your meter.

If the feature was included, a prompt appears to assign a function to the external analog input.

```
EXT. INPUT USAGE
>PID EXT. REF   ^v
```

5> Press the arrow keys to select PID EXT.REF, and then press **E**.
Press **P** to skip to the prompt without making changes.

You need to specify the 4-20 mA range of the external analog input by setting the 4 mA and 20 mA values.

The 4 mA value prompt sets the minimum value for the PID set point in flow rate or velocity units (determined when the PID was set up). The example uses the PID controlled variable as the flow rate.

```
INP VAL AT 4mA
>0.000000     SCFM
```

6> Use the numeric and decimal keys to enter the minimum PID set point, and then press **E**.
Press **P** to skip to the prompt without making changes.

The 20 mA value prompt sets the maximum value for the PID set point in flow rate or velocity units (determined when the PID was set up).

```
INP VAL AT 20mA
>0.000000     SCFM
```

7> Use the numeric and decimal keys to enter the maximum PID set point, and then press **E**.
Press **P** to skip to the prompt without making changes.

The prompt appears for the External Input digital filter time constant.

```
FILTER TC
>0.500         SEC
```

8> Use the numeric and decimal keys to enter the value, and then press **E**.
The default is 0.5 seconds.

9> Press **E** or **P** to exit the External Input Setup menu and return to the main Program mode prompt.

Determining the PID Control Mode

The PID controller can operate in Automatic or Manual mode. The PID operation is configured in Program mode using the Setup PID Data menu (option 21). See step 5 under “Accessing the PID Data Menu” for information about setting the PID control.

PID Control in Automatic Mode

Automatic mode starts a PID control action as soon as you specify the automatic setting. The flow rate or velocity is maintained to the PID set point value.

PID Control in Manual Mode

Note Before making changes in the Manual PID Control menu, the active state of PID must be turned ON and the Manual option enabled, as specified in “Accessing the PID Data Menu” (option 21).

The PID is under manual control if PID operation is in Manual mode and the PID state is ON. Under manual control, you adjust the PID output or 4-20 mA position signals.

To access the Manual PID Control menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **22** for the Manual PID Control menu, and then press **E**.

The following information appears if the feature was not purchased or was not available with the flow meter:

```
PID FUNCTION IS
NOT INSTALLED
```

You can perform a hardware check to see if this feature is available for your meter.

If the feature is installed, a prompt appears indicating the PID active state ON or OFF.

```
PID STATE IS OFF
NOT ACTIVE
```

To change the active state of PID from OFF to ON, go to the PID Data menu (option 21).

If Automatic mode is enabled, the following prompt appears.

```
PID IS AUTOMATIC
SET MANUAL MODE
```

To change the operation from Automatic to Manual, go to the PID Data menu (option 21).

When the flow meter is configured with the PID function, the PID state is ON, and PID operation is set to Manual, the following prompt appears.

```
OUT=   0 PERCENT
^=OPEN     v=CLOSE
```

5> Press the arrow keys to increase or decrease the output, and then press **E**.

- 100 percent is the maximum PID limit equivalent to the maximum output current is reached.
- 0 percent is the minimum PID limit equivalent to the minimum output current is reached.

Viewing the PID External Input Current

The External input current level is available in Display mode.

To view the External input current in Display mode:

1> Press **D**.

2> Press **2** to invoke the Quick Jump option.

3> Press **41** to view the External input current, and then press **E**.

The following information appears.

```
IN= XX.XXX       mA
AT YYYY.YY     SCFM
```

where:

XX.XXX value is the 4-20mA signal (current) read from the analog input.

YYYY.YY value is the equivalent PID reference (flow rate or velocity) at the XX.XXX current level.

The mapping of input current to flow rate or velocity is configured in the Set External Input Data menu.

4> Press **H** to exit the External input current and return to the main Display mode option entry prompt. Press **H** again to return to Run mode.

Manually Tuning A PID Loop

To manually tune a PID loop:

1> Place the unit in manual control mode or open loop control.

2> Increase or decrease the 4-20 mA output from 5 to 10 percent, and note the flow response change.

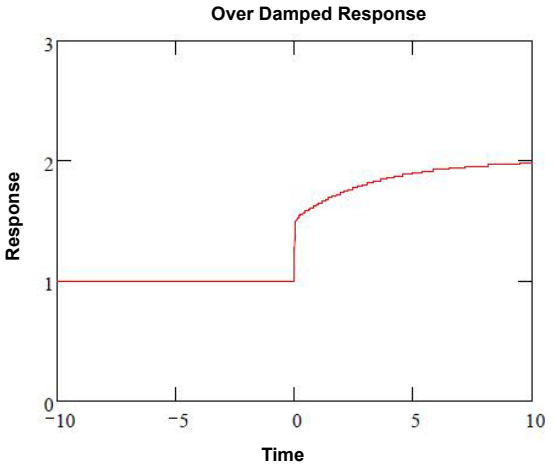
Then the Proportion Gain starting point is: 2 x output change (engineering units/flow response change) (this is a unit less number)

Note the system response time change (from 0 to 63 percent).

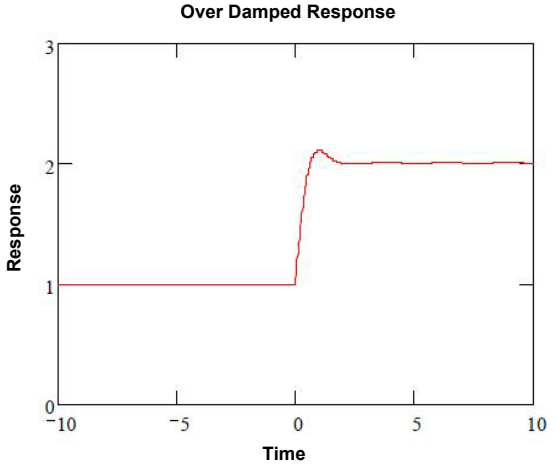
3> Set the Integral response time to this number.

4> Set the derivative time constant to 1/6 of the integral time.

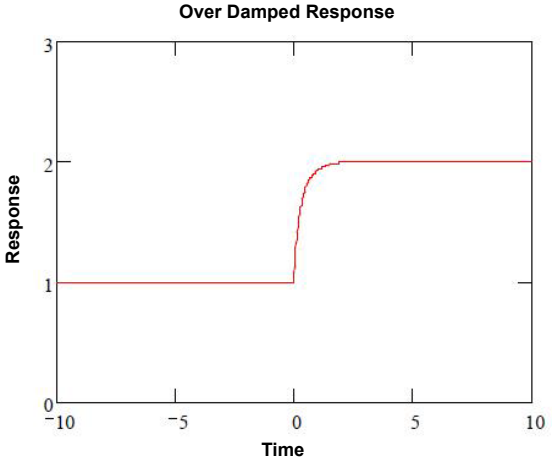
5> Place the flow meter in a closed loop or automatic operation. Make a small change to the set point and observe the reaction.



Increase the proportional gain and reduce the integral time constant.



Reduce the proportional gain and increase the integral time constant by the same percentage (such as 25 percent).



System tuned corre.ctly. Note the parameters.

Figure 2-2. Examples of system responses

6> Some flow meters require different parameters at different operating points. Rather than resetting the parameters multiple times, it is recommended that you optimally tune the flow meter at the normal flow rate and accept the less-than-optimal response at other flow rates. If the variation in loop stability is too large over normal operating flow ranges, then an advanced PID controller with variable gain settings is required to overcome the limitations of the built-in flow controller.

Changing the WGF Vapor Correction Factor

To access the WGF Parameters menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **27** for the WGF Parameters menu, and then press **E**.

```
PROCESS TMAX
>0.00000000 DEGF
```

This is the estimated maximum saturation temperature in the pipe. For a digester application, this will match the digester temperature (a typical digester operates at 100°F). If this value is set too high, it will overcorrect the wet-to-dry flow rate. The unit of measurement is either DegC or DegF. If the measure is zero (0), the dry flow rate value is assigned.

5> Press **E**.

```
PROCESS PRESSURE
>14.7000000 PSI
```

This is the pressure in the line where the flow is being measured. The unit of measurement is either kPA or PSI. If the measure is zero (0), the dry flow rate value is assigned.

6> Press **E** or **P** to exit the WGF Parameters menu.

The WGF vapor correction factor is also accessible through Modbus using function 03, holding registers 0x3b for WGF pressure and 0x3D for WGF Tmax. If you change WGF parameters via Modbus, you must also save the changes to EEPROM so the changes are saved if the flow meter is power cycled.

Setting Flow Meter Modbus Connectivity

For Modbus TCP/IP, enter the IP address of the Modbus TCP/IP device and the Modbus address of the device with which to communicate.

Table 2-6. Modbus Communication Parameters

Modbus RTU Communication Parameters	Modbus ASCII Communication Parameters
Baud rate — 9600	Baud rate — 9600
Data bits — 8	Data bits — 7
Parity — None	Parity — None
Stop bits — 1	Stop bits — 2
Flow control — None	Flow control — None
Default address — 1	Default address — 1

To access the Modbus Communications menu in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **19** for the Modbus Communication Setup menu, and then press **E**.

The menu prompts you for the flow meter device address.

```
DEV MODBUS ADDR
>1
```

The address can be in the from 1 to 247. The default address is **1**.

5> Press the numeric keys to enter the device address, and press then **E**.

The menu prompts you for the Modbus mode.

```
MODBUS MODE
>MODBUS ASCII ^v
```

The Modbus mode defines whether the master/slave device will communicate using the Modbus ASCII or Modbus RTU protocol. **Modbus RTU** is the default.

Note The B-Series Modbus setup for ASCII transmission framing is not supported by KzComm. If KzComm is to be used over Modbus, RTU transmission framing must be used.

6> Use the arrow keys to select either Modbus ASCII or Modbus RTU, and then press **E**.

The menu prompts you for the data transmission (baud) rate.

```
MODBUS BAUD RATE
>9600 BPS ^v
```

Slower rates (9600) are commonly used for longer distances between the device and the computer, while faster rates (57600) are for much shorter distances. The rates are 9600, 14400, 19200, 38400, and 57600. The default is 9600 BPS.

7> Use the arrow keys to select a data speed, and then press **E**.

The menu prompts you for the byte order of the Modbus registers.

```
REGISTER ORDER
>BYTE #12 34 ^v
```

This parameter ensures the Modbus Master correctly interprets the floating point data from the Modbus registers. There two options indicate the order of the Modbus registers when two registers are used for a device parameter.

- **BYTE #1 2 3 4** (the default) means that the low order byte is sent first, followed by the high order byte.
- BYTE # 3 4 1 2 means that the high order byte is sent first, followed by the low order byte.

8> Use the arrow keys to select a byte order, and then press **E**.

9> Press **E** or **P** to exit the Modbus Communication Setup menu.

Note If an issue occurs with reading floating point numbers, try changing the Register Order parameter.

Cleaning A Sensor

The velocity sensor was calibrated clean, and operating it clean preserves the best calibration. Any material that builds up on the thermal sensor can insulate it, causing it to lose less heat and read lower than when it was calibrated. Operating a dirty sensor that is field-calibrated with a correction factor for the proper flow rate tends to be unstable. After a process stops and cools down, the dirt buildup frequently flakes off. This causes the sensor to read higher when the process restarts. The absence of the insulating dirt causes the pre- and post-shutdown data from the same operating point to mismatch. This problem can be largely avoided by initiating an automatic cleaning system.

Using the Integrated Purge Controller

The B-Series is available for single-point or multi-point applications with a purge version that incorporates a purge control timer and data-hold function built into the flow transmitter. The cleaning sequence can be initiated from:

- Internal flow meter timer
- External contact closure
- Write Coil command via Modbus
- HART command

The Purge version of the flow meter provides an automated cleaning method to remove as much dirt buildup as possible using high velocity gas on the velocity sensor. This purge method is very effective at increasing the intervals between manual cleaning. In many cases it has altogether eliminated the need for manual cleaning, significantly reducing the cost of ownership.

The purge gas can be at ambient temperature or heated to the process temperature. The advantage of using heated purge gas is that it does not condense any of the process gas onto the sensor, which could cement the dirt onto the sensor instead of blowing it off.

Data is held during the Purge cycle. Implementing the internal timer with the cleaning control makes it easier to be independent of the process operation. The only verification for an active Purge cycle is querying a status register through Modbus (register 1XXXX - coil status #8). The meter's process variables (flow, velocity, and temperature) are held at their values prior to the start of the Purge cycle. Going from a dirty sensor to a clean sensor will show a spike in the flow rate and velocity after the Purge cycle completes. For applications that need tight control of the operation, the external contact closure offers the best results.

For example, the 454PFTB model is designed to directly drive a solenoid (up to 12 W at 24 VDC) to provide the compressed gas cleaning to the sensor. For the K-BAR 2000PB, only one of the sensor control boards needs to have the solenoid drive modifications. All units respond to the external trigger command at the same time and mask the purge blast from the output data.

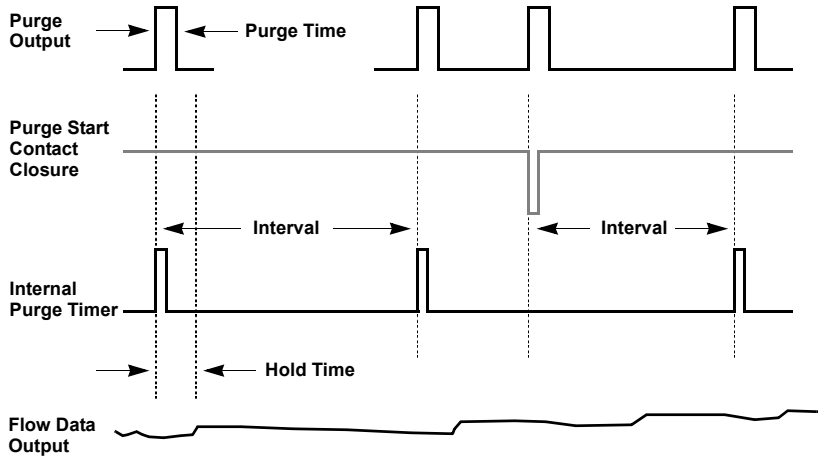


Figure 2-3. Masked purge blast

Wiring for the Purge Controller

The purge controller setup requires connecting a 24 VDC 12 W maximum solenoid to the DO2 or solid state relay channel #2. Pin # TB6-1 is +24 VDC and TB6-2 is the GND connection. See the field wiring diagram for an example of the solenoid wiring. The recommended wiring gage is 18 AWG (1.02 mm), although the gage and length are not critical for this connection.

> **Note** This wiring information only applies to the Purge version of model 454PFTB-16.

To activate the purge with an external contact closure, the contact closure is on pins TB6-8 or digital input 1 (DI1) and GND, TB6-5. The width of the activation pulse must be at least 25 ms long, and the purge will start on the leading edge (or falling from logic high to low).

Assigning a Relay to the Purge Function

To use the sensor purge cleaning feature of the meter, relay #2 must be assigned to PURGE OUTPUT.

To set the purge relay assignment in Program mode:

1> Press **P**.

2> Enter your advanced access password, and then press **E**.

3> Press **2** to invoke the Quick Jump option.

4> Press **8** for the Relay Output Setup menu, and then press **E**.

The meter will prompt for a relay number.

```
SELECT RELAY #
> 2
```

5> Press **2** and **E** to begin configuring Relay #2.

The meter prompts for a function to assign to Relay #2.

```
ASSIGN RELAY TO
>PURGE OUTPUT ^v
```

6> Use the arrow keys to change the selection to PURGE OUTPUT, and then press **E**.

Relay #2 is now assigned to the purge output function unless the following prompt indicates that Relay #2 is used by another function:

```
RELAY IS USED
CHANGE IT>NO
```

7> Press the arrow keys to change the response to YES, and then press **E**.

The meter will reassign Relay #2 to the PURGE OUT function. The previously assigned function is now unassigned and turned off, when applicable.

The user interface advances to the Setup Sensor Purge function (menu option 12).

Changing the Purge Controller Configuration

The first parameter in the Setup Sensor Purge menu turns the Purge Timer ON or OFF. When set to ON, the sensor purge cleaning sequence is initiated by an internal timer in the flow meter.

Note The PURGE TIMER does not need to be ON for the purge to be initiated via Modbus, HART, or the external contact closure.

```
PURGE TIMER
>ON ^v
```

1> Press the arrows keys to set the parameter to **ON**, and then press **E**.

If Relay #2 is used by another function, the following prompt appears:

```
DO2 IS USED
CHANGE IT>NO
```

2> Press the arrow keys to change the response to YES, and then press **E**.

The meter will reassign Relay #2 to the PURGE OUT function. The previously assigned function is now unassigned.

Note If Relay #2 was assigned to another function, you should go through the Relay Assignment menu so that a previous configuration is not inadvertently changed, as described in "Assigning a Relay to the Purge Function."

After the PURGE TIMER is turned on, the menu confirms the relay assignment with the following prompt:

```
PURGE OUTPUT
ASSIGNED to DO2
```

3> Press **E** or **P** to continue.

The PURGE TIME prompt appears. This is the length of time the purge solenoid is held open.

```
PURGE TIME
MSEC >500
```

4> Use the numeric keys and type in the number of milliseconds to hold the purge solenoid open during the purge, and then press **E**. (A short blast generally works best.)

The HOLD TIME prompt appears.

The HOLD TIME allows the sensor to recover from the purge by masking off the large flow spike following the purge. It can be a function of the purge gas temperature compared with the temperature of the process gas being measured. A longer HOLD TIME may be needed if there is a large temperature difference between these two variables. Following a purge, lower flow rates typically need more recovery time than higher flow rates.

Note A cleaned sensor changes the flow readings following a purge regardless of the specified hold time. Additionally, the rate at which the shift occurs is filtered by the meter time constant setting.

The HOLD TIME applies to the update of the flow rate, velocity, and temperature values with respect to the 4-20mA output, Modbus output, and display.

The HOLD TIME is the total time for the entire purge cycle. For example, a HOLD TIME of 2000 milliseconds with a PURGE TIME of 500 milliseconds means that the Purge Relay will be pulsed for 500 milliseconds, followed by an additional 1500 milliseconds of idle time to allow for sensor recovery.

Note The HOLD TIME value must be greater than or equal to the PURGE TIME value.

```
HOLD TIME MSEC
>2000
```

5> Use the numeric keys and type in the number of milliseconds for the desired HOLD TIME, and then press **E**.

The PURGE INTERVAL prompt appears. The PURGE INTERVAL is used to set the frequency (in minutes) of the purge cycle when it is triggered by the internal timer. For example, a PURGE INTERVAL of 60 minutes will trigger one purge per hour.

If the internal timer and the external purge contact closure are used to start the purge, set the internal timer PURGE INTERVAL to a value higher than is specified by the external closure. This will prevent the internal timer from purging too soon after the last externally commanded purge.

```
PURGE INTV MIN
> 60
```

The PURGE INTERVAL can be from 1 and 1440 minutes.

6> Use the numeric keypad and type the number of minutes for the desired PURGE INTERVAL, and then press **E**.

Operating and Monitoring Purge Cleaning Using Modbus

The purge sequence can be triggered by writing a 1 to the Modbus coil #8 (Register 0X). This operation does not require the purge timer to be ON; however, Relay #2 must be assigned to the PURGE OUT function. Once started, the Modbus purge operation ignores Program mode purge commands. The Modbus purge trigger is independent of the internal timer. For example, if the Program mode purge interval is configured for 60 minutes, any Modbus purge commands are performed without affecting the internal timer purge sequence.

The status of the purge via Modbus is provided at coil status #8, (Register 1X). A value of 1 indicates it is in the middle of a purge cycle, and a 0 indicates the cycle is idle.

Note An in-process purge sequence initiated through HART takes precedence over a purge sequence initiated through Modbus and causes the purge sequence initiated through Modbus to be ignored.

Operating and Monitoring Purge Cleaning Using HART

The parameters for setting up the purge sequence can be changed through the HART interface. Device-specific commands 137, 138, and 139 are used for the B-Series purge cleaning through the HART Master. The B-Series Field Device Specification describes the format of these commands. For HART Masters using the B-Series Device Descriptor (DD) files, the Purge Setup menu and purge method are available, as shown in Figure 2-4. Refer to the *HART Interface Guide* for information about the B-Series DD menu organization.

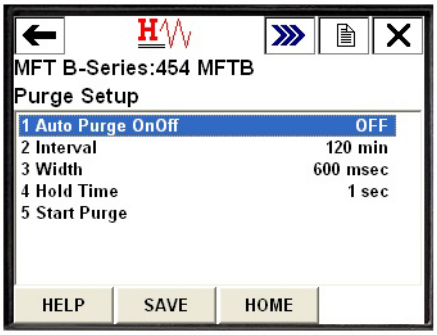


Figure 2-4. Hart Sensor Purge Setup menu

If the Purge Timer has been turned ON, the purge cycle initiated through the HART interface will not affect the purge sequence controlled by the internal timer.

Note An in-process purge sequence initiated through Modbus takes precedence over a purge sequence initiated through HART and causes the purge sequence initiated through HART to be ignored.

Automatically Triggering Drift Check and Purge

The Sensor Purge and the Drift Check zero, mid, and span parameters are two flow meter functions that can be configured to automatically trigger on a user configured interval. If both timers for these functions are turned ON and scheduled to initiate at the same time, the meter will run the activities consecutively (not concurrently).

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