Eldridge Products, Inc.

Master-Touch™

Thermal Gas Mass Flowmeters

Bi-Directional Configuration

INSTRUCTION MANUAL

Bi-Directional 2014 (Rev. 3)

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Section A Introduction and Installation

Introduction

Your bi-directional flowmeter includes two sets of flow sensing elements, temperature sensing elements, bridge amplifier/signal output boards, microprocessor circuit boards, transmitter enclosure, and probe support or flow section. These individual pieces are located in the flow transmitter and signal processor assembly (remote electronics). Additionally, the flowmeter's firmware is set up with two calibrated Meter Ranges. While operating as a bi-directional flowmeter, access to the firmware's menuing system is necessarily limited. If adjustments must be made to the calibrated ranges, the bi-directional functions must be disabled. After the adjustments have been completed, the Bi-directional operation must be enabled again. Please see *Section C* for instructions concerning this procedure.

Unpacking Your Instrument

Your Eldridge Products bi-directional thermal mass flowmeter is a precision piece of electronic flow instrumentation. Although these flowmeters are rugged, they should be inspected upon delivery to assure that no damage has taken place during transit. *If upon inspection it is found that damage has occurred, notify the carrier immediately and place a claim for damaged goods*. The shipping container or crate should be handled with care and carefully opened to avoid possible damage to the contents. After the container is opened the contents should be carefully removed and the individual pieces checked against the packing list. Please note that the packing list will show all of the options that were ordered for your instrument. Many, if not all, of those options will be incorporated into the flow meter itself and will not be separate components. The last verification is to check that the equipment and calibration range as shown on the flowmeter's documentation match your purchase order specifications. *If you discover a discrepancy or have any questions about what you have received, contact EPI immediately*.

Power Requirements

Please Note: The power requirements for bi-directional flowmeters with the "-DC24" option are user-supplied 18 to 24 Volts DC @ 500 mA.

Power requirements for bi-directional flowmeters with the "-AC115" option are 115 VAC 50/60 Hz standard, or 220 VAC 50/60 Hz with the "-AC230" option. If conduit is used to enclose the power input line, it should be suitable for the application, electrically conductive, and connected within the enclosure to the earth ground. Our recommendation on wire size is 18 Ga. stranded for all AC wiring.

All wiring and conduits shall be installed per the local requirements as appropriate for the application and conditions.

Installation and Mounting

Optimum installation requires sufficient straight run to allow a uniform, non-swirling, fully-developed flow profile within the flow conduit. The illustration at right is provided as a general guideline for minimum straight run requirements. *Depending upon the specific location details, more or less straight run may be required to produce a satisfactory flow profile.* It is best to avoid installations which are immediately downstream of bends, abrupt cross-sectional area increases or decreases, fans, louvers, or other equipment installed in the line. These situations can cause non-uniform flow profiles and swirl which can result in signal errors. Problematic flow profiles require flow conditioning to improve meter performance. Consult the factory for additional information.

Our insertion flowmeters are calibrated for the ANSI Point-of-Average-Flow (.243r) positioning in the process line with a fully-developed flow profile. You may need to make minor adjustments in the sensor position for best results in your process line. With either style of flowmeter, you may also need to utilize the C-Factor adjustments of the Master-Touch™ software for the most accurate flow readings due to a non-uniform flow profile in your process line.

Center-line calibration is available upon request.

The temperature parameters for the transmitter are listed in the specification section of this manual. Acceptable limits for the gas temperature and the environmental temperature limits to which the transmitter electronics may be subjected are also provided.

The flowmeter must be installed at a location where the gas is dry or above the dew point temperature. Installations which allow large droplets of water to condense out and come in contact with the sensing element must be avoided.

Installation of Insertion Flowmeters

The insertion style flowmeter requires the probe assembly to be inserted into the process gas flow conduit to allow the process gas to flow across the flow sensors. The insertion style flowmeter probe assembly may be inserted into any suitable flow section, pipe, or duct.

The Bi-Directional configuration has a 1" OD probes and may be installed with bored-through tube fittings to mount them in place. Tube fittings, with or without mounting flange, are available from the factory as an option. Installing the tube fitting consists of preparing the flow conduit to accept the fitting by first drilling a clearance hole for the transmitter probe assembly, welding it in place, or threading it into the proper size half coupling which has been welded to the flow conduit. The tube length must be specified upon ordering.

Optional ball valve assemblies are available through EPI which allow the removal of the insertion style flow transmitter assemblies for service, calibration, cleaning, etc. The valve provides a means to seal off leaks of the process gas at the point of insertion after the probe assembly has been removed. Installation requires fitting the flow section to which the insertion probe assembly will be inserted with a threaded half coupling of the proper size to accommodate the ball valve retractor. In some instances, this requires direct threading together (or with a reducing bushing) of the retractor assembly. In other cases, it requires welding the half coupling in place and drilling a clearance hole

through for the probe assembly. If the flow section is under pressure, a hot tap drill rig (not available through EPI) may be required.

The maximum pressure for insertion style flowmeters is stated in the General Specifications section of this manual. To reduce the possibility of personal injury when servicing the flowmeter, each size is rated such that the maximum force applied to the transmitter is approximately 25 pounds. Caution should be exercised if considering applying higher pressures, and AT HIGHER PRESSURES, A HOLDING DEVICE MAY BE REQUIRED TO PREVENT THE TRANSMITTER FROM BEING PROJECTED OUT OF THE PROCESS LINE WHEN REMOVING OR REPLACING THE TRANSMITTER ASSEMBLY.

Signal Interface

The microprocessor provides both 0–5 Volts DC and 4–20 mA flow output signals. Voltage signals should not be sent over long distances due to small currents causing voltage drops across the wire pair. If the voltage is to be sent over a distance (for example 50 feet), the wire AWG should be sized to reduce the voltage drop to acceptable levels. Knowing your load impedance is the only way this calculation may be achieved. Our 4–20 mA signal is provided to prevent this sort of signal loss. Current loops are normally not susceptible to noise and are not affected by voltage drops around the loop. However, it is important when using a current loop not to exceed the level of load resistance that the current loop may drive. Our current loop will drive a load (lead plus load resistance) of 500 ohms.

Section B General Operation

Sensor Theory and Operation

The bi-directional configuration includes two rugged, cleanable, thermal mass flow sensors consisting of two elements each. During operation, each temperature sensing element constantly measures the ambient temperature of the gas and maintains a reference resistance on one side of a Wheatstone bridge. The second element is forced through self-heating to a constant temperature above that of the gas stream and is controlled by the temperature sensor and our bridge circuitry. Our bridge is set up to maintain the overheat temperature and to counterbalance the temperature effects through our temperature compensation techniques.

Transmitter Operation

Since the sensor compensates for temperature changes and pressure effects are negligible, the heated sensor becomes a mass flow sensor. Gas mass flow across the heated sensor is measured by the thermal heat transfer (loss) of the sensor. As the gas velocity increases, more heat is transferred from the sensor to the gas stream. Gas molecules absorb heat while passing the heated sensor surface and thus more power is required of the sensor's drive circuit to maintain a constant sensor overheat temperature. This heat transfer is directly proportional to the mass velocity of the gas (density x velocity). The power demand of the flow transmitter is what we use as our non-linear mass flow or mass velocity transmitter signal. The sensors, bridge amplifier, enclosure, probe or flow conduit all form an integral flow transmitter assembly. Power is supplied to the flow transmitter by the user.

Signal Processor Operation

EPI's Master-Touch™ flowmeters incorporate the following subsystems to perform signal processing functions: sensor, bridge controller, microcomputer, and I/O communication outputs. Our proprietary microcomputer performs digital signal processing (DSP) functions utilizing a high speed, high resolution 16-bit analog to digital converter (ADC), a central processing unit (CPU) and a high resolution 14-bit digital to analog converter (DAC). Operations are performed in real time while supporting simultaneous full duplex RS232 and half-duplex RS485 communications.

Our CPU is an embedded microprocessor including random access memory (RAM), read-only memory (ROM), a serial communications controller (SCC), and I/O data lines. Peripheral CPU I/O subsystems include a real-time clock calendar (RTCC), an electrically erasable programmable read-only memory (EEPROM), lithium battery back up power, a two-line, 16 character dot matrix liquid crystal display (LCD) with programmable contrast, a 4-button keypad, and two high current relay channels with multifunction programmability. Voltage regulation and precision voltage referencing are also included.

The Master-Touch™ has a lithium battery with an operating life of >10 years. The battery is only used when no other input power is supplied. Therefore, the battery life is not consumed when a flowmeter is in use. Because it is soldered in place, it may only be replaced by the factory. The following list includes the data affected by a dead, damaged, or removed battery:

High Flow value
High Flow Time/Date
Low Flow value
Low Flow Time/Date
Totalizer value

Totalizer reset Time/Date
LCD contrast setting
Date format (MM/DD/YY; DD.MM.YY)
Real time clock time & date
Data Log pointer

All other values such as the flowmeter's serial number, the calibration coefficients, the full scale and maximum range settings, etc. are stored in the EEPROM and will not change due to power or battery status.

Section C Bi-Directional Controls and Functions

EPI considers the "normal" operational flow direction to be "Forward (Range 1)"; the opposite direction is "Reverse (Range 2)". The default factory set up is shown on Page G1. However, the probe assembly may be mounted in any direction necessary to match your requirement for flow direction.

Bi-directional flowmeters are shipped from the factory pre-set to operate in the bi-directional mode. As part of this this factory set up, it is assumed that Relay #1 will be wired for Normally Open. When the flowmeter is operating in Forward flow (Range #1), Relay #1 will be active (closed). When the flow direction changes, Relay #1 will be inactive (open) for Reverse flow (Range #2). This allows the flowmeter to indicate the gas flow direction based on the state of Relay #1.

Entering and Exiting Bi-Directional Mode

While operating in the bi-directional mode, access to the Master-Touch™ firmware menuing system is necessarily limited to whichever Range is currently active (1 or 2). If adjustments are necessary to either of the two stored Meter Range settings, EPI recommends that the bi-directional operation of the flowmeter be suspended.

The following procedure will allow the user to exit the bi-directional mode to make adjustments to the settings for each Meter Range, and to return to the bi-directional mode.

To exit the bi-directional mode, the settings must be unlocked:

```
1∞∞12.3456   SCFM
9876.54321    SCF
```

This is the basic **RUN MODE** screen display.

```
200 *Utility*
201-DAC Set
```

Press **MODE** two times to advance to the **200 *Meter*** menu. The display shown at left will appear. Using the **MIN** or **MAX** key, advance to Menu 219 – UnLock.

```
200 *Utility*  >
219-UnLock
```

Follow the step by step directions for unlocking the settings found on **Page D-1**. When unlocked, the display will have the symbol **>** in the upper right corner.

```
200 *Utility*  >
240-BiDir Mode
```

After entering the password and returning to the previous **219–UnLock** display, press **MAX** to advance to **Menu 240 – BiDir Mode**. Using the standard method for data entry, enter **0** to turn off the bi-directional mode.

The first Range accessible for changes will be whichever Range (1 or 2) was active when the process to exit the bi-directional operation was started. Use Menu 213–Set Meter to access the alternate Range, if necessary.

After suspending the bi-directional mode, the various microprocessor settings will be available for adjustments, per the instructions on the following pages. To return to bi-directional mode *with the settings still unlocked*, go to Menu 240 – BiDir Mode and enter **1**, then go to Run Mode (Menu 500 or 501). If the flowmeter is operating in the standard Run Mode, then follow the steps above but enter **1** in Menu 240 – BiDir Mode and go to Run Mode to return to bi-directional mode.

The Master-Touch™ LCD and Key Pad

Master-Touch™ flowmeters typically include a 2-line, 16-character LCD display and keypad to view and control the functions of the full menuing system. Each of the Menus and submenu items are accessible via the key pad, though many functions are more easily used with *EPICommunicator 2.0* software. The software and the instruction manual are available for downloading at no charge from our website, **www.epiflow.com**.

The illustration below shows the LCD Display when the flowmeter is in Run Mode:

Meter Range — indicates the active meter calibration range (1–4), an exclamation point (**!**) indicates that the flowmeter is operating with menu item 212–Track Hold selected, a box (□) indicates that the flow has exceeded the range of the 0–5VDC and 0–20mA output signals; a "D" indicates that the flowmeter is running the E-Log™ mode;

Relay Status — indicates status of Relays 1 and 2 (∞ = de-energized, * = energized);

Infrared Aperture — allows infrared communications with EPI's LightWIRE™ modules when the flowmeter has been ordered with this optional feature;

Current Flow Rate — indicates real-time flow rate;

Engineering Units — indicates currently selected engineering units for rate and total;

Elapsed Total — indicates real-time total flow since previous reset;

Key Pad — four-button key pad for accessing microprocessor settings.

Gas Temperature — Indicates the current and peak temperatures of the gas in degrees F or degrees C depending on the Engineering Units selected

The **SHIFT** key selects menu items for numeric entry, moves the active character position to the left when in numeric entry mode, and accepts or "enters" the specific numeric entry and returns the flowmeter to the selected menu item.

The **MODE** key scrolls the flowmeter through the modes, and moves the active character position to the right when in numeric entry mode.

The **MAX** and **MIN** keys work together to move "forward and backward" through the item menus and through the numeric entry characters:

_ . / - 0 1 2 3 4 5 6 7 8 9 e + : A P M

The flowmeter must be unlocked to make changes to the variable settings. The factory default value for menu item 219–UnLock is "9001". If the numeric entry mode is accessed while the flowmeter settings are still locked, the top line of the LCD display will show "METER LOCKED**" until you press the SHIFT key to exit the numeric entry mode.**

The following pages explain the LCD displays and the presentation of flow information. For step x step instructions to perform many of the most common adjustments to the flowmeter's settings, please see the following section.

100 *Meter* Menu

The 100 *Meter* Menu of the Master-Touch™ flowmeter includes a series of submenu items which allow you to easily change the engineering units for the flow rate and elapsed total, change the scaling of the 0–5VDC and 4–20mA output signals, and reset the stored values for elapsed total, high and low flow rates, timestamps, etc.

The flowmeter settings must be unlocked to change the engineering units, 4-20mA scaling or to reset the stored values (*see menu item 219–UnLock*).

```
1∞∞12.3456   SCFM
9876.54321    SCF
```

RUN MODE

```
100 *Meter*
101-SCFM
```

Press **MODE** one time to advance to the **100 *Meter*** menu. The display shown at left will appear. The top line will always show you that you are in the correct menu. The bottom line presents the specific submenu items.

The following list shows the submenus and assumes that you will use the MAX key to advance through the submenu items. You can use MIN key to go back to an item, or continue to use MAX until the desired submenu appears again.

100 *Meter* Submenus

101-SCFM	Standard Cubic Feet / Minute
102-SCFH	Standard Cubic Feet / Hour
103-LB/M	Pounds / Minute
104-LB/H	Pounds / Hour
105-SCIM	Standard Cubic Inches / Minute
106-SCIH	Standard Cubic Inches / Hour
107-	(unused)
108-LB/D	Pounds / Day
109-SFPM	Standard Feet / Minute
110-SFPS	Standard Feet / Second
111-BTUH	British Thermal Units / Hour
112-BTUD	British Thermal Units / Day

113-	(unused)
114-	(unused)
115-	(unused)
116-	(unused)
117-SLPM	Standard Liters / Minute
118-SCCM	Standard Cubic Centimeters / Minute
119-NCMH	Normal Cubic Meters / Hour
120-NCMM	Normal Cubic Meters / Minute
121-KG/M	Kilograms / Minute
122-KG/H	Kilograms / Hour
123-KG/S	Kilograms / Second
124-SLPH	Standard Liters / Hour
125-NMPS	Normal Meters / Second
126-NMPM	Normal Meters / Minute
127-NMPH	Normal Meters / Hour
128-SCMH	Standard Cubic Meters / Hour
129-NLPM	Normal Liters / Minute
130-NCCM	Normal Cubic Centimeters / Minute
131-NLPH	Normal Liters / Hour
132-	(unused)
140-FScale	This menu item is used to adjust the scaling of the 0 – 5VDC and 4 – 20mA output signals. This value cannot exceed the factory calibrated Maximum Range (*see Menu 814–MaxRange*).
160-Reset!	This menu item is used to reset the stored values for elapsed total flow, high and low flow rates, timestamps, etc.
	(blank)
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
400 *Alarms	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode* with full power down and restart. ***A Relay state — open or closed — may be may be affected by power down.***
501 *Run Mode*	Go to 500 *Run Mode* without full power down or restart.
700 *S-Curve Fit*	Go to 700 *S-Curve Fit* Menu
750 *PW-CurveFit*	Go to 750 *PW-CurveFit* Menu
800 *P-Curve Fit*	Go to 200 *P-Curve Fit* Menu
100 *Meter*	Go to 100 *Meter* Menu

200 *Utility* Menu

The 200 *Utility* Menu of the Master-Touch™ flowmeter includes a series of submenu items which allow you to easily change a wide variety of microprocessor parameters, such as the display update rate, the internal date and time, the analog-to-digital (ADC) and digital-to-analog (DAC) signal conversion filters, etc.

Although most settings are accessible by using the default user password of "9001", some of the parameters require a special password available only by contacting the factory. This has been instituted to prevent the accidental change of critical settings.

```
1∞∞12.3456   SCFM
9876.54321    SCF
```

RUN MODE

```
200 *Utility*
201-DAC Set
```

Press **MODE** two times to advance to the **200 *Utility*** menu. The display shown at left will appear. The top line will show you that you are in the correct menu. The bottom line presents the specific submenu items.

```
Actv Mtr#(1-4)
>1
```

When you select a submenu which supports data entry a brief description of the selected action will appear on the top line and the data entry field will appear on the bottom line. In the example at left, submenu 213-Set Meter has been selected and the flowmeter is displaying the active stored meter range.

The following list shows the submenus and assumes that you will use the MAX key to advance through the submenu items. You can use MIN key to go back to an item, or continue to use MAX until the desired submenu appears again.

200 *Utility* Submenus

201-	(unused)
202-DAC Time	This menu item is used to adjust the Digital-to-Analog converter (DAC) response time interval. The value entered here is multiplied by 50ms to establish the rate at which the DAC generates new output voltages. Acceptable values are 1 – 63.
203-DAC Filter	This menu item provides a smoothed DAC response to compensate for erratic input signals caused by flow fluctuations. Higher values result in greater dampening or smoothing; lower values result in a rapid response to changing signals from the internal curve linearizer. Acceptable values are 1 – 127.
204-DAC Readout	***This menu item requires the Diagnostic Password for access. Consult factory.***
205-ADC Filter	This menu item provides a smoothed Analog-to-Digital Converter (ADC) response to compensate for erratic input sensor signals caused by flow fluctuations. Higher values result in greater dampening or smoothing; lower values result in a rapid response to changing signals. Acceptable values are 1 – 255.
206-ADC Readout	***This menu item requires the Diagnostic Password for access. Consult factory.***

207-Disp Rate	This menu item adjusts the rate at which the rate and totalizer readouts are updated. It is often used to reduce the effect of a rapidly fluctuating flow rate on the LCD display. Any value less than 8 (ms) should be avoided because it will cause updates to the flow rate which will override the correct presentation of the total elapsed flow on the LCD display. ***This menu item only affects the totalizer and flow rate update period, not their accuracy, and does not affect the 0–5VDC or 4–20mA output signals.***
208-Disp Set	This menu item sets the LCD panel contrast value. A value of 128 should display digits at room temperature. Use the **SHIFT + MAX / MIN** keys during Run Mode to fine tune this setting if necessary.
210-Modbus Addr	This menu item sets the Modbus address for this flowmeter. A value of 0 disables Modbus protocol from the RS485 communications port and the data sent out the RS485 port is the same as the RS232 port. A value of 1-127 enables the Modbus protocol on the RS485 port and this number is also the flowmeter's Modbus address. See Modbus manual for more details.
211-Tracking On	This menu item restores the DAC and ADC tracking.
212-Track Hold	This menu item suspends the DAC and ADC tracking. ***This menu item requires the Diagnostic Password for access. Consult factory.***
213-Set Meter	This menu item is used to select the active meter range. All Master-Touch™ flowmeters are capable of storing configuration and parameter data for four separate meter ranges. A specific meter range is selected by entering 1–4 in this menu item. If a flowmeter has only one calibrated meter range, the factory will program it as meter range #1 and meter ranges #2–4 will not contain any valid variables. ***The flowmeter can also be set up to allow external switching between stored ranges by entering "0" at the prompt. However, EPICommunicator 2.0 software must be used for this function as it affects the use of the keypad for access to the menu system.***
214-Set Date	This menu item sets the time stamp functions to the current date for accurate reporting. The menu supports both MM/DD/YY and DD.MM.YY time formats where: • MM = month (01–12) • DD = day (01–31) • YY = year (00–99) Include a slash (/) as the delimiter between values for MM/DD/YY format, or a period (.) as the delimiter between values for DD.MM.YY format. The date will not be set if these formats are not followed exactly.
215-Set Time	This menu item sets the time stamp functions to the current time for accurate reporting. The time prompt indicates HH:MM:SS where: • HH = hour (00–23) • MM = minutes (00–59) • SS = seconds (00–59) • . (period) = AM /PM or 24 hour clock Include a colon (:) as the delimiter between values. The time will not be set if this format is not followed exactly. Example: 01:24:56P = 1:24:56 PM 13:24:56 = 1:24:56 PM displayed in 24 hour clock format.
216-No Curve Fit	This menu item suspends the factory P-Curve linearization. ***This menu item requires the Diagnostic Password for access. Consult factory.***

217-Curve Fit	This menu item selects the curve fit mode used by the microprocessor to generate the flow readings and output signals. The menu values are: 0 = NO = NO curve adjustment 1 = PO = Primary (factory) curve fit adjustment 2 = PS = Primary & Secondary curve fit adjustments 3 = PW = Primary & Pointwise curve fit adjustments
218-Reset Lock#	This menu allows the four digit numeric password to be changed. The flowmeter must be unlocked prior to accessing this menu item. All flowmeters are shipped with an initial password of 9001 unless otherwise specified at the time of purchase. The range of valid passwords is 9001–9999. ***If you set your own password, save it in a secure place to prevent loss and lockout from user variables.***
219-UnLock	This menu item is used to enter the pre-set four digit password that unlocks the flowmeter's settings. You can access any number of menu items while the settings are unlocked. The settings are locked again when the flowmeter is returned to Run Mode. ***See Page D-1 for detailed instructions on this menu item.***
220-Diagnostic P	This menu item is the factory password for certain menu items which should not ordinarily be accessed by users. These menu items include: 201–DAC Set 216–No Curve Fit 204–DAC Readout 801-812–CoeffTerm A-J (P-Curve coefficients) 206–ADC Readout 814–MaxRange 212–Tracking Off
221-SetCalDate	This menu item can be set to act as a reminder for periodic recalibrations. Enter the date of the next calibration reminder using the MM/DD/YY format, or enter a zero-zero (00) for either the month or day to disable the reminder.
222-Fix Decimal	This menu item controls the number of decimals shown in the flow rate display. Enter a value from zero to six (0 to 6), or enter an "A" for the automatic floating decimal. ***This setting does not affect the total elapsed flow display nor does it affect the accuracy of the flowmeter.***
223-Set WD Timer	This menu item allows the user to change the Watchdog (WD) timer "time-out" period. The factory default setting is 3 which equals 3 minutes. This timer is used to exit all menus after the time-out period. The MP will perform a reset similar to the power down/power up reset. The minimum allowable value is 1; the maximum allowable value is 120.
224-ProtocolOnOff	This menu item allows the flowmeter to use alternate communication protocols such as HART and Modbus. The factory default is Protocol Off (0); when HART, Modbus or other communication options are installed, the Protocol is On (1). Consult factory for supported protocols. ***When the Protocol is on (1) then EPIcommunicator's RS232 communication is disabled. You must use the flowmeter's keypad or an EPICom II handheld device to turn off the Protocol (0) which will enable the RS232 communications.***
225-Set RS232 Baud	This menu item adjusts the baud rate of the RS232 port. 0 = Factory Default (9600) 1 = 9600 2 = 14400 3 = 19200 4 = 28800 5 = 33400 6 = 56000 7 = 57600 8 = 115200 ***EPI's optional LightWIRE IR communication modules currently require an RS232 baud rate of 9600 and will not function correctly at other baud rates.***

226-Set RS485 Baud	This menu item adjusts the baud rate of the RS485 port. 0 = Factory Default (19200) 1 = 9600 2 = 14400 3 = 19200 4 = 28800 5 = 33400 6 = 56000 7 = 57600 8 = 115200 ***RS485 communications require an RS485-to-RS232 protocol converter for connecting the flowmeter to a PC running EPICommunicator or similar software.***
227-Flow 0-5,10	This menu item adjusts the Flow Output Voltage from either 0 to 5 or 0 to 10 Volts out: 0 = 0-5V Output;1 = 0-10V Output.
228-Temp 0-5,10	This menu item adjusts the Temperature Output Voltage from either 0 to 5 or 0 to 10 Volts out: 0 = 0-5V Output; 1 = 0-10V Output.
229-No LCD Disp	This menu item controls the microprocessor signal to the LCD: 0 = On, 1 = Off.
230-Temp Zero	This menu item sets the temperature value (°F) for the 0 VDC output. ***This value is always entered in °F. The temperature displayed will match the engineering units selected for the flow rate, either Imperial (English) or Metric. The factory default is 0°F. This setting does NOT affect the temperature compensation range for the process gas.***
231-Temp Span	This menu item sets the temperature value (°F) for the 5 VDC output. ***This value is always entered in °F. The temperature displayed will match the engineering units selected for the flow rate, either Imperial (English) or Metric. The factory default is 250°F. This setting does NOT affect the temperature compensation range for the process gas.***
232-No Display T	This menu item controls the temperature display: 0 = On, 1 = Off.
233-RS485Parity	This menu item adjusts the parity of the RS485 port. 0 = 1 8 NONE 1 1 = 1 8 EVEN 1 (Factory Default) 2 = 1 8 ODD 1 3 = 1 8 NONE 2
234-	(unused)
235-	(unused)
236-RestoreFact	Selecting this menu item immediately restores the original factory settings. ***Please note that this feature is inactive on the bi-directional configuration.***
237-SetPSWDMode	This menu item is available through EPI Communicator™ software.
240-BiDir Mode	This menu item controls the bi-directional mode: 0 = Off, 1 = On.
299-Cust PSWD	This menu item is used to access Menu 236 to restore the factory settings. Enter 1009 at the prompt.
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
300 *Status*	Go to 300 *Status* Menu
400 *Alarms	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode* with full power down and restart. ***A Relay state — open or closed — may be may be affected by power down.***
501 *Run Mode*	Go to 500 *Run Mode* without full power down or restart.
700 *S-Curve Fit*	Go to 700 *S-Curve Fit* Menu

750 *PW-CurveFit*	Go to 750 *PW-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

300 *Status* Menu

The 300 *Status* Menu of the Master-Touch™ flowmeter presents a series of menu items which allow you to rapidly get important information from the flowmeter.

The following directions assume your flowmeter is in Run Mode and will use the MAX key to advance through the menu items. You can use MIN key to go back to an item, or continue to use the MAX key until the desired item appears again.

```
1∞∞12.3456   SCFM
9876.54321    SCF
```

RUN MODE

```
300 *Status*
100 *Meter*
```

Press **MODE** three times to advance to the 300 *Status* menu. The display shown at the right will appear briefly. The top line will always show you that you are in the 300 *Status* menu. The second line presents the specific menu items.

```
300 *Status*
1> PO 4353 SCFM
```

The display will change automatically to the first Status menu item. The first character indicates which meter range is selected (1–4) or Tracking Off (!). The second and third characters indicate the selected curve fit mode (NO, PO, PS, PW). Each of the next four characters is the last digit of the currently selected condition for Ev1, Ev2, Ev3, and Ev4 (*see 400 *Alarm* section for details*). The final characters indicate the currently selected engineering units for the rate and total information.

```
300 *Status*
HV123.4567  SCFM
```

This display presents the highest flow value since the last start up or reset.

```
300 *Status*
HT=01:23:45PM
```

This display presents the time stamp for the highest flow value.

```
300 *Status*
HD=08/09/98
```

This display presents the date stamp for the highest flow value.

```
300 *Status*
LV=9.8765   SCFM
```

This display presents the lowest flow value since the last start up or reset.

```
300 *Status*
LT=05:43:21AM
```

This display presents the time stamp for the lowest flow value.

```
300 *Status*
LD=11/25/98
```

This display presents the date stamp for the lowest flow value.

```
300 *Status*
RT=10:23:45
```

This display presents the time stamp at which the totalizer was last reset to zero.

`300 *Status*` `RD=06/23/98`	This display presents the date stamp at which the totalizer was last reset to zero.
`300 *Status*` `12:34:56AM`	This display presents the real time clock.
`300 *Status*` `01/01/06`	This display presents the real time date.
`300 *Status*` `CT= 75F PT= 81F`	This display presents the current and peak temperatures of the process gas flow.
`300 *Status*` `BV=0.234  Volts`	This display is disabled in the bi-directional flowmeter.
`300 *Status*` `DAC =0.000 Volts`	This display is disabled in the bi-directional flowmeter.
`300 *Status*` `ADC =0.000 Volts`	This display is disabled in the bi-directional flowmeter.
`300 *Status*` `SN=12345678`	This display presents the unique serial number of the flowmeter.
`300 *Status*` `µP PCBA Rev =xx`	This display presents the microprocessor board revision number.

400 *Alarms* Menu

Alarm Relay Overview

Master-Touch™ flowmeters have two 1-amp SPDT relays that provide four relay Events (Ev1–Ev4):

- Relay 1 OFF (**Ev1**): the relay coil is de-energized with the Common and Normally Closed connected
- Relay 1 ON (**Ev2**): the relay coil is energized with the Common and Normally Open connected
- Relay 2 OFF (**Ev3**): the relay coil is de-energized with the Common and Normally Closed connected
- Relay 2 ON (**Ev4**): the relay coil is energized with the Common and Normally Open connected

These events can be used to activate other devices in response to a set of user-defined flow conditions, or to provide pulsed outputs based on the current flow rate or the elapsed flow total. There are eleven user-selectable conditions which will trigger an alarm relay response from a Master-Touch™ flowmeter. These response conditions are:

- **Trip High** — an alarm relay is triggered by a flow rate that is higher than the preset value;
- **Trip Low** — an alarm relay is triggered by a flow rate that is lower than the preset value;
- **MAX Key** — an alarm relay is reset by momentarily pressing the **MAX** key on the LCD panel;

- **MIN Key** — an alarm relay is reset by momentarily pressing the **MIN** key on the LCD panel;
- **Timer** — an alarm relay is triggered after a preset time delay value;
- **Total** — an alarm relay is triggered by an accumulated flow total that is higher than the preset value;
- **Pulse Output** — an alarm relay is triggered after an preset value of accumulated flow total;
- **ESD/EMI Rst** — an alarm relay is triggered by electromagnetic impulse noise.
- **Flow Hold 1 & 2** — the ADC input voltage is maintained at constant value, typically during gas purge cycle
- **Degrees High** — an alarm relay is triggered by a temperature that is higher than the preset value;
- **Degrees Low** — an alarm relay is triggered by a temperature that is lower than the preset value;
- **BiDir Relay** — an alarm relay is triggered by a flow rate in the preset direction.

The flowmeter settings must be unlocked to change the alarm relay parameters (*see menu item 219–UnLock*).

Alarm Programming

If Relay #1 is used to indicate flow direction, then only Relay #2 may be programmed for other relay Events, such as Trip High, Trip Low or Pulse Output.

The alarm relays only operate while the flowmeter is the Run Mode. To select and program alarm relay Events, use the 400 *Alarms* menu items. First, select the specific Event (Ev1–Ev4) in menu item **401–Set Event**. After selecting an Event, a condition is assigned (Timer, Max, etc.). With the exception of setting the **MAX** or **MIN** keys for manual operation or to **disable** an Event, each condition requires a numeric value to control the response. Depending upon the selected condition, these values refer to 50 millisecond (ms) increments or to the currently selected engineering units.

The flowmeter accepts settings for the Event until it returns to Run Mode, or until another Event is selected by returning to menu item 401. Therefore, if a mistake is made while setting the parameters for an Event, such as selecting Trip High instead of Trip Low, there is no need to undo the previous settings — simply select the correct menu item and continue entering the settings.

The following are examples of the steps required for a typical use of the alarm relays:

1) A Relay can be set for pulsed output by closing for a brief period to complete an energized circuit.

   To set Alarm Relay 2 to activate for each accumulated flow total of 100 SCF with a 100 millisecond pulse width:
   - Unlock the flowmeter settings and go to the **400 *Alarms*** menu;
   - Select menu item **401–Set Event**, then enter **3** at the prompt (3 = Ev 3, Relay 2 OFF);
   - Select menu item **407–Timer**, then enter **2** at prompt (2 x 50ms = 100ms);
   - Select menu item **401–Set Event**, then enter **4** at the prompt (4 = Ev 4, Relay 2 ON);
   - Select menu item **410–PulseOut**, then enter **100** (SCF) at menu prompt;
   - Select menu item **500 *Run Mode*** to lock the flowmeter and return to Run Mode.

2) While operating in the bi-directional mode, either of the Relays can be programmed to open or close based on the direction of the gas stream flow. (The factory default is Relay #1.) This function can be used to indicate the flow direction — the Relay will be active (closed) when the flow is moving in one direction, but inactive (open) when the flow is moving in the opposite direction. *This function must be programmed in both Ranges*.

   Assuming Relay #1 is wired to be Normally Open, then to set Alarm Relay 1 to activate

(Close) based on the flow direction of Range 1:

- Unlock the flowmeter settings, go to **Range 1** and then go to the **400 *Alarms*** menu;
- Select menu item **401–Set Event**, then enter **1** at the prompt;
- Select menu item **402–Disabled**;
- Select menu item **401–Set Event**, then enter **2** at the prompt;
- Select menu item **417–BiDir Relay**;
- Go to **Menu 213** to select **Range 2** and then go to the **400 *Alarms*** menu;
- Select menu item **401–Set Event**, then enter **1** at the prompt;
- Select menu item **417–BiDir Relay**;
- Select menu item **401–Set Event**, then enter **2** at the prompt;
- Select menu item **402–Disabled**.

If you are finished with any changes to the settings, go to Menu 240 – BiDir Mode and enter **1**, then go to Run Mode (Menu 500 or 501).

This programming matches the factory default. When operating in the bi-directional mode, Relay #1 will be active (closed) when the gas flow is in the Forward (Range 1) direction; Relay #1 will be inactive (open) when the gas flow is in the Reverse (Range 2) direction

```
1∞∞12.3456   SCFM
9876.54321    SCF
```

RUN MODE

```
400 *Alarms*
401-Set Event
```

Press **MODE** four times to advance to the **400 *Alarms*** menu. The display shown at left will appear. The top line will show you that you are in the correct menu. The bottom line presents the specific submenu items.

```
Event#(1-4)
>1
```

When you select a submenu which supports data entry a brief description of the selected action will appear on the top line and the data entry field will appear on the bottom line. In the example at left, submenu 401-Set Event has been selected and the flowmeter is displaying the Alarm.

The following list shows the submenus and assumes that you will use the MAX key to advance through the submenu items. You can use MIN key to go back to an item, or continue to use MAX until the desired submenu appears again.

400 *Alarms* Submenus

401-Set Event	This menu item selects the specific relay Event (Ev1–Ev4) to which a response condition is assigned.
402-Disabled	This menu item causes the current active Event to ignore all response conditions.
403-Trip High	This menu item sets the current active Event to respond to a flow rate that is higher than the preset value.
404-Trip Low	This menu item sets the current active Event to respond to a flow rate that is lower than the preset value.
405-Max Button	This menu item sets the current active Event to respond when the MAX key on the LCD panel is pressed or when Mode 1 is grounded.
406-Min Button	This menu item sets the current active Event to respond when the MIN key on the LCD panel is pressed or when Mode 2 is grounded.

407-Timer	This menu item sets current active Event to respond to a time duration, such as a pulsed output. Enter the desired preset duration value in units of 50ms.
408-	(unused)
409-Total	This menu item sets the current active Event to respond to an elapsed total. Enter the desired preset value in the current engineering units (whole numbers only – no decimals).
410-PulseOut	This menu item sets the current active Event to respond to an elapsed total. This function is used with remote data collection systems which count the pulses to generate an elapsed flow total. Enter a value to activate a relay for every X number of units on the totalized flow, i.e., every 1 unit, 12 units, 50 units, etc. Any whole number between 1 and 2,000,000 may be entered at the prompt (>), but we recommend decimal values (1, 10, 100, . . .). A timer function must be associated with this menu item to release the relay from the active state (*see menu item 407–Timer*). The timer must be set fast enough to release the relay before the next preset total value is reached.
411-Trip Delay	This menu item sets the response delay for the current active Event. Enter the desired value in increments of 50ms (20 = 1 second). The acceptable values are 1– 255.
412-ESD/EMI Rst	This menu item detects LCD errors caused by power supply noise or other electromagnetic interference. A value in increments of 50ms must be entered to determine the duration of such interference before the relay responds. A value of one (1) will cause a response to the shortest disturbance. Consult factory for additional information and a diagram of required wiring of input power to implement this function.
413-Flow Hold1	This menu item holds the ADC input value while Relay 1 Event 2 is on. When the value is set to one (1), it will hold the ADC input at its current value. A value of zero (0) will disable this feature.
414-Flow Hold2	This menu item holds the ADC input value while Relay 2 Event 4 is on. When the value is set to one (1), it will hold the ADC input at its current value. A value of zero (0) will disable this feature.
415-Degrees High	This menu item sets the current active Event to respond to a gas temperature that is higher than the preset value.
416-Degrees Low	This menu item sets the current active Event to respond to a gas temperature that is lower than the preset value.
417-BiDir Relay	This menu item sets the current active Event to respond to a flow rate that is lower than the preset value.
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
500 *Run Mode*	Go to 500 *Run Mode* with full power down and restart. ***A Relay state — open or closed — may be may be affected by power down.***

501 *Run Mode*	Go to 500 *Run Mode* without full power down or restart.
700 *S-Curve Fit*	Go to 700 *S-Curve Fit* Menu
750 *PW-CurveFit*	Go to 750 *PW-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

450 *E-Log* Menu

The Master-Touch™ 5.0 software supports the E-Log™ data logger module. The E-Log™ functions are accessible through the use of the 4-button keypad. Although data logging can be started and stopped at any time, the microprocessor settings must be unlocked using **Menu 219–UnLock** to make changes to the data logging options. The following list shows the submenus and their functions. Some titles may be truncated on the display due to the limitations of the 16 characters per line.

```
450 *E-Log*
451-Set StartDat
```

RUN MODE

451–Set StartDate	This menu item is used to set the date to start collecting the data snapshots. It uses the MM/DD/YY format.
452–Start Time(2)	This menu item is used to set the time to start collecting the data snapshots. It uses the HH:MM:SS format.
453–Set Stop Date	This menu item is used to set the date to stop collecting the data snapshots. It uses the MM/DD/YY format.
454–Stop Time(24)	This menu item is used to set the time to stop collecting the data snapshots. It uses the HH:MM:SS format.
455–Interval Time	This menu item is used to set the time interval for each data snapshot. It uses the HH:MM:SS format.
456–Option Date	This menu item is used to include the current date in the data snapshot. (0 = No; 1 = Yes)
457–Option Time	This menu item is used to include the current time in the data snapshot. (0 = No; 1 = Yes)
458–Option Flow	This menu item is used to include the current flow rate in the data snapshot. (0 = No; 1 = Yes)
459–Option Total	This menu item is used to include the current elapsed total in the data snapshot. (0 = No; 1 = Yes)
460–Option High	This menu item is used to include the highest flow rate in the data snapshot. (0 = No; 1 = Yes)
461–Option Low	This menu item is used to include the lowest flow rate in the data snapshot. (0 = No; 1 = Yes)
462–Option Relay	This menu item is used to include the status of Relay #1 in the data snapshot. (0 = No; 1 = Yes)

463—Option Relay	This menu item is used to include the status of Relay #2 in the data snapshot. (0 = No; 1 = Yes)
464—Start Elog No	This menu item is used to manually start collecting the data snapshots.
465—Stop Elog No	This menu item is used to manually stop collecting the data snapshots.
466—Start Timer	This menu item is used to start the internal timer for the programmed Start and Stop options (Menus 451 — 454) .
467—Display Setup	***This menu item is only for use with EPICommunicator software. The flowmeter will require a Restart if the Shift key is pressed while this submenu is shown on the display.***
468—	(unused)
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
500 *Run Mode*	Go to 500 *Run Mode* with full power down and restart. ***A Relay state — open or closed — may be may be affected by power down.***
501 *Run Mode*	Go to 500 *Run Mode* without full power down or restart.
700 *S-CurveFit*	Go to 700 *S-CurveFit* Menu
750 *PW-CurveFit*	Go to 750 *PW-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

700 *S-Curve Fit* Menu

The Master-Touch™ 5.0 software supports Secondary Curve (S-Curve) coefficients to modify the factory calibration. The S-Curve coefficients are based on a difference between the EPI flowmeter's readings and readings from another, or secondary, flow rate reference such as a pitot tube or other flow measurement device (*See Page-G2 for instructions*)

The flowmeter settings must be unlocked to change the S-Curve coefficients (*see menu item 219–UnLock*).

```
1∞∞12.3456   SCFM
9876.54321    SCF
```

RUN MODE

```
700 *S-Curve Fit
701-CoeffTerm A
```

Press **MODE** six times to advance to the **700 *S-Curve Fit*** menu. The display shown at left will appear. The top line will show you that you are in the correct menu. The bottom line presents the specific submenu items.

```
Term A Coeff
>0.000000e+00
```

When you select a submenu which supports data entry a brief description of the selected action will appear on the top line and the data entry field will appear on the bottom line. In the example at left, submenu 701-CoeffTermA has been selected and the flowmeter is displaying the current coefficient value.

The following list shows the submenus and assumes that you will use the MAX key to advance through the submenu items. You can use MIN key to go back to an item, or continue to use MAX until the desired submenu appears again.

700 *S-Curve Fit* Submenus

701-CoeffTermA	See Secondary Coefficient instructions.

through

710-CoeffTermJ	See Secondary Coefficient instructions
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
400 *Alarms	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode* with full power down and restart. ***A Relay state — open or closed — may be may be affected by power down.***
501 *Run Mode*	Go to 500 *Run Mode* without full power down or restart.
750 *PW-CurveFit*	Go to 750 *PW-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

750 *PW-Curve Fit* Menu

The Master-Touch™ 5.0 software supports Pointwise Curve (PW-Curve) adjustments to the linear output to correct for flow profile anomalies which may occur at different flow rates/velocities. The twenty PW-Curve menu items, 751 through 770, are used to assign multipliers to a segment of the linear output. Each segment is 5% of the linear range. Menu **751** adjusts the lowest segment, 0 to 5%; menu **752** adjusts the next segment, 5% to 10%, and so on. Menu **770** represents the highest segment, 95 to 100%. These multipliers are applied as necessary after the global C-Factor (see *menu **811–C-Factor***) has been applied. For example, a flow profile anomaly causes a reading which is 6% too low at 20 to 25% of the linear flow range.

- Unlock the flowmeter settings and go to the **750 *PW-Curve Fit*** menu;
- Select menu item **755**, then enter "**6**" at the prompt;
- Press the Max key to go to menu item **500 *Run Mode*;**
- Press the Shift key to return to Run Mode which will also relock the flowmeter settings.

It is recommended that adjustments be limited to values between +/- 10% of the flow reading. Larger adjustments may produce unwanted shifts at other segments.

```
1∞∞12.3456   SCFM
9876.54321    SCF
```

RUN MODE

```
750 *PW-CurveFit
751-Pointwise 5%
```

Press **MODE** seven times to advance to the **750 *PW-Curve Fit*** menu. The display shown at left will appear. The top line will show you that you are in the correct menu. The bottom line presents the specific submenu items.

```
Pt-Wise 5%
>0.000000
```

When you select a submenu which supports data entry a brief description of the selected action will appear on the top line and the data entry field will appear on the bottom line. In the example at left, submenu 751-Pointwise 5% has been selected and the flowmeter is displaying the current correction value for the first 5% of the calibrated flow range.

The following list shows the submenus and assumes that you will use the MAX key to advance through the submenu items. You can use MIN key to go back to an item, or continue to use MAX until the desired submenu appears again.

750 *PW-Curve Fit* Submenus

751-Pointwise 5%	This menu item is used to adjust the 0 – 5% segment of the flow range.
752-Pointwise 10	This menu item is used to adjust the 5 – 10% segment of the flow range.
753-Pointwise 15	This menu item is used to adjust the 10 – 15% segment of the flow range.
754-Pointwise 20	This menu item is used to adjust the 15 – 20% segment of the flow range.
755-Pointwise 25	This menu item is used to adjust the 20 – 25% segment of the flow range.
756-Pointwise 30	This menu item is used to adjust the 25 – 30% segment of the flow range.
757-Pointwise 35	This menu item is used to adjust the 30 – 35% segment of the flow range.
758-Pointwise 40	This menu item is used to adjust the 35 – 40% segment of the flow range.
759-Pointwise 45	This menu item is used to adjust the 40 – 45% segment of the flow range.
760-Pointwise 50	This menu item is used to adjust the 45 – 50% segment of the flow range.
761-Pointwise 55	This menu item is used to adjust the 50 – 55% segment of the flow range.
762-Pointwise 60	This menu item is used to adjust the 55 – 60% segment of the flow range.
763-Pointwise 65	This menu item is used to adjust the 60 – 65% segment of the flow range.
764-Pointwise 70	This menu item is used to adjust the 65 – 70% segment of the flow range.
765-Pointwise 75	This menu item is used to adjust the 70 – 75% segment of the flow range.
766-Pointwise 80	This menu item is used to adjust the 75 – 80% segment of the flow range.
767-Pointwise 85	This menu item is used to adjust the 80 – 85% segment of the flow range.
768-Pointwise 90	This menu item is used to adjust the 85 – 90% segment of the flow range.
769-Pointwise 95	This menu item is used to adjust the 90 – 95% segment of the flow range.
770-Pointwise 100	This menu item is used to adjust the 95 – 100% segment of the flow range.
780-All PW = 0%	This menu item is used to reset all segments to the factory default of zero (0).
	(blank)
100 *Meter*	Go to 100 *Meter* Menu

200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
400 *Alarms	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode* with full power down and restart. ***A Relay state — open or closed — may be may be affected by power down.***
501 *Run Mode*	Go to 500 *Run Mode* without full power down or restart.
700 *S-CurveFit*	Go to 700 *S-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

800 *P-Curve Fit* Menu

The Master-Touch™ 5.0 software stores the Primary Curve (P-Curve) coefficients which are generated by the factory NIST calibration, as well as the global C-Factor, process line cross-sectional area, etc.

Although most settings are accessible by using the default user password of "9001", some of the parameters require a special password available only by contacting the factory. This has been instituted to prevent the accidental change of critical settings. The P-Curve coefficients and MaxRange values should never be changed without direct factory instructions.

```
1∞∞12.3456   SCFM
9876.54321    SCF
```

RUN MODE

```
800 *P-Curve Fit
801-CoeffTerm A
```

Press **MODE** eight times to advance to the **800 *P-Curve Fit*** menu. The display shown at left will appear. The top line will show you that you are in the correct menu. The bottom line presents the specific submenu items.

```
Term A Coeff
>0.000000e+00
```

When you select a submenu which supports data entry a brief description of the selected action will appear on the top line and the data entry field will appear on the bottom line. In the example at left, submenu 801-CoeffTermA has been selected and the flowmeter is displaying the current coefficient value.

The following list shows the submenus and assumes that you will use the MAX key to advance through the submenu items. You can use MIN key to go back to an item, or continue to use MAX until the desired submenu appears again.

800 *P-Curve Fit* Submenus

801-CoeffTermA	Factory Calibration Coefficient.

through

810-CoeffTermJ	Factory Calibration Coefficient.

811-C Factor	This value is a multiplier used to adjust the P-Curve linearization. It is normally set to 1.0, but may be adjusted based the *Installation Guidelines*, or to correct for aberrations in sensor readings. The C Factor can also be used to change standard conditions (STP) or to apply a density factor (vapor density) when changing the engineering units from volumetric units (SCFM, NCMH, etc.) to gravimetric units (Lbs/Hr, Kg/Hr, etc.) in flowmeters calibrated for gases other than air.
812-Zero Offset	This voltage value is subtracted from the sensor curve linearizer to correct for minor sensor voltage errors. This ensures that zero flow is attained even though some bias voltage may exit which would otherwise prevent an absolute zero reading (*see also menu item 815–Auto Zero*).
813-SetXSect	This value is the cross-sectional area of the flow section or process line. The units of measure are determined by the engineering units selected (*see menu items 101–132*). For example, if the current engineering units are SCFM, then the menu item 813 value must represent square feet (F^2). A value of one (1) may be used if the current engineering units represent velocity (SFPM, NMPS, etc.) or if the flowmeter in an "inline" style with its own flow section.
814-MaxRange	This is the maximum value of the factory NIST calibration. The units of measure are determined by the engineering units selected (*see menu items 101–132*) and the value will change in response to changes to the engineering units. ***Requires Diagnostic Password for access. Consult factory.***
815-Auto Zero	This menu item automatically establishes a new Zero Offset (*see menu item 812–Zero Offset*). Entering a one (1) at the prompt changes the zero offset to the 0–5VDC output voltage of the flowmeter when the selection is made. This is particularly valuable for No Flow zeroing adjustments. Entering a zero (0) at the prompt leaves the existing zero offset value unchanged.
816-FlowCutoff	This menu item is used to set a percentage of the Maximum Range value (*menu item 814–MaxRange*) as the minimum readable flow rate. Actual flow rates below this minimum value will be treated as No Flow. The display will show "Low" instead of the real-time flow rate, no additional elapsed flow will be recorded, the 0–5VDC signal will drop to 0VDC, and the 4–20mA signal will drop to 4mA. For example, if the Maximum Range is 1000 SCFM, a value of 10 (10%) will cause the flowmeter to ignore flow rates below 100 SCFM or less. When the actual flow rate increases above this value, all of the flowmeter's functions will resume.
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
400 *Alarms	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode* with full power down and restart. ***A Relay state — open or closed — may be may be affected by power down.***
501 *Run Mode*	Go to 500 *Run Mode* without full power down or restart.
700 *S-CurveFit*	Go to 700 *S-CurveFit* Menu

750 *PW-Curve Fit*	Go to 750 *PW-Curve Fit* Menu

Section D Instructions for Specific Actions

Unlocking the Master-Touch™ — Menu Item 219–UnLock

Master-Touch™ bi-directional flowmeters are shipped from our factory with passkey protection for the variable settings to guard against unwanted or accidental changes. To make "permanent" changes, such as adjusting the Full Scale range or changing the engineering units, the flow averaging tube must be unlocked. Although menu item 219–UnLock can be accessed at any time, the flow averaging tube must be unlocked to make changes to the variable settings. If the numeric entry mode is accessed while the flow averaging tube settings are still locked, the top line of the LCD display will show "****METER LOCKED****" until you press the **SHIFT** key to exit the numeric entry mode:

```
**METER LOCKED**
>1200
```

You can change the passkey for your Master-Touch™ after the flow averaging tube is unlocked by entering a new passkey in menu item 218–Reset Lock. The acceptable range of possible numerical values is 9001–9999. However, EPI cannot recover user-defined passkeys. Therefore, if you set your own passkey code, you should note it in a secure location to prevent loss and lockout from access to the variable settings.

The following directions assume your flow averaging tube is in Run Mode.

Start	**RUN MODE**	`1∞∞12.3456  SCFM` `9876.54321  SCF`
Step 1	Press **MODE** twice to advance to the 200 *Utility* menu.	`200 *Utility*` `201–DAC Set`
Step 2	Press **MAX** or **MIN** to advance to the 200 *Utility* menu item 219–UnLock.	`200 *Utility*` `219–UnLock`
Step 3	Press **SHIFT** to access the numeric entry mode. The blinking character is the active digit. Use **MAX** or **MIN** to change the numerical value.	`Code#(9xxx)` `>9---`
Step 4	Press **MODE** to move the active digit to the right to change the numerical value of the other digits.	`Code#(9xxx)` `>90--`
Step 5	Complete the entry of the passkey (*default factory passkey is 9001*).	`Code#(9xxx)` `>9001`
Step 6	Press **SHIFT** to move active digit to the left until the meter returns to menu item 219–UnLock. The meter is unlocked as indicated by a ">" in the upper right corner of the LCD display.	`200 *Utility*  >` `219–UnLock`

Step 7 Press **MAX** or **MIN** to advance to other 200 *Utility* menu items or **MODE** to advance to other mode menus.

```
200 *Utility*  >
400 *Alarms*
```

DO NOT return to RUN MODE —
this will automatically LOCK the meter.

Selecting the Engineering Units — Menu Items 101–132

Master-Touch™ bi-directional flowmeters allow you to choose from a variety of engineering units to measure the flow rate and elapsed total. The menu items 101 through 132 have been designated for this purpose, though not all items are currently assigned. Please note that changing the engineering units from SCFM, NCMH, etc. to Lb/H, Kg/H, etc. requires factory assistance for all gases other than air.

The following directions assume that you have just unlocked the flow averaging tube. However, the 100 *Meter* menu can be accessed directly from the other mode menus by pressing MODE until it is shown on the LCD display and then pressing SHIFT.

Start — **Menu item 219–UnLock**

```
200 *Utility*  >
219-UnLock
```

Step 1 — Press **MAX** twice to advance to the 200 *Utility* menu item 100 *Meter*.

```
200 *Utility*  >
100 *Meter*
```

Step 2 — Press **SHIFT** to advance to the 100 *Utility* menu.

```
100 *Meter*    >
101-SCFM
```

Step 3 — Press **MAX** or **MIN** to advance to the 100 *Utility* menu item of the engineering unit you desire. Press **SHIFT** to select the engineering unit.

```
100 *Meter*    >
119-NCMH
```

NOTE — **<u>DO NOT select any blank menu item</u> — this will cause a failure and the flow averaging tube will need to be powered down and powered up again.**

```
100 *Meter*    >
107-
```

Step 4a — <u>If further adjustments are required</u>, press **MAX** or **MIN** to advance to other 100 *Meter* menu items or **MODE** to advance to other main menus.

```
100 *Meter*    >
800 *Factory*
```

DO NOT return to RUN MODE —
this will automatically LOCK the meter.

Step 4b — <u>If no further adjustments are required</u>, press **MAX** to advance to the 500 *Run Mode* menu item, then press **SHIFT** to lock the flow averaging tube and to return to Run Mode.

```
100 *Meter*    >
500 *Run Mode*
```

Changing the Full Scale range — Menu Item 140–FScale

Master-Touch™ bi-directional flowmeters allow you to set the Full Scale range to any value less than or equal to the calibrated MaxRange value. For example, if the factory calibration set your Full Scale to 5,000 SCFM and the MaxRange at 6,000 SCFM, the Full Scale can be set as high as 6,000 SCFM or as low as practical for your application. Adjustments to this setting scale the 0–5VDC and 4–20mA output signals to the new Full Scale range.

The following directions assume that you have just unlocked the flow averaging tube. However, the 100 *Meter* menu can be accessed directly from the other mode menus by pressing MODE until it is shown on the LCD display and then pressing SHIFT.

Start	**Menu item 219–UnLock**	`200 *Utility* >` `219–UnLock`
Step 1	Press **MAX** twice to advance to the 200 *Utility* menu item 100 *Meter*.	`200 *Utility* >` `100 *Meter*`
Step 2	Press **SHIFT** to advance to the 100 *Utility* menu.	`100 *Meter* >` `101–SCFM`
Step 3	Press **MAX** or **MIN** to advance to the 100 *Utility* menu item 140–FScale.	`100 *Meter* >` `140–FScale`
Step 4	Press **SHIFT** to access the numeric entry mode.	`Set Full Scale >` `>5000`
Step 5	The blinking character is the active digit. Use **MAX** or **MIN** to change the numerical value. Use **MODE** to move the active digit to the right and complete the entry of the new Full Scale value.	`Set Full Scale >` `>4500`
Step 6	Press **SHIFT** to move active digit to the left until the meter returns to menu item 140–FScale. The Full Scale setting is now changed.	`100 *Meter* >` `140–FScale`
Step 7a	<u>If further adjustments are required</u>, press **MAX** or **MIN** to advance to other 100 *Meter* menu items or **MODE** to advance to other main menus. **DO NOT return to RUN MODE — this will automatically LOCK the meter.**	`100 *Meter* >` `800 *Factory*`
Step 7b	<u>If no further adjustments are required</u>, press **MAX** four times to advance to the 500 *Run Mode* menu item, then press **SHIFT** to lock the flow averaging tube and to return to Run Mode.	`100 *Meter* >` `500 *Run Mode*`

Resetting the Flow Rate and Flow Total — Menu Item 160–Reset!

Master-Touch™ bi-directional flowmeters allow you to reset the flow rate and elapsed flow totals to zero at any time. The flow averaging tube must be unlocked for reset these values.

The following directions assume that you are in Run Mode. However, the 100 *Meter* menu can be accessed directly from the other mode menus by pressing MODE until it is shown on the LCD display and then pressing SHIFT.

Start	**Menu item 219–UnLock**	`200 *Utility* >` `219–UnLock`
Step 1	Press **MAX** four times to advance to the 200 *Utility* menu item 100 *Meter*.	`200 *Utility* >` `100 *Meter*`
Step 2	Press **SHIFT** to advance to the 100 *Utility* menu.	`100 *Meter* >` `101–SCFM`
Step 3	Press **MAX** or **MIN** to advance to the 100 *Utility* menu item 160–Reset!. Press **SHIFT** to reset the values to zero. The flow averaging tube will automatically return to Run Mode within 1–2 seconds.	`100 *Meter*` `160–Reset!`

Adjusting the Display Rate — Menu Item 207–Disp Rate

Master-Touch™ bi-directional flowmeters allow you to adjust the rate at which the rate and totalizer readouts are updated. This feature is often used to reduce the effect of a rapidly fluctuating flow rate on the LCD display. Values of 20–40 are typically used for this function. The PC terminal and LCD panel receive data in 50 milliseconds intervals — a value of 1 will output data every 50ms; a value of 100 will update the output data every 5000ms (5 seconds). This menu item only affects the totalizer and flow rate update period, not their accuracy.

The following directions assume that you have just unlocked the flow averaging tube. However, the 200 *Utility* menu can be accessed directly from the other mode menus by pressing MODE until it is shown on the LCD display and then pressing SHIFT.

Start — **Menu item 219–UnLock:**

```
200 *Utility*  >
219-UnLock
```

Step 1 — Press **MAX** or **MIN** to advance to the 200 *Utility* menu item 207–Disp Rate.

```
200 *Utility*  >
207-Disp Rate
```

Step 2 — Press **SHIFT** to access the numeric entry mode.

```
Disp Updt Rate >
>1
```

Step 3 — The blinking character is the active digit. Use **MAX** or **MIN** to change the numerical value. Use **MODE** to move the active digit to the right and complete the entry of the display update rate.

```
Disp Updt Rate >
>1
```

Step 4 — Press **SHIFT** to move active digit to the left until the meter returns to menu item 207–Disp Rate. The display update rate is now changed.

```
200 *Utility*  >
207-Disp Rate
```

Step 5a — <u>If further adjustments are required</u>, press **MAX** or **MIN** to advance to other 200 *Utility* menu items or **MODE** to advance to other main menus.

```
200 *Utility*  >
201 DAC Set
```

DO NOT return to RUN MODE —
this will automatically LOCK the meter.

Step 5b — <u>If no further adjustments are required</u>, press **MAX** or **MIN** to advance to the 500 *Run Mode* menu item, then press **SHIFT** to lock the flow averaging tube and to return to Run Mode.

```
200 *Utility*  >
500 *Run Mode*
```

Adjusting the LCD Display Contrast — Menu Item 208–Disp Set

Master-Touch™ bi-directional flowmeters allow you to adjust the LCD contrast value in menu item 208–Disp Set. The factory default value is 128. This setting should display all digits clearly at room temperature. Colder temperatures may darken the display; warmer temperatures may lighten it. Values lower than 128 lighten the display; values greater than 128 darken the display (the contrast can also be adjusted in Run Mode by pressing SHIFT+MAX to darken the display or SHIFT+MIN to lighten the display).

The following directions assume that you have just unlocked the flow averaging tube. However, the 200 *Utility* menu can be accessed directly from the other mode menus by pressing MODE until it is shown on the LCD display and then pressing SHIFT.

Start	**Menu item 219–UnLock:**	`200 *Utility*  >` `219–UnLock`
Step 1	Press **MAX** or **MIN** to advance to the 200 *Utility* menu item 208–Disp Set.	`200 *Utility*  >` `208–Disp Set`
Step 2	Press **SHIFT** to access the numeric entry mode.	`Contrast(1–200)>` `>128`
Step 3	The blinking character is the active digit. Use **MAX** or **MIN** to change the numerical value. Use **MODE** to move the active digit to the right and complete the entry of the display contrast.	`Contrast(1–200)>` `>145`
Step 4	Press **SHIFT** to move active digit to the left until the meter returns to menu item 208–Disp Set. The display contrast is now changed.	`200 *Utility*  >` `208–Disp Set`
Step 5a	<u>If further adjustments are required</u>, press **MAX** or **MIN** to advance to other 200 *Utility* menu items or **MODE** to advance to other main menus. **DO NOT return to RUN MODE — this will automatically LOCK the meter.**	`200 *Utility*  >` `201 DAC Set`
Step 5b	<u>If no further adjustments are required</u>, press **MAX** or **MIN** to advance to the 500 *Run Mode* menu item, then press **SHIFT** to lock the flow averaging tube and to return to Run Mode.	`200 *Utility*  >` `500 *Run Mode*`

Changing the Meter Range — Menu Item 213–Set Meter

Master-Touch™ bi-directional flowmeters can store settings for up to four separate calibration curves, or meter ranges. Each meter range will have its own settings for Full Scale, MaxRange, coefficient terms, etc. If your flow averaging tube has a single calibration curve, these values are set up as Meter 1. If your flow averaging tube has additional calibration curves, you can use menu item 213–Set Meter to select the other meter ranges (2–4). Only one meter range is active at a time.

Menu item 213–Set Meter is also used to switch the flow averaging tube to External Mode. This mode allows you to switch between active meter ranges via an external switch (please see the MP Wiring diagrams for the proper electrical connections). To go to External Mode, enter zero (0) as the value for menu item 213–Set Meter.

The following directions assume that you have just unlocked the flow averaging tube. However, the 200 *Utility* menu can be accessed directly from the other mode menus by pressing MODE until it is shown on the LCD display and then pressing SHIFT.

Start	**Menu item 219–UnLock:**	`200 *Utility*  >` `219-UnLock`
Step 1	Press **MAX** or **MIN** to advance to the 200 *Utility* menu item 213–Set Meter.	`200 *Utility*  >` `213-Set Meter`
Step 2	Press **SHIFT** to access the numeric entry mode.	`Actv Mtr#(1-4) >` `>1`
Step 3	The blinking character is the active digit. Use **MAX** or **MIN** to enter a number from **1** to **4** to select the new active meter range, or **0** to switch to External Mode.	`Actv Mtr#(1-4) >` `>3`
Step 4	Press **SHIFT** to move active digit to the left to return to menu item 213–Set Meter.	`200 *Utility*  >` `213-Set Meter`
Step 5	**The meter will now restart and return to RUN MODE using the newly selected meter range settings.**	`1∞∞12.3456  SCFM` `9876.54321  SCF`

Setting the Alarms — Menu Items 401–409

Master-Touch™ bi-directional flowmeters allow you to set two alarm relay events. These events can be used to activate other devices in response to user-defined flow conditions, or to provide pulsed outputs based on flow rate or flow total. Please see the EPITerm section of the Instruction Manual for a complete discussion of the alarm relay events.

The example below shows how to set Alarm Relay 1 to activate when flow rate exceeds 120 SCFM (when SCFM are current engineering units), then auto-reset Alarm Relay 1 after 10 seconds. The directions assume that you have just unlocked the flow averaging tube. However, the 400 *Alarms* menu can be accessed directly from the other mode menus by pressing MODE until it is shown on the LCD display and then pressing SHIFT.

Start	**Menu item 219–UnLock:**	`200 *Utility* >` `219–UnLock`
Step 1	Press **MAX** three times to advance to the 200 *Utility* menu item 400 *Alarms*.	`200 *Utility* >` `400 *Alarms*`
Step 2	Press **SHIFT** to advance to the 400 *Alarms* menu.	`400 *Alarms* >` `401–Set Event`
Step 3	Press **SHIFT** to access the numeric entry mode for menu item 401–Set Event. The blinking character is the active digit. Press **MAX** or **MIN** to select (Event#) **1**.	`Event#(1-4) >` `>1`
Step 4	Press **SHIFT** to return to menu item 401–Set Event.	`400 *Alarms* >` `401–Set Event`
Step 5	Press **MAX** to advance to menu item 407–Timer.	`400 *Alarms* >` `407–Timer`
Step 6	Press **SHIFT** to access the numeric entry mode for menu item 407–Timer. The blinking character is the active digit. Use **MAX** or **MIN** to change the numerical value. Use **MODE** to move the active digit to the right and complete the entry (200 x 50ms = 10s).	`Duration*50ms >` `>200`
Step 7	Press **SHIFT** to move active digit to the left until the meter returns to menu item 407–Timer. The timer function is now set for 10 seconds.	`400 *Alarms* >` `407–Timer`
Step 8	Press **MIN** to return to menu item 401–Set Event.	`400 *Alarms* >` `401–Set Event`
Step 9	Press **SHIFT** to access the numeric entry mode for menu item 401–Set Event. The blinking character is the active digit. Press **MAX** or **MIN** to select (Event#) **2**.	`Event#(1-4) >` `>2`

Step 10 Press **SHIFT** to return to menu item 401–Set Event.

```
400 *Alarms*   >
401-Set Event
```

Step 11 Press **MAX** to advance to menu item 403–Trip High.

```
400 *Alarms*   >
403-Trip High
```

Step 12 Press **SHIFT** to access the numeric entry mode for menu item 403–Trip High. The blinking character is the active digit. Use **MAX** or **MIN** to change the numerical value. Use **MODE** to move the active digit to the right and complete the entry for **120** (this value correlates to the currently selected engineering units).

```
High Value     >
>120
```

Step 13 Press **SHIFT** to move active digit to the left until the meter returns to menu item 403–Trip High. The high flow value is now set.

```
400 *Alarms*   >
403-Trip High
```

Step 14a <u>If further adjustments are required</u>, press **MAX** or **MIN** to advance to other 400 *Alarms* menu items or **MODE** to advance to other main menus.

```
400 *Alarms*   >
401-Set Event
```

DO NOT return to RUN MODE —
this will automatically LOCK the meter.

Step 14b <u>If no further adjustments are required</u>, press **MAX** or **MIN** to advance to the 500 *Run Mode* menu item, then press **SHIFT** to lock the flow averaging tube and to return to Run Mode.

```
400 *Alarms*   >
500 *Run Mode*
```

Adjusting the C Factor — Menu Item 811–C Factor

Master-Touch™ bi-directional flowmeters allow you to adjust the correction factor setting. The factory default for this value is 1. By changing the value in this menu item, you can rescale the flow averaging tube's curve linearization to correct for aberrations in the sensor readings.

The following directions assume that you have just unlocked the flow averaging tube. However, the 800 *Meter* menu can be accessed directly from the other mode menus by pressing MODE until it is shown on the LCD display and then pressing SHIFT.

Start	**Menu item 219–UnLock:**	`200 *Utility* >` `219–UnLock`
Step 1	Press **MAX** five times to advance to the 200 *Utility* menu item 800 *Factory*.	`200 *Utility* >` `800 *Factory*`
Step 2	Press **SHIFT** to advance to the 800 *Factory* menu.	`800 *Factory* >` `801–CoeffTermA`
Step 3	Press **MAX** or **MIN** to advance to the 800 *Factory* menu item 811–C Factor.	`800 *Factory* >` `811–C Factor`
Step 4	Press **SHIFT** to access the numeric entry mode.	`Set Correction >` `>1.000000e+00`
Step 5	The blinking character is the active digit. Use **MAX** or **MIN** to change the numerical value. Use **MODE** to move the active digit to the right and complete the entry of the new correction factor.	`Set Correction >` `>1.050000e+00`
Step 6	Press **SHIFT** to move active digit to the left until the meter returns to menu item 811–C Factor. The correction factor is now changed.	`800 *Factory* >` `811–C Factor`
Step 7a	<u>If further adjustments are required</u>, press **MAX** or **MIN** to advance to other 800 *Factory* menu items or **MODE** to advance to other main menus. **DO NOT return to RUN MODE — this will automatically LOCK the meter.**	`800 *Factory* >` `801–CoeffTermA`
Step 7b	<u>If no further adjustments are required</u>, press **MODE** twice to advance to the 600 *Turbo* menu. The flow averaging tube will return to Run Mode and relock.	`600 *Turbo* >` `100 *Meter*`

Setting the Low Flow Cutoff — Menu Item 816–FlowCutoff

Master-Touch™ bi-directional flowmeters allow you to easily set a flow signal cutoff for a full scale flow range that has a low end other than zero (0), i.e., 100–1000 SCFM. This function is controlled by

Menu 816-FlowCutoff. The value entered at this menu is the percentage of the Maximum Range that equals the desired cutoff limit (*see menu item 814–MaxRange*). As an example, if the specified flow range is 150–1000 SCFM and the Maximum Range value is 1200 SCFM, then to set the low end limit of 150 SCFM the menu item 816 value must be 12.5 (%) because 1200 x 0.125 = 150. When the flow rate is below this flow cutoff limit, the display reads "LOW" and the output signals will be 0VDC and 4mA. When the flow rate is above the cutoff limit the flow rate will be displayed and the output signals will resume at the correct level.

The following directions assume that you have just unlocked the flow averaging tube. However, the 800 *Meter* menu can be accessed directly from the other mode menus by pressing MODE until it is shown on the LCD display and then pressing SHIFT.

Start	**Menu item 219–UnLock:**	`200 *Utility* >` `219–UnLock`
Step 1	Press **MAX** five times to advance to the 200 *Utility* menu item 800 *Factory*.	`200 *Utility* >` `800 *Factory*`
Step 2	Press **SHIFT** to advance to the 800 *Factory* menu.	`800 *Factory* >` `801–CoeffTermA`
Step 3	Press **MAX** or **MIN** to advance to the 800 *Factory* menu item 816–FlowCutoff.	`800 *Factory* >` `816–FlowCutoff`
Step 4	Press **SHIFT** to access the numeric entry mode. The default in this menu item is always **0**.	`Set Low  >` `>0`
Step 5	The blinking character is the active digit. Use **MAX** or **MIN** to change the numerical value. Use **MODE** to move the active digit to the right and complete the entry of the flow signal cutoff percentage.	`Set Low  >` `>12.5`
Step 6	Press **SHIFT** to return to menu item 816–FlowCutoff. The flow signal cutoff is now set.	`800 *Factory* >` `816–FlowCutoff`
Step 7a	<u>If further adjustments are required</u>, press **MAX** or **MIN** to advance to other 800 *Factory* menu items or **MODE** to advance to other main menus. **DO NOT return to RUN MODE —** **this will automatically LOCK the meter.**	`800 *Factory* >` `801–CoeffTermA`
Step 7b	<u>If no further adjustments are required</u>, press **MODE** twice to advance to the 600 *Turbo* menu. The flow averaging tube will return to Run Mode and relock.	`600 *Turbo* >` `100 *Meter*`

Section E Factory Calibration

The factory calibration of an Eldridge thermal gas mass flowmeter is a two step process. Our first step is to perform a temperature calibration of each flow sensor. Once this calibration process has been performed, it need not be done again. Secondly, we perform a flow calibration of every flowmeter. Although all flow curves are similar, they are different enough to require individual calibrations be run for each flowmeter to yield the best accuracy.

Flow calibration is a process of comparing or verifying the meter under test against a meter of better accuracy used as a calibration standard. EPI flow calibrations are traceable to NIST through traceability of the instrumentation and equipment used.

Calibration of the flowmeter consists of the following steps. Flowmeters are checked against a calibration standard at many flow points and the data is graphed. From this graph the non-linearity of the flowmeter is determined and aligned through our signal processor to yield a linear flow output signal.

Although thermal gas mass flowmeters have good long term stability, EPI recommends a factory calibration and certification be performed on an annual basis to conform to most quality assurance programs. Where quality assurance programs do not require annual recertification, it shall be left at the users' discretion when to recertify.

Section F General Specifications

Linear signal output	0–5 VDC & 4–20 mA
Relay Output	Two 1-amp, user-selectable alarm functions
Signal Interface	RS232 & RS485
Accuracy including linearity (Ref.: 21°C):	± (1% of Reading + (0.5% + .02%/°C of Full Scale))
Repeatability	± 0.2% of Full Scale
Sensor response time	1 second (time constant per step change)
Turn down ratio	100:1 (15 SCFM/FT^2 minimum Reading)
Electronics internal temperature range	0° to 50°C (32° to 122°F) Standard -40° to 60°C (-40° to 140°F) Optional temperature range
Gas temperature range	0–200°C (32–392°F) *Consult factory for extended range.*
Gas temperature effect	0.02% /°C
Gas pressure effect	Negligible over ±20% of absolute calibration pressure
Pressure rating maximum:	
Transmitter power requirements	5 Watts or less
RAM Back-up	Lithium Battery, 2.5–3.5v, >10 years
Wetted materials:	316SS, including sensor
Standard temperature & pressure (STP)	70° F & 29.92" Hg (Air .075 lb/cubic foot)
NIST traceable calibration Standard	

Insertion probe PSI is rated to limit applied force at probe to a maximum of 25 pounds. Above the listed pressure, a restraining device is required to eliminate the potential of the probe being forced out of the line during installation or removal under pressure.

Specification Notice

Specifications contained herein are subject to change without notice, EPI cannot guarantee the applicability or suitability of our products in all situations since it is impossible to anticipate or control every condition under which our products and specifications may be used.

Service Work

In the event that service work is required or calibration and recertification is required, call the factory and a return materials authorization (RMA) number will be issued for each job. All units sent in for service work shall include a RMA, work instructions and be shipped prepaid. On receipt of your flow instrumentation, we will inspect the equipment and give a price quotation for service work to be performed, if not already given.

Storage

Equipment and instrumentation shall be stored in an environmentally controlled storage shelter or warehouse when not in use. All openings shall be sealed off to prevent foreign materials from entering the instrumentation.

Limited Warranty

Eldridge Products, Inc. (EPI) warrants its products to be free from defects in materials and workmanship for one year from the date of factory shipment. If there is a defect, the purchaser must notify EPI of the defect within the warranty period. Upon receipt of the defective product, EPI will either repair or replace the defective product at its sole option. EPI MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AS TO THE PRODUCTS. EPI MAKES NO WARRANTY THAT THE GOODS SOLD TO ANY PURCHASER ARE FIT FOR ANY PARTICULAR PURPOSE. FURTHERMORE, EPI MAKES NO WARRANTY OF MERCHANTABILITY WITH RESPECT TO ANY PRODUCTS SOLD TO ANY PURCHASERS. There are no other warranties that extend beyond the description on any brochure or price quote.

Limited Acceptance

Acceptance of any offer is limited to its terms. Acceptances or confirmations that state additional or differing terms from this price quote shall be operative as acceptances, but all additional or differing terms shall be deemed material alterations within the meaning of Commercial Code Section 2207(2)(b), and notice of objection to them pursuant to Commercial Code Section 2207(2)(c) is hereby given. The laws of the State of California govern this contract and venue is Monterey County. Risk of loss passes F.O.B. EPI factory. Payment due in full in US Dollars within credit terms granted from factory shipment. Additional fees shall include interest on unpaid balances that are outstanding for more than granted credit terms, plus all collection costs and attorneys' fees incurred in collecting any outstanding balance. Any and all additional or differing terms do not become part of the contract between EPI and any purchaser.

The terms of any offer are expressly limited to the terms detailed in any product brochure or price quote. Any modification to any of the terms of this offer must be in writing and must be signed by an officer of EPI.

Section G Product Drawings

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REVISIONS				
ZONE	REV	DESCRIPTIONS	DATE	APPROVED

ELDRIDGE PRODUCTS, INC.

APPROVALS	DATE	TITLE			
DRAWN		Bi-Directional Flowmeter Basic Configuration			
CHECKED					
ENGR.					
DESIGN		SIZE A	REV. CODE	DWG. NO. Basic Configuration	REV.
		SCALE			SHEET ___ OF ___

REVISIONS
ZONE
REV
DESCRIPTIONS
DATE
APPROVED
FLOW TRANSMITTER
back compartment
+ 24VDC
Ground
- RS485 RX
+ RS485 TX
Ground
+ 24VDC
REMOTE ENCLOSURE
cover panel not shown
OPTIONAL for 115/230VAC
OPTIONAL for 115/230VAC
AC Line 1
AC Line 2
Earth
ELDRIDGE PRODUCTS, INC.
APPROVALS
DATE
DRAWN
CHECKED
ENGR.
DESIGN
TITLE
Wiring Connections from Flow Transmitter to Remote Enclosure (115/230VAC Power Optional)
SIZE
A
REV. CODE
DWG. NO.
Field Wiring
REV.
A
SCALE
SHEET
OF
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REV/SISIONS
ZONE REV DESCRIPTIONS DATE APPROVED
RS232
RXD
TXD
Ground
RS485 +
RS485 -
Mode 2
Mode 1
Flow (0 – 5, 10 VDC)
Ground
Temp (0 – 5, 10 VDC)
Flow (4 – 20mA)
Ground
Temp (4 – 20mA)
Programmable Relay #2
NC COM NO
NC COM NO
Relay #1*
*Relay #1 programmed for:
Normally Open (NO) = Forward/Normal Flow
Normally Closed (NC) = Reverse Flow
ELDRIDGE PRODUCTS, INC.
APPROVALS DATE
DRAWN
CHECKED
ENGR.
DESIGN
TITLE
Signal Interface Board (SIB)
Wiring Diagram
SIZE A
REV. CODE
DWG. NO.
SIB Wiring
REV. A
SCALE
SHEET OF
REMOTE ENCLOSURE
OPTIONAL for 115/230VAC
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