

ELDRIDGE PRODUCTS, INC.

Master-Touch™

version 5.0A

Series 9000MP Multipoint System

Series 9600MP System Control Panel

Thermal Gas Mass Flowmeters

INSTRUCTION MANUAL

80201501 (Rev. 2.02)



www.epiflow.com

Eldridge Products, Inc.
2700 Garden Road, Building A
Monterey, CA 93940

Tel: 800/321-3569
or 831/648-7777
Fax: 831/648-7780
Email: sales@epiflow.com

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Table of Contents

Section A	Introduction and Installation	A-1
Introduction		A-1
Unpacking Your Instrument		A-1
Getting Acquainted		A-1
Section B	General Information	B-1
Construction		B-1
Sensitivity and Accuracy		B-1
Probe Configuration		B-1
Field Testing		B-1
System Control Panel		B-2
Installation And Mounting		B-2
Series 9600MP Power Requirements		B-3
Series 9000MP Power Requirements		B-3
Signal Interface		B-3
Section C	The Master-Touch™ LCD and Key Pad	C-1
100 *Meter* Menu		C-2
100 *Meter* Submenus		C-2
200 *Utility* Menu		C-4
200 *Utility* Submenus		C-4
300 *Status* Menu		C-8
400 *Alarms* Menu		C-10
Alarm Relay Overview		C-10
400 *Alarms* Submenus		C-11
Alarm Programming		C-12
450 *E-Log* Menu		C-14
700 *S-Curve Fit* Menu		C-16
700 *S-Curve Fit* Submenus		C-16
750 *PW-Curve Fit* Menu		C-17
750 *PW-Curve Fit* Submenus		C-17
800 *P-Curve Fit* Menu		C-19
800 *P-Curve Fit* Submenus		C-19
Section D	Instructions for Specific Actions	D-1
Unlocking the Master-Touch™ — Menu Item 219–UnLock		D-1
Selecting the Engineering Units — Menu Items 101–132		D-3
Changing the Full Scale range — Menu Item 140–FScale		D-4
Resetting the Flow Rate and Flow Total — Menu Item 160–Reset!		D-5
Adjusting the Display Rate — Menu Item 207–Disp Rate		D-6

Adjusting the LCD Display Contrast — Menu Item 208–Disp Set.....	D-7
Setting the Alarms — Menu Items 401–414.....	D-8
Adjusting the C Factor — Menu Item 811–C Factor	D-10
Adjusting the Zero Offset — Menu Item 815–Auto Zero	D-11
Setting the Low Flow Cutoff — Menu Item 816–FlowCutoff	D-13

Section E Factory Calibration..... E-1

Section F General Specifications..... F-1

Specification Notice	F-1
Service Work	F-1
Storage	F-1
Limited Warranty.....	F-2
Limited Acceptance	F-2

Section G Guidelines and Product Drawings G-1

Calculating Secondary Coefficients.....	G-1
Engineering Drawings	G-2
Example of Menu Data Sheet.....	G-8
Menu Item Interaction	G-9
Master-Touch™ Diagnostics	G-9
Master-Touch™ Auto-Ranging (External Mode)	G-10
Master-Touch™ ASCII Data Stream	G-11

Section A Introduction and Installation

Introduction

The EPI Series 9000MP Multipoint Thermal Dispersion Mass Flow meters are the net result of almost two decades of flow metering and design experience within the instrumentation industry. Series 9000MP Mass Flowmeter products directly measure the gas molecular rate of flow, correcting for temperature changes and being insensitive to pressure changes, resulting in a true mass rate of flow signal. Since no corrections are required, the signal may be directly interfaced with process or data acquisition systems. A variety of other optional communications protocols are available, including RS232/RS485, LightWIRE™ Infrared modules, data-logging with EPICommunicator™ 2.0, and Modbus- or HART-compatible modules.

Unpacking Your Instrument

Your Series 9000MP Multipoint 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. Should a discrepancy present itself, contact EPI shipping department right away. The last area of verification, will be to check that the equipment and calibration range match your purchase order specifications. If it is found that a mismatch has taken place, contact EPI sales department to resolve any discrepancies.

Getting Acquainted

We thank you for specifying our Series 9000MP Multipoint Thermal Dispersion Mass Flowmeters. As you know, thermal mass flow measuring devices have been around for many years and are known for their reliability, ease of use and, most importantly, their direct readings. This equipment does not require any peripheral devices to yield a mass rate of flow signal.

Your Series 9000MP Multipoint Mass Flowmeter product consists of two major components: the Series 9000MP Flow Transmitter probe assembly(ies) and the Series 9600MP System Control Panel. The Flow Transmitter probe assembly is the heart of the system. It consists of two or more flow sensors (to a maximum of 12). Each flow sensor is constructed with thermal flow sensing elements.

The Series 9000MP Flow Transmitter probe assembly is powered by the Series 9600MP System Control Panel over a two wire electrical connection. The Flow Transmitter sends its signal to the System Control Panel over a 4–20mA signal loop. Our System Control Panel converts this input signal to both 0–5 VDC & 4–20mA output signals for direct process control and/or reading. EPI Series 9000MP Multipoint Thermal Dispersion Mass Flowmeters are designed for air/gas measurement in ducts, stacks or other flow conduits, where two or more sensing points are required due to large areas or where irregular flow profiles are present to net a true average flow signal reading.

Section B General Information

Construction

EPI Series 9000MP Multipoint Flow Transmitter probe assemblies are constructed such that all wetted parts are 316 series stainless steel. Our probe assemblies have a continuous outside diameter of 1.5 inches. The probe may have up to twelve (12) sensors per assembly. Sensors will be spaced along the probe as specified but not closer than five (5) inches center to center. Probe assemblies greater than 4 feet in length require double ended support. One or more probes (12 maximum) may be specified per duct.

Probe assemblies are fitted with a 1½" ANSI 150 lb., 316SS probe mounting flange for securing probe assembly to user duct or stack. Attached to the outer flange surface is a fiberglass 8" x 10" NEMA 4X (or optional NEMA 7 & NEMA 4 enclosure), housing the probe electronics.

Sensitivity and Accuracy

Each sensor is individually calibrated and linearized at the probe assembly. Series 9000MP Flow Transmitter probes have a calibration turn down ratio of 100:1. Sensor point accuracy, including linearity is $\pm [1\% \text{ Reading} + (.5\% + .02\%/^{\circ}\text{C of Full Scale})]$. Repeatability is $\pm 0.2\%$. Calibration range is to be specified by user. Gas temperatures to 300°F (temperatures to 400°F optional).

Probe Configuration

Flow Transmitter Probe Assemblies may be specified with either one sensor (probe) average output signal or for multiple outputs to allow individual sensor readings at the Series 9600MP System Control Panel.

Series 9000MP standard probe configuration provides that the sensors are linearized and averaged at the probe assembly. The probe 4–20mA output signal average is transmitted to the remote Series 9600MP System Control Panel location for measurement (or averaging if required with one or more other probe assembly signals). This method requires a four (4) wire connection per probe assembly, (power supply positive, supply ground, 4–20mA average output and 4–20mA ground). The advantage of this system is the low number of wire connections.

Alternatively, each sensor 4–20mA signal output may be configured for transmission to the remote Series 9600MP System Control Panel for measurement and averaging. This method requires a wire pair for each sensor 4–20mA signal output, power supply positive and supply ground connection. The advantage of this system is availability of testing or reading each sensor at the remote Series 9600MP System Control Panel location.

Field Testing

Series 9000MP Flow Transmitter probe assembly sensors may be periodically tested at the probe location to verify performance. If one or more sensor signal outputs are not functioning as required, they may be removed from the sensor average board (located either at the Flow Transmitter Probe Assembly or at the Series 9600MP System Control Panel) by removing the individual signal input wire and turning off a dip switch, without affecting the system operation. One switch is on for each active sensor on the probe.

Series 9000MP Flow Transmitter probe assembly sensors may be periodically tested at the remote Series 9600MP System Control Panel location (if configured for individual measurement) and also at the Flow Transmitter location if desired, to verify performance. If one or more sensor signal outputs are not functioning as required, they may be removed from the sensor average board by disconnecting the individual signal input wire and turning off one dip switch without affecting the system operation. One switch on the averager board is on for each active sensor on the probe assembly.

System Control Panel

System electronics are mounted in the Series 9600MP System Control Panel's fiberglass 16" x 14" NEMA 4X or optional NEMA 7 enclosure remotely located from the Series 9000MP Flow Transmitter Probe Assemblies by a few feet to thousands of feet away. Contained within the System Control Panel enclosure are the power supply, probe average board, and sensor average boards (when not located at the flow transmitter assembly), and option modules such as: Option 133, a 2 line by 16 character LCD readout; Option 150, a current output module driving up to 1200Ω; or Option 160, a sensor or probe signal profiler. Three power supplies are available to power from 1–12, 13–24 or 25–36 sensors.

If it becomes necessary to remove or replace a probe assembly from service (where two or more probes are present), it may have its signal input removed from the remote System Control Panel probe averager board by removing or replacing one wire and turning off/on a dip switch without affecting system operation. One switch is on for each Transmitter Probe Assembly input to a maximum of twelve.

Installation And Mounting

Proper installation of the Flow Transmitter Probe Assembly is of great importance. It is important to install the Flow Transmitter at a position 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 sensor element must be avoided.

Temperature limitations of the transmitter are listed in the specification section of this manual and show acceptable limits for the gas temperature along with the environmental temperature limits which the transmitter electronics may be subjected to.

Avoid installations which are immediately downstream of bends, abrupt area increases or decreases, fans, louvers, or other equipment installed in the line, etc.. These situations can cause non-uniform flow profiles and swirl which can cause signal errors. It is desirable to have as much straight run as possible to achieve a uniform non-swirling flow profile within the flow conduit. Rule of thumb states that one should provide a minimum of 10 diameters of straight run upstream and 5 diameters downstream. Although this is not always possible, it is desirable. In the event of less straight run availability, the available length should be divided into thirds with two thirds upstream and one third downstream. **Where the installation is not ideal, more sensors should be specified.**

Multipoint Flow Transmitters require the assembly be inserted through and perpendicular to the flow conduit. The transmitter assembly is held in place by use of a 1½" flanged connection. This flange may be mounted to a flat surface or to a mating flanged connection. The mating flange (if required) is provided by the user or purchased as an option from EPI. Installing the mating flange (when required) consists of preparing the flow conduit to accept the flange by first drilling a clearance hole for the transmitter probe assembly, then welding or bolting it in place.

Mounting the Series 9600MP System Control Panel requires a flat surface or mounting rails. Four ¼" bolts are recommended with flat washers in contact with the enclosure and split lock washers

between the bolt and flat washer, to hold the enclosure firmly in place. The assembly weight will be 15 lbs. or less.

Series 9600MP Power Requirements

Power requirements for the Series 9600MP System are 115 VAC 50/60 Hz standard and 220 VAC 50/60 Hz optional. A six foot power cord is provided, however, it may be removed for permanently installed conduit wiring. If conduit is used, it should be suitable for the application, electrically conductive and connected within the enclosure to earth ground. Our recommendation on wire size is 18 Ga. stranded for all AC wiring.

Series 9000MP Power Requirements

Flow Transmitter power requirements are met with the 18 to 24 VDC (based on loop losses and panel adjustment) power provided by the System Control Panel. The wire should be sized for no more than $\frac{1}{2}\Omega$ resistance across the loop and not less than 22 AWG.

Signal Interface

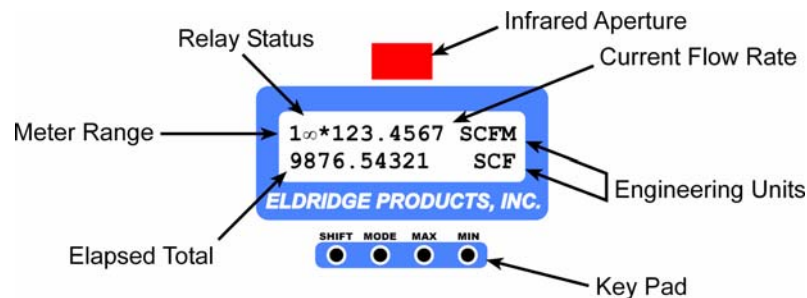
The micro-processor provides both 0–5 Volts DC and 4–20 mA flow output signals. Voltage signals should not be sent over long distances due to small currents causing voltage drops across the wire pair. If the voltage is to be sent over a distance (for example 50 feet), the wire AWG should be sized to 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 bridge board current loop will drive a load (lead plus load resistance) of 600 ohms for profiling. Our averager board current loop will drive a load (lead plus load resistance) of 1200 ohms.

RS232 and RS485 connections are available for direct communication with *EPICommunicator* software.

Section C 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; an “x” indicates that the flowmeter is in External mode; 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;

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.

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-	(unused)
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*
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

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-DAC Set	<i>This menu item requires the Diagnostic Password for access. Consult factory.</i>
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	<i>This menu item requires the Diagnostic Password for access. Consult factory.</i>
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	<i>This menu item requires the Diagnostic Password for access. Consult factory.</i>

207-Disp Rate	<p>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.</p> <p><i>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.</i></p>
208-Disp Set	<p>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.</p>
209-Curve Fit	<p>This menu item selects the curve fit mode used by the microprocessor to generate the flow readings and output signals. The menu values are:</p> <p>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</p>
210-	(unused)
211-Tracking On	<p>This menu item restores the DAC and ADC tracking.</p>
212-Track Hold	<p>This menu item suspends the DAC and ADC tracking.</p> <p><i>This menu item requires the Diagnostic Password for access. Consult factory.</i></p>
213-Set Meter	<p>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.</p> <p><i>The flowmeter can also be set up to allow external switching between stored ranges by entering “0” at the prompt. However, this disables the keypad functions for ranges 2–4. Therefore, EPI strongly recommends the use of EPICommunicator 2.0 for this function.</i></p>
214-Set Date	<p>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:</p> <ul style="list-style-type: none"> • MM = month (01–12) • DD = day (01–31) • YY = year (00–99) <p>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.</p>
215-Set Time	<p>This menu item sets the time stamp functions to the current time for accurate reporting. The time prompt indicates HH:MM:SS where:</p> <ul style="list-style-type: none"> • HH = hour (00–23) • MM = minutes (00–59) • SS = seconds (00–59) • . (period) = AM /PM or 24 hour clock <p>Include a colon (:) as the delimiter between values. The time will not be set if this format is not followed exactly. Example:</p> <p style="text-align: center;">01:24:56P = 1:24:56 PM</p> <p>13:24:56 = 1:24:56 PM displayed in 24 hour clock format.</p>

216-No Curve Fit	This menu item suspends the factory P-Curve linearization. <i>This menu item requires the Diagnostic Password for access. Consult factory.</i>
217-Curve Fit	This menu item is the same as 209-Curve Fit
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. <i>If you set your own password, save it in a secure place to prevent loss and lockout from user variables.</i>
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. <i>See Page D-1 for detailed instructions on this menu item.</i>
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. <i>This setting does not affect the total elapsed flow display nor does it affect the accuracy of the flowmeter.</i>
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.

<p>225-Set RS232 Baud</p>	<p>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</p> <p><i>EPI's LightWIRE IR communication modules currently require an RS232 baud rate of 9600 and will not function correctly at other baud rates.</i></p>
<p>226-Set RS485 Baud</p>	<p>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</p>
	<p>(blank)</p>
<p>100 *Meter*</p>	<p>Go to 100 *Meter* Menu</p>
<p>300 *Status*</p>	<p>Go to 300 *Status* Menu</p>
<p>400 *Alarms</p>	<p>Go to 400 *Alarms* Menu</p>
<p>500 *Run Mode*</p>	<p>Go to 500 *Run Mode*</p>
<p>700 *S-Curve Fit*</p>	<p>Go to 700 *S-Curve Fit* Menu</p>
<p>750 *PW-CurveFit*</p>	<p>Go to 750 *PW-CurveFit* Menu</p>
<p>800 *P-Curve Fit*</p>	<p>Go to 800 *P-Curve Fit* Menu</p>

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*
LV9.8765 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*  
Gas Temp = xxx°F
```

This display presents the temperature of the process gas flow.
(Not implemented in this version)

```
300 *Status*  
DAC=0.234 Volts
```

This display presents the digital-to-analog voltage output.

```
300 *Status*  
ADC=2.987 Volts
```

This display presents the analog-to-digital voltage output.

```
300 *Status*  
SN=12345678
```

This display presents the unique serial number of the flowmeter.

```
300 *Status*  
µP PCBA Rev =8
```

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;
- **Total** — an alarm relay is triggered by an accumulated flow total that is higher than the preset value;
- **Timer** — an alarm relay is triggered after a preset time delay value;
- **Proportional Pulse Output** — an alarm relay is triggered by a flow rate that is equal to a preset proportion of the value in menu item **140–FScale**;
- **Pulse Output** — an alarm relay is triggered after an preset value of accumulated flow total;
- **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;
- **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

The alarm relays can also be reset externally by using the Mode 1 or Mode 2 and Ground connections on Terminal Block One (TB1). Mode 1 is the same as using the MAX key; Mode 2 is the same as using the MIN key. Momentarily grounding the appropriate Mode connection resets the alarm relay. In addition, the alarm relays can be **disabled** so they do not trigger on any Event. The Disabled function is also used to latch or hold the relay at its current condition. If no Event programming has been requested at the time of purchase, Disabled is the default condition for the alarm relays.

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

1∞∞12.3456	SCFM	RUN MODE
9876.54321	SCF	

400 *Alarms*
401-Set Event
Event# (1-4)
>1

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.

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-PropPOut	This menu item sets the current active Event to respond to the current flow rate. The pulses are based upon flow rate per minute, proportional to the value in menu item 140-FScale. Using the keypad enter a value equal to the desired number of pulses per minute at the Full Scale flow rate. Any value between 1 and 250 may be entered at the prompt (>). <i>The same value must be entered for both relay events (1&2 or 3&4). This will give a 50/50 duty cycle.</i>
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).

<p>410-PulseOut</p>	<p>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.</p> <p>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, . . .).</p> <p>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.</p>
<p>411-Trip Delay</p>	<p>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.</p>
<p>412-ESD/EMI Rst</p>	<p>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.</p> <p>Consult factory for additional information and a diagram of required wiring of input power to implement this function.</p>
<p>413-Flow Hold1</p>	<p>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.</p>
<p>414-Flow Hold2</p>	<p>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.</p>
<p></p>	<p>(blank)</p>
<p>100 *Meter*</p>	<p>Go to 100 *Meter* Menu</p>
<p>200 *Utility*</p>	<p>Go to 200 *Utility* Menu</p>
<p>300 *Status*</p>	<p>Go to 300 *Status* Menu</p>
<p>500 *Run Mode*</p>	<p>Go to 500 *Run Mode*</p>
<p>700 *S-Curve Fit*</p>	<p>Go to 700 *S-Curve Fit* Menu</p>
<p>750 *PW-CurveFit*</p>	<p>Go to 750 *PW-CurveFit* Menu</p>
<p>800 *P-Curve Fit*</p>	<p>Go to 800 *P-Curve Fit* Menu</p>

Alarm Programming

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, PropPOut, 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 two typical uses of the Master-Touch™ alarm relays:

Example 1 — 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.

Example 2 — Set Alarm Relay 1 to activate if the flow rate falls below 10 SCFM for a period of four seconds:

- Unlock the flowmeter settings and go to the **400 *Alarms*** menu;
- Select menu item **401–Set Event**, then enter **1** at the prompt (1 = Ev 1, Relay 1 OFF);
- Select menu item **407–Timer**, then enter **20** at prompt (20 x 50ms = 1s);
- Select menu item **401–Set Event**, then enter **2** at the prompt (2 = Ev 2, Relay 1 ON);
- Select menu item **404–Trip Low**, then enter **10** (SCFM) at menu prompt;
- Select menu item **411–Trip Delay**, then enter **80** at prompt (80 x 50ms = 4s);
- Select menu item **500 *Run Mode*** to lock the flowmeter and return to Run Mode.

As an example of the results of this programming, assume that during Run Mode, the flow reads approximately 18 SCFM. Therefore Relay 1 is inactive. Then the flow decreases to 8 SCFM for 1.25 seconds but returns to 18 SCFM 1 second later. No alarm is generated because the total duration of the increased flow was less than the Trip Delay value (4 seconds). If the duration of the low flow (i.e., < 10 SCFM) exceeded 4 seconds, Relay 1 would activate for 1 second (the value for menu item 407–Timer) and then reset. The alarm relay will not be activated again until the flow increases above 10 SCFM and then falls below 10 SCFM.

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*	RUN MODE
451-Set StartDat	

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	<i>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.</i>
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*
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.
<i>through</i>	
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*
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 strongly recommended that just adjustments be limited to values between 0.90 and 1.10. 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 10	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*
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. <i>Requires Diagnostic Password for access. Consult factory.</i>
<i>through</i>	
810-CoeffTermJ	Factory Calibration Coefficient. <i>Requires Diagnostic Password for access. Consult factory.</i>
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 <i>Installation Guidelines</i> , 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 (<i>see also menu item 815-Auto Zero</i>).

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 Full Scale value (menu item 140–FScale) 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 full scale 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*
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™ 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 flowmeter must be unlocked. Although menu item 219–UnLock can be accessed at any time, the flowmeter must be unlocked to make changes to the variable settings. 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:

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

You can change the passkey for your Master-Touch™ after the flowmeter 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 flowmeter 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 (<i>default factory passkey is 9001</i>).	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™ 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 flowmeter. 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
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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 flowmeter 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 flowmeter and to return to Run Mode.	100 *Meter* > 500 *Run Mode*
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Changing the Full Scale range — Menu Item 140–FScale

Master-Touch™ 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 flowmeter. 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.	100 *Meter* > 800 *Factory*
DO NOT return to RUN MODE — this will automatically LOCK the meter.		
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 flowmeter and to return to Run Mode.	100 *Meter* > 500 *Run Mode*

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

Master-Touch™ flowmeters allow you to reset the flow rate and elapsed flow totals to zero at any time. The flowmeter 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 flowmeter 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™ 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 flowmeter. 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	If further adjustments are required, 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	If no further adjustments are required, press MAX or MIN to advance to the 500 *Run Mode* menu item, then press SHIFT to lock the flowmeter and to return to Run Mode.	200 *Utility* > 500 *Run Mode*
----------------	---	-----------------------------------

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

Master-Touch™ 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 flowmeter. 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:	<div style="border: 1px solid black; padding: 2px; width: fit-content;">200 *Utility* > 219–UnLock</div>
Step 1	Press MAX or MIN to advance to the 200 *Utility* menu item 208–Disp Set.	<div style="border: 1px solid black; padding: 2px; width: fit-content;">200 *Utility* > 208–Disp Set</div>
Step 2	Press SHIFT to access the numeric entry mode.	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Contrast (1–200) > >128</div>
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.	<div style="border: 1px solid black; padding: 2px; width: fit-content;">Contrast (1–200) > >145</div>
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.	<div style="border: 1px solid black; padding: 2px; width: fit-content;">200 *Utility* > 208–Disp Set</div>
Step 5a	If further adjustments are required, press MAX or MIN to advance to other 200 *Utility* menu items or MODE to advance to other main menus.	<div style="border: 1px solid black; padding: 2px; width: fit-content;">200 *Utility* > 201 DAC Set</div>
DO NOT return to RUN MODE — this will automatically LOCK the meter.		
Step 5b	If no further adjustments are required, press MAX or MIN to advance to the 500 *Run Mode* menu item, then press SHIFT to lock the flowmeter and to return to Run Mode.	<div style="border: 1px solid black; padding: 2px; width: fit-content;">200 *Utility* > 500 *Run Mode*</div>

Setting the Alarms — Menu Items 401–414

Master-Touch™ 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 flowmeter. 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** If further adjustments are required, 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** If no further adjustments are required, press **MAX** or **MIN** to advance to the 500 *Run Mode* menu item, then press **SHIFT** to lock the flowmeter and to return to Run Mode.
- | | |
|----------------|---|
| 400 *Alarms* | > |
| 500 *Run Mode* | |

Adjusting the C Factor — Menu Item 811–C Factor

Master-Touch™ 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 flowmeter’s curve linearization to correct for aberrations in the sensor readings.

The following directions assume that you have just unlocked the flowmeter. 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.	800 *Factory* > 801–CoeffTermA
DO NOT return to RUN MODE — this will automatically LOCK the meter.		
Step 7b	<u>If no further adjustments are required</u> , press MODE twice to advance to the 600 *Turbo* menu. The flowmeter will return to Run Mode and relock.	600 *Turbo* > 100 *Meter*

Adjusting the Zero Offset — Menu Item 815–Auto Zero

Master-Touch™ flowmeters allow you to easily adjust the Zero Offset setting. The factory default for the Zero Offset is usually 0. The Auto Zero function reads the sensor input voltage value and replaces the Zero Offset value. This voltage value is subtracted from the sensor curve linearization. By changing the value in this menu item, you can correct for minor sensor bias voltage errors and thus achieve an absolute zero reading at no flow. To use this feature, the flowmeter must be properly installed in the line with the process gas at its operating temperature and pressure and with no flow.

The following directions assume that you have just unlocked the flowmeter. 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 815–Auto Zero.	800 *Factory* > 815–Auto Zero
Step 4	Press SHIFT to access the numeric entry mode. The default in this menu item is always 0 .	Set Auto Zero=1> >0
Step 5	To automatically set the Zero Offset, press MAX to change the value to 1 .	Set Auto Zero=1> >1
	A 0 value leaves the Zero Offset unchanged. No other values are acceptable.	
Step 6	Press SHIFT to return to menu item 815–Auto Zero. The Zero Offset is now changed.	800 *Factory* > 815–Auto Zero
Step 7	To check the Zero Offset value, press MIN to advance to the 800 *Factory* menu item 812–Zero Offset.	800 *Factory* > 812–Zero Offset
Step 8	Press SHIFT to access the numeric entry mode. After reviewing the Zero Offset voltage value, press SHIFT again to return to the 812–Zero Offset menu.	Zero Offset > >0.942633

Step 9a If further adjustments are required, press **MAX** or **MIN** to advance to other 800 *Factory* menu items or **MODE** to advance to other main menus.

800 *Factory*	>
801-CoeffTermA	

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

Step 9b If no further adjustments are required, press **MODE** twice to advance to the 600 *Turbo* menu. The flowmeter will return to Run Mode and relock.

600 *Turbo*	>
100 *Meter*	

Setting the Low Flow Cutoff — Menu Item 816–FlowCutoff

Master-Touch™ 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 $1200 \times 0.125 = 150$. 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 flowmeter. 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	If further adjustments are required, 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	If no further adjustments are required, press MODE twice to advance to the 600 *Turbo* menu. The flowmeter 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 temperature range	0–50°C (32–122°F) <i>Consult factory for extended range.</i>
Gas temperature range	0–200°C (32–392°F) <i>Consult factory for extended range.</i>
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

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 and at no cost to the purchaser. 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 Guidelines and Product Drawings

Calculating Secondary Coefficients

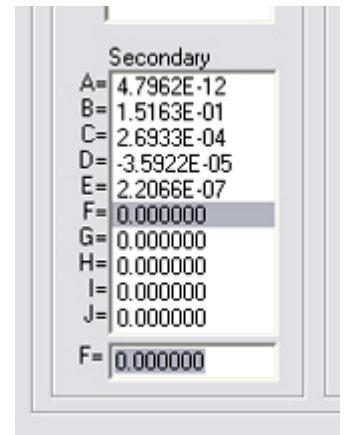
The Master-Touch™ 4.1 software supports Secondary Coefficients to modify the factory calibration. The Secondary Coefficients are based on a difference between the EPI flowmeter's readings and readings from another, or Secondary, flow rate reference such as a pitot tube or other flow measurement device. The calculations require the EPI Secondary Coefficients Calculator spreadsheet which is available by contacting our factory directly.

Please note the following before using the spreadsheet:

- 1) **The specific engineering units are NOT important in this calculation.**
- 2) **Any adjustments to the EPI flowmeter's "0" reading such as Flow Cutoff or Zero Offset MUST be made before taking the readings necessary to generate the coefficients. The spreadsheet requires a 0% correction at 0% flow.**
- 3) **The spreadsheet also requires an actual, or an estimated, 100% (Full Scale) correction.**

To generate the coefficients, you must know the correction percentage for at least one (1) non-zero flow data point in addition to the 0% and 100% requirements as noted above. The spreadsheet will support a maximum of 10 data points. The data points include two values: the percent of Full Scale at which the reading was taken and the required correction percentage. Calculate the correction percentage by subtracting the EPI reading from the Secondary reading and then dividing the difference by the EPI reading. The formula is "(Secondary – EPI)/EPI". For example, at 30% of Full Scale the EPI reading is 300 while the Secondary reading is 315. The correction percentage is (315 – 300)/300 = 0.05 or 5%. A sample coefficient table is shown below:

Enter the % of Full Scale in this Column	Enter the Correction % in this Column
0	0
30	5
45	4
80	4.5
100	4



The values in the table will generate a polynomial equation expressed in scientific notation. The equation will appear on the spreadsheet's line graph. The sample values above generated the following equation:

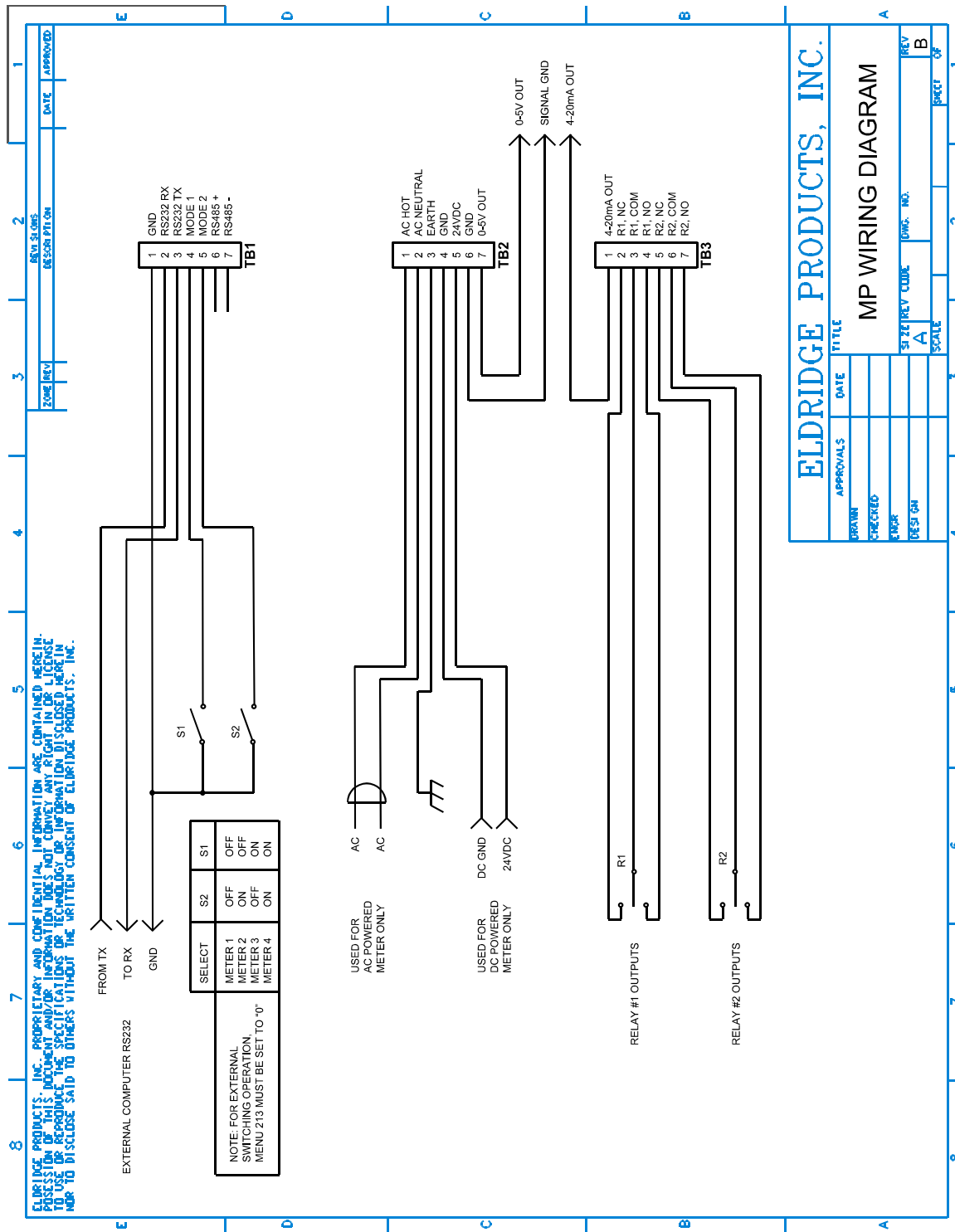
$$y = 2.2066E-07x^4 - 3.5922E-05x^3 + 2.6933E-04x^2 + 1.5163E-01x + 4.7962E-12$$

The coefficients are presented in right-to-left order — Coefficient A is on the right, Coefficient B (x) is next, then Coefficient C (x²), and so on. The numeric values may be either positive or negative. If the Coefficient A value is zero, it will not be displayed but it must be entered as "0" as discussed below.

To modify the factory calibration, the numeric value of each secondary coefficient must be entered into the appropriate data fields in EPICommunicator's Meter Module and then downloaded to the flowmeter.

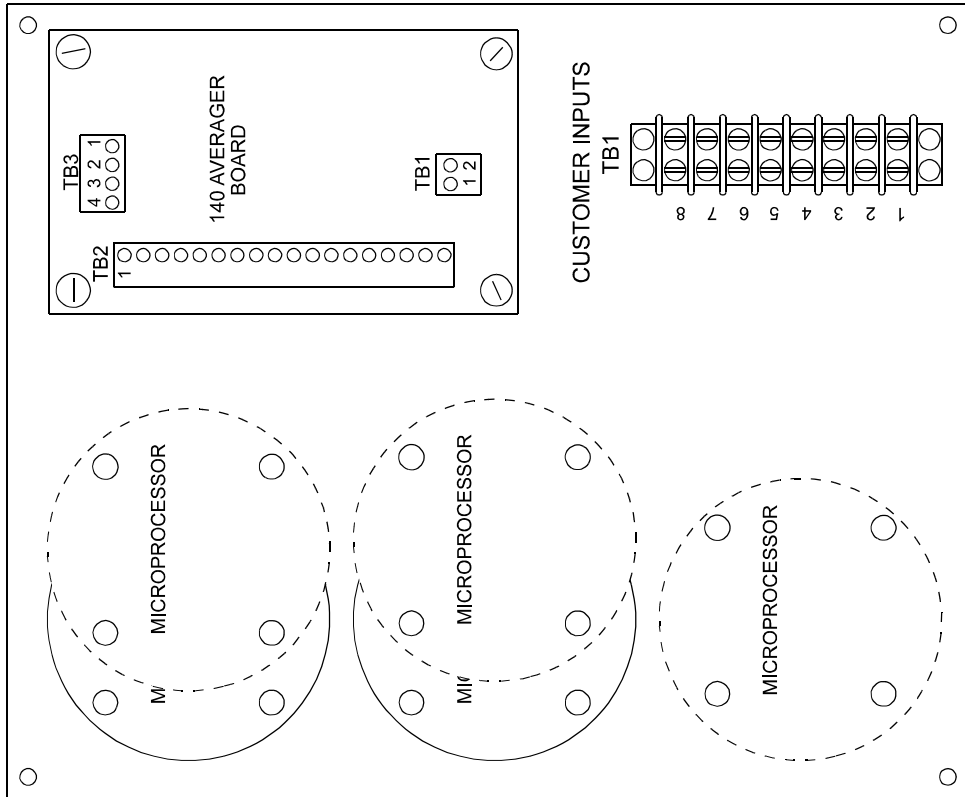
The following pages include technical/informational drawings related to the Master-Touch™ 9000MP Family of microprocessor-based thermal mass flowmeters. Not all drawings will refer to your meter. Please be especially careful when referencing the wiring diagrams.

Engineering Drawings

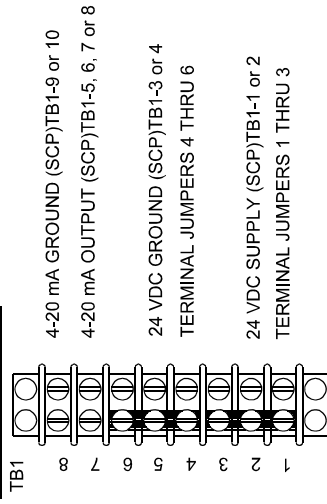


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TWT for Probe 1, 2, 3 or 4



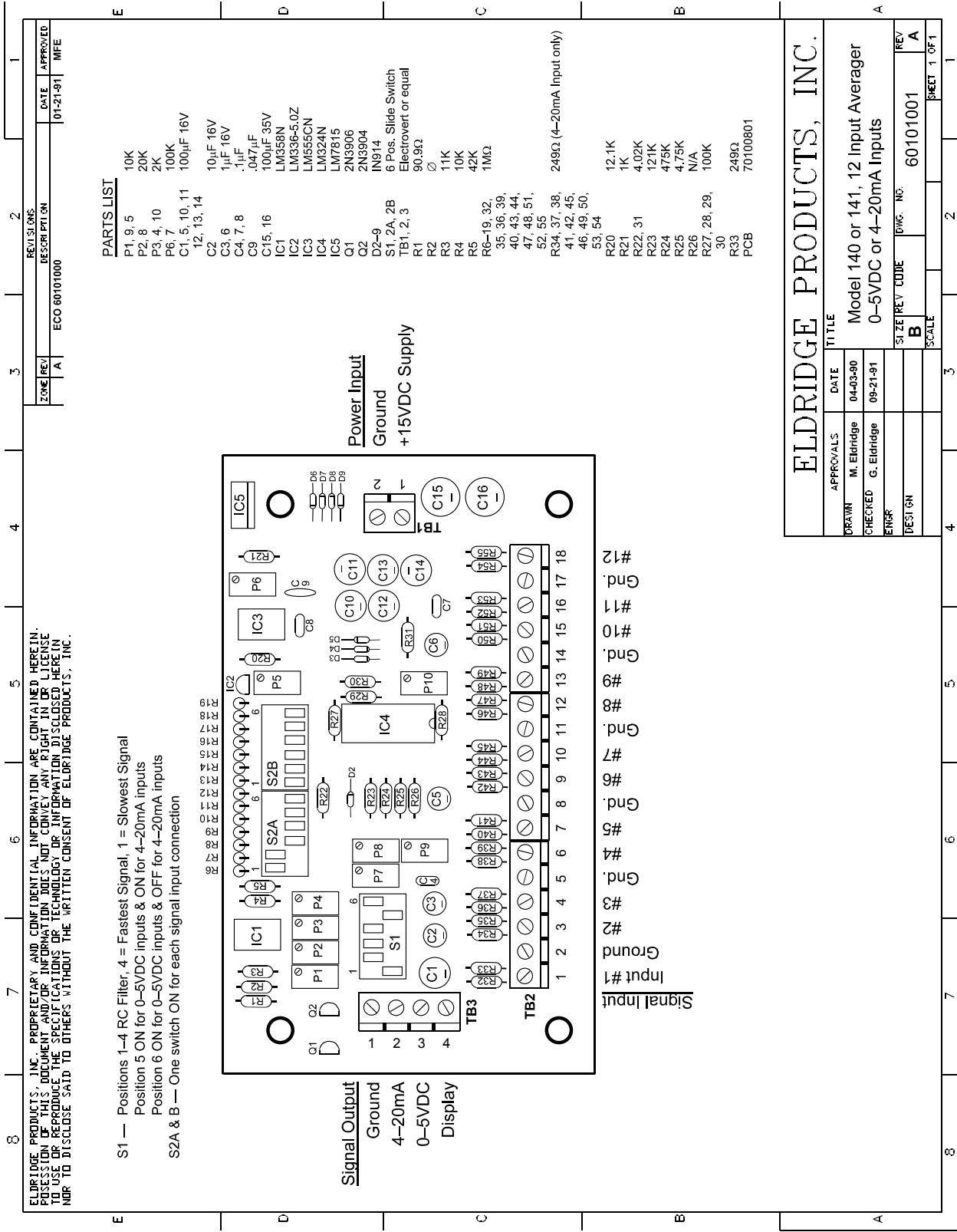
CUSTOMER INPUTS

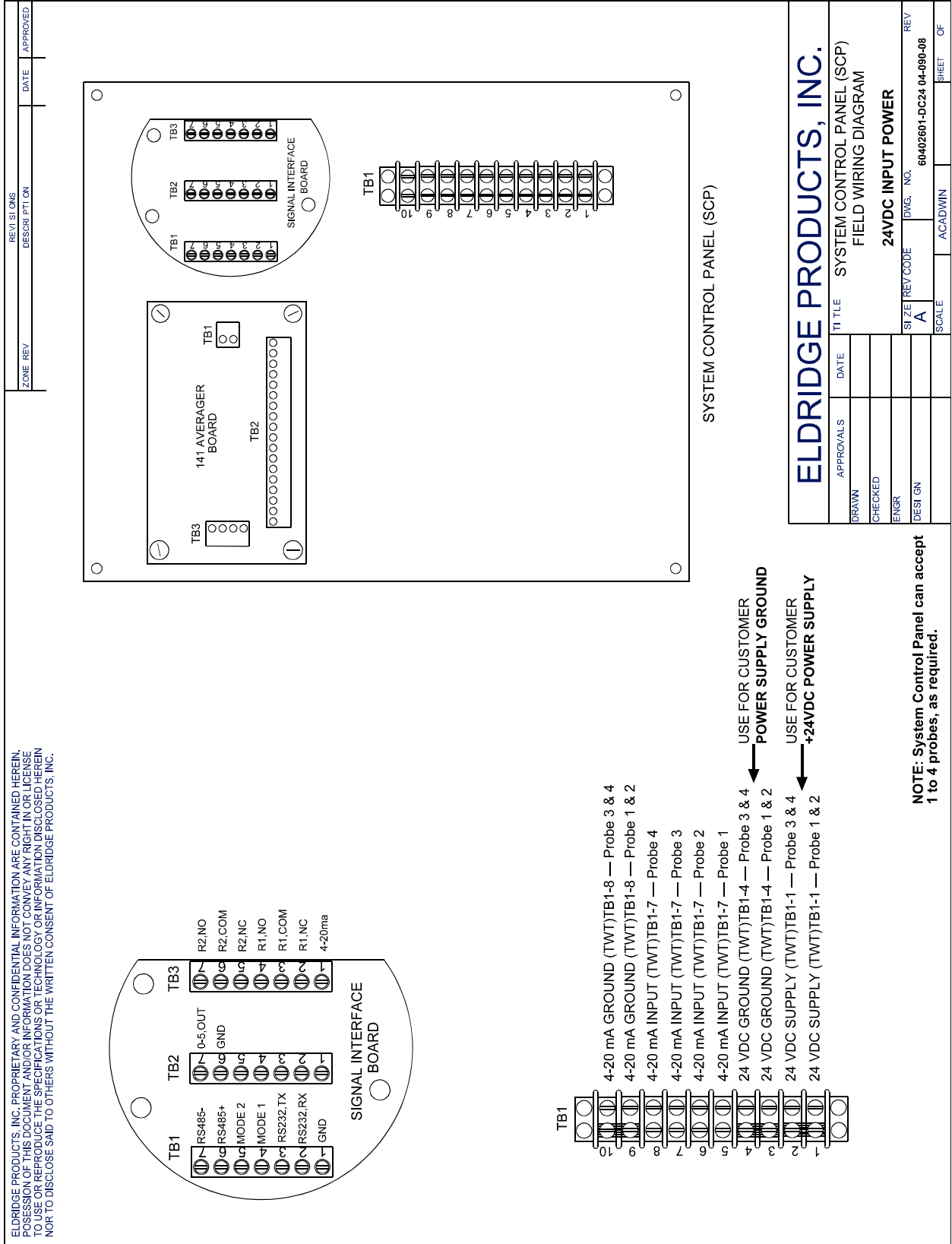


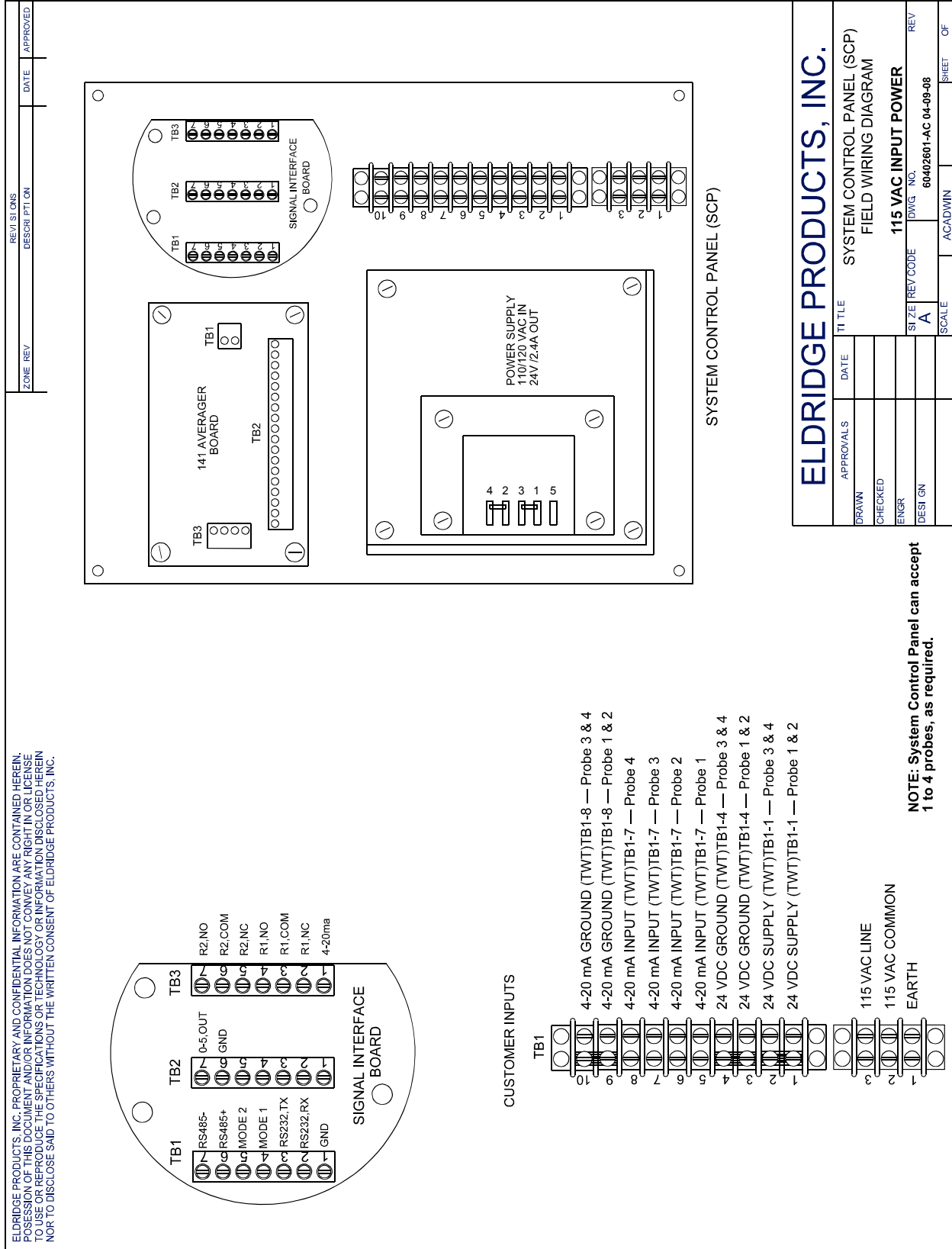
- 4-20 mA GROUND (SCP)TB1-9 or 10
- 4-20 mA OUTPUT (SCP)TB1-5, 6, 7 or 8
- 24 VDC GROUND (SCP)TB1-3 or 4
TERMINAL JUMPERS 4 THRU 6
- 24 VDC SUPPLY (SCP)TB1-1 or 2
TERMINAL JUMPERS 1 THRU 3

ELDRIDGE PRODUCTS, INC.		TITLE
APPROVALS	DATE	TRANSMITTER WIRING TERMINALS (TWT) INTERNAL WIRING DIAGRAM
DRAWN		
CHECKED		
ENGR		
DESIGN		
SIZE	REV CODE	DWG. NO.
A		60402604 TWT 04-09-08
SCALE	ACADMIN	SHEET OF

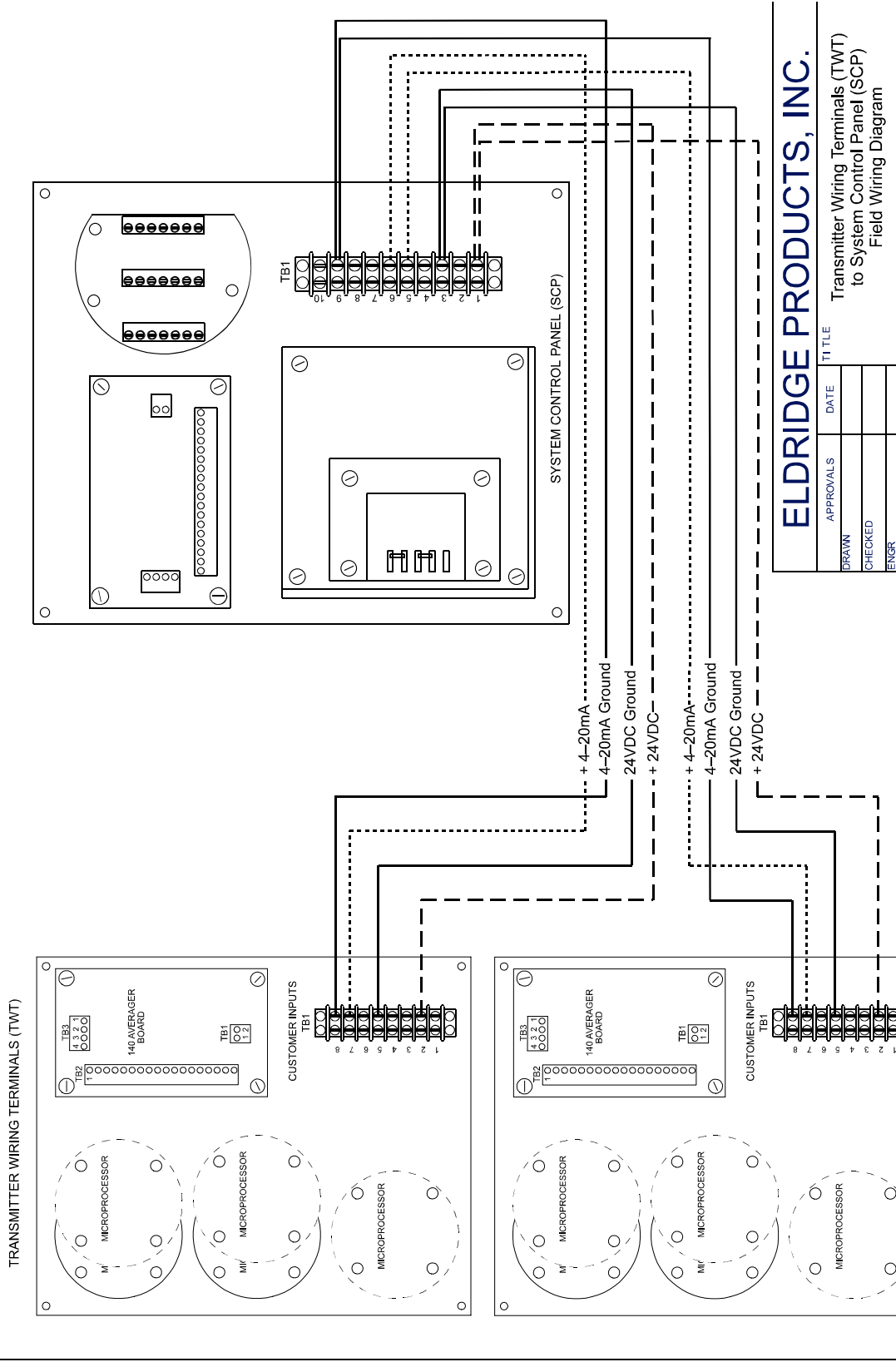
(Enclosure will include 2 – 5 microprocessor boards depending on system design)







REVISIONS		DATE	APPROVED
ZONE	REV		
DESCR: PFI 04			



NOTE: Wiring shows 2 probes (TWT) connected to System Control Panel.

ELDRIDGE PRODUCTS, INC.		TITLE	
APPROVALS	DATE	Transmitter Wiring Terminals (TWT) to System Control Panel (SCP) Field Wiring Diagram	
DRAWN		SIZE	REV
CHECKED		A	04-99-08
ENGR		DWG. NO.	Probe to SCP
DESIGN		SCALE	SHEET OF

Example of Menu Data Sheet

ELDRIDGE PRODUCTS INC. - Meter Datasheet

File Name: X:\EPICOM 2.00 - CUSTOMER\26000000_1.mtr
 Firmware Release: v4.1A rA Serial#: 26000000 uP PCBAssembly#: 0

General Meter Settings

207 - Update Rate => 8
 208 - LCD Contrast => 128
 214 - Date Format => 01/12/06
 215 - Time Format => 01:10:45PM
 219 - Password => 9001
 221 - Calib. Due => 01/12/07
 202 - DAC Time => 5
 203 - DAC Filter => 2
 205 - ADC Filter => 2
 213 - Selected Meter => 1

Alarm Settings

402 - Relay#1 OFF => DISABLED	Value =>	0	Delay =>	0	
402 - Relay#1 ON => DISABLED	Value =>	0	Delay =>	0	Hold Flow => False
402 - Relay#2 OFF => DISABLED	Value =>	0	Delay =>	0	
402 - Relay#2 ON => DISABLED	Value =>	0	Delay =>	0	Hold Flow => False

Parameters Settings

101 - Engineering Units => SCFM
 813 - X-Section => 0.250862
 814 - Max Range => 5000.000000
 140 - Full Scale => 5000.000000
 811 - C-Factor => 1.000000
 812 - Zero Offset => 0.000000
 816 - Zero Cutoff % => 0.00%

Curve Fit Settings

850 - Curve Fit => Primary Coefficients Only

801 - Primary Coefficient A => -0.000124000	
802 - Primary Coefficient B => 0.173681006	
803 - Primary Coefficient C => -0.062231001	
804 - Primary Coefficient D => 0.145145997	
805 - Primary Coefficient E => -0.037037998	
806 - Primary Coefficient F => 0.004101000	
807 - Primary Coefficient G => -0.000136000	
808 - Primary Coefficient H => 0.000000000	
809 - Primary Coefficient I => 0.000000000	
810 - Primary Coefficient J => 0.000000000	
701 - Secondary Coefficient A => 0.000000000	
702 - Secondary Coefficient B => 0.000000000	
703 - Secondary Coefficient C => 0.000000000	
704 - Secondary Coefficient D => 0.000000000	
705 - Secondary Coefficient E => 0.000000000	
706 - Secondary Coefficient F => 0.000000000	
707 - Secondary Coefficient G => 0.000000000	
708 - Secondary Coefficient H => 0.000000000	
709 - Secondary Coefficient I => 0.000000000	
710 - Secondary Coefficient J => 0.000000000	
751 - Point-Wise @ 5% => 0.000000000	752 - Point-Wise @ 10% => 0.000000000
753 - Point-Wise @ 15% => 0.000000000	754 - Point-Wise @ 20% => 0.000000000
755 - Point-Wise @ 25% => 0.000000000	756 - Point-Wise @ 30% => 0.000000000
757 - Point-Wise @ 35% => 0.000000000	758 - Point-Wise @ 40% => 0.000000000
759 - Point-Wise @ 45% => 0.000000000	760 - Point-Wise @ 50% => 0.000000000
761 - Point-Wise @ 55% => 0.000000000	762 - Point-Wise @ 60% => 0.000000000
763 - Point-Wise @ 65% => 0.000000000	764 - Point-Wise @ 70% => 0.000000000
765 - Point-Wise @ 75% => 0.000000000	766 - Point-Wise @ 80% => 0.000000000
767 - Point-Wise @ 85% => 0.000000000	768 - Point-Wise @ 90% => 0.000000000
769 - Point-Wise @ 95% => 0.000000000	770 - Point-Wise @ 100% => 0.000000000

Menu Item Interaction

One of the strengths of the Master-Touch™ flowmeters is the extensive support for users' adjustments to the menu item settings. Although various menu items, such as the alarm relays, are used in conjunction with one or more other menu items, most of the individual menu item values can be changed without affecting any other settings. However, changing the engineering units (menu items 101–132) or changing the cross-sectional area (menu item 813–SetXSect) will prompt the microprocessor to immediately recalculate the Full Scale (menu item 140–FScale) and Maximum Range (menu item 814–MaxRange) values. In addition, the proper sequence should be followed when making changes such as these:

- 1) Engineering Units (menu items 101–132),
- 2) Cross-sectional Area (menu item 813–SetXSect),
- 3) Full Scale (menu item 140–FScale)

The cross-sectional area of an inline style flowmeter must not be changed, and the Full Scale value must not be greater than the re-calculated Maximum Range.

Master-Touch™ Diagnostics

Although it is prudent to periodically send meters back for recalibration (typically 1 year is recommended), the Master-Touch™ has a variety of diagnostic menus to allow you to conduct your own interim verifications. For example, Menu 204 (the DAC readout) provides an on-board (filtered and unfiltered) voltage signal proportional to the linear 0-5 VDC full scale range that can be viewed with a lap top. Use EPICommunicator to help with this process. If the user has a calibration facility that can generate a stable flow rate (below the specified full scale range), you can note and record the meter's Menu 204 when the meter is new. Three months or six months later, you can repeat the test. If you receive a similar result, you can be assured that the meter has not drifted out of calibration. The same check should be done with Menu 206, (the ADC readout), although its value will be higher due to the non-linearity of the basic flow signal. Finally, you always have the option of checking the bridge voltage at zero flow. The meter should be oriented in the same orientation as its original calibration at Eldridge — with enclosure up and display/keypad facing towards you. There should be no flow, and the line pressure should be at the original calibration pressure. If the BV measurement off of the left side of resistor RFU and ground is the same as the original BV as recorded by Eldridge, this is another indication that the meter is still in calibration.

Master-Touch™ Auto-Ranging (External Mode)

The diagram below shows the wiring diagram for the auto-ranging circuit. This circuit works with the flowmeter's External Mode selection. The result is to automatically change the meter range in the Master-Touch™ based on flow rate, and thereby set a different scale for the 0–5VDC and 4–20mA output signals. This change will not have any effect on the accuracy of the flow rate shown on the flowmeter's LCD display. This method assumes:

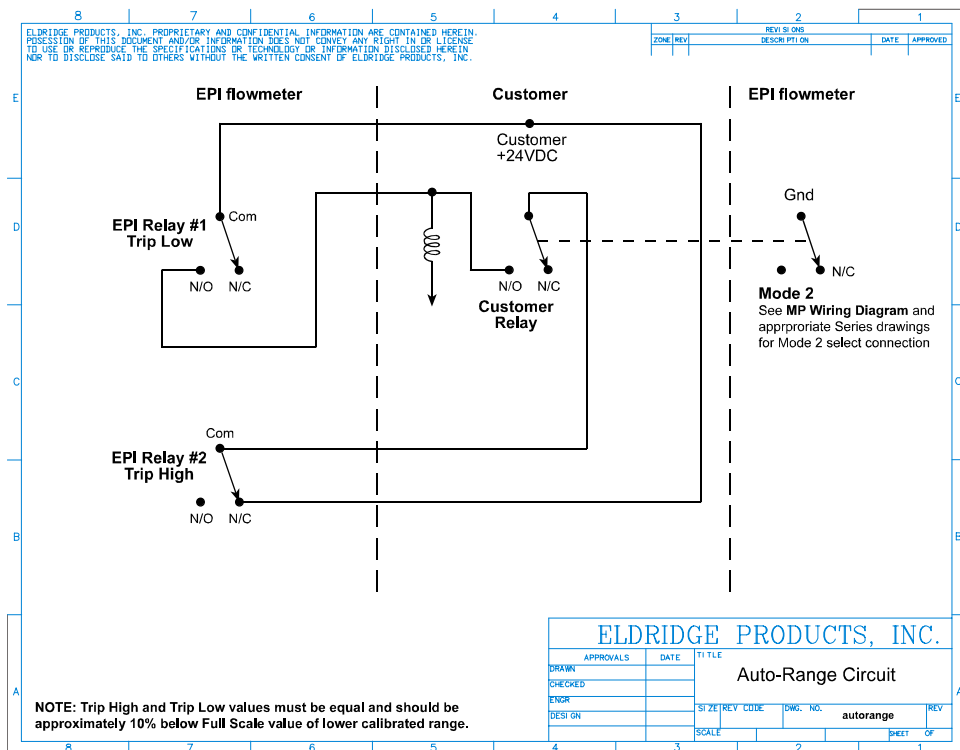
- 1) Meter ranges #1 & #2 are programmed into the flowmeter and that Meter #1 has a lower Full Scale than Meter #2.
- 2) The customer will add the external relays. These can be mounted outside the enclosure if they do not fit under the enclosure cover.

Use EPI Relay #2 when in Meter #1. Set this relay to trip at the “high” value. When the flow rate goes above this value, it will trip the relay which will then switch the flowmeter to Meter #2. The flowmeter will run through its reset routine and re-start in Meter Range 2. Disable Relay #1 in Meter Range 1.

Use EPI Relay #1 when in Meter #2. Set this relay to trip at the “low” value. When the flow rate goes below this value, it will trip the relay which will then switch the flowmeter to Meter #1. The flowmeter will run through its reset routine and re-start in Meter Range 1. Disable Relay #2 in Meter Range 2.

The “high” and “low” values set for the relays must be the same. To avoid unwanted cycling between the two ranges if the actual flow rate stays too close to the trip point, set a time delay on the relay response.

After setting up the relays, the flowmeter must be set to External Mode (see Section D, Menu 213–Set Meter) and the customer relay connected to Ground and Mode 2 select.



Master-Touch™ ASCII Data Stream

The following is an example of the fixed width ASCII data stream continuously transmitted from the Master-Touch™ microprocessor:

```
21.98· · · · SCFM· · · · 239184.68952· SCF· · · 962.15· · · · · 0.00· · · · · R1=· R2=· · · · · □
22.48· · · · SCFM· · · · 239184.85641· SCF· · · 962.15· · · · · 0.00· · · · · R1=· R2=· · · · · □
22.56· · · · SCFM· · · · 239184.99947· SCF· · · 962.15· · · · · 0.00· · · · · R1=· R2=· · · · · □
23.71· · · · SCFM· · · · 239185.21404· SCF· · · 962.15· · · · · 0.00· · · · · R1=· R2=· · · · · □
23.83· · · · SCFM· · · · 239185.35709· SCF· · · 962.15· · · · · 0.00· · · · · R1=· R2=· · · · · □
24.42· · · · SCFM· · · · 239185.59551· SCF· · · 962.15· · · · · 0.00· · · · · R1=*· R2=· · · · · □
26.86· · · · SCFM· · · · 239185.76241· SCF· · · 962.15· · · · · 0.00· · · · · R1=*· R2=· · · · · □
```

The following describes the data stream elements:

```
26.86· · · · SCFM· · · · 239185.76241· SCF· · · 962.15· · · · · 0.00· · · · · R1=*· R2=· · · · · □
```

Flow Rate

```
26.86· · · · SCFM· · · · 239185.76241· SCF· · · 962.15· · · · · 0.00· · · · · R1=*· R2=· · · · · □
```

Elapsed Total

```
26.86· · · · SCFM· · · · 239185.76241· SCF· · · 962.15· · · · · 0.00· · · · · R1=*· R2=· · · · · □
```

Highest Flow

```
26.86· · · · SCFM· · · · 239185.76241· SCF· · · 962.15· · · · · 0.00· · · · · R1=*· R2=· · · · · □
```

Lowest Flow

```
26.86· · · · SCFM· · · · 239185.76241· SCF· · · 962.15· · · · · 0.00· · · · · R1=*· R2=· · · · · □
```

Relay #1 Status

```
26.86· · · · SCFM· · · · 239185.76241· SCF· · · 962.15· · · · · 0.00· · · · · R1=*· R2=· · · · · □
```

Relay #2 Status

The flowmeter can also be controlled by sending the various menu commands and values to the Master-Touch™ as an ASCII stream. These communications could be transmitted through either the RS232 or RS485 communications protocols but, without EPI's full menuing system, the commands must be sent "blind" after referring to the Instruction Manual for the proper sequence of input characters.

ELDRIDGE PRODUCTS, INC.

Attn: Customer Service
2700 Garden Road, Building A
Monterey, California 93940



Fax: 831/648-7780
Telephone: 831/648-7777
Email: customersupport@epiflow.com
Internet: www.epiflow.com

CUSTOMER SATISFACTION REPORT

Eldridge Products, Inc. is interested in your level of satisfaction with the purchase and operation of your new thermal gas mass flow meter(s) or switch(es). Please take a few moments to complete the following form and then either fax or mail it to EPI. Thank you for your cooperation.

Your Name:	Instrumentation Serial Number(s):
Company:	Date:
Fax No.:	Tel. No.:

Sales Order:

Did you receive a confirming Sales Order from Eldridge Products, Inc. for your review that was correct in its details for invoicing, order shipment, and the technical details of the required instrumentation?

Yes ___ No (Please explain):

Order Shipment:

Did you receive all instrumentation as ordered and per the Purchase Order shipping instructions?

Yes ___ No (Please explain):

Instrument Performance:

Did the instrumentation perform in accordance within factory specifications?

Yes ___ No (Please explain):
