Eldridge Products, Inc.

Master-Touch™

Thermal Gas Mass Flowmeters

version 5.x

Series 8000MPNH–8200MPNH, Series 8600MPNH–8800MPNH

Approved for use in Non-Hazardous locations

INSTRUCTION MANUAL

80201102 (Rev. 2.21)

CE

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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Section A Introduction and Installation

Introduction

Your Master-Touch™ flowmeter includes a flow sensing element, temperature sensing element, bridge amplifier/signal output board, microprocessor circuit board, transmitter enclosure, and probe support or flow section. Depending upon your requirements, these individual pieces may be integrated into one flow transmitter assembly or you may have a flow transmitter with an additional signal processor assembly (remote electronics). In either configuration, the microprocessor converts the nonlinear input signal received from the flow transmitter to linear 0–5 VDC & 4–20 mA output signals. 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 Master-Touch™ thermal mass flowmeter is a precision piece of electronic flow instrumentation. Although these flowmeters are rugged, they should be inspected upon delivery to assure that no damage has taken place during transit. *If upon inspection it is found that damage has occurred, notify the carrier immediately and place a claim for damaged goods*. The shipping container or crate should be handled with care and carefully opened to avoid possible damage to the contents. After the container is opened the contents should be carefully removed and the individual pieces checked against the packing list. Please note that the packing list will show all of the options that were ordered for your instrument. Many, if not all, of those options will be incorporated into the flow meter itself and will not be separate components. The last verification is to check that the equipment and calibration range as shown on the flowmeter's documentation match your purchase order specifications. *If you discover a discrepancy or have any questions about what you have received, contact EPI immediately*.

Power Requirements

Power requirements for Master-Touch™ flowmeters with the "-DC24" option are user-supplied 18 to 24 Volts DC @ 250 mA.

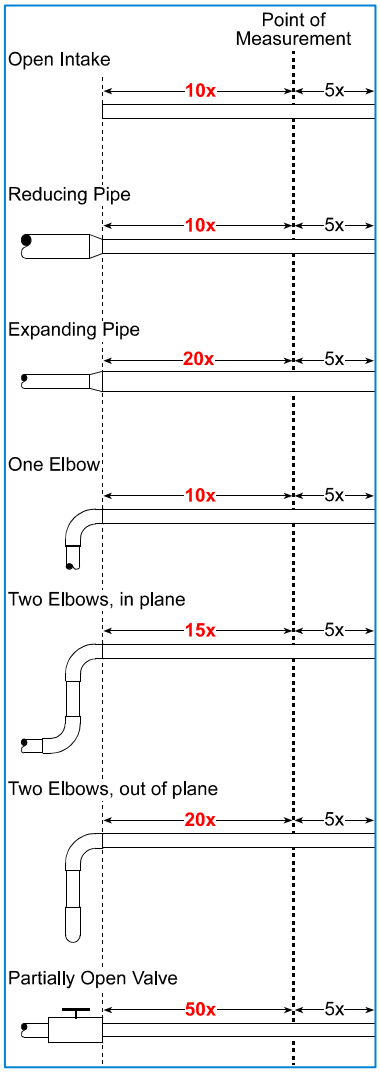
Power requirements for Master-Touch™ flowmeters with the "-AC115" option are 115 VAC 50/60 Hz standard, or 220 VAC 50/60 Hz with the "-AC230" option. If conduit is used to enclose the power input line, it should be suitable for the application, electrically conductive, and connected within the enclosure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

If the flowmeter includes a remote electronics assembly, then the flow transmitter power is provided by the connection to the remote assembly (see the wiring instructions in Section G which correspond to your configuration). Ten feet of two wire connection cable is provided with the remote assembly. If more cable is required, the 10' length should be replaced with a two-wire, twisted pair shielded cable. The wire should be sized for no more than 5 Ohms resistance across the loop and not less than 22 AWG. The transmitter is independent of cable length and won't suffer any signal degradation with length changes.

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

Installation and Mounting

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



Our inline style flowmeters are calibrated with the sensors in a fixed postion within the provided flow section. Our insertion flowmeters are calibrated for the ANSI Point-of-Average-Flow (.243r) positioning in the process line with a fully-developed flow profile. You may need to make minor adjustments in the sensor position for best results in your process line. With either style of flowmeter, you may also need to utilize the C-Factor adjustments of the Master-Touch™ software for the most accurate flow readings due to a non-uniform flow profile in your process line. For additional information concerning Point-of-Average-Flow and installation suggestions, see the *Probe Insertion Guidelines* located in Section G.

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

The flowmeter must be installed at a location where the gas is dry or above the dew point temperature. Installations which allow large droplets of water to condense out and come in contact with the sensing element must be avoided. EPI has developed a strategy which is usually successful in minimizing or eliminating this effect. For installations where the formation of condensing water droplets in a horizontal process line is unavoidable, the flowmeter should be mounted at an angle of 30°–45° from the vertical. This will allow any droplets which collect on the inner pipe wall and run down probe assembly to drop off before they come into contact with the sensor.

Installation of Inline Flowmeters

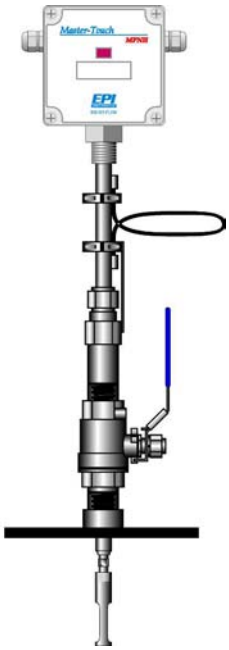
The inline style flowmeter assembly includes the flow sensing element, temperature sensing element, bridge amplifier/signal output board, microprocessor circuit board, transmitter enclosure, and flow section. The flow section is typically specified to match the user's flow conduit and is plumbed directly in the flow line. This design has the sensing elements mounted directly in the flow section for exposure to the process gas. Inline mounting styles are available through EPI in sizes from 1/4" pipe through 4" pipe. The standard end configuration is MNPT (male national pipe thread) threaded ends

for flow sections up to 2 1/2"; flow sections of 3" and larger are assembled with the appropriate size of ANSI 150# Class flanges. If required, optional end mounting styles may be specified, such as tube ends, tube end fittings, butt weld ends, flanged end configurations, etc. Pipe sizes in excess of 4" require the insertion mounting style discussed below.

Inline flowmeters are calibrated with the sensing element mounted in place within the flow section. The sensor should not be removed as the accuracy of the flow signal will be slightly affected. Should it become necessary to remove the sensing element for any reason, the element should be replaced in the same alignment as it was originally positioned. Consult the factory before disassembling.

Installation of Insertion Flowmeters

The insertion style flowmeter includes the flow sensing element, temperature sensing element, bridge amplifier/signal output board, microprocessor circuit board, transmitter enclosure, and the probe assembly which supports the sensing elements. This design requires the probe assembly to be inserted into the process gas flow conduit to allow the process gas to flow across the sensor assembly. The insertion style flowmeter probe assembly may be inserted into any suitable flow section, pipe, or duct.



Insertion styles are available with 1/2", 3/4" or 1" OD probes and may be installed with bored-through tube fittings to mount them in place. Tube fittings, with or without mounting flange, are available from the factory as an option. Installing the tube fitting consists of preparing the flow conduit to accept the fitting by first drilling a clearance hole for the transmitter probe assembly, welding it in place, or threading it into the proper size half coupling which has been welded to the flow conduit. The tube length must be specified upon ordering. Standard lengths range from a minimum of 6" to a maximum of 36". For other probe diameters and lengths, please consult the factory.

Optional ball valve assemblies are available through EPI which allow the removal of the insertion style flow transmitter assemblies for service, calibration, cleaning, etc. The valve provides a means to seal off leaks of the process gas at the point of insertion after the probe assembly has been removed. Installation requires fitting the flow section to which the insertion probe assembly will be inserted with a threaded half coupling of the proper size to accommodate the ball valve retractor. In some instances, this requires direct threading together (or with a reducing bushing) of the retractor assembly. In other cases, it requires welding the half coupling in place and drilling a clearance hole through for the probe assembly. If the flow section is under pressure, a hot tap drill rig (not available through EPI) may be required.

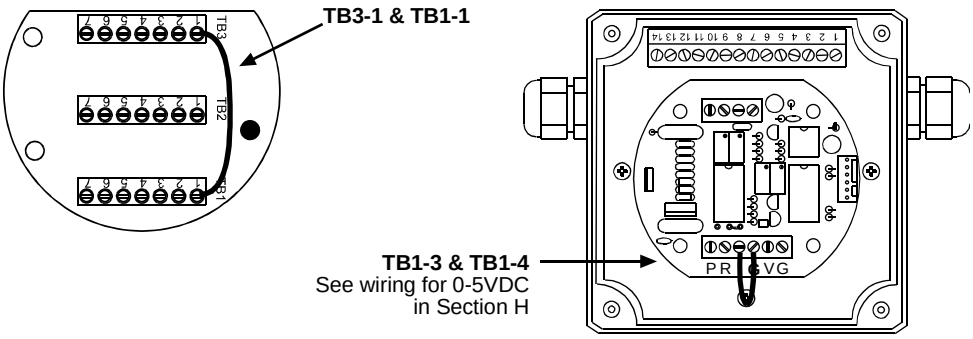
The maximum pressure for insertion style flowmeters is stated in the General Specifications section of this manual. To reduce the possibility of personal injury when servicing the flowmeter, each size is rated such that the maximum force applied to the transmitter is approximately 25 pounds. Caution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

Signal Interface

The microprocessor provides both 0–5 Volts DC and 4–20 mA flow output signals. Voltage signals should not be sent over long distances due to small currents causing voltage drops across the wire pair. If the voltage is to be sent over a distance (for example 50 feet), the wire AWG should be sized to reduce the voltage drop to acceptable levels. Knowing your load impedance is the only way this calculation may be achieved. Our 4–20 mA signal is provided to prevent this sort of signal loss.

Current loops are normally not susceptible to noise and are not affected by voltage drops around the loop. However, it is important when using a current loop not to exceed the level of load resistance that the current loop may drive. Our current loop will drive a load (lead plus load resistance) of 500 ohms. When the 4–20mA current loop output is not to be used, a jumper must be placed around the loop at the output signal connections (see below).

Jumper on 4–20mA Out & Ground when using 0–5 VDC Output ONLY



The Master-Touch™ Series has been tested and approved as CE Compliant.

Section B General Operation

Sensor Theory and Operation

Master-Touch™ products include a rugged, cleanable, thermal mass flow sensor. These units consist of a sensor assembly which utilizes two RTD (Resistance Temperature Detector) sensing elements. The sensors are constructed of reference grade platinum, ceramic, glass, and stainless steel. Two platinum resistance sensors are built up upon the ceramic substrate and then given a thin glass coating. The assembly is then slipped into a stainless steel sheath for corrosion and abrasion resistance. The sensor assembly is large, rugged, and relatively insensitive to dirt buildup.

During operation, the temperature sensor constantly measures the ambient temperature of the gas and maintains a reference resistance on one side of a Wheatstone bridge. The second sensor is forced through self heating to a constant temperature above that of the gas stream and is controlled by the temperature sensor and our forced null Wheatstone bridge amplifier. Our bridge is set up with precise resistance values to maintain the overheat temperature and to counterbalance the temperature effects through our temperature compensation techniques.

Transmitter Operation

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

Signal Processor Operation

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

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

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

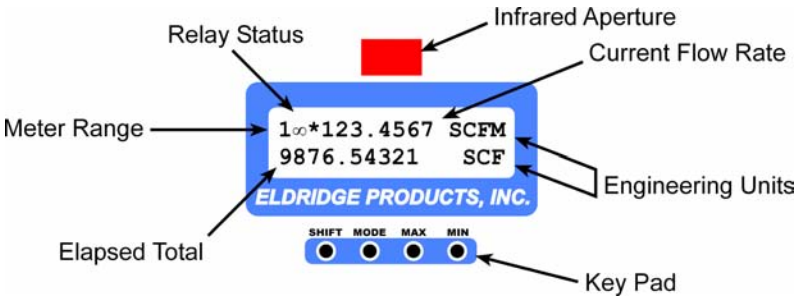
High Flow value
High Flow Time/Date
Low Flow value
Low Flow Time/Date
Totalizer value
Totalizer reset Time/Date
LCD contrast setting
Date format (MM/DD/YY; DD.MM.YY)
Real time clock time & date
Data Log pointer

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

Section C The Master-Touch™ LCD and Key Pad

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

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



Meter Range — indicates the active meter calibration range (1–4), an exclamation point (**!**) indicates that the flowmeter is operating with menu item 212–Track Hold selected, a box (□) indicates that the flow has exceeded the range of the 0–5VDC and 0–20mA output signals; a "D" indicates that the flowmeter is running the E-Log™ mode;
Relay Status — indicates status of Relays 1 and 2 (∞ = de-energized, * = energized);
Infrared Aperture — allows infrared communications with EPI's LightWIRE modules (the blinking red light is normal);
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

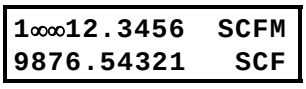
The flowmeter must be unlocked to make changes to the variable settings. The factory default value for menu item 219–UnLock is "9001". If the numeric entry mode is accessed while the flowmeter settings are still locked, the top line of the LCD display will show "METER LOCKED**" until you press the SHIFT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



RUN MODE

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

207-Disp Rate	This menu item adjusts the rate at which the rate and totalizer readouts are updated. It is often used to reduce the effect of a rapidly fluctuating flow rate on the LCD display. Any value less than 8 (ms) should be avoided because it will cause updates to the flow rate which will override the correct presentation of the total elapsed flow on the LCD display. ***This menu item only affects the totalizer and flow rate update period, not their accuracy, and does not affect the 0–5VDC or 4–20mA output signals.***
208-Disp Set	This menu item sets the LCD panel contrast value. A value of 128 should display digits at room temperature. Use the **SHIFT + MAX / MIN** keys during Run Mode to fine tune this setting if necessary.
209-Curve Fit	This menu item selects the curve fit mode used by the microprocessor to generate the flow readings and output signals. The menu values are: 0 = NO = NO curve adjustment 1 = PO = Primary (factory) curve fit adjustment 2 = PS = Primary & Secondary curve fit adjustments 3 = PW = Primary & Pointwise curve fit adjustments
210-Modbus Addr	This menu item sets the Modbus address for this flowmeter. A value of 0 disables Modbus protocol from the RS485 communications port and the data sent out the RS485 port is the same as the RS232 port. A value of 1-127 enables the Modbus protocol on the RS485 port and this number is also the flowmeter's Modbus address. See Modbus manual for more details.
211-Tracking On	This menu item restores the DAC and ADC tracking.
212-Track Hold	This menu item suspends the DAC and ADC tracking. ***This menu item requires the Diagnostic Password for access. Consult factory.***
213-Set Meter	This menu item is used to select the active meter range. All Master-Touch™ flowmeters are capable of storing configuration and parameter data for four separate meter ranges. A specific meter range is selected by entering 1–4 in this menu item. If a flowmeter has only one calibrated meter range, the factory will program it as meter range #1 and meter ranges #2–4 will not contain any valid variables. ***The flowmeter can also be set up to allow external switching between stored ranges by entering "0" at the prompt. However, EPICommunicator 2.0 software must be used for this function as it affects the use of the keypad for access to the menu system.***
214-Set Date	This menu item sets the time stamp functions to the current date for accurate reporting. The menu supports both MM/DD/YY and DD.MM.YY time formats where: • MM = month (01–12) • DD = day (01–31) • YY = year (00–99) Include a slash (/) as the delimiter between values for MM/DD/YY format, or a period (.) as the delimiter between values for DD.MM.YY format. The date will not be set if these formats are not followed exactly.

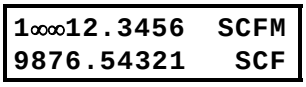
215-Set Time	This menu item sets the time stamp functions to the current time for accurate reporting. The time prompt indicates HH:MM:SS where: • HH = hour (00–23) • MM = minutes (00–59) • SS = seconds (00–59) • . (period) = AM /PM or 24 hour clock Include a colon (:) as the delimiter between values. The time will not be set if this format is not followed exactly. Example: 01:24:56P = 1:24:56 PM 13:24:56 = 1:24:56 PM displayed in 24 hour clock format.
216-No Curve Fit	This menu item suspends the factory P-Curve linearization. ***This menu item requires the Diagnostic Password for access. Consult factory.***
217-Curve Fit	This menu item 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. ***If you set your own password, save it in a secure place to prevent loss and lockout from user variables.***
219-UnLock	This menu item is used to enter the pre-set four digit password that unlocks the flowmeter's settings. You can access any number of menu items while the settings are unlocked. The settings are locked again when the flowmeter is returned to Run Mode. ***See Page D-1 for detailed instructions on this menu item.***
220-Diagnostic P	This menu item is the factory password for certain menu items which should not ordinarily be accessed by users. These menu items include: 201–DAC Set 204–DAC Readout 206–ADC Readout 212–Tracking Off 216–No Curve Fit 801-812–CoeffTerm A-J (P-Curve coefficients) 814–MaxRange
221-SetCalDate	This menu item can be set to act as a reminder for periodic recalibrations. Enter the date of the next calibration reminder using the MM/DD/YY format, or enter a zero-zero (00) for either the month or day to disable the reminder.
222-Fix Decimal	This menu item controls the number of decimals shown in the flow rate display. Enter a value from zero to six (0 to 6), or enter an "A" for the automatic floating decimal. ***This setting does not affect the total elapsed flow display nor does it affect the accuracy of the flowmeter.***
223-Set WD Timer	This menu item allows the user to change the Watchdog (WD) timer "time-out" period. The factory default setting is 3 which equals 3 minutes. This timer is used to exit all menus after the time-out period. The MP will perform a reset similar to the power down/power up reset. The minimum allowable value is 1; the maximum allowable value is 120.

224-ProtocolOnOff	This menu item allows the flowmeter to use alternate communication protocols such as HART and Modbus. The factory default is Protocol Off (0); when HART, Modbus or other communication options are installed, the Protocol is On (1). Consult factory for supported protocols. ***When the Protocol is on (1) then EPIcommunicator's RS232 communication is disabled. You must use the flowmeter's keypad or an EPICom II handheld device to turn off the Protocol (0) which will enable the RS232 communications.***
225-Set RS232 Baud	This menu item adjusts the baud rate of the RS232 port. 0 = Factory Default (9600) 1 = 9600 2 = 14400 3 = 19200 4 = 28800 5 = 33400 6 = 56000 7 = 57600 8 = 115200 ***EPI's LightWIRE IR communication modules currently require an RS232 baud rate of 9600 and will not function correctly at other baud rates.***
226-Set RS485 Baud	This menu item adjusts the baud rate of the RS485 port. 0 = Factory Default (19200) 1 = 9600 2 = 14400 3 = 19200 4 = 28800 5 = 33400 6 = 56000 7 = 57600 8 = 115200 ***RS485 communications require an RS485-to-RS232 protocol converter for connecting the flowmeter to a PC running EPICommunicator or similar software.***
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
300 *Status*	Go to 300 *Status* Menu
400 *Alarms	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode*
700 *S-Curve Fit*	Go to 700 *S-Curve Fit* Menu
750 *PW-CurveFit*	Go to 750 *PW-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

300 *Status* Menu

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

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



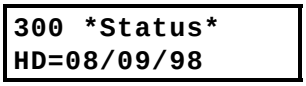
RUN MODE

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.

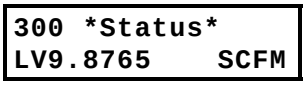
The display will change automatically to the first Status menu item. The first character indicates which meter range is selected (1–4) or Tracking Off (!). The second and third characters indicate the selected curve fit mode (NO, PO, PS, PW). Each of the next four characters is the last digit of the 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.

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

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

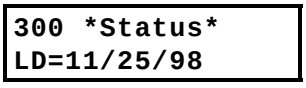


This display presents the date stamp for the highest flow value.



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

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



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

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):

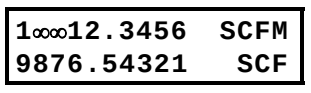
- Relay 1 OFF (**Ev1**): the relay coil is de-energized with the Common and Normally Closed connected
- Relay 1 ON (**Ev2**): the relay coil is energized with the Common and Normally Open connected
- Relay 2 OFF (**Ev3**): the relay coil is de-energized with the Common and Normally Closed connected
-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

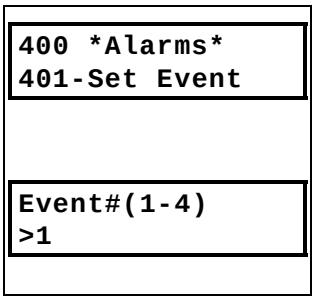
- **Trip High** — an alarm relay is triggered by a flow rate that is higher than the preset value;
- **Trip Low** — an alarm relay is triggered by a flow rate that is lower than the preset value;
- **Total** — an alarm relay is triggered by an accumulated flow total that is higher than the preset value;
- **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*).



RUN MODE



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 (>). ***The same value must be entered for both relay events (1&2 or 3&4). This will give a 50/50 duty cycle.***
409-Total	This menu item sets the current active Event to respond to an elapsed total. Enter the desired preset value in the current engineering units (whole numbers only – no decimals).

410-PulseOut	This menu item sets the current active Event to respond to an elapsed total. This function is used with remote data collection systems which count the pulses to generate an elapsed flow total. Enter a value to activate a relay for every X number of units on the totalized flow, i.e., every 1 unit, 12 units, 50 units, etc. Any whole number between 1 and 2,000,000 may be entered at the prompt (>), but we recommend decimal values (1, 10, 100, . . .). A timer function must be associated with this menu item to release the relay from the active state (*see menu item 407–Timer*). The timer must be set fast enough to release the relay before the next preset total value is reached.
411-Trip Delay	This menu item sets the response delay for the current active Event. Enter the desired value in increments of 50ms (20 = 1 second). The acceptable values are 1– 255.
412-ESD/EMI Rst	This menu item detects LCD errors caused by power supply noise or other electromagnetic interference. A value in increments of 50ms must be entered to determine the duration of such interference before the relay responds. A value of one (1) will cause a response to the shortest disturbance. Consult factory for additional information and a diagram of required wiring of input power to implement this function.
413-Flow Hold1	This menu item holds the ADC input value while Relay 1 Event 2 is on. When the value is set to one (1), it will hold the ADC input at its current value. A value of zero (0) will disable this feature.
414-Flow Hold2	This menu item holds the ADC input value while Relay 2 Event 4 is on. When the value is set to one (1), it will hold the ADC input at its current value. A value of zero (0) will disable this feature.
	(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-Curve Fit*	Go to 700 *S-Curve Fit* Menu
750 *PW-CurveFit*	Go to 750 *PW-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

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*
451-Set StartDat
```

RUN MODE

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

466—Start Timer	This menu item is used to start the internal timer for the programmed Start and Stop options (Menus 451 — 454) .
467—Display Setup	***This menu item is only for use with EPICommunicator software. The flowmeter will require a Restart if the Shift key is pressed while this submenu is shown on the display.***
468—	(unused)
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
500 *Run Mode*	Go to 500 *Run Mode*
700 *S-CurveFit*	Go to 700 *S-CurveFit* Menu
750 *PW-CurveFit*	Go to 750 *PW-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

700 *S-Curve Fit* Menu

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

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

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

RUN MODE

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

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

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

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

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

700 *S-Curve Fit* Submenus

701-CoeffTermA	See Secondary Coefficient instructions.
	through
710-CoeffTermJ	See Secondary Coefficient instructions
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
400 *Alarms	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode*
750 *PW-CurveFit*	Go to 750 *PW-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

750 *PW-Curve Fit* Menu

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

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

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

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

RUN MODE

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

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

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

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

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

750 *PW-Curve Fit* Submenus

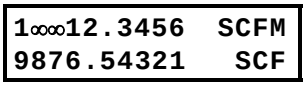
751-Pointwise 5%	This menu item is used to adjust the 0 – 5% segment of the flow range.
752-Pointwise 10	This menu item is used to adjust the 5 – 10% segment of the flow range.
753-Pointwise 15	This menu item is used to adjust the 10 – 15% segment of the flow range.
754-Pointwise 20	This menu item is used to adjust the 15 – 20% segment of the flow range.
755-Pointwise 25	This menu item is used to adjust the 20 – 25% segment of the flow range.
756-Pointwise 30	This menu item is used to adjust the 25 – 30% segment of the flow range.
757-Pointwise 35	This menu item is used to adjust the 30 – 35% segment of the flow range.
758-Pointwise 40	This menu item is used to adjust the 35 – 40% segment of the flow range.

759-Pointwise 45	This menu item is used to adjust the 40 – 45% segment of the flow range.
760-Pointwise 50	This menu item is used to adjust the 45 – 50% segment of the flow range.
761-Pointwise 55	This menu item is used to adjust the 50 – 55% segment of the flow range.
762-Pointwise 60	This menu item is used to adjust the 55 – 60% segment of the flow range.
763-Pointwise 65	This menu item is used to adjust the 60 – 65% segment of the flow range.
764-Pointwise 70	This menu item is used to adjust the 65 – 70% segment of the flow range.
765-Pointwise 75	This menu item is used to adjust the 70 – 75% segment of the flow range.
766-Pointwise 80	This menu item is used to adjust the 75 – 80% segment of the flow range.
767-Pointwise 85	This menu item is used to adjust the 80 – 85% segment of the flow range.
768-Pointwise 90	This menu item is used to adjust the 85 – 90% segment of the flow range.
769-Pointwise 95	This menu item is used to adjust the 90 – 95% segment of the flow range.
770-Pointwise 100	This menu item is used to adjust the 95 – 100% segment of the flow range.
780-All PW = 0%	This menu item is used to reset all segments to the factory default of zero (0).
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
400 *Alarms	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode*
700 *S-CurveFit*	Go to 700 *S-CurveFit* Menu
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

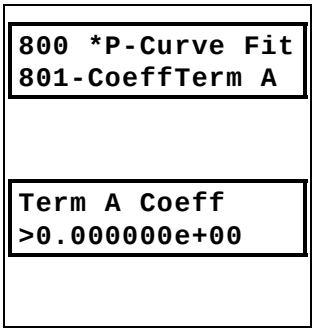
800 *P-Curve Fit* Menu

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.



RUN MODE



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.

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. ***Requires Diagnostic Password for access. Consult factory.***

through

810-CoeffTermJ	Factory Calibration Coefficient. ***Requires Diagnostic Password for access. Consult factory.***
811-C Factor	This value is a multiplier used to adjust the P-Curve linearization. It is normally set to 1.0, but may be adjusted based the *Installation Guidelines*, or to correct for aberrations in sensor readings. The C Factor can also be used to change standard conditions (STP) or to apply a density factor (vapor density) when changing the engineering units from volumetric units (SCFM, NCMH, etc.) to gravimetric units (Lbs/Hr, Kg/Hr, etc.) in flowmeters calibrated for gases other than air.
812-Zero Offset	This voltage value is subtracted from the sensor curve linearizer to correct for minor sensor voltage errors. This ensures that zero flow is attained even though some bias voltage may exit which would otherwise prevent an absolute zero reading (*see also menu item 815–Auto Zero*).

813-SetXSect	This value is the cross-sectional area of the flow section or process line. The units of measure are determined by the engineering units selected (*see menu items 101–132*). For example, if the current engineering units are SCFM, then the menu item 813 value must represent square feet (F^2). A value of one (1) may be used if the current engineering units represent velocity (SFPM, NMPS, etc.) or if the flowmeter in an "inline" style with its own flow section.
814-MaxRange	This is the maximum value of the factory NIST calibration. The units of measure are determined by the engineering units selected (*see menu items 101–132*) and the value will change in response to changes to the engineering units. ***Requires Diagnostic Password for access. Consult factory.***
815-Auto Zero	This menu item automatically establishes a new Zero Offset (*see menu item 812–Zero Offset*). Entering a one (1) at the prompt changes the zero offset to the 0–5VDC output voltage of the flowmeter when the selection is made. This is particularly valuable for No Flow zeroing adjustments. Entering a zero (0) at the prompt leaves the existing zero offset value unchanged.
816-FlowCutoff	This menu item is used to set a percentage of the Maximum Range value (*menu item 814–MaxRange*) as the minimum readable flow rate. Actual flow rates below this minimum value will be treated as No Flow. The display will show "Low" instead of the real-time flow rate, no additional elapsed flow will be recorded, the 0–5VDC signal will drop to 0VDC, and the 4–20mA signal will drop to 4mA. For example, if the Maximum Range is 1000 SCFM, a value of 10 (10%) will cause the flowmeter to ignore flow rates below 100 SCFM or less. When the actual flow rate increases above this value, all of the flowmeter's functions will resume.
	(blank)
100 *Meter*	Go to 100 *Meter* Menu
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
400 *Alarms	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode*
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 (*default factory passkey is 9001*).	`Code#(9xxx)` `>9001`
Step 6	Press **SHIFT** to move active digit to the left until the meter returns to menu item 219–UnLock. The meter is unlocked as indicated by a ">" in the upper right corner of the LCD display.	`200 *Utility* >` `219–UnLock`

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

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`
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 *Meter* menu.	`100 *Meter*  >` `101–SCFM`
Step 3	Press **MAX** or **MIN** to advance to the 100 *Meter* 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 *P-Curve Fit*`
	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*`

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	If further adjustments are required, press **MAX** or **MIN** to advance to other 100 *Meter* menu items or **MODE** to advance to other main menus.	`100 *Meter*  >` `800 *P-Curve Fit*`
	DO NOT return to RUN MODE — this will automatically LOCK the meter.	
Step 7b	If no further adjustments are required, 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 *Meter* menu.	`100 *Meter*  >` `101–SCFM`
Step 3	Press **MAX** or **MIN** to advance to the 100 *Meter* 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.

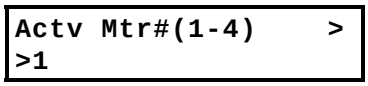
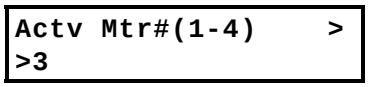
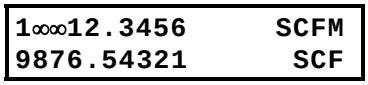
Start	**Menu item 219–UnLock:**	`200 *Utility*  >` `219–UnLock`
Step 1	Press **MAX** or **MIN** to advance to the 200 *Utility* menu item 208–Disp Set.	`200 *Utility*  >` `208–Disp Set`
Step 2	Press **SHIFT** to access the numeric entry mode.	`Contrast(1–200)  >` `>128`
Step 3	The blinking character is the active digit. Use **MAX** or **MIN** to change the numerical value. Use **MODE** to move the active digit to the right and complete the entry of the display contrast.	`Contrast(1–200)  >` `>145`
Step 4	Press **SHIFT** to move active digit to the left until the meter returns to menu item 208–Disp Set. The display contrast is now changed.	`200 *Utility*  >` `208–Disp Set`
Step 5a	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*`

Changing the Meter Range — Menu Item 213–Set Meter

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

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

The following directions assume that you have just unlocked the 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:**	
Step 1	Press **MAX** or **MIN** to advance to the 200 *Utility* menu item 213–Set Meter.	
Step 2	Press **SHIFT** to access the numeric entry mode.	
Step 3	The blinking character is the active digit. Use **MAX** or **MIN** to enter a number from **1** to **4** to select the new active meter range, or **0** to switch to External Mode.	
Step 4	Press **SHIFT** to move active digit to the left to return to menu item 213–Set Meter.	
Step 5	**The meter will now restart and return to RUN MODE using the newly selected meter range settings.**	

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 *P-Curve Fit* 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 *P-Curve Fit*.	`200 *Utility*  >` `800 *P-Curve Fit*`
Step 2	Press **SHIFT** to advance to the 800 *P-Curve Fit* menu.	`800 *P-Curve Fit*  >` `801–CoeffTermA`
Step 3	Press **MAX** or **MIN** to advance to the 800 *P-Curve Fit* menu item 811–C Factor.	`800 *P-Curve Fit*  >` `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 *P-Curve Fit*  >` `811–C Factor`
Step 7a	If further adjustments are required, press **MAX** or **MIN** to advance to other 800 *P-Curve Fit* menu items or **MODE** to advance to other main menus.	`800 *P-Curve Fit*  >` `801–CoeffTermA`

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

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*`

Changing the Cross-Sectional Area — Menu Item 813–SetXSect

Insertion-style Master-Touch™ flowmeters allow you to change the cross-sectional area setting. This allows an insertion flowmeter to be used in more than one size process line. When the cross-sectional area is changed, the flowmeter automatically recalculates the 140–FScale and 814–MaxRange values based upon the velocity of factory calibration. Although no units of measurement are included in the cross-sectional area entry, the flowmeter's microprocessor assumes compatibility with the selected engineering units, i.e., a value of "4" is assumed to be 4 square feet if the engineering units are SCFM, whereas a value of "4" is assumed to be 4 square meters if the engineering units are NCMH.

The following directions assume that you have just unlocked the flowmeter. However, the 800 *P-Curve Fit* 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 *P-Curve Fit*.	`200 *Utility*  >` `800 *P-Curve Fit*`
Step 2	Press **SHIFT** to advance to the 800 *P-Curve Fit* menu.	`800 *P-Curve Fit*  >` `801–CoeffTermA`
Step 3	Press **MAX** or **MIN** to advance to the 800 *P-Curve Fit* menu item 813–SetXSect.	`800 *P-Curve Fit*  >` `813–SetXSect`
Step 4	Press **SHIFT** to access the numeric entry mode.	`Set X-Sec  >` `>4.5`
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 cross-sectional area.	`Set X-Sec  >` `>3.75`
Step 6	Press **SHIFT** to move active digit to the left until the meter returns to menu item 813–SetXSect. The cross-sectional area is now changed.	`800 *P-Curve Fit*  >` `813–SetXSect`
Step 7a	If further adjustments are required, press **MAX** or **MIN** to advance to other 800 *P-Curve Fit* menu items or **MODE** to advance to other main menus.	`800 *P-Curve Fit*  >` `801–CoeffTermA`

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

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*`

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 x 0.125 = 150. When the flow rate is below this flow cutoff limit, the display reads "LOW" and the output signals will be 0VDC and 4mA. When the flow rate is above the cutoff limit the flow rate will be displayed and the output signals will resume at the correct level.

The following directions assume that you have just unlocked the flowmeter. However, the 800 *P-Curve Fit* 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 *P-Curve Fit*.	`200 *Utility*  >` `800 *P-Curve Fit*`
Step 2	Press **SHIFT** to advance to the 800 *P-Curve Fit* menu.	`800 *P-Curve Fit* >` `801–CoeffTermA`
Step 3	Press **MAX** or **MIN** to advance to the 800 *P-Curve Fit* menu item 816–FlowCutoff.	`800 *P-Curve Fit* >` `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 *P-Curve Fit* >` `816–FlowCutoff`
Step 7a	If further adjustments are required, press **MAX** or **MIN** to advance to other 800 *P-Curve Fit* menu items or **MODE** to advance to other main menus. **DO NOT return to RUN MODE — this will automatically LOCK the meter.**	`800 *P-Curve Fit* >` `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 Modbus RTU
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	-40–85°C (-40–185°F)
Gas temperature range	0–200°C (32–392°F) *Consult factory for extended range.*
Gas temperature effect	0.02% /°C
Gas pressure effect	Negligible over ±20% of absolute calibration pressure
Pressure rating maximum:	
Inline flowmeters	500 PSI Std., >500 special
Insertion flowmeters (*See note below*)	
.500" OD	125 PSI Std., >125 special
.750" OD	55 PSI Std., >55 special
1.000" OD	30 PSI Std., >30 special
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
Approvals	
MPNH Series —	For use in Ordinary (Non-Hazardous) area locations: Type 4X, IP66

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

Specification Notice

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

Service Work

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

Storage

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

Limited Warranty

Eldridge Products, Inc. (EPI) warrants its products to be free from defects in materials and workmanship for one year from the date of factory shipment. If there is a defect, the purchaser must notify EPI of the defect within the warranty period. Upon receipt of the defective product, EPI will either repair or replace the defective product at its sole option 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

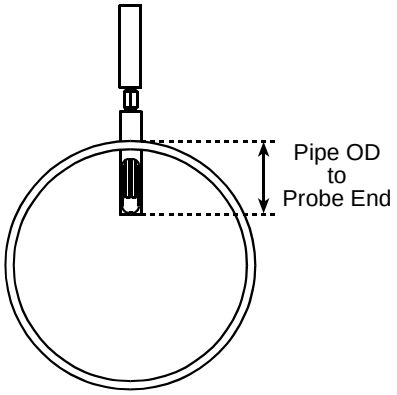
Acceptance of any offer is limited to its terms. Acceptances or confirmations that state additional or differing terms from this price quote shall be operative as acceptances, but all additional or differing terms shall be deemed material alterations within the meaning of Commercial Code Section 2207(2)(b), 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

Probe Insertion Guidelines

The following chart presents the C-Factor adjustments for **insertion** style Master-Touch™ flowmeters. To use the information properly, insert the probe assembly to the correct position in the process line according to "Pipe OD to Probe End" guidelines, and enter the C-Factor corresponding to probe OD and pipe size into the microprocessor settings (Menu 811–C-Factor). The C-Factor can be entered into the settings before or after insertion into the process line.



The calculation for the probe insertion depth (pipe OD to probe end) includes the point-of-average-flow, the 1.3" slot in the protective sensor window, and the wall thickness of each nominal pipe size, as well as a further adjustment on smaller line sizes to be sure that the slot is fully inserted through the pipe wall. The C-Factor corrects the blockage effect created by inserting the probe assembly into the pipe to the depth listed.

The information below assumes a well-developed flow profile in the process line. The actual flow profile may not conform to this standardized profile. Therefore, a further adjustment to the position or C-Factor may be required to improve the overall accuracy of the flowmeter readings. If an additional adjustment is necessary, the C-Factors below must be multiplied by the second correction to calculate the revised C-Factor. For example, if an adjustment of 0.975 must be made to the listed C-Factor for a ½" probe in a 4" line (0.868), the revised C-Factor is 0.975 x 0.868 = 0.8463.

Sch 40 Nominal Pipe Size	Inside Diameter (inches)	Wall Thickness (inches)	Cross-sectional Area (ft^2)	Pipe OD to Probe End (inches)	Menu 811 – C-Factor		
					1/2" OD Probe	3/4" OD Probe	1" OD Probe
2"	2.067	0.154	0.0233	**1.6**	0.858	0.856	0.854
2.5"	2.469	0.203	0.0332	**1.6**	0.795	0.793	0.792
3"	3.068	0.216	0.0513	**1.6**	0.813	0.811	0.810
4"	4.026	0.237	0.0884	**1.7**	0.868	0.866	0.864
6"	6.065	0.280	0.2006	**1.8**	0.978	0.976	0.974
8"	7.981	0.322	0.3474	**2.1**	1.000	1.000	1.000
10"	10.020	0.365	0.5476	**2.4**	1.000	1.000	1.000
12"	12.000	0.375	0.7854	**2.6**	1.000	1.000	1.000
14"	13.250	0.375	0.9575	**2.8**	1.000	1.000	1.000
16"	15.250	0.375	1.2684	**3.0**	1.000	1.000	1.000
18"	17.250	0.375	1.6230	**3.2**	1.000	1.000	1.000
20"	19.250	0.375	2.0211	**3.5**	1.000	1.000	1.000
24"	23.250	0.375	2.9483	**4.0**	1.000	1.000	1.000

Calculating Secondary Coefficients

The Master-Touch™ 5.0 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.**

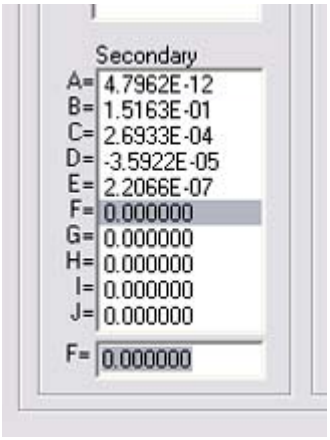
To generate the coefficients, you must know the correction percentage for at least one (1) non-zero flow data point in addition to the 0% and 100% requirements as noted above. The spreadsheet will support a maximum of 10 data points. The data points include two values: the percent of Full Scale at which 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-07x4 - 3.5922E-05x3 + 2.6933E-04x2 + 1.5163E-01x + 4.7962E-12

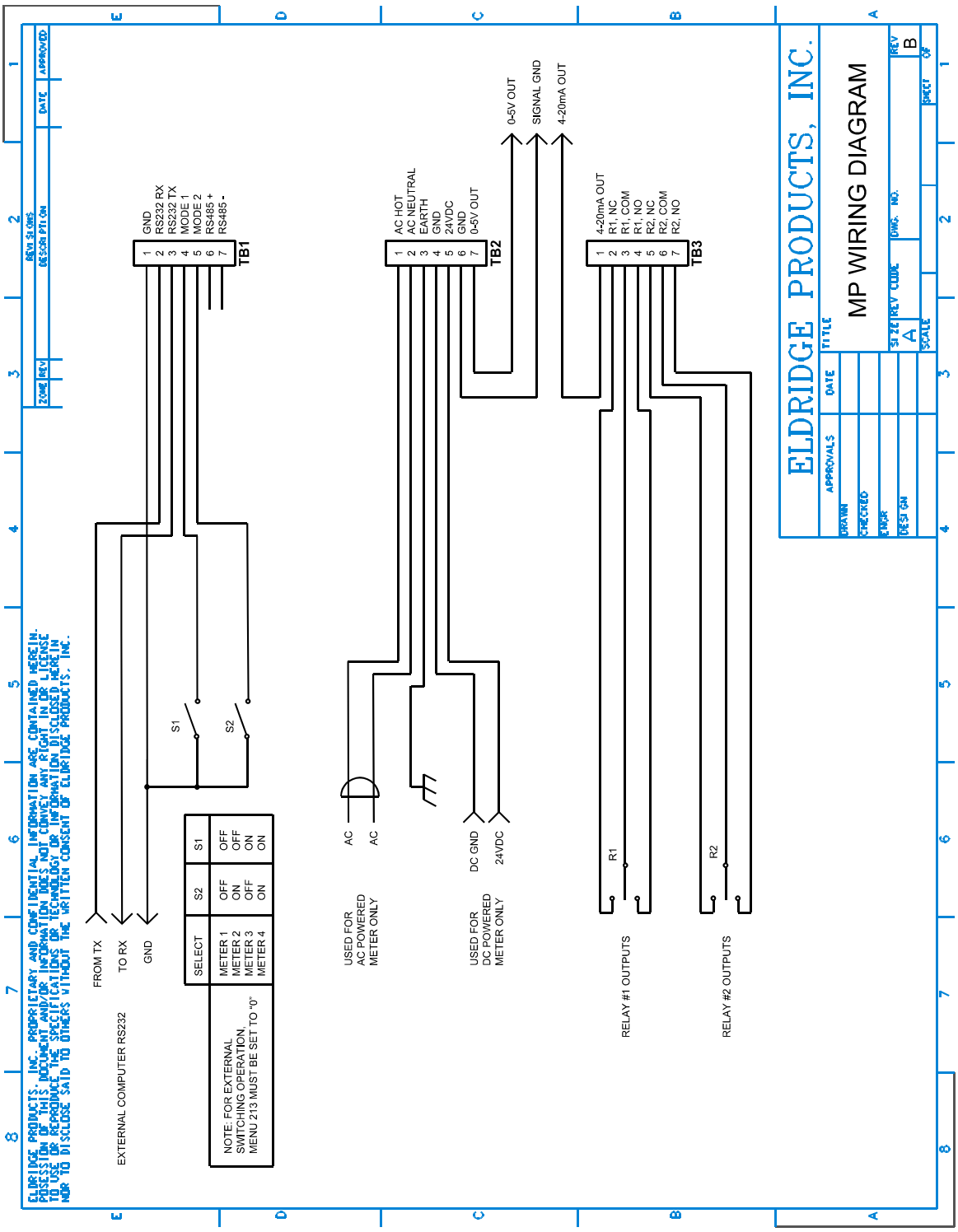
The coefficients are presented in right-to-left order — Coefficient A is on the right, Coefficient B (x) is next, then Coefficient C (x2), and so on. The numeric values may be either positive or negative. If the Coefficient A value is zero, it will not be displayed but it must be entered as "0" as discussed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

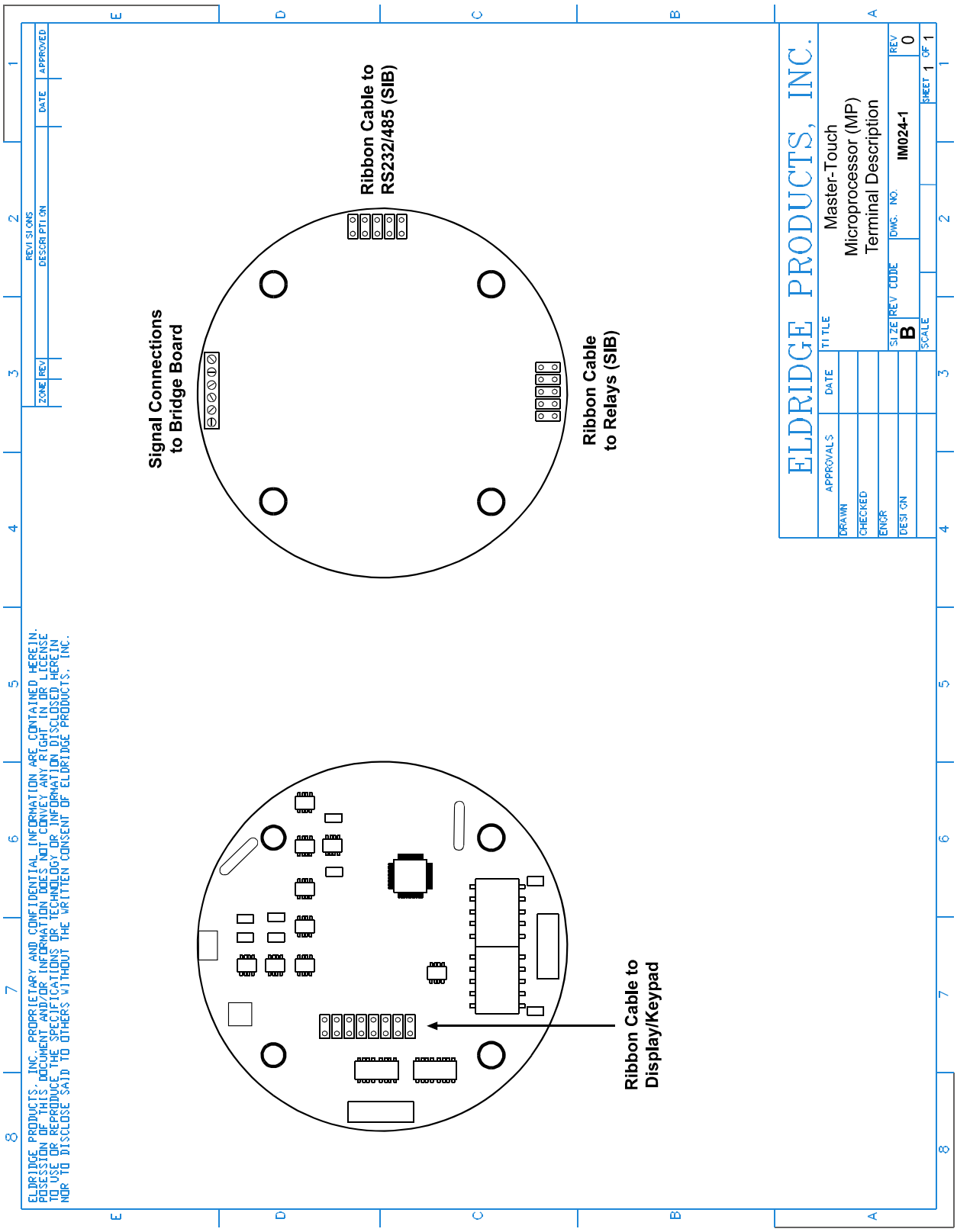


To modify the factory calibration, the numeric value of each secondary coefficient must be entered into the appropriate data fields in EPICommunicator's Meter Module and then downloaded to the flowmeter.

The following pages include technical/informational drawings related to the Master–Touch™ 8000MP 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




Ribbon Cable to
RS232/485 (SIB)
Signal Connections
to Bridge Board
Ribbon Cable
to Relays (SIB)
Ribbon Cable to
Display/Keypad
ELDRIDGE PRODUCTS, INC.
Master-Touch
Microprocessor (MP)
Terminal Description
IM024-1
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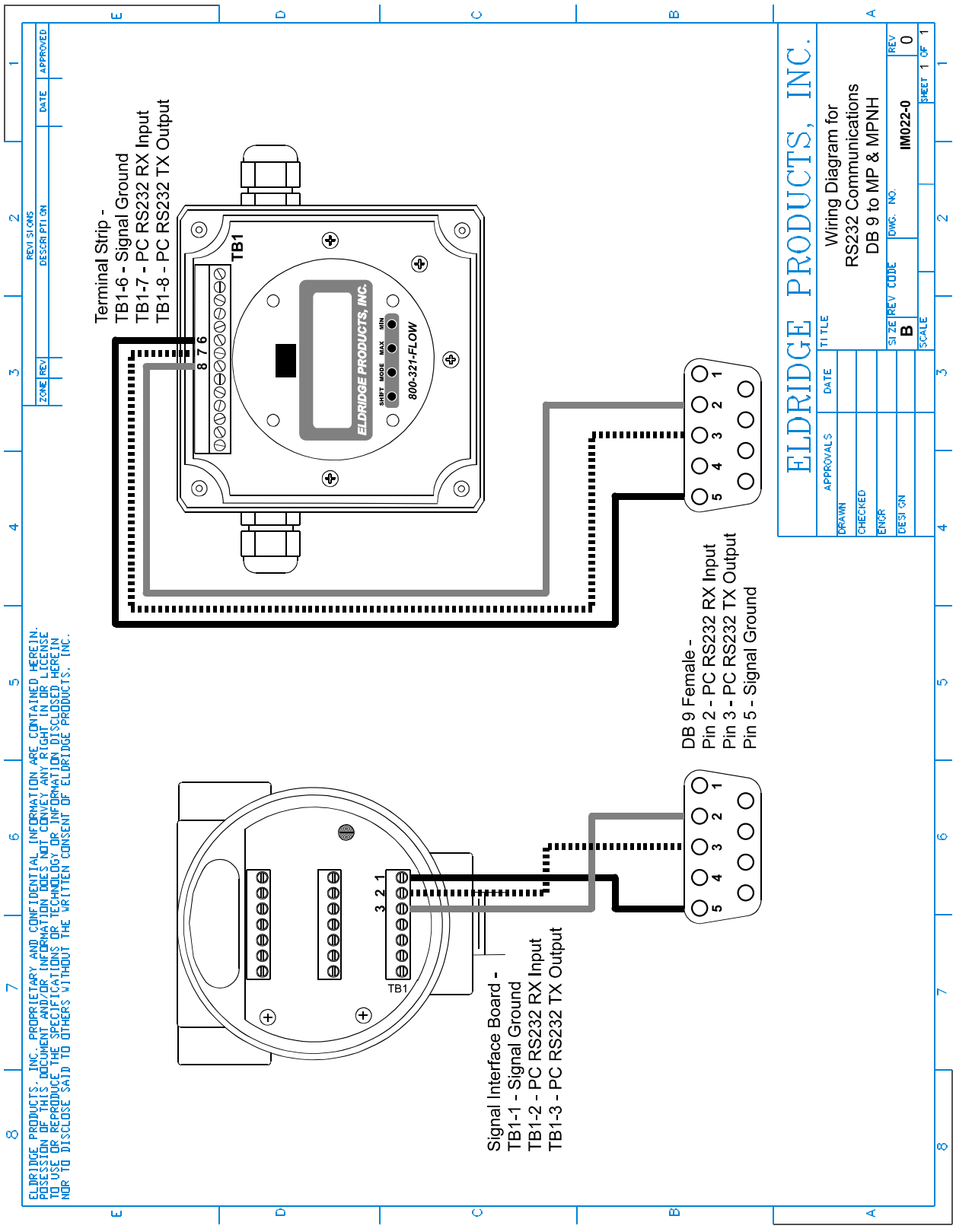
Terminal Strip -
TB1-6 - Signal Ground
TB1-7 - PC RS232 RX Input
TB1-8 - PC RS232 TX Output
TB1
8 7 6
ELDRIDGE PRODUCTS, INC.
800-321-FLOW
SHIFT MODE MAX MIN
DB 9 Female -
Pin 2 - PC RS232 RX Input
Pin 3 - PC RS232 TX Output
Pin 5 - Signal Ground
5 4 3 2 1
Signal Interface Board -
TB1-1 - Signal Ground
TB1-2 - PC RS232 RX Input
TB1-3 - PC RS232 TX Output
3 2 1
TB1
ELDRIDGE PRODUCTS, INC.
Wiring Diagram for
RS232 Communications
DB 9 to MP & MPNH
IM022-0
REV 0
SIZE B
SHEET 1 OF 1
ZONE REV DESCRIPTION DATE APPROVED
REVISIONS
APPROVALS DATE
DRAWN
CHECKED
ENGR
DESIGN
TITLE
SCALE
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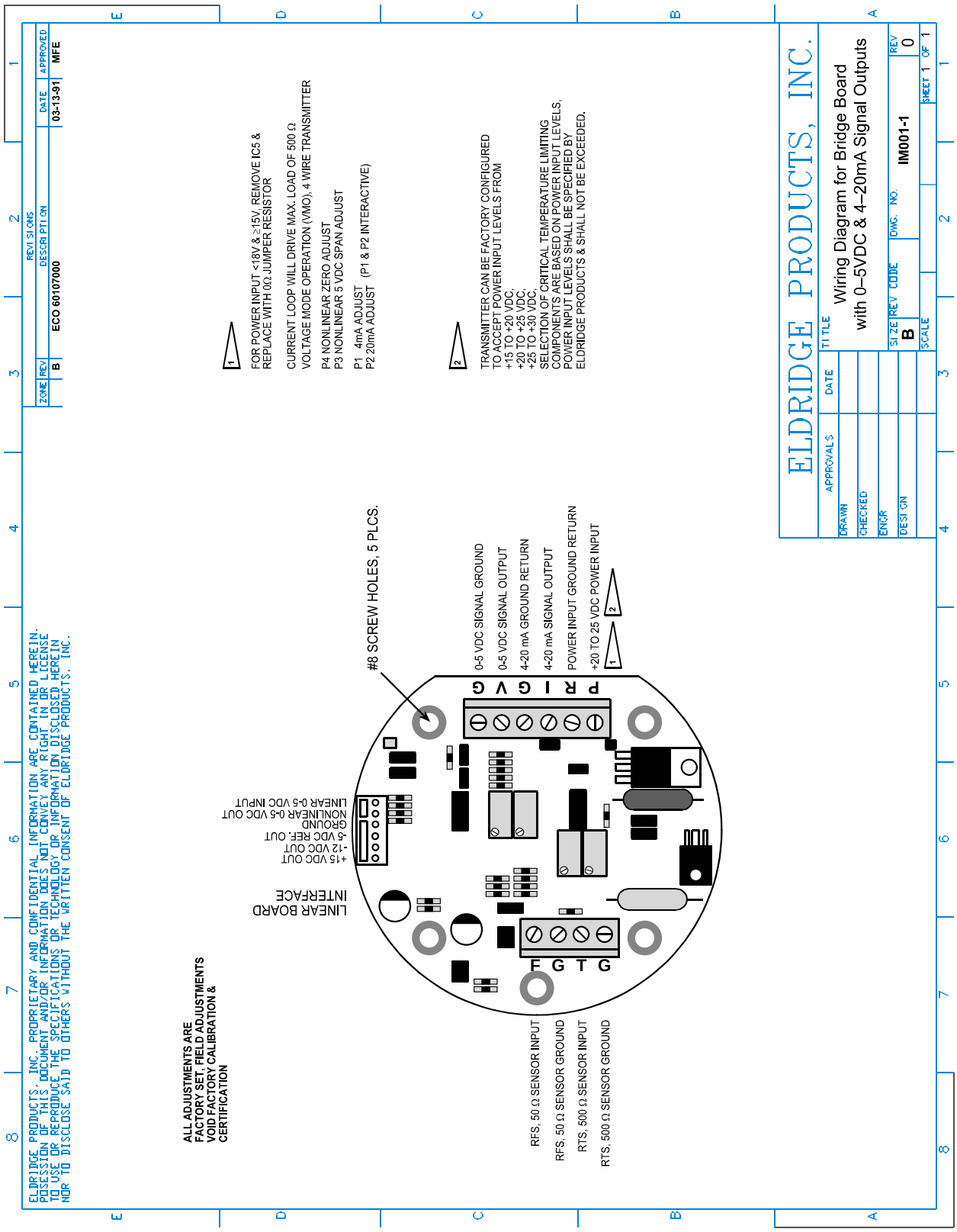
ELDRIDGE PRODUCTS, INC.
Wiring Diagram for Bridge Board
with 0–5VDC & 4–20mA Signal Outputs
IM001-1
ECO 60107000
03-13-91 MFE
FOR POWER INPUT <18V & >15V, REMOVE IC5 & REPLACE WITH 0Ω JUMPER RESISTOR
CURRENT LOOP WILL DRIVE MAX. LOAD OF 500 Ω VOLTAGE MODE OPERATION (VMO), 4 WIRE TRANSMITTER
P4 NONLINEAR ZERO ADJUST
P3 NONLINEAR 5 VDC SPAN ADJUST
P1 4mA ADJUST
P2 20mA ADJUST (P1 & P2 INTERACTIVE)
TRANSMITTER CAN BE FACTORY CONFIGURED TO ACCEPT POWER INPUT LEVELS FROM +15 TO +20 VDC, +20 TO +25 VDC, +25 TO +30 VDC. SELECTION OF CRITICAL TEMPERATURE LIMITING COMPONENTS ARE BASED ON POWER INPUT LEVELS, POWER INPUT LEVELS SHALL BE SPECIFIED BY ELDRIDGE PRODUCTS & SHALL NOT BE EXCEEDED.
#8 SCREW HOLES, 5 PLCS.
0-5 VDC SIGNAL GROUND
0-5 VDC SIGNAL OUTPUT
4-20 mA GROUND RETURN
4-20 mA SIGNAL OUTPUT
POWER INPUT GROUND RETURN
+20 TO 25 VDC POWER INPUT
P R I G V G
F G T G
LINEAR BOARD INTERFACE
+15 VDC OUT
-12 VDC OUT
-5 VDC REF. OUT
GROUND
NONLINEAR 0-5 VDC OUT
LINEAR 0-5 VDC INPUT
RFS, 50 Ω SENSOR INPUT
RFS, 50 Ω SENSOR GROUND
RTS, 500 Ω SENSOR INPUT
RTS, 500 Ω SENSOR GROUND
ALL ADJUSTMENTS ARE FACTORY SET, FIELD ADJUSTMENTS VOID FACTORY CALIBRATION & CERTIFICATION
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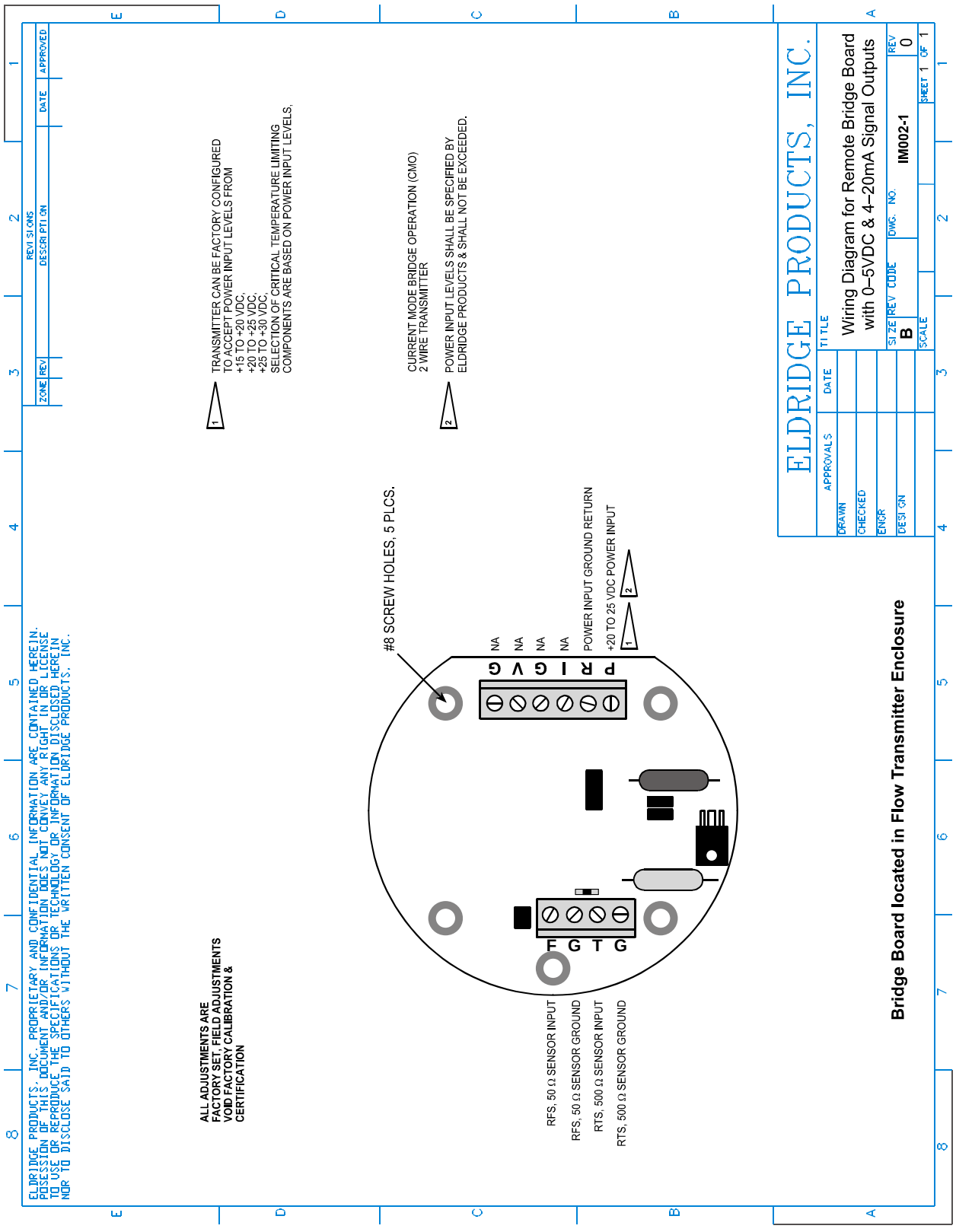
ELDRIDGE PRODUCTS, INC.
Wiring Diagram for Remote Bridge Board with 0–5VDC & 4–20mA Signal Outputs
IM002-1
Bridge Board located in Flow Transmitter Enclosure
TRANSMITTER CAN BE FACTORY CONFIGURED TO ACCEPT POWER INPUT LEVELS FROM +15 TO +20 VDC, +20 TO +25 VDC, +25 TO +30 VDC, SELECTION OF CRITICAL TEMPERATURE LIMITING COMPONENTS ARE BASED ON POWER INPUT LEVELS.
CURRENT MODE BRIDGE OPERATION (CMO) 2 WIRE TRANSMITTER
POWER INPUT LEVELS SHALL BE SPECIFIED BY ELDRIDGE PRODUCTS & SHALL NOT BE EXCEEDED.
#8 SCREW HOLES, 5 PLCS.
P R I G V G
NA NA NA NA
POWER INPUT GROUND RETURN
+20 TO 25 VDC POWER INPUT
F G T G
RFS, 50 Ω SENSOR INPUT
RFS, 50 Ω SENSOR GROUND
RTS, 500 Ω SENSOR INPUT
RTS, 500 Ω SENSOR GROUND
ALL ADJUSTMENTS ARE FACTORY SET, FIELD ADJUSTMENTS VOID FACTORY CALIBRATION & CERTIFICATION
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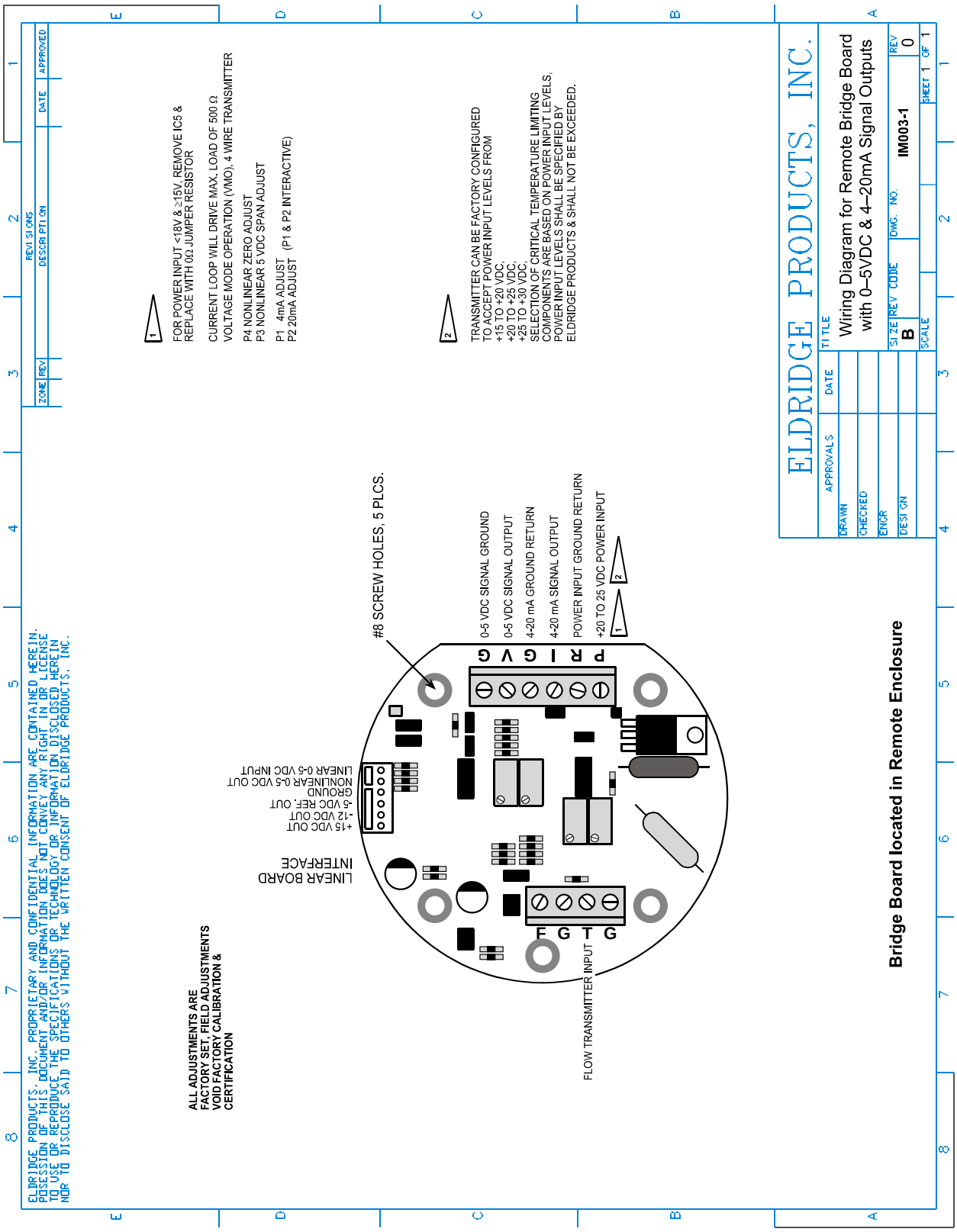
ELDRIDGE PRODUCTS, INC.
Wiring Diagram for Remote Bridge Board with 0–5VDC & 4–20mA Signal Outputs
IM003-1
Bridge Board located in Remote Enclosure
LINEAR BOARD INTERFACE
#8 SCREW HOLES, 5 PLCS.
FLOW TRANSMITTER INPUT
F G T G
P R I G V G
0-5 VDC SIGNAL GROUND
0-5 VDC SIGNAL OUTPUT
4-20 mA GROUND RETURN
4-20 mA SIGNAL OUTPUT
POWER INPUT GROUND RETURN
+20 TO 25 VDC POWER INPUT
+15 VDC OUT
-12 VDC OUT
-5 VDC REF. OUT
GROUND
NONLINEAR 0-5 VDC OUT
LINEAR 0-5 VDC INPUT
ALL ADJUSTMENTS ARE FACTORY SET, FIELD ADJUSTMENTS VOID FACTORY CALIBRATION & CERTIFICATION
FOR POWER INPUT <18V & ≥15V, REMOVE IC5 & REPLACE WITH 0Ω JUMPER RESISTOR
CURRENT LOOP WILL DRIVE MAX. LOAD OF 500 Ω VOLTAGE MODE OPERATION (VMO), 4 WIRE TRANSMITTER
P4 NONLINEAR ZERO ADJUST
P3 NONLINEAR 5 VDC SPAN ADJUST
P1 4mA ADJUST (P1 & P2 INTERACTIVE)
P2 20mA ADJUST
TRANSMITTER CAN BE FACTORY CONFIGURED TO ACCEPT POWER INPUT LEVELS FROM +15 TO +20 VDC; +20 TO +25 VDC; +25 TO +30 VDC. SELECTION OF CRITICAL TEMPERATURE LIMITING COMPONENTS ARE BASED ON POWER INPUT LEVELS. POWER INPUT LEVELS SHALL BE SPECIFIED BY ELDRIDGE PRODUCTS & SHALL NOT BE EXCEEDED.
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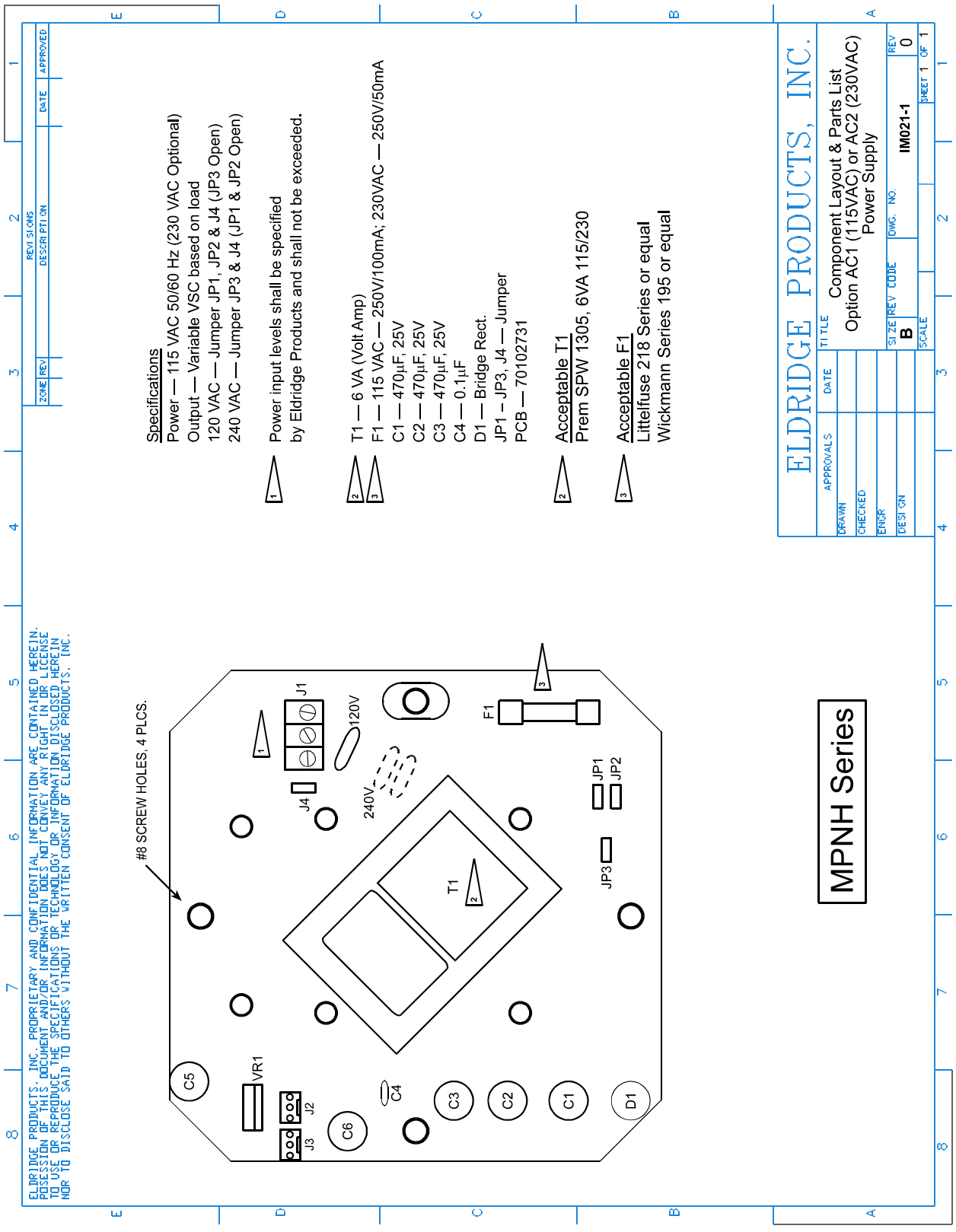
Specifications
Power — 115 VAC 50/60 Hz (230 VAC Optional)
Output — Variable VSC based on load
120 VAC — Jumper JP1, JP2 & J4 (JP3 Open)
240 VAC — Jumper JP3 & J4 (JP1 & JP2 Open)
1 Power input levels shall be specified by Eldridge Products and shall not be exceeded.
2 3 T1 — 6 VA (Volt Amp)
F1 — 115 VAC — 250V/100mA; 230VAC — 250V/50mA
C1 — 470µF, 25V
C2 — 470µF, 25V
C3 — 470µF, 25V
C4 — 0.1µF
D1 — Bridge Rect.
JP1 – JP3, J4 — Jumper
PCB — 70102731
2 Acceptable T1
Prem SPW 1305, 6VA 115/230
3 Acceptable F1
Littelfuse 218 Series or equal
Wickmann Series 195 or equal
#8 SCREW HOLES, 4 PLCS.
J1
120V
240V
J4
F1
JP1
JP2
JP3
T1
VR1
J2
J3
C4
C5
C6
C3
C2
C1
D1
MPNH Series
ELDRIDGE PRODUCTS, INC.
APPROVALS DATE
DRAWN
CHECKED
ENGR
DESIGN
TITLE
Component Layout & Parts List
Option AC1 (115VAC) or AC2 (230VAC)
Power Supply
SIZE B
REV CODE
DWG. NO. IM021-1
REV 0
SCALE
SHEET 1 OF 1
REVISIONS
ZONE REV DESCRIPTION DATE APPROVED
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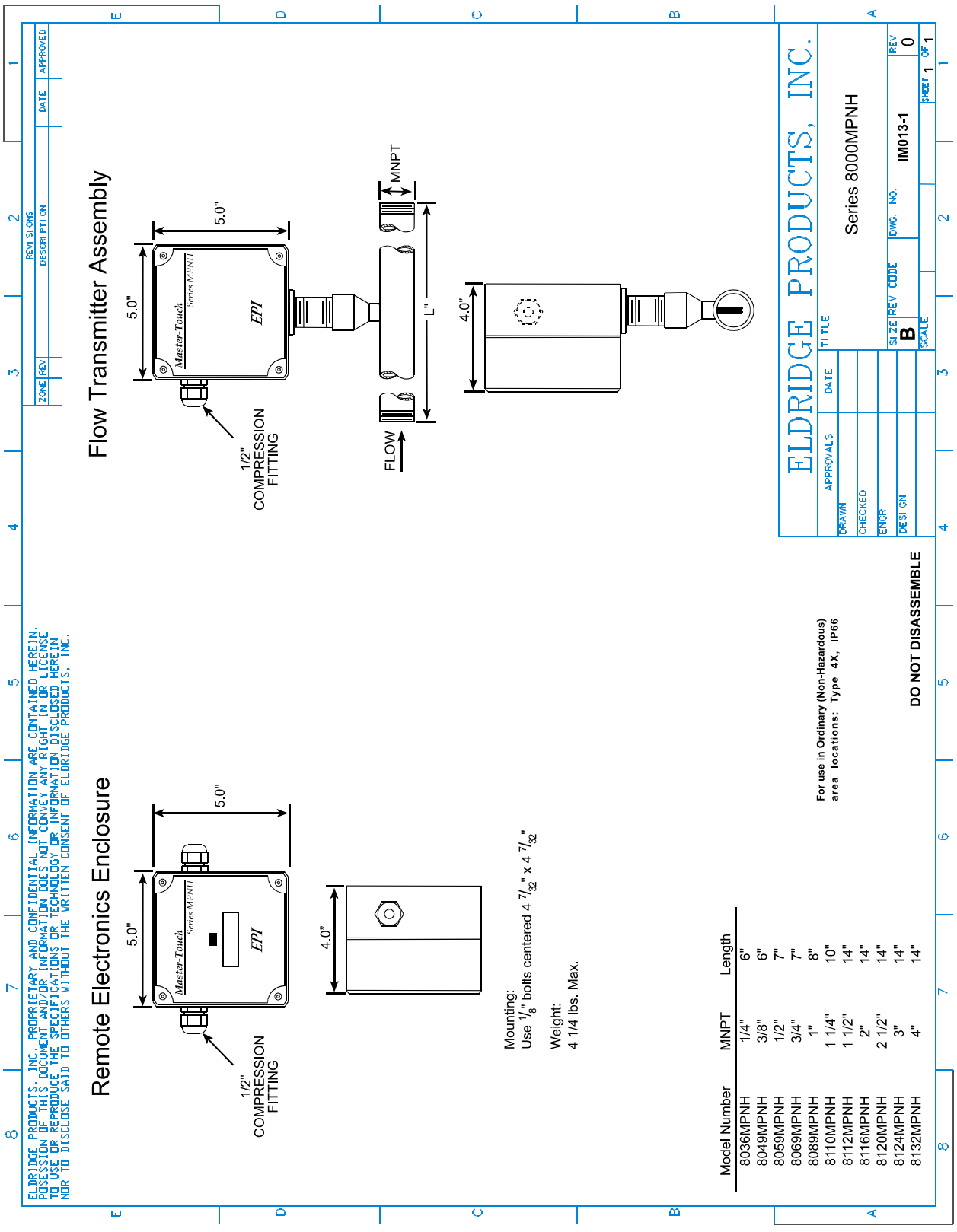
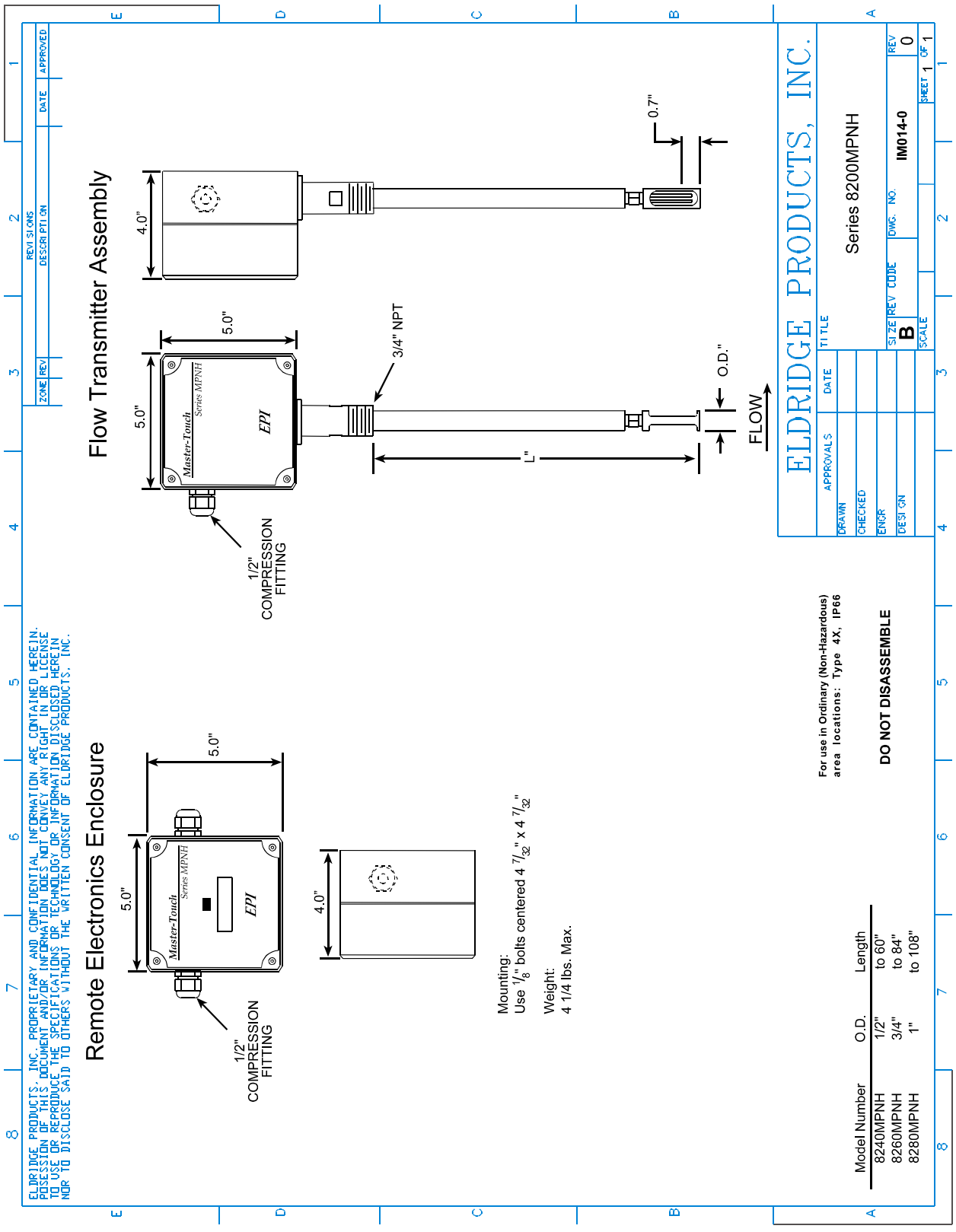


Model Number	MNPT	Length
8036MPNH	1/4"	6"
8049MPNH	3/8"	6"
8059MPNH	1/2"	7"
8069MPNH	3/4"	7"
8089MPNH	1"	8"
8110MPNH	1 1/4"	10"
8112MPNH	1 1/2"	14"
8116MPNH	2"	14"
8120MPNH	2 1/2"	14"
8124MPNH	3"	14"
8132MPNH	4"	14"


Flow Transmitter Assembly
Remote Electronics Enclosure
4.0"
5.0"
0.7"
3/4" NPT
O.D."
L"
FLOW
1/2" COMPRESSION FITTING
Master-Touch
Series MPNH
EPI
Mounting:
Use 1/8" bolts centered 4 7/32" x 4 7/32"
Weight:
4 1/4 lbs. Max.
For use in Ordinary (Non-Hazardous) area locations: Type 4X, IP66
DO NOT DISASSEMBLE
Model Number O.D. Length
8240MPNH 1/2" to 60"
8260MPNH 3/4" to 84"
8280MPNH 1" to 108"
ELDRIDGE PRODUCTS, INC.
Series 8200MPNH
IM0014-0
REV 0
SHEET 1 OF 1
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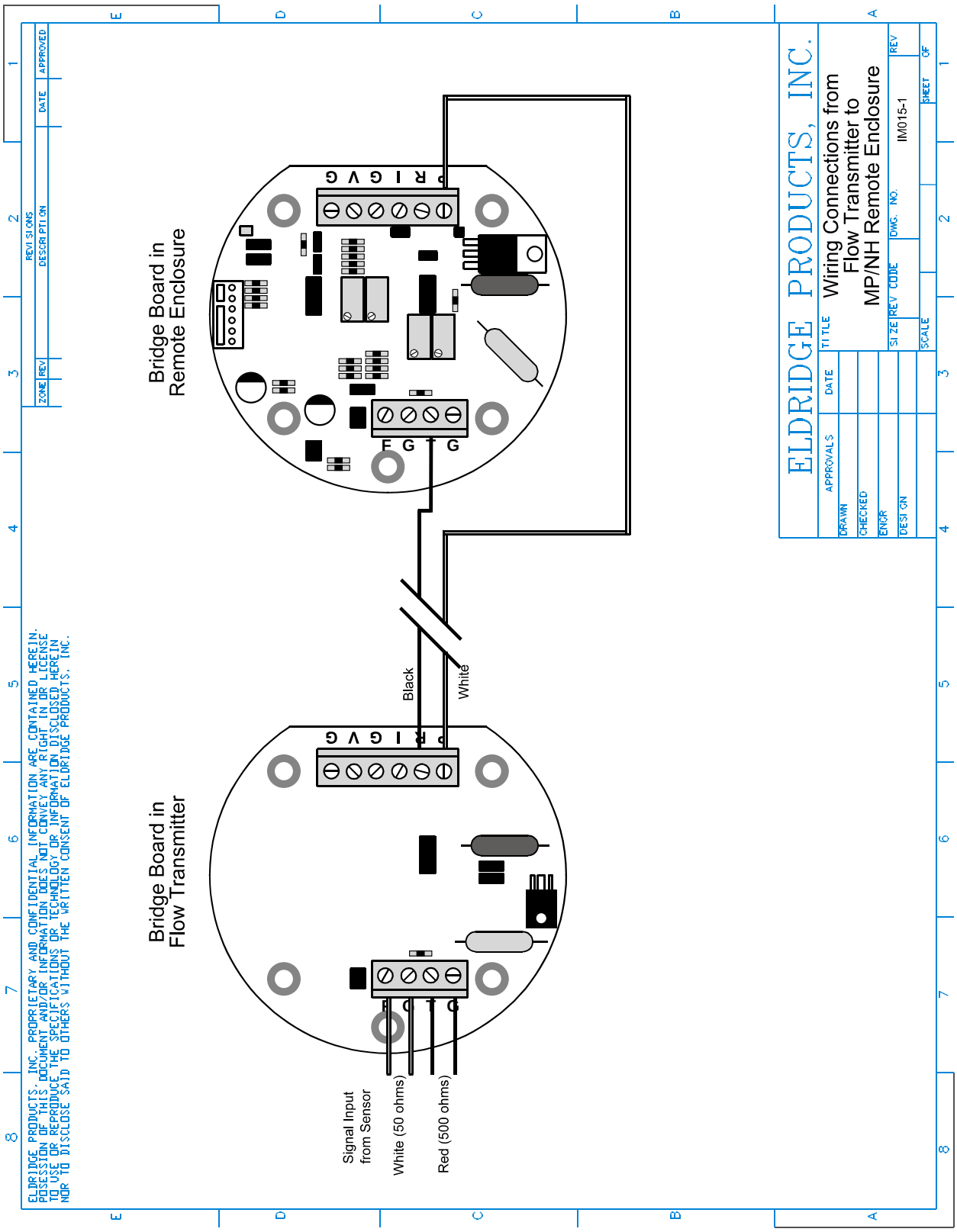
Bridge Board in
Remote Enclosure
Bridge Board in
Flow Transmitter
Black
White
Signal Input
from Sensor
White (50 ohms)
Red (500 ohms)
ELDRIDGE PRODUCTS, INC.
Wiring Connections from
Flow Transmitter to
MP/NH Remote Enclosure
IM015-1
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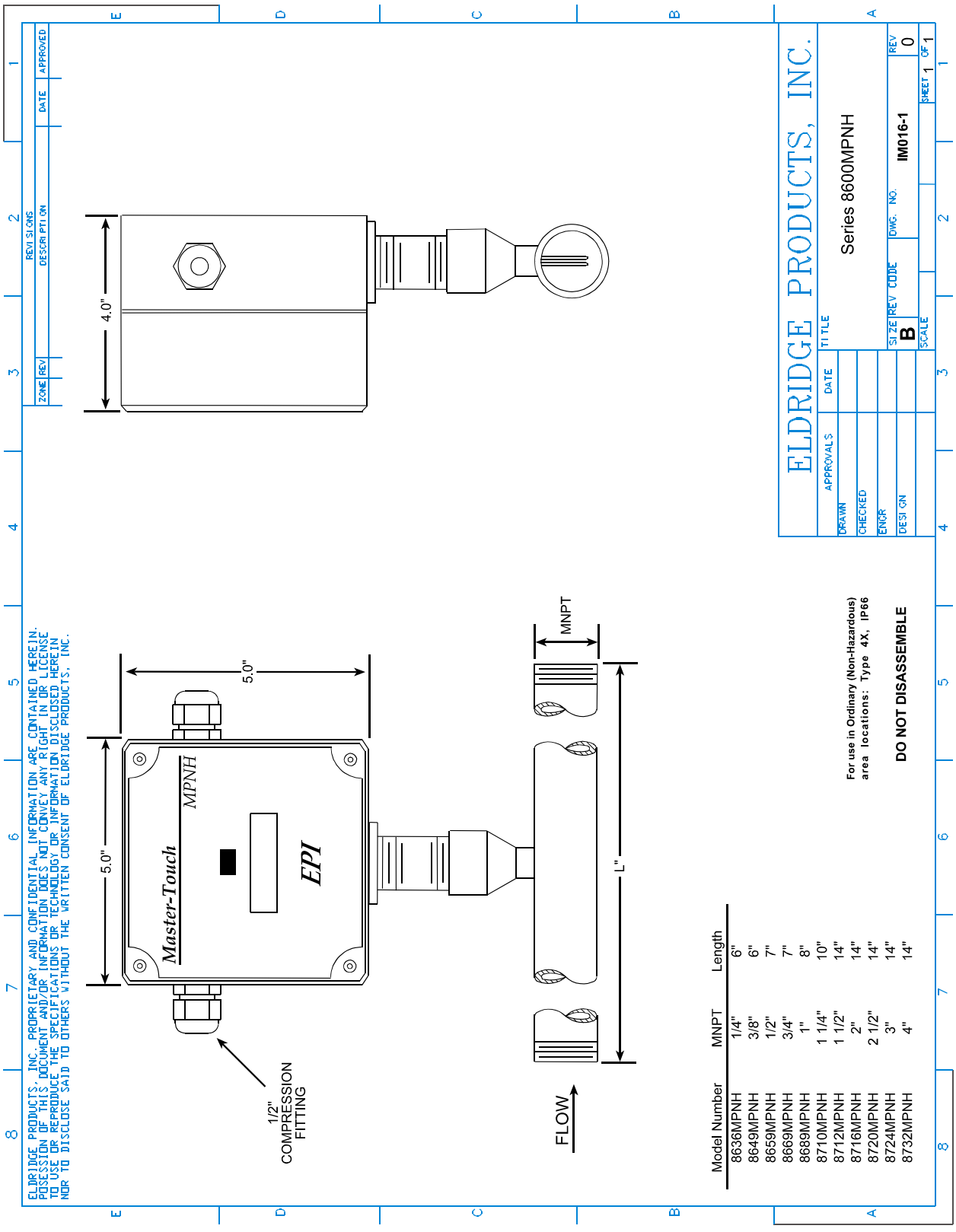
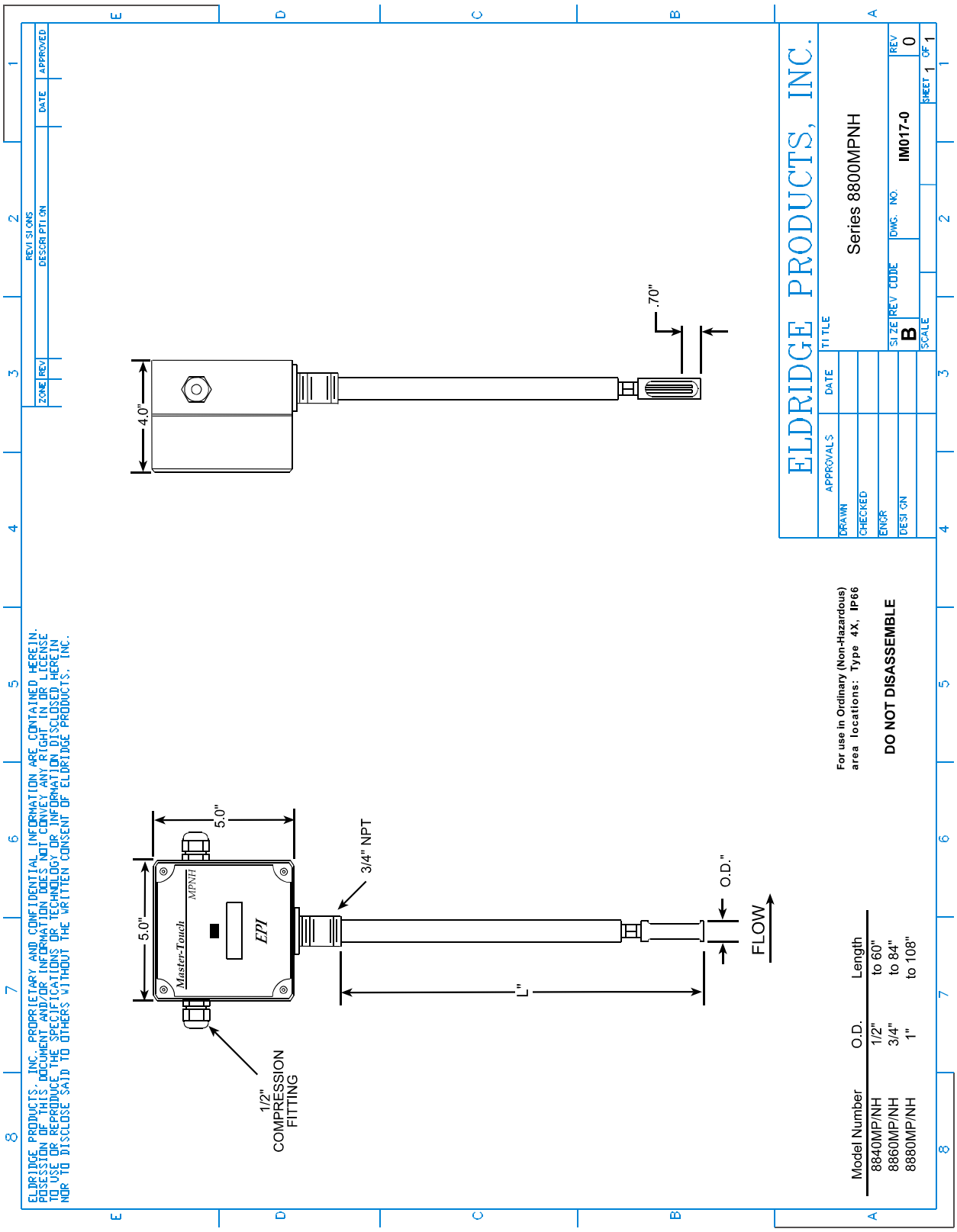


Model Number	MNPT	Length
8636MPNH	1/4"	6"
8649MPNH	3/8"	6"
8659MPNH	1/2"	7"
8669MPNH	3/4"	7"
8689MPNH	1"	8"
8710MPNH	1 1/4"	10"
8712MPNH	1 1/2"	14"
8716MPNH	2"	14"
8720MPNH	2 1/2"	14"
8724MPNH	3"	14"
8732MPNH	4"	14"


ELDRIDGE PRODUCTS, INC.
Series 8800MPNH
IM017-0
REV 0
SHEET 1 OF 1
SIZE B
REV CODE
DWG. NO.
SCALE
TITLE
APPROVALS
DATE
DRAWN
CHECKED
ENGR
DESIGN
ZONE REV
REVISIONS
DESCRIPTION
DATE
APPROVED
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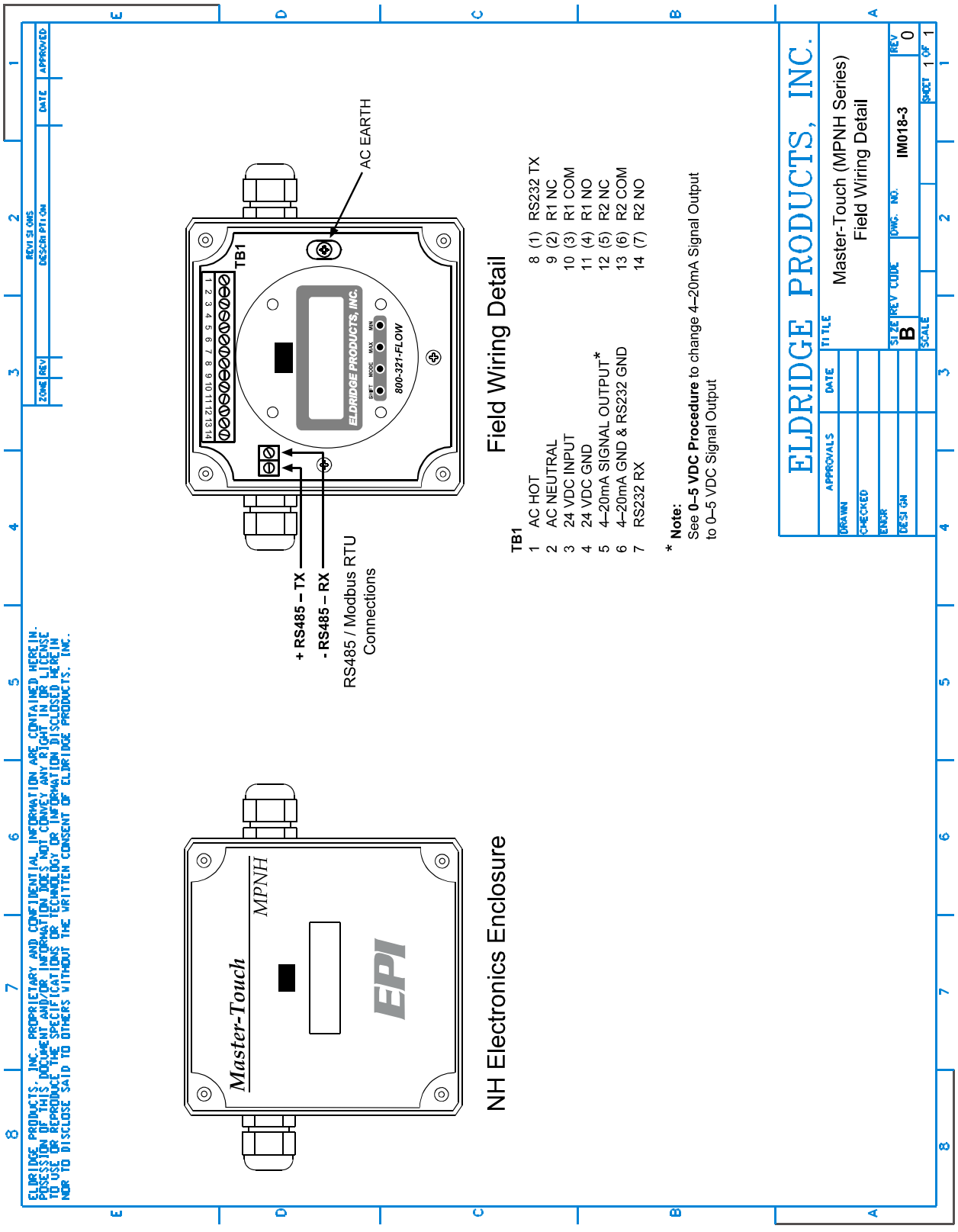
NOR TO DISCLOSE SAID TO OTHERS WITHOUT THE WRITTEN CONSENT OF ELDRIDGE PRODUCTS, INC.
.70"
4.0"
5.0"
5.0"
3/4" NPT
O.D."
L"
FLOW
1/2"
COMPRESSION
FITTING
Master-Touch
MPNH
EPI
For use in Ordinary (Non-Hazardous) area locations: Type 4X, IP66
DO NOT DISASSEMBLE
Model Number O.D. Length
8840MP/NH 1/2" to 60"
8860MP/NH 3/4" to 84"
8880MP/NH 1" to 108"


ELDRIDGE PRODUCTS, INC.
Master-Touch (MPNH Series)
Field Wiring Detail
IM018-3
REV 0
SHEET 1 OF 1
Field Wiring Detail
TB1
1 AC HOT
2 AC NEUTRAL
3 24 VDC INPUT
4 24 VDC GND
5 4–20mA SIGNAL OUTPUT*
6 4–20mA GND & RS232 GND
7 RS232 RX
8 (1) RS232 TX
9 (2) R1 NC
10 (3) R1 COM
11 (4) R1 NO
12 (5) R2 NC
13 (6) R2 COM
14 (7) R2 NO
* Note:
See 0–5 VDC Procedure to change 4–20mA Signal Output to 0–5 VDC Signal Output
AC EARTH
+ RS485 – TX
- RS485 – RX
RS485 / Modbus RTU Connections
NH Electronics Enclosure
Master-Touch
MPNH
EPI
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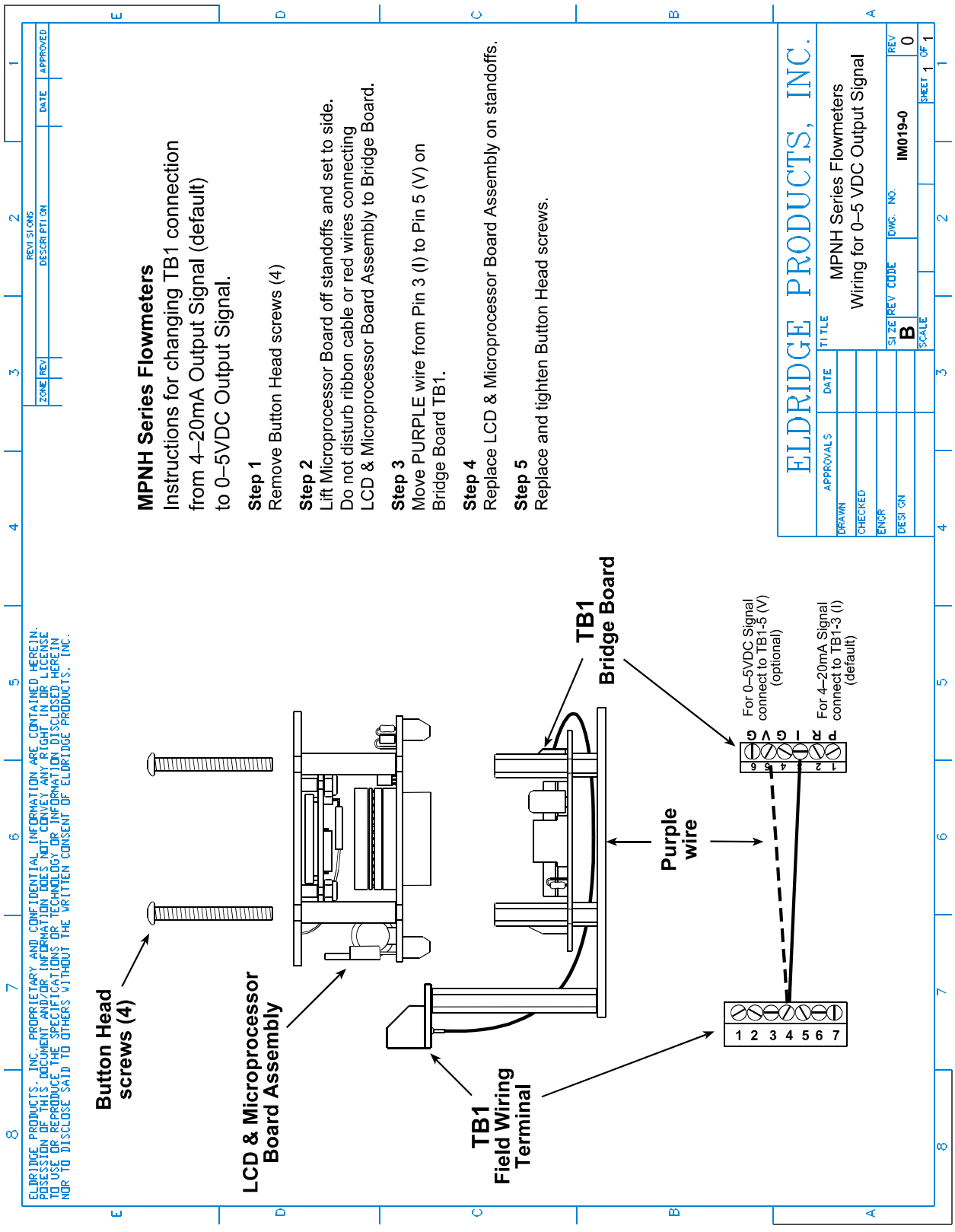
MPNH Series Flowmeters
Instructions for changing TB1 connection
from 4–20mA Output Signal (default)
to 0–5VDC Output Signal.
Step 1
Remove Button Head screws (4)
Step 2
Lift Microprocessor Board off standoffs and set to side.
Do not disturb ribbon cable or red wires connecting
LCD & Microprocessor Board Assembly to Bridge Board.
Step 3
Move PURPLE wire from Pin 3 (I) to Pin 5 (V) on
Bridge Board TB1.
Step 4
Replace LCD & Microprocessor Board Assembly on standoffs.
Step 5
Replace and tighten Button Head screws.
ELDRIDGE PRODUCTS, INC.
MPNH Series Flowmeters
Wiring for 0–5 VDC Output Signal
IM019-0
Button Head screws (4)
LCD & Microprocessor Board Assembly
TB1 Field Wiring Terminal
TB1 Bridge Board
Purple wire
For 0–5VDC Signal connect to TB1-5 (V) (optional)
For 4–20mA Signal connect to TB1-3 (I) (default)
P R I G V G
1 2 3 4 5 6
1 2 3 4 5 6 7
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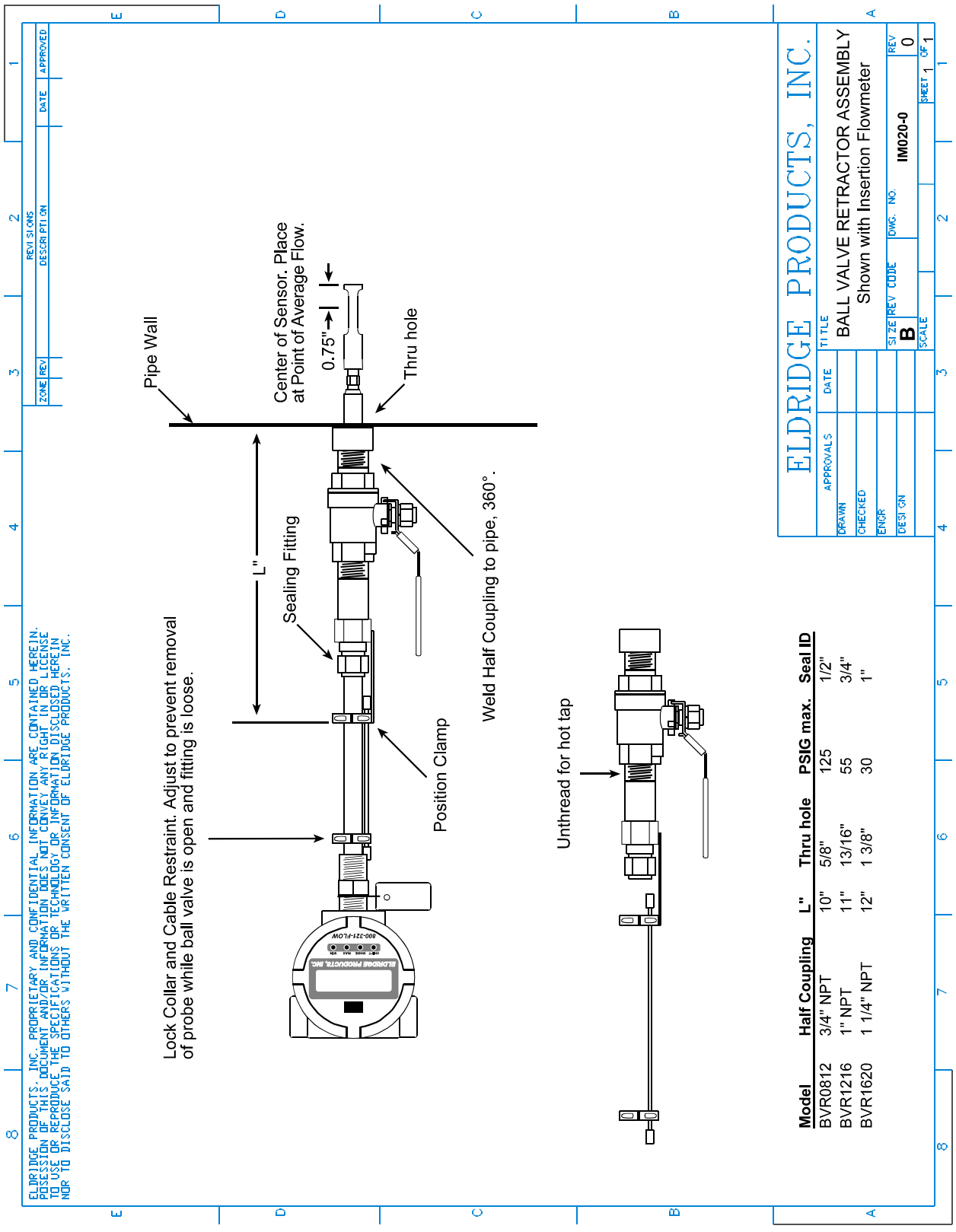


Model	Half Coupling	L"	Thru hole	PSIG max.	Seal ID
BVR0812	3/4" NPT	10"	5/8"	125	1/2"
BVR1216	1" NPT	11"	13/16"	55	3/4"
BVR1620	1 1/4" NPT	12"	1 3/8"	30	1"

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.

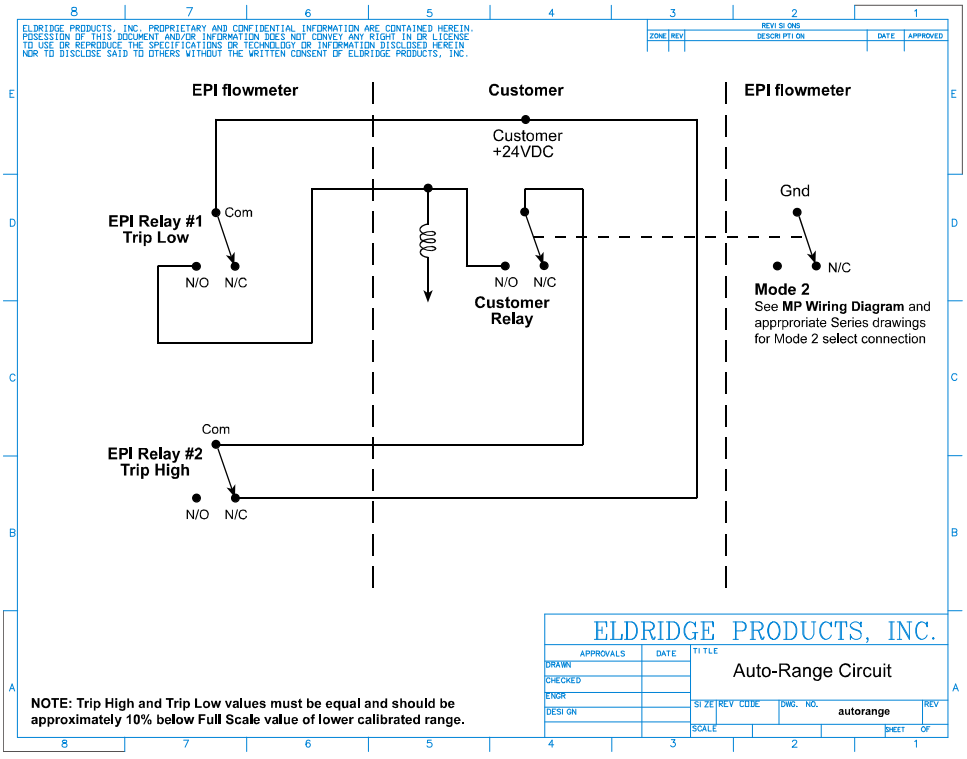
2) The customer will add the external relays. These can be mounted outside the enclosure if they do not fit under the enclosure cover.

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):