



ValuMass is a division of Eldridge Products, Inc.

Version 1.2

Series 500 & 540 Thermal Gas Mass Flowmeters

INSTRUCTION MANUAL

80202401 (Rev. 1.08)

CE Compliant

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Section A Introduction and Installation

Introduction

Your ValuMass™ 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 mounted on the flow probe or flow body (integral electronics) or you may have a flow transmitter assembly separate from the flow probe or flow body (remote electronics). In either configuration, the microprocessor converts the nonlinear input signal received from the flow transmitter to linear 0–5/10 VDC & 4–20 mA output signals. A variety of other optional communications protocols are available including 0 – 1 kHz output, LightWIRE™ Communicator I & II infrared modules, and Modbus- or HART-compatible modules.

Unpacking Your Instrument

Your ValuMass™ 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 ValuMass™ flowmeters with the “-D024” option are user-supplied 18 to 24 Volts DC @ 250 mA.

Power requirements for ValuMass™ flowmeters with the “-A115” option are 115 VAC 50/60 Hz standard, or 220 VAC 50/60 Hz with the “-A230” 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 H 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.

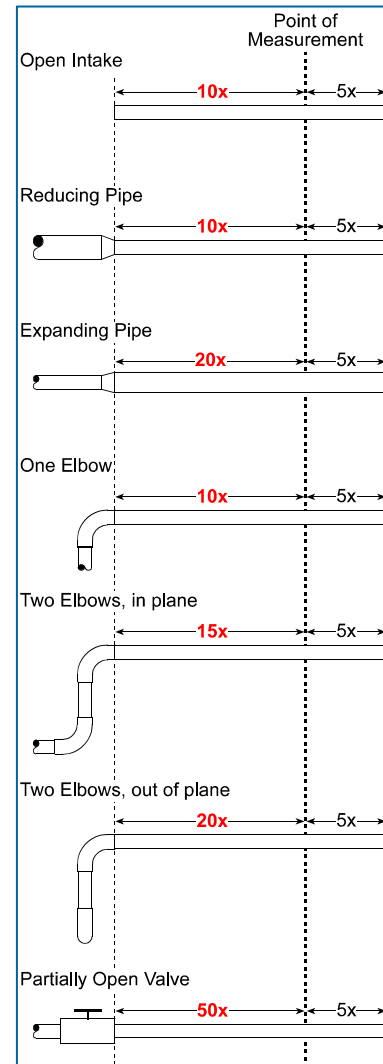
Installation and Mounting

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 position 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 ValuMass™ 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 affect. 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 2"



pipe. The standard end configuration is MNPT (male national pipe thread) threaded ends or Butt Ends for welding. If required, optional end mounting styles may be available (consult factory). Pipe sizes in excess of 2" 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 that 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 style flowmeters are shipped with a bored-through tube fitting to mount the probe in place. 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 are 6", 12" and 18". 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.

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.

Signal Interface

The microprocessor provides 0–5 or 0–10 Volts DC output signals for flow rate or gas temperature, and a 4–20 mA flow output signal. Voltage signals should not be sent over long distances due to small currents causing voltage drops across the wire pair. If the voltage is 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.

ValuMass™ flowmeters also provide a 0 – 1 kHz frequency output proportional to the calibrated flow rate. The signal is both Sink and Source capable. The following specifications apply when this option is ordered:

	24 VDC		115/230 VAC	
	24V Mode (JP6)	15V Mode (JP5)	24V Mode (JP6)	15V Mode (JP5)
Sinking	<= 40VDC 200mA Each Output	<= 40VDC 200mA Each Output	<= 40VDC 200mA Each Output	<= 40VDC 200mA Each Output
Sourcing	24VDC 200mA Each Output	15VDC 90mA (1 Output) 15VDC 45mA (2 Outputs)	TBD – Currently Testing	TBD – Currently Testing

Frequency Output Formula:

Frequency Span x (Actual Flow Rate / Full Scale) = Frequency Output

Examples:

1. Full Scale = 1000 SCFM
Flow Rate = 150 SCFM
Frequency Span = 1 kHz
 $1 \text{ kHz} \times (150 / 1000) = 0.15 \text{ kHz}$
2. Full Scale = 500 NCMH
Flow Rate = 425 NCMH
Frequency Span = 1 kHz
 $1 \text{ kHz} \times (425 / 500) = 0.85 \text{ kHz}$

The ValuMass™ Series is CE Compliant.

Section B General Operation

Sensor Theory and Operation

ValuMass™ 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 ValuMass™ 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 IR communications.

Our CPU is an embedded 32-bit microprocessor including random access memory (RAM), flash memory, 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. Voltage regulation and precision voltage referencing are also included.

The ValuMass™ 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:

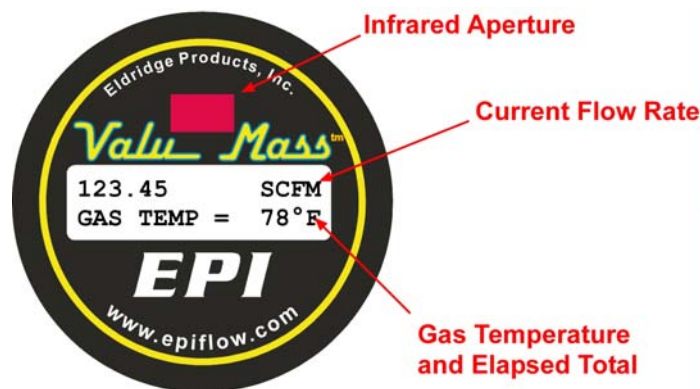
- High Flow value
- High Flow Time/Date
- Low Flow value
- Low Flow Time/Date
- Totalizer value
- Totalizer reset Time/Date
- LCD contrast setting
- Date format (MM/DD/YY; DD.MM.YY)
- Real time clock time & date

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 ValuMass™ Menuing System (LightWIRE™ Handheld Module)

ValuMass™ flowmeters optionally include a 2-line, 16-character LCD display to view the flow rate, elapsed flow total/gas temperature as well as the full menuing system. Each of the Menus and their submenu items are accessible by using a LightWIRE™ II handheld module, or by running *EPICommunicator 2.03* (or higher) software on a PC. This section describes the use of the menuing system via the handheld module. Section D discusses the use of the PC.

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



Infrared Aperture — allows infrared communications with EPI's LightWIRE™ I & II modules;

Line 1 — Current Flow Rate is the real-time flow rate in currently selected engineering units;

Line 2 alternates between —

Gas Temperature is the current temperature of the process gas;

Elapsed Total is the elapsed total flow since previous reset.

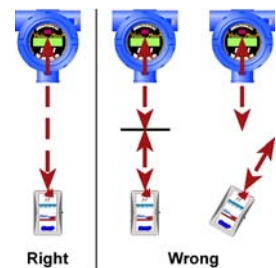
LightWIRE™ Communicator II

The LightWIRE™ Communicator II hand-held module is used to access the flowmeter's menuing system.

NOTE: To begin communicating with the flowmeter, press the MODE key for approximately 2– 3 seconds.



When transmitting to a flowmeter, caution must be used to assure that the signal is not interrupted. DO NOT block the infrared signal or move the module out of direct line to the flowmeter receiver. This will interrupt the signals to flowmeter and any interrupted transmissions will need to be repeated.



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 207–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. When the settings are unlocked, a caret (>) will appear in the upper right corner of the display.

The following pages explain the LCD displays and the presentation of flow information. Some menu item headings may be truncated in the display due to the 16-character per line limitation.

100 *Units* Menu

The 100 *Units* Menu of the ValuMass™ flowmeter includes a series of submenu items which allow you to easily change the engineering units for the flow rate and elapsed total. With the meter settings unlocked, select the desired engineering units by advancing to the correct menu item and then pressing SHIFT. The flowmeter will restart using new operational engineering units. The Full Scale and Maximum Range values are recalculated as part of this process (*see menu items 212–FScale and 814–MaxRange*).

The flowmeter settings must be unlocked to change the engineering units, 4-20mA scaling or to reset the various stored values (*see menu item 207–UnLock*). The conversion of engineering units is “1:1” — the flowmeter does not make adjustments for differences in Reference Conditions between English (Imperial) and metric units, nor does it adjust for volume to weight conversions for gases other than Air or Nitrogen. Consult the factory for help with the additional adjustments required for these situations.

112.3456	SCFM
9876.54321	SCF

RUN MODE (showing Elapsed Total)

112.3456	SCFM
Gas Temp = 123°F	

RUN MODE (showing Temperature)

100 *Units*
101–SCFM

Press **MODE** one time to advance to the **100 *Units*** 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 *Units* 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-	Standard Meters / Hour
129-NLPM	Normal Liters / Minute
130-NCCM	Normal Cubic Centimeters / Minute
131-NLPH	Normal Liters / Hour
200 *Utility*	Go to 200 *Utility* Menu
300 *Status*	Go to 300 *Status* Menu
500 *Run Mode*	Go to 500 *Run Mode*
800 *P-Curve Fit*	Go to 200 *P-Curve Fit* Menu

200 *Utility* Menu

The 200 *Utility* Menu of the ValuMass™ 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, etc. Values for timing functions are in millisecond (ms) increments.

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.

12.3456	SCFM
9876.54321	SCF

RUN MODE

200 *Utility*
201-LCD Update R
Disp Updt Rate
>2

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.

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 201-LCD Update Rate has been selected and the flowmeter is displaying the active stored 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.

200 *Utility* Submenus

201-LCD Update R	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. Acceptable values are between 8 (ms) and 255 (ms). <i>This menu item only affects the totalizer and flow rate update period, not their accuracy, and does not affect the 0-5/10 VDC or 4-20 mA output signals.</i>
202-DAC Update R	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-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: <ul style="list-style-type: none"> • 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.
205-Set Time	<p>This menu item sets the time stamp functions to the current time for accurate reporting. The time prompt indicates HH:MM:SS where:</p> <ul style="list-style-type: none"> • HH = hour (00–23) • MM = minutes (00–59) • SS = seconds (00–59) • . (period) = AM /PM or 24 hour clock <p>Include a colon (:) as the delimiter between values. The time will not be set if this format is not followed exactly. Example: 01:24:56P = 1:24:56 PM 13:24:56 = 1:24:56 PM displayed in 24 hour clock format.</p>
206-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.
207-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.
208-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
209-ProtocolOnOf	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.
210-Vout 0-5,10	This menu item is used to set the voltage output to either 0 – 5 VDC or 0 – 10 VDC (See Menu 211). 0 = 0 – 5 VDC; 1 = 0 – 10 VDC
211-Config Output	<p>This menu item is used to set the 4 – 20 mA and 0– 5/10 VDC output signal configurations as shown below:</p> <p>0 = Flow 4 – 20 mA / Flow 0 – 5/10 VDC 1 = Flow 4 – 20 mA / Temp 0 – 5/10 VDC 2 = Temp 4 – 20 mA / Flow 0 – 5/10 VDC 3 = Temp 4 – 20 mA / Temp 0 – 5/10 VDC</p>
212-Full Scale	This menu item is used to adjust the scaling of the 0 – 5/10 VDC and 4 – 20 mA output signals.
213-Diag PSWD	This menu item is the factory password for certain menu items that should not ordinarily be accessed by users. These menu items include: 801-812–CoeffTerm A-J (Curve coefficients) 814–MaxRange
214-Reset Total	This menu item is used to reset the elapsed total, Hi and Lo flow values and timestamps.
215-FactoryReset	This menu item is used to reset the flowmeter to the Factory defaults.
216-FreqPolarity	<p>This menu item is used to set the Frequency Output polarity (<i>refer to the Sink/Source table on page A-4</i>):</p> <p>0 = LOW @ No Flow with Low to High pulse at flow;</p>

	1 = HIGH @ No Flow with High to Low pulse at flow. Factory Default = 0
217-Pulse Width	This menu item is used to set the pulse width of the Frequency Output in 50µs (50 microseconds) increments between 50µs and 950µs. Non-standard values are rounded to the nearest 50µs increment. Factory Default = 500µs
229-No LCD Disp	This menu item controls the microprocessor signal to the LCD: 0 = On, 1 = Off.
230-Temp Zero	This menu item sets the temperature value (°F) for the 0 VDC output. <i>This value is always entered in °F. The temperature displayed will match the engineering units selected for the flow rate, either Imperial (English) or Metric. The factory default is 0°F. This setting does NOT affect the temperature compensation range for the process gas.</i>
231-Temp Span	This menu item sets the temperature value (°F) for the 5 VDC output. <i>This value is always entered in °F. The temperature displayed will match the engineering units selected for the flow rate, either Imperial (English) or Metric. The factory default is 250°F. This setting does NOT affect the temperature compensation range for the process gas.</i>
232-No Display T	This menu item controls the temperature display: 0 = On, 1 = Off.
100 *Units*	Go to 100 *Meter* Menu
300 *Status*	Go to 300 *Status* Menu
500 *Run Mode*	Go to 500 *Run Mode*
800 *Curve Fit*	Go to 800 *Curve Fit* Menu

300 *Status* Menu

The 300 *Status* Menu of the ValuMass™ 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.

12.3456	SCFM
9876.54321	SCF

RUN MODE

300 *Status*
100 *Meter*

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

300 *Status*
1 PO SCFM

The display will change automatically to the first Status menu item. The first character indicates the meter range, the second and third characters indicate the curve fit mode, and the final characters indicate the currently selected engineering units for the rate and total information.

300 *Status* HV123.4567 SCFM	This display presents the highest flow value since the last start up or reset.
300 *Status* HT=01:23:45PM	This display presents the time stamp for the highest flow value.
300 *Status* HD=08/09/98	This display presents the date stamp for the highest flow value.
300 *Status* LV9.8765 SCFM	This display presents the lowest flow value since the last start up or reset.
300 *Status* LT=05:43:21AM	This display presents the time stamp for the lowest flow value.
300 *Status* LD=11/25/98	This display presents the date stamp for the lowest flow value.
300 *Status* RT=10:23:45	This display presents the time stamp at which the totalizer was last reset to zero.
300 *Status* RD=06/23/98	This display presents the date stamp at which the totalizer was last reset to zero.
300 *Status* 12:34:56AM	This display presents the real time clock.
300 *Status* 01/01/06	This display presents the real time date.
300 *Status* Gas Temp = xxx°F	This display presents the temperature of the process gas flow. (Not implemented in this version)
300 *Status* BV = 0.234 Volts	This display presents the bridge voltage generated by the gas flow.
300 *Status* FS = 2.987 Volts	This display presents the Flow Sensor voltage output.
300 *Status* TR = 2.987 Volts	This display presents the Temperature Reference voltage output.
300 *Status* TS = 2.987 Volts	This display presents the Temperature Sensor voltage output.

```
300 *Status*
TL = 2.987 Volts
```

This display presents the Temperature Sensor lead sense voltage output.

```
300 *Status*
Fl = 2.987 Volts
```

This display presents the Flow Sensor lead sense voltage output.

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

This display presents the unique serial number of the flowmeter.

```
300 *Status*
µP PCBA Rev = 1
```

This display presents the microprocessor board revision number.

800 *Curve Fit* Menu

The ValuMass™ software stores the calibration 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 curve coefficients and MaxRange values should never be changed without direct factory instructions.

```
12.3456      SCFM
9876.54321   SCF
```

RUN MODE

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

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

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

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

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

800 *Curve Fit* Submenus

801-CoeffTermA	Factory Calibration Coefficient. <i>Requires Diagnostic Password for access. Consult factory.</i>
through	
810-CoeffTermJ	Factory Calibration Coefficient. <i>Requires Diagnostic Password for access. Consult factory.</i>
811-C Factor	This value is a multiplier used to adjust the Curve linearization. It is normally set to 1.0, but may be adjusted based the <i>Installation Guidelines</i> , or to correct for aberrations in sensor readings. The C Factor can also be used to change standard conditions (STP) or to apply a density factor (vapor density) when changing the engineering units from volumetric units (SCFM, NCMH, etc.) to gravimetric units (Lbs/Hr, Kg/Hr, etc.) in flowmeters calibrated for gases other than air.
812-Zero Offset	This voltage value is subtracted from the sensor curve linearizer to correct for minor sensor voltage errors. This ensures that zero flow is attained even though some bias voltage may exit which would otherwise prevent an absolute zero reading (<i>see also menu item 815-Auto Zero</i>).
813-SetXSect	This value is the cross-sectional area of the flow section or process line. The units of measure are determined by the engineering units selected (<i>see menu items 101-132</i>). 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 (<i>see menu items 101-132</i>) and the value will change in response to changes to the engineering units. <i>Requires Diagnostic Password for access. Consult factory.</i>
815-Auto Zero	This menu item automatically establishes a new Zero Offset (<i>see menu item 812-Zero Offset</i>). Entering a one (1) at the prompt changes the zero offset to the 0-5VDC output voltage of the flowmeter when the selection is made. This is particularly valuable for No Flow zeroing adjustments. Entering a zero (0) at the prompt leaves the existing zero offset value unchanged.
816-FlowCutoff	This menu item is used to set a percentage of the Full Scale value (<i>menu item 140-FScale</i>) as the minimum readable flow rate. Actual flow rates below this minimum value will be treated as No Flow. The display will show "Low" instead of the real-time flow rate, no additional elapsed flow will be recorded, the 0-5VDC signal will drop to 0VDC, and the 4-20mA signal will drop to 4mA. For example, if the full scale is 1000 SCFM, a value of 10 (10%) will cause the flowmeter to ignore flow rates below 100 SCFM. 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
500 *Run Mode*	Go to 500 *Run Mode*

Section D The ValuMass™ Menuing System (EPICommunicator™ software)

The following section describes the use of EPICommunicator™ software running on a PC to communicate with your ValuMass™ flowmeter's menuing system. For descriptions of the specific functions, please refer to Section C.

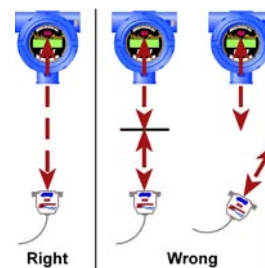
LightWIRE™ Communicator I

The LightWIRE™ Communicator I module is used to connect a ValuMass™ flowmeter to a PC running EPICommunicator 2.03 or higher software.



NOTE: To begin communicating with the flowmeter, press the MODE key for approximately 2– 3 seconds.

When transmitting to a flowmeter, caution must be used to assure that the signal is not interrupted. DO NOT block the infrared signal or move the module out of direct line to the flowmeter receiver. This will interrupt the signals to flowmeter and any interrupted transmissions will need to be repeated.



EPICommunicator™ v2.xx

EPICommunicator™ (EPICom) v2.03 (or higher) is proprietary software for use with Master-Touch™ and ValuMass™ flowmeters. EPICom uses the RS232 communication protocol to connect a ValuMass™ flowmeter directly to a PC running Windows XP®. Alternately, LightWIRE™ Communicator I modules use an infrared signal for communications between the flowmeter and the PC. The software is available to download in .zip format at no charge from our web site, www.epiflow.com.

Please note that older versions of the software do NOT support the ValuMass™ menuing system.

Connecting Your PC to Your ValuMass™ Flowmeter

Use the connection terminals on the ValuMass™ flowmeter to connect the flowmeter to the correct COM port on your PC. EPICom is pre-configured so that no configuration adjustments should be necessary. Alternately, you may also use line-of-sight infrared communications if you have purchased the required EPI LightWIRE™ module(s). Contact the factory or your local sales representative for more information concerning LightWIRE™ products.

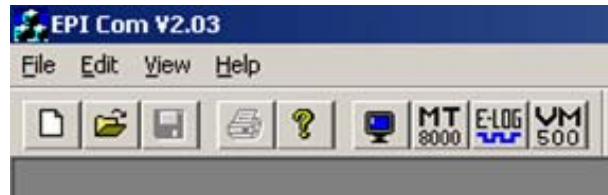
Installing and Starting EPICom

The EPICommunicator .zip file (EPICom V2.x.zip) contains the basic files required for the proper operation of the software. To install EPICom, first create a folder into which the .zip file will be extracted. The name of this folder is not critical to the installation process. Extract all of the files to the folder. No other installation steps — such as the typical Windows™ installation wizard — are required.

These files are all essential to the proper operation of EPICom software. They must all be stored in the same folder. Do not modify them in any way.

Upon request, you may also receive the data files for your specific ValuMass™ flowmeters directly from EPI. The naming convention for these files is “XXXXXXXX_1.vmm.” The first eight digits are the flowmeter’s serial number.

To start EPICom, open the EPICom folder and double-click on EPICom V2.x.exe file or its icon. EPICom will open to a blank screen with the menu bar shown below:



To open the EPITerm module, click on . To open the ValuMass™ module, click on .

To communicate with your ValuMass™ flowmeter, begin by opening the EPITerm module. Successfully connecting to the flowmeter with EPITerm should assure that any subsequent connection to the VM500 module would also be successful. If you experience any problems in establishing the connection with EPITerm, first check the connection and to the COM port selection. EPI technicians use EPICommunicator as part of the set up process for all ValuMass™ flowmeters, and they verify that the communications are working correctly as part of the final testing process at our facility. However, if problems with the connection continue on site, please contact the factory.

The ValuMass™ flowmeter does NOT work with the MT8000 (Master-Touch™) or E-LOG (E-Logger™) modules. They are intended for use with EPI’s Master-Touch™ flowmeters.

Data Entry Prompt

```
100 *Units*           300 *Sta
800 *Curve Fit*

Enter Selection >
```

Use the **Enter Selection >** prompt to navigate to the various ValuMass™ menus and submenus by typing in the appropriate menu number, and then pressing **ENTER** on the PC keyboard.

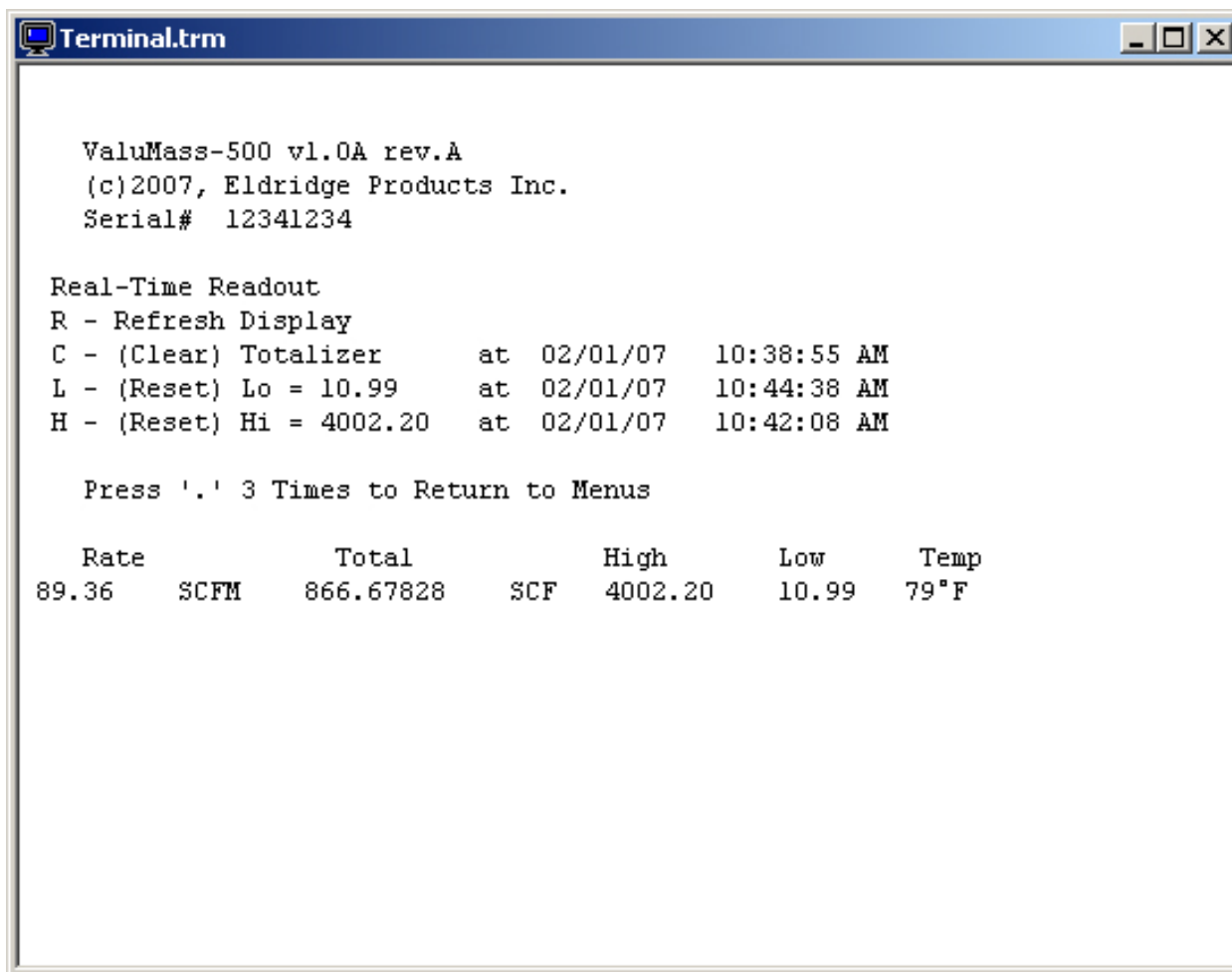
The flowmeter settings must be unlocked to change the engineering units, 4-20mA scaling or to reset the various stored values (see menu item 207–UnLock). When the settings are unlocked, the meter will go to the *100 Units* by default and the prompt will change to “>”.

The data entry prompt will change as required for the specific submenu. For example, to change from SCFM to SCFH you would simply type “102” (for submenu 102–SCFH) and press **Enter**. However, to change the rate at which the LCD is updated, first type “201” (for submenu 201–LCD Update Rate) and press **Enter**. The screen will show the currently stored value, followed by the data entry prompt. Type in the new value and press Enter to make the change, or just press Enter to leave the value unchanged.

The following pages show the PC menuing system screens. Please see *Section C* for a full description of the menus and their functions.

500 *Run Mode* Menu Screen

The 500 *Run Mode* Menu of the Master-Touch™ flowmeter shows the basic operations of the flowmeter when in use.



The **Real-Time Readout** commands are available while the flowmeter is in the basic Run Mode:

- **R** Press “**R**” three times to refresh the information displayed in the 500 *Run* screen;
- **C** Press “**C**” three times to clear the accumulated total flow value and record the time stamp for the most recent reset of this value, and then press “**R**” three times to refresh the displayed information;
- **L** Press “**L**” three times to clear the low flow value and the time stamp for the most recent reset of this value, and then press “**R**” three times to refresh the displayed information;
- **H** Press “**H**” three times to clear the high flow value and the time stamp for the most recent reset of this value, and then press “**R**” three times to refresh the displayed information;
- **.** Press “**.** (period)” three times to go to the **100 *Units* Menu** and the data entry prompt.

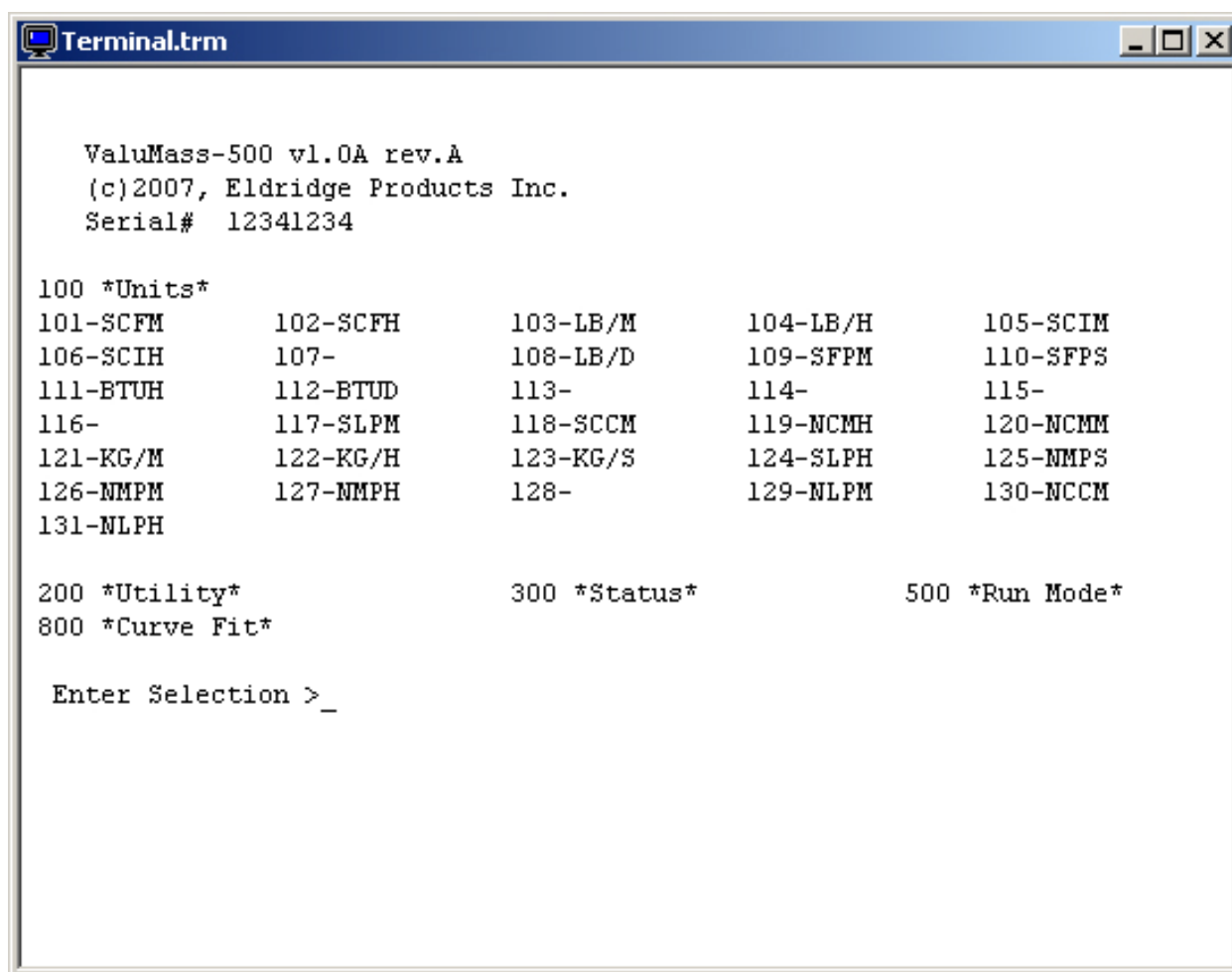
In addition, pressing “9” three times will cause the flowmeter to shutdown briefly and then restart.

The **Real-Time Data** line is updated as the values change without any need to refresh the screen:

- **Rate** The current flow rate in current engineering units;
- **Total** The accumulated flow total since the last Total reset;
- **High** The highest flow rate since the last High reset;
- **Low** The lowest flow rate since the last Low reset;
- **Temp** The current gas temperature (Fahrenheit or Celsius dependent upon the selected engineering units)

100 *Units* Menu Screen

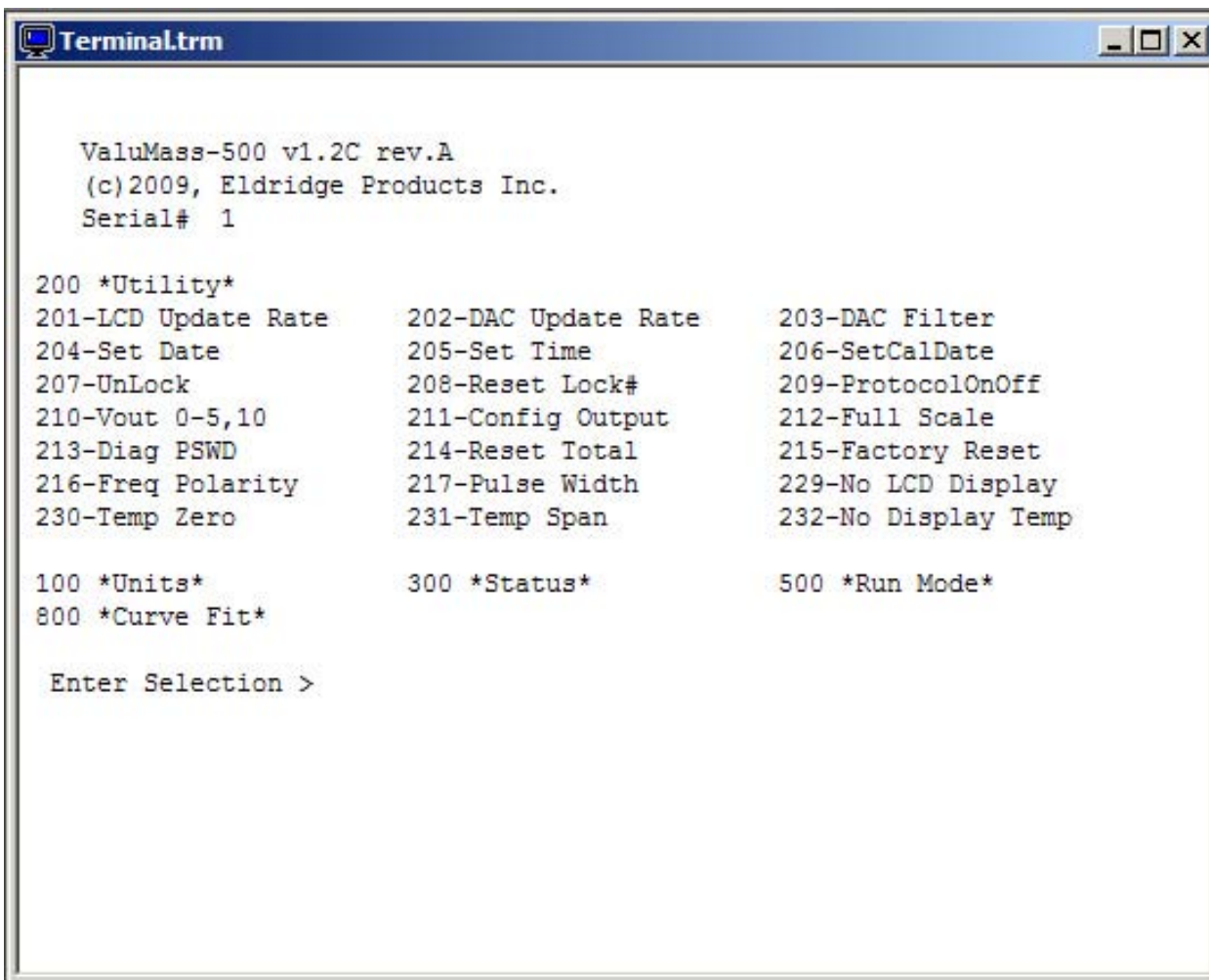
The 100 *Units* Menu of the ValuMass™ flowmeter includes a series of submenu items which allow you to easily change the engineering units for the flow rate and elapsed total.



With the meter settings unlocked, type the menu number of desired engineering unit at the prompt and then press ENTER. The flowmeter will restart using new operational engineering units. The Full Scale and Maximum Range values are recalculated as part of this process (*see menu items 212-FScale and 814-MaxRange*).

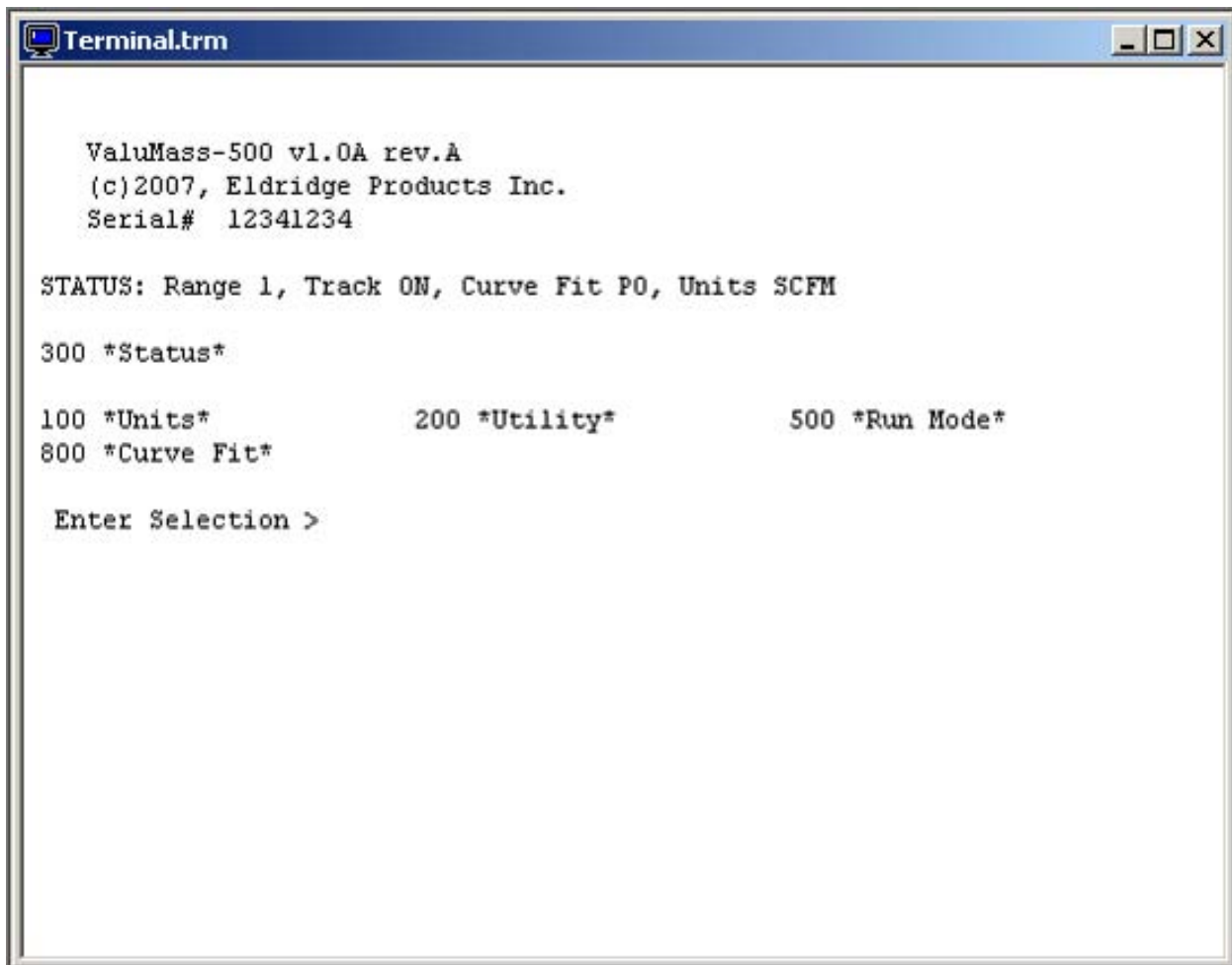
The flowmeter settings must be unlocked to change the engineering units, 4-20mA scaling or to reset the various stored values (*see menu item 207–UnLock*). The conversion of engineering units is “1:1” — the flowmeter does not make adjustments for differences in Reference Conditions between English (Imperial) and metric units, nor does it adjust for volume to weight conversions for gases other than Air or Nitrogen. Consult the factory for help with the additional adjustments required for these situations.

200 *Utility* Menu Screen



The 200 *Utility* Menu of the ValuMass™ 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, etc. Values for timing functions are in millisecond (ms) increments.

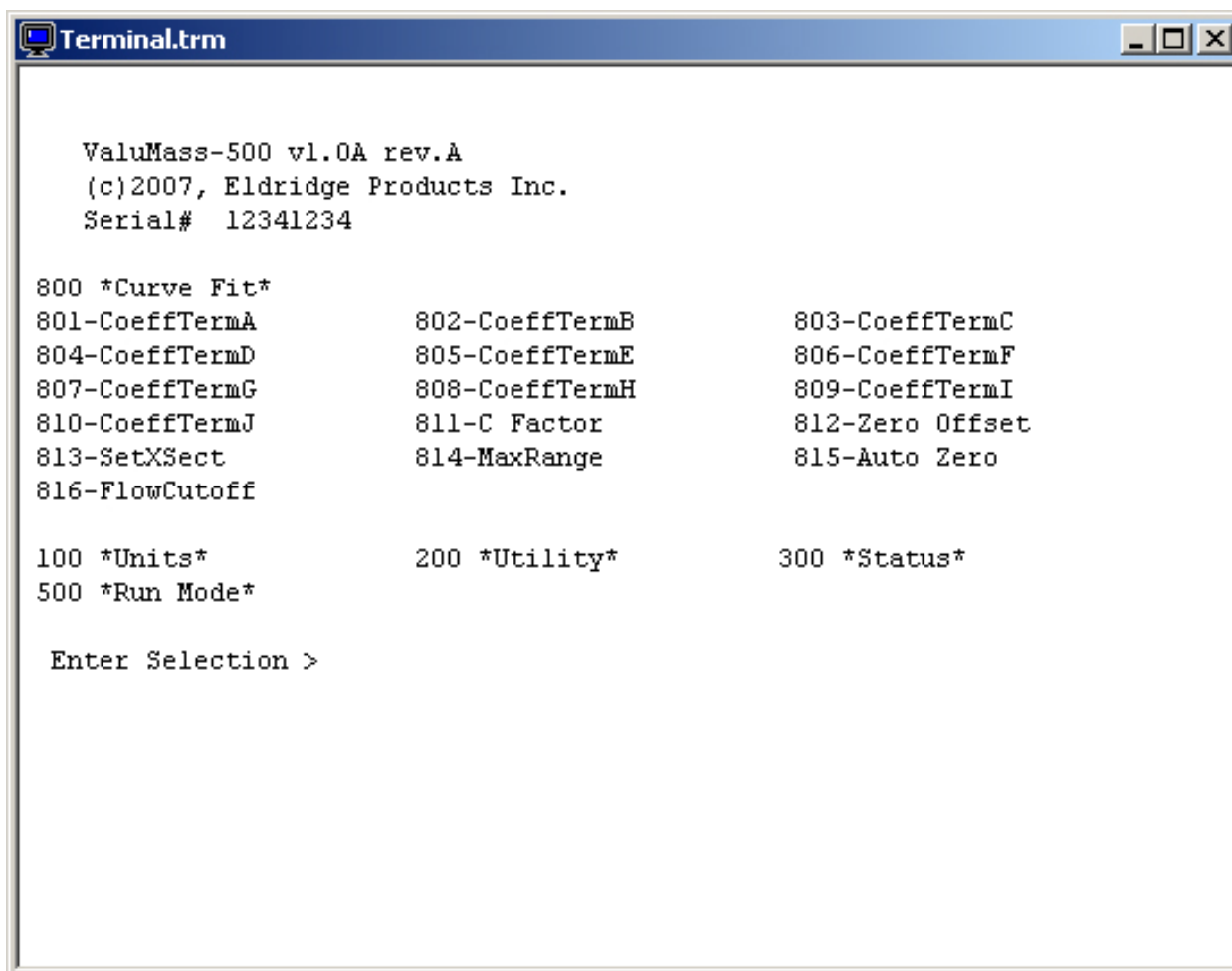
Although most settings are accessible by using the default user password of “9001”, some of the parameters require a special password available only by contacting the factory. This has been instituted to prevent the accidental change of critical settings.

300 *Status* Menu Screen

The 300 *Status* Menu is intended for use with the LCD display and does not present information on the PC screen.


800 *Curve Fit* Menu Screen

The ValuMass™ software stores the calibration curve coefficients which are generated by the factory NIST calibration, as well as the global C-Factor, process line cross-sectional area, etc.

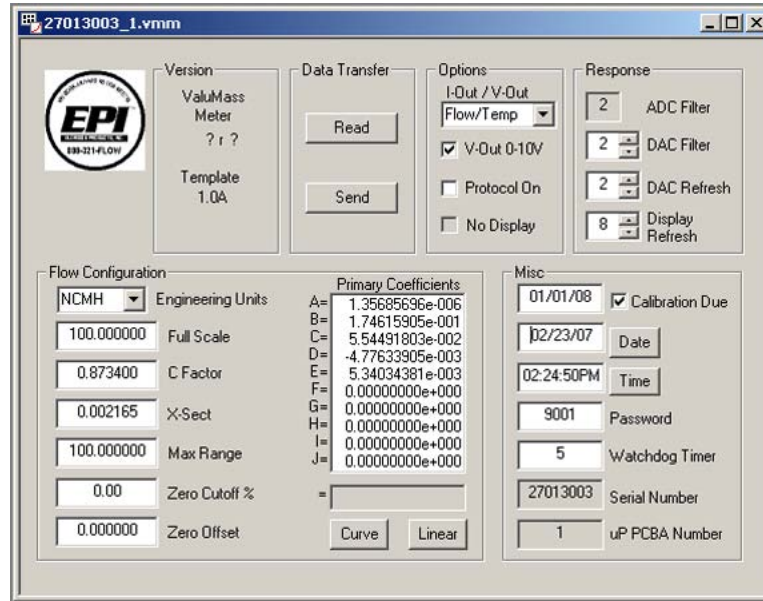


Although most settings are accessible by using the default user password of “9001”, some of the parameters require a special password available only by contacting the factory. This has been instituted to prevent the accidental change of critical settings. The curve coefficients and MaxRange values should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

The ValuMass™ Module

The ValuMass™ Module presents most of the flowmeter's stored settings in one convenient screen display. You can access the module by clicking on the  icon.

The screen shown below will appear, though it will not have data for your flowmeter at first. To populate the data fields with the settings from your flowmeter, click the “Read” button. You may also open stored files for review through the “File” menu by selecting “Open” and locating the appropriate *.vmm file as you would when opening any other file.



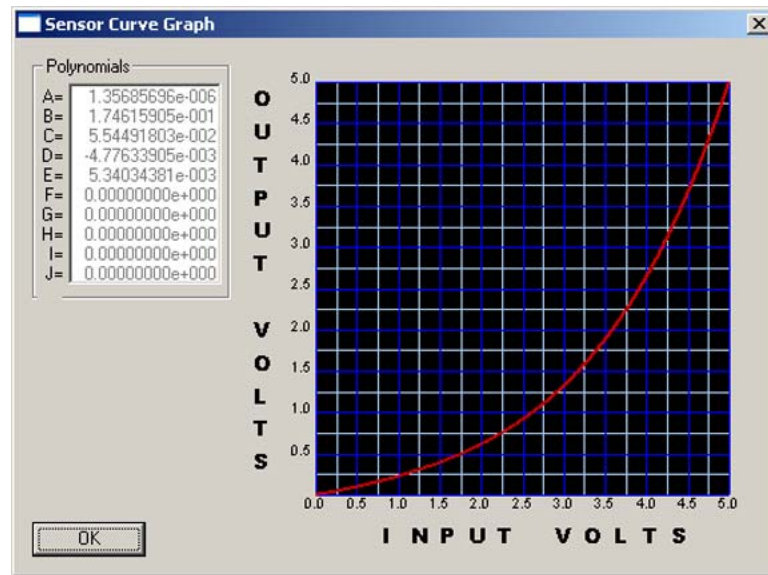
The screenshot shows the ValuMass 500 software interface with the following sections:

- Version:** ValuMass Meter, Template 1.0A
- Data Transfer:** Read, Send buttons
- Options:** I-Out / V-Out (Flow/Temp), V-Out 0-10V (checked), Protocol On (unchecked), No Display (unchecked)
- Response:** ADC Filter (2), DAC Filter (2), DAC Refresh (2), Display Refresh (8)
- Flow Configuration:**
 - Engineering Units: NCMH
 - Full Scale: 100.000000
 - C Factor: 0.873400
 - X-Sect: 0.002165
 - Max Range: 100.000000
 - Zero Cutoff %: 0.00
 - Zero Offset: 0.000000
- Primary Coefficients:**
 - A= 1.35685696e-006
 - B= 1.74615905e-001
 - C= 5.54491803e-002
 - D= -4.77633905e-003
 - E= 5.34034381e-003
 - F= 0.00000000e+000
 - G= 0.00000000e+000
 - H= 0.00000000e+000
 - I= 0.00000000e+000
 - J= 0.00000000e+000
- Misc:**
 - Calibration Due: 01/01/08 (checked)
 - Date: 02/23/07
 - Time: 02:24:50PM
 - Password: 9001
 - Watchdog Timer: 5
 - Serial Number: 27013003
 - uP PCBA Number: 1

The various settings can be adjusted by either entering the new values directly into the data fields, by selecting from a dropdown list or by using the Up/Down arrows, depending on which values you are modifying. The values in grey fields cannot be modified by the user and are presented for reference only. When you have made any required adjustments, click the “Send” button to download the settings to the flowmeter.

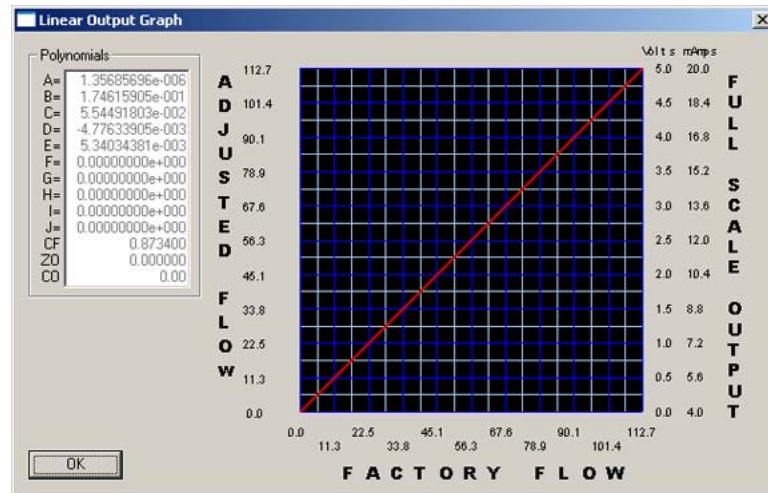
The Primary Coefficients and Max Range values must not be changed in any way unless directed to do so authorized Factory technicians. Also, ALL of the flowmeter's settings will be overwritten by the values in the Module screen so you must be certain that you have confirmed the values before sending them to the flowmeter.

Clicking on the “Curve” button will display the following screen:



This screen shows the non-linear 0–5 VDC scaling of the bridge voltage and the Primary Coefficients used by the microprocessor to linearize the signal.

Clicking on the “Linear” button will display the following screen:



This screen shows the linear outputs and the corresponding flow rates. Adjustments made to the Full Scale, C-Factor, Zero Offset and Flow Cutoff will be reflected in this display.

Section E Instructions for Specific Actions

Unlocking the ValuMass™ — Menu Item 207–UnLock

ValuMass™ 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 207–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 ValuMass™ after the flowmeter is unlocked by entering a new passkey in menu item 208–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	12.3456 SCFM 9876.54321 SCF
Step 1	Press MODE twice to advance to the 200 *Utility* menu.	200 *Utility* 201-LCD Updt R
Step 2	Press MAX or MIN to advance to the 200 *Utility* menu item 207-UnLock.	200 *Utility* 207-UnLock
Step 3	Press SHIFT to access the numeric entry mode. The blinking character is the active digit. Use MAX or MIN to change the numerical value.	Code#(9xxx) >9---
Step 4	Press MODE to move the active digit to the right to change the numerical value of the other digits.	Code#(9xxx) >90--
Step 5	Complete the entry of the passkey (<i>default factory passkey is 9001</i>).	Code#(9xxx) >9001
Step 6	Press SHIFT to move active digit to the left until the meter returns to menu item 207-UnLock. The meter is unlocked as indicated by a ">" in the upper right corner of the LCD display.	200 *Utility* > 207-UnLock

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

200	*Utility*	>
800	*Curve Fit*	

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

Selecting the Engineering Units — Menu Items 101–132

ValuMass™ 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 *Units* 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 207–UnLock	<div>200 *Utility* ></div> <div>207–UnLock</div>
Step 1	Press MAX twice to advance to the 200 *Utility* menu item 100 *Units*.	<div>200 *Utility* ></div> <div>100 *Units*</div>
Step 2	Press SHIFT to advance to the 100 *Units* menu.	<div>100 *Units* ></div> <div>101–SCFM</div>
Step 3	Press MAX or MIN to advance to the 100 *Units* menu item of the engineering unit you desire. Press SHIFT to select the engineering unit.	<div>100 *Units* ></div> <div>119–NCMH</div>
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.	<div>100 *Units* ></div> <div>107–</div>
Step 4a	<u>If further adjustments are required</u> , press MAX or MIN to advance to other 100 *Units* menu items or MODE to advance to other main menus.	<div>100 *Units* ></div> <div>800 *Curve Fit*</div>
<p style="text-align: center;">DO NOT return to RUN MODE — this will automatically LOCK the meter.</p>		
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.	<div>100 *Units* ></div> <div>500 *Run Mode*</div>

Changing the Full Scale range — Menu Item 212–Full Scale

ValuMass™ 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 0–5/10 VDC and 4–20 mA output signals to the new Full Scale range.

The following directions assume that you have just unlocked the flowmeter.

Start	Menu item 207–UnLock	200 *Utility* > 207–UnLock
Step 1	Press MAX or MIN to advance to the 200 *Utility* menu item 212–Full Scale.	200 *Utility* > 212–Full Scale
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 212–Full Scale. The Full Scale setting is now changed.	200 *Utility* > 212–Full Scale
Step 7a	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 *Meter* > 800 *Curve Fit*

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

Step 7b	If no further adjustments are required, press MAX six times to advance to the 500 *Run Mode* menu item, then press SHIFT to lock the flowmeter and to return to Run Mode.	200 *Meter* > 500 *Run Mode*
----------------	---	---------------------------------

Resetting the Flow Rate and Flow Total — Menu Item 214–Reset!

ValuMass™ 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 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 207–UnLock	<div>200 *Utility* > 207–UnLock</div>
Step 1	Press MAX or MIN to advance to menu item 214–Reset!. Press SHIFT to reset the values to zero. The flowmeter will automatically return to Run Mode within 1–2 seconds.	<div>200 *Utility* > 214–Reset Total</div>

Adjusting the C Factor — Menu Item 811–C Factor

ValuMass™ flowmeters allow you to adjust the correction factor setting. 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 *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 *Factory*.	200 *Utility* > 800 *Curve Fit*
Step 2	Press SHIFT to advance to the 800 *Factory* menu.	800 *Curve Fit*> 801–CoeffTermA
Step 3	Press MAX or MIN to advance to the 800 *Factory* menu item 811–C Factor.	800 *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 *Curve Fit*> 811–C Factor
Step 7a	<u>If further adjustments are required</u> , press MAX or MIN to advance to other 800 *Curve Fit* menu items or MODE to advance to other main menus.	800 *Curve Fit*> 801–CoeffTermA
DO NOT return to RUN MODE — this will automatically LOCK the meter.		
Step 7b	<u>If no further adjustments are required</u> , press MODE to advance to the 500 *Run Mode* menu and press SHIFT. The flowmeter will return to Run Mode and relock.	800 *Curve Fit*> 500 *Run Mode*

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

Insertion-style ValuMass™ 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 *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 *Factory*.	200 *Utility* > 800 *Factory*
Step 2	Press SHIFT to advance to the 800 *Factory* menu.	800 *Curve Fit*> 801–CoeffTermA
Step 3	Press MAX or MIN to advance to the 800 *Factory* menu item 813–SetXSect.	800 *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 *Curve Fit*> 813–SetXSect
Step 7a	<u>If further adjustments are required</u> , press MAX or MIN to advance to other 800 *Curve Fit* menu items or MODE to advance to other main menus.	800 *Curve Fit*> 801–CoeffTermA
DO NOT return to RUN MODE — this will automatically LOCK the meter.		
Step 7b	<u>If no further adjustments are required</u> , press MODE to advance to the 500 *Run Mode* menu and press SHIFT. The flowmeter will return to Run Mode and relock.	800 *Curve Fit*> 500 *Run Mode*

Section F 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 G General Specifications

Flow Accuracy (including linearity)	± [2% of Reading + (0.5% Full Scale + 0.05% / °C)]
Repeatability	± 0.5% of Full Scale
Temperature Accuracy (NA)	Expected ± 2°F (1°C), ± 1°F (0.5°C) optional
Linear Signal Output	0 – 5 or 10 VDC, 4 – 20 mA (Flow and Temperature) 0 – 1 kHz (proportional to Flow)
Sensor Response Time	1 second
Turndown Ratio	100:1 (not less than 15 SCFM / FT ²)
Transmitter Operating Temperature	0 – 130°F (-18° – 55°C)
Temperature Compensation	Standard 40° – 100°F (4 – 38°C) Optional 0° – 250°F (-18° – 121°C)
Gas Pressure Effect	Negligible over ± 20% of absolute calibration pressure
Pressure Rating Maximum:	
Inline Flowmeters	500 PSIG
Insertion Flowmeters	500 PSIG (Stainless Steel ferrule) 150 PSIG (Teflon™ ferrule)
Input Power Requirement	24 VDC @ 250 mA 115 VAC 50/60 Hz optional 230 VAC 50/60 Hz optional
Transmitter Power Requirements	5 Watts or less
Communications Port	RS-232C Optional LightWIRE™ infrared
Display	Optional 2-lines, 16 characters per line, backlit LCD
Wetted Materials	316 & 316L Stainless Steel
Standard Temperature & Pressure (STP)	70°F & 29.92" Hg (Air = 0.075 Lbs. / FT ³)
NIST Traceable Calibration	Standard
Enclosure Rating	NEMA 4X (IP66)
Approvals	CE Mark

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.

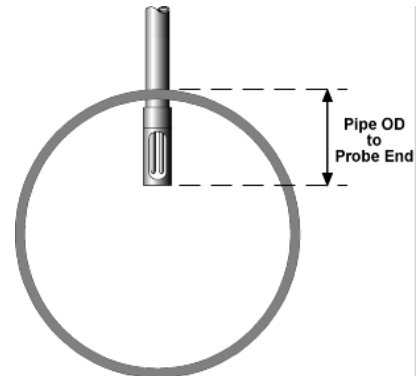
The terms of any offer are expressly limited to the terms detailed in any product brochure or price quote. Any modification to any of the terms of this offer must be in writing and must be signed by an officer of EPI.

Section H Guidelines and Product Drawings

Probe Insertion Guidelines

Most insertion style ValuMass™ flowmeters are calibrated for a specific line size, so no C-Factor adjustment is required for the basic installation.

The following chart presents the C-Factor adjustments for insertion style ValuMass™ flowmeters calibrated for a specified universal velocity to be used in multiple line sizes. 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 may be entered into the settings before or after insertion into the process line.

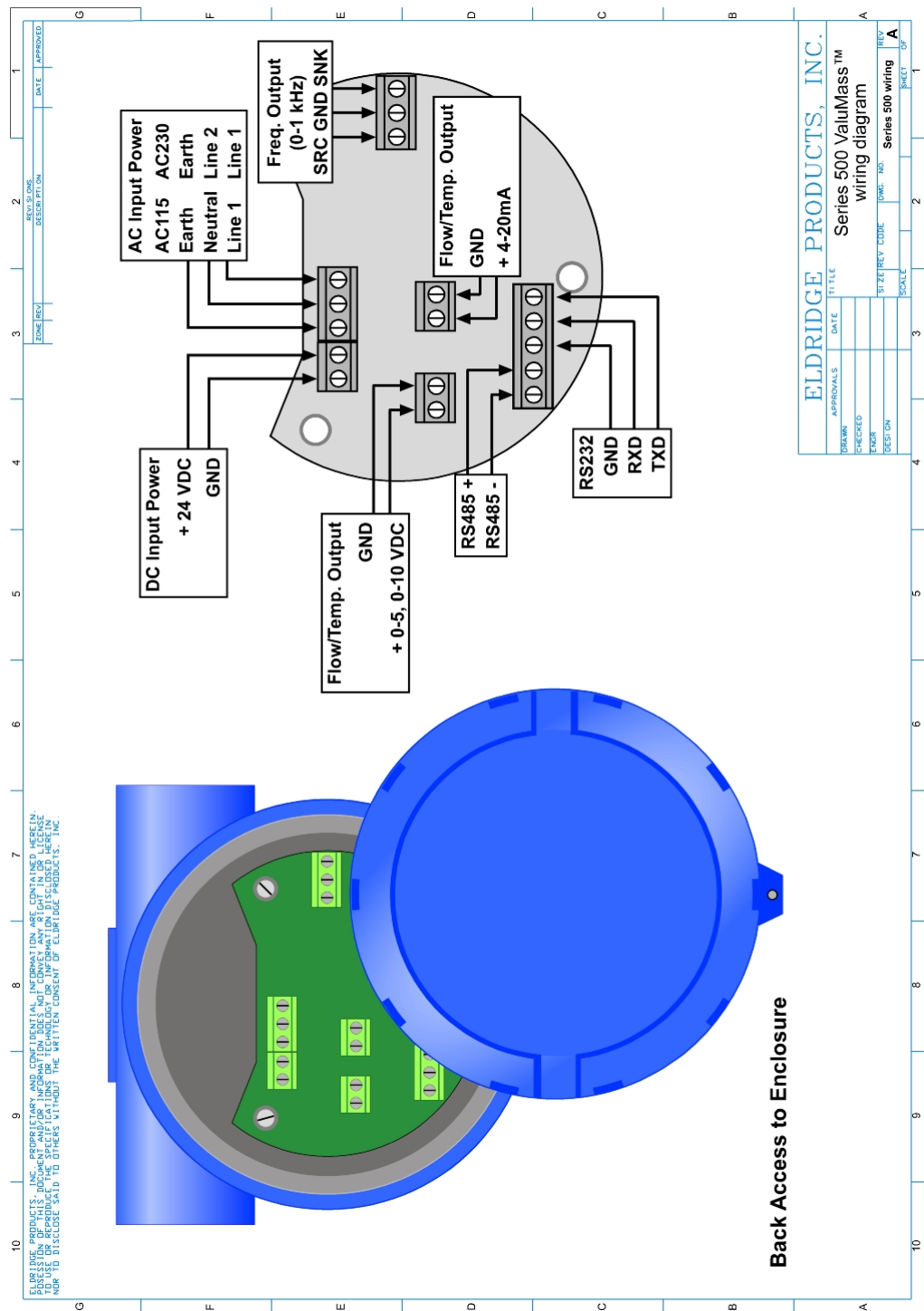


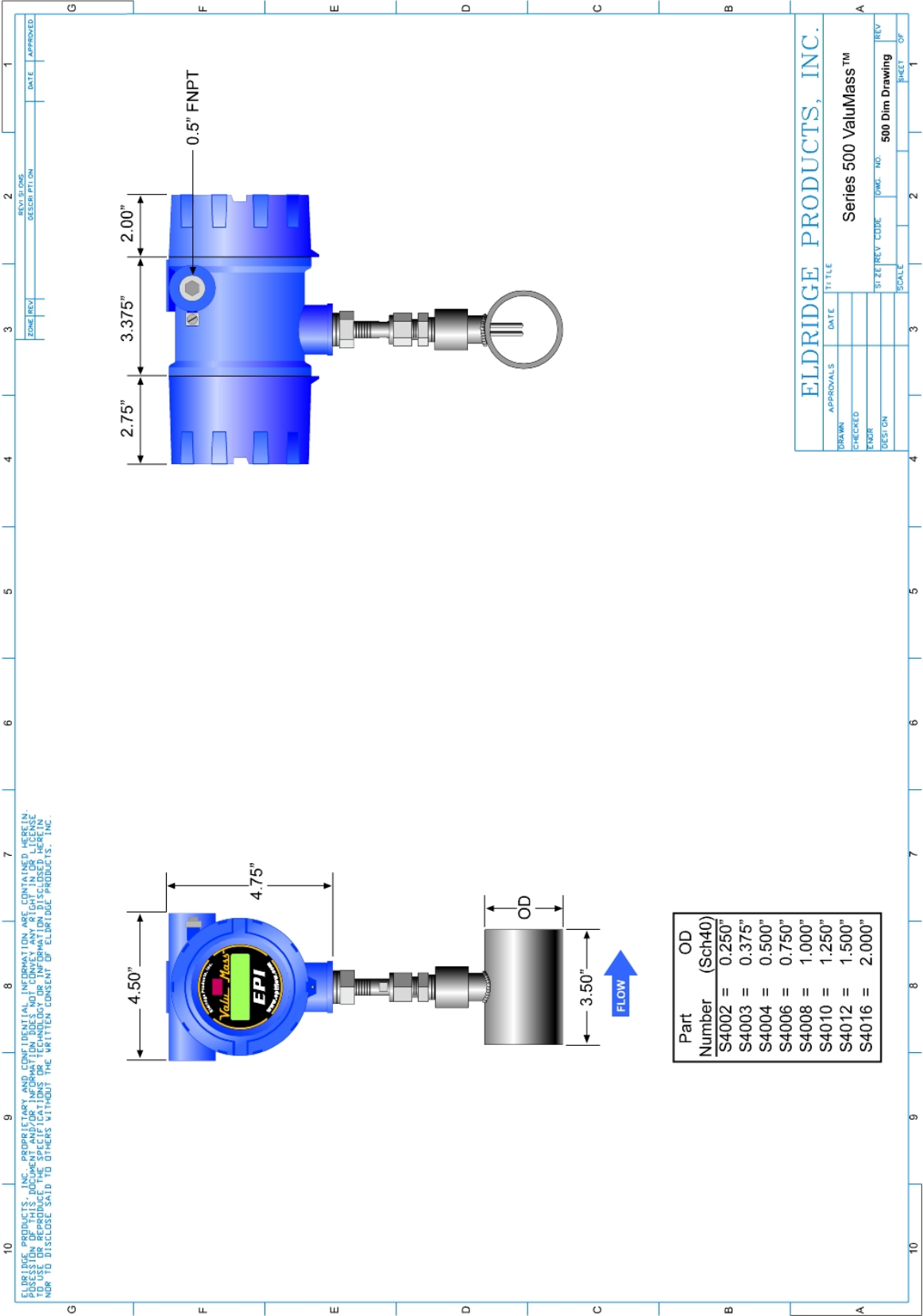
The calculation for the probe insertion depth (pipe OD to probe end) includes the point-of-average-flow, the slot in the protective sensor window, and the wall thickness of each nominal pipe size, as well as a further adjustment on smaller line sizes to be sure that the slot is fully inserted through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

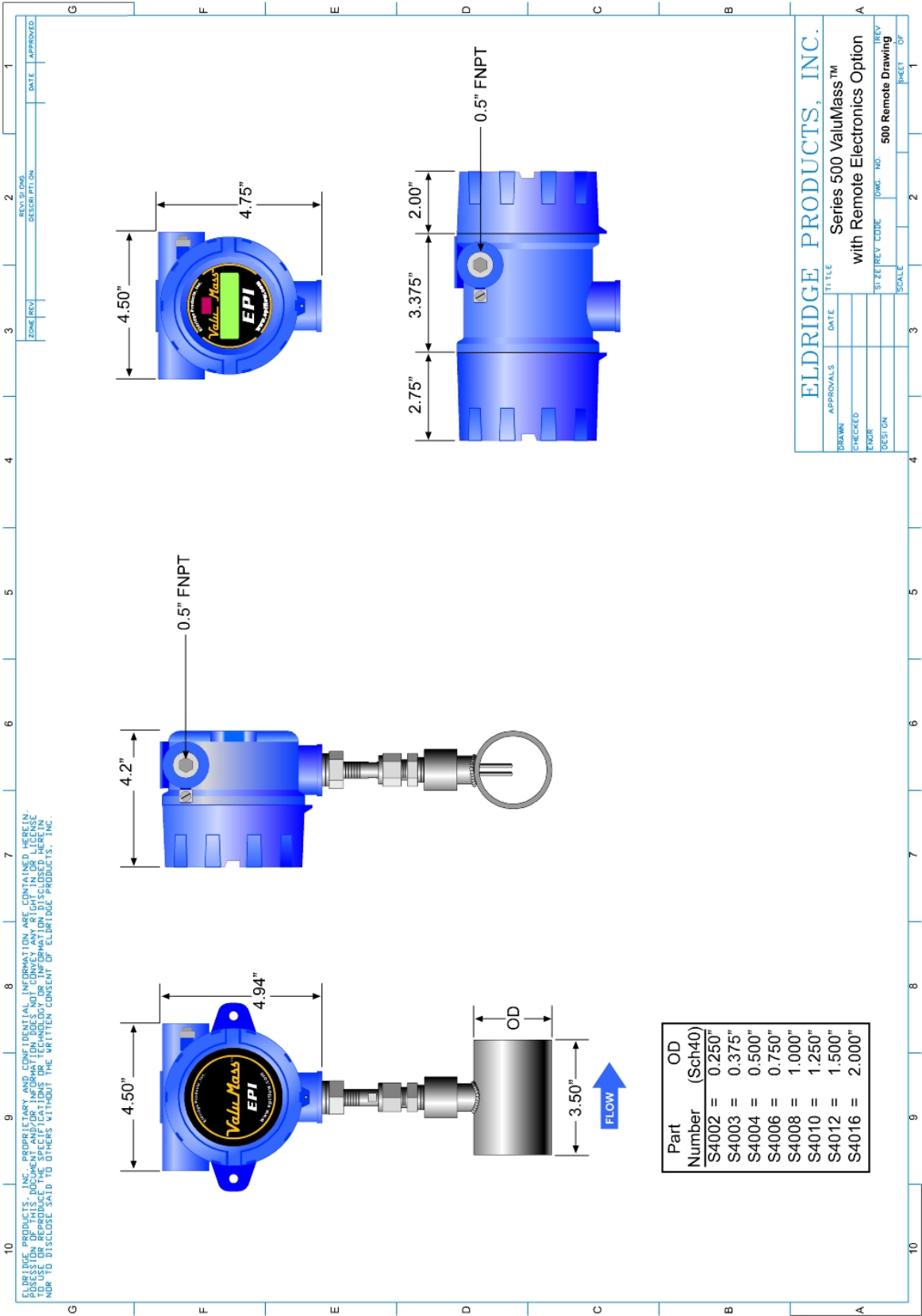
The information below assumes a well-developed flow profile in the process line. The actual flow profile may not conform to this standardized profile. Therefore, a further adjustment to the position or C-Factor may be required to improve the overall accuracy of the flowmeter readings. If an additional 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 4" line (0.883), the revised C-Factor is $0.975 \times 0.883 = 0.861$.

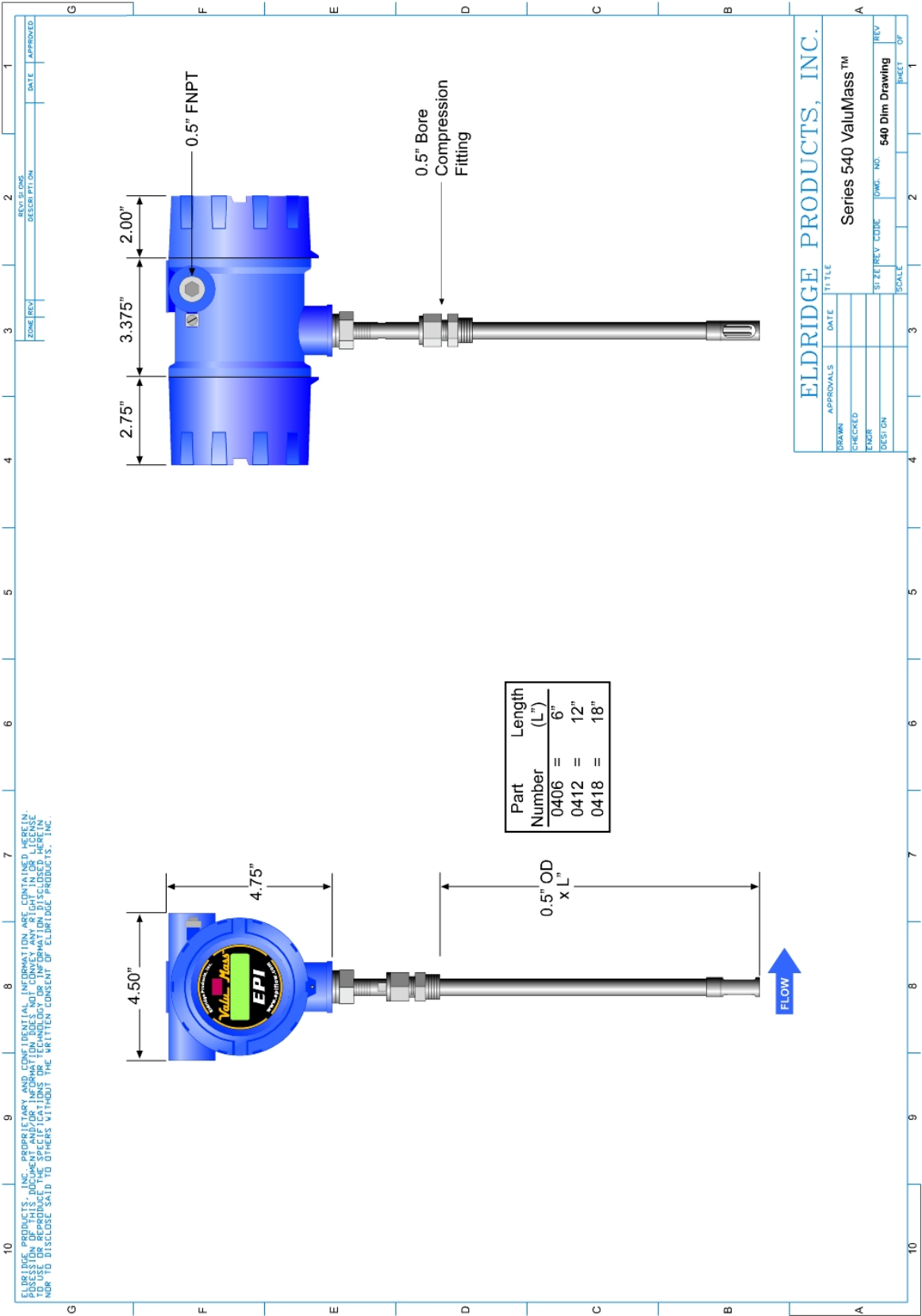
Sch 40 Nominal Pipe Size	Inside Diameter (inches)	Wall Thickness (inches)	Cross- sectional Area (ft ²)	Pipe OD to Probe End (inches)	Menu 811 – C-Factor
2"	2.067	0.154	0.0233	1.3	0.750
2.5"	2.469	0.203	0.0332	1.3	0.750
3"	3.068	0.216	0.0513	1.3	0.750
4"	4.026	0.237	0.0884	1.7	0.750
6"	6.065	0.280	0.2006	1.8	0.950
8"	7.981	0.322	0.3474	2.1	1.000
10"	10.020	0.365	0.5476	2.4	1.000
12"	12.000	0.375	0.7854	2.6	1.000
14"	13.250	0.375	0.9575	2.8	1.000
16"	15.250	0.375	1.2684	3.0	1.000
18"	17.250	0.375	1.6230	3.2	1.000
20"	19.250	0.375	2.0211	3.5	1.000
24"	23.250	0.375	2.9483	4.0	1.000

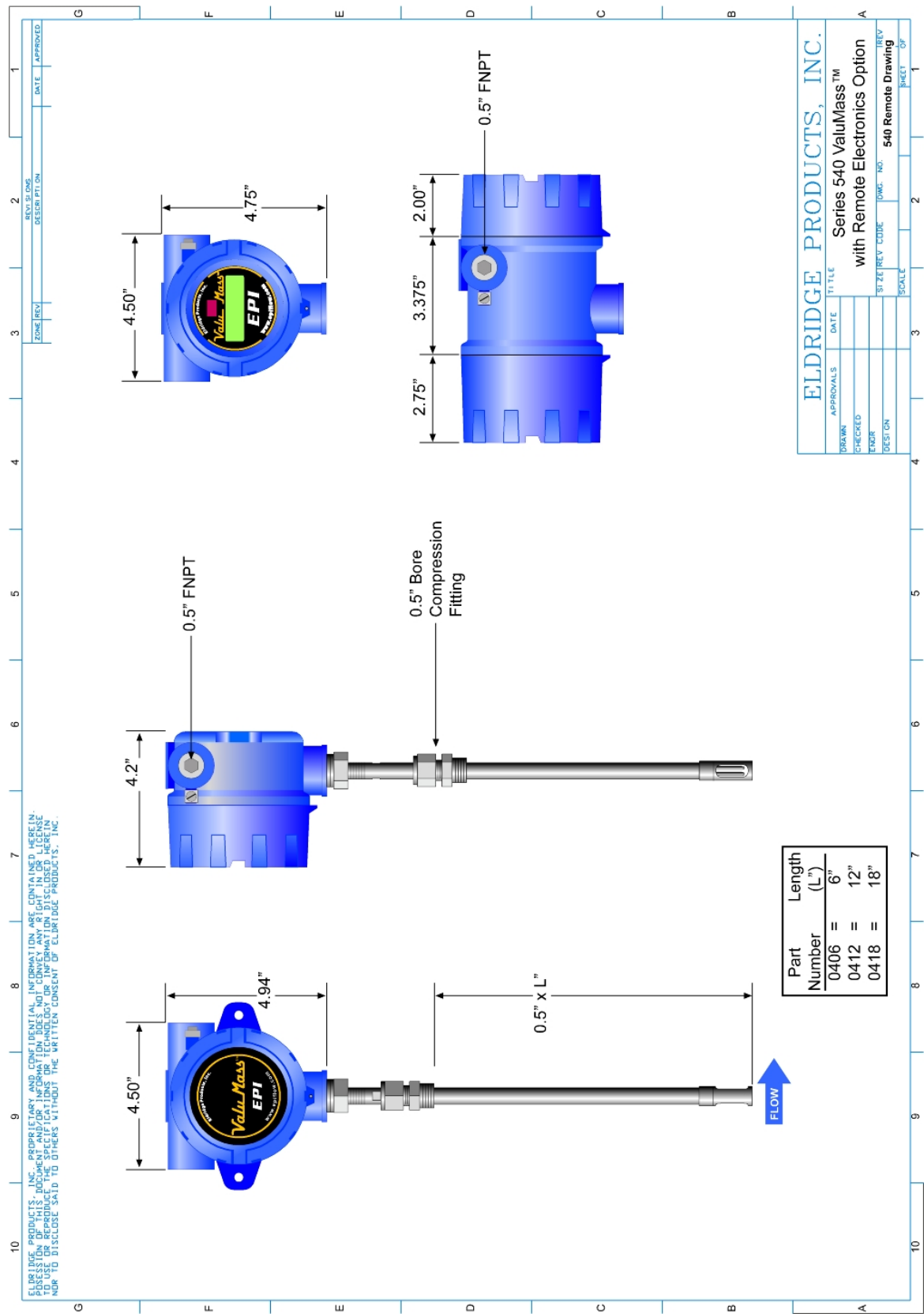
Engineering Drawings

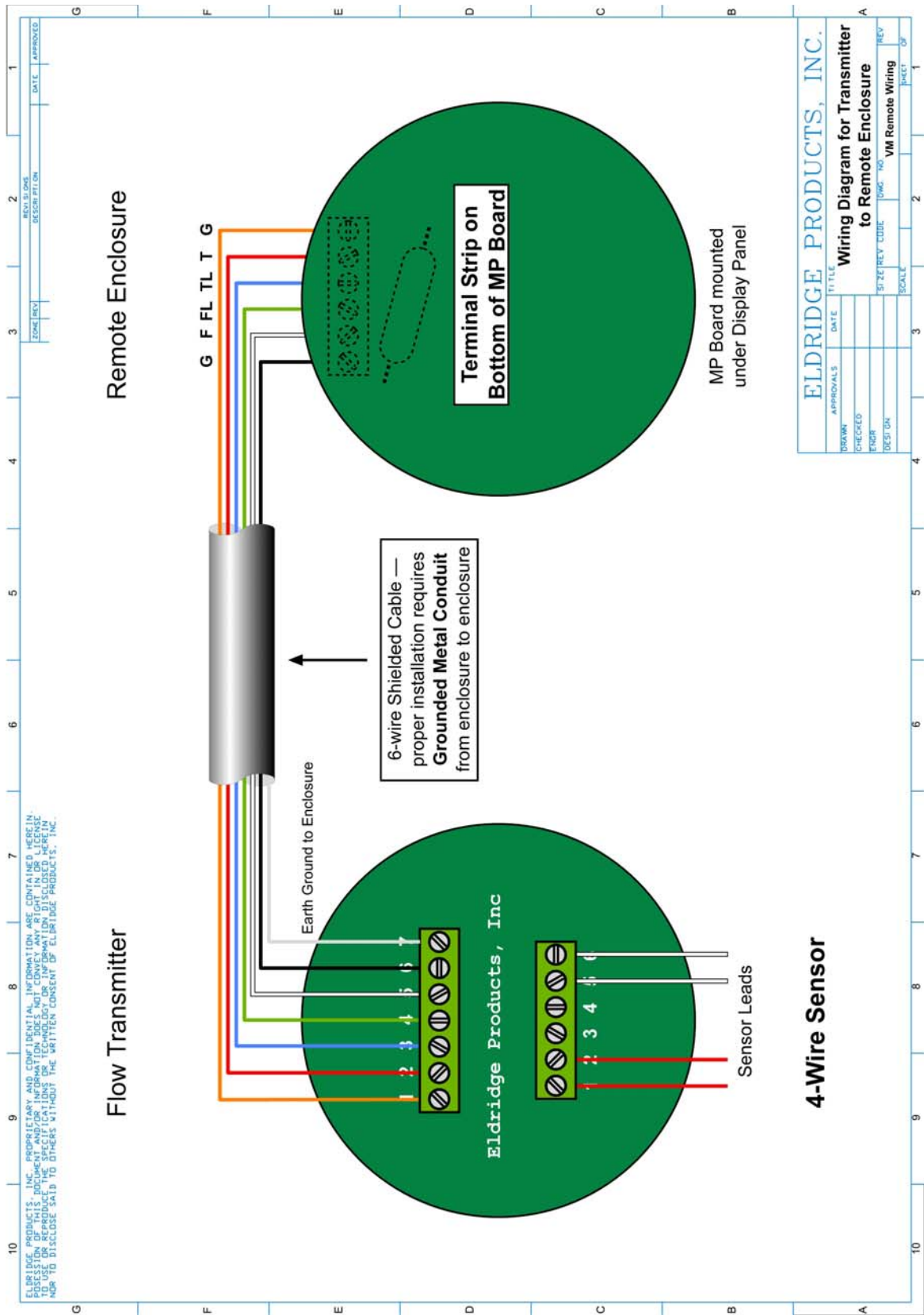












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CUSTOMER SATISFACTION REPORT

The staff of ValuMass 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 it or mail it to us. 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 ValuMass 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):
