ValuMass is a division of Eldridge Products, Inc.

Version 1.x

Series 400 & 440 Thermal Gas Mass Flowmeters

INSTRUCTION MANUAL

80202601 (Rev. 1.06)

FOR USE WITH SIM-BASED FIRMWARE
SHIPPED MAY 1, 2013 OR LATER

CE Compliant

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Section A Introduction and Installation

Introduction

Your ValuMass™ Series 400 flowmeter includes a flow sensing element, temperature sensing element, a digital bridge amplifier/signal output board, electronics enclosure(s), and probe support or flow section. Depending upon your requirements, these individual pieces may be integrated into one enclosure mounted on the flow probe or flow body (integral electronics) or you may have multiple enclosures (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, RS485 Modbus RTU, a HART-compatible module.

Unpacking Your Instrument

Your ValuMass™ Series 400 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

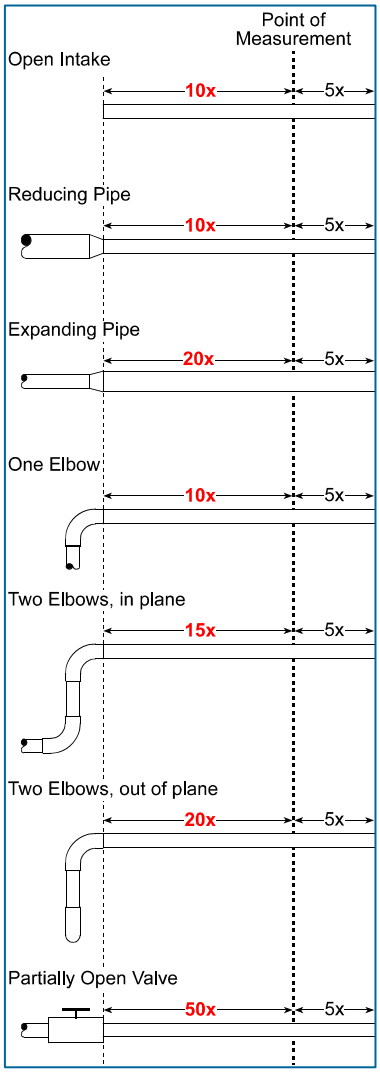
Power requirements for ValuMass™ Series 400 flowmeters with the "-D024" option are user-supplied 18 to 24 Volts DC @ 250 mA.

Power requirements for ValuMass™ Series 400 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 sensor power is provided by the connection to the Remote Enclosure and/or AC Power Enclosure (see the wiring instructions in Section F which correspond to your configuration).

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 ValuMass™ Series 400 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 F.

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 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, 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™ Series 400 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:

Sinking (User provides power input)	40 VDC max. 200mA max.
Sourcing (ValuMass™ provides power input)	. 15 VDC 50mA max. 300 ohm min.

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 kHz x (150 / 1000) = 0.15 kHz
2. Full Scale = 500 NCMH
   Flow Rate = 425 NCMH
   Frequency Span = 1 kHz
   1 kHz x (425 / 500) = 0.85 kHz

Please see Page F–14 for Sink and Source wiring diagrams

The ValuMass™ Series 400 Series is CE Compliant.

Section B General Operation

Sensor Theory and Operation

ValuMass™ Series 400 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™ Series 400 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.

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™ Series 400 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:

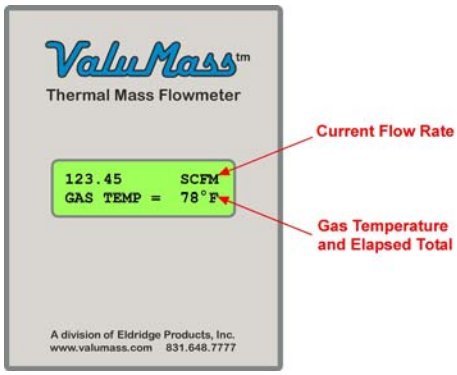
High Flow value
High Flow Time/Date
Low Flow value
Low Flow Time/Date
Totalizer value
Totalizer reset Time/Date
LCD contrast setting
Date format (MM/DD/YY; DD.MM.YY)
Real time clock time & date

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™ Series 400 Menuing System (EPICommunicator™ software)

The following section describes the use of EPICommunicator™ software running on a PC or laptop to communicate with your ValuMass™ Series 400 flowmeter's menuing system. ValuMass™ Series 400 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.

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



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.

EPICommunicator™ v2.xx

EPICommunicator™ (EPICom) v2.03 (or higher) is proprietary software for use with Master-Touch™ and ValuMass™ Series 400 flowmeters. EPICom uses the RS232 communication protocol to connect a ValuMass™ Series 400 flowmeter directly to a PC running Windows XP/Vista/7 operating systems. The software is available to download is .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™ Series 400 menuing system.

Connecting Your PC to Your ValuMass™ Series 400 Flowmeter

Use the connection terminals on the ValuMass™ Series 400 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.

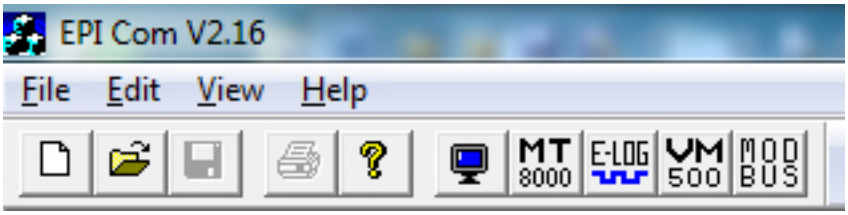
Installing and Starting EPICom

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™ Series 400 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™ Series 400 module, click on  .

To communicate with your ValuMass™ Series 400 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™ Series 400 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™ Series 400 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™ Series 400 menus and submenus by typing in the appropriate menu number, and then pressing **ENTER** on the PC keyboard.

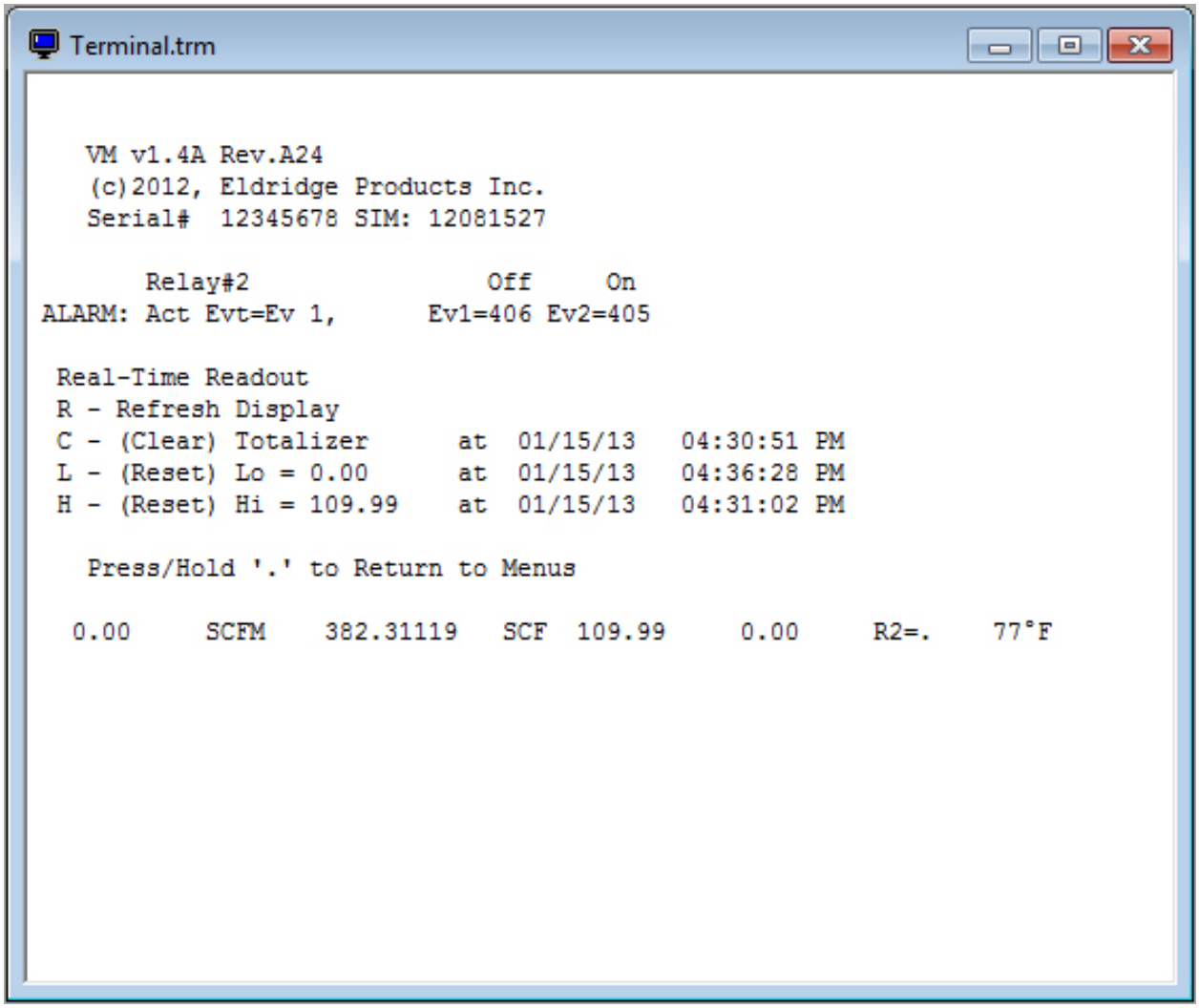
The flowmeter settings must be unlocked to change the engineering units, 4-20mA scaling or to reset the various stored values (*see menu item 207–UnLock*). When the settings are unlocked, the meter will go to the *100 Units* by default and the prompt will change to ">>".

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 and the 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.

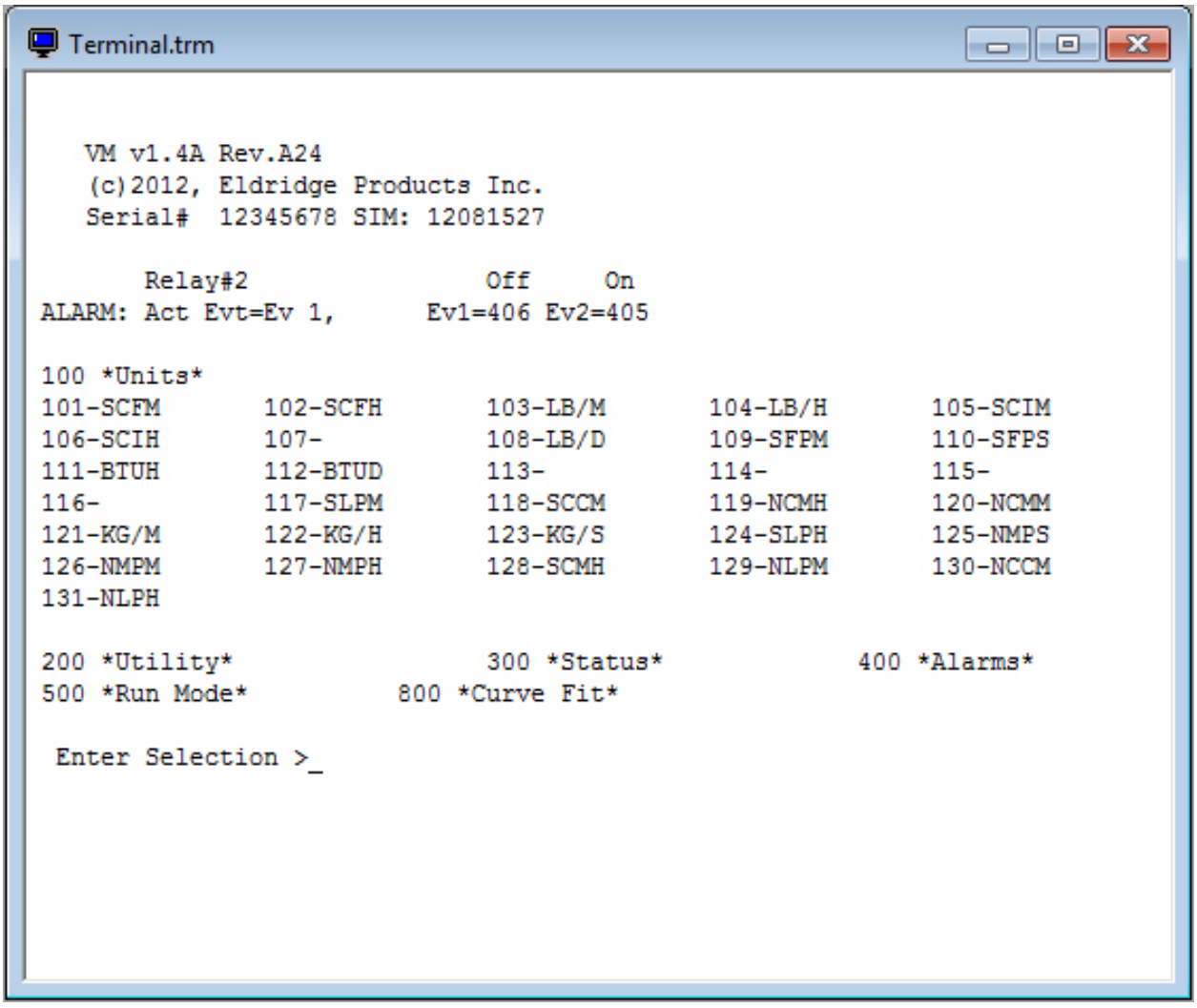
In addition, pressing "**9**" three times will cause the flowmeter to shutdown briefly and then restart.

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™ Series 400 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*).

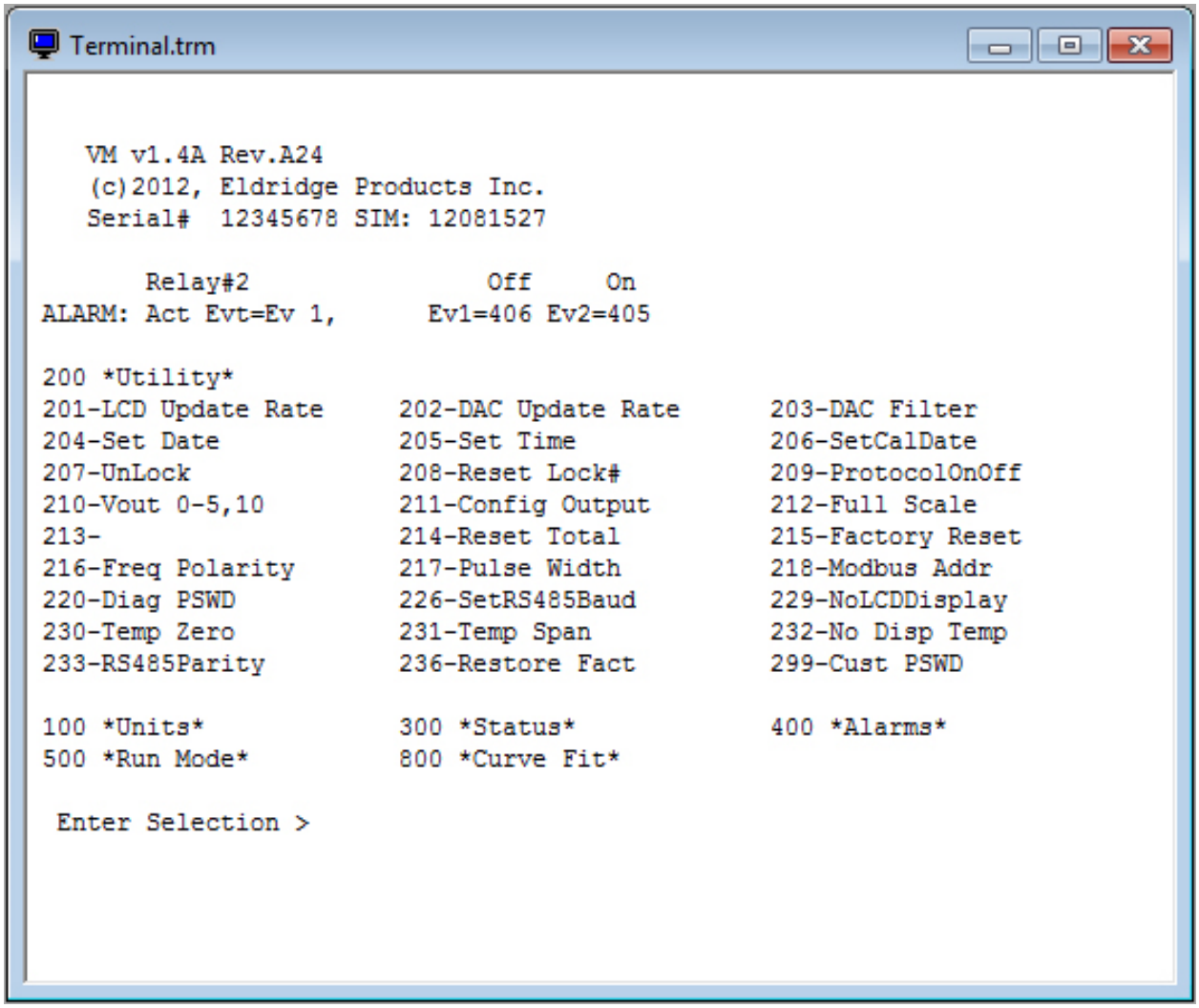
100 *Units* Submenus

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
400 *Alarms*	Go to 400 *Alarms* Menu
500 *Run Mode*	Go to 500 *Run Mode*
800 *P-Curve Fit*	Go to 200 *P-Curve Fit* Menu

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™ Series 400 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.

200 *Utility* Submenus

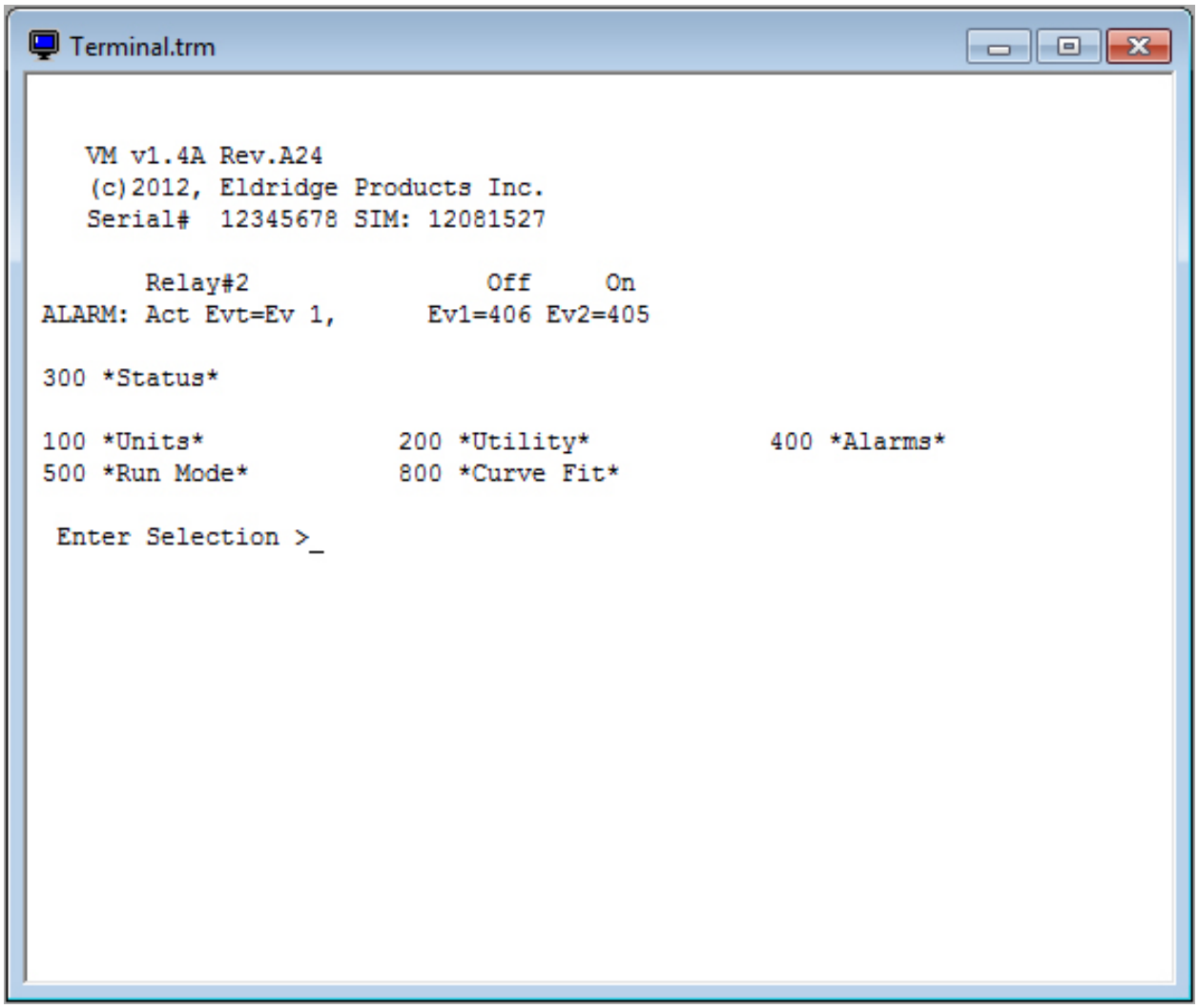
201-LCD Update R	This menu item adjusts the rate at which the rate and totalizer readouts are updated. It is often used to reduce the effect of a rapidly fluctuating flow rate on the LCD display. Acceptable values are between 8 (ms) and 255 (ms). ***This menu item only affects the totalizer and flow rate update period, not their accuracy, and does not affect the 0–5/10 VDC or 4–20 mA output signals.***
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: • 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	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.
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 Outpu	This menu item is used to set the 4 – 20 mA and 0– 5/10 VDC output signal configurations as shown below: 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
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	(unused)
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-Freq Polarity	This menu item is used to set the Frequency Output polarity (*refer to the Sink/Source table on page A-4*): 0 = LOW @ No Flow with Low to High pulse at flow; 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
218-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.
226-SetRS485Baud	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.***
229-NoLCDDisp	This menu item controls the microprocessor signal to the LCD: 0 = On, 1 = Off.

230-Temp Zero	This menu item sets the temperature value (°F) for the 0 VDC output. ***This value is always entered in °F. The temperature displayed will match the engineering units selected for the flow rate, either Imperial (English) or Metric. The factory default is 0°F. This setting does NOT affect the temperature compensation range for the process gas.***
231-Temp Span	This menu item sets the temperature value (°F) for the 5 VDC output. ***This value is always entered in °F. The temperature displayed will match the engineering units selected for the flow rate, either Imperial (English) or Metric. The factory default is 250°F. This setting does NOT affect the temperature compensation range for the process gas.***
232-No Disp Temp	This menu item controls the temperature display: 0 = On, 1 = Off.
233-RS485 Parity	This menu item is used with Modbus communications. ***Refer to the EPI Modbus Manual***
236-Restore Fact	This menu item restores the factory settings.
299-Cust PSWD	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.***
	(blank)
100 *Units*	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*
800 *Curve Fit*	Go to 800 *Curve Fit* Menu

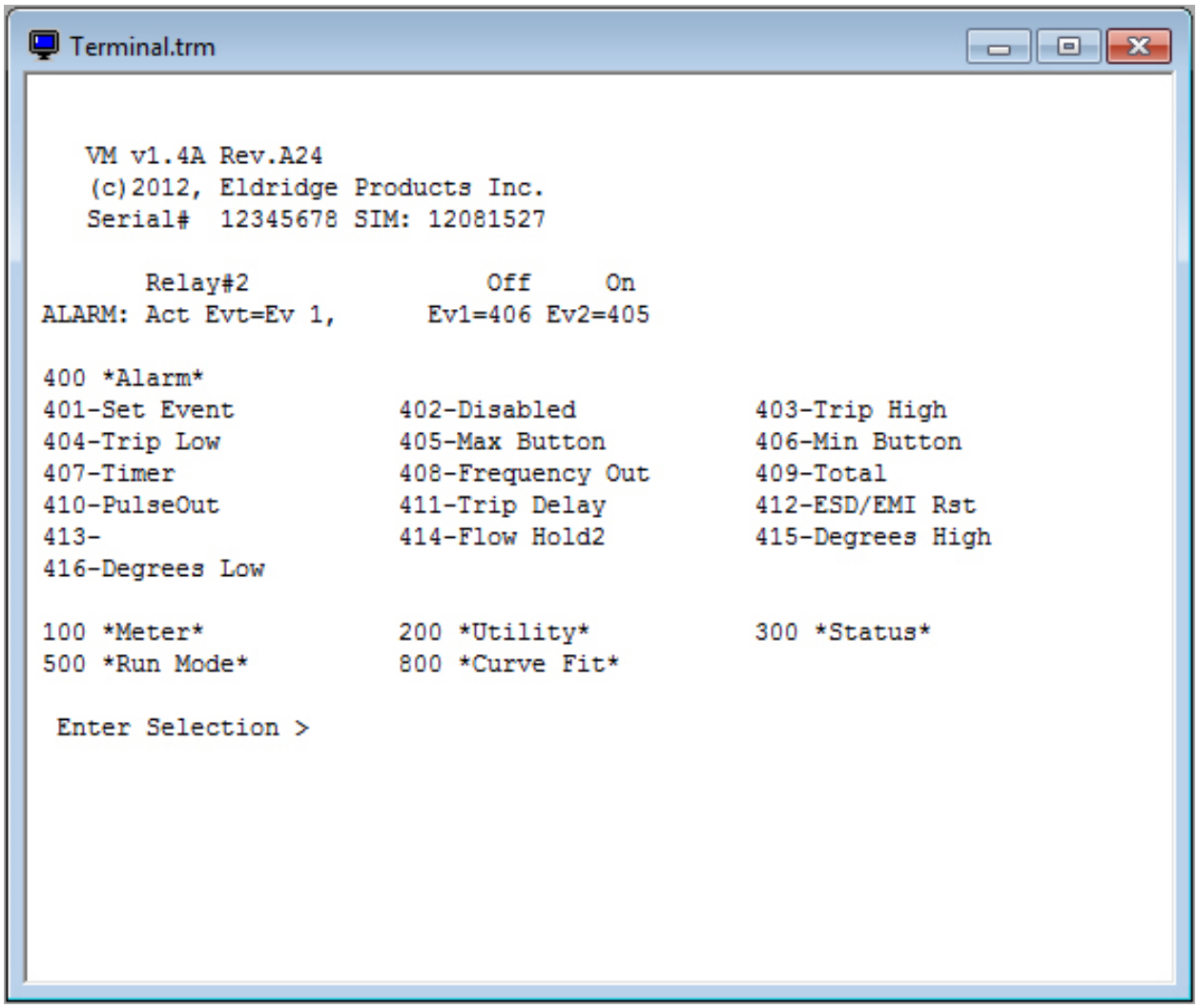
Although most settings are accessible by using the default user password of "9001", some of the parameters require a special password available only by contacting the factory. This has been instituted to prevent the accidental change of critical settings.

300 *Status* Menu Screen



The 300 *Status* menus are not available on the ValuMass™ 400 Series flowmeters.

400 *Alarm* Menu Screen



The **STATUS** line indicates the following:

- current active meter range (see *200 *Utility* section*);
- tracking status (see *200 *Utility* section*);
- curve fit mode (see *200 *Utility* section*);
- currently selected engineering units (see *100 *Meter* section*).

The **ALARMS** line displays the current status of the alarms events:

- Current Active Event — (Ev1–Ev2) displays the current active relay Event
- Relay#2 Off/Ev1 — indicates selected response condition for Ev1

The ValuMass™ product line does not include "Relay #1" as supported by the Master-Touch™ product line.

Alarm Relay Overview

ValuMass™ flowmeters have one 1-amp SPDT relays that provide two relay Events (Ev1–Ev2):

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

The ValuMass™ product line does not include "Relay 1" as supported by the Master-Touch™ product line.

These events can be used to activate other devices in response to user-defined flow conditions, or to provide a pulsed output based on an elapsed flow total. There are thirteen user-selectable conditions which will trigger an alarm relay response from a Master-Touch flowmeter. These 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;
- **Frequency 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;
- **ESD/EMI Rst** — an alarm relay is triggered by electromagnetic impulse noise.
- **Flow Hold 2** — the ADC input voltage is maintained at constant value, typically during gas purge cycle
- **Temp High** — an alarm relay is triggered by a process gas temperature that is higher than the preset value;
- **Temp Low** — an alarm relay is triggered by a process gas temperature that is lower than the preset value;

In addition, the alarm relay can be **Disabled** so it does 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 relay.

Alarm Programming

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

The alarm relay only operates 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–Ev2) in menu item **401–Set Event**. After selecting an Event, a condition is assigned (Timer, Max, Pulse Out, etc.). With the exception of setting the **Disable**, 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 is an example of the steps required for a typical use of the Master-Touch alarm relays:

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 **1** at the prompt (1 = Ev 1, 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 **2** at the prompt (2 = Ev 2, 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.

EPIMeter supports Alarm programming through a series of pull-down menus which provide the simplest means of setting up complex Alarm parameters.

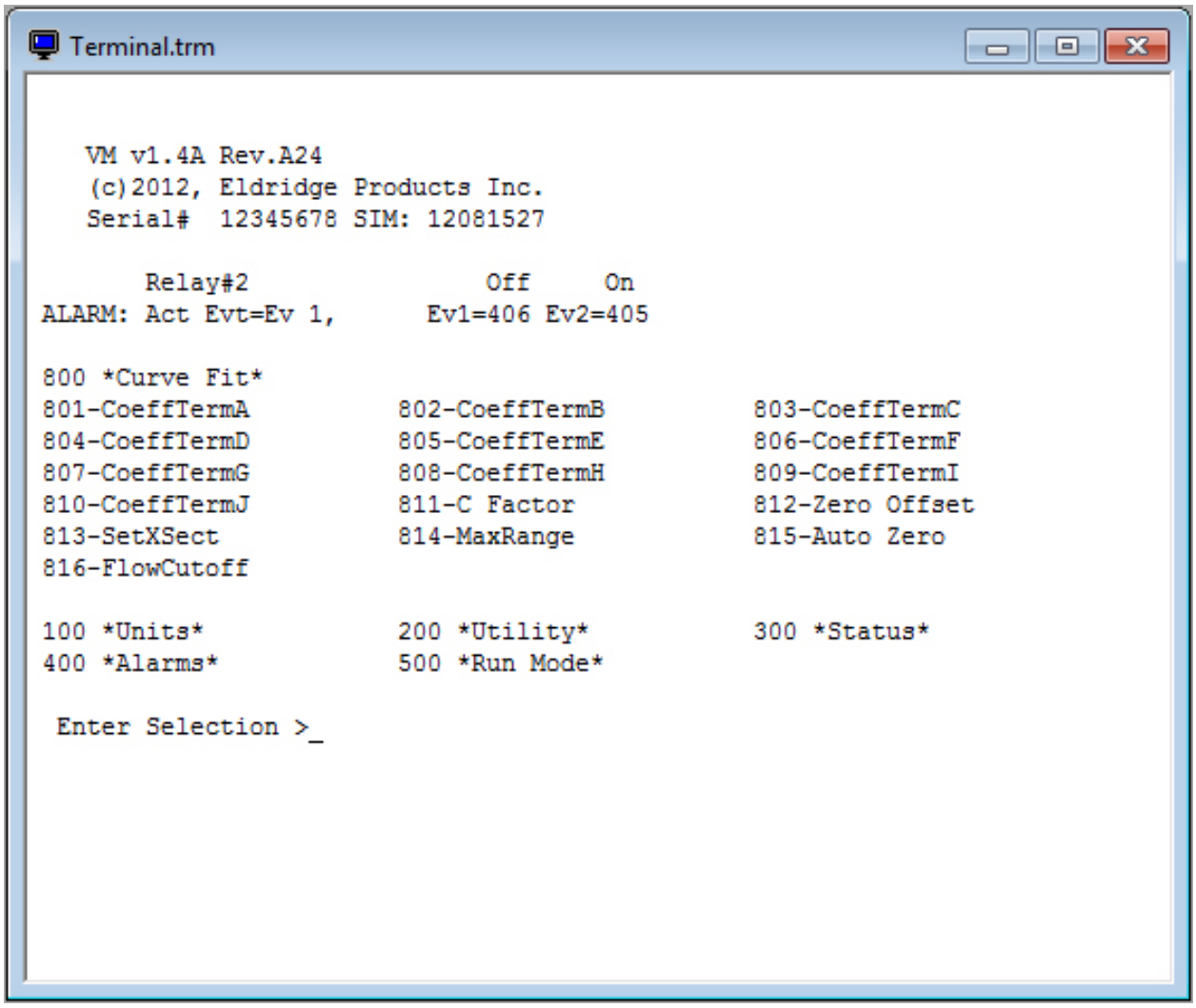
400 *Alarm* Submenus

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 pre-set value.
404-Trip Low	This menu item sets the current active Event to respond to a flow rate that is lower than the pre-set value.
405-	This menu item is unused.
406-	This menu item is unused.
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-Frequency Out	This menu item sets the current active Event to respond proportionally to the current flow rate. The Event is activated at a rate of 1 pulse per second when the flow rate is equal to the value in menu item 140–FScale.
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-	This menu item is unused.
414-Flow Hold2	This menu item holds the ADC input value while Relay 2 Event 4 is on. When the value is set to one (1), it will hold the ADC input at its current value. A value of zero (0) will disable this feature.
415-Degrees High	This menu item sets the current active Event to respond to a gas temperature that is higher than the pre-set value.
416-Degrees Low	This menu item sets the current active Event to respond to a gas temperature that is lower than the pre-set value.
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*
800 *P-Curve Fit*	Go to 800 *P-Curve Fit* Menu

800 *Curve Fit* Menu Screen

The ValuMass™ Series 400 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.

800 *Curve Fit* Submenus

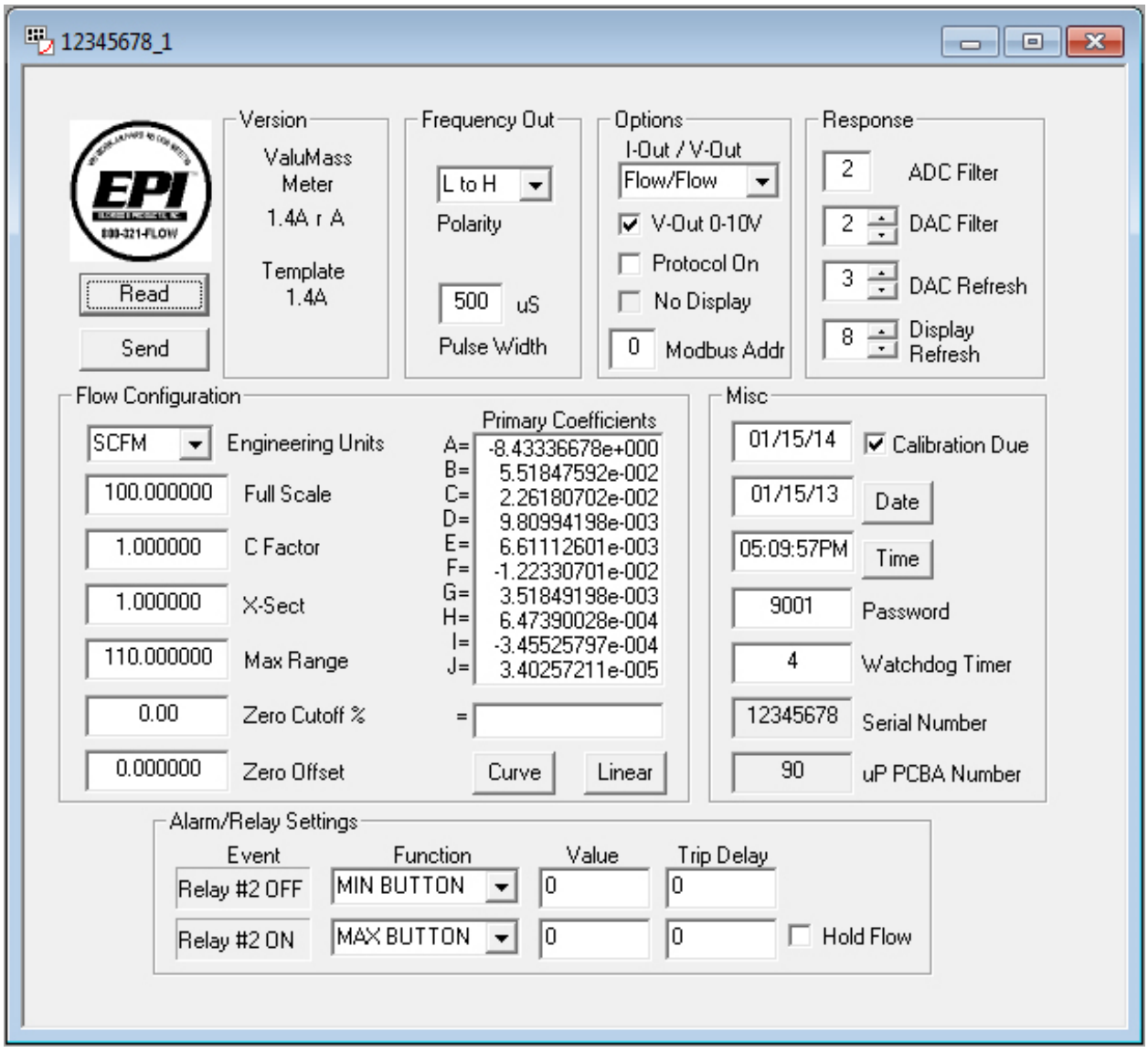
801-CoeffTermA *through* **810-CoeffTermJ**	Factory Calibration Coefficients. ***Requires Diagnostic Password for access. Consult factory.***
811-C Factor	This value is a multiplier used to adjust the Curve linearization. It is normally set to 1.0, but may be adjusted based the *Installation Guidelines*, 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 Full Scale value (*menu item 140–FScale*) as the minimum readable flow rate. Actual flow rates below this minimum value will be treated as No Flow. The display will show "Low" instead of the real-time flow rate, no additional elapsed flow will be recorded, the 0–5VDC signal will drop to 0VDC, and the 4–20mA signal will drop to 4mA. For example, if the full scale is 1000 SCFM, a value of 10 (10%) will cause the flowmeter to ignore flow rates below 100 SCFM. 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*

The ValuMass™ Series 400 Module

The ValuMass™ Series 400 Module presents most of the flowmeter's stored settings in one convenient screen display. You can access the module by clicking on the 

icon.

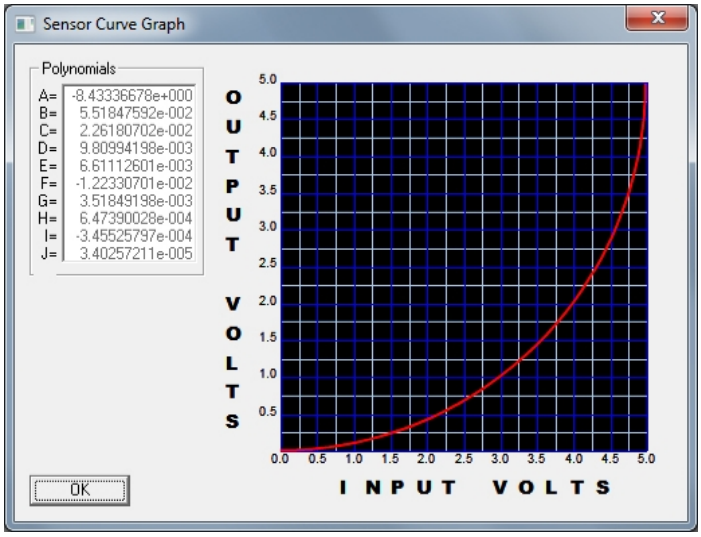
The screen shown below will appear, though it will not have data for your flowmeter at first. To populate the data fields with the settings from your flowmeter, click the "Read" button. You may also open stored files for review through the "File" menu by selecting "Open" and locating the appropriate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



The 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.

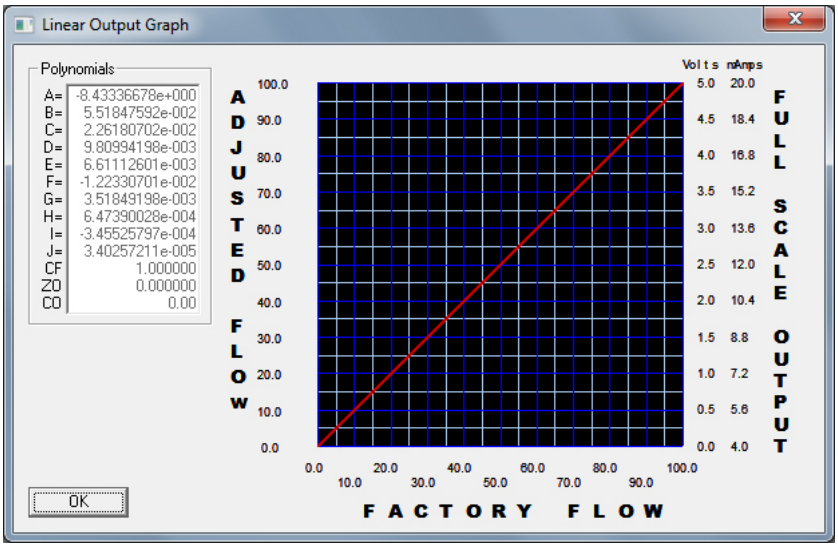
The Primary Coefficients and Max Range values must not be changed in any way unless directed to do so authorized Factory technicians. Also, ALL of the flowmeter's settings will be overwritten by the values in the Module screen so you must be certain that you have confirmed the values before sending them 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 D 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 E 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	225 PSIG (Stainless Steel ferrule) 25 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
Relay Output Rating	1 Amp @ 30VDC (33W)
Communications Port	RS-232C
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. 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.

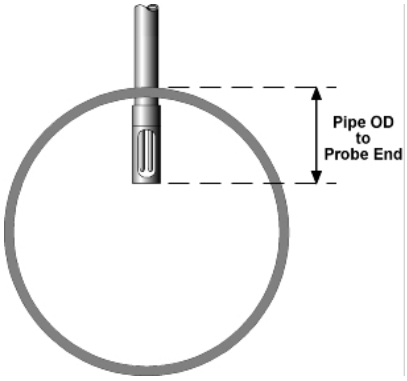
The terms of any offer are expressly limited to the terms detailed in any product brochure or price quote. Any modification to any of the terms of this offer must be in writing and must be signed by an officer of EPI.

Section F Guidelines and Product Drawings

Probe Insertion Guidelines

Most insertion style ValuMass™ Series 400 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™ Series 400 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.

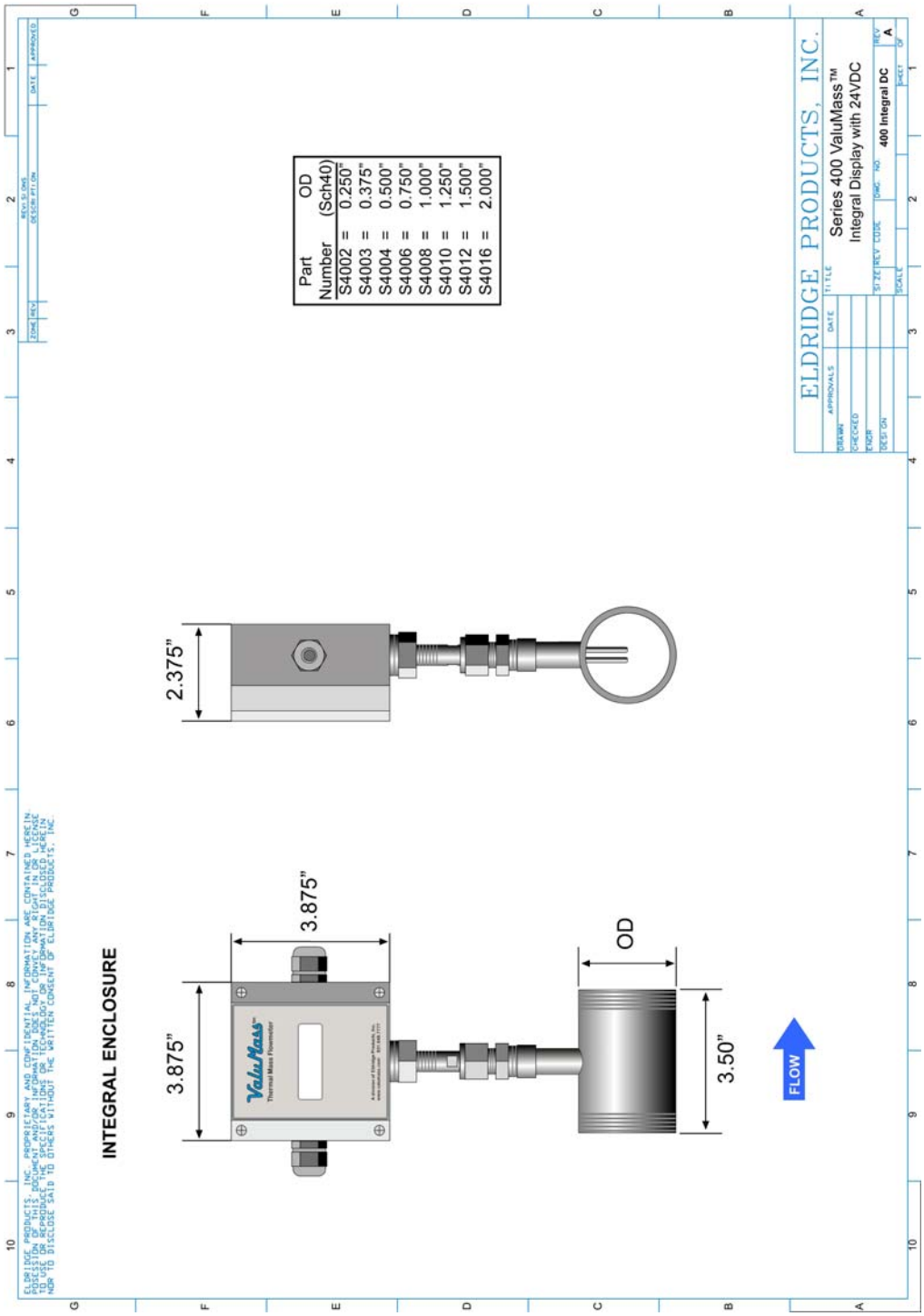


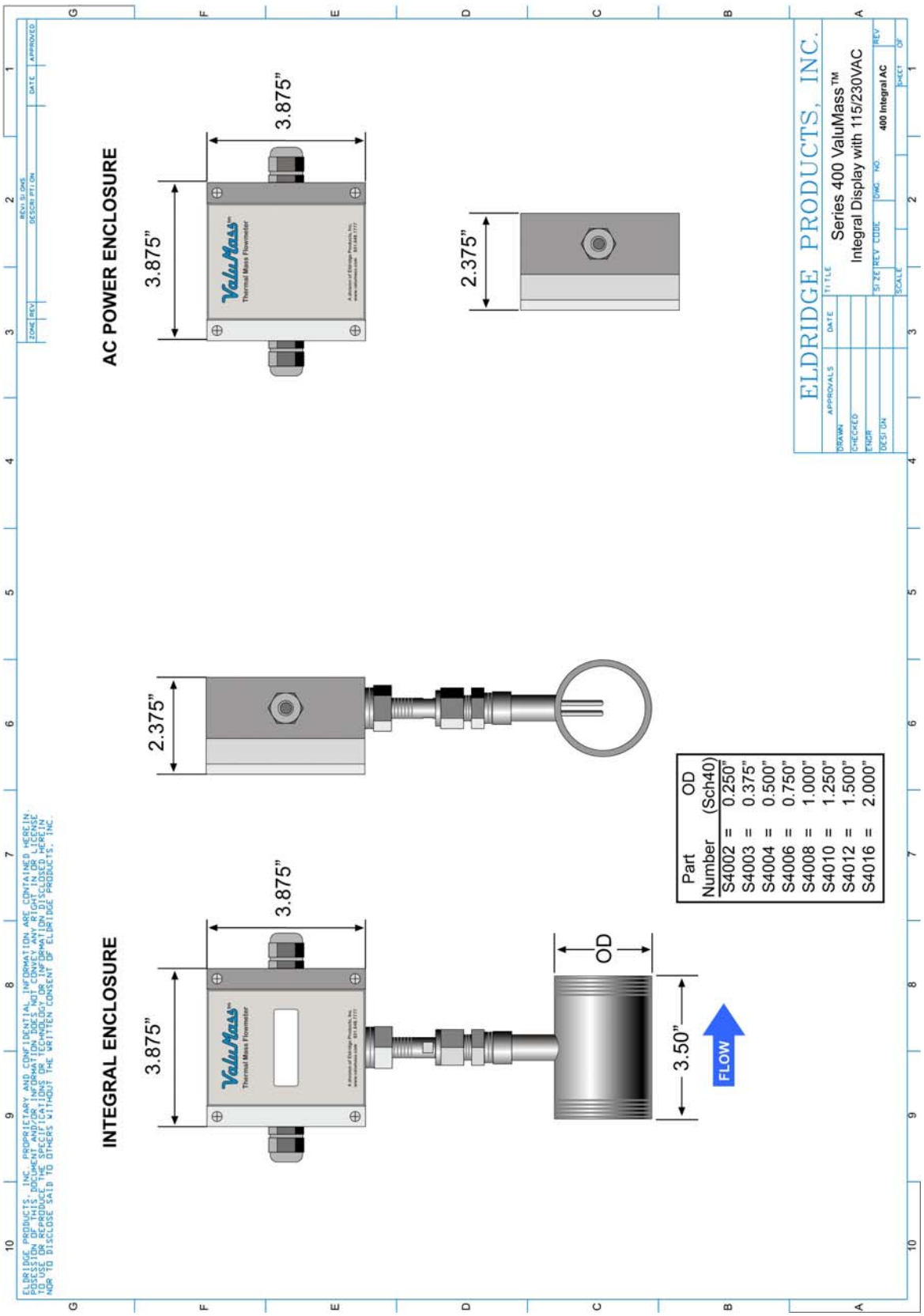
The calculation for the probe insertion depth (pipe OD to probe end) includes the point-of-average-flow, the slot in the protective sensor window, and the wall thickness of each nominal pipe size, as well as a further adjustment on smaller line sizes to be sure that the slot is fully inserted through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

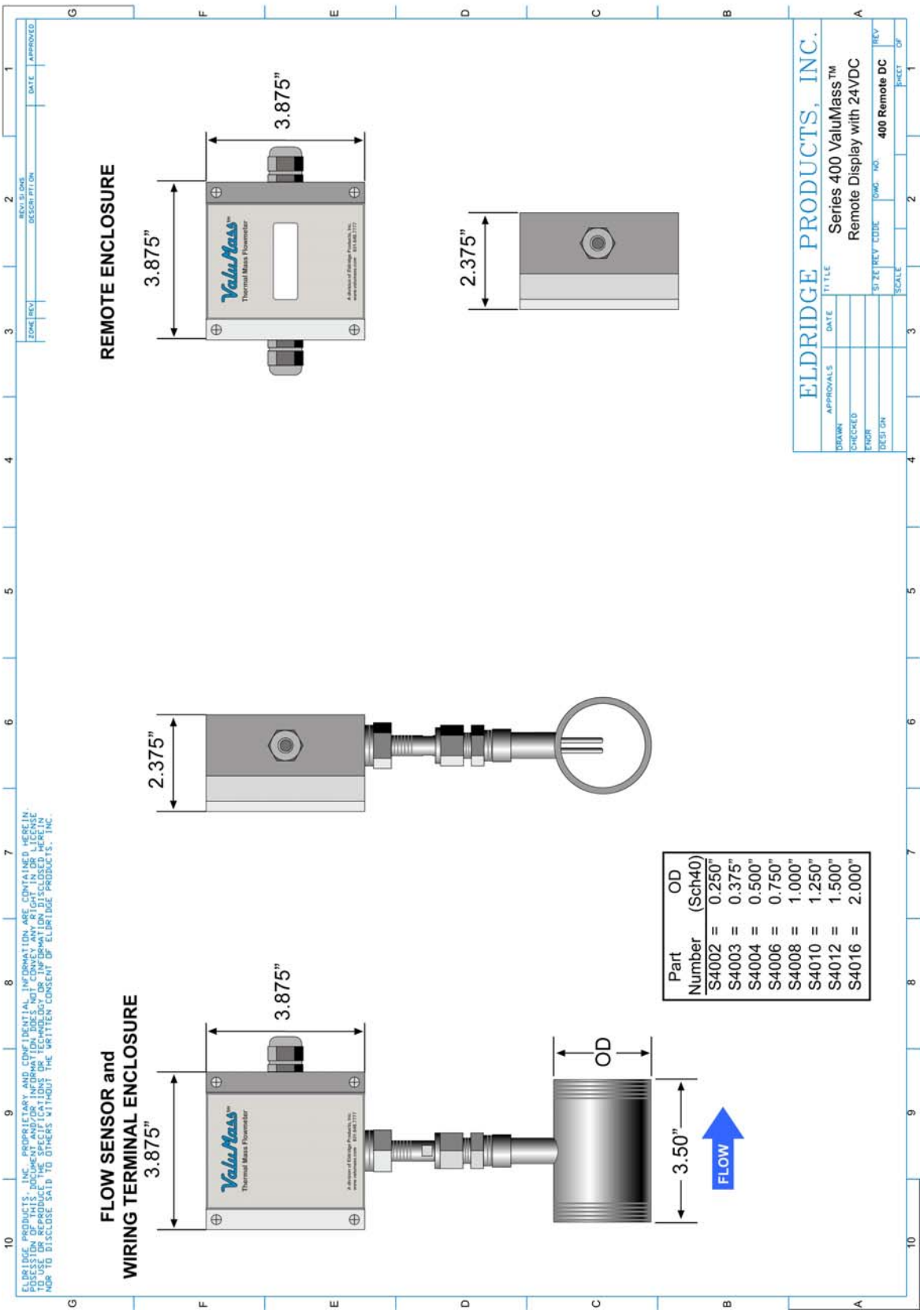
The information below assumes a well-developed flow profile in the process line. The actual flow profile may not conform to this standardized profile. Therefore, a further adjustment to the position or C-Factor may be required to improve the overall accuracy of the flowmeter readings. If an additional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

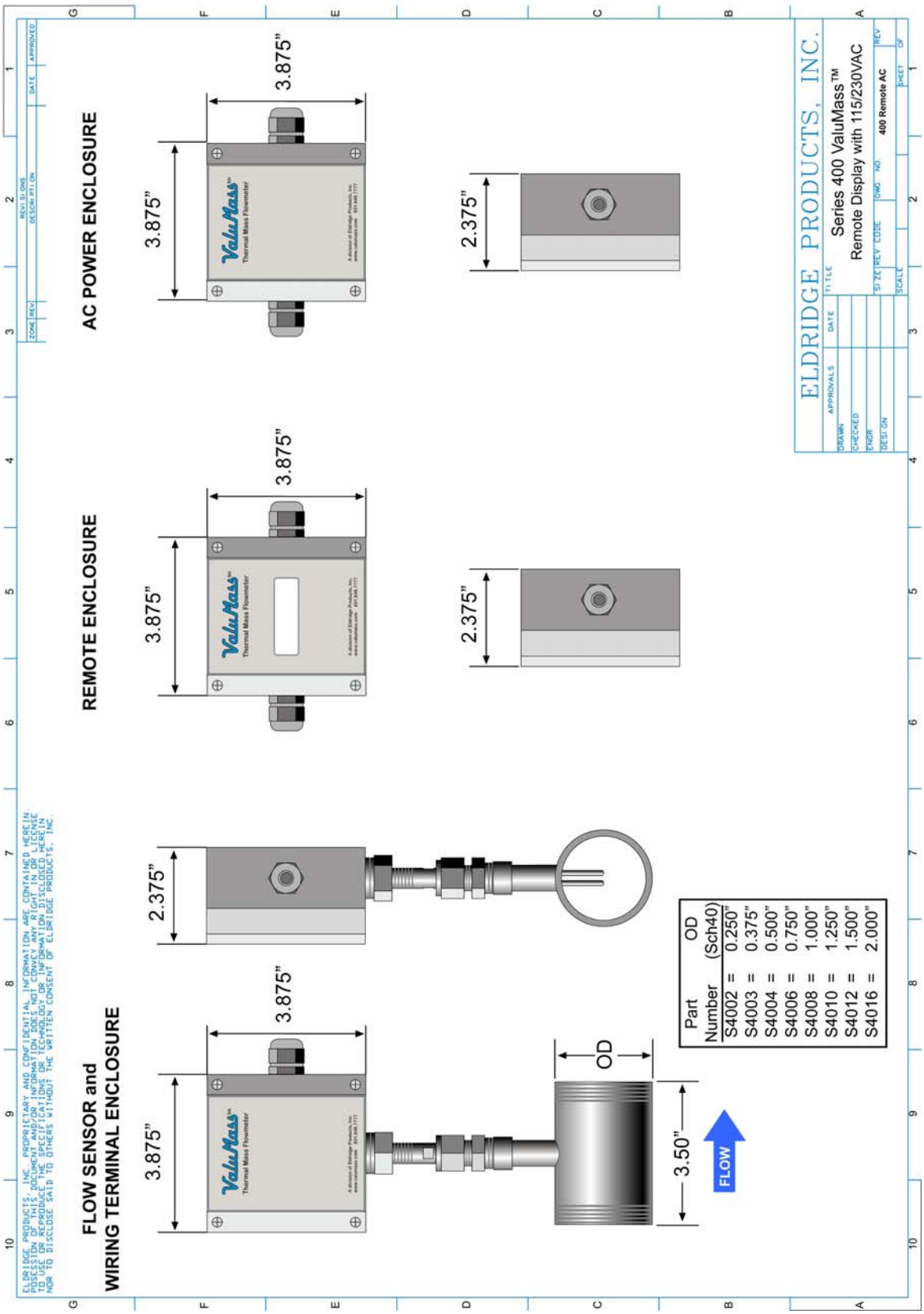
Sch 40 Nominal Pipe Size	Inside Diameter (inches)	Wall Thickness (inches)	Cross-sectional Area (ft^2)	Pipe OD to Probe End (inches)	Menu 811 – C-Factor
2"	2.067	0.154	0.0233	**1.3**	0.750
2.5"	2.469	0.203	0.0332	**1.3**	0.750
3"	3.068	0.216	0.0513	**1.3**	0.750
4"	4.026	0.237	0.0884	**1.7**	0.750
6"	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

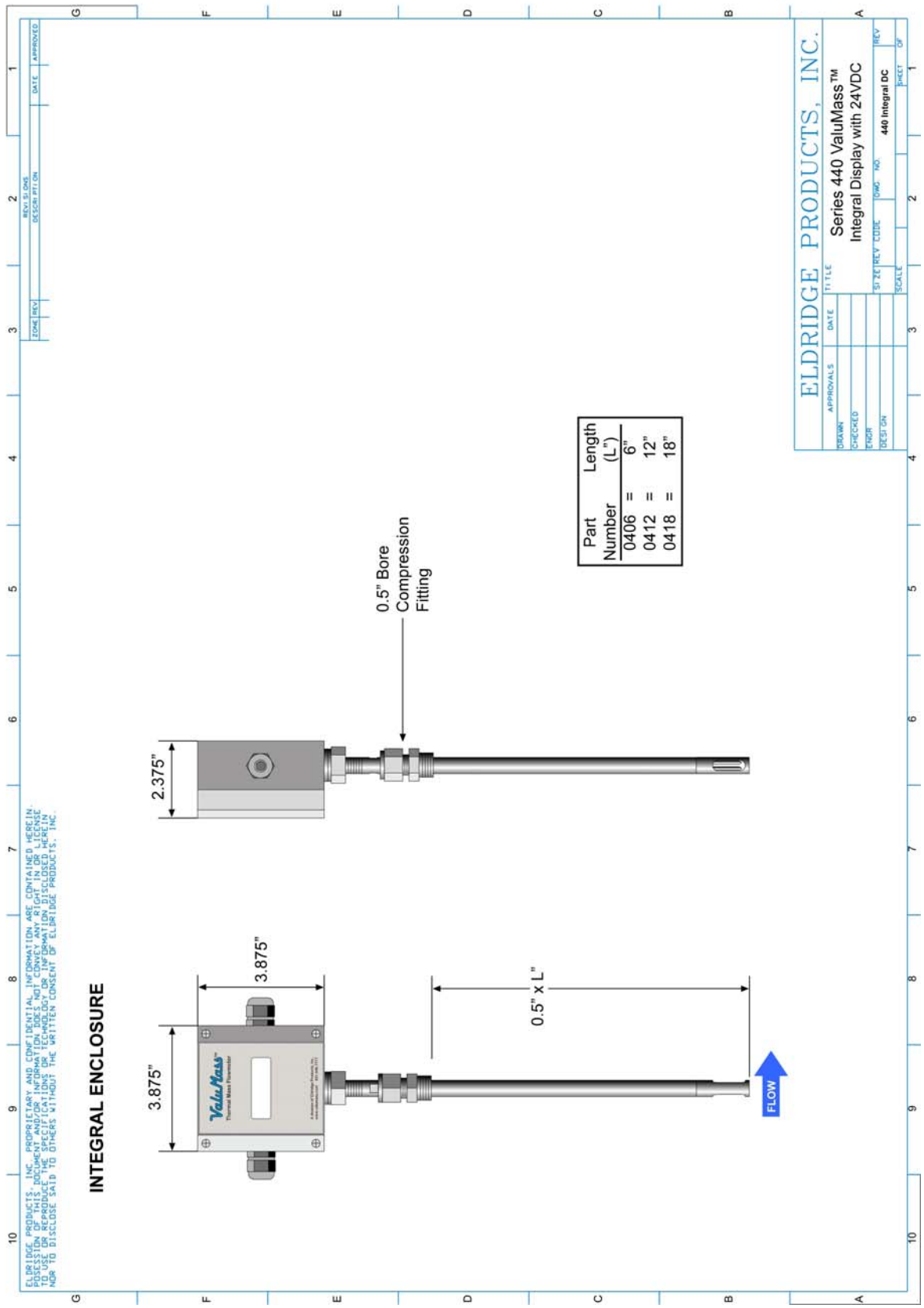
Engineering Drawings

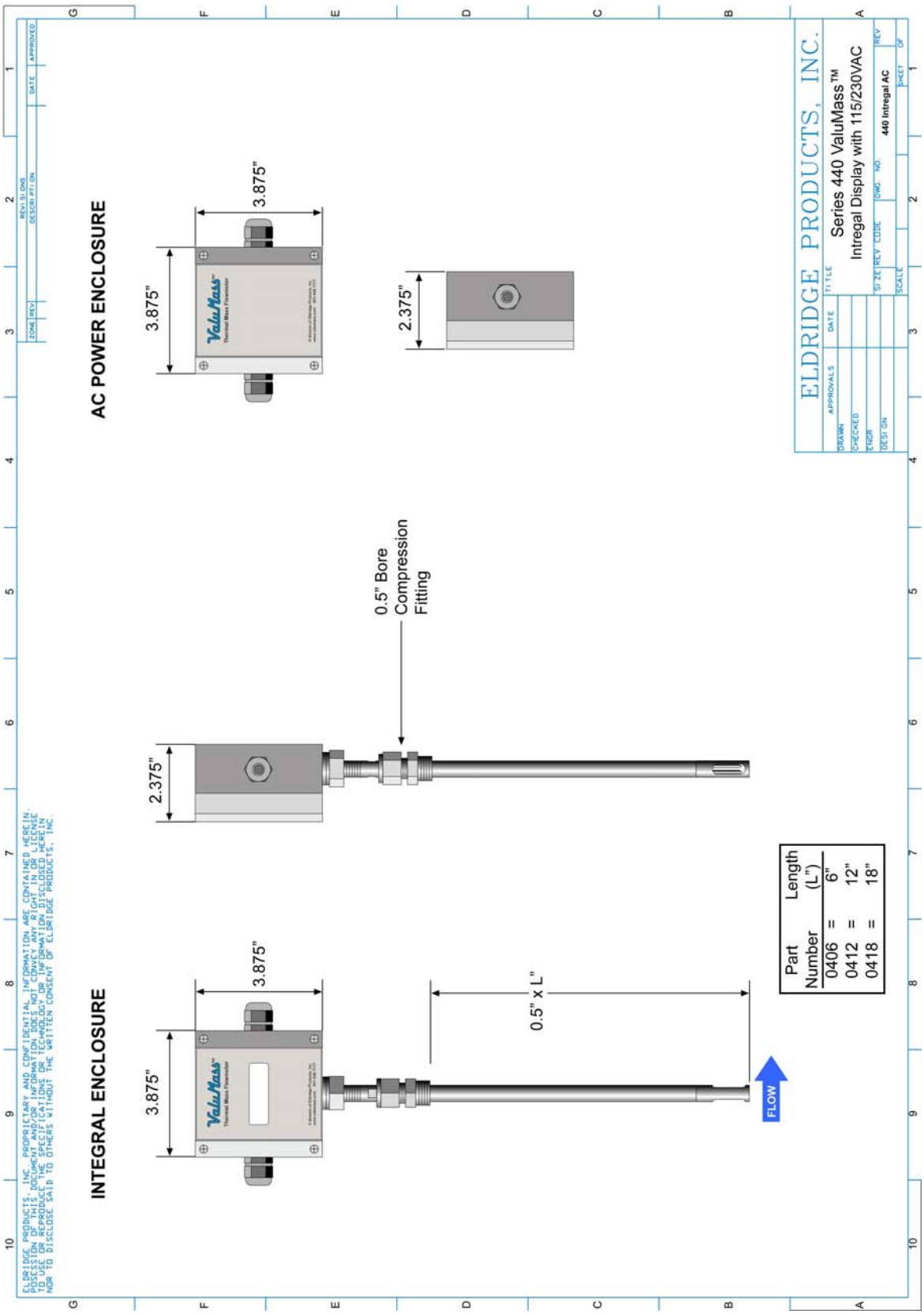


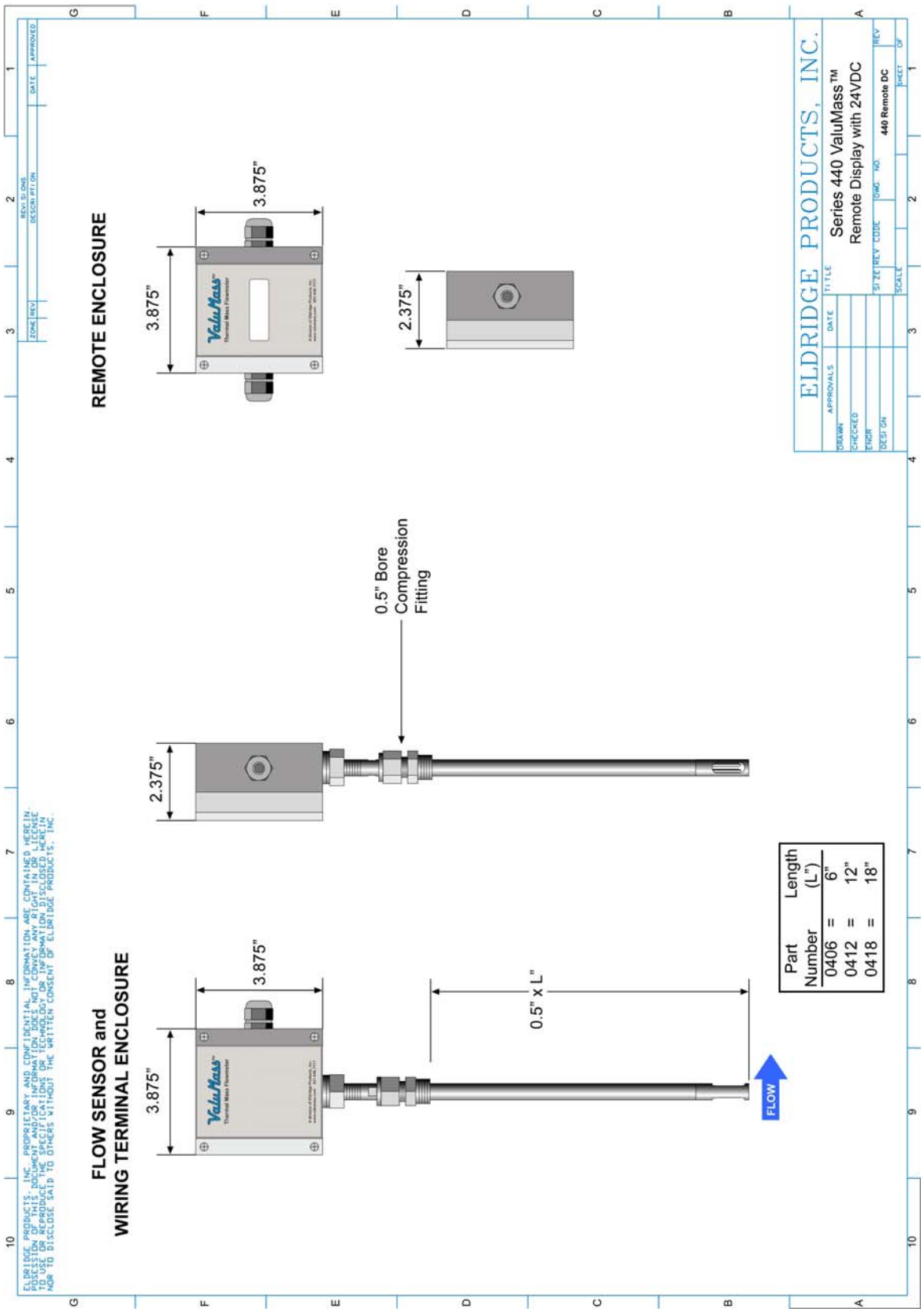

AC POWER ENCLOSURE
3.875"
3.875"
2.375"
INTEGRAL ENCLOSURE
2.375"
3.875"
3.875"
OD
3.50"
FLOW
Part Number
OD (Sch40)
S4002 = 0.250"
S4003 = 0.375"
S4004 = 0.500"
S4006 = 0.750"
S4008 = 1.000"
S4010 = 1.250"
S4012 = 1.500"
S4016 = 2.000"
ELDRIDGE PRODUCTS, INC.
Series 400 ValuMass™
Integral Display with 115/230VAC
400 Integral AC

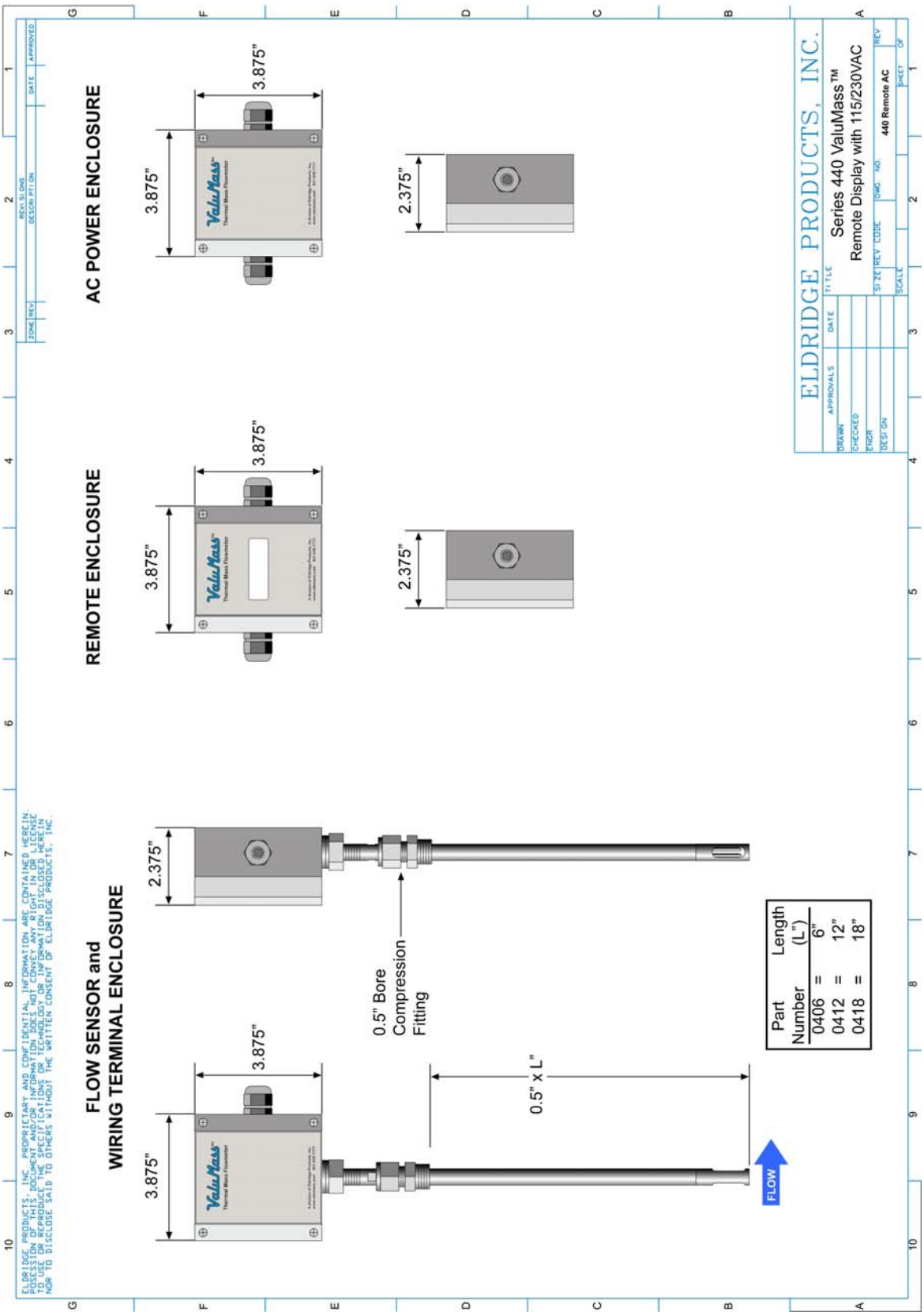

REMOTE ENCLOSURE
3.875"
3.875"
2.375"
FLOW SENSOR and
WIRING TERMINAL ENCLOSURE
3.875"
2.375"
3.875"
OD
3.50"
FLOW
Part Number
OD (Sch40)
S4002 = 0.250"
S4003 = 0.375"
S4004 = 0.500"
S4006 = 0.750"
S4008 = 1.000"
S4010 = 1.250"
S4012 = 1.500"
S4016 = 2.000"
ELDRIDGE PRODUCTS, INC.
Series 400 ValuMass™
Remote Display with 24VDC
400 Remote DC

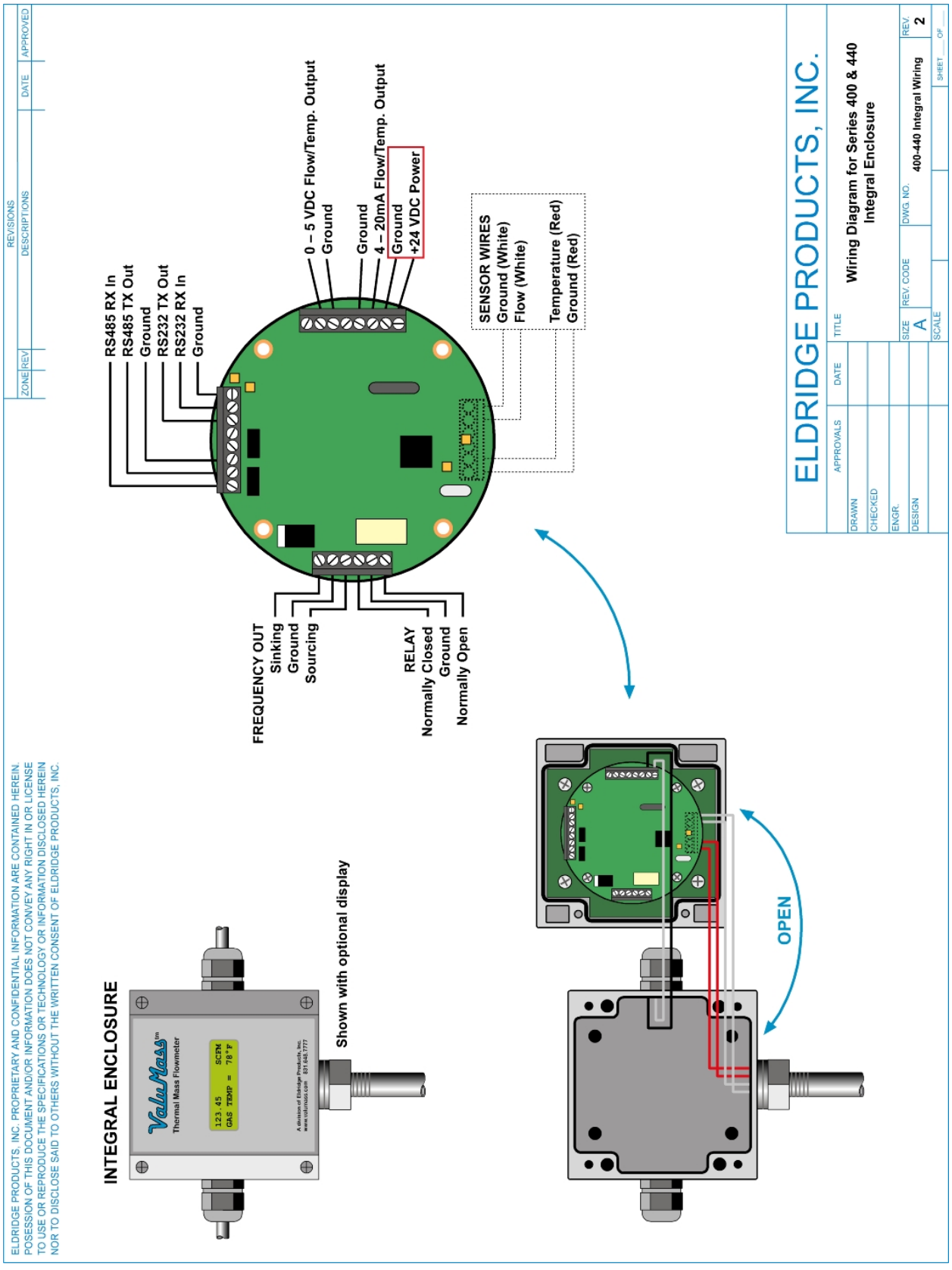

AC POWER ENCLOSURE
REMOTE ENCLOSURE
FLOW SENSOR and
WIRING TERMINAL ENCLOSURE
3.875"
2.375"
3.50"
OD
FLOW
Part Number
OD (Sch40)
S4002 = 0.250"
S4003 = 0.375"
S4004 = 0.500"
S4006 = 0.750"
S4008 = 1.000"
S4010 = 1.250"
S4012 = 1.500"
S4016 = 2.000"
ELDRIDGE PRODUCTS, INC.
Series 400 ValuMass™
Remote Display with 115/230VAC
400 Remote AC


ELDRIDGE PRODUCTS, INC.
Series 440 ValuMass™
Integral Display with 24VDC
440 Integral DC
INTEGRAL ENCLOSURE
0.5" Bore
Compression
Fitting
Part Number = Length (L")
0406 = 6"
0412 = 12"
0418 = 18"
2.375"
3.875"
3.875"
0.5" x L"
FLOW


AC POWER ENCLOSURE
3.875"
3.875"
2.375"
INTEGRAL ENCLOSURE
0.5" Bore
Compression
Fitting
2.375"
3.875"
3.875"
0.5" x L"
FLOW
Part Number
Length (L")
0406 = 6"
0412 = 12"
0418 = 18"
ELDRIDGE PRODUCTS, INC.
Series 440 ValuMass™
Intregal Display with 115/230VAC
440 Intregal AC


REMOTE ENCLOSURE
3.875"
3.875"
2.375"
FLOW SENSOR and
WIRING TERMINAL ENCLOSURE
0.5" Bore
Compression
Fitting
2.375"
3.875"
3.875"
0.5" x L"
FLOW
Part Number
Length (L")
0406 = 6"
0412 = 12"
0418 = 18"
ELDRIDGE PRODUCTS, INC.
Series 440 ValuMass™
Remote Display with 24VDC
440 Remote DC


AC POWER ENCLOSURE
REMOTE ENCLOSURE
FLOW SENSOR and
WIRING TERMINAL ENCLOSURE
3.875"
2.375"
0.5" Bore
Compression
Fitting
0.5" x L"
FLOW
Part Number
Length (L")
0406 = 6"
0412 = 12"
0418 = 18"
ELDRIDGE PRODUCTS, INC.
Series 440 ValuMass™
Remote Display with 115/230VAC
440 Remote AC


RS485 RX In
RS485 TX Out
Ground
RS232 TX Out
RS232 RX In
Ground
0 – 5 VDC Flow/Temp. Output
Ground
Ground
4 – 20mA Flow/Temp. Output
Ground
+24 VDC Power
SENSOR WIRES
Ground (White)
Flow (White)
Temperature (Red)
Ground (Red)
FREQUENCY OUT
Sinking
Ground
Sourcing
RELAY
Normally Closed
Ground
Normally Open
INTEGRAL ENCLOSURE
Shown with optional display
OPEN
ELDRIDGE PRODUCTS, INC.
Wiring Diagram for Series 400 & 440
Integral Enclosure
400-440 Integral Wiring
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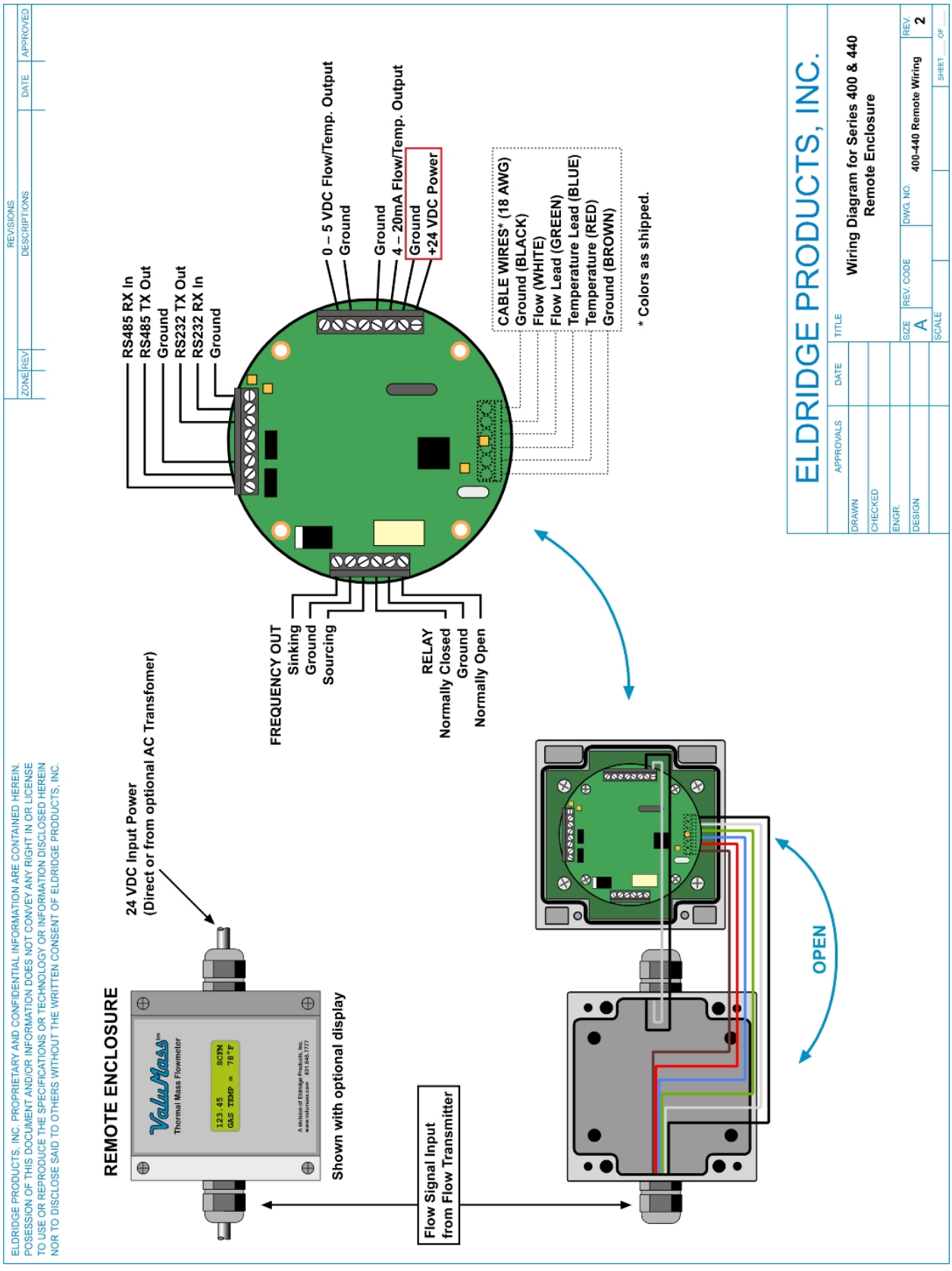
ELDRIDGE PRODUCTS, INC.
Wiring Diagram for Series 400 & 440
Remote Enclosure
400-440 Remote Wiring
REMOTE ENCLOSURE
24 VDC Input Power
(Direct or from optional AC Transfomer)
Shown with optional display
Flow Signal Input
from Flow Transmitter
RS485 RX In
RS485 TX Out
Ground
RS232 TX Out
RS232 RX In
Ground
0 – 5 VDC Flow/Temp. Output
Ground
Ground
4 – 20mA Flow/Temp. Output
Ground
+24 VDC Power
CABLE WIRES* (18 AWG)
Ground (BLACK)
Flow (WHITE)
Flow Lead (GREEN)
Temperature Lead (BLUE)
Temperature (RED)
Ground (BROWN)
* Colors as shipped.
FREQUENCY OUT
Sinking
Ground
Sourcing
RELAY
Normally Closed
Ground
Normally Open
OPEN
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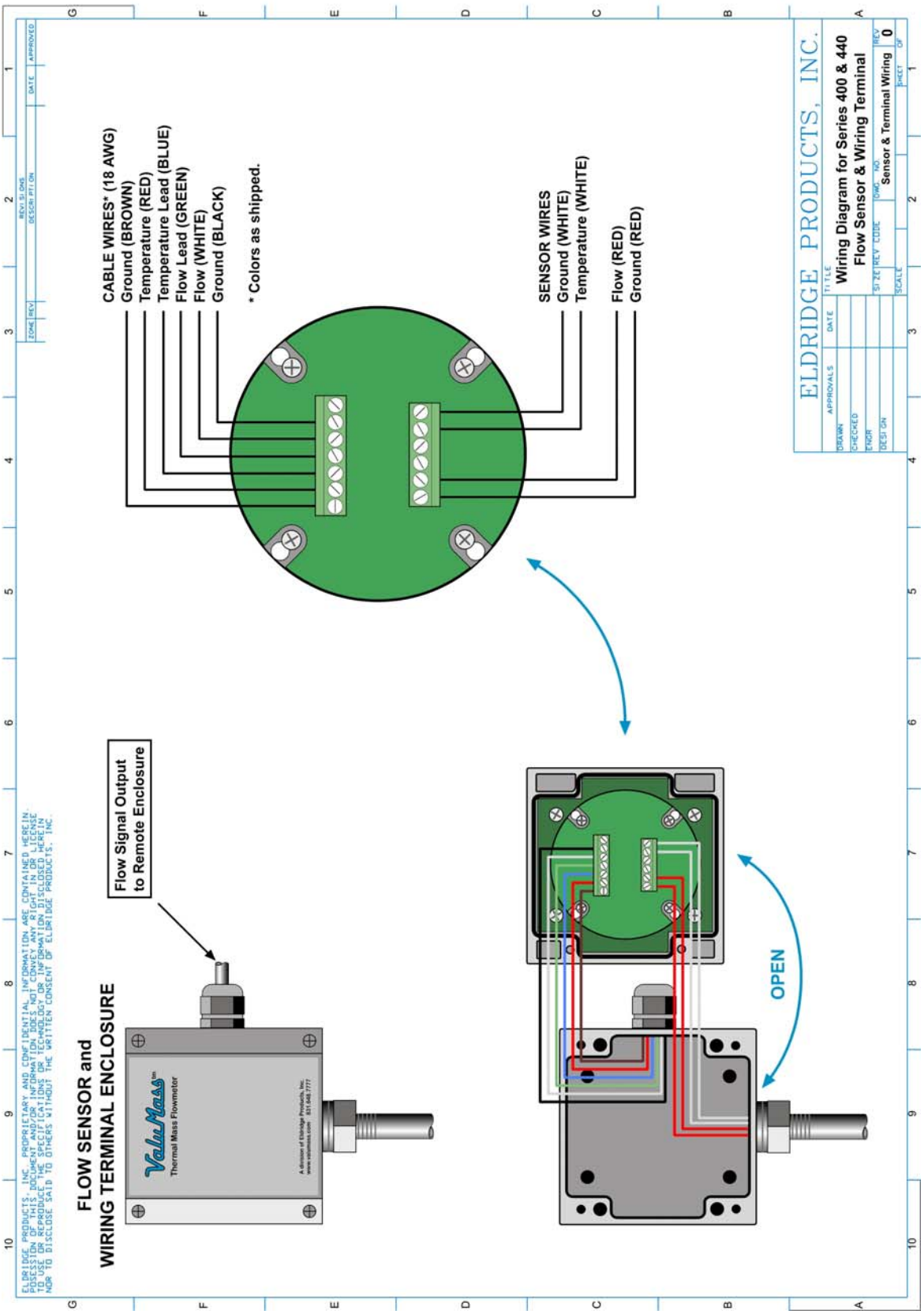
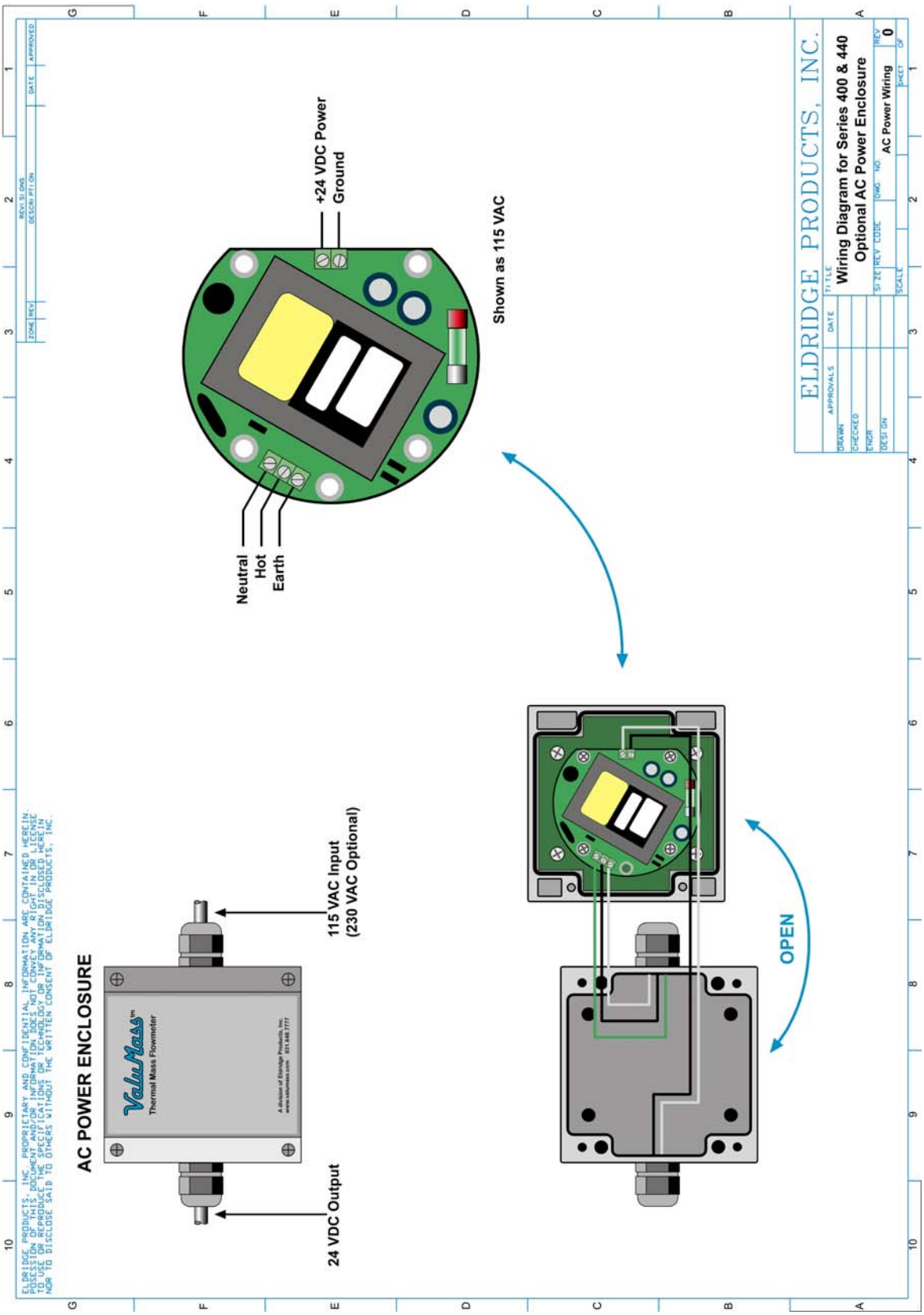
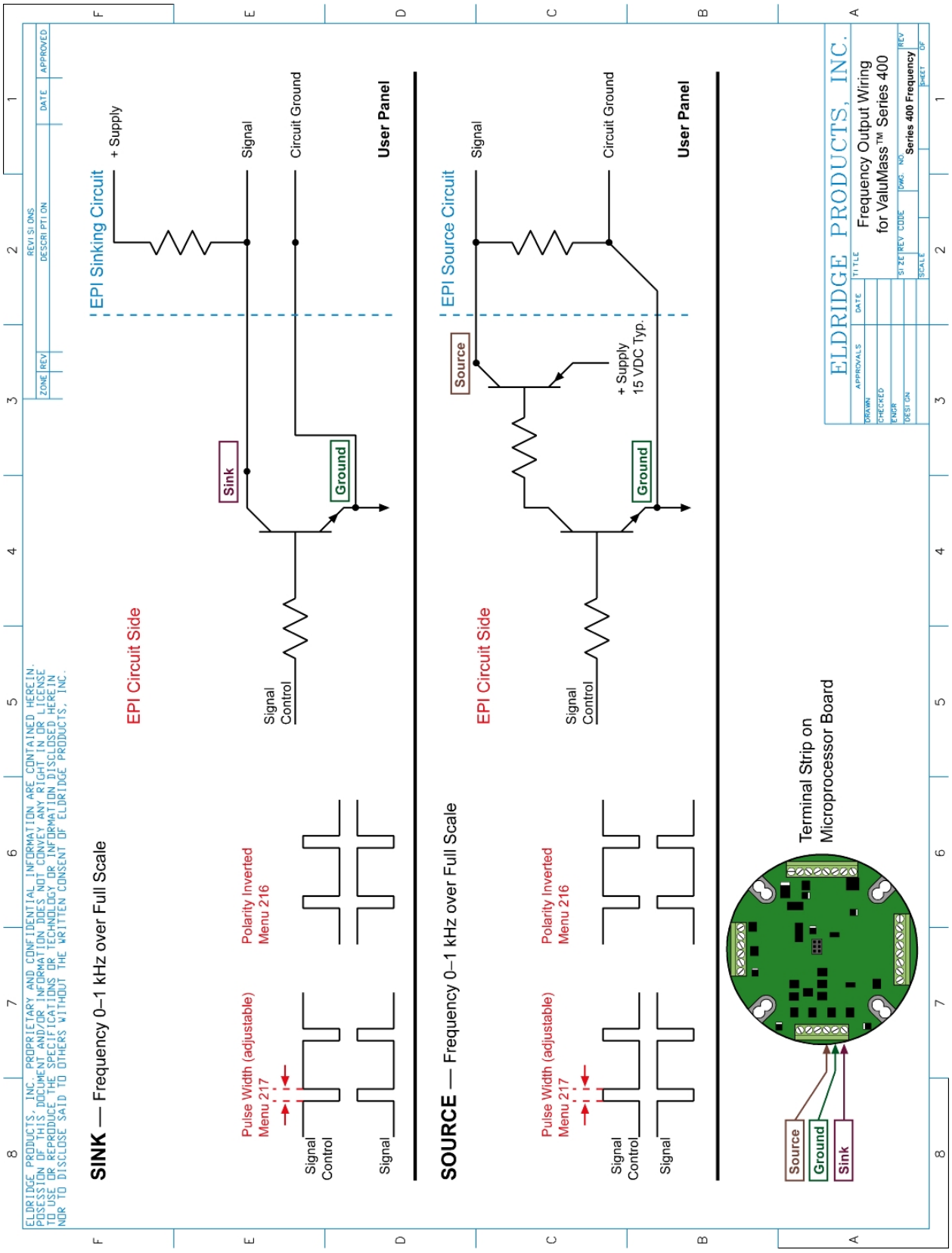

CABLE WIRES* (18 AWG)
Ground (BROWN)
Temperature (RED)
Temperature Lead (BLUE)
Flow Lead (GREEN)
Flow (WHITE)
Ground (BLACK)
* Colors as shipped.
SENSOR WIRES
Ground (WHITE)
Temperature (WHITE)
Flow (RED)
Ground (RED)
ELDRIDGE PRODUCTS, INC.
Wiring Diagram for Series 400 & 440
Flow Sensor & Wiring Terminal
Sensor & Terminal Wiring
0
Flow Signal Output
to Remote Enclosure
FLOW SENSOR and
WIRING TERMINAL ENCLOSURE
ValuMass
Thermal Mass Flowmeter
OPEN


ELDRIDGE PRODUCTS, INC.
Wiring Diagram for Series 400 & 440
Optional AC Power Enclosure
AC Power Wiring
+24 VDC Power
Ground
Shown as 115 VAC
Neutral
Hot
Earth
AC POWER ENCLOSURE
115 VAC Input
(230 VAC Optional)
24 VDC Output
OPEN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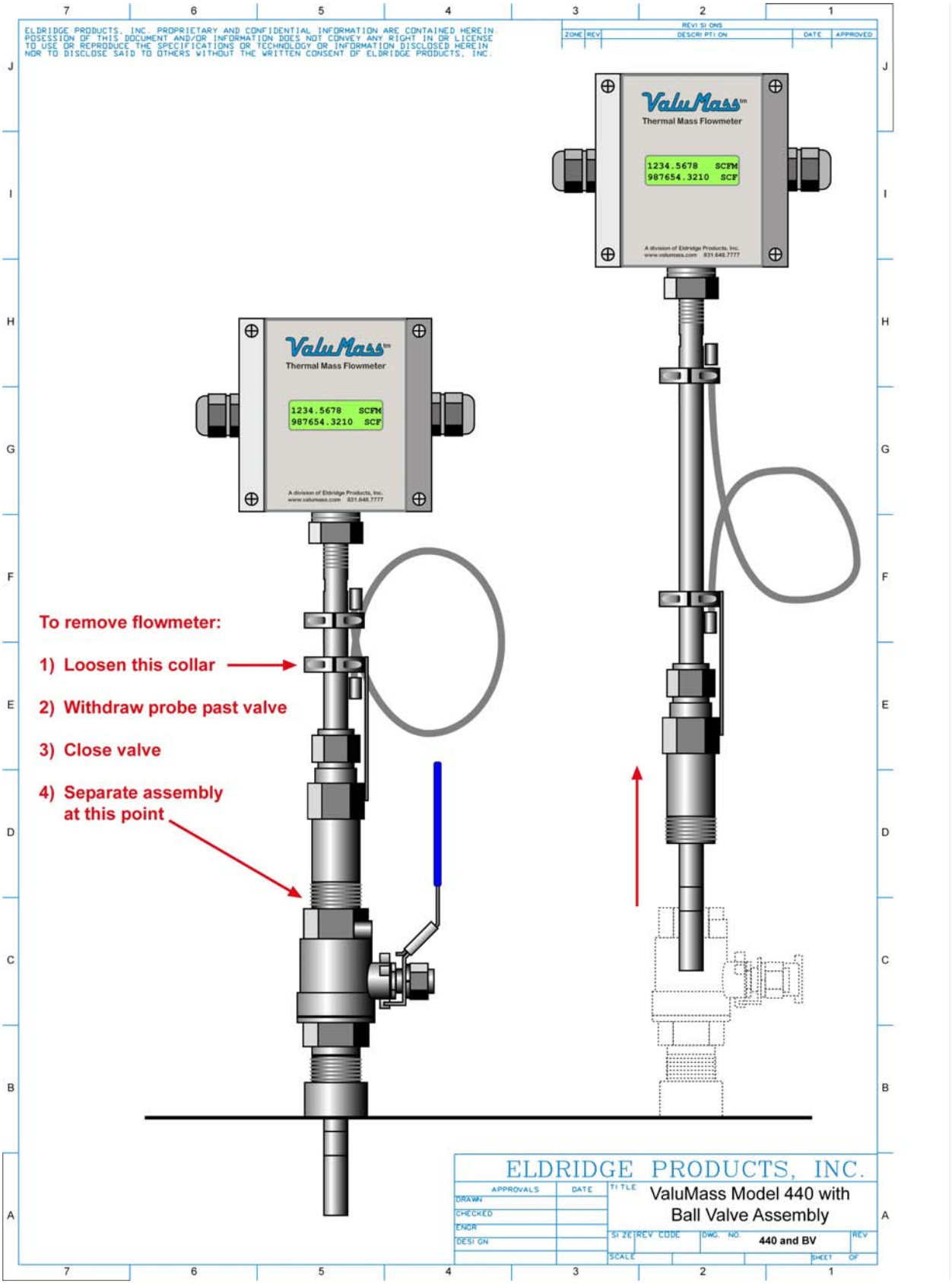
ZONE REV
REVISIONS
DESCRIPTION
DATE
APPROVED
SINK — Frequency 0–1 kHz over Full Scale
EPI Sinking Circuit
+ Supply
Signal
Circuit Ground
User Panel
EPI Circuit Side
Sink
Ground
Signal
Control
Pulse Width (adjustable)
Menu 217
Polarity Inverted
Menu 216
Signal
Signal
Control
SOURCE — Frequency 0–1 kHz over Full Scale
EPI Source Circuit
Signal
Circuit Ground
User Panel
EPI Circuit Side
Source
+ Supply
15 VDC Typ.
Ground
Signal
Control
Pulse Width (adjustable)
Menu 217
Polarity Inverted
Menu 216
Signal
Control
Signal
Terminal Strip on
Microprocessor Board
Source
Ground
Sink
ELDRIDGE PRODUCTS, INC.
APPROVALS
DATE
DRAWN
CHECKED
ENGR
DESIGN
TITLE
Frequency Output Wiring
for ValuMass™ Series 400
SIZE
REV
CODE
DWG. NO
Series 400 Frequency
REV
SCALE
SHEET
OF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REVISIONS
ZONE REV DESCRIPTION DATE APPROVED
ValuMass
Thermal Mass Flowmeter
1234.5678 SCFM
987654.3210 SCF
To remove flowmeter:
1) Loosen this collar
2) Withdraw probe past valve
3) Close valve
4) Separate assembly at this point
ELDRIDGE PRODUCTS, INC.
APPROVALS DATE
DRAWN
CHECKED
ENGR
DESIGN
TITLE
ValuMass Model 440 with Ball Valve Assembly
SIZE REV CODE DWG. NO. 440 and BV REV
SCALE SHEET OF

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

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

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):