

M-302
Rev. A
Pulsmate Electronic Register



Operating and Maintenance Manual For the Pulsmate Electronic Register



Table of Contents

Description.....	1
Specifications.....	1
Installation.....	3
Dimensions.....	4
Theory of Operation.....	5
Wiring.....	5
Removing the Pulsmate from the meter.....	6
Programming Flowchart.....	7
Definitions.....	9
Operation.....	12
Magnetic Reset.....	12
Maintenance.....	13
Error Messages.....	14
Analog Output Calibration.....	14
PULSMATE Rate Alarm Total Model	
Description.....	15
Alarm Output.....	15
PULSMATE Dual Total Model	
Description.....	15
Accuracy.....	15
Theory of Operation.....	15
Resetting the Totalizers.....	15
Configuration Record.....	16
Configuration Example.....	17

The Pulsmate Electronic Register

Description

The Pulsmate is a battery or externally powered electronic register that features 4.5 digit display of rate, 8 digits of total, and a scaled output pulse. The unit can be ordered with an optional 4-20mA output and uses the 4-20mA loop to provide power in this case. Rate and Total are displayed simultaneously. There is also a dual totalizer display option.

The PULSMATE is enclosed in Isoplast (Nema 4X), which combines the best properties of plastics and metals. Isoplast adds thermal stability, toughness and chemical resistance to the PULSMATE.

The PULSMATE is available for fitment to Actaris 1/2", 1", 2", and 3" MP meters as well as 1-1/2" and 2" Type S Magnetic Drive Meters. The meter magnetic drive operates as an integral switch closure input to the register.

Specifications

Power:

- Battery Powered
 - Supplied with 1 C size Lithium Battery
- External power input
 - Voltage 8.5 – 30 VDC
 - Current less than 5 mA
 - (Battery must be installed to power display)
- Loop powered
 - Voltage: 8.5 to 30 VDC supplied with 1 C size Lithium Battery.
 - (Battery must be installed to power display)
- Protection
 - Reverse Polarity protection on current loop

Battery Life Expectancy:

<u>Idle</u>	<u>2 hrs / day</u>	<u>8 hrs / day</u>	<u>24 hrs / day</u>
2.5 yrs.	2.25 yrs.	1.75 yrs.	1 yr.

Display Models

Three basic Displays are available:

	Rate Display			Totalizer Display		
	Digits	Descriptors	Min. Freq. Input	Resettable	Digits	Descriptors
Rate and Total	4.5	Sec/Min/Hr	.125 - 10 Hz	yes	8	Gal, Lit, FT3, M3
Rate Alarm Total	4.5	Sec/Min/Hr	.125 - 10 Hz	yes	8	Gal, Lit, FT3, M3
Dual Total	N/A	N/A	N/A	yes	5	Gal, Lit, FT3, M3

	Non-Resettable Total	Warning Displays	Alarm
	Digits		
Rate and Total	N/A	Low Battery	N/A
Rate Alarm Total	N/A	Low Battery	yes
Dual Total	8	Low Battery	N/A

The Dual Total model displays two totalizers – one resettable and one cumulative.

Pulse Output (Standard with Rate Total and Dual Total models)

The pulse output advances with the least significant digit of the totalizer.

Type: Opto isolated open collector transistor

Max. Voltage (off State): 30 VDC

Current (on state): 5 mA @ .9 V drop, .1 mA @ .7 drop

Pulse Rate / Duration: 65 msec

Pulse Output Divider: User selectable, ÷1, ÷10, ÷100 or off

Note: Select off for maximum battery life

Accuracy

0.01% Reading, ± 1 Count

Temperature Drift: 50 ppm/ °C worst case

Environmental

Operating Temperature

-4° F (-20°C) to 158°F (70° C)

Extended Temperature

-22° F (-30° C) to +158 ° F (70° C)

Humidity: 0 – 90% Non Condensing

K-Factor:

Range 0.001 to 59999

Decimal point locations: XX.XXX TO XXXXX

Analog Output Option (Standard with Rate and Total and Rate Alarm Total Models)

Type 4-20 mA follows rate display, two-wire hookup

Accuracy: 0.15% Full Scale at 20° C

Temperature Drift

50 ppm / °C Typical

200 ppm / °C Worst case

Reverse Polarity Protected

Note: The PULSMATE uses the 4-20 mA loop power as its power source when this option is used. The battery is still required to power the display.

UL-C- Flow Monitor, intrinsically safe, provides intrinsically safe outputs suitable for use in Class I, Groups A , B, C, D when installed in accordance with Control Drawing D600078-000.

Installation

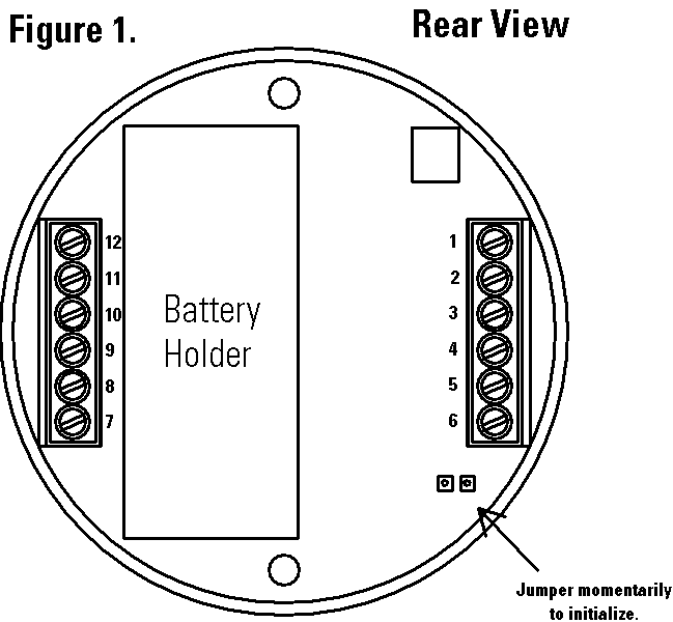
Battery Installation and PULSMATE Initialization:

All PULSMATE models are shipped without the battery installed. This preserves battery life when the unit is not in service but requires that the PULSMATE hardware be initialized when the battery is installed.

To install the battery, begin by locating the battery holder. The PULSMATE requires opening the enclosure cover and removing the PULSMATE to expose the battery holder.

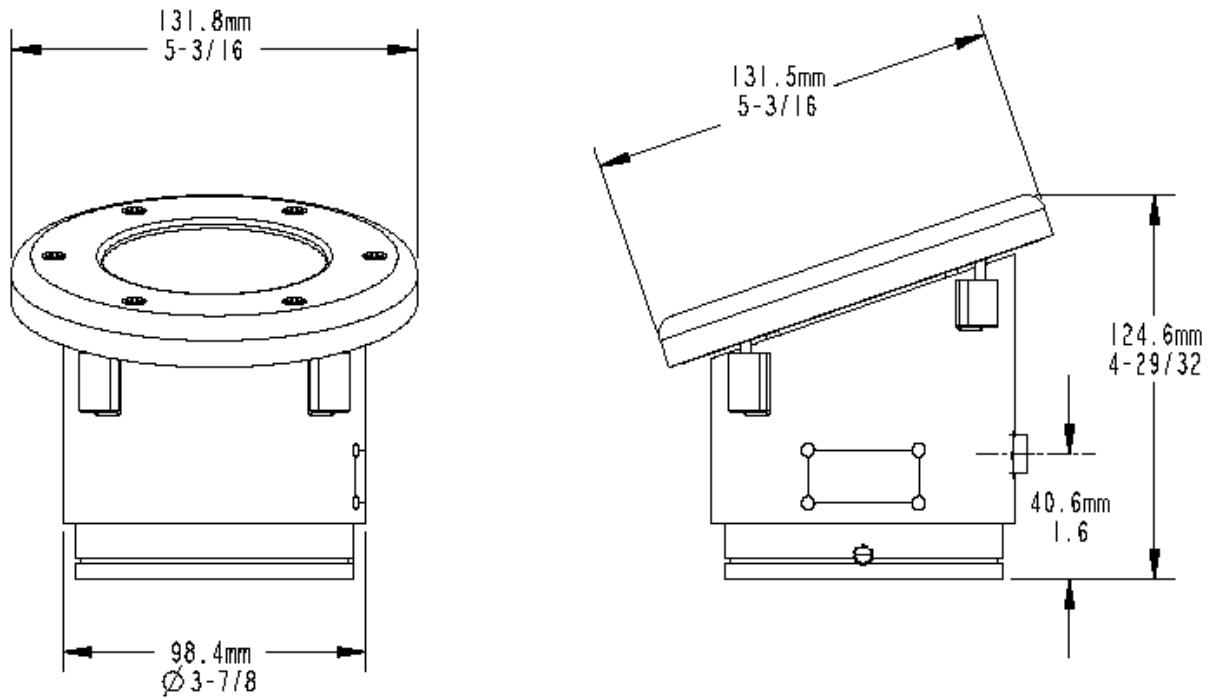
The positive terminal of the battery is marked with a (+) symbol stamped into the battery holder. Be sure to install the battery correctly (consider 'The positive end of the battery is marked '+' as well).

Locate the "initialize" terminals on the PULSMATE (See Fig 1). Using a small length of wire, temporarily jumper across the initialize terminals. The unit will respond by showing its software version number and then illuminating the LCD display. See Programming Flowchart to setup desired operating parameters.

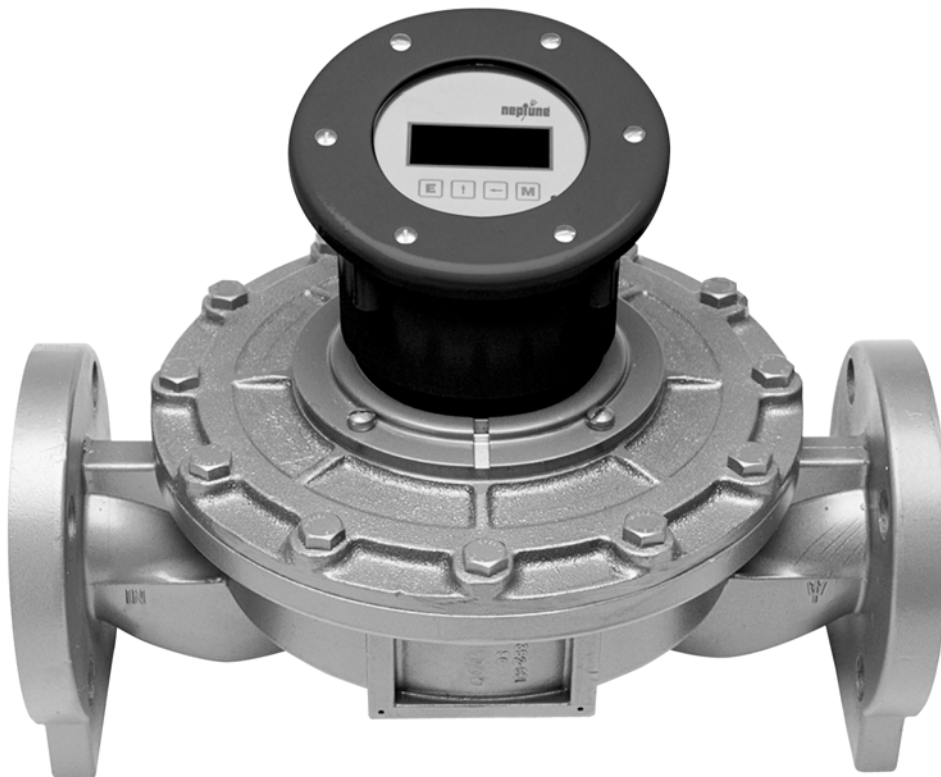


Caution: If the PULSMATE is not provided an external power source, information and programming will be lost, and the unit will have to be re-initialized as described above when the battery is changed. It is a good idea to record the configuration of the counter on the Configuration Record Form in the back of this manual.

Dimensions



SCALE 0.500



Theory of Operation

Flow rate equations:

$$\text{Flow Rate Indication} = \frac{\text{Input Frequency}}{\text{FAC} \times \text{FAC mul}^*} \times \text{Time Scaler}$$

$$\text{Flow Total Equation} = \frac{\text{Sum of Input Frequency}}{\text{FAC} \times \text{FAC mul}^*}$$

*See Definitions

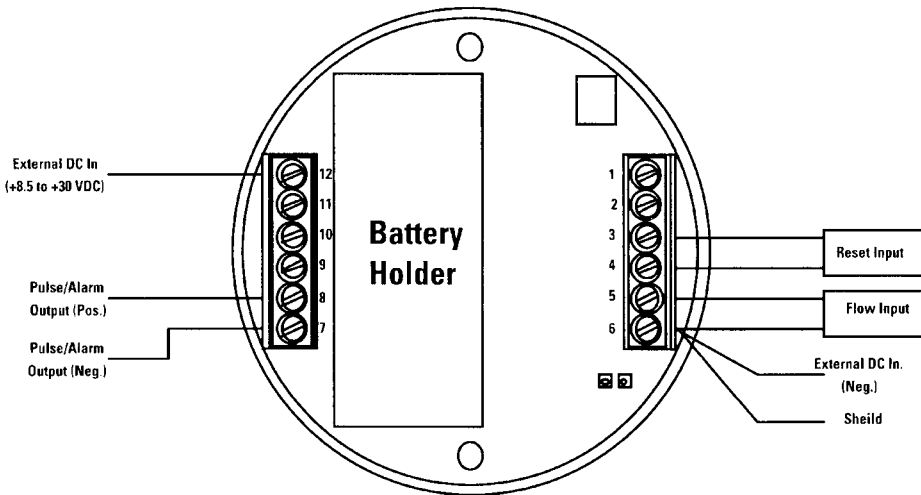
Alarm Output equation: Alarm on if rate value < low setpoint or rate > high setpoint
Otherwise alarm is off

Where Time Scaler is equal to:

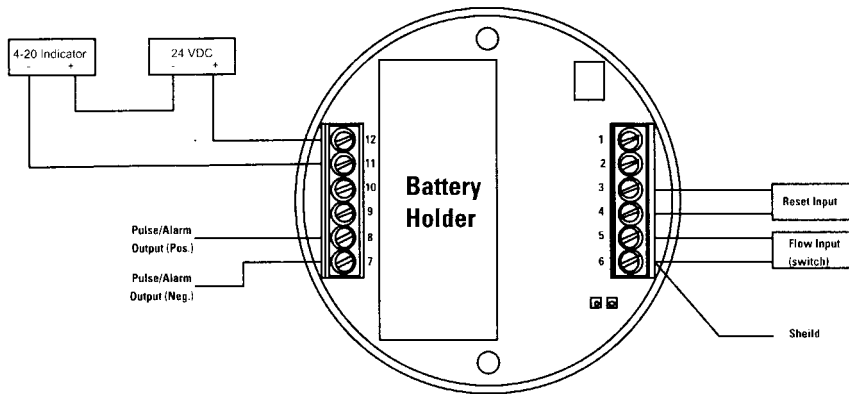
- 1 for rate per second read out
- 60 for rate per minute read out
- 3600 for rate per hour read out
- 14400 for rate per day read out

Wiring

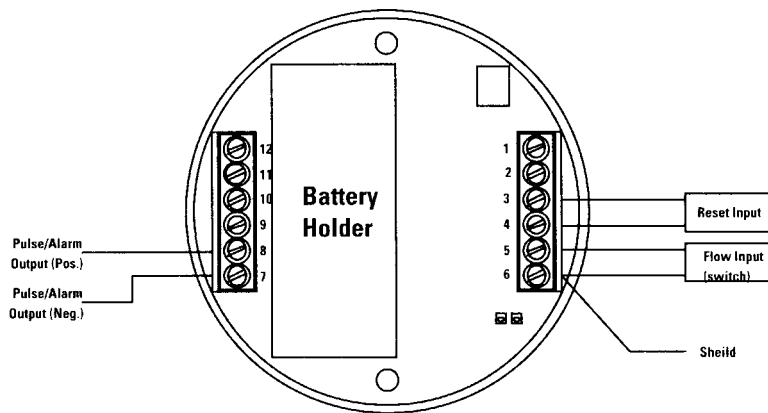
Several typical applications of the PULSMATE Rate and Total model are shown below. The isolated pulse output may be freely used so long as proper polarity is observed.



Counter Wiring with External Power Supply



Counter Wiring with Loop Powered Analog Output



Counter Wiring with Battery Power

Caution:

When 4-20 mA loop option is provided, the power wiring to the loop power option should always be to terminals (+) 12 and (-) 11. Accidental wiring to (+) 12 and (-) 6 should be avoided since excessive current flow may result.

Caution:

Accidental connections from circuit common (3 or 6) to earth or terminal (11) may result in erroneous operation of the analog output and/or excessive current flow.

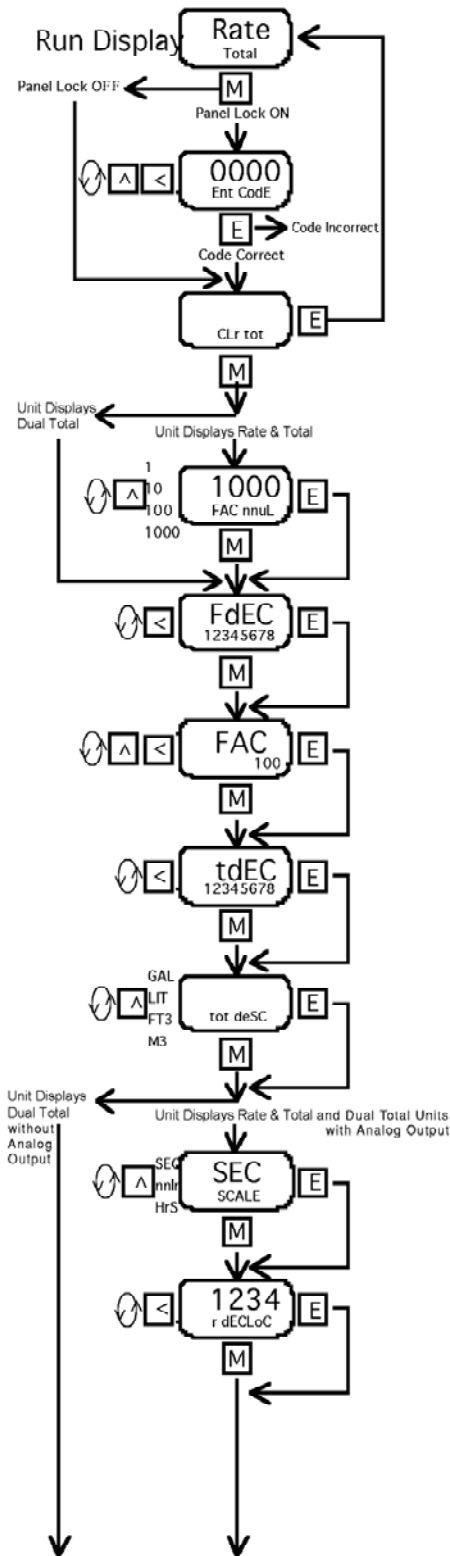
Removing the Pulsmate from the meter

$\frac{1}{2}$ " MP Meter:

Remove the set screw from the Pulsmate and twist the register $\frac{1}{8}$ th turn counter clockwise to release the retaining spring. The Pulsmate is now free and can be withdrawn from the meter cover. The Pulsmate can be remounted in any one of 4 positions at 90° intervals on the meter cover.

1" – 3" MP and $1\frac{1}{2}$ " – 2" Type S Magnetic Drive:

The Pulsmate is fixed to the meter cover by 2 clamp rings secured by 4 bolts. To remove the register from the meter, loosen the screws and disengage the clamp rings from the groove in the Pulsmate body. The Pulsmate can be positioned at any angle prior to clamping to the meter cover.



Continued on next page.

From the Run Display, press the M key to enter the programming menu.
If the panel lock is off, skip to CLr tot..

Ent CodE

If the panel lock is on, you must enter the 4-digit lock code to gain access to the menu.
Press the ^ key to increment each individual digit of the code.
Press the < key to advance to the next digit.
Press the E key to enter the displayed code.
If the code is correct, display advances to "CLr tot", if not, display returns to run mode

CLr tot

Press the E key to clear the totalizer and return to the programming menu.
Press the M key to skip and go to next menu item.

FAC nnuL

Press the ^ key to choose the factor multiplier (1,10,100, 1000).
Press the E key to enter the displayed factor multiplier.
Press the M key to skip and keep the existing factor multiplier.

FdEC

Press the < key to step the factor decimal to the desired location.
Press the E key to enter the displayed decimal location.
Press the M key to skip and keep the existing location
NOTE: For best performance and resolution choose as many decimal places as possible in the K-Factor. Example: Enter a K-Factor of 1 as 1.000.

FAC

Press the ^ key to increment each individual digit of the factor.
Press the < key to advance to the next digit.
Press the E key to enter the displayed factor.
Press the M key to skip and keep the existing factor.

tdEC

Press the < key to step the totalizer decimal to the desired location.
Press the E key to enter the displayed decimal location.
Press the M key to skip and keep the existing location

tot deSC

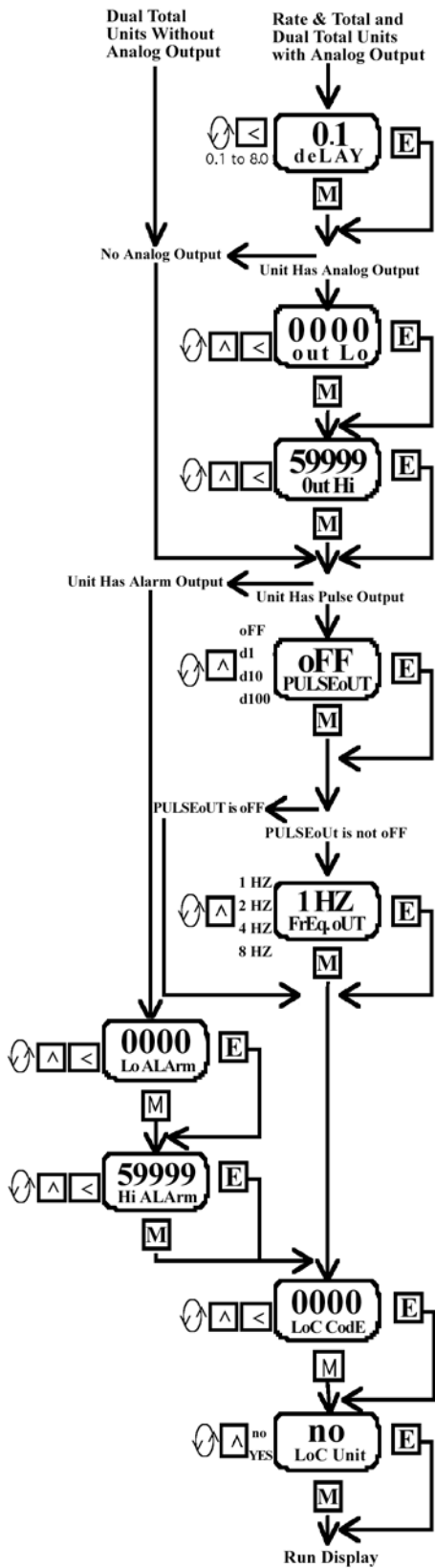
Press the ^ key to step to the desired totalizer descriptor.
Press the E key to enter the displayed descriptor.
Press the M key to skip and keep the existing descriptor.

SCALE

Press the ^ key to step to the desired scale setting.
Press the E key to enter the displayed scale setting.
Press the M key to skip and keep the existing setting.

r dECLoC

Press the < key to step the ratemeter decimal to the desired location.
Press the E key to enter the displayed decimal location.
Press the M key to skip and keep the existing location



dELAY

Press the ^ key to increment each individual digit of the delay.
 Press the < key to advance to the next digit.
 Press the E key to enter the displayed value.
 Press the M key to skip and keep the existing value.

outLo

Press the ^ key to increment each digit. Press the < key to step to the next digit to the left. Press the E key to enter the displayed out lo value.

outHi

Press the ^ key to increment each digit. Press the < key to step to the next digit to the left. Press the E key to enter the displayed out hi value.

Skip to LoC CodE if PULSEoUt is oFF

PULSEoUt

Press the ^ key to step to the desired divider for the pulse output.
 Press the E key to enter the displayed divider.
 Press the M key to skip and keep the existing divider.

FrEq. oUt

Press the ^ key to step to the desired frequency for the pulse output.
 Press the E key to enter the displayed frequency.
 Press the M key to skip and keep the existing frequency.

LoALArnn

Press the ^ key to increment each digit.
 Press the < key to step to the next digit to the left.
 Press the E key to enter the displayed value. Set to "0" if not used.

HiALArnn

Press the ^ key to increment each digit.
 Press the < key to step to the next digit to the left.
 Press the E key to enter the displayed value. Set to "99999" if not used.

LoC CodE

Press the ^ key to increment each individual digit of the lock code.
 Press the < key to advance to the next digit.
 Press the E key to enter the displayed value.
 Press the M key to skip and keep the existing value.

LoC Unit

Press the ^ key to step to the desired lock setting.
 Press the E key to enter the displayed lock setting, and return to Run Display.
 Press the M key to skip and keep the existing setting, and return to Run Display.

Definitions

ent Code : (enter code) This prompt will only appear if the panel lock is ON. Press the ↑ key to increment each digit. Press the ← key to step to the next digit to the left. Press the **E** key to enter the 4 digit code. If the entered code is correct, the display will advance to the next menu prompt (CLr tot). If incorrect, the display will return to the run mode.

Clr tot : (clear total) Clears (resets) the totalizer. Press the **E** key to clear the total and return to the run mode. Press the **M** key to skip and advance to the next menu selection.

FAC nnUI : (factor multiplier) Sets the factor multiplier value. Press the ↑ key to select 1 , 10 , 100 , 1000 . Press the **E** key to enter the displayed value.

fdeC : (factor decimal) Sets the decimal location for the factor. This location is restricted to 3 places (59.999). The use of this decimal automatically limits the number of decimal locations allowable in the rate and total to acceptable ranges. Press the ← key to move the decimal. Press the **E** key to select the displayed decimal location.

NOTE: For best performance and resolution choose as many decimal places as possible in the K-Factor.

Example: Enter a K-Factor of 1 as 1.000.

faC : (factor) This prompt appears on all units with linear inputs. The Factor is the number of pulses per unit volume for the flow sensor. The pulses/unit volume is implied by the totalizer descriptor when a descriptor is used. The implied units for the Factor are then as follows:

GAL pulses/gallon
M3 pulses/M3

Factors from 0.001 to 59999 may be used. A 0 value for the factor is not allowed and a warning message will be given. The factor is displayed on the subsidiary (lower) display. Press the ↑ key to increment each digit. Press the ← key to step to the next digit to the left. Press the **E** key to enter the displayed factor.

tdeC : (totalizer decimal) Sets the decimal location for the totalizer. The totalizer decimal is not a dummy decimal and will scale the totalizer display accordingly. (i.e. if the tdec is set in the tenths position (1234567.8), 100 will be displayed as 100.0). The location of the decimal point allows for greater resolution of both the totalizer display and the pulse output. The pulse output advances at a rate dependent on the least significant digit of the totalizer. The totalizer decimal location is restricted to a maximum of 4 places (1234.5678). However, the number of totalizer decimal locations allowable is reduced with each decimal place added to the factor decimal. Press the ← key to move the decimal. Press the **E** key to enter the displayed decimal location.

Note:

The selection of the factor decimal point limits the available selections for the number of decimal points available for the totalizer. This is automatic.

Enter your selection of the Factor's decimal point before entering the totalizer decimal point to assure the proper selection of the totalizer decimal point has been made.

tot desC : (totalizer descriptor) This allows you to illuminate one of the available descriptors on the display (GAL, M3 or "blank"). Press the ↑ key to select the descriptor. Press the **E** key to enter the selected descriptor.

sScale : (ratemeter scaling) Sets the rate readout. Choose rate per hour (Hrs) or minutes (nnln). The scale setting is shown on the main (upper) display. Press the ↑ key to step to the desired choice. Press the **E** key to enter the displayed scale setting.

Note: *A rate descriptor corresponding to the above choice will be illuminated on the display.*

lo alarm : (low alarm) Sets the setpoint for the low alarm. Key in the low alarm setpoint. Press the ↑ key to increment each digit. Press the ← key to step to the next digit to the left. Press the **E** key to enter the displayed value. Set to "0" if not used. (For models with Alarm)

hi alarm : (high alarm) Sets the setpoint for the high alarm. Key in the high alarm setpoint. Press the ↑ key to increment each digit. Press the ← key to step to the next digit to the left. Press the **E** key to enter the displayed value. Set to "99999" if not used. (For models with Alarm)

r deCloC : (ratemeter decimal location) Sets the decimal location for the ratemeter. The ratemeter decimal is not a dummy decimal and will scale the rate display accordingly. (i.e. if the r decloc is set in the tenths position (123.4), 100 will be displayed as 100.0). The ratemeter decimal location is restricted to a maximum of 4 places (.1234). However, the number of ratemeter decimal locations allowable is reduced with each decimal place added to the factor decimal. Press the ← key to move the decimal. Press the **E** key to enter the displayed decimal location.

Note: The flow rate indicator will flash "59999" if the computed flow rate exceeds the 59999 display capability of the indicator. Choose a new decimal point location to avoid this.

delay : (delay) Sets the amount of time (0.1 to 8.0 seconds) that the unit will "look" for valid input data. If pulses are not detected within this "window", the rate will display 0. The display will update once every two seconds as long as the unit receives valid data within two seconds. Some internal mathematics may delay this update. Press the ↑ key to increment each digit. Press the ← key to step to the next digit to the left. Press the **E** key to enter the displayed delay value.

oUt lo : (out low) Sets the low setting for the 4-20 mA analog output. Key in the low rate value at which the unit will output 4mA. Press the ↑ key to increment each digit. Press the ← key to step to the next digit to the left. Press the **E** key to enter the displayed out lo value. (For Rate Alarm Total model)

oUt HI : (out high) Sets the high setting for the 4-20 mA analog output. Key in the high rate value at which the unit will output 20 mA. Press the ↑ key to increment each digit. Press the ← key to step to the next digit to the left. Press the **E** key to enter the displayed out hi value. (For Rate Alarm Total model)

pUlseUt : (pulse out divider) This allows the unit to output a pulse for each least significant total count divided by the selected divider. The pulse out can be divided by 1 (d 1), 10 (d 10), 100 (d 100), or turned off (off). With the divider set at 1, the unit will give a pulse out for every increment of the LSD displayed.

Note: For maximum battery life, turn the pulse output off when pulse output is not used. Selecting the proper pulse output divider may be needed so that the pulse output does not exceed the maximum rate of the pulse output (10 Hz). If the pulse output pulses too quickly a flashing display will result. Pressing the “M” key will result in a display of an error message “E PULSE”. Press the “E” key to return to the run mode.

FrEQ.OUT : (pulse out frequency) Sets the pulse output frequency / duration. Selections are: 1, 2, 4 or 8 Hz. This menu item is skipped if pUlseUt is turned off.

loC Code : (lock code) Sets the 4 digit lock code to be entered when the unit prompts ent Code . This allows the user to gain access to the menu when the unit is locked. Press the ↑ key to increment each digit. Press the ← key to step to the next digit to the left. Press the **E** key to enter the displayed code.

Record this number for later use!

loC Unit : (lock unit) Sets the panel lock ON or OFF. Press the ↑ key to select On or OFF. Press the **E** key to enter the displayed selection.

Operation

Power to the unit may be provided by internal battery, external DC , or the current loop. In all cases, the internal battery will provide for continued operation and power the display in the event primary power is lost.

Once properly wired and programmed, the operation of the PULSMATE is automatic.

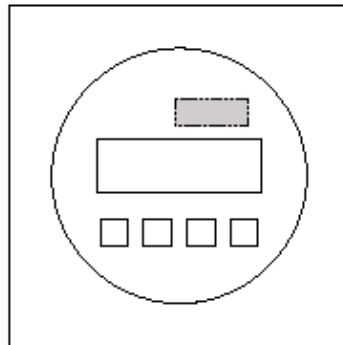
The flow totalizer is updated every 2 seconds* with the latest total. If no input counts are received the unit remains in a low power state to conserve power.

The flow total may be cleared by the front panel switch sequence or by using a magnet as described below.

Magnetic Reset:

The 8 digit total can be reset on the rate and total versions using a magnet as follows:

Place the magnet over the area shown by the dotted line and gray fill in the drawing below. Slide the magnet across the top of the housing. This may take more than one attempt. The 5-digit total will reset when the magnet activates the switch.



To reset the unit from the front panel, the following key sequence is required:

Press **M** “CLr tot” will be displayed (if the panel lock is on, the display will prompt “Ent Code”. Enter the proper code to advance to the “CLr tot” prompt)

Press **E** To clear the total. Unit will return to operation.

The flow rate indicator will measure the flow rate once every 2 seconds* and display the flow rate.

If the input pulses are not detected within the delay setting (0.1 to 8.0 seconds), a flow rate of 0 will be indicated on units with a rate indicator.

The analog output will be scaled based on the user selected zero and full scale and the measured flow rate. The analog output is updated every 2 seconds*.

The pulse or alarm output will generate a burst of pulses every 2 seconds* in accordance with the instrument setup of pulse scaling.

*A large delay setting and internal math operations may delay the update rate and alarm activation on models with alarm outputs.

Maintenance

The only scheduled maintenance for the PULSMATE register is periodic replacement of the battery.

Battery Replacement:

The PULSMATE has a battery monitor feature that illuminates when the lithium battery voltage approaches its end of life. A descriptor, “BAT”, illuminates when the battery voltage falls below this predetermined value. The low battery detector operates correctly with all power options.

The battery should be replaced within several weeks of the first occurrence of low battery warning, “BAT”. Left unattended, the unit may become inaccurate, cease to operate or lose setup information or malfunction.

See INSTALLATION section for battery installation instructions.

Error Messages

The PULSMATE is provided with an extensive self check, which assists the user in the location of setup entry errors, and in reporting malfunctions or unusual operating conditions. When an error occurs, the display will flash. Press any key to see the error message corresponding to the error that has occurred. Press any key again to acknowledge the error. (If the error can be eliminated by a change of setup values, the unit will automatically advance to the MENU so that the appropriate setup changes can be made).

Table-2 illustrates the warning message, problem, and recommended corrective actions.

Diagnostic Error Messages Table-2

Warning Message	Cause	Corrective Action
rAtE Er for units with Analog Output	Rate Low set higher than Rate Hi	Set Rate Hi greater than Rate Lo
FAC Err	Factor = 0	Set in correct Factor
“BAT” Descriptor	Low Battery	Replace Battery
E totAL	Total rollover	None required
E rAtE	Rate exceeds 59999	Use lower rate dec point
E PuLSE for units with Pulse Output	Pulse out Overflow	Use different pulse scaler or totalizer decimal point

Analog Output Calibration

Full Scale Adjust:

The 4-20 mA has been accurately set to 20.000 mA by the factory. No adjustments should be required.

The 4-20 mA output may be verified periodically by installing a digital milliamp meter in series with the analog output and simulating a full scale or over range flow rate.

The full-scale adjustments may be trimmed to 20.000 mA \pm .020 mA if required. To adjust, locate the span adjust potentiometer mounted on component side of PCB, above the display to the left (rear view). Turn clockwise to increase the current output, counter-clockwise to reduce.

The 4 mA is set automatically

PULSMATE Rate Alarm Total Model

Description

The PULSMATE Rate Alarm Total is a battery or externally powered indicator that features 4.5 digit display of rate and 8 digits of total and non batching flow rate alarm output. The unit can be ordered with an optional 4-20mA output and uses the 4-20mA loop to provide power in this case.

Alarm Output

Non-Latching

The alarm output activates when rate is less than low alarm setpoint or greater than high alarm setpoint.

Type: Opto-isolated Photomos Relay

Max Voltage (off state): 100 VDC

Current (on state): On resistance 100 mA – less than 30 ohms

External diode clamps are required when driving inductive loads

PULSMATE Dual Total Model

Description

Featuring 5 digits of resettable total and 8 digits of grand total, the PULSMATE Dual Total is a battery or externally powered indicator. Pulse output is standard and 4-20mA output is optional.

Accuracy:

± 1 Count

Theory of Operation

Flow Total Equation:

$$\text{Flow total} = \frac{\text{Sum of Input Pulses}}{\text{FAC}}$$

Resetting the Totalizers:

The 8 digit grand total may only be cleared by using the following key sequence:

Press **M** “Clr tot” will be displayed (if the panel lock is on, the display will prompt “Ent Code”
Enter the proper code to advance to the Clr tot prompt)

Press **E** To clear the total. Unit will return to operation

The 5 digit total can only be reset by a contact closure on the remote reset terminal to circuit common.

Configuration Record

The user should record the configuration of the PULSMATE in the table below. The configuration will revert to the values listed in the Default Value column if the battery is removed or dies and no external power is available.

Function	Programming Mnemonic	Default Value	Current Value
Factor Multiplier (rate and total display only)	FAC nnuL	1	1 10 100 1000
Factor Decimal Location	FdEC	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
Factor (scaling)	FAC	100	
Totalizer Decimal Location	TdEC	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
Totalizer Descriptor	Tot dESC	'Blank'	'Blank' GAL LIT FT3 M3
Scale (ratemeter)	SCALE	SEC	SEC min HrS
Rate Decimal Location	R dECLoC	1 2 3 4	1 2 3 4
Delay	dELAY	0.2	
Out Low (analog output only)	out Lo	0000	
Out Hi (analog output only)	out Hi	59999	
Lo Alarm (alarm output only)	LoALARnn	0000	
Hi Alarm (alarm output only)	HiALARnn	5999	
Divider, Pulse Output (pulse output only)	PuLSEoUt	OFF	OFF 1 10 100
Pulse Output Frequency (pulse output only)	FrEq. oUt	1 HZ	1 HZ 2 HZ 4 HZ 8 HZ
Lock Code	LoC CodE	00000	
Lock Unit	LoC Unit	no	no YES

Configuration Example

The table below will configure the PULSMATE as follows:

Factor has two decimal places and is 12.16 counts per unit of measure.

The totalizer will display one decimal place and the descriptor for liters.

Rate time units are minutes, the rate will be displayed with two decimal places, and the rate will go to zero when there has been no flow input for four seconds.

One output pulse will be generated for every 10 tenth of a liter measured at a burst frequency of 4 Hz.

The lock code is 01234 and is 'on'.

Function	Programming Mnemonic	Default Value	Current Value
Factor Multiplier	FAC nnuL	1	<u>1</u> 10 100 1000
Factor Decimal Location	FdEC	1 2 3 4 5 6 7 8	1 2 3 4 5 6 <u>7</u> 8
Factor (scaling)	FAC	100	<u>12.16</u>
Totalizer Decimal Location	TdEC	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 <u>8</u>
Totalizer Descriptor	Tot dESC	'Blank'	'Blank' GAL <u>LIT</u> FT3 M3
Scale (ratemeter)	SCALE	SEC	SEC <u>min</u> HrS
Rate Decimal Location	R dECLoC	1 2 3 4	1 2 <u>3</u> 4
Delay	dELAY	0.2	<u>4.0</u>
Out Low	out Lo	0000	
Out Hi	out Hi	59999	
Lo Alarm	LoALARnn	0000	
Hi Alarm	HiALARnn	5999	
Divider, Pulse Output	PuLSEoUt	OFF	OFF 1 <u>10</u> 100
Pulse Output Frequency	FrEq. oUt	1 HZ	1 HZ 2 HZ <u>4 HZ</u> 8 HZ
Lock Code	LoC CodE	00000	<u>01234</u>
Lock Unit	LoC Unit	no	no <u>YES</u>

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