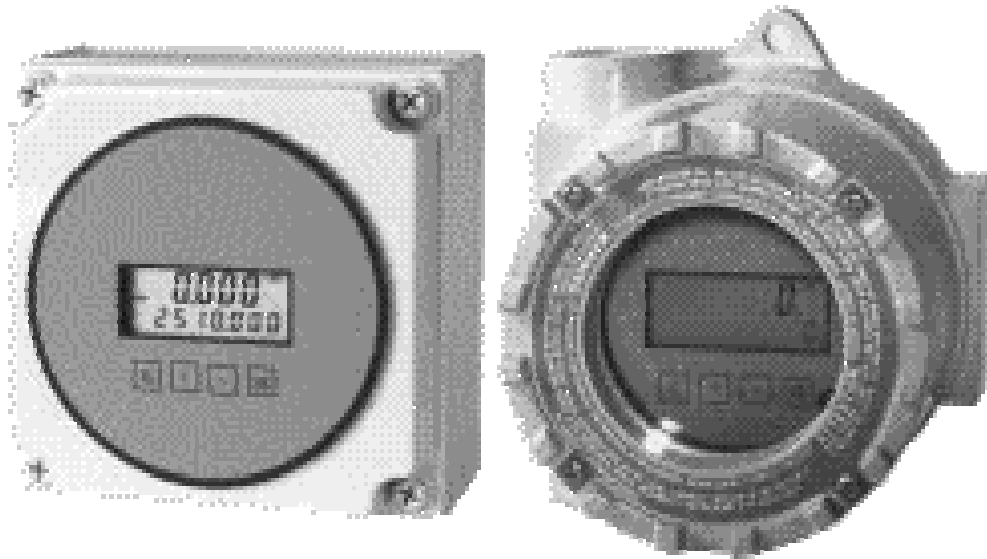




*Proven Performance  
for Over 50 Years*

# **MODEL RT 200/RT200-XP RATEMETER AND TOTALIZER**

INSTALLATION and OPERATING INSTRUCTIONS



**15555 North 79th Place  
Scottsdale, AZ 85260  
tel: (480) 922-7446 • fax: (480) 948-3610  
Email: [sales@cox-instruments.com](mailto:sales@cox-instruments.com)  
Web: [www.cox-instruments.com](http://www.cox-instruments.com)**



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# SPECIFICATIONS

## **DESCRIPTION:**

Featuring 4 1/2 digits of rate and 8 digits of total, the RT 200/RT 200-XP is a battery powered indicator capable of accepting magnetic pickup, DC pulse and switch closure inputs. The unit is provided with an optional 4-20 mA output. The RT 200/RT 200-XP uses the 4-20 mA loop to provide power when this is used.

## **POWER:**

### **Loop Powered**

Voltage: 8.5 to 30 VDC (Supplied with one C Size Lithium Battery)

Protection: Reverse Polarity Protection on Current Loop

Loop Burden: 8.5 V Maximum

## **DISPLAY:**

Rate Display: (Selectable Decimal) 4.5 Digits (19999), 0.35" High, Display updates every two seconds

Rate Descriptors: /sec, /min, /hr

Minimum Input Frequency: 0.125 Hz to 10 Hz (selectable delay of 0.1 to 8 seconds)

Totalizer Display: (Selectable Decimal) 8 Digits (99999999), 0.2" High

Totalizer Descriptors: gal, lit, ft<sup>3</sup>, m<sup>3</sup>, "blank"

Warning Display: Low Battery Warning "BAT"

## **PULSE OUTPUT:**

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

Type: Opto-Isolated open collector transistor

Max Voltage (Off State): 30 VDC

Max Current (On State): 5 mA @ 0.9 V drop, 0.1 mA @ 0.7 V drop

Pulse Duration: Selectable (see below)

Pulse Output Rate: Selectable (see below)

SPEED (HZ)	1	2	3	4
Min. on/off (msec)	500	250	125	62.5

Pulse Output Divider: Use selectable, 1, 10, 100 or OFF

**NOTE:** Select OFF for max. battery life.

## **ACCURACY:**

0.01% Reading  $\pm 1$  Count

Temp. Drift: 50 ppm/Degree C (Worse Case)

## **ENVIRONMENT:**

Operating Temperature: -4°F (-20°C) to +158°F (+70°C)

Humidity: 0 – 90% Non condensing

## **INPUTS:**

### **Magnetic Pickup Input**

Frequency Range: 0 to 3500 Hz

Trigger Sensitivity: 30 mV p-p

Over Voltage Protected: 30 VDC

### **Opto-Isolated DC Pulse Input**

High (Logic 1): 4-30 VDC

Low: (Logic 0): Less than 1 VDC

Minimum Current: 0.50 mA

Hysterersis: 0.4 VDC

Frequency Range: 0 to 5 KHz

Minimum Pulse Width: 0.1 msec

### **Contact Closure Input (Contact Closure to Common)**

Input Pullup Resistor: 100K to +3.6 VDC

High (Logic 1): Open or 4-30 VDC

Low: (Logic 0): Less than 0.5 VDC

Internal Switch Debounce Filter: 0 to 40 Hz

CAUTION: Sustained contact closure will shorten battery life.

### **Reset Input (Contact Closure to Common)**

Internal Pullup Resistor: 100K to +3.6 VDC

High (Logic 1): Open or 4-30 VDC

Low: (Logic 0): Less than 0.5 VDC

Minimum On: 25 msec

CAUTION: Sustained contact closure will shorten battery life.

## **K-Factor**

Range: 0.001 to 59999 (divider)

Decimal Point Locations: XX .XXX to XXXX

## **ANALOG OUTPUT**

Type: 4-20 mA follows rate display, 2 wire hookup

Accuracy: 0.15% Full Scale at 20C

Temperature Drift: 50 ppm/C (Typical)

200 ppm/C (Worse Case)

Reverse Polarity Protected: Unit uses 4-20 mA loop power as its power source.

# INSTALLATION

## **Battery Installation & Initialization:**

All models are shipped without battery installed. This preserves battery life when the unit is not in service but requires that the electronics hardware be initialized when the battery is installed. When using external BATPACK, mount within 12" and plug connector into 3 position square posts (see Figure 1). Polarity is not a concern because center is common.

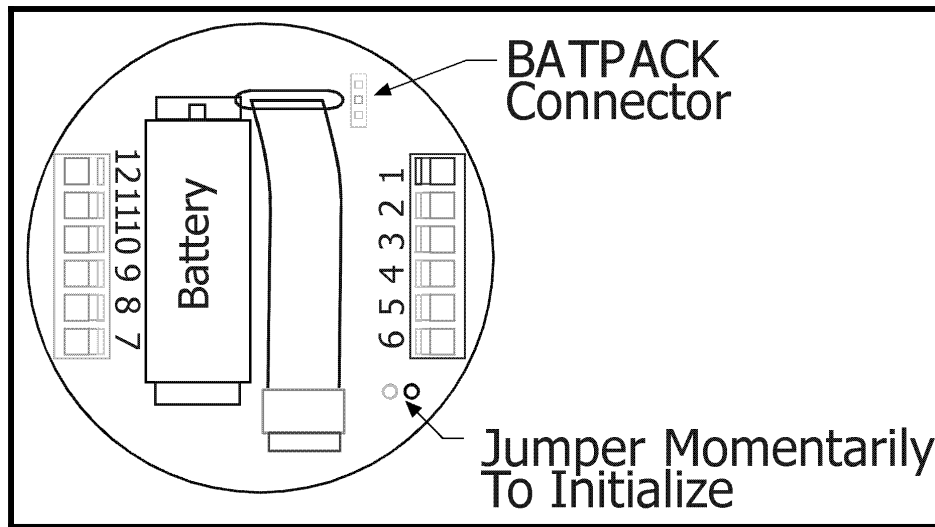


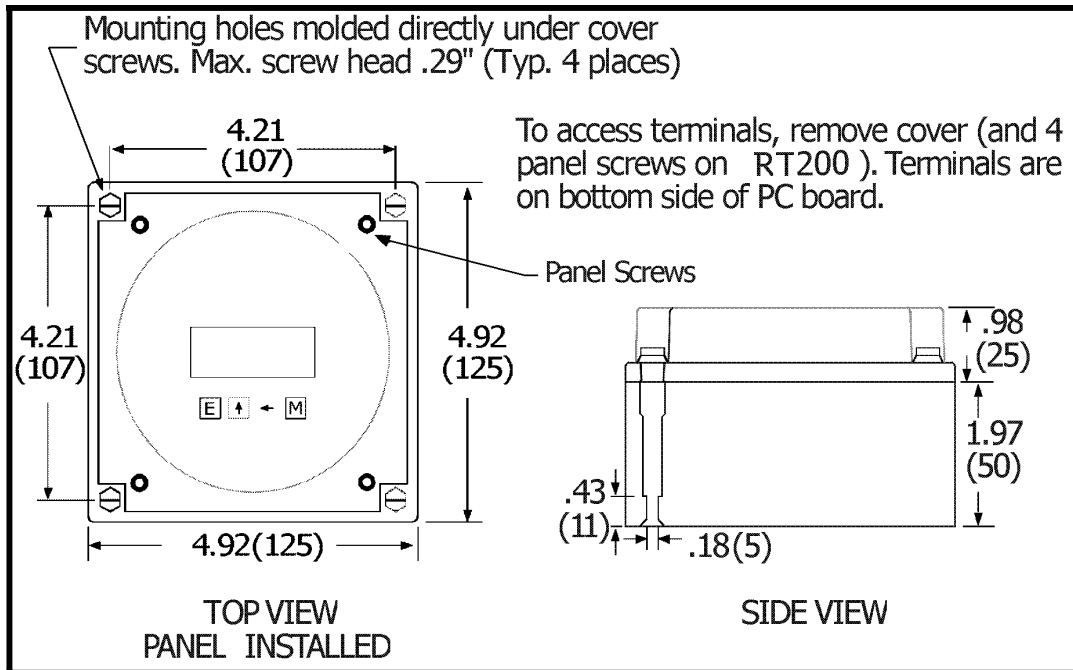
Figure 1: Rear View

To install the battery, begin by locating the battery holder. The RT 200 (Figure 2) and the RT 200-XP (Figure 3) require opening the enclosure cover and removing the electronics board to expose the battery holder.

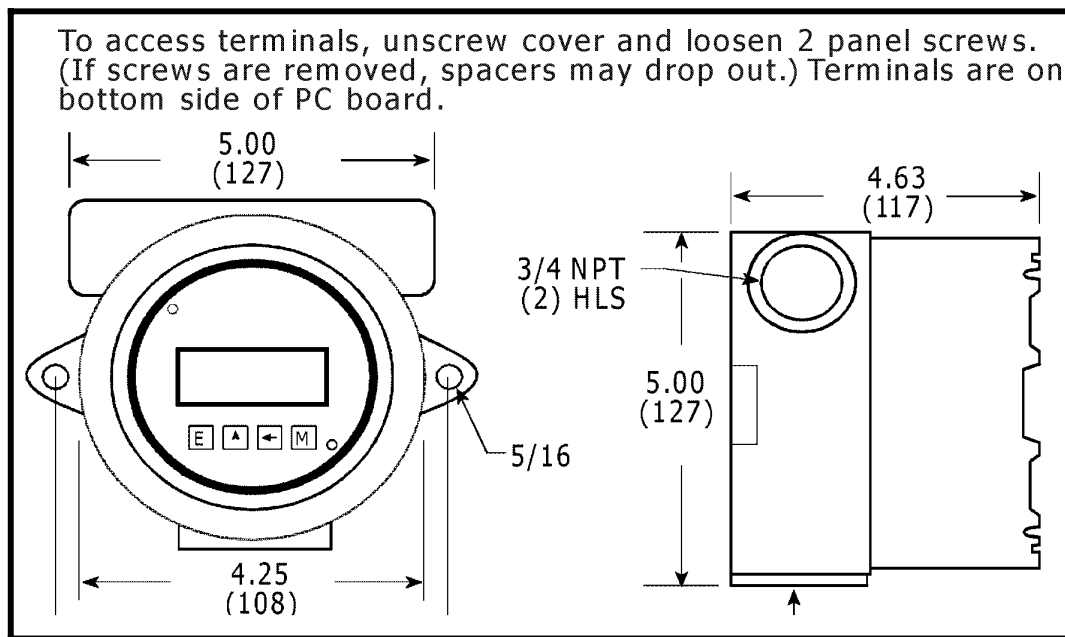
The plus terminal of the battery is marked with (+) symbol stamped into the battery holder. Be sure to install the battery(ies) correctly.

Locate the "initialize" terminals on the PCB(see Figure 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: All units are provided with two or more sources of power. The power should not be interrupted when changing batteries. For models with two batteries, change one battery at a time. If all power sources are interrupted, information will be lost and the unit will have to be re-initialized as described above.**



**Figure 2: RT 200 (Non-Explosion Proof)**



**Figure 3: RT 200-XP (Explosion Proof)**

## THEORY OF OPERATION

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

Where Time Scaler is equal to:

1 for rate per second readout

60 for rate per minute readout

3600 for rate per hour readout

$$\text{Flow Total} = \frac{\text{Sum of Input Pulses}}{\text{FAC} \times \text{FAC mul}}$$

# WIRING

Several typical applications of the RT200/RT200-XP are shown in figures 4a, 4b and 4c. Please observe that the various pulse inputs and power options may be intermixed in many ways to solve common applications. The isolated pulse output may be freely used so long as proper polarity is observed.

**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:** The magnetic pickoff input requires an isolated floating input for proper operation. Accidental connections to earth may result in erroneous operation of the analog output and/or excessive current flow.

**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.

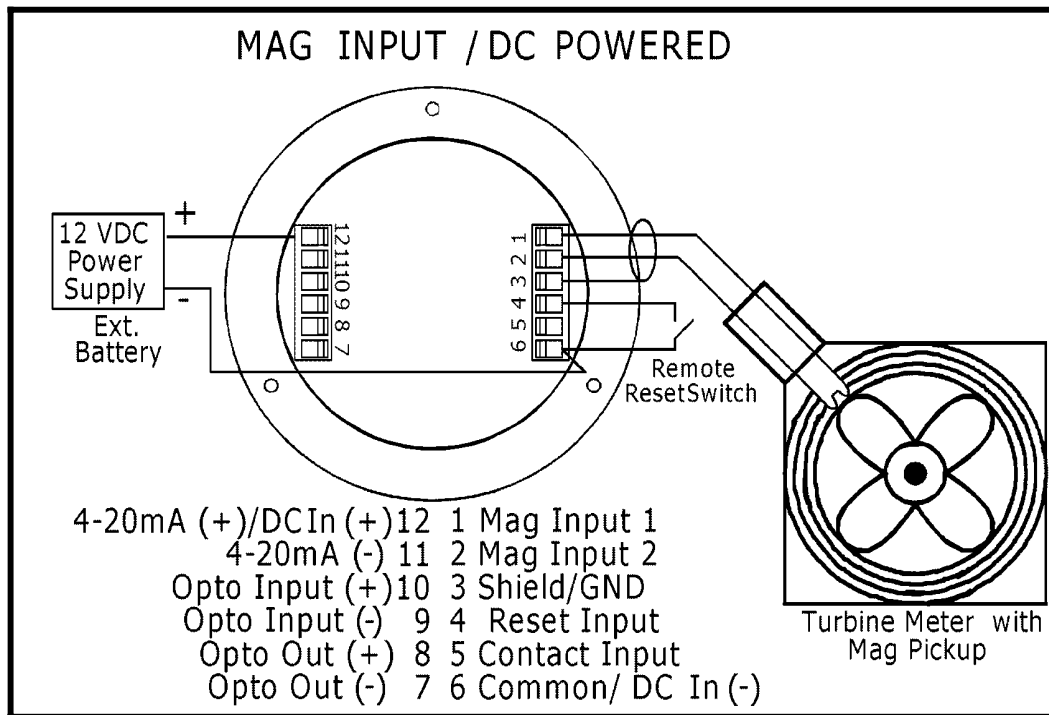


Figure 4a: Magnetic Pickup/DC Powered

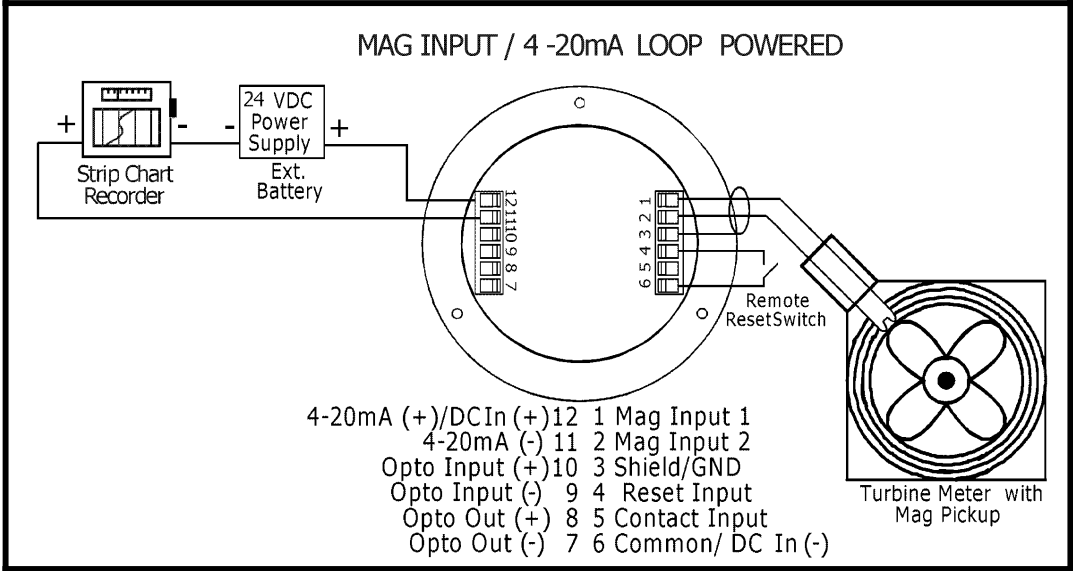


Figure 4b: Magnetic input / 4-20 mA Loop Powered

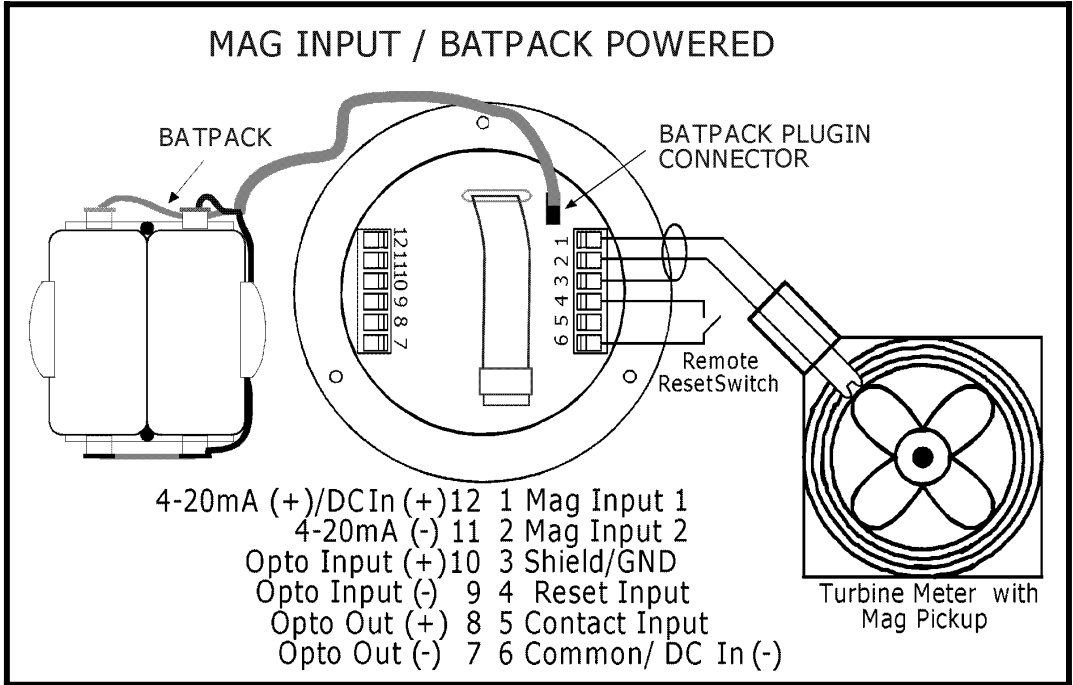


Figure 4c: Magnetic input / Battery Pack Powered

## 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.

### **clrtot: (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.

### **factnnul: (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.

### **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 descriptor is used. The implied units for the Factor are the as follows:

GAL	pulses/gallon
LIT	pulses/liter
FT3	pulses/ft3
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.

### **Fr#: (frequency for point #)**

This prompt will only appear when 10 point selected. It sets the frequency for each of the 10 points (#). Press the h key to increment each digit. Press the ← key to step to the next digit to the left. Press E key to enter the desired frequency for point #.

**FAC#:** (factor for point #)

This prompt will only appear when 10 point selected. It sets the factor for each of the 10 points (#). 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 desired factor for point #.

**NOTE:** The display will advance to the next (Fr#) after each entry of the Fr & Fac until all 10 points are complete. Entering a 0 in the Fr or fac setting will advance the display to the next menu prompt (tdec).

**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 100.00. 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 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, LIT, FT3, M3, or "blank"). Press the ↑ key to select the descriptor. Press the E key to enter the selected descriptor.

**SCALE:** (ratemeter scaling)

Sets the rate readout. Choose rate per hour (HrS), minutes (nnin) or seconds (SEC). 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.

**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 high rate value at which the unit will output 20 mA. Press the ↑ key to increment each digit. Press the ← key to the next digit to the left. Press the **E** key to enter the displayed out lo value.

**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.

**PuLSEout: (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.

**FrE9.out: (pulse out frequency)**

Sets the pulse output frequency / duration. Selections are: 1, 2, 4 or Hz. This menu item is skipped if PuLSEout is turned off.

**LoCCode: (lock code)**

Sets the 4 digit lock code to be entered when the unit prompts EntCodE. This allows the user to gain access to the menu when the unit is locked. 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.

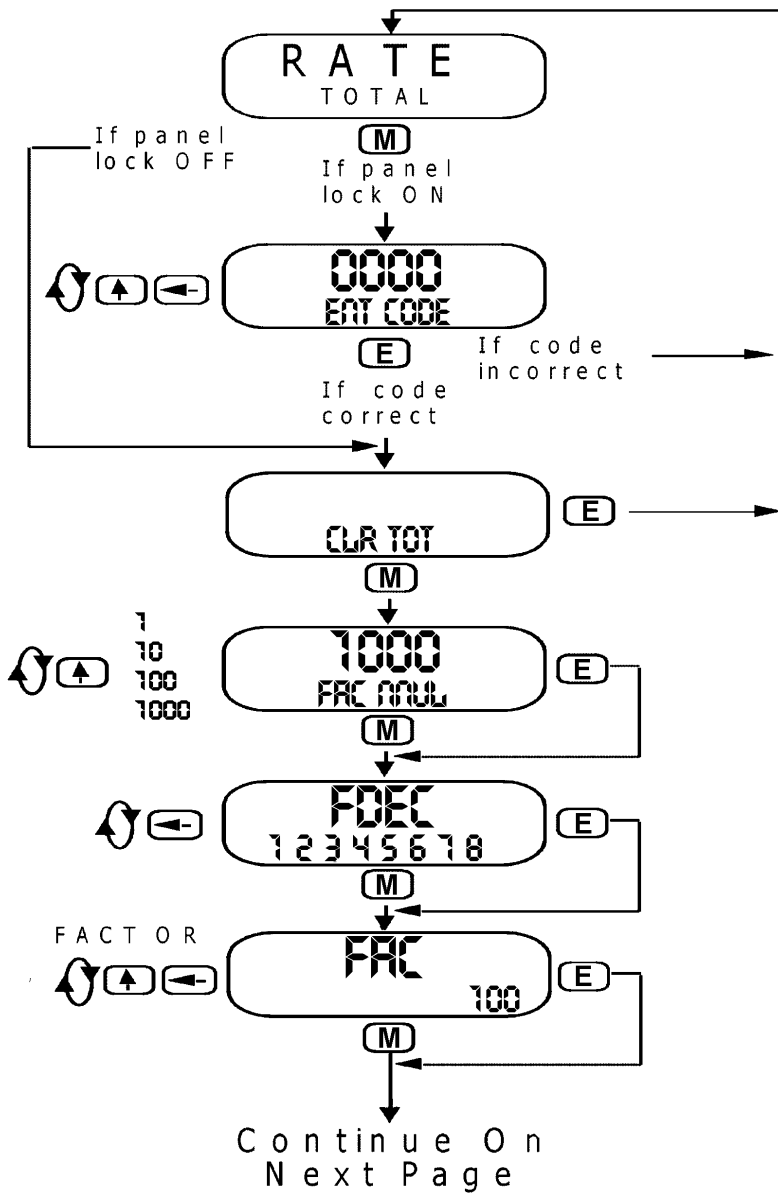
RUN MODE

ENTER CODE

CLEAR TOTAL

FACTOR MULTIPLIER

FACTOR DECIMAL



# PROGRAMMING FLOWCHART

Press the **M** key to enter the programming menu.

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.

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.

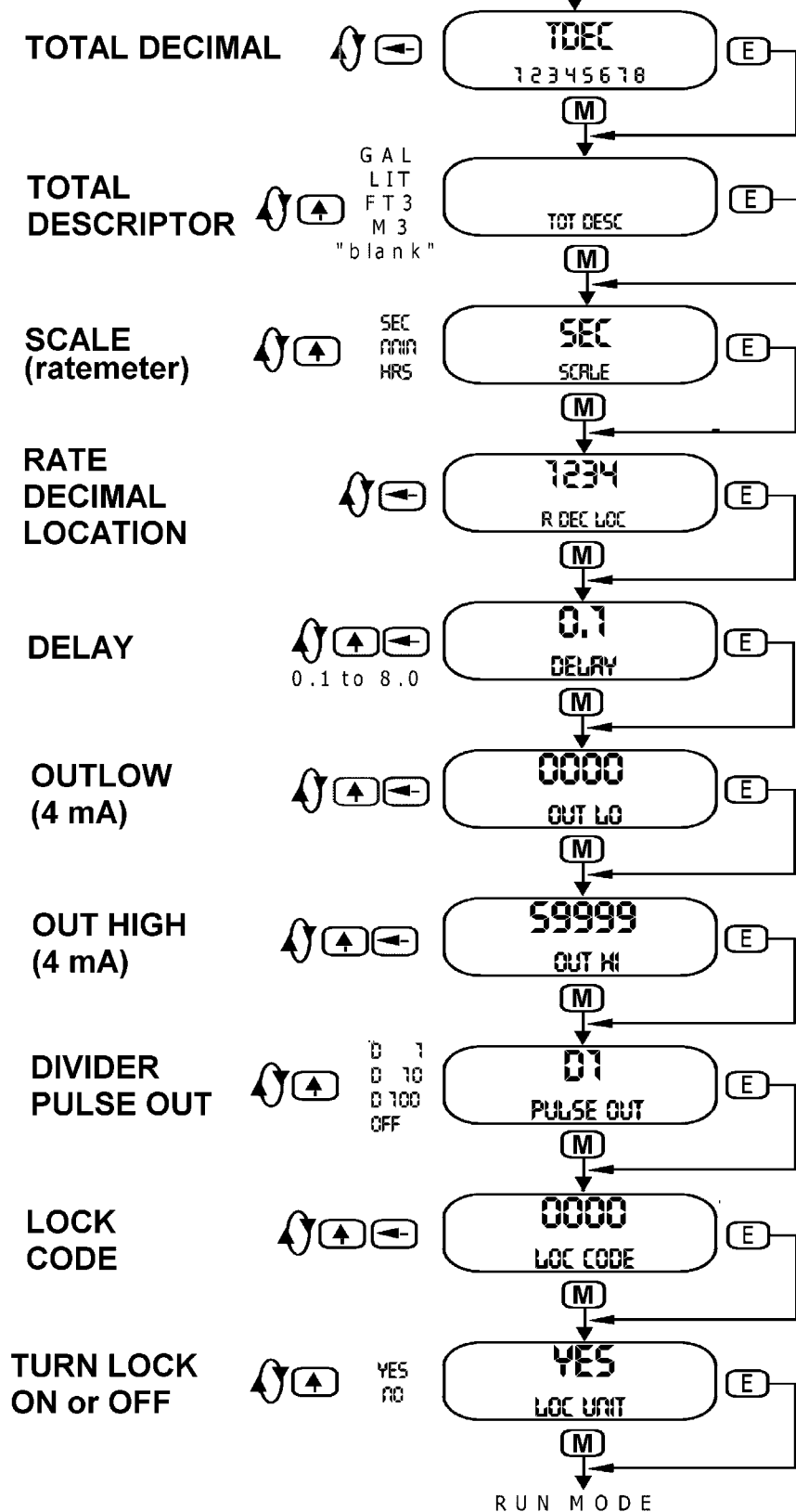
Press the **↑** key to choose the factor multiplier (1, 10, 100, 1000).  
Press the **E** key to enter the displayed factor multiplier.  
Press the **M** key to skip and keep the existing factor multiplier.

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 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.

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.

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## PROGRAMMING FLOWCHART (CON'T)

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.

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.

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.

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.

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.

Press the ↑ key to increment each individual digit of the out low setting (4mA value). This will only display on units with Analog Output.  
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.

Press the ↑ key to increment each individual digit of the out high setting (20mA value). This will only display on units with Analog Output.  
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.

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.

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.

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

# OPERATION

A suitable pulse producing device or flow meter is wired to one of the three pulse inputs provided on the RT200/RT200-XP. Only one of these inputs is used in a given application. There are no connections to the two unused pulse inputs.

Isolated magnetic pickups may be connected to terminals 1 and 2. Isolated contact closures may be connected to terminals 5 and 6. Any pulse type may be connected to terminals 9(-) and 10(+).

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

Once properly wired, the operation of the RT200/RT200-XP 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 a contact closure on the remote reset terminal to circuit common.

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.

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 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.

## **ERROR MESSAGES**

The RT200/RT200-XP is provided with extensive self checking which assists the user in the location of setup entry errors and in reporting malfunctions 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 – 1 illustrates the warning message, problem, and recommended corrective actions.

## **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.

## **MAINTENANCE**

The only scheduled maintenance for the RT200/RT200-XP is periodic replacement of the battery.

Battery Replacement:

The RT200/RT200-XP has a battery monitor feature which 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, or batteries, 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 loose setup information or malfunction.

Batteries should be replaced one at a time to avoid interrupting the power.

See INSTALLATION section for battery installation instructions.

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