

**Models ER-10 &  
ER-10H**

**Digital Resettable Totalizers and  
Digital Rate of Flow Indicators**

# **Installation & Operation Manual**



**ER-10**



**ER-10H**

**(For Portable Large Meter Tester Only)**

***This Product Contains Lithium Batteries.***

***Read This Manual Before Attempting Any Installation,  
Wiring Or Operation.***



**BadgerMeter, Inc.**

**IOM-124-02**  
Part No. 53400-124

3-09

## Scope of this manual

This manual contains information concerning the installation, operation and maintenance of the Badger® ER-10 and ER-10H electronic registers. To ensure proper performance, the instructions given in this manual should be thoroughly understood. Retain the manual in a readily accessible location for future reference.

Installation, wiring and programming of either unit is fairly simple and straight forward. This manual is designed so as to provide you with a step by step guide for this purpose.

Examples are provided only to facilitate programming. Your specific application will most likely require a different set of numbers for proper programming.

The troubleshooting section attempts to illustrate the most common problems that can be encountered, their most likely cause and the recommended solution. If a problem persists, please contact our technical support group at:

Badger Meter, Inc.  
Technical Support  
1-800-456-5023

## General Information

The ER-10 and ER-10H are external or battery powered electronic registers that display rate of flow and total flow. They have independent programmable scale factors for rate and totalization, allowing you to program these displayed values in different but meaningful engineering units, such as gallons per minute and total gallons.

The LCD display with 8 digits for total, and 4 digits plus legend for rate, provides easy viewing at a glance. For conditions where ambient light is poor, the display can be

backlit by connecting an external DC (10-30 VDC) power supply. A single unit can accept NPN or dry contact inputs for low or high speed applications.

The ER-10 and ER-10H models are powered by one 3V Lithium battery.

Setup on either model is quick and easy as the two front panel keys are used to scroll through and preset values in all program mode choices.

## Specifications

### POWER

Internal Battery: 3V, Lithium  
Battery Life Expectancy: 5 years  
Replacement Part #: 65765-001  
External DC Power Source(10-30VDC)  
Max Current Draw = 30mA

### BACKLIGHT

Requires 10-30VDC power input (max. current draw= 30mA)  
(Derate operating temperature 1°C/Volt above 17VDC)  
Reverse polarity protected

### PHYSICAL

Operating Temperatures:  
32°F (0°C) to 130°F (55°C)  
Storage Temperature:  
-4°F (-20°C) to 160°F (70°C)  
Operating Humidity: 60% Non-condensing  
Weight: 2.2 oz. net  
Display Size: .43" high  
Front Panel Rating: NEMA 4X when mounted with gasket provided  
Case Material: Cycolac X-17

### TOTALIZER

Digits: 8  
Scaler: 0.0001 - 99.999  
Decimal Point: 5 positions, programmable

### RATE INDICATOR

Digits: 4/5, (4 calculated, 5 displayed with fixed 0 in LSD)  
Scaler Range: .001 to 9999  
Decimal Point: 5 positions, programmable  
Accuracy: +/-0.2%  
Update Time: .7 seconds  
Zero Time: 10 seconds

### DC COMMON (Terminal 1) COUNT INPUT (Terminal 2)

Speed: 0 to 100 hz  
Min. Low Time: 3.3 mS  
Min. High Time: 6.7 mS  
Impedance: 101K ohm  
Voltage Thresholds: Low: 0 to 0.4 VDC  
High: 2.0 to 28 VDC  
Max: High 28 VDC

### RESET INPUT (Terminal 4)

Resets totalizer to zero when connected to DC common.  
Min. Low Time: 0.25 to 1.0 sec. (maintained)  
The required pulse width varies with count speed, scale factor and number of digits displayed.  
Voltage Thresholds: Low: 0 to 0.4 VDC  
High: 2.0 to 28 VDC

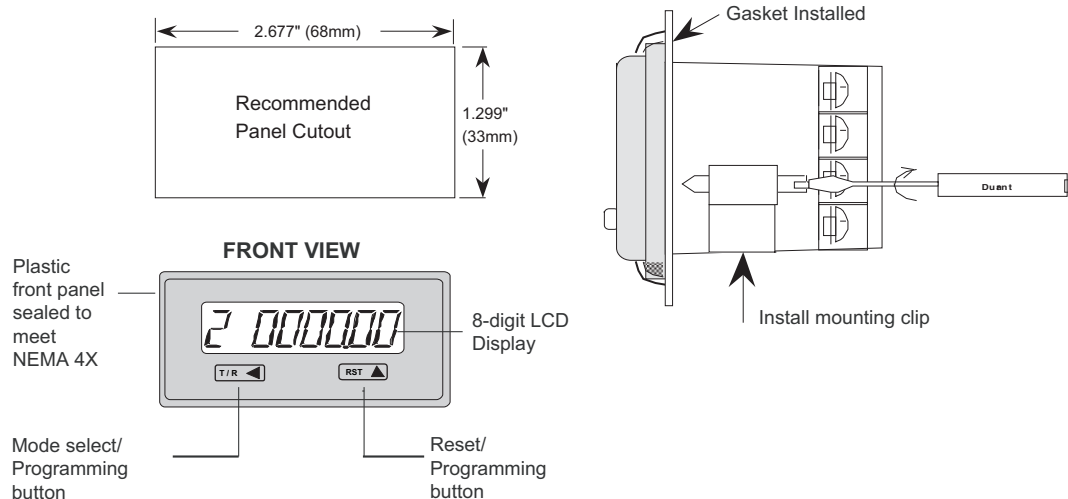
### PROGRAM ENABLE INPUT (Terminal 5)

Operation: Level sensitive (maintained)

### COUNT ACCURACY

100% when operated within specifications

## Installation



### Panel Installation

Slide the included gasket over the rear of the unit. Place the unit in the panel through a 33mm x 68mm cutout. Use the provided panel mount screws to tighten the mounting clips until there is a secure seal against the gasket. Do not over tighten. Slide the mounting clips into the grooves in the side of the ER10.

## Wiring Instructions

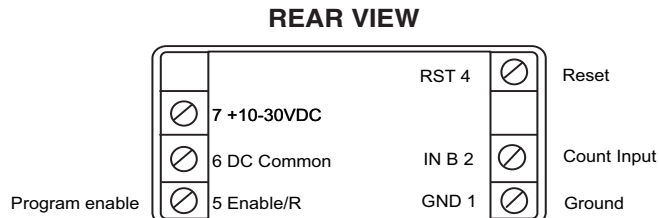
Terminal	Function	Operation
1	Ground	
2	Input B Count Input	Count Input Contact Closure or NPN 100 Hz. Max.
3		Not Used
4	Reset	Connect to Ground to Reset Totalizer. This is a maintained or Level Sensitive Reset.
5	Program Enable	Connect to Ground to Enter Program Mode
6	Backlight Common	
7	Backlight Power	Connect to Power to Light Display

### TRANSMITTER CONNECTIONS

For connecting to Badger Meter transmitters, refer to the Industrial Technical Brief (ITB) for your specific transmitter, and the chart to the right. "Connections" refers to the wires on the transmitter. The numbers in parenthesis refer to the terminal numbers on the ER-10. Connect the wire coming from the transmitter to the corresponding terminal number for the ER Remote models.

To connect a generic reed switch to the ER-10, connect one of the wires to terminal 1. Connect the remaining wire to terminal 2.

To connect a generic NPN transmitter to the ER-10, connect the emitter to terminal 1. Connect the collector to terminal 2.



Transmitter	Connections	
FT1 (1/2" OP)	Black (1)	Black (2)
FT1	White (1)	White (2)
FT2	White (1)	White (2)
FT420	Pulse Output Terminal – (1)	Pulse Output Terminal + (2)
MSE1	Black (1)	Red (2)
MSE5	Black (1)	Red (2)
PFT2	White (1)	White (2)
PFT3	White (1)	White (2)
PFT420	Pulse Output Terminal – (1)	Pulse Output Terminal + (2)
PFT420/2	Pulse Output Terminal – (1)	Pulse Output Terminal + (2)
PM5	Black (1)	Red (2)

## Operation

By pressing the **T/R** key during normal operation, the ER-10 will alternatively display the Flow Total or the Flow Rate. The Letter R on the left indicates that the Flow Rate is being displayed.

**Total Display:** Indicates the present count value, which is equal to the number of pulses received (since the last reset) multiplied by the Totalizer Scaler Value in Program mode #1.



**Rate Display:** Indicates the rate value, which is equal to the input frequency multiplied by the Rate Prescale Value in Program Mode #3. (If no pulses are received for 2 seconds, the rate value goes to zero.)



### Reset Key: **RST**

If the total value is being displayed, depressing this key will cause the value to be reset to 0 as long as program mode #7 is preset accordingly.

or

When the program input is active (see wiring) this key is used to select a menu item for editing.

**T/R** **Down Key:** Toggles the unit between the total and rate display. When the program input is active this key is used to scroll through the menu items. After a menu item has been chosen for editing, the down key is used to set the value for the currently selected (flashing) digit.

## Programming

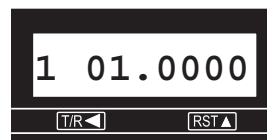
To enter the program mode, a connection must be made between terminals 1 and 5.

### Programming Screens

Press and hold the **T/R** key while repeatedly pressing the **RST** key to advance to successive screens.

Programming Screens	
Screen	Function
1	Totalizer Scale Factor
2	Totalizer Decimal Point
3	Rate Scale Factor
4	Rate Scale Factor Decimal Point
5	Rate x1/x10
6	Reset Key Enable/Disable

**Mode #1:** Is used to enter the count scale factor. The far right digit will be flashing. Press the **RST** key until reaching the desired digit value.



**NOTE:** pressing and holding the **RST** key will cause the numbers to autoscroll. Next press the **T/R** key to move the flashing digit one place to the left. Change this digit to the desired value with the **T/R** key. Repeat this process until all digits are set correctly. (Setting the count scale factor to 00.0000 will allow scaling by 100 in ER Series.)

**Mode #2:** Is used to enter the decimal point display on the totalizer screen. Press and hold the **T/R** key and then press the **RST** key to move from screen one to screen two. Press the **RST** key to move the decimal point to the desired position.



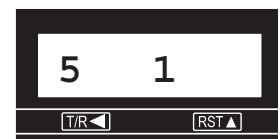
**Mode #3:** Allows the user to enter the rate scale factor. The lower case "d" appears on the right of the display when it is time to enter the decimal point position for the rate scaler. **NOTE:** This decimal point is used for the rate scaler only and will not appear on the ratemeter screen. Press the **RST** key to change the first digit to the correct value. Press the **T/R** key to select the next digit to be changed. Repeat this process until all the digits are correct. When the 'd' appears, press the **RST** key until the decimal point is in the desired location.



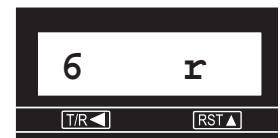
**Mode #4:** Is used to enter the decimal point position for the ratemeter run-mode display. The display will show the screen number (4) and four zero's. Press the **RST** key until the decimal point is in the correct position.



**Mode #5:** Is used to select the rate display multiplier of one or ten. Selecting rate x10 will add a zero to the far right of the display. This zero will not change value and does not affect the decimal point. The display will show the screen number (5) and a 1 at the right. Press the **RST** key to select 1 or 10.



**Mode #6:** Is used to determine whether the front panel reset key will function. The screen will show a number 6 on the left and an R on the right. Press the **RST** key to choose the option you want. (R - Reset, NoR - Non-Reset) **NOTE:** The reset terminal on the rear panel is still active when the front reset button is disabled. To exit the program mode, break the connection between terminals 1 and 5.



## ER-10/ER-10H Programming Calculations

### TOTALIZER PROGRAMMING

Totalizer values can be expressed in any engineering unit of measure such as gallons, quarts, liters, etc. For each unit a unique scale factor must be programmed.

To determine the **Totalizer Scale Factor** (Program Mode #1), use the following formula:

$$\text{Totalizer Scale Factor} = \frac{1}{(\text{Transmitter pulses per unit} \times \text{Decimal Factor})}$$

where:

**Transmitter Pulses per Unit** is the number from the chart at the right, or the Industrial Tech Brief (ITB) for your particular transmitter/meter combination. The chart is expressed in gallons and liters. If you wish to read in other units, use the appropriate conversion factor.

**Decimal Factor (from 1.0 to .001)** determines the resolution of the reading. If you wish to read to the nearest 1/10 unit, the Decimal Factor would be 0.1.

Example: You have a model 35 RCDL meter with a PFT2 transmitter that has a pulse output of 126.7 pulses per gallon. You wish to read the totalizer to the nearest tenth gallon.

$$1/(126.7 \times 0.1) = \mathbf{0.0789 \text{ (scale factor)}}$$

**Step #1:** Set the Totalizer Scale Factor to 00.0789. (Program Mode #1)

**Step #2:** Set the totalizer Decimal Point Factor to "00000.0" (one decimal place) (Program Mode #2).

### RATE OF FLOW PROGRAMMING

Rate of flow can be expressed in any engineering unit of measure for any time base such as gallons/minute, liters/second, barrels/hour, etc.

To determine the Rate Scale Factor (Program Mode #3), use the following formula:

$$\text{Rate Scale Factor} = \frac{\text{Seconds}}{(\text{Transmitter Pulses per Unit} \times \text{Decimal Factor})}$$

where:

**Seconds** is the number of seconds in the rate time unit. If you wish to read flow in units per minute, seconds would equal 60. If you wish to read flow in units per hour, seconds would equal 3600.

**Transmitter Pulses per Unit** is the number from the chart to the right or the Industrial Tech Brief (ITB) for your particular transmitter/meter combination. The chart is expressed in gallons and liters. If you wish to read in other units, use the appropriate conversion factor.

**Decimal Factor (from 1.0 to 0.001)** determines the resolution of the reading. If you wish to read the rate to the nearest 1/10 unit, the Decimal Factor should be 0.1.

Before you program the Rate Scale Factor, you must set the Rate Decimal Point position (Program Mode #4). This decimal point will correspond to the decimal in the Rate Scale Factor number.

Example: You have a model 35 RCDL meter with a PFT2 transmitter that has a pulse output of 126.7 pulses per gallon. You wish to read rate of flow in gallons per minute.

$$\begin{aligned} & (60 \text{ seconds} / 126.7 \text{ pulses per gallon} \times 1.0 \\ & = 60/126.7 = \mathbf{0.473 \text{ (rate scale factor)}} \end{aligned}$$

**Step #1:** Set the rate scale factor to 0.473 (Program mode #3).

**Step #2:** Since we are reading in whole gallons, set program mode #4 (Rate Decimal Point) to 0000.

**Step #3:** Since we are reading in whole gallons (no multiplier), set program mode #5 to 1.

Transmitter Pulses per Unit chart			
FT1	FT2		
PFT2	PFT3		
PFT2E	FT1E		
FT420	PFT420		

Size (Inches)	Meter Model	Gallons	Liters
1/2	OP	223.0	58.9
1/2	OP(FT1 only)	111.5	29.4
1	OP	76.6	20.2
2	OP	20.6	5.4
2	IND'L TURBO	* 17.36	* 4.6
3	IND'L TURBO	* 12.4	* 3.2
4	IND'L TURBO	* 2.56	* 0.6
6	IND'L TURBO	* 1.08	* 0.2
5/8	25 IND RCDL	198.4	52.4
3/4	35 IND RCDL	126.7	33.5
1	40 IND RCDL	89.8	23.7
1	70 IND RCDL	46.8	12.4
1 1/2	120 IND RCDL	23.8	6.3
2	170 IND RCDL	14.6	3.9
3	TSM METER	1.598	0.422

\*If using a PFT3E transmitter, multiply number by 2.

## Troubleshooting

PROBLEM	POSSIBLE CAUSES	REMEDIES
Screen is blank	1. Battery is dead.	1. Replace battery.
Will not count in totalizer mode	1. Improperly programmed. 2. Broken or defective wiring. 3. Improperly connected. 4. Transmitter defective.	1. Check programming. 2. Check wiring. 3. Check connections. 4. Repair or replace transmitter.
Will not indicate rate of flow	1. Improperly programmed. 2. Improperly connected. 3. Transmitter defective.	1. Check programming. 2. Check connections. 3. Repair or replace transmitter.
Cannot program	1. Program enable jumper is not installed or installed improperly.	1. Install jumper from Terminal #1 to #5.
Cannot reset from front panel	1. Reset enable is not programmed.	1. Reprogram mode #6 to "R."
Erroneous readings	1. Improperly programmed. 2. Defective transmitter.	1. Check programming. 2. Repair or replace transmitter.

For further assistance, call our Technical Support Staff at 1-877-243-1010.

## Field Calibration

Field calibration consists of determining the exact transmitter pulse output per unit of measure for your particular meter/transmitter combination and then using this value as the transmitter pulse output value when calculating the counter and time base values on page 4.

The procedure is as follows:

1. Set the totalizer scale factor to 01.0000. (MODE #1)
2. Set the totalizer Decimal Point to 000000. (MODE #2)
3. Reset the counter to "zero".
4. Run fluid into a weigh tank or calibrated vessel.
5. Determine number of pulses per gallon by dividing indicator reading by number of gallons of fluid in the vessel. Use this value for your calculations.

### Example:

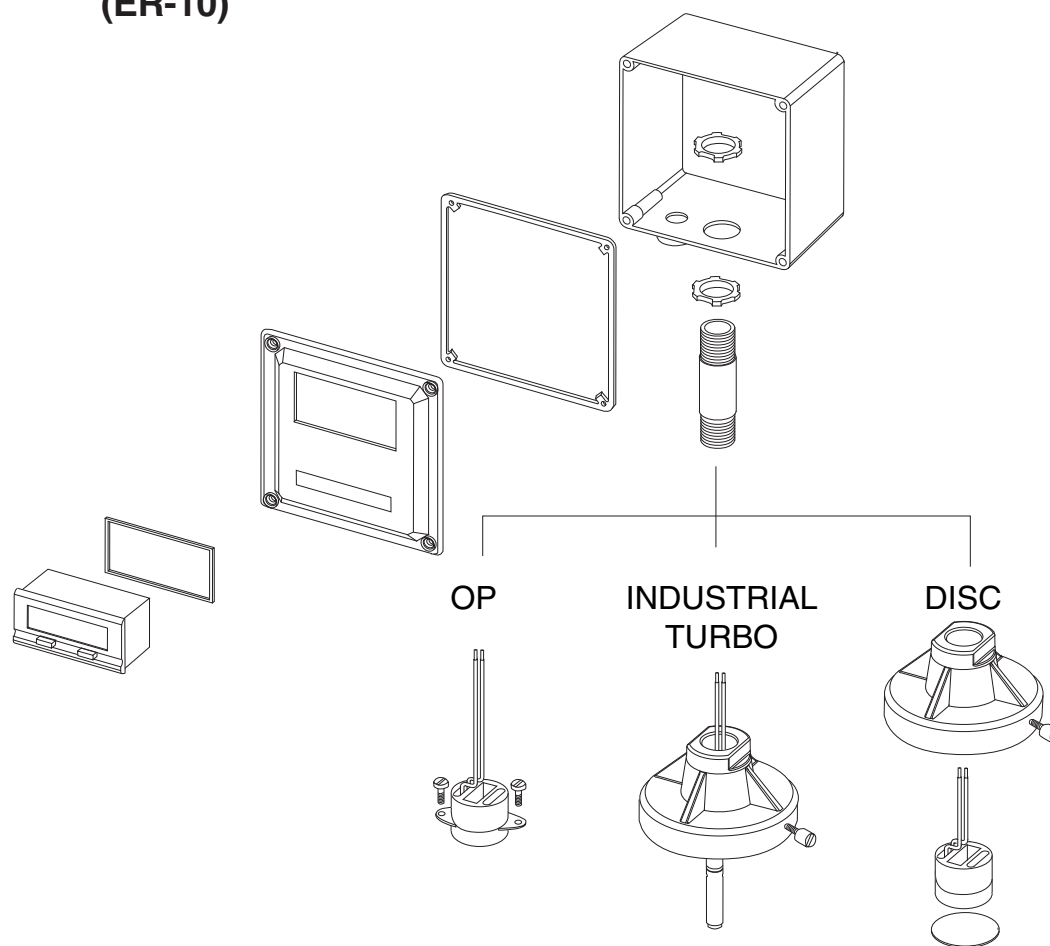
You programmed the indicator for calibration and connected the outlet of a 1" OP meter to a calibrated vessel. You opened the valve and allowed fluid to flow into the vessel. You determined that there was 22.35 gallons of fluid in the vessel. The reading on the indicator is 1720.

$$1720 / 22.35 = 76.95$$

The transmitter output is 76.95 pulses per gallon. Use 76.95 when calculating the Totalizer Scale Factor on page 5.



## METER MOUNT SURFACING (ER-10)



If replacement of your sensor pickup on your meter is required, please follow the following steps:

### **INDUSTRIAL TURBO METER**

1. Remove the front cover on the ER-10 unit and disconnect all wiring.
2. Remove meter head bolts and lift meter head assembly from housing.
3. Remove retaining ring which retains the accessory unit to the head.
4. Loosen the side seal screw on the accessory adapter, twist 90 degrees and pull entire assembly unit from the meter head.
5. Twist drop pipe in counterclockwise direction to remove it and the ER-10 unit from the adapter assembly.
6. Obtain new adapter assembly and reassemble to drop pipe and ER-10 unit.
7. Reverse the balance of the above steps.

3. Pull the reed switch pickup assembly and pad from adapter.
4. Replace pickup and pad in adapter, feeding wires up through the drop pipe.
5. Reposition entire assembly on meter.
6. Rewire sensor to ER-10 unit.

### **OP METER**

### **DISC METER**

1. Remove the front cover on the ER-10 unit and disconnect sensor wiring.
2. Loosen the side seal screw on the assembly adapter, twist 90 degrees and lift entire accessory unit off bare meter.

1. Remove the front cover on the ER-10 unit and disconnect sensor wiring.
2. Remove the back plate on the meter to expose the pickup assembly.
3. Remove the reed switch pickup assembly and replace.
4. Feed wires up through the drop pipe.
5. Reassembly the back plate in position.
6. Rewire sensor wires to ER-10 unit.

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Please see our website at  
**[www.badgermeter.com](http://www.badgermeter.com)**  
for specific contacts.

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