Badger Meter

Oval Gear
Industrial Meter and Register

IMPORTANT:
This manual contains important information.
READ AND KEEP FOR REFERENCE.

IOM-189-02 (10-11)

Installation & Operation Manual

CONTENTS

Scope of this Manual

This manual contains installation and operation instructions for the Badger Meter Industrial Line of Oval Gear Meters and Registers.

Proper performance and reliability of these meters and registers depends upon installation in accordance with these instructions.

Be sure to read all safety information beginning on page vi and throughout this manual.

Product Unpacking and Inspection

Upon receipt of the product, perform the following unpacking and inspection procedures:

Note: If there is damage to the shipping container, request the carrier to be present when unpacking the product.

Carefully open the shipping package and follow any instructions marked on the exterior. Remove all packing material and carefully lift the product from the package.

Retain the package and all packing material for possible use in reshipment or storage.

Visually inspect the product and applicable accessories for any physical damage such as scratches, loose or broken parts or any other sign of damage that may have occurred during shipment.

> **Note:** If you find damage, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier.

A claim for equipment damage in transit is the sole responsibility of the purchaser.

Product Identification

Record the product identification numbers from the nameplate.

Model #_____

Serial Number # _____

Tag # _____(if applicable)

Disclaimer

The user/purchaser is expected to read and understand the information provided in this manual, follow any listed safety precautions and instructions and keep this manual for future reference.

Misuse, mishandling and/or inadequate maintenance may impair performance and/or compromise safety.

Questions or Service Assistance

If you have questions regarding the product or this document contact:

Badger Meter, Inc.
P.O. Box 245036
Milwaukee, WI 53224-9536
Telephone: 414-355-0400, 800-876-3837
Fax: 888-371-5982
Web site: www.badgermeter.com
or call your local Badger Meter representative.

Safety

⚠WARNING

Explosion and Fire Hazards

- Improper grounding, poor ventilation, open flames or sparks can cause a hazardous condition and result in an explosion or fire and cause serious injury.
- Be sure the fluid system is properly grounded. See your pump instruction manual for details.
- If there is static sparking or if you feel an electric shock while using the meter, stop dispensing immediately. Identify and correct the problem before continuing.
- Provide fresh air ventilation. This will avoid the buildup of fumes from the fluid being dispensed.
- Do not smoke while dispensing flammable fluids.
- Keep the dispensing area free of debris including solvents, rags and spilled gasoline.

⚠WARNING

Meter Hazards

- Equipment misuse can cause the meter to rupture or malfunction and cause serious injury.
- This equipment is for professional use only.
- Read all instructions, tags and labels before operating the equipment.
- Use the equipment only for its intended purpose.
- Do NOT modify or alter the equipment.
- Do NOT leave equipment unattended while dispensing.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do NOT exceed the maximum working pressure level of the lowest rated system component.
- Use only extensions and nozzles that are designed for use with this equipment.
- Use only fluids and solvents that are compatible with the equipment. Read all fluid and solvent manufacturer's warnings.
- Tighten all fluid connections before operating this equipment.
- Do NOT stop or deflect leaks with hands, body, gloves or rags.
- Do NOT dispense towards any person or any part of the body.
- Do NOT place hands or fingers over the end of or into the dispense valve.
- Comply with all local, state and federal fire, electrical and safety regulations.
- Use of this product in a manner other than specified in this manual may result in impaired operation or damage to equipment.

These meters are designed to dispense a wide range of chemicals. Consult the factory for chemical compatibility.

Meter Installation

⚠CAUTION

READ THE FOLLOWING INFORMATION AND HAVE A THOROUGH UNDERSTANDING BEFORE PROCEEDING WITH METER INSTALLATION. ONLY QUALIFIED PERSONNEL SHOULD PERFORM METER INSTALLATION.

- Install a type 60 mesh strainer or Y or basket as close to the inlet side of the meter as possible. Strainers prevent dirt and other fluid contaminants from impeding meter performance. Strainers require periodic cleaning, as clogged strainers also impede meter performance. Contact your local representative for specific information, per your specific application.

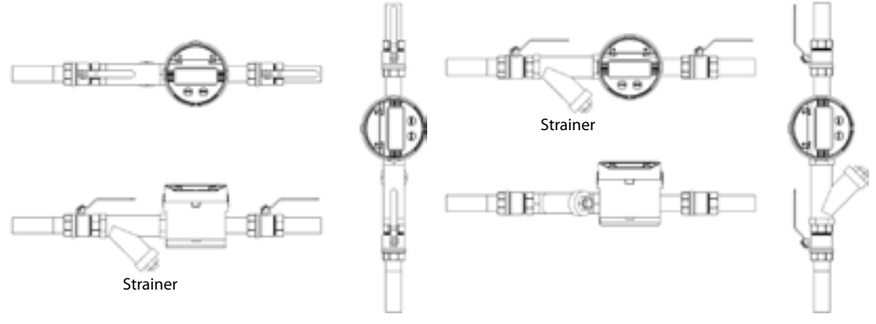

Figure 1: Meter Installation

- Turn off any associated pumps to reduce line pressure and slowly fill the line and meter with fluid before restarting pumps. Doing so reduces the possibility of meter damage caused by errant air pressures in the line and meter.
- Make sure all pipe conforms to the same pressure output rating as the pump.
- Make sure to apply thread sealant to all pipe threads.
- Install the meter along the meter shafts in a horizontal plane (see Figure 1).
- Check for and repair leaks upon initialization of fluid flow.

Meter Operation

Figure 2: Operation Depiction

Fluid enters the inlet port and then passes through the metering chamber. Inside the chamber, fluid forces the internal gears to rotate before exiting through the outlet port. Each rotation of the gears displaces a specific volume of fluid. As the gears rotate, a magnet on each end of the gear pass a reed switch in the top-mounted register's circuit board. The reed switches send pulses to the microprocessor in the register to change the LED display segments.

Upon initialization and continuation of fluids through the line and meter, the expected pressures per flow are:

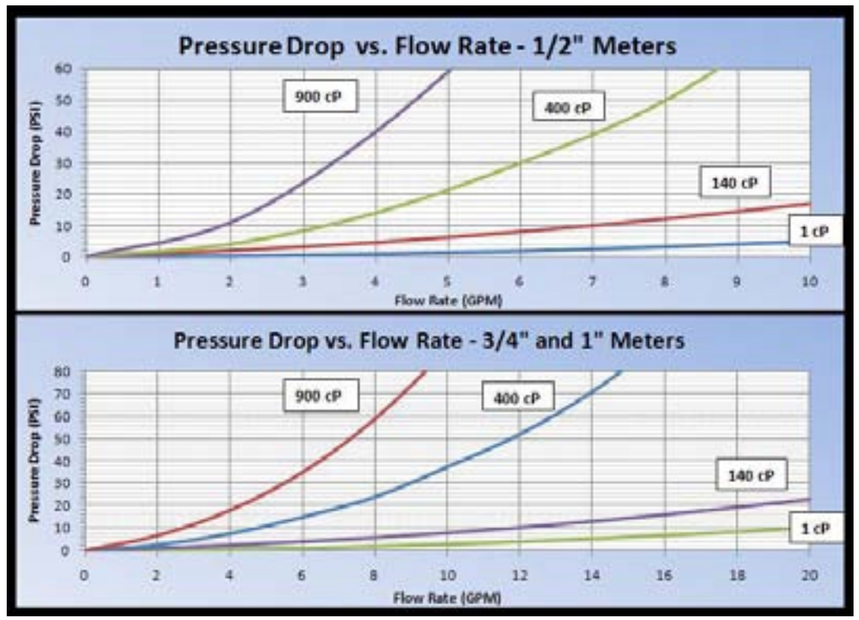

Figure 3: Pressure Drop vs. Flow

Register Operation

The following describes register operation and program settings for all four Industrial Oval Gear (IOG) Series registers: Industrial Standard (ILR 700), Industrial Pulse (ILR 710), Industrial Quadrature/Dual Pulse (ILR 720) and Industrial Analog (ILR 730). See ""Additional Programming: Industrial Analog and Industrial Pulse (ILR 710 & ILR 730)" on page 14. The Pulse Transmitter (ILR 740) wiring is indicated on page 20.

The register display consists of two rows of seven-segment digits, status, unit of measures, flow rate and battery indicators. Operating function settings and programming are provided using the **TOTAL** and **RESET** buttons.

Figure 4: Register Display and Buttons

Normal Operation

(for models ILR 700, 710, 720 and 730)

To enter normal operation mode - when the screen is blank after exiting programming mode or upon initial use:

1. Press either the TOTAL or RESET button once.

Status

The status indicators are RESET and TOTAL.

Totalizers

The top row of indicators is the Batch Totalizer. This Totalizer displays the cumulative volume of flow through the meter with six digits. The Batch Totalizer totalizes in selected units of measure.

To reset the Batch Totalizer:

1. After 2 seconds of no flow, press and release the RESET button.

Note: For the ILR 720 model only, the Batch Totalizer can be reset by a low pulse on the external reset input.

The bottom row of indicators display the Resettable Totalizer with five digits or the five least significant digits of the Non-Resettable Totalizer. RESET and TOTAL is indicated when the Resettable total is displayed in the five-digit lower row. Only TOTAL is indicated when the non-Resettable total is displayed.

To toggle between the Non-Resettable totalizer and the Resettable Totalizer:

1. Press and release the TOTAL button.

To display 11-digit Non-Resettable Totalizer:

1. While the Non-Resettable total is displayed, press and hold the TOTAL button for 2 seconds. The top row displays the 6 most significant digits; the bottom row displays five least significant digits.

Note: The Non-Resettable Totalizer normally displays 5 least significant digits.

Flow Rate

PER MIN is displayed in conjunction with the unit of measure. All flow rates are calculated in volume unit per minute.

Battery

The "LBat" indicator will indicate when the battery is approaching end of life. When the indicator is illuminated, the 2/3AA, 3.0 VDC lithium battery is drained to 10% of its total capacity and should be changed. Normal battery life is four years. "Normal" assumes operating conditions of an ambient temperature of 25°C (77° F) and a throughput of 60,000 liters (15,850 gallons, 63,400 quarts, 126,800 pints (US)).

Note: A 2/3AA, 3.6 VDC battery may also be used as a replacement.

Figure 5: Low Battery Indicator

Checksum

(To display the firmware checksum:

1. Press and hold the RESET button for three seconds. To return to normal display, release the RESET button.

Display Scale Factor

To display the Scale Factor:

1. At the same time, press and hold the TOTAL and RESET buttons for two seconds to display the programmed scale factor. To return to the normal display, release both buttons.

Register Programming

In programming mode only, pressing and releasing the **TOTAL** button advances to the next parameter on the current screen. Pressing and releasing the **RESET** button changes the current flashing selection to another selection (such as "L" to "GAL").

To enter the programming mode:

1. Press the TOTAL button three times and then press the RESET button three times (the time lag between pressing both buttons six times must be within two seconds).

Changing the Unit of Measure and Scale Factor

(for models ILR 700, 710, 720 and 730)

Unit of Measure

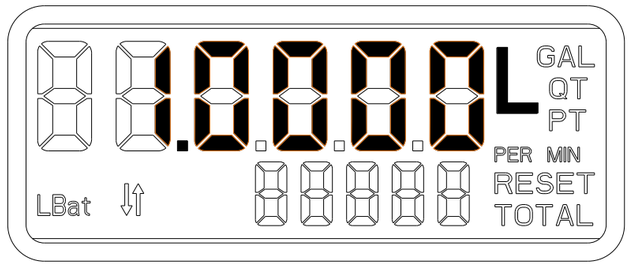

Figure 6: Unit of Measure & Scale Factor Programming

1. Press and release the RESET button to change the unit of measure (L, GAL, QT, PT).
2. Press and release the TOTAL button to select desired the unit of measure (the selected unit of measure will flash).
3. When the appropriate unit of measure is selected, press the TOTAL button to advance to the scale factor programming.

Scale Factor

(for models ILR 700, 710, 720 and 730)

The register collects input pulses from the oval gear meter and then determines the appropriate display output using the scale factor. This scale factor varies depending upon the viscosity of the liquid being measured, therefore calibrating the meter and register in the appropriate liquid will affect the scale factor. The scale factor is displayed as 5 digits (on the top row) next to the unit of measure. The scale factor consists of 1 integer digit and 4 decimal digits (see Figure 6).

1. Press the **TOTAL** button to select a digit (selected digits flash). After cycling through all 5 digits of the scale factor, the register will return to the unit of measure selection.
2. Press **RESET** to change the selected digit. The scale factor must fall between the values of 0.5000 and 2.0000. The Badger Meter factory preset is set between those values at 1.0000.
3. When finished adjusting the unit of measure and scale factor, press and hold the **TOTAL** button for one second to advance to the Pulse Rate section.

Note: Error checking will not allow the user to advance to the next screen.

Changing the Meter Pulse Rate

(for models ILR 700, 710, 720 and 730)

The meter pulse rate (screen is indicated by the "I" on the top row, on the left side) is the number of pulses per unit of measure as detected by the register. The pulse rate varies according to the type of attached meter. The bottom row consists of the 5-digit integer value of the meter pulse rate, whereas the top row consists of the 2-digit decimal value of the meter pulse rate.

The meter pulse rate is entered in pulses per liter if the selected unit of measure is liters. The meter pulse rate is entered in pulses per gallon if the selected unit of measure is gallons, quarts or pints.

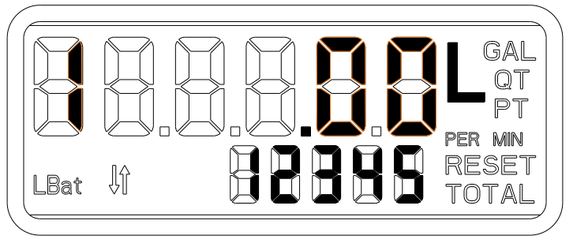

Figure 7: Meter Pulse Rate

Note: The pulses per unit of measure data is available on page 20 of the ER420 Register manual IOM-160-02.

1. Press the **TOTAL** button to select a digit (selected digits flash). Press RESET to change the selected digit. The pulse rate can be any value between 00000.01 and 99999.99 on the top row; integer values are displayed on the bottom row. Example: 10.45 would display .45 on the top row and 10 would be displayed on the bottom row.
2. When finished adjusting the pulse rate, press and hold the **TOTAL** button for one second to advance to the Register Orientation section.

Note: Error checking will not allow the user to advance to the next screen.

Changing the Register Orientation

(for models ILR 700, 710, 720 and 730)

Depending on the orientation (perpendicular or inline on the meter); this setting may need to be changed.

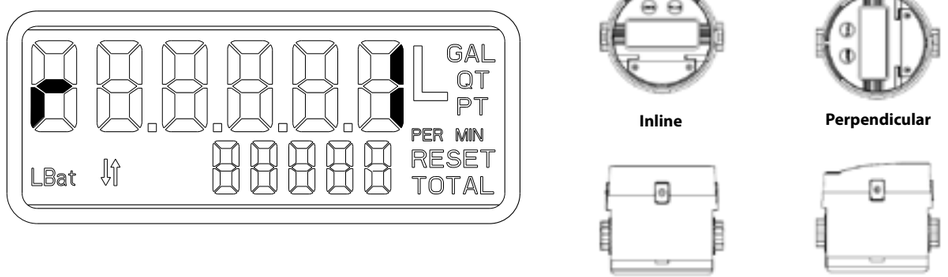

Figure 8: Register Orientation

1. Press the RESET button to toggle between available options ("I, for an inline-to-flow orientation and "P" for a perpendicular-to-flow orientation).
2. When finished adjusting the register orientation, press and hold the TOTAL button for one second to advance to the Default Display section.

Changing the Display Mode

(for models ILR 700, 710, 720 and 730)

The display mode screen (indicated by a "d" on the top row, on the left side) determines the information displayed on the top line of the register during normal operation. The display mode may be either the Totalizer screen or the Flow Rate screen.

"C," indicates the Totalizer screen and "F" indicates the Flow Rate screen. The Totalizer screen is depicted below:

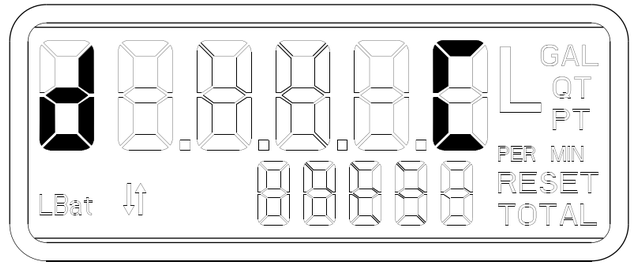

Figure 9: Default Display

1. While a letter is flashing on the display, press the **RESET** button to select either Totalizer or Flow Rate.
2. Upon completion of this setting, the programming the Industrial Standard Register and the Industrial Dual Pulse Output is complete. for ILR 710 and ILR 730 models, see additional programming parameters.

Note: For ILR 710 and ILR 730 models, see "Additional Programming: Industrial Analog and Industrial Pulse (ILR 710 & ILR 730)" on page 14.

Exiting Programming Mode

(for models ILR 700, 710, 720 and 730)

To exit the programing mode:

1. On any screen, press and hold the both the TOTAL and RESET buttons. The screen will revert back to the programmed scale factor and then flash. Following the three flashes, the register display will be blank.

Note: Pressing the TOTAL or RESET buttons wil turn the display back on.

Additional Programming: Industrial Analog and Industrial Pulse (ILR 710 & ILR 730)

Output Pulse Length

(for models ILR 710 only)

Indicated by a "P" on the left hand side of the display, this screen allows the selection of the low duration of the output pulse.

- "0" for zero milliseconds (Pulse Output is disabled)
- "2" for 2 milliseconds
- "10" for 10 milliseconds
- "20" for 20 milliseconds
- "40" for 40 milliseconds
- "100" for 100 milliseconds

To advance to the next programming screen, hold the **TOTAL** button.

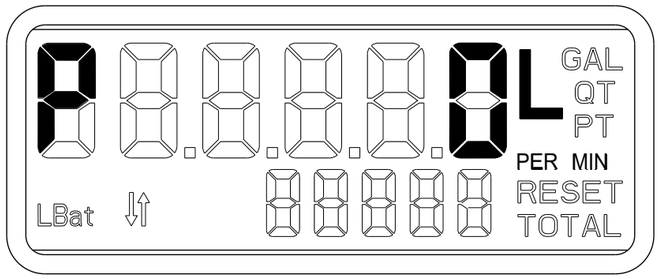

Figure 10: Output Pulse Length Screen

About Output Pulse Length: The pulse rate duration should take into account the "Pulse Rate Out" and maximum meter flow rate, to prevent an output pulse duration greater than the required time between pulses. The Output Pulse Length should be set to less than the value of "t."

Per the equation:

$$t = \frac{\text{Maximum Meter Flow Rate (in GPM or LPM)}}{60X \text{ Output Pulse Rate}} \times 1000$$

where t = the required pulse rate in milliseconds.

The Output Pulse Rate = the programmed parameter (default = 1.00 PPL/PPG)

The Maximum Meter Flow Rate = the maximum flow rate of the meter for the application.

Pulse Rate Out

(for model ILR 710 only)

Indicated by an "o" on the left hand side of the display, this screen allows selection of the of pulses output per liter or per gallon depending on unit of measure (0.01 PPL/PPG to 100 PPL/PPG).

The meter pulse rate is entered in pulses per liter if the selected unit of measure is liters. The meter pulse rate is entered in pulses per gallon if the selected unit of measure is gallons, quarts or pints.

To advance to the next programming screen, hold the **TOTAL** button.

Note: Error checking will not allow the user to advance to the next screen.

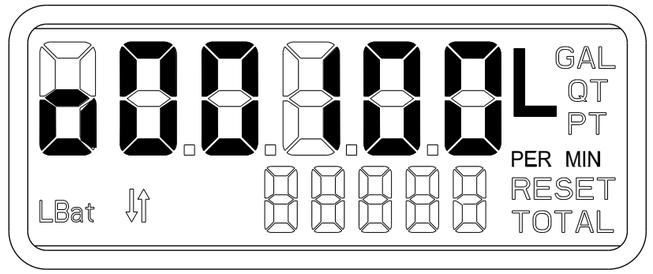

Figure 11: Pulse Rate Out Screen

Analog Minimum Flow Rate

(for models ILR 730 only)

Indicated by a "L" on the left hand side of the display, this screen allows the setting of the flow rate that corresponds to the 4mA output:

Note: The minimum flow rate value must be less that the maximum flow rate value.

- Minimum 0.0 LPM/GPM
- Maximum 100.0 LPM/GPM
- Default 0.0 LPM/GPM

Note: Error checking will not allow the user to advance to the next screen.

To advance to the next programming screen, hold the **TOTAL** button for one second.

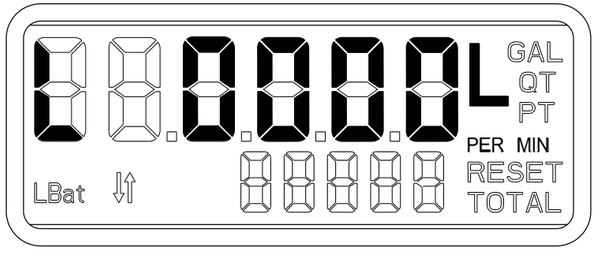

Figure 12: Analog Minimum Flow Rate Screen

Analog Maximum Flow Rate (for models ILR 730 only)

Indicated by a "H" on the left hand side of the display, this screen allows the setting of the flow rate that corresponds to the 20mA output:

Note: The maximum flow rate value must be greater than the minimum flow rate value.

- Minimum 0.0 LPM/GPM
- Maximum 100.0 LPM/GPM
- Default 30 LPM / 8 GPM

To advance to the next programming screen, hold the **TOTAL** button.

Note: Error checking will not allow the user to advance to the next screen.

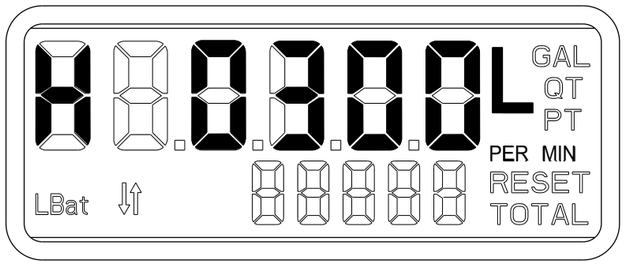

Figure 13: Analog Maximum Flow Rate Screen

Register Output Specifications & Wiring

Pulse (model ILR 710)

Register Wiring

External DC+: Yellow

External Ground: Brown

Pulse Output: White

DC Input: 6 to 24 VDC; 10 to 20mA

Outputs: Pulse Output with internal pull-up resistor; optional open collector output with output jumper removal; pulse output is scalable in pulses per liter or pulses per gallon.

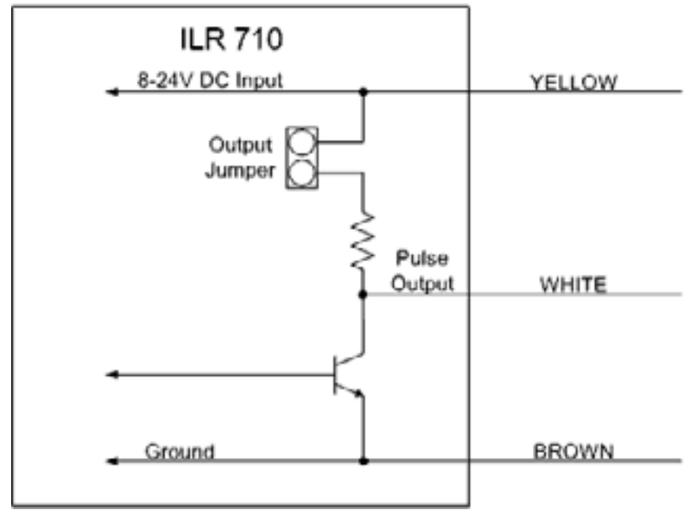

Figure 14: LR 710 Wiring

Dual Pulse (model ILR 720)

Register Wiring

External DC+: Yellow

External Ground: Brown

Pulse Output 1: White

Pulse Output 2: Green

External Reset: Grey

DC Input: 6 to 24 VDC; 10 to 20mA

Outputs: Dual-pulse output with internal pull-up resistor; optional open collector output with output jumper removed; dual pulse output forms a quadrature signal for direction of flow.

Inputs: External reset pulled low to reset the batch totalizer.

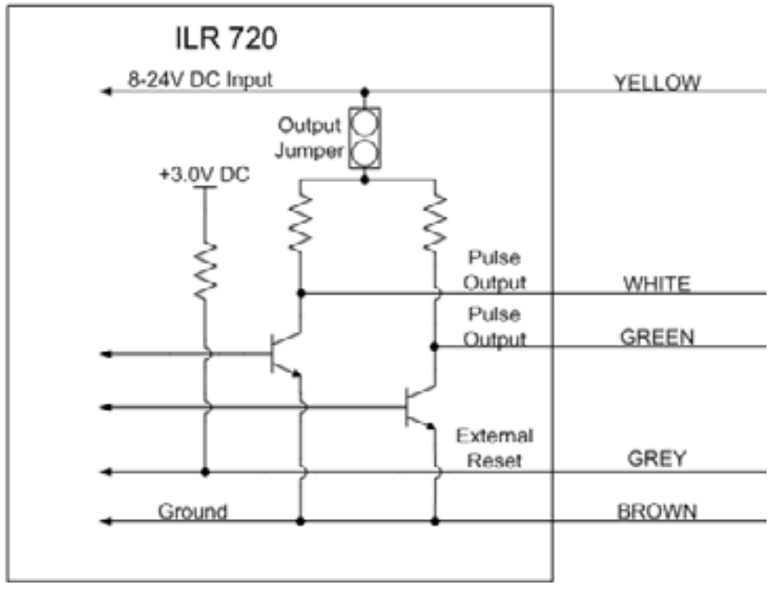

Figure 15: ILR 720 Wiring

Analog (model ILR 730)

Register Wiring

External DC+: Yellow

External Ground: Brown

Analog Output: White

DC Input: 6 to 24 VDC; 10 to 20mA

Outputs: Analog 4 to 20mA output in loop powered configuration; external load of 50 ohms to 250 ohms; flow rate is linear scaled between 4mA minimum and 20mA maximum set points; flow rates below programmed minimum read 4mA.

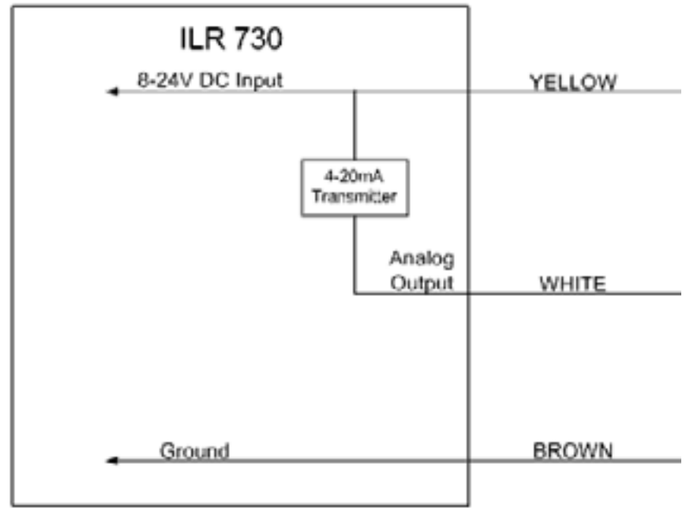

Figure 16: ILR 730 Wiring

Pulse Transmitter (model ILR 740)

Figure 17: Pulse Transmitter

Orientation: The register must be mounted as shown above (mounted in-line with the flow) with the flow going left to right or right to left as shown on this page. The transmitter will not function if mounted perpendicular to the flow.

Transmitter Wiring

Reed switch outputs: Green and white.

Ratings:

Maximum Power:	10 watts
Maximum Voltage:	200 VDC / peak AC
Maximum Current:	0.5 A DC / peak AC

Outputs: Raw reed switch output with no signal conditioning.

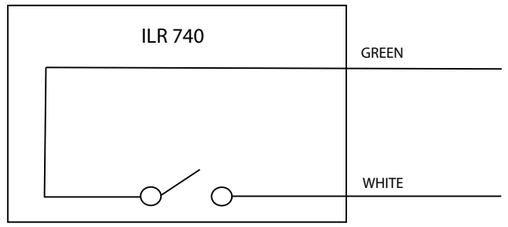

Figure 18: ILR 740 Wiring

Pulse per unit of measure

Meter Size	Liter	Quart	Gallon
1-1/2 inch	100.00	95.00	380.00
3/4 inch	67.00	63.00	253.00
1 inch	67.00	63.00	253.00

Note: Actual pulses per unit of measure are listed on the certificate provided with the meter.

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Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding contractual obligation exists.

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