Oval Gear
Industrial Oval Gear Flow Meters

Industrial Oval Gear

Meters and Registers

Badger Meter

IOG-UM-03384-EN-04 (November 2022)

User Manual

CONTENTS

⚠DANGER Indicates a hazardous situation, which, if not avoided, will result in death or serious personal injury.

⚠WARNING Indicates a hazardous situation, which, if not avoided, could result in death or serious personal injury.

⚠CAUTION Indicates a hazardous situation, which, if not avoided, could result in minor or moderate personal injury or damage to property.

BASIC SAFETY RECOMMENDATIONS

Before installing or using this product, please read this instruction manual thoroughly. Only qualified personnel should install and/or repair this product. If a fault appears, contact your distributor.

Before the first installation

Please flush the meter with fresh water or the medium to measure before the first installation.

Installation

Do not place any unit on an unstable surface that may allow it to fall.
Never place the units above a radiator or heating unit.
Route all cabling away from potential hazards.
Isolate from the mains before removing any covers.

Power connection

Use only the type of power source suitable for electronic equipment. If in doubt, contact your distributor. Ensure that any power cables are of a sufficiently high current rating.
All units must be earthed to eliminate risk of electric shock.
Failure to properly earth a unit may cause damage to that unit or data stored within it.

Protection class

The device has protection class IP 65 and needs to be protected against dripping water, water, oils, etc.

Setup & operation

Adjust only those controls that are covered by the operating instructions. Improper adjustment of other controls may result in damage, incorrect operation or loss of data.

Cleaning

Switch off all units and isolate from mains before cleaning.

Clean using a damp cloth. Do not use liquid or aerosol cleaners.

Repair of faults

Disconnect all units from power supply and have it repaired by a qualified service person if any of the following occurs:

- If any power cord or plug is damaged or frayed
- If a unit does not operate normally when operating instructions are followed
- If a unit exposed to rain/water or if any liquid has been spilled into it
- If a unit has been dropped or damaged
- If a unit shows a change in performance, indicating a need for service.

⚠DANGER Failure to adhere to these safety instructions may result in damage to the product or serious bodily injury.

RoHs

Our products are RoHs compliant.

Battery disposal

The batteries contained in our products need to be disposed of as per your local legislation acc. to EU directive 2006/66/EG.

Requirements for use in hazardous areas:

- Reed switch: Connection to intrinsically safe electric circuit (simple electrical equipment must be operated intrinsically safe with a suitable barrier according to EN 60079-11).
- Equipotential bonding has to be ensured upon the pipe system.
- Meters with plastic housing: do not clean the meters with a dry cloth as this would cause electrostatic charge.
- The fluid conductivity must be higher than 1000 pico/Siemens/meter to avoid electrostatic charges.

⚠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 build-up 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.

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

PRODUCTION 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, lose 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.

PRODUCTION 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 of this document contact:

Badger Meter, Inc.
P.O. 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

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 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.

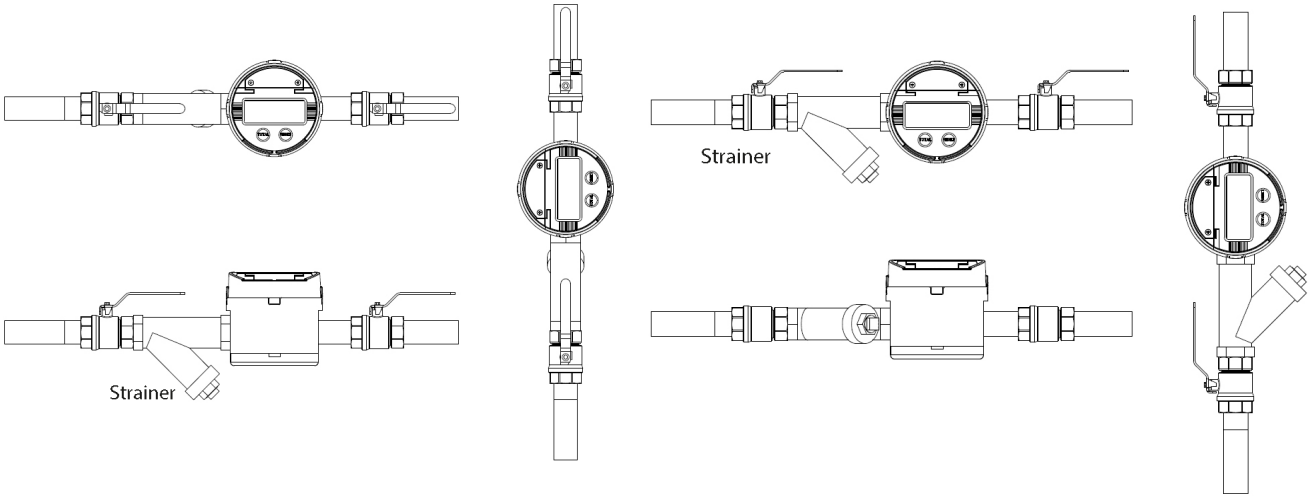


Figure 1: Meter installation

- 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.
- Make sure to install the meter as shown in *"Figure 1"*.
- Check for and repair leaks upon initialization of fluid flow.
- Max. torque for meters with PVC housing is 8 Nm!

RECOMMENDED FILTER SIZES

	Filter / Pore size (in mesh)	Filter / Pore size (in mm)
1/4"	200	0.08
1/2"	60	0.250
3/4"	60	0.250
1"	60	0.250
1 1/2"	60	0.250
2"	60	0.250
3"	40	0.4

METER OPERATION

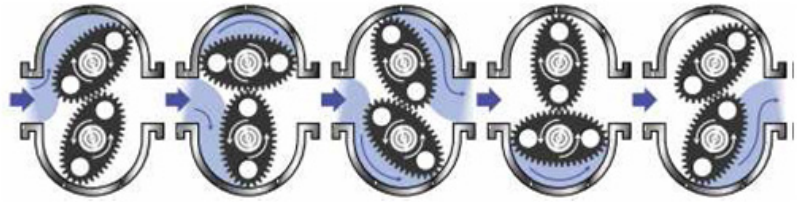
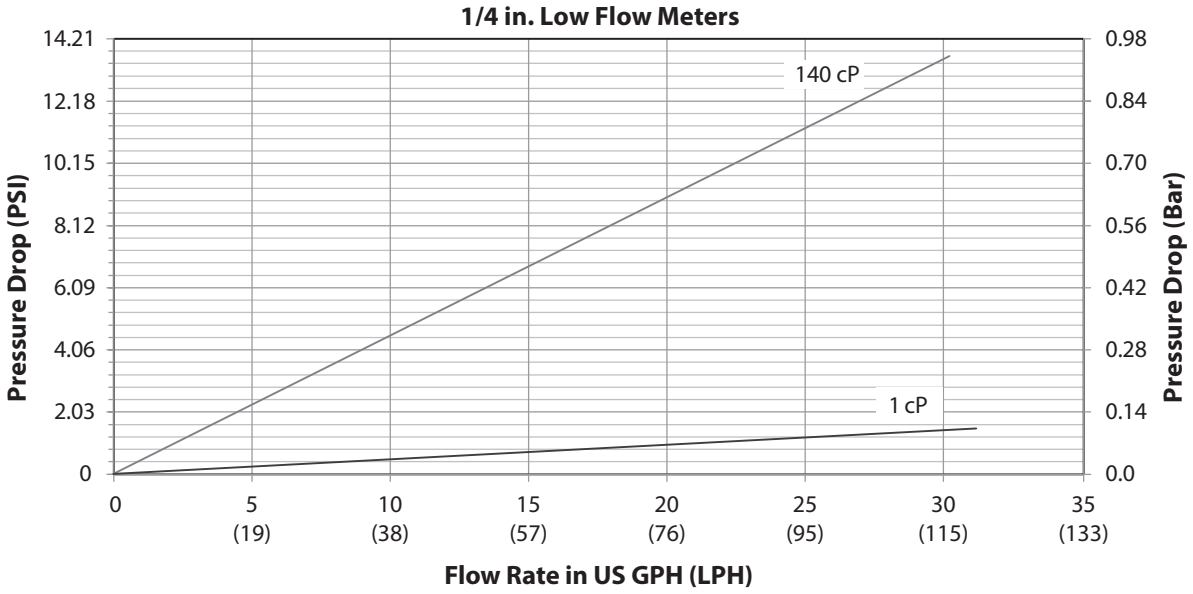
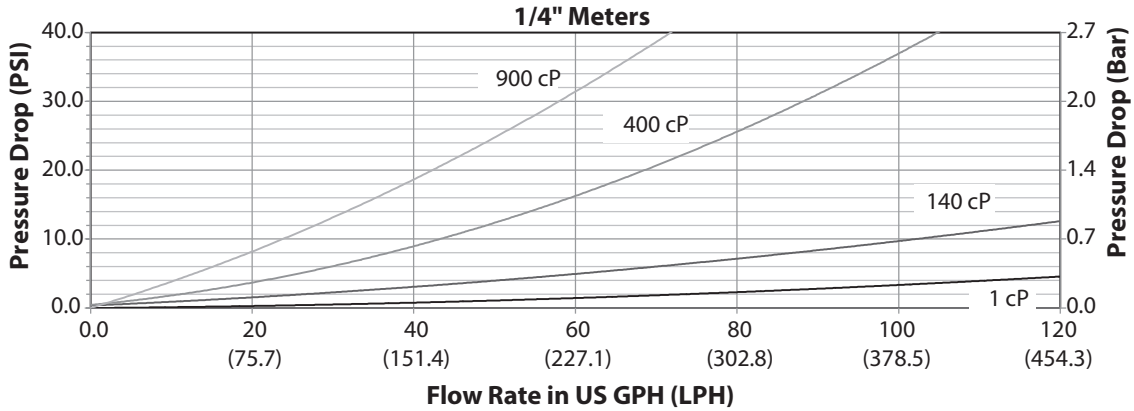


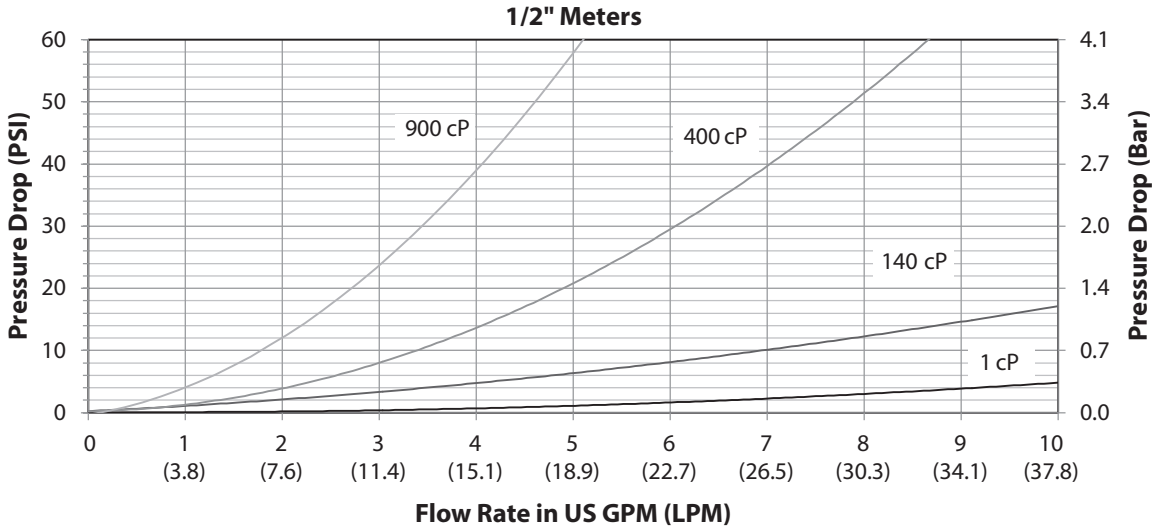
Figure 2: Operation deciption

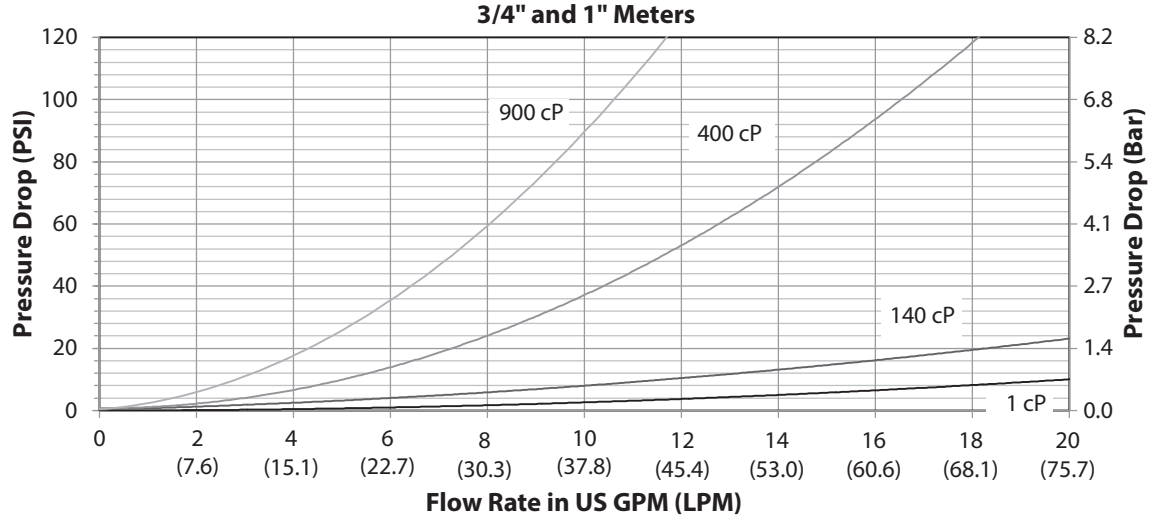
Fluid enters the inlet port and then passes through the metering chamber. Inside the chamber, fluid forces the internal gears to rotate before exiting through the outlet port. Each rotation of the gears displaces a specific volume of fluid. As the gears rotate, a magnet on each end of the gear pass a 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.

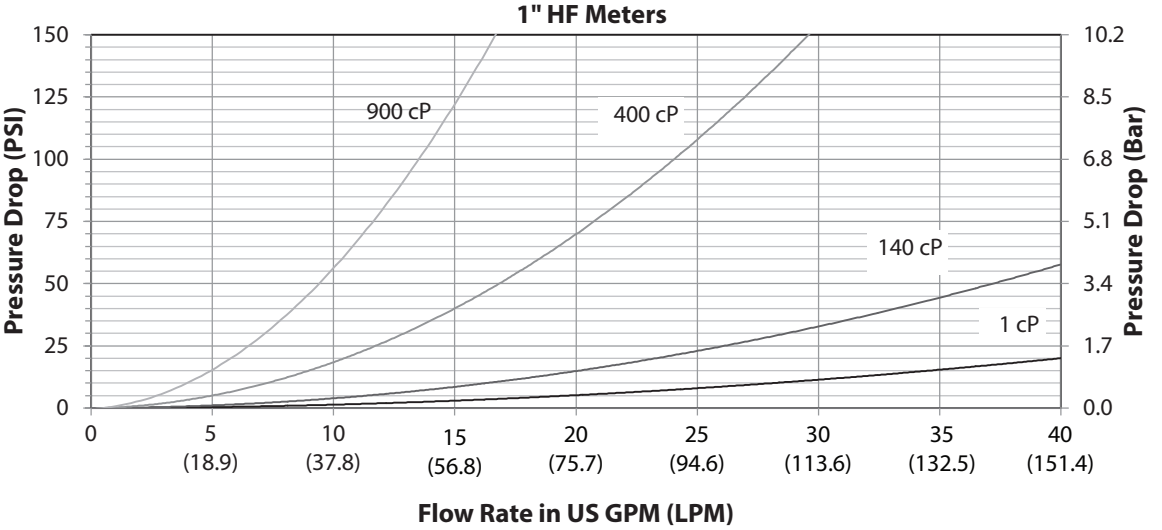
Upon initialization and continuation of fluids through the line and meter, the expected pressures are:






1/2" Meters
Pressure Drop (PSI)
Pressure Drop (Bar)
900 cP
400 cP
140 cP
1 cP
0
10
20
30
40
50
60
0.0
0.7
1.4
2.0
2.7
3.4
4.1
0
1 (3.8)
2 (7.6)
3 (11.4)
4 (15.1)
5 (18.9)
6 (22.7)
7 (26.5)
8 (30.3)
9 (34.1)
10 (37.8)
Flow Rate in US GPM (LPM)


3/4" and 1" Meters
Pressure Drop (PSI)
Pressure Drop (Bar)
900 cP
400 cP
140 cP
1 cP
0
20
40
60
80
100
120
0.0
1.4
2.7
4.1
5.4
6.8
8.2
0
2 (7.6)
4 (15.1)
6 (22.7)
8 (30.3)
10 (37.8)
12 (45.4)
14 (53.0)
16 (60.6)
18 (68.1)
20 (75.7)
Flow Rate in US GPM (LPM)


1" HF Meters
Pressure Drop (PSI)
Pressure Drop (Bar)
900 cP
400 cP
140 cP
1 cP
0
25
50
75
100
125
150
0.0
1.7
3.4
5.1
6.8
8.5
10.2
0
5 (18.9)
10 (37.8)
15 (56.8)
20 (75.7)
25 (94.6)
30 (113.6)
35 (132.5)
40 (151.4)
Flow Rate in US GPM (LPM)

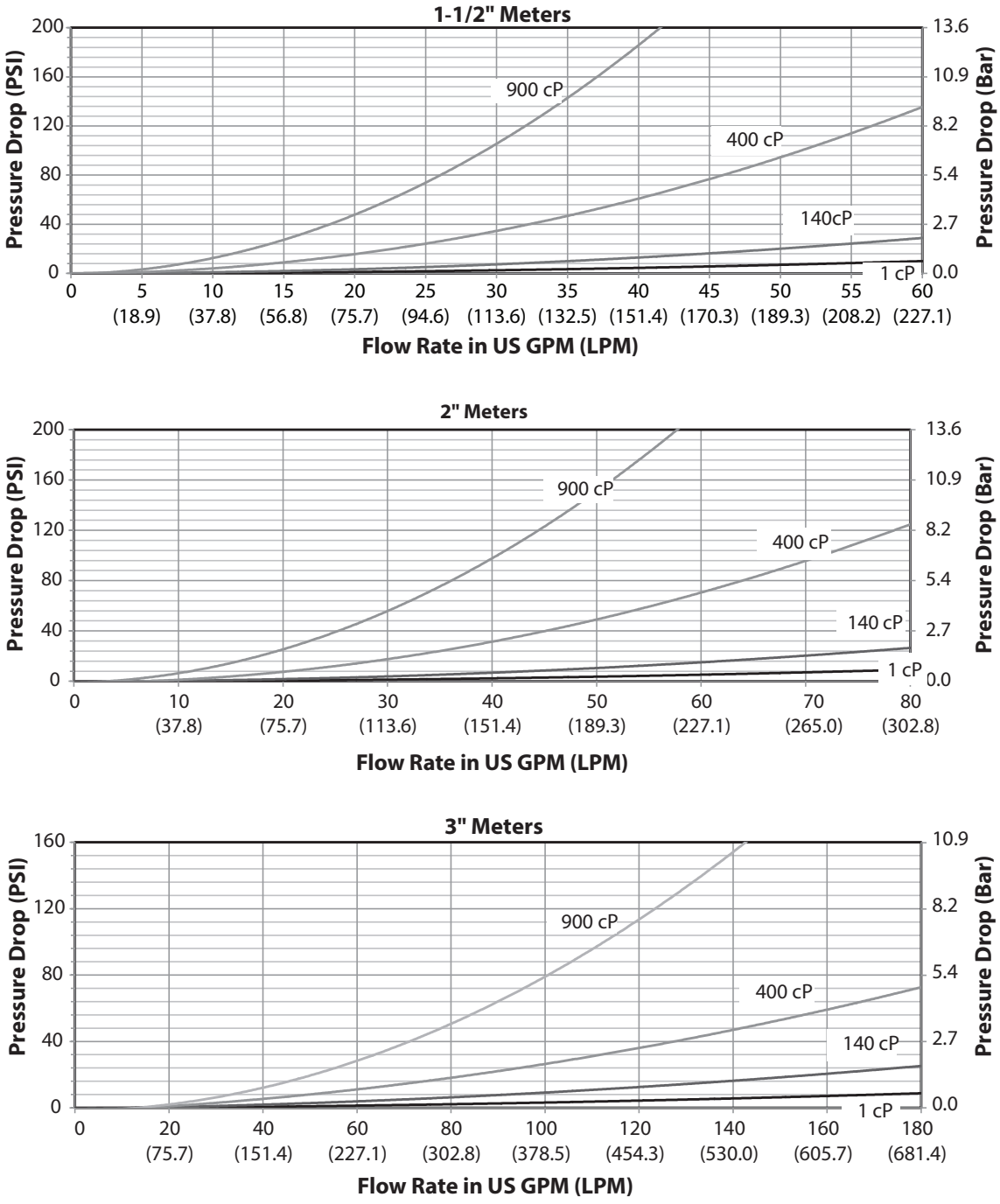


Figure 3: Pressure drop vs. flow

REGISTER OPERATION

The following describes register operation and program settings for the industrial oval gear series registers: Industrial Standard (ILR 700 / 701 / 701T), Industrial Pulse and the Industrial Analogue (ILR 750 / 750T).

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 button

Normal operation

(for models ILR 7XX)

To enter normal operation mode- when the screen is blank after exiting programming mode, or upon initial use, press either the **TOTAL** or **RESET** once.

Status

The status indicators are **TOTAL** and **RESET**.

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*, after 2 seconds of no flow, press and release the **RESET** button.

The bottom row of indicators displays 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*, press and release the **TOTAL** button.

To reset the *Resettable Totalizer*, press and hold the **TOTAL** button and then press and release the **RESET** button.

To display 11-digit *Non-Resettable Totalizer*, while the *Non-Resettable total* is displayed, press and hold the **TOTAL** button for 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 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 CR123A, 3.0 VDC lithium battery is drained to 10% of its total capacity and should be changed. Normal battery life is five years.

"Normal" assumes oparation conditions of an ambient temperature of 77° F (25° C) and a throughput of 15,850 gallons (60,000 liters, 63,400 quarts, 126,800 pints (US)).

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

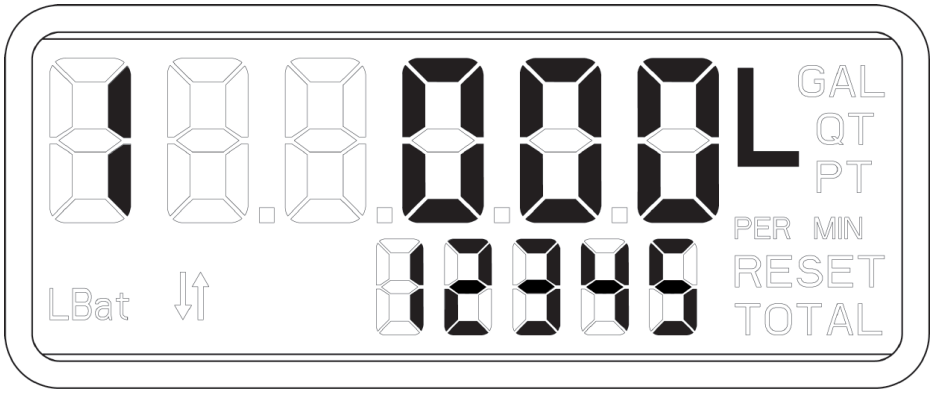


Figure 5: Low battery indicator

Checksum

To display the firmware checksum, 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:

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

To enter the programming mode, 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):

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").

3x TOTAL then 3x RESET (Keys must be pressed quickly one after the other!)

The menu can only be opened if no flow is currently detected.

Changing the unit of measure

(for all ILR models with display)

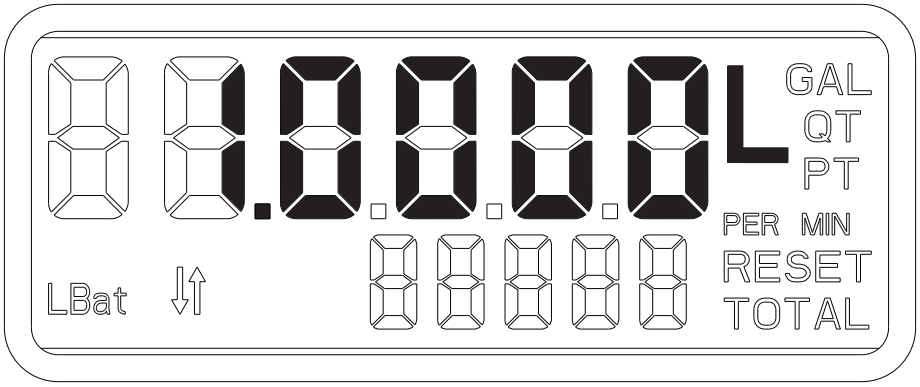


Figure 6: Unit of measure & scale factor programming

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.

Changing the scale factor#

(for all ILR models with display)

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 on page 14*).

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 all ILR models with display)

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 US-gallons, quarts or pints.

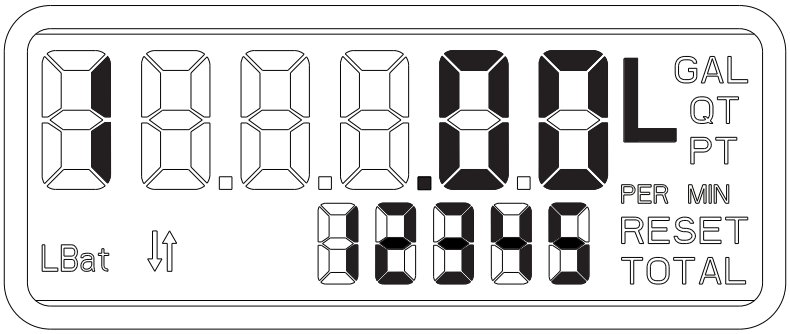


Figure 7: Meter pulse rate

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 all ILR models with display)

Depending on the orientation perpendicular or inline on the meter. For remote version, this will be set to "o".

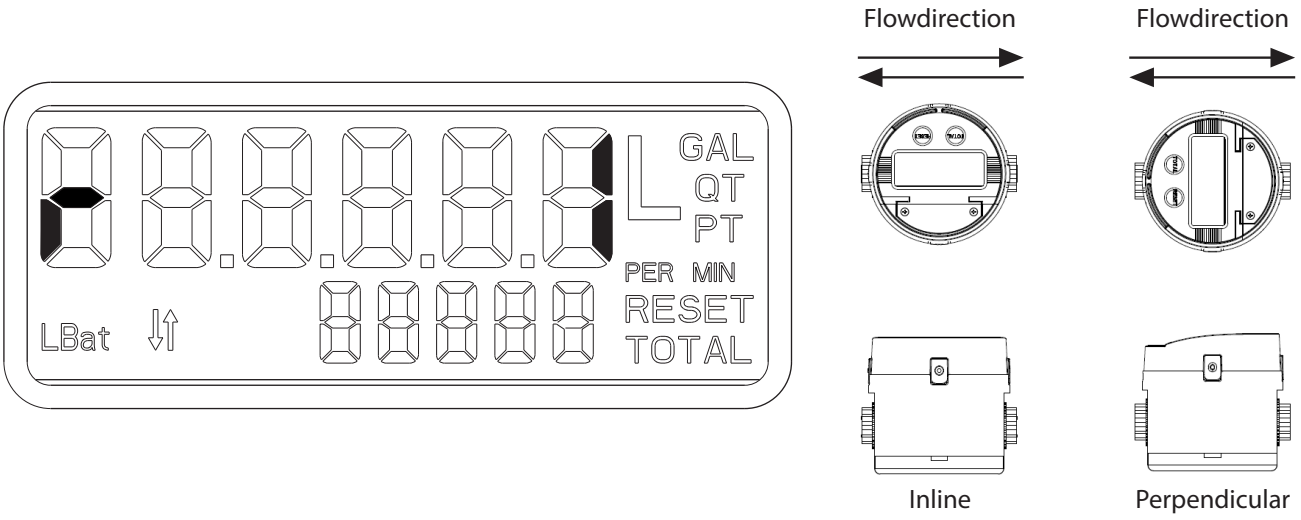


Figure 8: Register orientation

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 or "O" for Remote versions and for the RCDL-nutating disc meters and the Vision turbine meters).
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 all ILR models with display)

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:

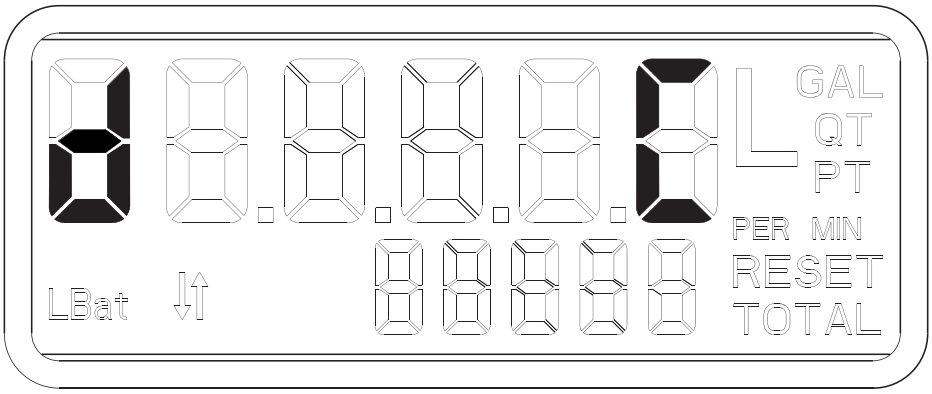


Figure 9: Default display

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 of the industrial standard register and the industrial dual pulse output is complete. For ILR701, ILR701T, ILR750 and ILR750T models, see additional programming parameters.

Exiting programming mode

(for all ILR models with display)

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 will turn the display back on.

ADDITIONAL PROGRAMMING: INDUSTRIAL ANALOG AND INDUSTRIAL PULSE (ILR750, ILR750T, ILR701, ILR701T)

Analog minimum flow rate

(for models ILR750 and ILR750T)

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.

- 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.

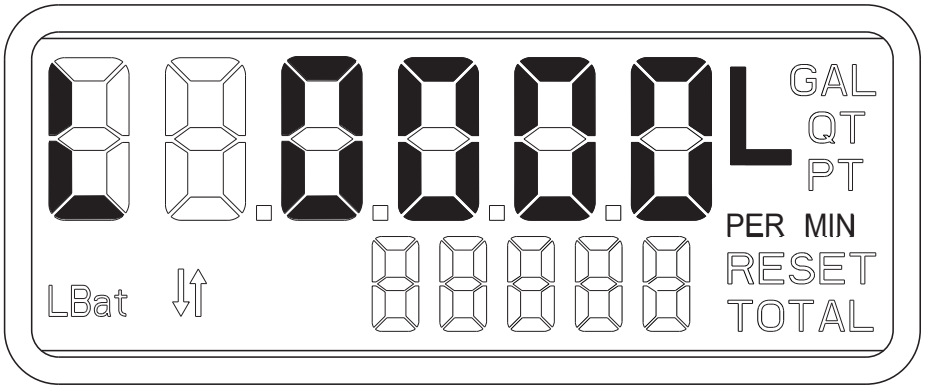


Figure 10: Analog minimum flow rate screen

Analog maximum flow rate

(for models ILR750 and ILR750T)

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.

- 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.

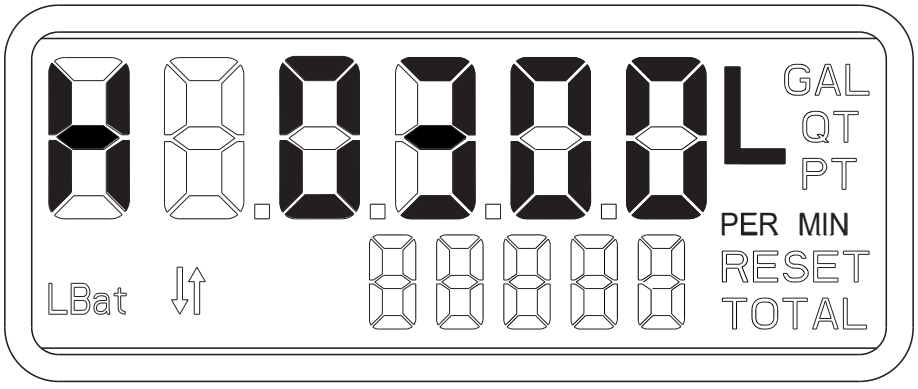


Figure 11: Analog maximum flow rate screen

Output pulse length

(for models ILR750 and ILR750T)

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.

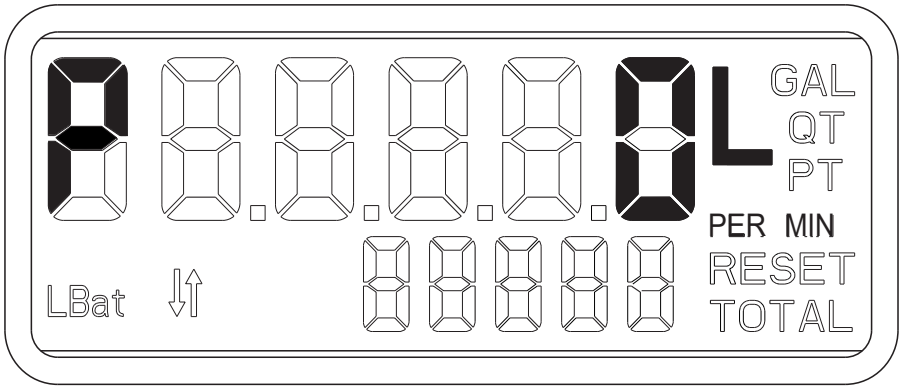


Figure 12: Output pulse length screen

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:

$$t = \frac{60 \times \text{output pulse rate}}{\text{Maximum meter flow rate (in GPM or liter per minute)}} \times 1000$$

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 ILR750 and ILR750T)

Indicated by an "**o**" on the left hand side of the display, this screen allows selection of the pulses output per liter or per US-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 US-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

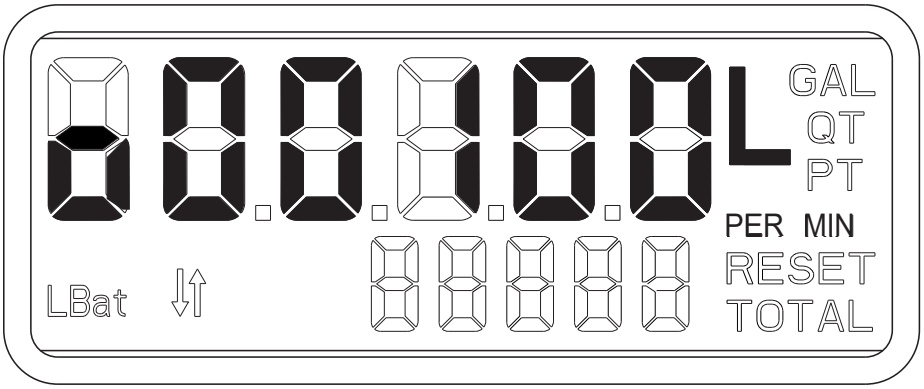


Figure 13: Pulse rate out screen

Signal sequence of pulse output

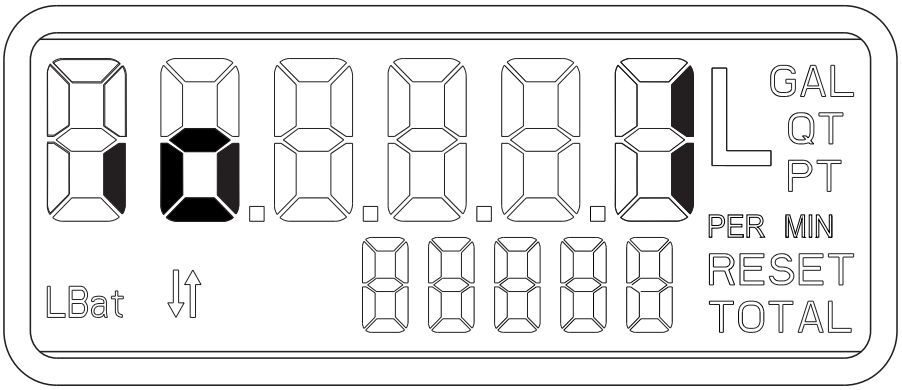


Figure 14: Signal sequence of pulse output

This parameter can be changed for the signal inversion of the pulse output.

io=1 default setting – (no signal inversion) at no flow condition the pulse output signal is "1" (high) 24 V for example

io=0 the output is inverted by the software, at no flow condition the pulse output signal is "0" (low) 0 V

Linearisation

(for models ILR701, ILR701T, ILR750 and ILR750T)

Indicated by 1…9 on the left hand side of the display, followed by a hyphen (-), this screen allows the setting of the linearisation (in total 9 points).

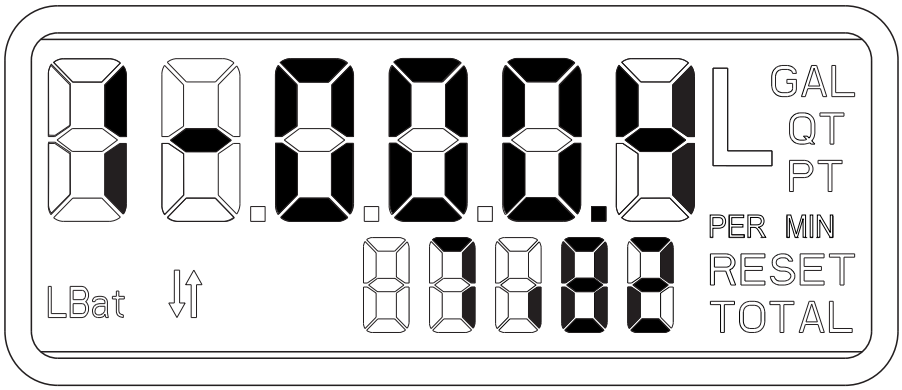


Figure 15: Linearisation point 1 (of 9)

Press the **TOTAL** button to select a digit (selected digits' flash). Press **RESET** to change the selected digit. The flow rate will be set in the top row of the meter and is displayed in the unit you selected at *"Changing the unit of measure" on page 14*. In the sample shown above this would be the flow rate 0.4 liter per minute. On the bottom line of the meter you can set in the correction of the error in %. In the sample below, the error at a flow rate of 0.4 liters per minute would be -7.82%; to correct this, +7.82% needs to be set in (the plus symbol [+] will not be shown).

Once the adjustment of the linearisation is completed, press and hold the **TOTAL** button for one second to advance to the next linearisation point.

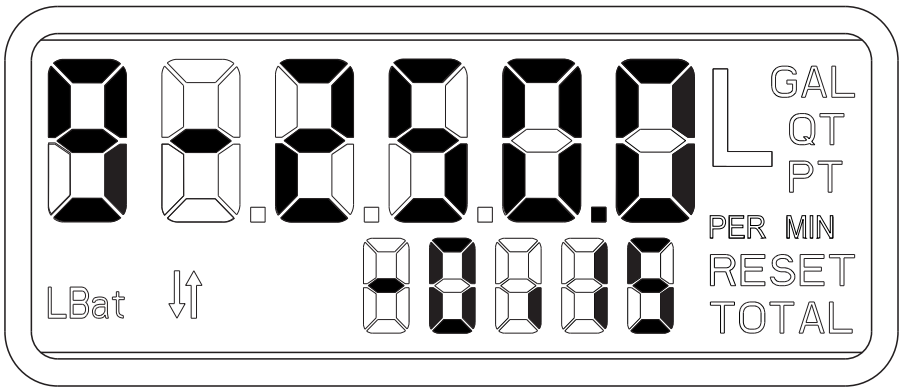


Figure 16: Linearisation point 9 (of 9)

Number 9 at the left hand side of the display shows the 9th linearisation point. The sample shows a flow rate of 250.0 liter per minute and a deviation of the flow meter of +0.15%. To correct this error, -0.15% needs to be set as correction.

NOTE:

- Minimum 3 linearisation points needs to be programmed.
- The flow rates do not have to be programmed from low to high; the software will sort the flow rates automatically, no matter at which point (1…9) they are programmed.

To exit the programming mode

On any screen, press and hold 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 will turn the display back on.

REGISTER OUTPUT SPECIFICATIONS AND WIRING

Pulse transmitter (model ILR 740)

Figure 17: ILR 740 pulse transmitter

Orientation: The transmitter register must be mounted as shown above, perpendicular to the flow. The transmitter will not function properly if mounted inline to the flow.

Transmitter wiring	
Reed switch outputs	green and white
Power	max. 10 W (not to exceed!)
Voltage	max. 200V DC/peak AC
Current	max. 0.5 A DC/peak AC
Outputs	Raw reed switch output with no signal conditioning

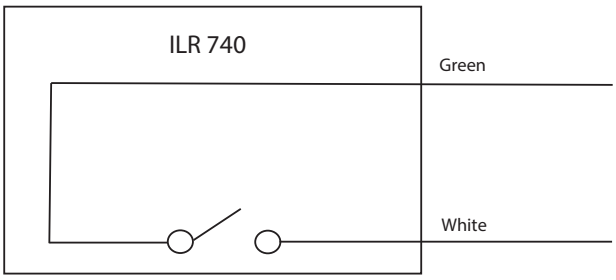


Figure 18: ILR 740 wiring

Pulse per unit of measure (IOG series)

Meter	**Pulse per US-gallon**	**Pulse per liter**
1/2 in.	378.5	100
3/4 in.	236.6	62.5
1 in.	236.6	62.5
1 in. HF	162.8	43
1-1/2 in.	64.4	17
2 in.	34.1	9
3 in.	11.4	3

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

Marking	
ATEX	Ex II "G h II B T4 Gb

Model ILR 741 (reed board)

The meter size selector switch must be set to correspond to the size of the meter to properly detect fluid flow:

- Position 1 (top): 1/2 in., 3/4 in., 1 in.
- Position 2 (center): 1-1/2 in.
- Position 3 (bottom): 2 in., 3 in.

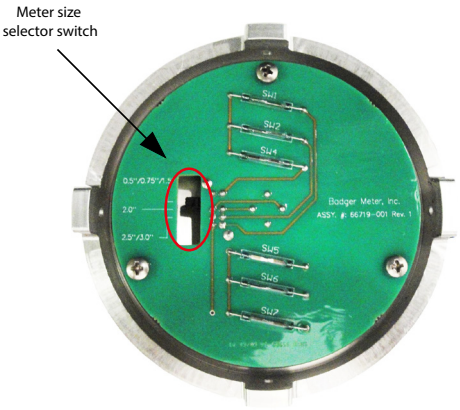


Figure 19: ILR 741 transmitter switch positions

Transmitter wiring ILR 741 (reed board)

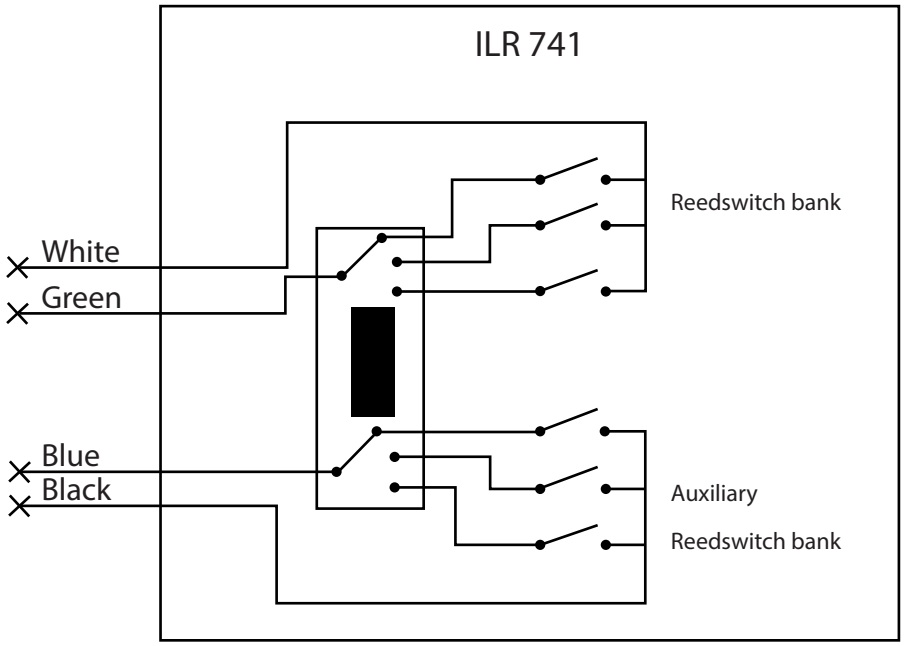


Figure 20: ILR 741 wiring

Pulse and analog output (model ILR 750 and 750T)

Register wiring	
External DC+	Yellow
External Ground	Brown
Pulse output	White
Analog output	Green
DC input	8…24V DC; 20…40 mA
Outputs	Analogue 4…20 mA output; external load of 0 ohms to 250 ohms; flow rate is linear scaled between 4 mA minimum and 20 mA maximum set points. Pulse output with internal pull-up resistor (1 KΩ); optional open collector output when the jumper is removed. Please open the battery compartment. The jumper may only be removed if no external voltage is present. The output is scalable in pulses per liter or pulses per US-gallon.

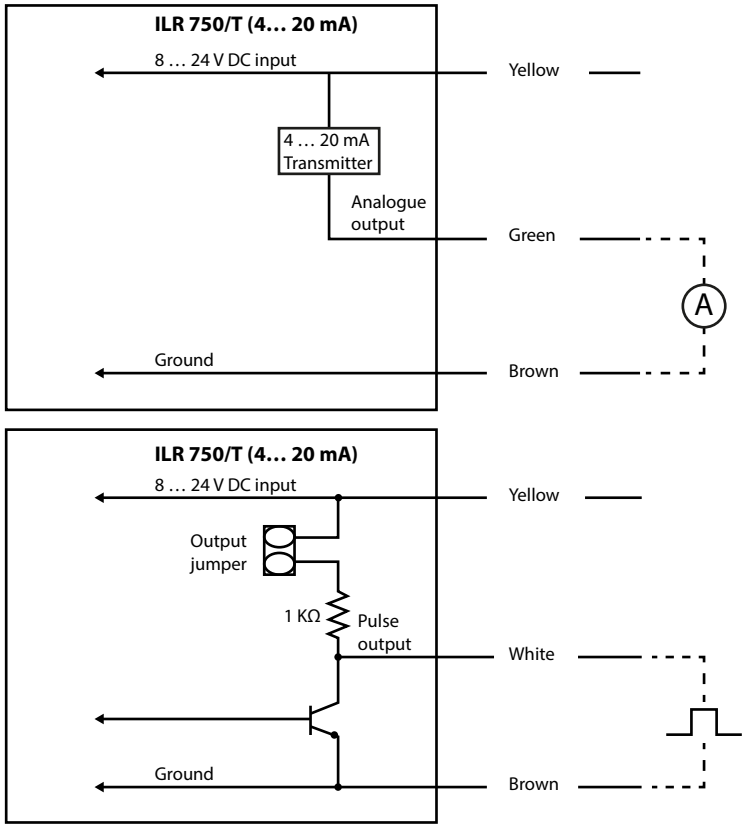
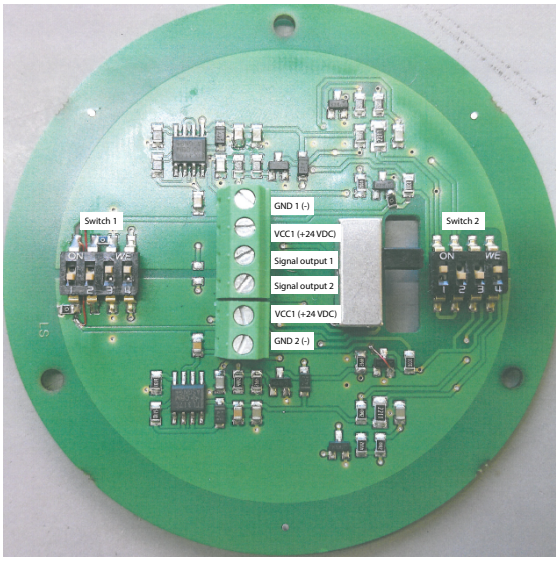


Figure 21: ILR 750, 750T wiring

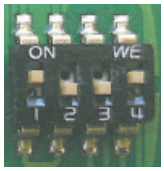
Pulse transmitter hall



Sample

The switches need to be set as explained in the chart below.

1 means "ON"
0 means "OFF"
The sample in the picture would be 1-0-0-1.

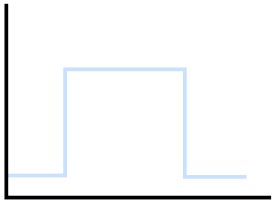


GND 1	Ground channel 1 (-)
VCC1	Power supply +24V DC for channel 1
SIG 1	Signal output channel 1

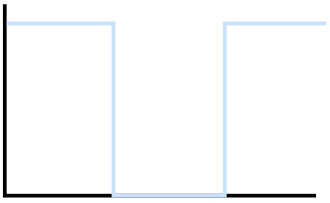
GND 2	Ground channel 1 (-)
VCC2	Power supply +24V DC for channel 1
SIG 2	Signal output channel 1

Switch 1				Switch 2				Output 1 and 2
1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	
1	1	0	0	0	0	0	0	No Pull-up, signal level high, 1 power source for each output *
1	1	1	1	0	0	0	0	No Pull-up, signal level high, only 1 power source for both outputs
0	0	0	0	0	1	1	0	No Pull-up, signal level low, 1 power source for each output
0	0	1	1	0	1	1	0	No Pull-up, signal level low, only 1 power source for both outputs
1	1	0	0	1	0	0	1	Pull-up, signal level high, 1 power source for each output
1	1	1	1	1	0	0	1	Pull-up, signal level high, only 1 power source for both outputs
0	0	0	0	1	1	1	1	Pull-up, signal level low, 1 power source for each output
0	0	1	1	0	1	1	0	Pull-up, signal level low, only 1 power source for both outputs

*Standard setup if nothing else is described in the order.

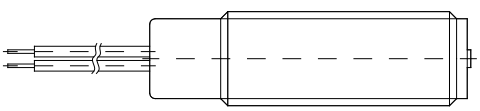


Signal level low



Signal level high

NPN AND PNP SENSOR FOR HAZARDOUS LOCATION



Technical data	
Switching function	Open collector
Output type	NPN or PNP 3-wire (2 versions available)
Supply voltage	5…30V DC (I ≤ 15 mA)
Supply current	100 mA max (Pmax = 0.66 watt)
Effective internal inductivity	Ci ≤ 12 nF
Effective internal inductance	Li ≤ 0 µH
Cable length	118 inch (3 meters)
Material	Stainless steel 1.4404 (316L)
Protection class	IP66 / IP67

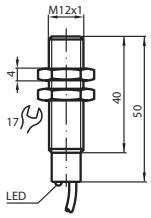
Marking	
USA	Intrinsically safe Class I, II, III, Division 1 GROUP ABCDEFG T6 to T5
Canada	Intrinsically safe Class I, Division 1 GROUP ABCD T6 to T5 Class I, Zone 0, Ex ia IIC T6 to T5
ATEX	Ex II 1G Ex ia IIC T6 to T4 Ga
IIECEx	Ex ia IIC T6 to T4 Ga

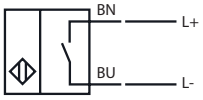
Pulse rate		
Meter	**Pulse per US-gallon**	**Pulse per liter**
1/2 in.	378.5	100
3/4 in.	236.6	62.5
1 in.	236.6	62.5
1 in. HF	162.8	43
1-1/2 in.	64.4	17
2 in.	34.1	9
3 in.	11.4	3

NAMUR SENSOR









Technical data	
Switching function	Normally open (NO)
Output type	NAMUR 2-wire
Nominal voltage	Uo 8.2 V (Ri ca. 1 KΩ)
Effective internal inductivity	Ci ≤ 15 nF a cable lenght of 32.8 feet (10 m) is considered
Effective internal inductance	Li ≤ 35 µH; a cable lenght of 32.8 feet (10 m) is considered
Switch state indicator	LED (yellow)
Ambient temperature	-13…158° F (-25…70° C)
Cable length	78 inch (2 meters) (PVC)
Core cross-section	(0.34 mm^2)
Material	Stainless steel 1.4404 (316L)
Protection class	IP66 / IP67

Marking	
Namur	CE 0102 / Ex II2G Ex ib IIC T6 Gb

Pulse rate		
Meter	**Pulse per US-gallon**	**Pulse per liter**
1/2 in.	378.5	100
3/4 in.	236.6	62.5
1 in.	236.6	62.5
1 in. HF	162.8	43
1-1/2 in.	64.4	17
2 in.	34.1	9
3 in.	11.4	3

PULSE TRANSMITTER (FOR 1/4 IN. AND 1/8 IN.)

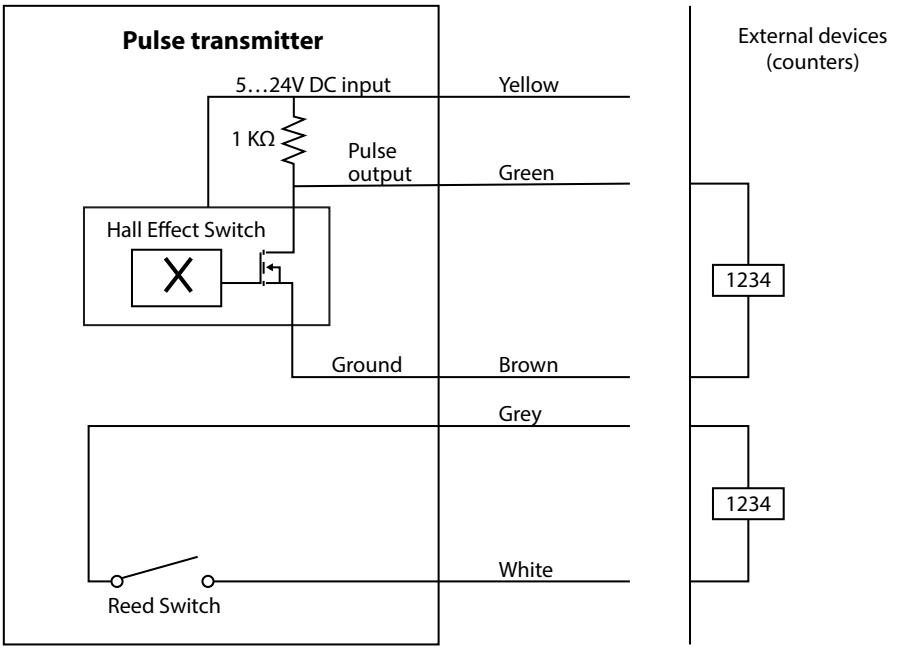


Figure 22: 1/4 in. and 1/4 in. low flow wiring

Rating	Power supply	Supply input range: 5…24V DC Supply current: 3.5 mA
	Pulse output	Output current: 30 mA, max.

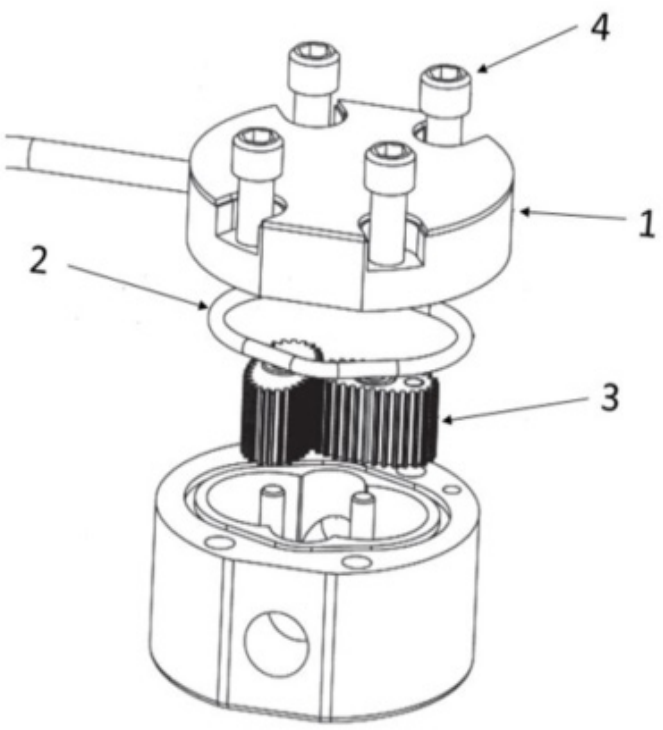
Wiring	Yellow	Supply 5…24V DC
	Brown	Ground
	Green	Hall pulse output
Internal pull-up	1 KΩ	

Reed Switch		
Rating	Power rating	10W
	Switching voltage	100V (DC or peak AC)
	Switching current	500 mA (DC or peak AC)

Wiring	Grey	Reed Switch
	White	Reed Switch

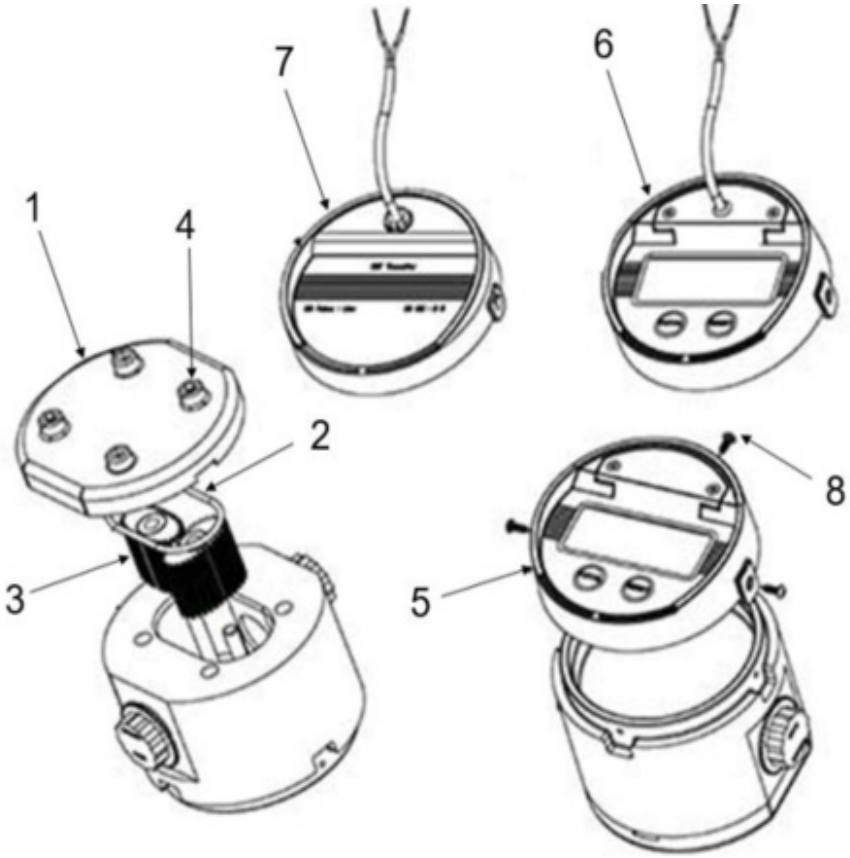
Pulse per liter (PPL)		
Meter size	**Pulse per US-gallone**	**Pulse per liter**
1/4 in.	8213.4	approx. 390
1/4 in. LF	1476	approx. 2170
1/8 in.	16654	approx. 4400

REPAIR PARTS



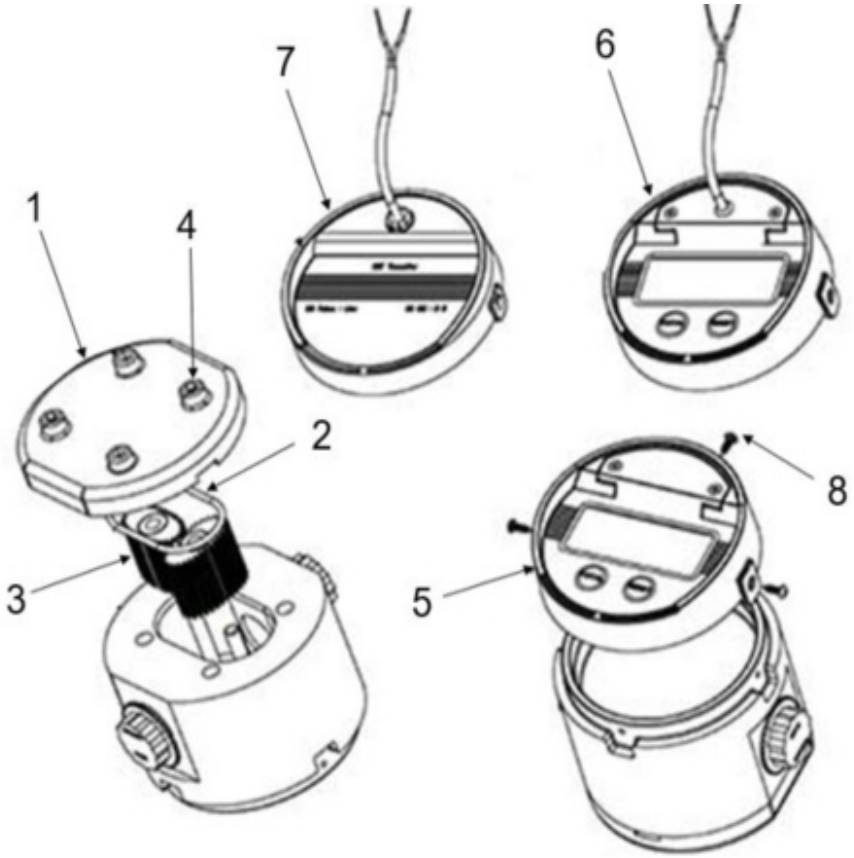
Part numbers for Bare Meter Size 1/8 ... 1/4 in.

Item	Description	1/8 in.	1/4 LF in.	1/4 in.
		Part No.	Part No.	Part No.
1 (Covers)	Aluminum	—	67052-002	67052-002
	Stainless Steel	67052-001	67052-001	67052-001
2 (Seals)	Viton	66657-007	66657-007	66657-007
	Aflas	66657-009	66657-009	66657-009
	Kalrez	66657-026	66657-026	66657-026
	EPDM	i66657-008	66657-008	66657-008
3 (Oval gears) *part no. includes 1 oval gear*	Stainless steel (with magnet) -FDA	66832-009	66832-002	66832-003
	Stainless steel (without magnet) -FDA	66832-010	66832-005	66832-006
	Stainless steel HV (with magnet) -FDA	—	—	66832-007
	Stainless steel HV (without magnet) -FDA	—	—	66832-008
	PPS (with magnet)	—	339557	339560
	PPS (without magnet)	—	339556	339559
4 (Screws for cover)	Screw (4 pcs/cover required)	55320-002	55320-002	55320-002



Part numbers for 1/2 ... 3 in.

Item	Description	1/2 in.	3/4 in.	1 in.	1 in. HF	1-1/2 in.	2 in.	3 in.
		Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
1 (Covers)	Aluminum	339029	339028	339028	336266	67172-002	66544-002	66548-002
	Stainless Steel	339027	339026	339026	339265	67172-001	66544-001	66548-001
2 (Seals)	Viton	66657-002	66657-002	66657-002	66657-011	66657-015	66657-019	66657-023
	Aflas	66657-004	66657-004	66657-004	66657-013	66657-017	66657-021	66657-025
	Kalrez	66657-027	66657-027	66657-027	66657-028	66657-029	66657-030	66657-031
	EPDM	66657-003	66657-003	66657-003	66657-012	66657-016	66657-020	66657-024
3 (Oval gears) *Part no. includes 1 oval gear*	Stainless steel (FDA)	66658-001	66658-002	66658-002	66658-003	67167-001	67167-002	67167-003
	Stainless steel HV (FDA)	66658-004	66658-005	66658-005	66658-006	67167-004	67167-005	67167-006
	PPS	339635	339636	339636	339637	339638	339639	—
	PPS HV	66658-004	339651	339651	339652	339653	339654	—
	LCP (Vectra)	67092-001	66213-001	66213-001	—	—	—	—
4 (Screws for cover)	Screw (4 pcs/cover required)	55320-001	55320-001	55320-001	55320-001	55320-003	55320-003	55320-003



Part numbers for IRL Register

Item	Description	1/2 ... 3 in.
		Part No.
5 (Electronic register)	ILR700	67516-001
	ILR701	67516-007
6 (Electronic register + pulse transmitter)	ILR750 (display + pulse/analog output)	67516-006
7 (Pulse transmitter)	ILR740	67516-005
8 (Screws for register)	Screw (3 pcs/register required)	314066

Part numbers for F-Series and ER-420 Adapter

Description	1/2 ... 3 in.
	Part No.
F-Series / ER-420 adapter kit (Stainless steel)	66885-010
F-Series / ER-420 adapter kit (Aluminum)	66885-011

INTENTIONAL BLANK PAGE

Control. Manage. Optimize.

www.badgermeter.com

Legacy Document Numbers: IOG-UM-00046-EN-09 and OG_IOG_BA_02_0082