



Badger Meter

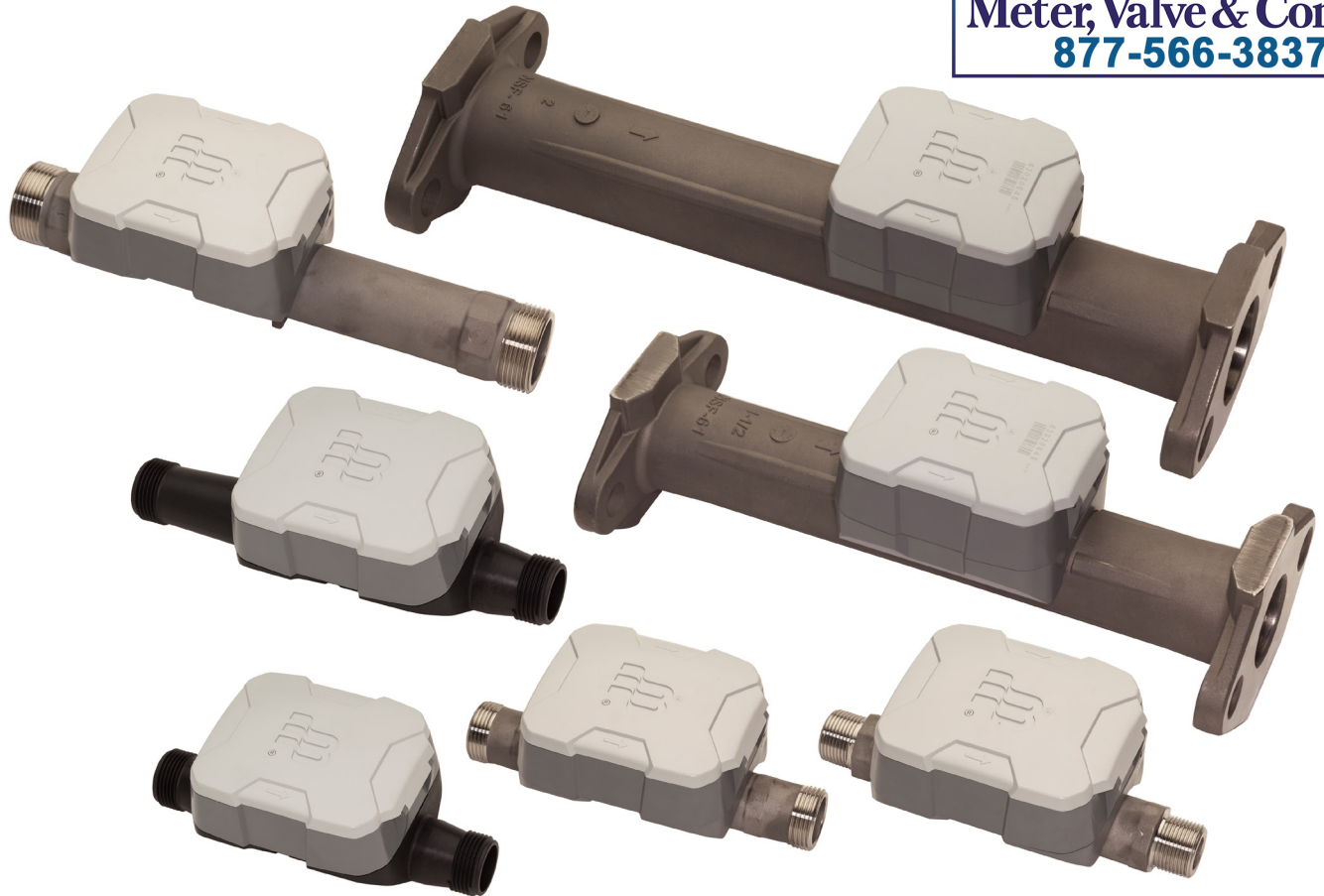
E-Series® Ultrasonic Meters

Cold Water Meters

Distributed By



Meter, Valve & Control
877-566-3837



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IMPORTANT

For proper handling of the higher reading resolution and the extended status indicator capabilities of the HR-E-Series® Ultrasonic meter, the following software versions are required for your reading system:

Reading Data Management Software

- ReadCenter Data: Version 1.11.12.27 or higher (does not include extended status indicator capabilities)
- ReadCenter Analytics and ReadCenter Analytics Mobile: Version 2.12.7.6 or later

Mobile Reading Systems

- ORS: Version 2.2.1 or later

Handheld Reading Systems

- Badger Field Application Suite: Version 2.2.3 or later
- ORION Field Application route reading software: Version 2.2.3 or later
- ORION Endpoint Utility programming & quick read software: Version 2.2.2 or later

For assistance, please contact Badger Meter Technical Support at 1-800-876-3837 or the appropriate endpoint provider.

ABOUT THE E-SERIES ULTRASONIC METER

The Badger Meter E-Series Ultrasonic meter is an electronic meter using ultrasonic technology and solid-state electronics contained in a compact, totally encapsulated, weatherproof and UV-resistant housing for residential and commercial applications. The ultrasonic measurement system has no moving parts, provides long-term accuracy and eliminates measurement errors due to sand, suspended particles, air pockets and pressure fluctuations.

The Ultrasonic meter is permanently sealed to eliminate the intrusion of moisture, dirt or other contaminants and is suitable for installation in all environments, including meter pits subject to continuous submergence.

The meter can be installed using horizontal or vertical piping, with water flow in the up direction. The meter will not measure flow when an "empty pipe" condition is experienced. An empty pipe is defined as a condition when the flow sensors are not fully submerged.

METER STORAGE MODE

All E-Series Ultrasonic meters are delivered in a storage mode so that a meter alarm is not triggered. During storage mode, the empty pipe shows up on the LCD display as an error message, but it will not trigger a meter alarm. The meter needs to sense a full pipe for 24 hours for the meter to go from storage mode to normal operation. If installed when the meter is still in storage mode, the meter will function as expected with the addition of also displaying "err" on the flow rate screen. The meter will display consumption and, if connected to AMR/AMI, will send a reading to the endpoint. When the meter is in normal operation, the meter alarm displays immediately upon detecting the empty pipe condition. The alarm clears immediately after the condition is corrected and the pipe is full. Systems that support the additional alarm conditions will be notified that an empty pipe condition has occurred.

METER PRE-INSTALLATION

Take into account the following considerations before you begin an installation:

- Inspect the piping around the meter setting for suitable conditions. The service line, valves, connections and meter must be watertight. Repair the piping system if pipes are corroded or damaged.
- Set the meter in a horizontal or vertical position with flow in the up direction. Registration should be upright and protected from damage, freezing, and tampering.
- Position the meter so it is accessible for installation, removal and reading.
- Verify that a suitable, electrical grounding wire is properly attached to the upstream and downstream pipe connections of the meter. The grounding wire provides an alternative path for any electrical current that may exist across the opening in the line.
- Close the curb (shut-off) valve to relieve water pressure in the line before starting the cutting operation. Provide a high-quality upstream shut-off valve with a low pressure drop.
- When cutting into a new section of service pipe, flush the pipe to clear chips, pipe dope or other plumbing residue.
- For the 5/8" to 1" meters, the line opening in which the meter is to be set should match the laying length of the meter, allowing slight additional space for coupling gaskets. The inlet and outlet sides of the meter setting should be axially aligned to the pipe.
- For the 1-1/2" and 2" meters, the line opening in which the meter is to be set should match the laying length of the meter. For optimal performance and accuracy, it is also recommended that five to ten diameters of straight pipe be installed upstream of the meter.
- The installed meter must not be an obstacle or a hazard to the customer or interfere with public safety.

⚠ CAUTION

- **DO NOT ATTEMPT TO USE ANY METER AS A LEVER OR CROWBAR TO STRAIGHTEN A MISALIGNED METER SETTING. THIS COULD DAMAGE THE METER.**
- **DO NOT ATTEMPT TO SET A METER INTO AN OPENING THAT IS TOO LONG BY FORCING THE PIPING INTO PLACE WITH THE METER'S COUPLING NUTS. THIS WILL CAUSE SERIOUS DAMAGE TO THE THREADED ENDS OF THE METER AND HOUSING.**

To avoid potential problems, correct any irregularities in pipe spacing and misalignment before placing the meter into its setting.

SPECIAL INSTRUCTIONS FOR REMOVING A METER

⚠ WARNING

THE LINE MUST BE DEPRESSURIZED BEFORE STARTING ANY DISASSEMBLY OPERATION. REMOVING A METER THAT IS UNDER LINE PRESSURE CAN RESULT IN COMPONENTS BECOMING PROJECTILES, CAPABLE OF CAUSING PERSONAL INJURY.

SPECIAL FITTINGS AND ACCESSORIES

To accommodate 5/8" to 1" meter installations, special fittings and accessories are available. Metal meter setters, re-setters, horns and meter yokes are available for holding the service pipe in proper alignment to the meter and laying length spacing. The metal setters and meter yokes can provide an electrical continuity to protect meters and consumers from electrical shocks. Using a meter setter for the 1-1/2" and 2" is possible—however, be aware that the setter may affect the accuracy of the meter. During meter installation, you may choose to replace the old gaskets with the provided 9/64" thick rubber gaskets.

INSTALLING E-SERIES ULTRASONIC METERS

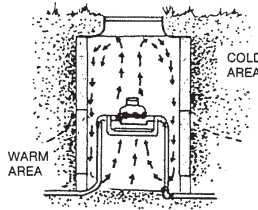
Outdoor Installations

When installed outdoors in a meter box, the E-Series Ultrasonic meter should have a two- to three-inch clearance to avoid damage or strain to the service piping or meter, and to accommodate any "settling" that may occur after installation.

The service pipe in the meter box should be properly bedded to ensure that it is not axially misaligned and that it lays evenly on the bottom of the pipe trench. The backfill material covering the pipe should be placed appropriately to maintain pipe alignment in the event of eventual ground shifts. This will prevent damage to the pipe.

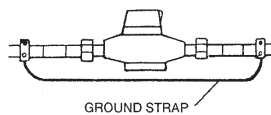
The service lines and the water meter must be protected from freezing. The earth covering the service line must be adequate to prevent frost penetration. Due to the smaller volume of water, service line pipes will freeze sooner than the main distribution line.

The meter box pit should be excavated below the frost line. Even though the meter itself may be positioned above the frost line, the warmer air rising from the earth below the frost line will reduce the possibility of freezing.



Indoor Installations

As a precautionary measure when working with metallic pipes, indoor settings must be checked for electrical continuity through the service pipe before you remove or service a meter. American Water Works Association (AWWA) policy specifies that service pipes must not be used as an electrical ground. Check your local codes and practices. A permanent ground strap or metal setter must be used if electrical grounding to water services is required in your community. This is especially important for the engineered polymer ultrasonic meter.



To prevent floor damage, close the valve downstream from the meter before installing or removing a meter.

Installing a 5/8" to 1" Meter

To prepare for meter installation, follow these steps:

1. Close the meter's inlet-side valve.
2. Open a faucet and wait until water flow stops, to depressurize the system. Do not remove the meter until the flow stops.
3. Check valves and make necessary repairs to the curb (shut-off) valve or inlet side valve if necessary.
4. Close the meter's outlet-side valve. Protect the floor below the meter against potential spills or leaks that could occur. Protect the coupling area from debris, so that the new meter will not be damaged or contaminated.
5. To replace an existing meter continue with Step 6. To install a new meter skip to Step 8.
6. Loosen meter couplings and remove the meter and the old gaskets in the coupling nuts.
7. Clean the coupling nuts, removing any pipe dope or dirt from the threads.
8. Check the existing setting for proper alignment and spacing. Correct any misalignment and spacing in the setting.
9. Place the connection gaskets inside the connection coupling nuts.
10. Set the meter between the coupling nuts properly positioned so that the flow arrow on the meter housing points in the direction of flow.
11. Start the coupling nuts at the threaded meter ends. Verify that the nuts are properly aligned to avoid cross threading damage (stripping) to the meter ends. This is especially important for the engineered polymer ultrasonic meter.

An effective method for starting a coupling nut is:

- a. Position the nut squarely against the meter's spud end.
- b. Turn the nut counterclockwise (in reverse) while holding the nut against the meter spud end. When the first threads on both the nut and the spud end coincide, you will hear a slight click and feel the nut move into the starting position.
- c. Tighten the nut by hand until it is "hand tight."
- d. With an open-end wrench, apply a partial turn. Do not over tighten. For plastic swivel connections, a one-quarter turn beyond hand tight is usually sufficient.

Installing a 1-1/2" and 2" Meter

To prepare for the meter installation, follow these steps:

1. Close the meter's inlet-side valve.
2. Open a faucet and wait until water flow stops, to depressurize the system. Do not remove the meter until the flow stops.
3. Check valves and make necessary repairs to the curb (shut-off) valve or inlet side valve if necessary.
4. Close the meter's outlet-side valve. Protect the floor below the meter against potential spills or leaks that could occur.
5. To replace an existing meter continue with Step 6. To install a new meter skip to Step 8.
6. Loosen meter flange connection bolts and remove the meter and the old gaskets.
7. Clean the flanged ends, removing any dirt from the ends.
8. Check the existing setting for proper alignment and spacing. Correct any misalignment and spacing in the setting.
9. Place new connection gaskets inside the connection.
10. Set the meter in the pipeline so that the flow arrow on the meter housing points in the direction of flow.
11. With the meter and gaskets in place, tighten the flange connection bolts. Verify that the nuts are properly aligned to avoid damage to the flanged ends.

Protect Against Leakage

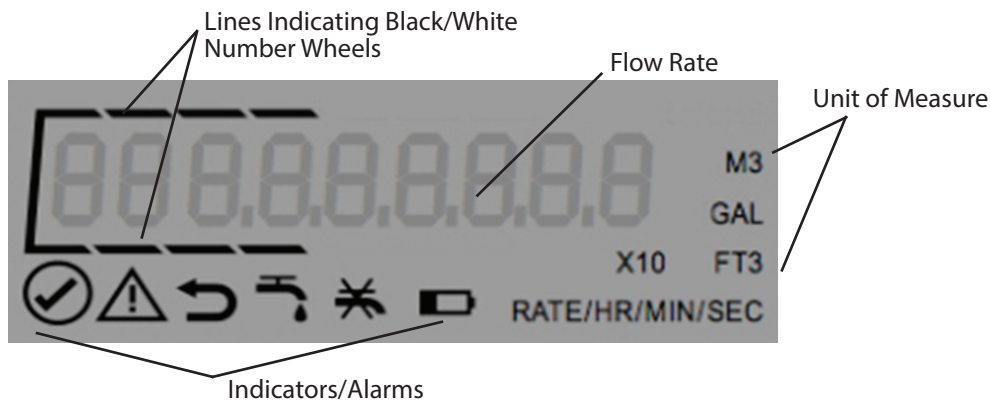
Before turning on the service water, use care to protect against potential leakage.

1. Shut off the valves on both the inlet and outlet sides of the meter.
2. Open the curb (shut-off) valve slowly to pressurize the service line to the meter.
3. Slowly open the meter's inlet-side valve to fill the meter.
4. Check for leaks around the meter and its connections.
5. Slowly open the meter's outlet-side valve to pressurize the consumer side of the system.
6. Open a faucet to allow entrapped air to escape.
7. Once water is flowing normally, turn off the faucet.

E-SERIES ULTRASONIC METER OPERATIONS

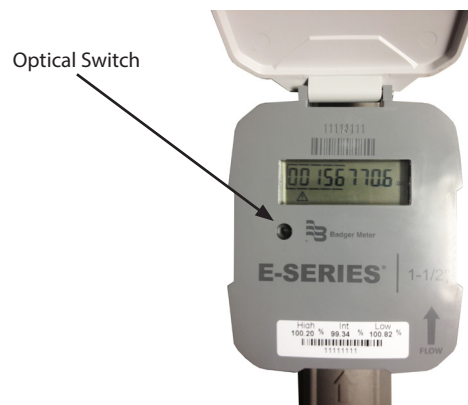
Meter Display

The Badger Meter E-Series Ultrasonic meters use a nine-digit Liquid Crystal Display (LCD) to show consumption, flow rate and alarm information. See the Status Indicators chart on page 13 for detailed descriptions.



Activating the Display

The Ultrasonic meter's display illuminates when the register cover is opened. After a period of time, the display will revert to sleep mode. You can alternate the display between total flow and rate of flow mode by touching the optical display switch or by closing and opening the meter's lid. The optical switch is located just below the LCD on the left side of the register's face.



Unit of Measure

The unit of measure and resolution are factory programmed and options include gallons, cubic feet and cubic meters.

For 5/8" through 1" meters, totalized flow displays up to one million gallons with a resolution of 0.01 gallons, 100 thousand cubic feet with a resolution of 0.001 cubic feet, or ten thousand cubic meters with a resolution of 0.0001 cubic meters.

For the 1-1/2" and 2" meters, totalized flow displays up to 10 million gallons with a resolution of 0.1 gallons, one million cubic feet with a resolution of 0.01 cubic feet, or 100 thousand cubic meters with a resolution of 0.001.

Rate of Flow

The rate of flow is factory programmed for either gallons per minute or meters cubed per hour. The LCD displays both the unit of measure and rate of flow. The rate of flow display also serves as the flow finder indicator. The rate of flow display is shown without leading zeros. When rate of flow is displayed it is updated every two seconds.

Flow Direction

The direction of water flow is noted on the face of the electronics housing and cast into the meter housing.

Consumption

The consumption display includes all nine digits, including leading zeroes and a decimal point. The displayed value is the sum of the forward flow minus the reverse flow. This display also includes indicator lines above and below the digits to provide the electronic equivalent of white and black number wheels on mechanical registers. The following examples show typical displays for three different units of measure:

5/8", 3/4" and 1" Meters

1	2	3	4	5	6	7.	8	9
---	---	---	---	---	---	----	---	---

- Visual reading for typical consumption/billing purposes: 1234 thousands of gallons.
- Detailed meter reading with full display resolution: 1234567.89 gallons.

1-1/2" and 2" Meters

1	2	3	4	5	6	7	8.	9
---	---	---	---	---	---	---	----	---

- Visual reading for typical consumption/billing purposes: 12345 thousands of gallons.
- Detailed meter reading with full display resolution: 12345678.9 gallons.

Gallons

Cubic Feet

1	2	3	4	5	6.	7	8	9
---	---	---	---	---	----	---	---	---

- Visual reading for typical consumption/billing purposes: 1234 hundreds of cubic feet.
- Detailed meter reading with full display resolution: 123456.789 cubic feet.

1	2	3	4	5	6	7.	8	9
---	---	---	---	---	---	----	---	---

- Visual reading for typical consumption/billing purposes: 12345 hundreds of cubic feet.
- Detailed meter reading with full display resolution: 1234567.89 cubic feet.

Cubic Meters

1	2	3	4	5.	6	7	8	9
---	---	---	---	----	---	---	---	---

- Visual reading for typical consumption/billing purposes: 12345 cubic meters.
- Detailed meter reading with full display resolution: 12345.6789 cubic meters.

1	2	3	4	5	6.	7	8	9
---	---	---	---	---	----	---	---	---

- Visual reading for typical consumption/billing purposes: 12345 cubic meters.
- Detailed meter reading with full display resolution: 123456.789 cubic meters.

AMR/AMI Output

The Ultrasonic meter is an integrated design where the electronics are housed, fully potted, and permanently sealed to the meter housing.

The RTR protocol provides a digital switch closure to the AMR/AMI endpoint. The Absolute Digital Encoder (ADE) option uses industry standard ASCII protocol. Ultrasonic meters with encoder protocol programmed as high resolution have the ability to transmit meter status indicators to ORION ME/SE endpoints as part of the extended encoder/meter reading message. The details can also be read through an IR interface. The output protocol is indicated on the AMR output wire and is determined at the time of order.

An optional output wire (three conductor) that is fully potted and submersible is available for factory connection to the Badger Meter ORION or GALAXY remote endpoints. For future connectivity, the Ultrasonic meter may be ordered with either a Badger Meter 308 in-line connector or an Itron connector for approved endpoints.

Endpoint Reading Resolution

The reading resolution sent to the reading software is dependent on the endpoint to which the encoder is connected. Readings reported from the endpoints are the left-most significant digits of the encoder reading.

Technology	E-Series RTR	E-Series ADE	High Res E-Series ADE
ORION ME/SE	7 digit reading	6 digit reading	8 digit reading
ORION CE	7 digit reading	6 digit reading	7 digit reading
GALAXY	7 digit reading	6 digit reading	6 digit reading
Itron 100W	7 digit reading	6 digit reading	8 digit reading

See LCD-A-03 for appropriate test circle code/reading resolutions for the HR-E-Series with ORION or GALAXY endpoints.

Status Indicators







Indicators and alarms appear in the display as symbols that illuminate when the condition is active and dim when the alarm condition is eliminated.

All E-Series Ultrasonic meters are delivered in a storage mode so that a meter alarm is not triggered. During storage mode, the empty pipe shows up on the LCD display as an error message, but it will not trigger a meter alarm. The meter needs to sense a full pipe for 24 hours for the meter to go from storage mode to normal operation. If installed when the meter is still in storage mode, the meter will function as expected with the addition of also displaying “err” on the flow rate screen. The meter will display consumption and, if connected to AMR/AMI, will send a reading to the endpoint. When the meter is in normal operation, the meter alarm displays immediately upon detecting the empty pipe condition. The alarm clears immediately after the condition is corrected and the pipe is full. Systems that support the additional alarm conditions will be notified that an empty pipe condition has occurred.

For the High Resolution E-Series Ultrasonic meter, ORION ME/SE endpoint firmware version 1.8 or higher is required.

The following chart indicates the E-Series Ultrasonic meter conditions when connected to a Badger Meter ORION ME/SE AMR/AMI endpoint.

The chart does *not* apply to ORION CE endpoints. Reverse Flow, Suspected Leak and 30 Day No Usage alarms are determined by the endpoint radio and are not obtained from the Ultrasonic meter.

Status Indicator	Icon	Alarm Description	High Resolution with ORION ME/SE	Encoder Protocol with ORION ME/SE	RTR with ORION ME/SE
Meter functioning correctly		Meter operating correctly.	Normal operation. Indicator not sent to endpoint.	Normal operation. Indicator not sent to endpoint.	Normal operation. Indicator not sent to endpoint.
Meter alarm		<p>Several potential conditions may exist, including:</p> <ul style="list-style-type: none"> • Empty pipe: “err” displays on LCD. Alarm clears when pipe is filled. • Low Temperature limits exceeded: meter continues to operate but outside specified accuracy range. Alarm clears after 35 days unless alarm condition continues. • Maximum flow rate is exceeded. No consumption is displayed until back within specified flow range. Both the meter functioning correctly and the meter alarm are active. • Other meter or sensor issue: meter continues to operate if possible. Alarm clears after 35 days unless alarm condition continues. 	Meter alarm sent to the ORION ME/SE endpoint.	<p>Meter Alarm is sent to ORION ME/SE endpoint.</p> <p>NOTE: No consumption data is sent to endpoint.</p>	Alarm condition not sent or reported.
Reverse flow		<p>Meter detects reverse flow. This alarm remains active for 35 days. The alarm automatically clears after 35 days if reverse flow condition has not recurred.</p> <ul style="list-style-type: none"> • ADE – displays exactly what is happening. • RTR – does not record flow until meter is back in forward flow. 	Meter detects reverse flow and sends alarm message to ORION ME/SE endpoint.	Meter does not send the alarm. The ORION ME/SE endpoint detects and reports the reverse flow.	No alarm condition reported by ORION ME/SE.
Suspected leak		Meter detects 24 hours without one 15-minute interval of no flow. The alarm clears automatically when a 15-minute no-flow interval occurs.	Meter detects suspected leak and sends alarm message to ORION ME/SE endpoint.	Meter does not send the alarm. The ORION ME/SE endpoint detects continuous consumption over 24-hour period and reports suspected leak.	
30 day no usage		No measured flow in past 30 days. The alarm automatically clears once flow occurs.	Meter detects 30 day no usage and sends alarm to ORION ME/SE endpoint.	Meter does not send the alarm. The ORION ME/SE endpoint detects no change in consumption over 30-day period and reports 30 day no usage.	
End of life battery indicator		Indicated battery life based on pre-calculated consumption. Alarm is activated after 19 years and 6 months and does not clear.	Meter sends alarm to ORION ME/SE endpoint.	Meter does not send the alarm.	

SPECIFICATIONS

5/8", 5/8" x 3/4", 3/4" and 1" Meters

E-Series Ultrasonic Meter Size	5/8" (15 mm)	5/8" x 3/4" (15 mm)	3/4" (20 mm)	1" (25 mm)
Operating Range	0.1...25 gpm	0.1...25 gpm	0.1...32 gpm	0.4...55 gpm
Extended Low-Flow Rate	0.05 gpm	0.05 gpm	0.05 gpm	0.25 gpm
Maximum Continuous Operation	25 gpm	25 gpm	32 gpm	55 gpm
Pressure Loss	4.3 psi at 15 gpm	2.3 psi at 15 gpm	2.0 psi at 15 gpm	1.8 psi at 25 gpm
Reverse Flow - Maximum Rate	4.0 gpm	4.0 gpm	4.0 gpm	9.0 gpm
Operating Performance	In the normal temperature range of 45...85° F (7...29° C), new meter consumption measurement is accurate to: <ul style="list-style-type: none"> • ±1.5% over the normal flow range • ±3.0% from the extended low flow range to the minimum flow value 			
Storage Temperature	- 40...140° F (- 40...60° C)			
Maximum Ambient Storage (Storage for One Hour)	150° F (72° C)			
Measured-Fluid Temperature Range	34...140° F (1°...60° C)			
Humidity	0...100% condensing; meter is capable of operating in fully submerged environments			
Maximum Operating Pressure of Meter Housing	175 psi (12 bar)			
Register Type	Straight reading, permanently sealed electronic LCD; digits are 0.28" (7 mm) high			
Register Display	<ul style="list-style-type: none"> • Consumption (up to nine digits) • Rate of flow • Alarms • Unit of measure factory programmed for gallons, cubic feet and cubic meters 			
Register Capacity	<ul style="list-style-type: none"> • 10,000,000 gallons • 1,000,000 cubic feet • 100,000 cubic meters 			
Totalization Display Resolution	<ul style="list-style-type: none"> • Gallons: 0.XX • Cubic feet: 0.XXX • Cubic meters: 0.XXXX 			
Battery	3.6-volt lithium thionyl chloride; battery is fully encapsulated within the register housing and is not replaceable; 20-year battery life			

1-1/2" and 2" Meters

E-Series Ultrasonic Meter Size	1-1/2" (40 mm)	2" (50 mm)
Operating Range	1.25...100 gpm	1.5...160 gpm
Extended Low-Flow Rate	0.40 gpm	0.50 gpm
Maximum Continuous Operation	100 gpm	160 gpm
Pressure Loss at Maximum Flow	3.8 psi	5.2 psi
Reverse Flow – Maximum Rate	12 gpm	18 gpm
Operating Performance	In the normal temperature range of 45...85° F (7...29° C), new meter consumption measurement is accurate to: <ul style="list-style-type: none"> • ±1.5% over the normal flow range • ±3.0% from the extended low flow range to the minimum flow value 	
Storage Temperature	– 40...140° F (– 40...60° C)	
Maximum Ambient Storage (Storage for One Hour)	150° F (72° C)	
Measured-Fluid Temperature Range	34...140° F (1...60° C)	
Humidity	0...100% condensing; meter is capable of operating in fully submerged environments	
Maximum Operating Pressure of Meter Housing	175 psi (12 bar)	
Register Type	Straight reading, permanently sealed electronic LCD; digits are 0.28" (7 mm) high	
Register Display	<ul style="list-style-type: none"> • Consumption (up to nine digits) • Rate of flow • Alarms • Unit of measure factory programmed for gallons, cubic feet and cubic meters 	
Register Capacity	<ul style="list-style-type: none"> • 100,000,000 gallons • 10,000,000 cubic feet • 1,000,000 cubic meters 	
Totalization Display Resolution	<ul style="list-style-type: none"> • Gallons: 0.X • Cubic feet: 0.XX • Cubic meters: 0.XXX 	
Battery	3.6-volt lithium thionyl chloride; battery is fully encapsulated within the register housing and is not replaceable; 20-year battery life	

MAINTENANCE

Badger Meter E-Series Ultrasonic meters are designed and manufactured to provide long-term service with no maintenance. The enclosure, which includes the electronic meter's ultrasonic sensors, battery and display, is completely potted, permanently sealed, and non-removable.

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www.badgermeter.com

The Americas | Badger Meter | 4545 West Brown Deer Rd | PO Box 245036 | Milwaukee, WI 53224-9536 | 800-876-3837 | 414-355-0400
México | Badger Meter de las Americas, S.A. de C.V. | Pedro Luis Ogazón N°32 | Esq. Angelina N°24 | Colonia Guadalupe Inn | CP 01050 | México, DF | México | +52-55-5662-0882
Europe, Middle East and Africa | Badger Meter Europa GmbH | Nurtinger Str 76 | 72639 Neuffen | Germany | +49-7025-9208-0
Czech Republic | Badger Meter Czech Republic s.r.o. | Mařikova 2082/26 | 621 00 Brno, Czech Republic | +420-5-41420411
Slovakia | Badger Meter Slovakia s.r.o. | Racianska 109/B | 831 02 Bratislava, Slovakia | +421-2-44 63 83 01
Asia Pacific | Badger Meter | 80 Marine Parade Rd | 21-04 Parkway Parade | Singapore 449269 | +65-63464836
China | Badger Meter | 7-1202 | 99 Hangzhong Road | Minhang District | Shanghai | China 201101 | +86-21-5763 5412

| sales@mvandc.com | Phone: 877.566.3837 | Fax: 925.407.2903