

OVERVIEW

The BEACON® solution with ORION® Network as a Service (NaaS) presents a simple, yet powerful solution to bring a new level of utility optimizing information to light.

The solution combines our intuitive BEACON Software as a Service (SaaS) with a NaaS approach using proven ORION Cellular endpoints to deliver greater visibility and control over utility management.

Built-in infrastructure management services and a system design that keeps you in step with technology advancements, allows you to do what you do best—manage your water utility. Plus, built-in consumer engagement tools help enhance customer service, increase satisfaction and reduce costs.

SOFTWARE APPLICATIONS

BEACON SaaS

With tools beyond meter reading and network management, BEACON SaaS offers targeted advanced metering analytics. BEACON puts interval meter data to work to increase efficiency in day-to-day utility operations and address demands for actionable intelligence.

- **Problem solver** – User intuitive data tools place the power of water consumption data at your fingertips, allowing you to rapidly respond to customer inquiries and quickly resolve—and even eliminate—many billing issues.
- **Customized design** – A customizable dashboard delivers information configured to user security access level in a format matched to the utility's individual requirements, providing data management integrity, security and control.
- **Works with you** – Integration with utility systems—billing, work order, inventory, Customer Relationship Management (CRM) and Geographic Information Systems (GIS)—streamlines and improves utility operations without disrupting the current utility billing interface file transfer process.
- **Find out fast** – Alert conditions can be set to monitor and notify users of system exceptions, including continuous flow, for faster leak detection.
- **Innovation at your service** – Secure, hosted platform with automatic software upgrades ensures the latest technology and features are always available.

EyeOnWater®

The BEACON software suite includes informative consumer outreach tools to improve customer service consisting of the EyeOnWater consumer engagement website, smartphone mobile apps, and email or SMS text alerts, providing easy access to personal consumption data and alerts to potential leaks.



With these tools, water consumers are able to view their usage activity, and gain greater understanding and control of what they use and the value you provide.

HARDWARE

ORION NaaS is powered by the proven ORION system for interval data capture and two-way communication. The solution employs cellular endpoints which, as they leverage the public cellular network and require no proprietary gateways to operate, dramatically reduce infrastructure requirements compared to a traditional fixed network. This speeds installations and simplifies expansion as a system evolves.

- **High resolution data** – ORION Cellular endpoints are programmed to automatically broadcast 15-minute meter reading and event data to the BEACON software up to four (4) times per day. The high resolution data helps identify potential customer-side leaks and other anomalies in water use, and provides the utility with a potent tool to enhance its customer service.
- **Two-way communication** – BEACON software communicates with ORION Cellular endpoints to accomplish a number of system tasks, including requesting additional information from the endpoint and synchronizing the internal endpoint clock. If needed, the ORION two-way system architecture sends upgrades to the endpoint firmware over the air via the network, utilizing the powerful BEACON software suite.
- **Data integrity** – Each message from the ORION Cellular endpoint is securely transported to the BEACON software only via private network and never over the public internet.

SECURITY

BEACON is ISO 27001 certified and SOC 2 examined for security, availability and confidentiality.

TECHNICAL SUPPORT AND TRAINING

Configured for the utility, safe and secure BEACON SaaS provides utilities with regular software updates, long-term support and maintenance. Comprehensive BEACON training courses are available for online or on-site delivery at the time of system deployment. To maintain best practices, a library of online resources and options for group web-based training and support are also available. Once deployed, our technical support specialists can be contacted by phone, email and web to provide ongoing, customer-friendly support. Customized one-on-one training is available (fee applies) to further enhance user expertise.

Additionally, Badger Meter offers extended customized training to further enhance user expertise.

TECHNICAL REQUIREMENTS

BEACON

Developed as a hosted software platform, BEACON is a cloud-based application accessed through a standard web browser. Internet access is required. User logins provide secure access.

BEACON supported web browsers include the latest and next previous major releases of Google® Chrome, Microsoft® Edge, Mozilla® Firefox®, Microsoft® Internet Explorer® (IE 11 only); and Apple® Safari®.

EyeOnWater Consumer Engagement

The EyeOnWater consumer engagement website is a cloud-based application accessed through a standard web browser. Internet access is required. Water consumer user logins provide secure access to their information.

Supported web browsers include the latest and next previous major releases of Google® Chrome, Microsoft® Edge, Mozilla® Firefox®, Microsoft® Internet Explorer® (IE 11 only); and Apple® Safari®.

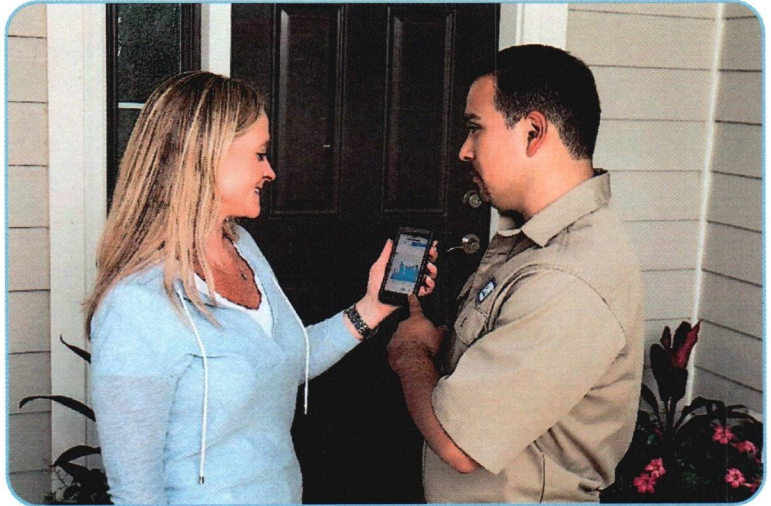
Smartphone applications require the following operating systems that can be downloaded from Google Play or the Apple Store:

- Android 7.0 or later
- iPhone, iPad iOS 16.0 or later



Badger Meter

BEACON® Software as a Service (SaaS) EyeOnWater® Consumer Engagement



Direct Water Consumption Data

Gives utility customers direct access to their water consumption data, allowing them to easily view, understand and manage their water usage.

Improved Customer Service

Improved customer service and reduced calls to the utility.

Promotes Water Conservation

Promotes changes in behavior related to water conservation.

EyeOnWater® is a consumer engagement application that goes beyond traditional monthly statements to connect utilities and their customers like never before. Available exclusively through BEACON® SaaS, EyeOnWater enables utility customers to view and understand their usage profile through easy-to-understand consumption graphs and provides a simple method to establish alerts to better manage their water use.

Literally putting water usage data in the palm of consumers' hands, EyeOnWater mobile apps bring the power of the online portal to your customer's iOS device or Android smartphone.

Features:

- Secure, cloud-based – ISO 27001 certified and SOC 2 examined for security, availability and confidentiality
- Hourly, daily, monthly, and yearly data and charts
- Temperature and precipitation overlays
- Week-over-week consumption comparisons
- Configurable leak alerts by email or SMS text
- Web-based consumer portal, plus Android and iOS mobile apps

**Better information. Better utility management.
Clearly Better.**

SMART WATER IS BADGER METER

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DESCRIPTION

ORION® Cellular water endpoints are innovative, two-way endpoints for smart water applications. The endpoints utilize existing IoT (Internet of Things) cellular infrastructure to efficiently and securely deliver meter reading data to the utility in a Network as a Service (NaaS) approach. Leveraging existing cellular infrastructure, the NaaS solution offers all the performance benefits of AMI, while eliminating network-related maintenance and technology concerns and enhancing deployment flexibility.

Cellular endpoints are members of the time-tested ORION family of products from Badger Meter, designed for maximum flexibility. Since 2002, the ORION product family has provided comprehensive Advanced Metering Analytics (AMA) for interval meter reading and data capture using both one-way and two-way communications.

FUNCTIONALITY

Operation: ORION Cellular water endpoints communicate with the encoder and capture 15-minute interval read data and meter status information. The endpoints then automatically broadcast the information, including endpoint status information, via the cellular network to BEACON® Software as a Service (SaaS). ORION NaaS is powered by the proven ORION system for interval data capture and two-way communication. The solution employs cellular endpoints which, as they leverage the public cellular network and require no proprietary gateways to operate, dramatically reduce infrastructure requirements compared to a traditional fixed network. This speeds installations and simplifies expansion as a system evolves.

The endpoints are designed to call in four times each workday and feature a configurable schedule that enables utility customers to select call-in times that best support their processes.

Activation: ORION Cellular water endpoints are shipped in an inactive, non-transmitting state. The Badger Meter IR Communication Device can be used to activate the endpoints and verify the encoder connection. Successful endpoint function can be confirmed through a web app demonstrating that communication has been verified to both the encoder and the network.

Alternatively, the endpoints offer a Smart Activation feature. After installation, the endpoints begin broadcasting data when the encoder senses the first usage of water. No field programming or special tools are required.

Broadcast Mode: ORION Cellular water endpoints broadcast fixed network reading data through the secure cellular network within the service area.

Specific configurations also transmit a radio frequency (RF) message to facilitate troubleshooting in the field. See ["Configurations" on page 2](#).

Data Storage: The endpoints store 42 days of 15-minute data.



ORION Cellular C endpoint (pictured)

Output Message: ORION Cellular water endpoints broadcast a unique serial number, meter reading data, and applicable status indicators. As an advanced data security measure, each message is securely transported to BEACON SaaS only via private network and never over the public internet.

APPLICATION

Configurations: ORION Cellular water endpoints are multi-purpose endpoints that can be deployed in indoor, outdoor and pit (non-metal pit lid) applications. The electronics and battery assembly are fully encapsulated in epoxy for environmental integrity. The endpoint is available with a connector assembly for ease of installation.

Meter Compatibility: When attached to a Badger Meter High Resolution Encoder, the ORION Cellular water endpoint is compatible with all current Badger Meter Recordall® Disc, Turbo Series, Compound Series, Combo Series and Fire Service meters and assemblies, and with E-Series G2® Ultrasonic, E-Series® Ultrasonic, E-Series® Ultrasonic Plus, and ModMAG® electromagnetic flow meters.

Encoder Compatibility: The ORION Cellular water endpoint is suitable for use with a Badger Meter High Resolution Encoder as well as the following Badger Meter approved three-wire encoder registers that have a manufacture date within 10 years of the current date as long as the encoder has three wires connected to it and is programmed into the three-wire output mode for AMR/AMI: Honeywell® (Elster/ABB) ScanCoder, evoQ4 meter with Sensus® protocol module; Master Meter® Octave® Ultrasonic meter encoder output; Metron-Farnier Hawkeye; Mueller Systems 420 Solid State Register (SSR) LCD; Neptune® ProRead, E-Coder®, ARB-V®, and ProCoder; and Sensus iPerl®.

SPECIFICATIONS

Dimensions	5.125 in. (130 mm) (H)
	1.75 in. (44 mm) Diameter at top
	2.625 in. (W) x 2.875 in. (D) at base
	(67 mm (W) x 73 mm (D) at base)
Broadcast Network	LTE-M cellular network (primary communication technology)
	NB-IoT (secondary communication technology for certain variants)
RF Message for Troubleshooting	Where available (see table below) frequency is FCC-regulated 902...928 MHz frequency hopping modulation
Operating Temperature Range	
	• Storage, Meter Reading and RF Message (for troubleshooting) –40...60° C (–40...140° F)
	• Cellular Communications –20...60° C (–4...140° F)
Humidity	0%...100% condensing
Battery	One (1) lithium thionyl chloride D cell (nonreplaceable)

Construction: All ORION Cellular water endpoints are housed in an engineered polymer enclosure with an ORION RF board, battery and antenna. For long-term performance, the enclosure is fully potted to withstand harsh environments and to protect the electronics in flooded or submerged pit applications.

Wire Connections: ORION Cellular water endpoints are available with inline connectors (Twist Tight® or Nicor®) for easy installation and connection to compatible encoders/meters. The endpoints are also available with flying leads for field splice connections. Other wire connection configurations may be available upon request.

FEATURES

Smart City Ready	Future-proof technology
Communication Type	Two-way
Application Type	Control/Monitor
Endpoint Communication	Configurable call-in schedule, up to four times each workday
Reading Interval Type	15-minute
Encoder Compatibility	Absolute
Fixed Network Reading	✓
Cut-Wire Indication	✓
Encoder Error	✓
Low Battery Indication	✓
Remote Clock Synchronization	✓
Firmware Upgrades	✓

CONFIGURATIONS

Endpoint	Notes
ORION Cellular C	Includes RF and IR messages for troubleshooting
ORION Cellular HLD	Includes RF and IR messages for troubleshooting
ORION Cellular LTE-M	Includes RF and IR messages for troubleshooting

NOTE: For the ORION Cellular LTE-MP endpoint, see the *ORION Cellular LTE-MP Endpoint product data sheet*, available at www.badgermeter.com.

ORION Cellular endpoints are IoT Network Certified by CTIA, an association representing the U.S. wireless communications industry and companies throughout the mobile ecosystem. The certification signifies that the endpoints meet global 4G and 5G standards and are ready for use on wireless IoT networks.



License Requirements:	ORION Cellular water endpoints comply with Part 15, Part 22, Part 24, and Part 27 of the FCC Rules. No license is required by the utility to operate an ORION meter reading system. This device complies with Industry Canada license-exempt RSS standard(s).
Transportation:	WARNING: The operation of transmitters and receivers on airlines is strictly prohibited by the Federal Aviation Administration. As such, the shipping of radios and endpoints via air is prohibited. Please follow all Badger Meter return and/or shipping procedures to prevent exposure to liability.
Warning:	To reduce the possibility of electrical fire and shock hazards, never connect the cable from the endpoint to any electrical supply source. The endpoint cable provides SELV low voltage limited energy power to the load and should only be connected to passive elements of a water meter register.
Caution:	Endpoint batteries are <i>not</i> replaceable. Users should make no attempt to replace the batteries. Changes or modifications to the equipment that are not expressly approved by Badger Meter could void the user's authority to operate the equipment.

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DESCRIPTION

The E-Series® Ultrasonic meter uses solid-state technology in a compact, totally encapsulated, weatherproof, and UV-resistant housing, suitable for residential and commercial applications. Electronic metering provides information—such as rate of flow and reverse flow indication—and data not typically available through traditional, mechanical meters and registers. Electronic metering eliminates measurement errors due to sand, suspended particles and pressure fluctuations.

The Ultrasonic 5/8, 5/8 x 3/4, 3/4, and 1 inch meters feature:

- Minimum extended low-flow rate lower than typical positive displacement meters.
- Simplified one-piece electronic meter and register that are integral to the meter body and virtually maintenance free.
- Sealed, non-removable, tamper-protected meter and register.
- Easy-to-read, 9-digit LCD display presents consumption, rate of flow, reverse-flow indication, and alarms (empty pipe, temperature, exceeding max flow, sensor error, reverse flow, suspected leak, 30 day no usage, end of life).
- High resolution industry standard ASCII encoder protocol sends alarms and data to ORION® Cellular endpoints and BEACON® SaaS* suite to establish a smart water solution.

The Ultrasonic meter is available with an in-line connector for easy connection and installation to AMR/AMI endpoints. It is also available with a flying lead for field splice connection.

* Software as a Service

APPLICATIONS

Use the Ultrasonic meter for measuring potable cold water in residential, commercial and industrial services. The meter is also ideal for non-potable, irrigation water applications or less than optimum water conditions where small particles exist.

E-Series Ultrasonic meters meet and exceed ANSI/AWWA C715 standards. The meters comply with the lead-free provisions of the Safe Drinking Water Act, are certified to NSF/ANSI/CAN Standards 61 and 372 and carry the NSF-61 mark on the housing.

OPERATION & PERFORMANCE

As water flows into the measuring tube, ultrasonic signals are sent consecutively in forward and reverse directions of flow. Velocity is then determined by measuring the time difference between the measurement in the forward and reverse directions. Total volume is calculated from the measured flow velocity using water temperature and pipe diameter. The LCD display shows total volume and alarm conditions and can toggle to display rate of flow.



Badger Meter

ESM-DS-00041-EN-09 (November 2022)



In the normal temperature range of 45...122° F (7...50° C), the Ultrasonic "new meter" consumption measurement is accurate to:

- ±1.5% over the normal flow range
- ±3.0% from the extended low flow range to the minimum flow value

CONSTRUCTION

E-Series Ultrasonic meters feature an engineered polymer, lead-free meter housing, an engineered polymer and stainless steel metering insert, a meter-control circuit board with associated wiring, LCD, and battery. Wetted elements are limited to the pressure vessel, polymer/stainless steel metering insert and the transducers. The electronic components are housed and fully potted within a molded, engineered polymer enclosure, which is permanently attached to the meter housing. The transducers extend through the polymer housing and are sealed by O-rings.

The metering insert holds the stainless steel ultrasonic reflectors in the center of the flow area, enabling turbulence-free water flow through the tube and around the ultrasonic signal reflectors. The metering insert's patented design virtually eliminates chemical buildup on the reflectors, ensuring long-term metering accuracy.

METER INSTALLATION

The meter is completely submersible and can be installed using horizontal or vertical piping, with 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.

SPECIFICATIONS

E-Series Ultrasonic Meter Size	5/8 in. (15 mm)	5/8 x 3/4 in. (15 mm)	3/4 in. (20 mm)	1 in. (25 mm)
Normal Test Flow Limits	0.1...25 gpm (0.02...5.7 m ³ /hr)	0.1...25 gpm (0.02...5.7 m ³ /hr)	0.1...32 gpm (0.02...7.3 m ³ /hr)	0.4...55 gpm (0.09...12.5 m ³ /hr)
Minimum Test Flow Limits	0.05 gpm (0.01 m ³ /hr)	0.05 gpm (0.01 m ³ /hr)	0.05 gpm (0.01 m ³ /hr)	0.25 gpm (0.06 m ³ /hr)
Safe Maximum Operating Condition (SMOC)	25 gpm (5.7 m ³ /hr)	25 gpm (5.7 m ³ /hr)	32 gpm (7.3 m ³ /hr)	55 gpm (12.5 m ³ /hr)
Typical Pressure Loss	4.3 psi at 15 gpm (0.3 bar @ 3.4 m ³ /hr)	2.3 psi at 15 gpm (0.16 bar @ 3.4 m ³ /hr)	2.0 psi at 15 gpm (0.14 bar @ 3.4 m ³ /hr)	1.8 psi at 25 gpm (0.12 bar @ 5.7 m ³ /hr)
Reverse Flow - Maximum Rate	4.0 gpm (0.9 m ³ /hr)	4.0 gpm (0.9 m ³ /hr)	4.0 gpm (0.9 m ³ /hr)	9.0 gpm (2.0 m ³ /hr)
Operating Performance	In the normal temperature range of 45...122° F (7...50° 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 (66° 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 in. (7 mm) high			
Register Display	<ul style="list-style-type: none"> • Consumption (up to nine digits) • Rate of flow • Alarms (empty pipe, temperature, exceeding max flow, sensor error, reverse flow, suspected leak, 30 day no usage, end of life) • 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			

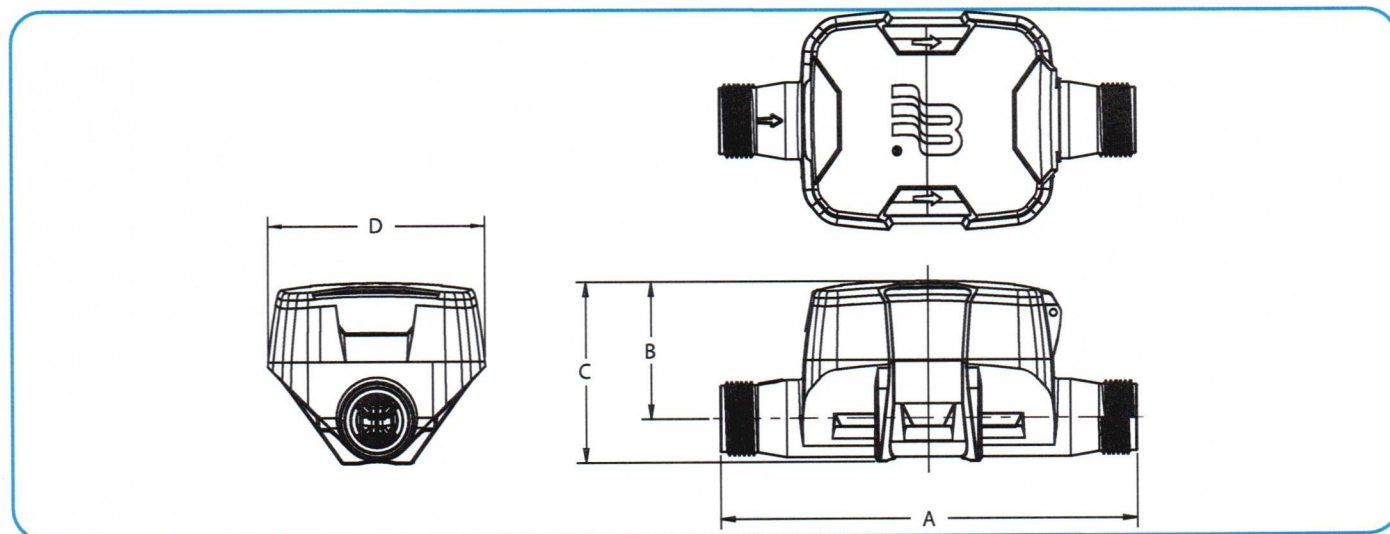
MATERIALS

Meter Housing	Engineered polymer
Measuring Element	Pair of ultrasonic sensors located in the flow tube
Register Housing & Lid	Engineered polymer
Metering Insert	Engineered polymer & stainless steel
Transducers	Piezo-ceramic device with wetted surface of stainless CrNiMo

PHYSICAL DIMENSIONS

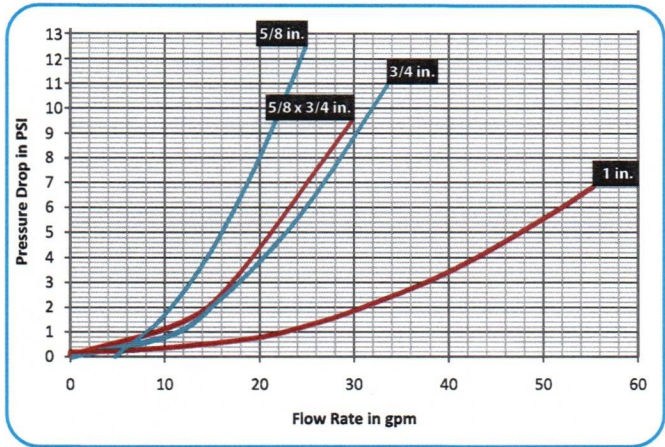
E-Series Ultrasonic Meter Size	5/8 in. (15 mm)	5/8 (15 mm) x 3/4 in. (20 mm)	3/4 in. (20 mm)	1 in. (25 mm)
Size Designation X Lay Length	5/8 x 7-1/2 in. (16 x 191 mm)	5/8 x 3/4 x 7-1/2 in. (16 x 19 x 191 mm)	3/4 x 7-1/2 in. or 3/4 x 9 in. (19 x 191 mm or 19 x 229 mm)	1 x 10-3/4 in. (25 x 273 mm)
Weight (without AMR)	1.60 lb (0.73 kg)	1.58 lb (0.72 kg)	3/4 x 7-1/2 in.: 1.58 lb or 3/4 x 9 in.: 1.64 lb (19 x 191 mm: 0.72 kg or 19 x 229 mm: 0.74 kg)	2.3 lb (1.04 kg)
See illustration below for Measurement Designations.				
Length (A)	7.5 in. (191 mm)	7.5 in. (191 mm)	7.5 in. or 8.85 in. (191 mm or 225 mm)	10.75 in. (273 mm)
Height (B)	2.46 in. (62 mm)	2.46 in. (62 mm)	2.46 in. (62 mm)	2.66 in. (68 mm)
Height (C)	3.27 in. (83 mm)	3.23 in. (82 mm)	3.23 in. (82 mm)	3.62 in. (92 mm)
Width (D)	3.90 in. (99 mm)	3.90 in. (99 mm)	3.90 in. (99 mm)	3.90 in. (99 mm)
Bore Size	5/8 in. (15 mm)	3/4 in. (19 mm)	3/4 in. (19 mm)	1 in. (25 mm)
Coupling Nut & Spud Thread	3/4 in. x 14 NPSM	1 in. x 11-1/2 NPSM	1 in. x 11-1/2 NPSM	1-1/4 in. x 11-1/2 NPSM
Tailpiece Pipe Thread (NPT)	1/2 in.	3/4 in.	3/4 in.	1 in.
Service Pipe Thread (NPT)	1/2 in.	3/4 in.	3/4 in.	1 in.

MEASUREMENT DESIGNATIONS



PRESSURE LOSS CHART

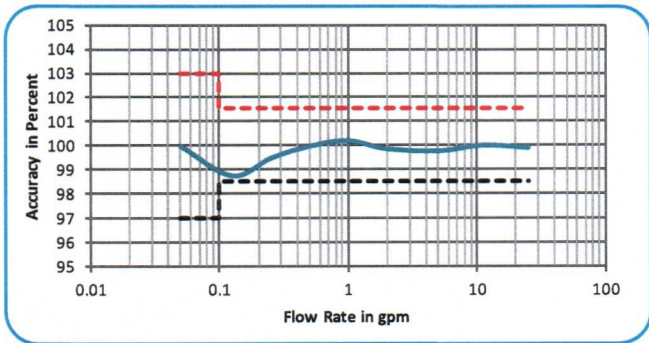
Rate of Flow in gallons per minute (gpm)



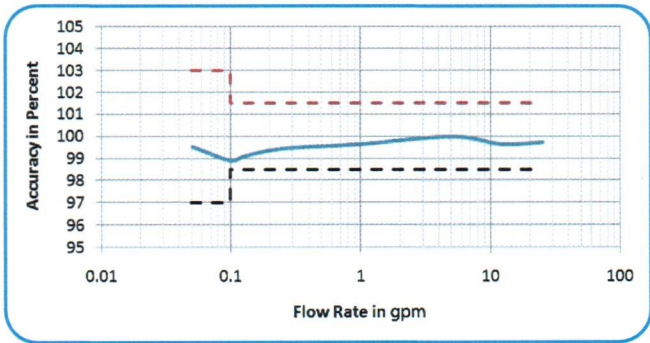
ACCURACY CHARTS

Rate of Flow in gallons per minute (gpm)

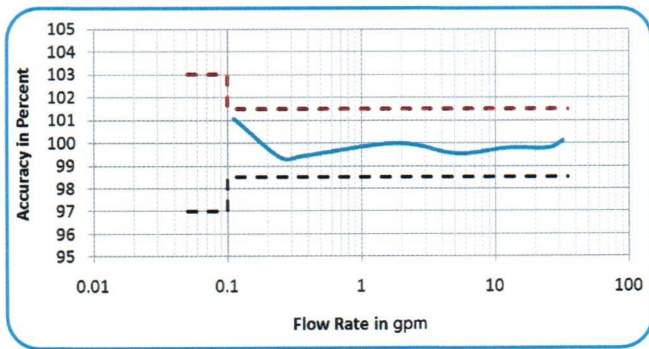
5/8 IN. METER



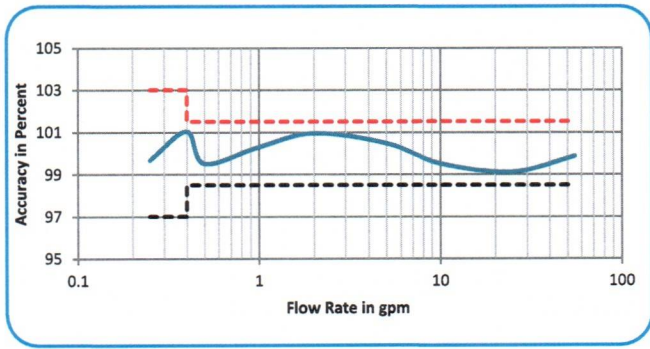
5/8 x 3/4 IN. METER



3/4 IN. METER



1 IN. METER



SMART WATER IS BADGER METER

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E-Series G2® Ultrasonic Meters

Lead-Free Bronze Alloy, 5/8, 5/8 x 3/4, 3/4, 1 inch

DESCRIPTION

The next generation E-Series G2® Ultrasonic meter uses solid-state technology in a compact, tamper protected, weatherproof and UV-resistant housing, suitable for residential applications. Electronic metering provides information—such as rate of flow and status and alarm indication—and data not typically available through traditional, mechanical meters and registers. Electronic metering minimizes measurement errors due to sand, suspended particles and pressure fluctuations.

Ultrasonic Meter Features

- Flow tube design prevents obstruction of flow, and provides greater turn-down ratio for extended flow ranges and increased revenue
- No moving parts for increased performance and maximized revenue
- Easy-to-read, 9-digit LCD display for consumption, rate of flow, unit of measure, pressure, temperature, alarm conditions (reverse-flow, no usage, empty pipe, exceeding max flow, suspected leak, pressure*, temperature, end of life and measurement error) and firmware version
- High resolution industry standard ASCII encoder protocol sends alarms and data to ORION® endpoints and BEACON® Software as a Service (SaaS) suite to establish a smart water solution for better visibility and management
- Pressure* and temperature data and alarms reported at meter and through ORION endpoints and BEACON SaaS
- Field programmable registration and maintains an hourly internal logging capacity of 160 days of data
- Maximum flow reporting analytics available to improve meter right sizing and monitor irrigation events
- Single and dual outputs include encoder, scaled/unscaled and 4-20 mA

**available with optional integrated pressure sensor*

OPERATION AND PERFORMANCE

As water flows into the measuring tube, ultrasonic signals are sent consecutively in forward and reverse directions of flow. Velocity is then determined by measuring the time difference between the measurement in the forward and reverse directions. Total volume is calculated from the measured flow velocity using water temperature and pipe diameter.

The LCD screen toggles to total volume, unit of measure, rate of flow, pressure*, temperature, firmware and alarm conditions (reverse-flow, no usage, empty pipe, exceeding max flow, suspected leak, pressure*, temperature, end of life and measurement error).

When connected to ORION endpoints, both the pressure and temperature information are communicated to and presented in BEACON, helping utilities understand and proactively manage their water systems faster and more efficiently.



Badger Meter

ESM-DS-03096-EN-11 (December 2024)



In the normal temperature range of 45...122° F (7...50° C), the “new meter” consumption measurement is accurate to:

- $\pm 1.5\%$ over the normal flow range
- $\pm 3.0\%$ from the extended low flow range to the minimum flow value

**available with optional integrated pressure sensor*

APPLICATIONS

Use the E-Series Ultrasonic meter for measuring potable cold water in residential applications. The meter is also ideal for non-potable, reclaimed irrigation water applications, or less than optimum water conditions where small particles exist.

E-Series Ultrasonic meters meet and exceed ANSI/AWWA C715 Standards. The lead-free bronze alloy meters comply with the lead-free provisions of the Safe Drinking Water Act and NSF/ANSI/CAN Standards 61 and 372.

The 3/4 and 1 inch Ultrasonic meters are UL Listed under UL Subject 327B, inferential type water meters used in residential fire service applications. These applications are regulated by local codes and requirements established by the Authority Having Jurisdiction (AHJ). Additional application information is provided in NFPA 13D, one- and two-family residences.

CONSTRUCTION

The E-Series Ultrasonic meter features lead-free bronze alloy meter housing, ultrasonic transducers, a meter-control circuit board with associated wiring, LCD, and battery. Wetted elements are limited to the pressure vessel and transducers. The electronic components are housed and fully potted within a molded, engineered polymer enclosure, which is attached to the meter housing. The transducers extend through the housing and are sealed by O-rings, enabling turbulence-free water flow through the tube. The flow tube is designed to reduce pressure loss and provide long-term accuracy.



Product Data Sheet

METER INSTALLATION

For long-term performance the meter is weatherproof, UV-resistant, fully submersible and can be installed using horizontal or vertical piping. The registration electronics and battery are encapsulated to withstand harsh environments and protect the electronics in flooded or submerged pit applications. The meter will not measure flow when an “empty pipe” condition is experienced.

NOTE: An empty pipe is defined as a condition that occurs when the flow sensors are not fully submerged.

The meter is available with an inline connector for easy installation and connection to ORION endpoints. It is also available with a flying lead for field splice connection.

SPECIFICATIONS

E-Series G2 Ultrasonic Meter Size	5/8 in.	5/8 x 3/4 in.	3/4 in. (7-1/2 in.)	3/4 in. (9 in.)	1 in.
Normal Test Flow Limits	0.08...30 gpm (0.02...6.81 m ³ /hr)	0.08...30 gpm (0.02...6.81 m ³ /hr)	0.1...35 gpm (0.02...7.95 m ³ /hr)	0.1...35 gpm (0.02...7.95 m ³ /hr)	0.16...62 gpm (0.04...14.08 m ³ /hr)
Minimum Test Flow Limits	0.04 gpm (0.009 m ³ /hr)	0.04 gpm (0.009 m ³ /hr)	0.04 gpm (0.009 m ³ /hr)	0.04 gpm (0.009 m ³ /hr)	0.075 gpm (0.017 m ³ /hr)
Safe Maximum Operating Condition (SMOC)	30 gpm (6.81 m ³ /hr)	30 gpm (6.81 m ³ /hr)	35 gpm (7.95 m ³ /hr)	35 gpm (7.95 m ³ /hr)	62 gpm (14.08 m ³ /hr)
Typical Pressure Loss	TBD	2.6 psi @ 15 gpm (0.18 bar @ 3.4 m ³ /hr)	4.2 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	4.2 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	4.1 psi @ 40 gpm (0.28 bar @ 9.1 m ³ /hr)
UL Approval for Residential Fire Service Meters - File No. EX15653	NA	NA	UL 327B	UL 327B	UL 327B
UL Test Flow Limits (at ±1.5% accuracy)	NA	NA	2...30 gpm (0.45...6.81 m ³ /hr)	2...30 gpm (0.45...6.81 m ³ /hr)	2...50 gpm (0.45...11.36 m ³ /hr)
Typical UL Pressure Loss	NA	NA	4.2 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	4.2 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	4.1 psi @ 40 gpm (0.28 bar @ 9.1 m ³ /hr)
Operating Performance	In the normal temperature range of 45...122 °F (7...50 °C), new meter consumption measurement is accurate to: 100% ±1.5% over the normal test flow limits, 100% ±3.0% for the minimum test flow limits				
Storage Temperature	- 40...140° F (- 40...60° C)				
Maximum Ambient Storage (Storage for One Hour)	150° F (66° 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 Working Pressure of Meter Housing	175 psi (12 bar)				
Maximum Operating Pressure of Pressure Sensor	175 psi (12 bar)				
Pressure Sensor Accuracy	±2% of full scale pressure, up to 175 psi (12 bar)				
Register Type	Straight reading, permanently sealed electronic LCD; digits are 0.28 in. (7 mm) high				
Register Display	<ul style="list-style-type: none"> Total consumption (nine digits) Rate of flow Temperature Pressure (Optional: for meters ordered with integrated pressure sensor) Alarm and operating mode Firmware version Alarm indicators Unit of measure (factory programmed for gallons, cubic feet and cubic meters) 				
Totalization Display Resolution	<ul style="list-style-type: none"> Gallons: 0.01 Cubic feet: 0.001 Cubic meters: 0.0001 				
Scaled/Unscaled Output*	Solid-state relay and Open Collector				
Max. Voltage	30V DC				
Current	10 mA				
Pulse Width	50 ms (programmable 25...100 ms)				
Analog 4-20 mA Output*	Two-wire/passive flow rate measurement				
Input Voltage Range	9...50V DC supply				
Current	4...20 mA				
Max. Load Resistance (Ohms)	(50 Ohms + 50 Ohms) × (Supply Voltage - 9V)				
Battery	3.6-volt lithium thionyl chloride; battery is fully encapsulated within the register housing and is not replaceable; 20-year battery life				

*Applicable to meters with dual output options

MATERIALS

Meter Housing	Lead-free bronze alloy
Measuring Section	Ultrasonic sensors located in the flow tube
Register Housing and Lid	Engineered polymer
Strainer*	Engineered composite

* Fire Service meters do not have a Strainer

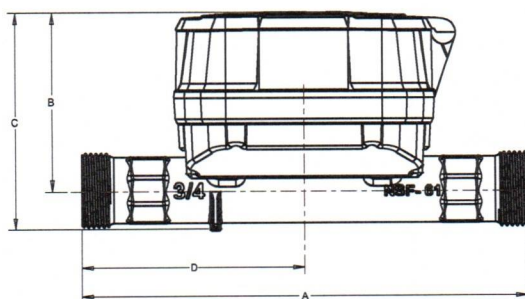
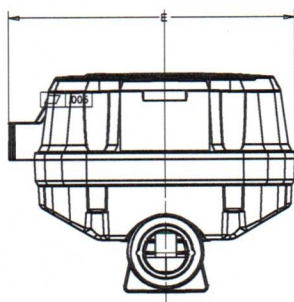
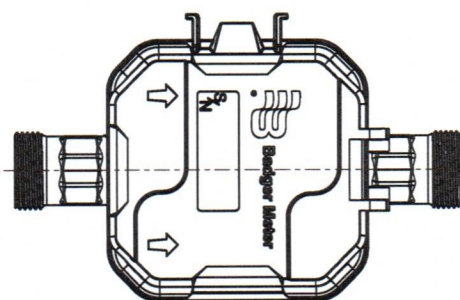
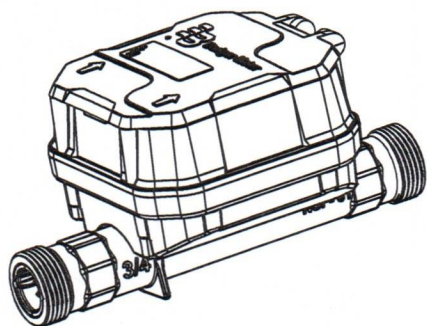
PHYSICAL DIMENSIONS

E-Series G2 Ultrasonic Meter Size	5/8 in.	5/8 x 3/4 in.	3/4 in. (7-1/2 in.)	3/4 in. (9 in.)	1 in.
Size Designation X Lay Length	5/8 x 7-1/2 in. (16 x 191 mm)	5/8 x 3/4 x 7-1/2 in. (16 x 19 x 191 mm)	3/4 x 7-1/2 in. (19 x 191 mm)	3/4 x 9 in. (19 x 229 mm)	1 x 10-3/4 in. (25 x 273 mm)
Bore Size	5/8 in. (16 mm)	3/4 in. (19 mm)	3/4 in. (19 mm)	3/4 in. (19 mm)	1 in. (25 mm)
Coupling Nut & Spud Thread (NPSM)	3/4 in. (19 mm) x 14 NPSM	1 in. (25 mm) x 11-1/2 NPSM	1 in. (25 mm) x 11-1/2 NPSM	1 in. (25 mm) x 11-1/2 NPSM	1-1/4 in. (32 mm) x 11-1/2 NPSM
Service Pipe Thread (NPSM)	1/2 in. (13 mm)	3/4 in. (19 mm)	3/4 in. (19 mm)	3/4 in. (19 mm)	1 in. (25 mm)
Tailpiece Pipe Thread (NPSM)	1/2 in. (13 mm)	3/4 in. (19 mm)	3/4 in. (19 mm)	3/4 in. (19 mm)	1 in. (25 mm)
Weight (without AMR)	TBD	2.7 lb (1.23 kg)	2.62 lb (1.19 kg)	2.86 lb (1.30 kg)	4.02 lb (1.82 kg)

See illustration below for Measurement Designations

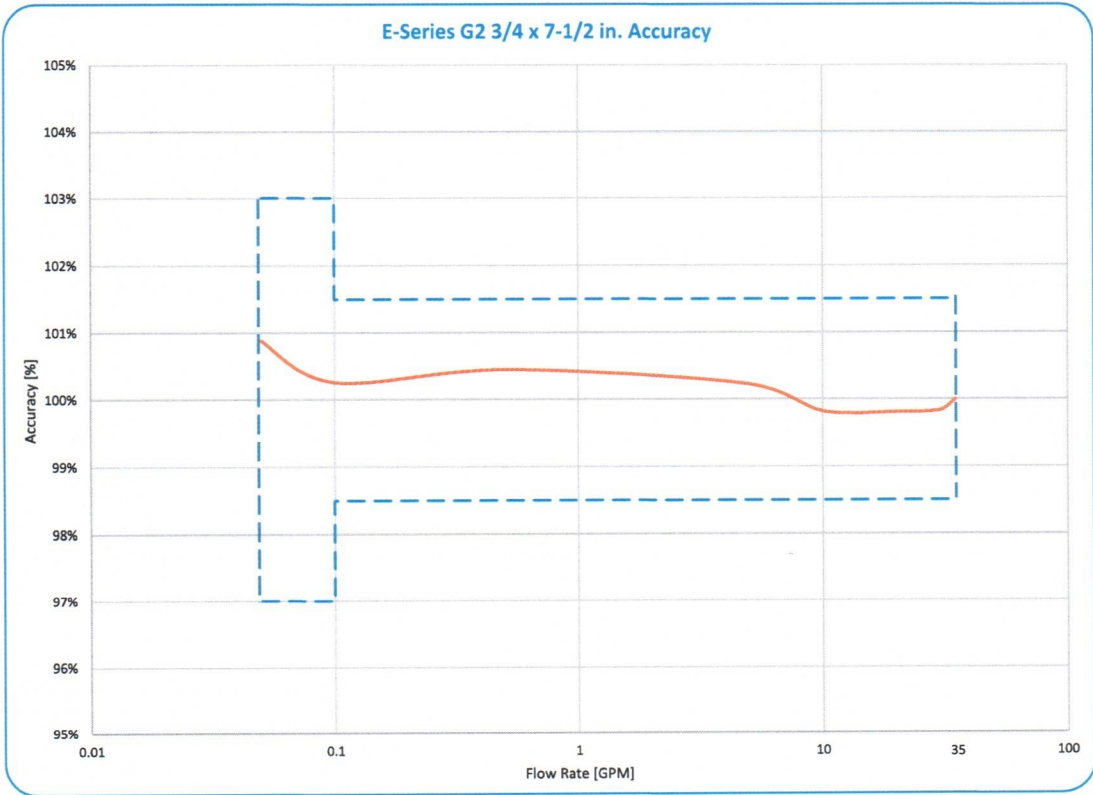
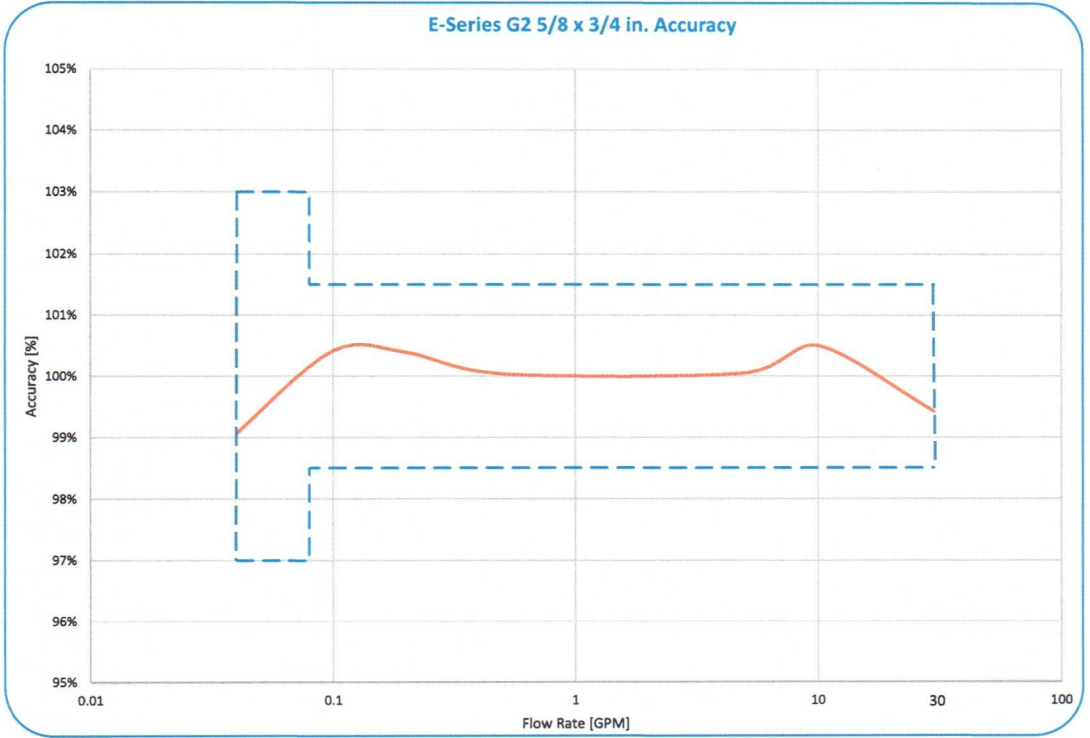
Length (A)	7.49 in. (190 mm)	7.46 in. (189 mm)	7.46 in. (189 mm)	8.93 in. (227 mm)	10.75 in. (273 mm)
Height (B)	2.95 in. (75 mm)	2.99 in. (76 mm)	2.99 in. (76 mm)	2.99 in. (76 mm)	3.19 in. (81 mm)
Height (C)	3.55 in. (90 mm)	3.66 in. (93 mm)	3.66 in. (93 mm)	3.69 in. (94 mm)	4.06 (103 mm)
Length (D)	3.74 in. (95 mm)	3.74 in. (95 mm)	3.74 in. (95 mm)	3.77 in. (96 mm)	3.94 (100 mm)
Width (E)	4.82 in. (122 mm)				

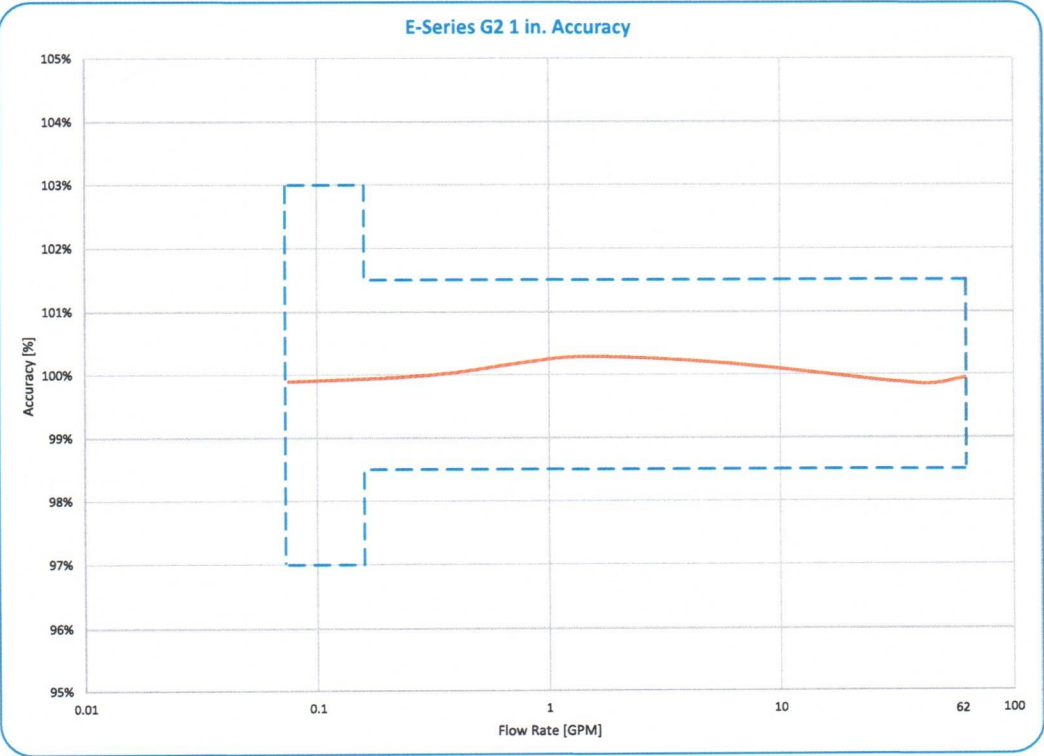
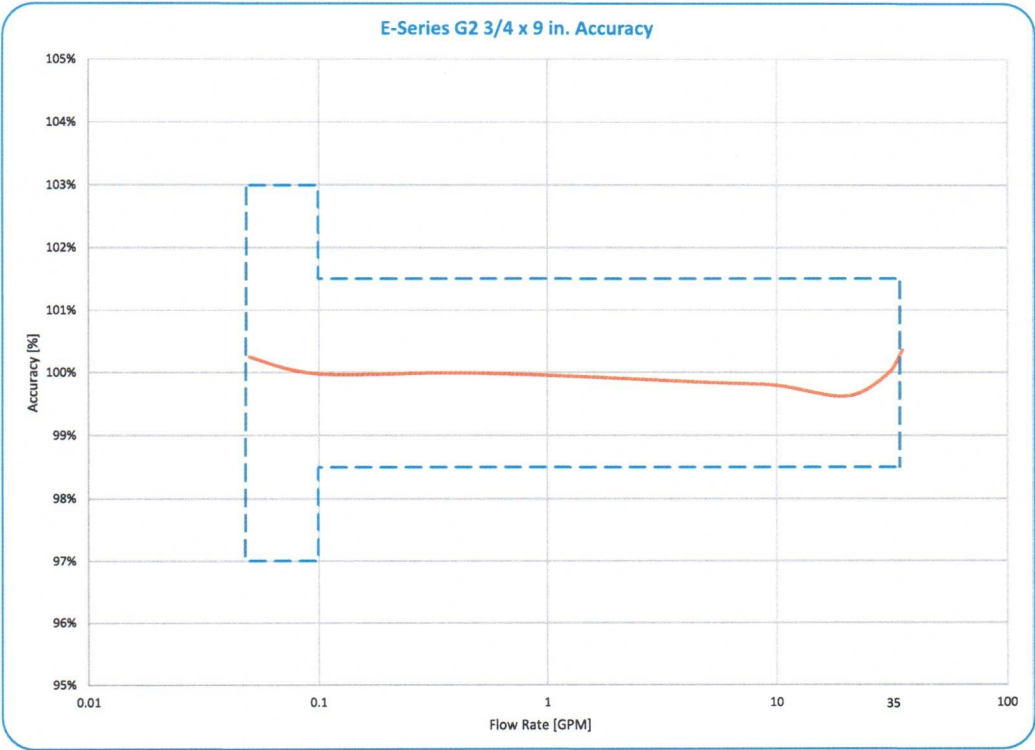
Measurement Designations



ACCURACY CHARTS

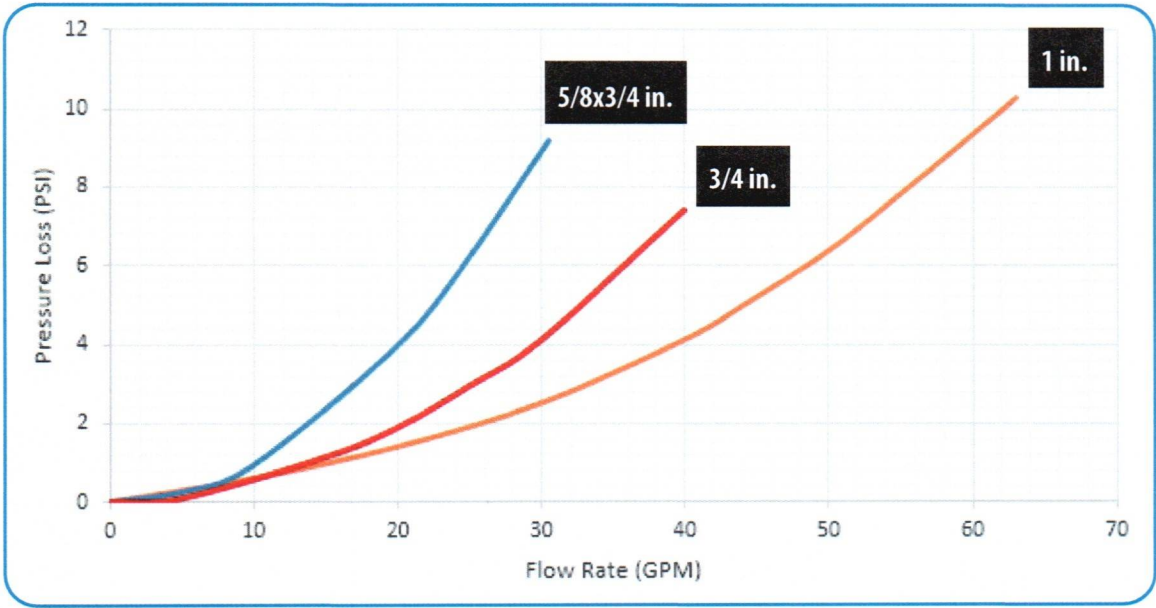
Each chart represents typical meter performance. Rate of flow in gallons per minute (gpm).





PRESSURE LOSS CHART

Chart represents typical meter performance. Rate of flow in gallons per minute (gpm).



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DESCRIPTION

The E-Series® Ultrasonic meter uses solid-state technology in a compact, totally encapsulated, weatherproof, and UV-resistant housing, suitable for residential and commercial applications. Electronic metering provides information—such as rate of flow and reverse flow indication—and data not typically available through traditional, mechanical meters and registers. Electronic metering eliminates measurement errors due to sand, suspended particles and pressure fluctuations.

The Ultrasonic 1-1/2 and 2 inch meters feature:

- Minimum extended low-flow rate lower than typical positive displacement meters.
- Simplified one-piece electronic meter and register that are integral to the meter body and virtually maintenance free.
- Sealed, non-removable, tamper-protected meter and register.
- Easy-to-read, 9-digit LCD display presents consumption, rate of flow, reverse-flow indication, and alarms (empty pipe, temperature, exceeding max flow, sensor error, reverse flow, suspected leak, 30 day no usage, end of life).
- High resolution industry standard ASCII encoder protocol sends alarms and data to ORION® Cellular endpoints and BEACON® SaaS* suite to establish a smart water solution.

The Ultrasonic meter is available with an in-line connector for easy connection and installation to AMR/AMI endpoints. It is also available with a flying lead for field splice connection.

* Software as a Service

APPLICATIONS

Use the Ultrasonic meter for measuring potable cold water in residential, commercial and industrial services. The meter is also ideal for non-potable, reclaimed irrigation water applications or less than optimum water conditions where small particles exist.

E-Series Ultrasonic meters meet and exceed ANSI/AWWA C715 standards. The meters comply with the lead-free provisions of the Safe Drinking Water Act, are certified to NSF/ANSI/CAN Standards 61 and 372 and carry the NSF-61 mark on the housing.

OPERATION & PERFORMANCE

As water flows into the measuring tube, ultrasonic signals are sent consecutively in forward and reverse directions of flow. Velocity is then determined by measuring the time difference between the measurement in the forward and reverse directions. Total volume is calculated from the measured flow velocity using water temperature and pipe diameter. The LCD display shows total volume and alarm conditions and can toggle to display rate of flow.



In the normal temperature range of 45...122° F (7...50° C), the Ultrasonic “new meter” consumption measurement is accurate to:

- ±1.5% over the normal flow range
- ±3.0% from the extended low flow range to the minimum flow value

CONSTRUCTION

E-Series Ultrasonic meters feature a stainless steel, lead-free meter housing, an engineered polymer and stainless steel metering insert, a meter-control circuit board with associated wiring, LCD, and battery. Wetted elements are limited to the pressure vessel, the polymer/stainless steel metering insert and the transducers. The electronic components are housed and fully potted within a molded, engineered polymer enclosure, which is permanently attached to the meter housing. The transducers extend through the stainless steel housing and are sealed by O-rings.

The metering insert holds the stainless steel ultrasonic reflectors in the center of the flow area, enabling turbulence-free water flow through the tube and around the ultrasonic signal reflectors. The metering insert's patented design virtually eliminates chemical buildup on the reflectors, ensuring long-term metering accuracy.

METER INSTALLATION

The meter is completely submersible and can be installed using horizontal or vertical piping, with 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 that occurs when the flow sensors are not fully submerged.

SPECIFICATIONS

E-Series Ultrasonic Meter Size	1-1/2 in. (40 mm)	2 in. (50 mm)
Normal Test Flow Limits	1.25...100 gpm (0.28...22.7 m ³ /hr)	1.5...160 gpm (0.34...36.3 m ³ /hr)
Minimum Test Flow Limits	0.40 gpm (0.09 m ³ /hr)	0.50 gpm (0.11 m ³ /hr)
Safe Maximum Operating Condition (SMOC)	100 gpm (22.7 m ³ /hr)	160 gpm (36.3 m ³ /hr)
Typical Pressure Loss	3.8 psi (0.26 bar)	5.2 psi (0.36 bar)
Reverse Flow – Maximum Rate	12 gpm (2.73 m ³ /hr)	18 gpm (4.09 m ³ /hr)
Operating Performance	In the normal temperature range of 45...122° F (7...50° 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 (66° 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 in. (7 mm) high	
Register Display	<ul style="list-style-type: none"> • Consumption (up to nine digits) • Rate of flow • Alarms (empty pipe, temperature, exceeding max flow, sensor error, reverse flow, suspected leak, 30 day no usage, end of life) • 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	

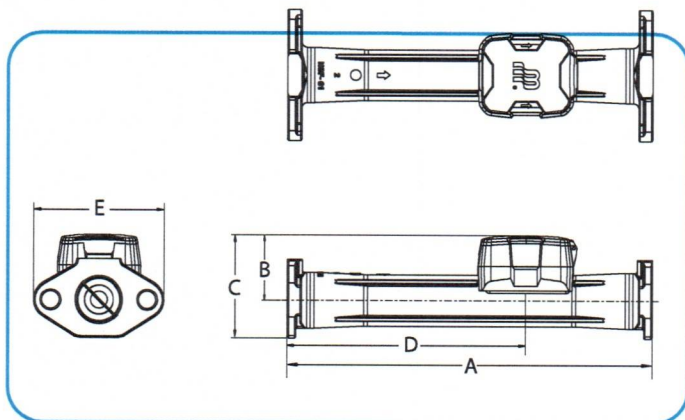
MATERIALS

Meter Housing	316 stainless steel
Measuring Element	Pair of ultrasonic sensors located in the flow tube
Register Housing & Lid	Engineered polymer
Metering Insert	Engineered polymer & stainless steel
Transducers	Piezo-ceramic device with wetted surface of stainless CrNiMo

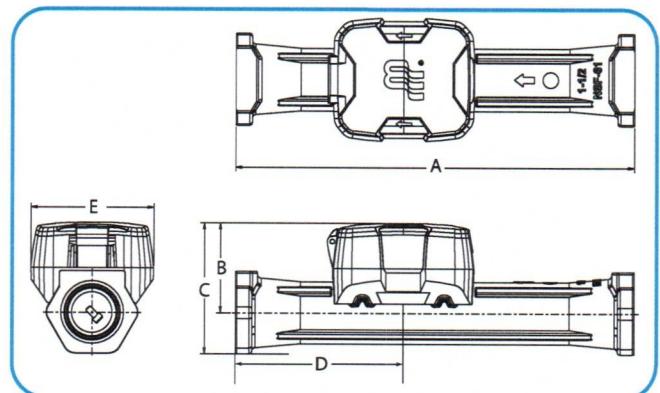
PHYSICAL DIMENSIONS

E-Series Ultrasonic Meter Size	1-1/2 in. (40 mm)	1-1/2 in. (40 mm)	2 in. (50 mm)	2 in. (50 mm)
Housing	Elliptical	HEX	Elliptical	HEX
Size Designation X Lay Length	1-1/2 x 13 in. (38 x 330 mm)	1-1/2 x 12.62 in. (38 x 321 mm)	2 x 17 in. (51 x 432 mm)	2 x 15.25 in. (51 x 387 mm)
Weight (without AMR)	8.2 lb (3.7 kg)	6.5 lb (2.9 kg)	11.9 lb (5.4 kg)	8.9 lb (4.0 kg)
See illustration below for Measurement Designations.				
Length (A)	13 in. (330 mm)	12.62 in. (321 mm)	17 in. (432 mm)	15.25 in. (387 mm)
Height (B)	2.80 in. (71 mm)	2.84 in. (72 mm)	3.01 in. (77 mm)	3.06 in. (78 mm)
Height (C)	4.55 in. (116 mm)	4.15 in. (105 mm)	4.76 in. (121 mm)	4.68 in. (119 mm)
Length (D)	7.10 in. (180 mm)	5.31 in. (135 mm)	11.10 in. (282 mm)	5.05 in. (128 mm)
Width (E)	5.50 in. (140 mm)	3.90 in. (99 mm)	6.08 in. (154 mm)	3.90 in. (99 mm)
Bore Size	1-1/2 in. (40 mm)	1-1/2 in. (40 mm)	2 in. (51 mm)	2 in. (51 mm)
Two-Bolt Elliptical Flange (AWWA)	1-1/2 in. (40 mm)	—	2 in. (51 mm)	—
Bolt Hole Diameter	0.69 in. (17.53 mm)	—	0.81 in. (20.57 mm)	—
Companion Flange	1-1/2 in. (40 mm)	—	2 in. (51 mm)	—
Internal Thread Size	—	1-1/2 in. NPT	—	2 in. NPT

Elliptical Measurement Designations

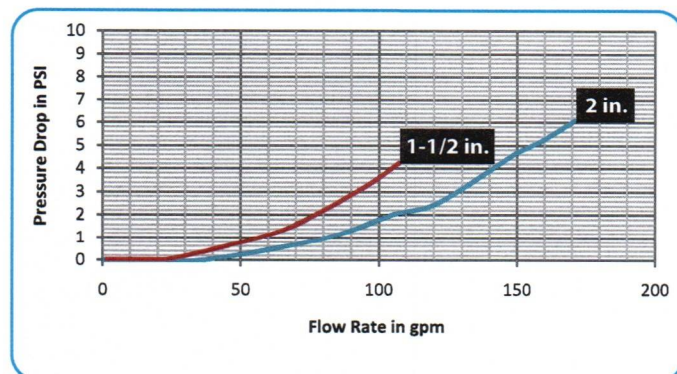


HEX Measurement Designations



PRESSURE LOSS CHART

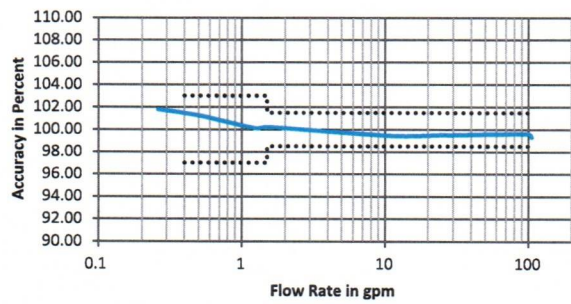
Flow rate in Gallons Per Minute (gpm)



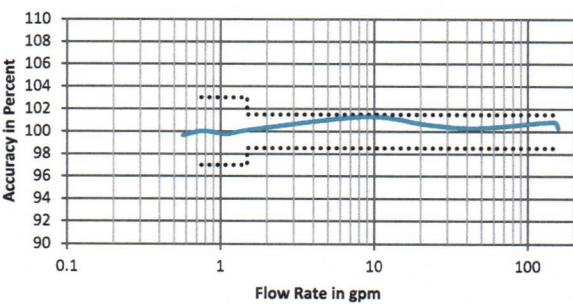
ACCURACY CHARTS

Rate of Flow in gallons per minute (gpm)

1-1/2 in. Meter



2 in. Meter



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Badger Meter

IR Communication Device

The IR Communication Device (**68891-001**) can be used with ORION® Cellular endpoints* and E-Series G2® Ultrasonic meters. See general information about the device below and the instructions for use on other side of this document.

* Refer to the *ORION Water Endpoint Installation Manual* available at www.badgermeter.com for a complete list of ORION Cellular endpoints.

HOW TO USE

1. Point the device toward the endpoint/meter IR communication port as shown in *Figure 1*. **Range: 1/2 to 3 inches**
2. Press a numbered button to activate. See instructions on *page 2*.

LED Indicator

- Solid **green** LED = success
- Blinking **green** LED = in process
- Blinking **red** LED = fail, error

When activated, the LED indicators next to the numbered buttons light up for 10 seconds. Another command can be issued at any time, which will clear the last command.

Optional Tools

- **ORION Cellular Endpoint IR Alignment Tool (68779-091)** is recommended for use with ORION endpoints. Available from Badger Meter.
- **E-Series Ultrasonic Meter IR Alignment Tool (68877-001)** is recommended for use with E-Series meters. Available from Badger Meter.
- Small (#1) Phillips screwdriver (customer supplied) to remove device back and replace CR2450 3V lithium coin battery.
- Micro B USB cable (customer supplied) to connect IR Communication Device to a computing device for file download or IR communications.

View the *IR Communication Device* video for a short step-by-step tutorial about activating an ORION Cellular endpoint. Visit <https://helpbeaconama.net/training-2/#videos> or scan the QR code to access the list of available videos on the Training page in BEACON Help.



About the IR Communication Device

- Has micro USB port for extracting data files (*Figure 1*). Requires micro B USB cable to download files.
 - Not rechargeable. Uses replaceable CR2450 3V lithium coin battery. Remove back of device to replace.
 - Functions with Windows®10 devices.
 - USB IR passthrough COM device: Functions the same as IR programming cable when micro B USB cord is attached.
 - USB storage: Stores log files from network sessions. Use micro USB port to extract files. Requires micro B USB cable to download files.
- NOTE:** Network logs are stored on the device and must be periodically downloaded/cleared via the micro USB port.

Point this end toward the IR communication port of the meter or endpoint

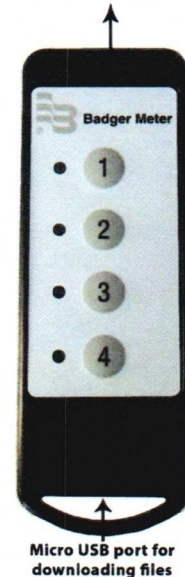
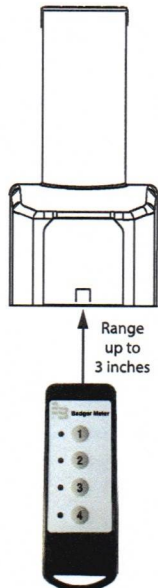


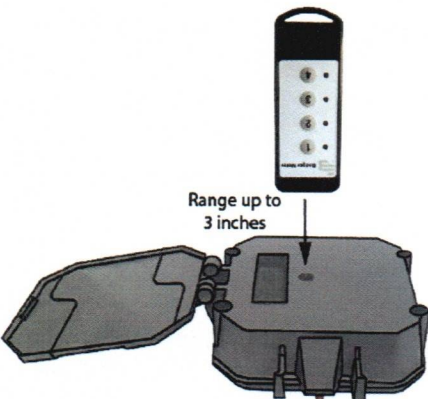
Figure 1: IR Communication Device

ORION® CELLULAR ENDPOINTS

NOTE: IR Communication Devices shipped prior to March 8, 2021 require a firmware update to support use with ORION Cellular C endpoints. Contact Badger Meter Technical Support (800-616-3837).

 <p>Range up to 3 inches</p> <p>Figure 2: Using device with ORION Cellular endpoint</p>	Button	Press Length	Command	Operation
	1	SHORT*	Start/Active/Run	One SHORT press will START the 3-part process to activate an endpoint in Pause or Stop mode. NOTE: LED 1, 3, and 4 automatically light up in sequence as process continues. (No need to press additional buttons.) Endpoint LED flashes when process is done. IMPORTANT: Keep IR Communication Device aligned to endpoint IR port until process is complete. Alignment Tool recommended! Process is completed when device LEDs are no longer lit. NOTE: Network session generates a log file.
		LONG**	n/a	n/a
	2	SHORT*	Pause	One SHORT press will PAUSE the endpoint radio signal.
		LONG**	Stop/Sleep	One LONG press will STOP the endpoint radio signal.
	3	SHORT*	Force Encoder Read	One SHORT press checks status of the attached encoder. If error occurs (red blinking), press/release again after initial process is complete.
		LONG**	n/a	n/a
	4	SHORT*	Run Network Session	One SHORT press forces endpoint to run a network session. Network session generates a log file: ICD_SerialNumber_n.log. If error occurs (red blinking), press/release again after initial process is complete.
		LONG**	n/a	n/a

E-SERIES G2® ULTRASONIC METERS

 <p>Range up to 3 inches</p> <p>Figure 3: Using device with E-Series G2 Ultrasonic meter</p>	Button	Press Length	Command	Operation
	1	SHORT*	Start/Active/Run	One SHORT press sets the meter into ACTIVE mode.
		LONG**	Storage	One LONG press sets the meter into STORAGE mode.
	2	SHORT*	Clear All Alarms	One SHORT press clears all alarms set for meter. Alarm icons displayed on the meter LCD are removed and replaced with the OK symbol.
		LONG**	Download Data Profile	One LONG press extracts the full data profile of meter and writes a log file.
	3	SHORT*	Display Next Screen	One SHORT press displays the next available information screen on the meter LCD.
		LONG**	Display Standard Totalizer	One LONG press displays the information screen that contains the standard totalizer on the meter LCD.
	4	SHORT*	None	n/a
		LONG**	None	n/a

*SHORT = Press and release **LONG = Press and hold for (at least) 5 seconds

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www.badgermeter.com



Badger Meter

E-Series® Ultrasonic Meter

Cold Water Lead-Free Meters

5/8, 5/8 x 3/4, 3/4, 1 inch

PRODUCTS

This warranty shall apply to all Badger Meter E-Series® Ultrasonic lead-free meters (stainless steel, bronze alloy or engineered polymer), sizes 5/8 inch, 5/8 x 3/4 inch, 3/4 inch, and 1 inch, when used to measure potable water and the internal register/encoder and battery used with these meters (collectively "Product"), sold on or after June 28, 2021. This warranty is not transferable and is extended only to utilities, municipalities, other commercial users and authorized distributors, hereafter referred to as "Customer" and does NOT apply to consumers or any person or entity who is not an original customer of Badger Meter or its authorized distributors.

MATERIALS AND WORKMANSHIP

Badger Meter, Inc. ("Badger Meter") warrants Product to be free from defects in materials and workmanship appearing within the earlier of the following time frames.

Lead-Free Housings

Twenty (20) years and six (6) months after shipment from Badger Meter.

Electronics, Battery, Transducers, and Register/Encoder Supplied with the Meters Listed Herein

Twenty (20) years and six (6) months, prorated, after shipment from Badger Meter.

This warranty is prorated as follows: For the first ten (10) years of the warranty the Product is replaced at no charge, and the warranty is prorated at price discounts during the last ten (10) years of the warranty.

Specifically, Badger Meter will repair or replace, at its discretion, a non-performing Product at no cost during the first ten (10) years of the warranty and at prorated price discounts during the last ten (10) years of the warranty. Badger Meter will apply these prorated price discounts to the Product list prices in effect at the time of Product return and according to the following prorated price discount schedule:

- Years 11 through 12—75% discount
- Years 13 through 15—50% discount
- Year 16—40% discount
- Year 17—30% discount
- Year 18—20% discount
- Years 19 through 20—10% discount

Replacement Products are warranted for and under the balance of the original applicable Product warranty.

Pressure Sensor

Five (5) years and six (6) months after shipment from Badger Meter.

This warranty is only applicable for the bronze E-Series G2® Ultrasonic meter with the optional pressure sensor installed.

METER ACCURACY

The Product will meet or exceed all applicable specifications outlined in AWWA Standard C715 in addition to meeting meter accuracy of $\pm 1.5\%$ for the published ranges set forth in Badger Meter's current published product data sheet for twenty (20) years from the date of shipment from Badger Meter.

EXTENDED LOW-FLOW METER ACCURACY

Badger Meter further warrants the Product will meet extended minimum test flow accuracy of $\pm 3\%$ for the published ranges set forth in Badger Meter's current published product data sheet for twenty (20) years from the date of shipment from Badger Meter.

PRODUCT RETURNS

Any Product proved to the satisfaction of Badger Meter to have failed the foregoing warranties will, at the option of Badger Meter, be repaired or replaced without charge to the Customer. Any eligible Product repaired or replaced by Badger Meter will retain the original Product's warranty based on the original Product purchase date, at Badger Meter's sole discretion. The Badger Meter obligation hereunder shall be limited to such repair and replacement and shall be conditioned upon Badger Meter receiving written notice of any alleged defect within ten (10) days after its discovery. This exclusive remedy shall not be deemed to have failed its essential purpose so long as Badger Meter is willing and able to replace defective products or issue a credit to purchaser within a reasonable time of proof to Badger Meter that a defect is involved. Product returns must be shipped by the Customer prepaid F.O.B. to the nearest Badger Meter factory or distribution center. The Customer shall be responsible for all direct and indirect costs associated with removing the original Product and reinstalling the repaired or replacement Product.

LIMITS OF LIABILITY

This warranty shall not apply to Product repaired or altered by parties other than Badger Meter, or read by equipment not explicitly approved or licensed by Badger Meter. The foregoing warranty applies only to the extent that the Product is installed, serviced and operated strictly in accordance with AWWA Standard C715 and AWWA M6 Manual, as applicable. The warranty shall not apply and shall be void with respect to Product exposed to conditions other than those detailed in the Badger Meter Product

technical and/or operational literature, or which, as determined at Badger Meter's sole discretion, have affected the ability of the Product to perform, including, but not limited to: exposure to adverse installation conditions; misuse; vandalism; negligence; accident; acts of God; alteration; improper installation, operation or repair; damage from passage of high-speed air slugs; damage by water quality conditions, including but not limited to: aggressive water, foreign matter, biofilms, or extreme corrosivity; damage caused by actions not in accordance with the intended use; or other circumstances which are beyond the reasonable control of Badger Meter, as determined at Badger Meter's sole discretion. With respect to product not manufactured by Badger Meter, the warranty obligations of Badger Meter shall in all respects conform and be limited to the warranty extended to Badger Meter by the supplier of product.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES WHATSOEVER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (except warranties of Title).

Any description of Product, whether in writing or made orally by Badger Meter or its agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets, or similar materials used in connection with any Customer's order are for the sole purpose of identifying Product and shall not be construed as an express warranty. Any suggestions by Badger Meter or its agents regarding use, application or suitability of Product shall not be construed as an express warranty unless confirmed to be such in writing by Badger Meter.

Exclusion of Consequential Damages and Disclaimer of Other Liability

Badger Meter liability with respect to breaches of the foregoing warranty shall be limited as stated therein. Badger Meter liability shall in no event exceed the contract price. BADGER METER SHALL NOT BE SUBJECT TO AND DISCLAIMS: (1) ANY OTHER OBLIGATIONS OR LIABILITIES ARISING OUT OF BREACH OF CONTRACT OR OF WARRANTY (2) ANY OBLIGATIONS WHATSOEVER ARISING FROM TORT CLAIMS (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR ARISING UNDER OTHER THEORIES OF LAW WITH RESPECT TO PRODUCTS SOLD OR SERVICES RENDERED BY BADGER METER, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO, AND (3) ALL CONSEQUENTIAL, INCIDENTAL AND CONTINGENT DAMAGES WHATSOEVER.

SMART WATER IS BADGER METER

E-Series and E-Series G2 are registered trademarks of Badger Meter, Inc. Other trademarks appearing in this document are the property of their respective entities. 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. © 2021 Badger Meter, Inc. All rights reserved.

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Badger Meter

E-Series® Ultrasonic Meter

Cold Water Stainless Steel Lead-Free Meters, 1-1/2, 2 in.

PRODUCTS

This warranty shall apply to all Badger Meter E-Series® Ultrasonic lead-free meters, sizes 1-1/2 in. and 2 in., when used to measure potable water and the internal register/encoder and battery used with these meters (collectively "Product"), sold on or after June 3, 2020. This warranty is not transferable and is extended only to utilities, municipalities, other commercial users and authorized distributors, hereafter referred to as "Customer" and does NOT apply to consumers or any person or entity who is not an original customer of Badger Meter or its authorized distributors.

MATERIALS AND WORKMANSHIP

Badger Meter, Inc. ("Badger Meter") warrants Product to be free from defects in materials and workmanship appearing within the following time frames.

Lead-Free Housings

Ten (10) years and six (6) months after shipment from Badger Meter.

Electronics, Battery, Transducers, and Register/Encoder Supplied with the Meters Listed Herein

Ten (10) years and six (6) months after shipment from Badger Meter.

METER ACCURACY

The Product will meet or exceed all applicable specifications outlined in AWWA Standard C715 in addition to meeting meter accuracy of $\pm 1.5\%$ for the published ranges set forth in Badger Meter's current published product data sheet for ten (10) years from the date of shipment from Badger Meter.

EXTENDED LOW-FLOW METER ACCURACY

Badger Meter further warrants the Product will meet extended minimum test flow accuracy of $\pm 3\%$ for the published ranges set forth in Badger Meter's current published product data sheet for ten (10) years from the date of shipment from Badger Meter.

PRODUCT RETURNS

Any Product proved to the satisfaction of Badger Meter to have failed the foregoing warranties will, at the option of Badger Meter, be repaired or replaced without charge to the Customer. Any eligible Product repaired or replaced by Badger Meter will retain the original Product's warranty based on the original Product purchase date, at Badger Meter's sole discretion. The Badger Meter obligation hereunder shall be limited to such repair and replacement and shall be conditioned upon Badger Meter receiving written notice of any alleged defect within ten (10) days after its discovery. This exclusive remedy shall not be deemed to have failed its essential purpose so long as Badger Meter is willing and able to replace defective products or issue a credit to purchaser within a reasonable time of proof to Badger Meter that a defect is involved. Product returns must be shipped by the Customer prepaid F.O.B. to the nearest Badger Meter factory or distribution center. The Customer shall be responsible for all direct and indirect costs associated with removing the original Product and reinstalling the repaired or replacement Product.

LIMITS OF LIABILITY

This warranty shall not apply to Product repaired or altered by parties other than Badger Meter, or read by equipment not explicitly approved or licensed by Badger Meter. The foregoing warranty applies only to the extent that the Product is installed, serviced and operated strictly in accordance with AWWA Standard C715 and AWWA M6 Manual, as applicable. The warranty shall not apply and shall be void with respect to Product exposed to conditions other than those detailed in the Badger Meter Product technical and/or operational literature, or which, as determined at Badger Meter's sole discretion, have affected the ability of the Product to perform, including, but not limited to: exposure to adverse installation conditions; misuse; vandalism; negligence; accident; acts of God; alteration; improper installation, operation or repair; damage from passage of high-speed air slugs; damage by water quality conditions, including but not limited to: aggressive water, foreign matter, biofilms, or extreme corrosivity; damage caused by actions not in accordance with the intended use; or other circumstances which are beyond the reasonable control of Badger Meter, as determined at Badger Meter's sole discretion. With respect to product not manufactured by Badger Meter, the warranty obligations of Badger Meter shall in all respects conform and be limited to the warranty extended to Badger Meter by the supplier of product.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES WHATSOEVER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (except warranties of Title).

Any description of Product, whether in writing or made orally by Badger Meter or its agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets, or similar materials used in connection with any Customer's order are for the sole purpose of identifying Product and shall not be construed as an express warranty. Any suggestions by Badger Meter or its agents regarding use, application or suitability of Product shall not be construed as an express warranty unless confirmed to be such in writing by Badger Meter.

Exclusion of Consequential Damages and Disclaimer of Other Liability

Badger Meter liability with respect to breaches of the foregoing warranty shall be limited as stated therein. Badger Meter liability shall in no event exceed the contract price. BADGER METER SHALL NOT BE SUBJECT TO AND DISCLAIMS: (1) ANY OTHER OBLIGATIONS OR LIABILITIES ARISING OUT OF BREACH OF CONTRACT OR OF WARRANTY (2) ANY OBLIGATIONS WHATSOEVER ARISING FROM TORT CLAIMS (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR ARISING UNDER OTHER THEORIES OF LAW WITH RESPECT TO PRODUCTS SOLD OR SERVICES RENDERED BY BADGER METER, OR ANY UNDERTAKINGS, ACTS OR OMISSIONS RELATING THERETO, AND (3) ALL CONSEQUENTIAL, INCIDENTAL AND CONTINGENT DAMAGES WHATSOEVER.

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Badger Meter

ORION® Water Products

with BEACON® Software as a Service (SaaS)

PRODUCTS

This warranty shall apply to Badger Meter ORION® series AMR/AMI Water Endpoints, reading hardware and software for a BEACON® system, sold on or after April 11, 2024.

ORION series AMR/AMI Water Endpoints include Fixed Network (SE), ME and Mobile M endpoints.

This warranty is not transferable and is extended only to utilities, municipalities, other commercial users and authorized distributors, hereafter referred to as "Customer" and does NOT apply to consumers or any person or entity who is not an original Customer of Badger Meter or its authorized distributors.

MATERIAL AND WORKMANSHIP

Badger Meter warrants all ORION series AMR/AMI Water Endpoints including battery, reading hardware and software, hereafter referred to as "Product(s)" as listed below, to be free from defects in material and workmanship for the time period stated.

ORION SE, ORION ME ³ and ORION Mobile M Water Endpoints ¹	20 years and 6 months after shipment
ORION Cellular LTE-MP Endpoints	10 years and 6 months after shipment
Trimble® T10 Tablet ²	3 years after shipment
Dell® Latitude 5430 Laptop ² and Latitude 7230 Tablet ²	3 years after shipment
Panasonic Toughbook® Laptop for BEACON Mobile Solution ²	3 years after shipment
Trimble® Ranger 7 Handheld ²	3 years after shipment
Trimble Yuma 7 Tablet ²	3 years after shipment
ORION ME Modules ² for Trimble Yuma 7 Tablet and Trimble Ranger 7 Handheld	3 years after shipment
Microsoft® Surface Go 3 Tablet ²	1 year after shipment
ORION Mobile (ME) Transceiver ²	3 years after shipment
ORION Mobile Integrated Receiver ²	1 year after shipment
ORION Fixed Network (SE) Gateway Transceiver	1 year after shipment

¹ Water Endpoints and Endpoint batteries—collectively ORION Water Endpoint Products—are warranted to be free from defects in material and workmanship for twenty (20) years and six (6) months after shipment from Badger Meter. Badger Meter will repair or replace, at its discretion, a non-performing ORION Water Endpoint Product at no cost during the first ten (10) years, and at a prorated price during the last ten (10) years of the warranty. Badger Meter will apply these prorated price discounts to the ORION Water Endpoint Product list prices at the time of ORION Water Endpoint Product return and according to the following prorated price discount schedule: Years 11 through 12 - 75% discount; Years 13 through 15 - 50% discount; Year 16 - 40% discount; Year 17 - 30% discount; Year 18 - 20% discount; and Years 19 through 20 - 10% discount. Replacement Products are warranted for and under the balance of the original.

² Batteries, antennas, cables and accessories warranty is limited to 12 months from the date of shipment.

³ Mobile solutions deployed prior to February 1, 2023 include ORION ME endpoints that are migratable to fixed network. BEACON SaaS mobile solutions deployed on or after February 1, 2023 include ORION ME endpoints that operate in mobile mode only.

PRODUCT RETURNS

Product failures must be proven and verified to the satisfaction of Badger Meter. The Badger Meter obligation hereunder shall be limited to such repair and replacement and shall be conditioned upon Badger Meter receiving written notice of any asserted defect within 10 (ten) days after its discovery. This exclusive remedy shall not be deemed to have failed its essential purpose so long as Badger Meter is willing and able to replace the defective Product for the Customer within a reasonable time, after receipt of proof that a defect is involved. Product returns must be shipped by the Customer prepaid F.O.B. to the nearest Badger Meter factory or distribution center. The Customer shall be responsible for all direct and indirect costs associated with removing the Product and reinstalling the repaired or replacement Product.

LIMITS OF LIABILITY

This warranty shall not apply to any Product repaired or altered by any Party other than Badger Meter. The foregoing warranty applies only to the extent that the Product is installed, serviced and operated strictly in accordance with Badger Meter instructions. The warranty shall not apply and shall be void with respect to Products exposed to conditions other than those detailed in Product technical literature or which have been subject to vandalism, negligence, accident, acts of God, improper installation, operation or repair, alteration or other circumstances which are beyond the reasonable control of Badger Meter. With respect to products not manufactured by Badger Meter, the warranty obligations of Badger Meter shall in all respects conform and be limited to the warranty extended to Badger Meter by the supplier.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES WHATSOEVER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (except warranties of Title).

Any description of the Product, whether in writing or made orally by Badger Meter or its agents, specifications, samples, models, bulletins, drawings, diagrams, engineering sheets or similar materials used in connection with any Customer's order are for the sole purpose of identifying the Product and shall not be construed as an express warranty. Any suggestions by Badger Meter or its agents regarding use, application or suitability of the Product shall not be construed as an express warranty unless confirmed to be such, in writing, by Badger Meter.

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