



Badger Meter

City of Fullerton

Request for Proposal 2526-RFP-007

RFP #2526-RFP-007 WATER METERS

Opening Day: Monday, February 23, 2026, at 4:00 p.m. PST



Badger Meter

4545 W Brown Deer Road
Milwaukee, Wisconsin 53223

Ryan Fenton Sales Manager

303-339-9100
RFenton@badgermeter.com

Submitted on February 23, 2026



4545 W Brown Deer Road
PO Box 245036
Milwaukee, Wisconsin 53224-9536
414-355-0400 | 800-876-3837
www.badgermeter.com

February 23, 2026

Mr. Jose Alfredo Gonzalez
Purchasing Supervisor
City of Fullerton
303 W. Commonwealth Ave.
Fullerton, CA 92832

RE: RFP #2526-RFP-007 WATER METERS Request for Proposal (RFP) 2526-RFP-007
Opening Date: Monday, February 23, 2026, at 4:00 p.m. PST

Dear Mr. Gonzalez:

Accompanying this letter is the response from Badger Meter, Inc. ("Badger Meter") to the City of Fullerton's ("the City") RFP #2526-RFP-007 WATER METERS Request for Proposal (RFP) 2526-RFP-007, requesting a supply of new meters. Badger Meter appreciates the opportunity to support the City's objectives set forth with the release of this RFP. At Badger Meter, we take our customers' needs seriously and look forward to demonstrating to the City what it means to partner with us. The commitment of Badger Meter is to provide the City high-quality products that are readily available and offer extraordinary value. Our people, operations, and products have allowed us to deliver on this commitment consistently, providing an exceptional customer experience and Smart Water solution for the complete water ecosystem.

Badger Meter is a market leader in water meter technology with 120+ years of experience designing, manufacturing, and supplying water meters, including over 35 million water meters installed nationwide. With more than a century in the metering business, the City can rest assured Badger Meter is a reputable company renowned for providing the highest-quality products.

This letter, as well as the general disclosures attached, become part of the Badger Meter response. In the event you have any questions regarding this correspondence, our Proposals department can be reached by email at proposals@badgermeter.com or by telephone at 800-876-3837. Additionally, you may contact your Sales Manager, Ryan Fenton, by email at RFenton@badgermeter.com or by telephone at 303-339-9100.

A copy of the bid tabulation, for our records, is appreciated. Electronic results can be emailed to proposals@badgermeter.com.

Utilities continue to choose Badger Meter as a partner due to our commitment to excellence and our ability to deliver proven solutions that meet their current and evolving requirements. Thank you for considering Badger Meter.

Sincerely,

BADGER METER, INC.

A handwritten signature in blue ink that reads 'Allison D. Cardona'.

Allison D. Cardona
Assistant Secretary and Proposal Lead



GENERAL DISCLOSURES

CONFIDENTIALITY STATEMENT

The information contained herein is to be considered confidential and proprietary to the extent allowable by law. © 2026 Badger Meter, Inc. All rights reserved.

DISCLOSURES

For this response to the City's RFP, please note payment terms are net 30 days. Prices quoted in this bid, if awarded to Badger Meter, will remain firm for two (2) years, through February 22, 2028, if a contract has been executed between Badger Meter and the City within 120 days. If a contract has not been executed within 120 days, Badger Meter reserves the right to adjust the pricing based on changes to market prices and pricing indices. If no separate contract needs to be executed, pricing will remain firm for one-year from notice of award. In addition, Badger Meter reserves the right to adjust pricing during the term to account for changes in law or other geoeconomic influences that are not enacted at the time of bid including, but not limited to, tariffs, duties, and taxes.

If applicable, sales tax and freight will be calculated based on rates and tax status in effect at the time of invoicing.

Due to continuous improvements and redesign of our products and technology solutions, Badger Meter reserves the right to provide our newest product solutions as an alternative to the proposed products, provided they are in conformance with the requirements of the specifications and do not exceed the prices quoted.

We provide certification files to help you manage your meter and endpoint inventory along with the corresponding meter accuracy data. The standard method of delivery for this format is via electronic mail. Any deviations from our standard format, or any custom file formats, will be considered on a time and material basis.

EXCEPTIONS/CLARIFICATIONS

With respect to the first paragraph on the top of Page 5 of the RFB, Badger Meter provides serial numbers on packing slips and the cert files electronically at time of meter shipment. This has been standard for meter deliveries for the City of Fullerton.

With respect to the extension of contract to other public agencies, we will extend bid pricing to participating agencies based on similarly situated products, including exact product specifications and similar quantities, as per this bid, provided those agencies qualify as direct customers of Badger Meter and are not authorized accounts to a distributor of Badger Meter.

With respect to the Pricing form, Badger Meter quoted the longer of optional lay lengths for E-Series meters. If shorter lay lengths are required, pricing can be provided at a later date.

For all products bid herein, Badger Meter standard warranties will apply and govern. The extent of the warranty to be provided by Badger Meter is set forth in the standard warranties that have been enclosed herein



TABLE OF CONTENTS

Pricing

Forms

Appendix

- NSF Certification

- Alternative Product Pricing

- Product Data Sheets

- Warranty Documentation

- User Manuals and Installation Guides





PRICING



WATER METERS					RFP ID: #2526-RFP		
Proposal Pricing					Vendor Name: _____		
Item	Qty	Unit	Description	Unit Cost Direct Read	Unit Cost Encoded Register W/Nicor	Lead Time (days)	
1	0 - 1,500	EA	5/8" X 3/4" Disc				
2	0 - 1,500	EA	1" Disc				
3	0 - 150	EA	1-1/2" Disc				
4	0 - 150	EA	2" Disc				
5	0 - 50	EA	1-1/2" Compound Meters				
6	0 - 50	EA	2" Compound Meters				
7	0 - 25	EA	3" Compound Meters				
8	0 - 25	EA	4" Compound Meters				
9	0 - 3	EA	6" Compound Meters				
10	0 - 50	EA	2" Turbine Meters				
11	0 - 10	EA	3" Turbine Meters				
12	0 - 10	EA	4" Turbine Meters				
13	0 - 2	EA	6" Turbine Meters				
14	0 - 2	EA	8" Turbine Meters				
15	0 - 2	EA	10" Turbine Meters				
16	0-200	EA	5/8" X 3/4" Ultrasonic				
17	0-200	EA	1" Ultrasonic				
16	0 - 50	EA	1-1/2" Ultrasonic Meters				
17	0 - 50	EA	2" Ultrasonic Meters				
18	0 - 25	EA	3" Ultrasonic Meters				

Item	Qty	Unit	Description	Unit Cost Direct Read	Unit Cost Encoded Register W/Nicor	Lead Time (days)
19	0 - 10	EA	4" Ultrasonic Meters			
20	0 - 2	EA	6" Ultrasonic Meters			
21	0 - 2	EA	8" Ultrasonic Meters			
22	0 - 2	EA	10" Ultrasonic Meters			
23	0 - 250	EA	1" Domestic Fire Meters			
24	0 - 25	EA	2" Domestic Fire Meters			
25	0 - 25	EA	3" Fire Hydrant Meter W/Backflow			
26	0 - 25	EA	2" Strainers			
27	0 - 5	EA	4" Strainers			

Vendor Representative Name: _____

Vendor Representative Title: _____

Signature: _____

Date: _____



FORMS



5.1. VENDOR QUESTIONNAIRE

1. *Proposal Submission**

Please submit your proposal, according to the instructions in [INSTRUCTIONS TO PROPOSERS](#). The Proposal Pricing table can be downloaded from the attachments and must be uploaded with your proposal in this section.

*Response required

2. *Extension of Contract to Other Public Agencies**

The prices, terms, and conditions of this proposal shall be extended to other public agencies after proposal award by lead agency. All requirements of the specifications, purchase orders, invoices, and payments with other agencies shall be handled directly by the additional agency(ies) and the vendor. The City of Fullerton shall be notified immediately of any additional agency(ies) participating in the contract.

- Yes [*Please See Exceptions for precise language regarding](#)
 No [Extension of Contract to Other Public Agencies](#)

*Response required

3. *Confirmation**

The Vendor confirms that all the information provided is true and accurate.

- Please confirm

*Response required



APPENDIX





NSF CERTIFICATION





The Public Health and Safety Organization

NSF Product and Service Listings

These NSF Official Listings are current as of **Friday, January 23, 2026** at 12:15 a.m. Eastern Time. Please [contact NSF](#) to confirm the status of any Listing, report errors, or make suggestions.

Alert: NSF is concerned about fraudulent downloading and manipulation of website text. Always confirm this information by clicking on the below link for the most accurate information: <http://info.nsf.org/Certified/PwsComponents/Listings.asp?Company=04680&Standard=061&>

NSF/ANSI/CAN 61 Drinking Water System Components - Health Effects

NOTE: Unless otherwise indicated for Materials, Certification is only for the Water Contact Material shown in the Listing. Click here for a list of Abbreviations used in these Listings. Click here for the definitions of Water Contact Temperatures denoted in these Listings. Products certified to NSF/ANSI/CAN 61 comply with the health effects criteria in NSF/ANSI/CAN 600.

Badger Meter, Inc.

4545 West Brown Deer Road

Milwaukee, WI 53223

United States

414-371-5744

Visit this company's website (<http://www.badgermeter.com>)

Facility : # 1 USA

Mechanical Devices

Trade Designation	Size	Water Contact Temp	Water Contact Material
Couplings[1] [2] [G] Epoxy Coated 57335 Spool Assembly	>= 2"	CLD 23	MLTPL

[1] Product also complies with NSF/ANSI 372.

[2] Certified for all lengths with a diameter of 2" and greater.

[G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Strainer [G]

Badger® Steel Plate Strainers[1] 8" - 12" CLD 23 MLTPL

[1] Product also complies with NSF/ANSI 372.

[G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Facility : Collegeville, PA

Mechanical Devices

Trade Designation	Size	Water Contact Temp	Water Contact Material
Switches/Sensors [G] MetriNet[1]	20 X 14 in.	CLD 23	MLTPL

[1] Certified for a minimum daily flow of 288 L.

[G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Facility : Milwaukee, WI

Mechanical Devices

Trade Designation	Size	Water Contact Temp	Water Contact Material
Miscellaneous Process Devices/Components Plate Strainer LL-NS[1] [G]	2" - 6"	CLD 23	MLTPL

[1] Product also complies with NSF/ANSI 372.

[G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Water Meters[1] [G]

Combo-01	8"	CLD 23	MLTPL
Compound Series LL-NS	2" - 6"	CLD 23	MLTPL
Dynasonics® U500W Ultrasonic Meter[3]	2" - 8"	CLD 23	MLTPL
Dynasonics® U500W Ultrasonic Meter[4]	1 1/2" - 2"	CLD 23	MLTPL
Dynasonics® U500W Ultrasonic Meter	[2]	CLD 23	MLTPL
E-Series G2 Ultrasonic Meter	[2]	CLD 23	MLTPL
E-Series G2® Ultrasonic Meter[3]	2" - 8"	CLD 23	MLTPL
E-Series® Ultrasonic Meter[4]	1 1/2" - 2"	CLD 23	MLTPL
E-Series® Ultrasonic Plus[5]	5/8" - 3/4"	CLD 23	MLTPL
E-Series® Ultrasonic Plus (valve ready)[5] [6]	5/8" - 3/4"	CLD 23	MLTPL
FSAA-01[7]	4" - 10" x 12"	CLD 23	MLTPL
FSMA-01	3" - 10"	CLD 23	MLTPL
M120 LL	1 1/2" x 12 5/8"	CLD 23	MLTPL
M120 LL	1 1/2" x 13"	CLD 23	MLTPL
M170 LL	2" x 17"	CLD 23	MLTPL
M170 LL	2" x 15 1/4"	CLD 23	MLTPL
M25 PN	[8]	CLD 23	MLTPL
M25 LL	[9]	CLD 23	MLTPL
M35 LL	[9]	CLD 23	MLTPL
M55 LL	[9]	CLD 23	MLTPL
M70 LL	[9]	CLD 23	MLTPL
Turbo Series	6", 12"	CLD 23	MLTPL
Turbo Series LL-NS	2" - 10"	CLD 23	MLTPL
Turbo Series LL-NS (with Integral Strainer)	1 1/2" - 4"	CLD 23	MLTPL

[1] Product also complies with NSF/ANSI 372.

[2] E-Series G2 Ultrasonic Meter & Dynasonics® U500W:

5/8" x 7-1/2"

5/8" x 3/4" x 7-1/2"

3/4" x 7-1/2"

3/4" x 9"

3/4" x 1" x 9"

1" x 10-1/4"

[3] E-Series® G2 Ultrasonic Meter & Dynasonics® U500W Ultrasonic Meters

2" x 10"

2" x 17"

3" x 17"

3" x 12"

4" x 20"

4" x 14"

6" x 18"

6" x 24"

8" x 20"

[4] E-Series® & Dynasonics® U500W

1 1/2" x 12 5/8"

1 1/2" x 13"

2" x 15 1/4"

2" x 17"

E-Series® only

- 1 1/2" x 300mm (DN40)
 1 1/2" x 330mm (DN40)
 2" (DN50)
- [5] 5/8" x 3/4" x 7 1/2"
 3/4" x 7 1/2"
 3/4" x 9"
- [6] Certification of the E-Series® Ultrasonic Plus (valve ready) covers the unmodified water meter only. Certification does not include meters that have been retrofitted
- [7] FSAA-01 Water Meters are Certified for the following sizes and configurations:
 FSAA-01 w/ 2" LL turbo meter bypass (4-10, 10 x 12 in.)
 FSAA-01 w/ 1" M70 LL disc meter bypass (4-6 in.)
 FSAA-01 w/ 1.5" M170 LL disc meter bypass (6 in.)
 FSAA-01 w/ 2" M170 LL disc meter bypass (6-10, x 10 x 12 in.)
- [8] M25 PN is Certified in the following sizes:
 5/8" x 7 1/2"
 5/8" x 3/4" x 7 1/2"
 3/4" x 9"
- [9] M25 LL is Certified for the following sizes:
 5/8" x 3/4" x 7 1/2"
 5/8" x 7 1/2"
- M35 LL is Certified for the following sizes:
 3/4" x 7 1/2"
 3/4" x 9"
- M55 LL is Certified for the following size:
 1" x 10 3/4"
- M70 LL is Certified for the following size:
 1" x 10 3/4"
- [G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Facility : Racine, WI

Mechanical Devices

Trade Designation	Size	Water Contact Temp	Water Contact Material
Switches/Sensors [G]			
HPR-32A-2-MMM-P-T-AAA	[8]	CLD 23	MLTPL
HPR-32iA-2-MMM-P-T-AAA	[8]	CLD 23	MLTPL
Impeller Data Industrial SDI Series Insert Style Flow Sensors[1]	1 1/2" - 60"	C. HOT	MLTPL

[1] Nomenclature:

SDI A B C D E-F G H I

A - Ø - Stainless steel/PPS tip, 2 - stainless steel/PEEK tip

B - Type

D1 - Direct Insert for Pipe 1 1/2" - 10"

D2 - Direct Insert for Pipe 12" - 36"

D3 - Direct Insert 36" and UP*

H1 - Hot Tap for Pipe 1½" - 10"

H2 - Hot Tap for Pipe 12" - 36"

H3 - Hot Tap for Pipe 36" and UP

C - Electronic housing

D - Output

E - Display

F - O-ring (Ø: Viton, 1: EPDM)

G - Shaft (2: Tungsten Carbide)

H - Impeller (Ø: Stainless steel)

I - Bearing (Ø: Torlon)

[8] HPR-32A-2-MMM-P-T-AAA & HPR-32iA-2-MMM-P-T-AAA: All models are 5" x 3.5"

MMM = Modem Type

AAA = Activation Type

P = Pressure Range

T = Thread Type

B = 2-1/2" Female - Akron

D = 2-1/2" Female - British Columbia

E = 2-1/2" Female - Barberton

C = 2-1/2" Female - Canadian Standard

G = 2-1/2" Female - Cleveland, OH

H = 2-1/2" Female - Cedar Rapids

I = 2-1/2" Female - Erie, PA

N = 2-1/2" Female - National Hydrant

J = 2-1/2" Female - New York City

L = 2-1/2" Female - North Shores, MI

M = 2-1/2" Female - Phoenix, AZ

O = 2-1/2" Female - Pittsburg, PA

P = 2-1/2" Female - Sioux City

[G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Water Meters [G]

Dynasonics® U500W Ultrasonic Meter	[2]	CLD 23	MLTPL
Dynasonics® U500W Ultrasonic Meter	[7]	D. HOT	MLTPL
E-Series G2 Ultrasonic Meter	[2]	CLD 23	MLTPL
E-Series G2 Ultrasonic Meter	[7]	D. HOT	MLTPL
M-Series® M1000 Flanged	1/2" - 8"	D. HOT	MLTPL
M-Series® M5000 Flanged	1/2" - 24"	D. HOT	MLTPL

M-Series® Mag Meter M1000 Flanged	1/2" - 8"	D. HOT	MLTPL
M-Series® Mag Meter M5000 Flanged	1/2" - 24"	D. HOT	MLTPL
M-Series® Mag Meter Model M2000 Flanged	1/2" - 54"	D. HOT	MLTPL
M-Series® Mag Meter Model M3000	1/2" - 24"	D. HOT	MLTPL
M-Series® Mag Meter Model M4000	1/2" - 12"	D. HOT	MLTPL
M-Series® Mag Meter Model M7600	1/2" - 4"	D. HOT	MLTPL
M-Series® Model M2000 Flanged	1/2" - 54"	D. HOT	MLTPL
M-Series® Model M3000	1/2" - 24"	D. HOT	MLTPL
M-Series® Model M4000	1/2" - 12"	D. HOT	MLTPL
M-Series® Model M7600	1/2" - 4"	D. HOT	MLTPL
M25 LL	[3]	CLD 23	MLTPL
M35 LL	[4]	CLD 23	MLTPL
M55 LL	[5]	CLD 23	MLTPL
M70 LL	[6]	CLD 23	MLTPL
MagnetoFlow® Flanged	1/2" - 54"	D. HOT	MLTPL
MagnetoFlow® Wafer	1" - 4"	D. HOT	MLTPL
Magnetoflow® Mag Meter Flanged	1/2" - 54"	D. HOT	MLTPL
Magnetoflow® Mag Meter Wafer	1" - 4"	D. HOT	MLTPL

[2] E-Series G2 Ultrasonic Meter & Dynasonics® U500W:

5/8" x 7 1/2"

5/8" x 3/4" x 7 1/2"

3/4" x 7 1/2"

3/4" x 9"

3/4" x 1" x 9"

1" x 10 1/4"

[3] M25 LL is Certified for the following sizes:

5/8" x 3/4" x 7 1/2"

5/8" x 7 1/2"

[4] M35 LL is Certified for the following sizes:

3/4" x 7 1/2"

3/4" x 9"

[5] M55 LL is Certified for the following size:

1" x 10 3/4"

[6] M70 LL is Certified for the following size:

1" x 10 3/4"

[7] E- Series G2 Ultrasonic Meter & Dynasonics® U500W:

DN15 x 110 mm

DN15 x 114 mm

DN15 x 165 mm

DN20 x 190 mm

DN25 x 260 mm

[G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

NOTE: Only products bearing the NSF Mark on the product, product packaging, and/or documentation shipped with the product are Certified.

Facility : Brno, Czech Republic**Mechanical Devices**

Trade Designation	Size	Water Contact Temp	Water Contact Material
Water Meters[G]			
M-Series® M1000 Flanged	1/2 - 8"	D. HOT	MLTPL
M-Series® M5000 Flanged	1/2 - 24"	D. HOT	MLTPL
M-Series® Mag Meter M1000 Flanged	1/2 - 8"	D. HOT	MLTPL
M-Series® Mag Meter M5000 Flanged	1/2 - 24"	D. HOT	MLTPL
M-Series® Mag Meter Model M2000 Flanged	1/2 - 54"	D. HOT	MLTPL
M-Series® Mag Meter Model M3000	1/2 - 24"	D. HOT	MLTPL
M-Series® Mag Meter Model M4000	1/2 - 12"	D. HOT	MLTPL
M-Series® Mag Meter Model M7600	1/2 - 4"	D. HOT	MLTPL
M-Series® Model M2000 Flanged	1/2 - 54"	D. HOT	MLTPL
M-Series® Model M3000	1/2 - 24"	D. HOT	MLTPL
M-Series® Model M4000	1/2 - 12"	D. HOT	MLTPL
M-Series® Model M7600	1/2 - 4"	D. HOT	MLTPL
MagnetoFlow® Flanged	1/2 - 54"	D. HOT	MLTPL
MagnetoFlow® Wafer	1- 4"	D. HOT	MLTPL
Magnetoflow® Mag Meter Flanged	1/2 - 54"	D. HOT	MLTPL
Magnetoflow® Mag Meter Wafer	1- 4"	D. HOT	MLTPL

[G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Facility : Nogales, Sonora, Mexico**Mechanical Devices**

Trade Designation	Size	Water Contact Temp	Water Contact Material
Water Meters[1] [G]			
Dynasonics U500W Ultrasonic Plus[2]	5/8" - 3/4"	D. HOT	MLTPL
Dynasonics U500W Ultrasonic Plus Valve Kit[2]	5/8" - 3/4"	D. HOT	MLTPL
Dynasonics® U500W Ultrasonic Meter[5]	1/2" - 1 1/4"	CLD 23	MLTPL
Dynasonics® U500W Ultrasonic Meter	[4]	CLD 23	MLTPL
Dynasonics® U500W Ultrasonic Meter	[3]	D. HOT	MLTPL
E-Series G2 Ultrasonic Meter	[3]	D. HOT	MLTPL

E-Series G2® Ultrasonic Meter	[4]	CLD 23	MLTPL
E-Series® Ultrasonic Meter[5]	1/2" - 1 1/4"	CLD 23	MLTPL
E-Series® Ultrasonic Plus[2]	5/8" - 3/4"	CLD 23	MLTPL
E-Series® Ultrasonic Plus (valve ready)[2]	5/8" - 3/4"	CLD 23	MLTPL
E-Series® Ultrasonic Plus (valve ready) Valve Kit[2]	5/8" - 3/4"	D. HOT	MLTPL
E-Series® Ultrasonic Plus Valve Kit[2]	5/8" - 3/4"	D. HOT	MLTPL
M25 LL	[6]	CLD 23	MLTPL
M25 PN	[7]	CLD 23	MLTPL
M35 LL	[8]	CLD 23	MLTPL
M55 LL	[9]	CLD 23	MLTPL
M70 LL	[10]	CLD 23	MLTPL

[1] Product also complies with NSF/ANSI 372.

[2] 5/8" x 3/4" x 7-1/2"
 3/4" x 7-1/2"
 3/4" x 9"

[3] E-Series G-2 Ultrasonic Meter & Dynasonics® U500W:
 DN15 x 110 mm
 DN15 x 114 mm
 DN15 x 165 mm
 DN20 x 190 mm
 DN25 x 260 mm

[4] E-Series G2® Ultrasonic Meter & Dynasonics® U500W:
 5/8" x 7 1/2"
 5/8" x 3/4" x 7 1/2"
 3/4" x 7 1/2"
 3/4" x 9"
 3/4" x 1" x 9"
 1" x 10 1/4"

[5] E- Series® & Dynasonics® U500W:
 5/8" x 7 1/2" or 5/8" x 3/4" x 7 1/2"
 3/4" x 7 1/2" or 3/4" x 9"
 1" x 10 3/4"

E Series® Only:

1/2" x 4 1/3" [110mm] (DN15)
 1/2" x 6 1/2" [165mm] (DN15)
 3/4" x 7 1/2" [190.5mm] (DN20)
 1" x 10 1/4" [259.8mm] (DN25)
 1 1/4" x 10 1/4" [259.8mm] (DN32)

[6] M25 LL is Certified for the following sizes:
 5/8" x 3/4" x 7 1/2"
 5/8" x 7 1/2"

[7] M25 PN is Certified in the following sizes:
 5/8" x 7 1/2"
 5/8" x 3/4" x 7 1/2"
 3/4" x 9"

[8] M35 LL is Certified for the following sizes:
 3/4" x 7 1/2"
 3/4" x 9"

[9] M55 LL is Certified for the following size:

1" x 10 3/4"

[G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

[10] M70 LL is Certified for the following size:

1" x 10 3/4"

Facility : Bern, Switzerland

Mechanical Plumbing Devices

Trade Designation

Water Meters[G]

BV-1000-TRV-025-A[1] [2]

BV-2000-TRV-WXY-Z[1] [2]

VISION 1000® 5654X-163-2F66[2] [3]

VISION 2000® 565VV-16W-XFXX-Z[2] [4]

[1] V - End connection

G - G

N - NPT

R - O-Ring end connection

WXY - Flow range

050 - 0.13 ... 1.3 gpm

075 - 0.13 ... 2.0 gpm

080 - 0.50 ... 2.11 gpm

100 - 0.26 ... 2.7 gpm

150 - 0.26 ... 4.0 gpm

250 - 0.26 ... 6.6 gpm

350 - 0.53 ... 9.2 gpm

Z - Electrical connection

A - 3 pin

B - Cable, 1 meter long

C - Cable, custom made cable length

[2] This product does not require a Q statistic. It is made from material or materials that do not require lead analysis when reviewed per NSF/ANSI/CAN Standard 61, Section 3.3.

[3] X - Housing

8 - NPT

7 - G

[4] VV - Housing

00 or 10 - G

20 or 21 - Customer supplied ring

12 or 02 - NPT

W - Electrical Connection

X - Number of turbine blade

- XX - Turbine type (Flow range, K-factor)
- Z - Cable Length

[G] Product is Certified to NSF/ANSI/CAN 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Number of matching Manufacturers is 1

Number of matching Products is 92

Processing time was 0 seconds



ALTERNATIVE PRODUCT PRICING



WATER METERS					RFP ID: #2526-RFP		
Proposal Pricing					Vendor Name: _____		
Item	Qty	Unit	Description	Unit Cost Direct Read	Unit Cost Encoded Register W/Nicor	Lead Time (days)	
1	0 - 1,500	EA	5/8" X 3/4" Disc				
2	0 - 1,500	EA	1" Disc				
3	0 - 150	EA	1-1/2" Disc				
4	0 - 150	EA	2" Disc				
5	0 - 50	EA	1-1/2" Compound Meters				
6	0 - 50	EA	2" Compound Meters				
7	0 - 25	EA	3" Compound Meters				
8	0 - 25	EA	4" Compound Meters				
9	0 - 3	EA	6" Compound Meters				
10	0 - 50	EA	2" Turbine Meters				
11	0 - 10	EA	3" Turbine Meters				
12	0 - 10	EA	4" Turbine Meters				
13	0 - 2	EA	6" Turbine Meters				
14	0 - 2	EA	8" Turbine Meters				
15	0 - 2	EA	10" Turbine Meters				
16	0-200	EA	5/8" X 3/4" Ultrasonic				
17	0-200	EA	1" Ultrasonic				
16	0 - 50	EA	1-1/2" Ultrasonic Meters				
17	0 - 50	EA	2" Ultrasonic Meters				
18	0 - 25	EA	3" Ultrasonic Meters				

Item	Qty	Unit	Description	Unit Cost Direct Read	Unit Cost Encoded Register W/Nicor	Lead Time (days)
19	0 - 10	EA	4" Ultrasonic Meters			
20	0 - 2	EA	6" Ultrasonic Meters			
21	0 - 2	EA	8" Ultrasonic Meters			
22	0 - 2	EA	10" Ultrasonic Meters			
23	0 - 250	EA	1" Domestic Fire Meters			
24	0 - 25	EA	2" Domestic Fire Meters			
25	0 - 25	EA	3" Fire Hydrant Meter W/Backflow			
26	0 - 25	EA	2" Strainers			
27	0 - 5	EA	4" Strainers			

Vendor Representative Name: _____

Vendor Representative Title: _____

Signature: Allison Cantoni

Date: _____



PRODUCT DATA SHEETS



Recordall® Disc Meters

Lead-Free Bronze Alloy, Sizes 5/8, 5/8 x 3/4, 3/4 & 1 inch
 NSF/ANSI/CAN Standards 61 and 372 Certified



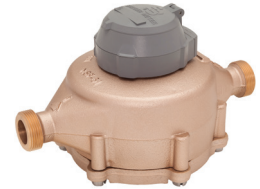
Model 25—5/8 in., 5/8 x 3/4 in.



Model 35—3/4 in.



Model 55—1 in.



Model 70—1 in.

DESCRIPTION

The Recordall Disc Series meters meet or exceed the most recent revision of AWWA Standard C700 and are available in a lead-free bronze alloy. The meters comply with the lead-free provisions of the Safe Drinking Water Act, are certified to NSF/ANSI/CAN Standards 61 and 372 (Trade Designations: M25-LL, M35-LL, M55-LL, M70-LL) and carry the NSF-61 mark on the housing. All components of the lead-free bronze alloy meter (housing, measuring element, seals, and so on) comprise the certified system.

Applications: For use in measurement of potable cold water in residential, commercial and industrial services where flow is in one direction only.

Operation: Water flows through the meter's strainer and into the measuring chamber where it causes the disc to nutate. The disc, which moves freely, nutates on its own ball, guided by a thrust roller. A drive magnet transmits the motion of the disc to a follower magnet located within the permanently sealed register. The follower magnet is connected to the register gear train. The gear train reduces the disc nutations into volume totalization units displayed on the register or encoder face.

Operating Performance: The Recordall Disc Series meters meet or exceed registration accuracy for the low flow rates (95%), normal operating flow rates (100 ± 1.5%), and maximum continuous operation flow rates as specifically stated in AWWA Standard C700.

Construction: Recordall Disc meter construction, which complies with ANSI/AWWA standard C700, consists of three basic components: meter housing, measuring chamber and permanently sealed register or encoder. The meter is available in a lead-free bronze alloy with externally threaded spuds. A corrosion-resistant engineered polymer material is used for the measuring chamber.

Magnetic Drive: Direct magnetic drive, through the use of high-strength magnets, provides positive, reliable and dependable register coupling for straight-reading or AMR/AMI meter reading options.

Tamper-Proof Features: Unauthorized removal of the register or encoder is inhibited by the option of a tamper detection seal wire screw, TORX® tamper-resistant seal screw or the proprietary tamper-resistant keyed seal screw. Each can be installed at the meter site or at the factory.

Maintenance: Badger Meter Recordall Disc Series meters are designed and manufactured to provide long-term service with minimal maintenance. When maintenance is required, it can be performed easily either at the meter installation or at any other convenient location.

To simplify maintenance, the register, measuring chamber, and strainer can be replaced without removing the meter housing from the installation. No change gears are required for accuracy calibration. Interchangeability of parts among like-sized meters and meter models also minimizes spare parts inventory investment. The built-in strainer has an effective straining area of twice the inlet size.

Connections: Tailpieces/Unions for installations of meters on various pipe types and sizes, including misaligned pipes, are available as an option.

Meter Spud and Connection Sizes

Model	Size Designation (in.)	×	"L" Laying Length (in.)	"B" Bore Dia. (in.)	Coupling Nut and Spud Thread (in.)	Tailpiece Pipe Thread (NPT) (in.)
25	5/8	×	7-1/2	5/8	3/4 (5/8)	1/2
	5/8 x 3/4	×	7-1/2	5/8, 3/4	1 (3/4)	3/4
35	3/4	×	7-1/2	3/4	1 (3/4)	3/4
	3/4	×	9	3/4	1 (3/4)	3/4
	3/4 x 1	×	9	3/4	1-1/4 (1)	1
55	1	×	10-3/4	1	1-1/4 (1)	1
70	1	×	10-3/4	1	1-1/4 (1)	1

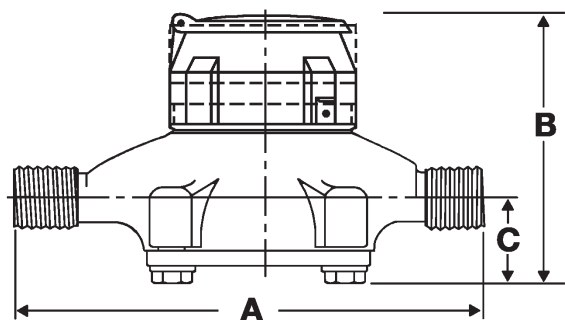
SPECIFICATIONS

	Model 25 (5/8 in. & 5/8 x 3/4 in.)	Model 35 (3/4 in.)	Model 55 (1 in.)	Model 70 (1 in.)
Typical Operating Range (100% ±1.5%)	0.5...25 gpm (0.11...5.7 m ³ /hr)	0.75...35 gpm (0.17...7.9 m ³ /hr)	1...55 gpm (0.23...12.5 m ³ /hr)	1.25...70 gpm (0.28...16 m ³ /hr)
Low Flow	0.25 gpm (0.057 m ³ /hr) Min. 98.5%	0.375 gpm (0.085 m ³ /hr) Min. 97%	0.5 gpm (0.11 m ³ /hr) Min. 95%	0.75 gpm (0.17 m ³ /hr) Min. 95%
Maximum Continuous Operation	15 gpm (3.4 m ³ /hr)	25 gpm (5.7 m ³ /hr)	40 gpm (9.1 m ³ /hr)	50 gpm (11.3 m ³ /hr)
Pressure Loss at Maximum Continuous Operation	5/8 in. size: 3.5 psi @ 15 gpm (0.24 bar @ 3.4 m ³ /hr) 5/8 x 3/4 in. size: 2.8 psi @ 15 gpm (0.19 bar @ 3.4 m ³ /hr)	5 psi @ 25 gpm (0.37 bar @ 5.7 m ³ /hr)	3.4 psi @ 40 gpm (0.23 bar @ 9.1 m ³ /hr)	6.5 psi @ 50 gpm (0.45 bar @ 11.3 m ³ /hr)
Maximum Operating Temperature	80° F (26° C)			
Maximum Operating Pressure	150 psi (10 bar)			
Measuring Element	Nutating disc, positive displacement			
Meter Connections	<i>Available in NL bronze and engineered polymer to fit spud thread bore diameter sizes:</i>			
	5/8 in. size: 5/8 in. (DN 15 mm) 5/8 x 3/4 in. size: 3/4 in. (DN 15 mm)	3/4 in. (DN 20 mm)	1 in. (DN 25 mm)	1 in. (DN 25 mm)

MATERIALS

	Model 25 (5/8 in. & 5/8 x 3/4 in.)	Model 35 (3/4 in.)	Model 55 (1 in.)	Model 70 (1 in.)
Meter Housing	Lead-free bronze alloy			
Housing Bottom Plates	Cast iron, lead-free bronze alloy, engineered polymer	Cast iron, lead-free bronze alloy		
Measuring Chamber	Engineered polymer			
Disc	Engineered polymer			
Trim	Stainless steel			
Strainer	Engineered polymer			
Disc Spindle	Stainless steel	Stainless steel	Engineered polymer	Stainless steel
Magnet	Ceramic	Ceramic	Ceramic	Ceramic
Magnet Spindle	Engineered polymer	Engineered polymer	Engineered polymer	Stainless steel
Register Lid and Shroud	Engineered polymer, bronze			

DIMENSIONS



Meter Size	Model	A Laying Length	B Height Reg.	C Centerline Base	Width	Approx. Shipping Weight
5/8 in. (15 mm)	25	7-1/2 in. (190 mm)	4-15/16 in. (125 mm)	1-11/16 in. (42 mm)	4-1/4 in. (108 mm)	4-1/2 lb (2 kg)
5/8 in. × 3/4 in. (15 mm)		7-1/2 in. (190 mm)	4-15/16 in. (125 mm)	1-11/16 in. (42 mm)	4-1/4 in. (108 mm)	4-1/2 lb (2 kg)
3/4 in. (20 mm)	35	7-1/2 in. (190 mm)	5-1/4 in. (133 mm)	1-5/8 in. (41 mm)	5 in. (127 mm)	5-1/2 lb (2.5 kg)
3/4 in. (20 mm)		9 in. (229 mm)	5-1/4 in. (133 mm)	1-5/8 in. (41 mm)	5 in. (127 mm)	5-3/4 lb (2.6 kg)
3/4 in. × 1 in. (20 mm)		9 in. (229 mm)	5-1/4 in. (133 mm)	1-5/8 in. (41 mm)	5 in. (127 mm)	6 lb (2.7 kg)
1 in. (25 mm)	55	10-3/4 in. (273 mm)	6 in. (152 mm)	2-1/32 in. (52 mm)	6-1/4 in. (159 mm)	8-3/4 lb (3.9 kg)
1 in. (25 mm)	70	10-3/4 in. (273 mm)	6-1/2 in. (165 mm)	2-5/16 in. (59 mm)	7-3/4 in. (197 mm)	11-1/2 lb (5.2 kg)

ENCODER / REGISTER

High Resolution Encoders (HR-E®, HR-E® LCD) for AMR/AMI Reading Solutions

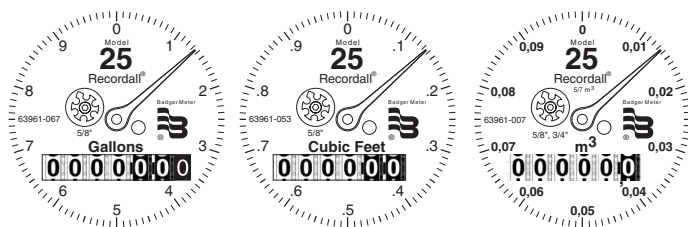
High resolution encoder solutions are available for all Recordall Disc Series meters. Badger Meter high resolution encoders provide years of reliable, accurate readings for a variety of applications. See details at badgermeter.com.

Local Register—Mechanical Sweep-Hand Registration

The local register is a straight-reading, permanently sealed magnetic drive register. The register is permanently sealed to eliminate the intrusion of moisture, dirt or other contaminants. The register achieves true water resistance due to the unique adhesive technology used to seal the glass dome to the corrosion-resistant metal bottom. Due to this sealing process, the register exceeds all applicable requirements of AWWA Standard C707 and is suitable for installation in all environments, including meter pits subject to continuous submergence.

The local register has a six-odometer wheel totalization display, 360° test circle with center sweep hand, and flow finder to detect leaks. Register gearing is made of self-lubricating engineered polymer, which minimizes friction and provides long life. The multi-position register simplifies meter installation and reading. The register capacity is 10,000,000 gallons (1,000,000 ft³, 100,000 m³).

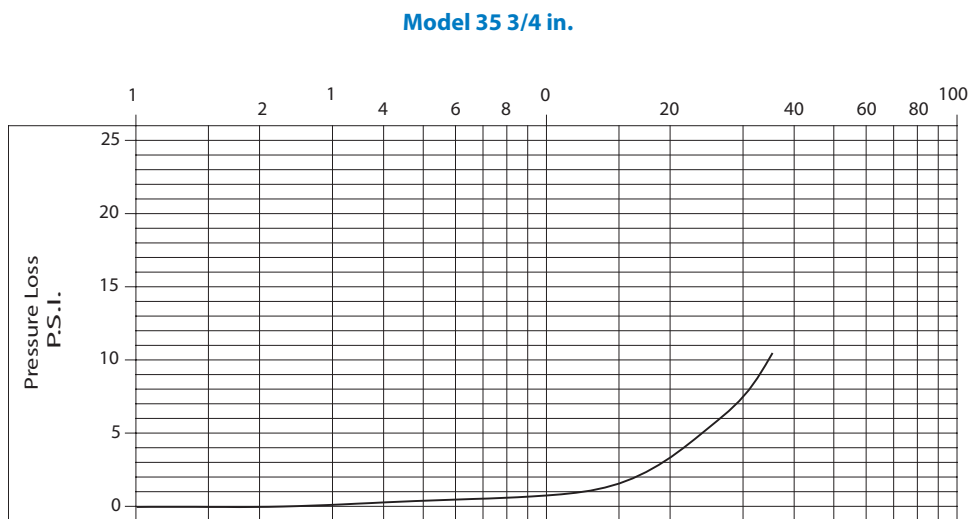
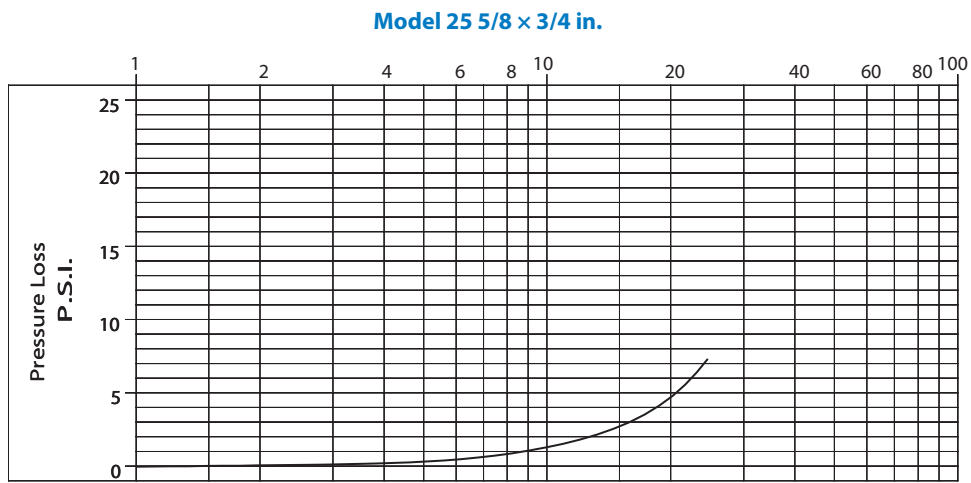
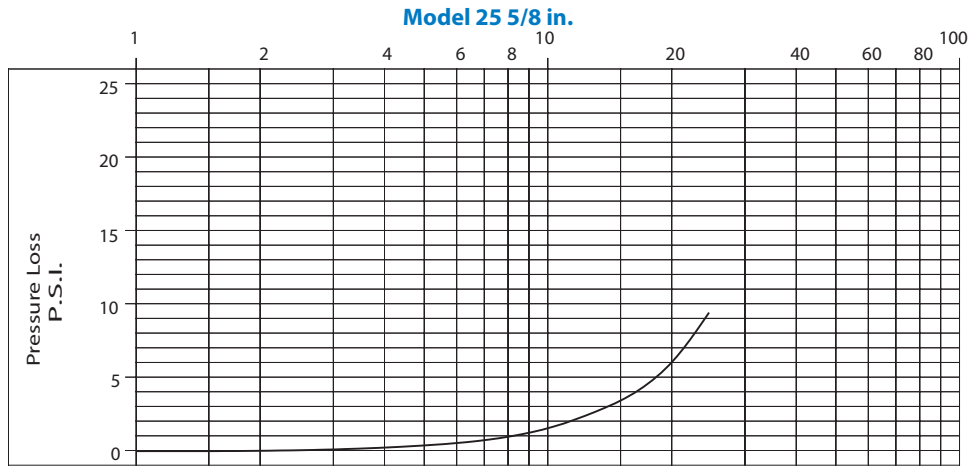
A Model 25 register is used in the following example:



Model	Gallon	Cubic Feet	Cubic Meter
25 (5/8 in.)	10	1	0.1/0.01
25 (5/8 × 3/4 in.)	10	1	0.1/0.01
35	10	1	0.1
55	10	1	0.1
70	10	1	0.1

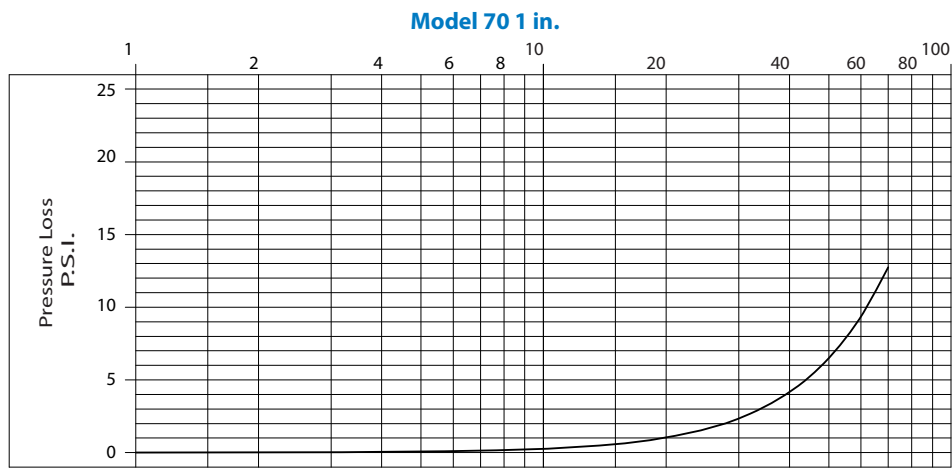
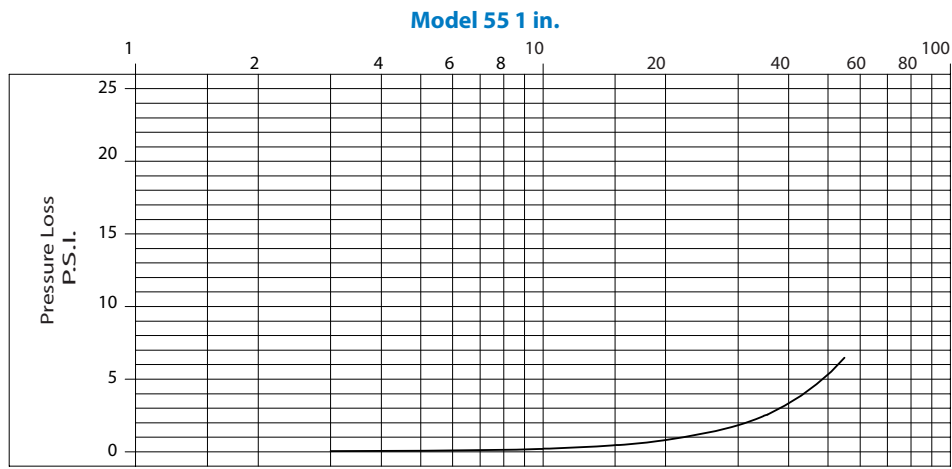
PRESSURE LOSS CHARTS

Rate of Flow in Gallons per Minute



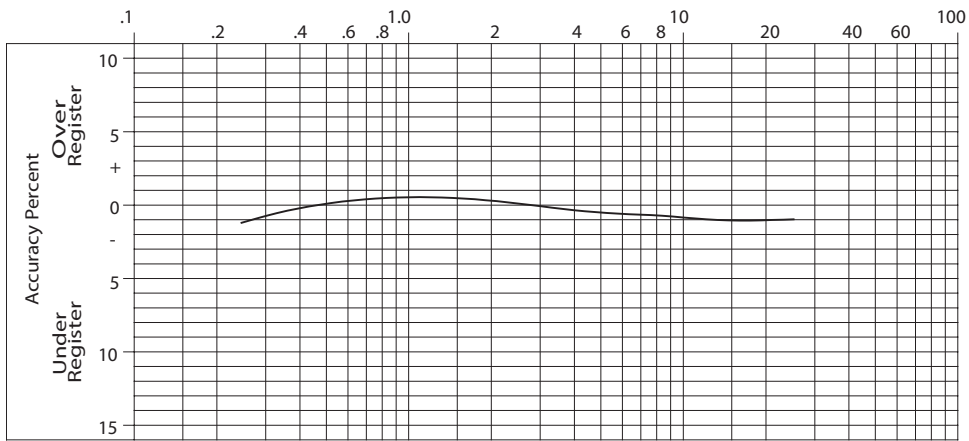
PRESSURE LOSS CHARTS (CONTINUED)

Rate of Flow in Gallons per Minute

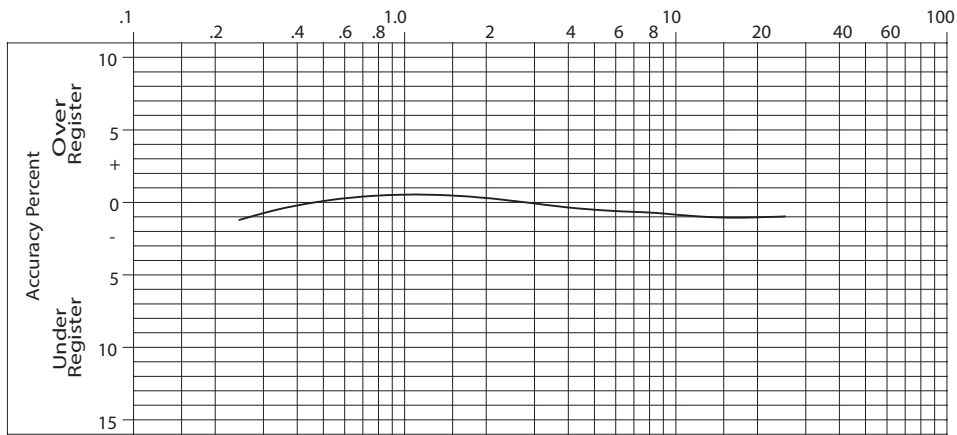


ACCURACY CHARTS

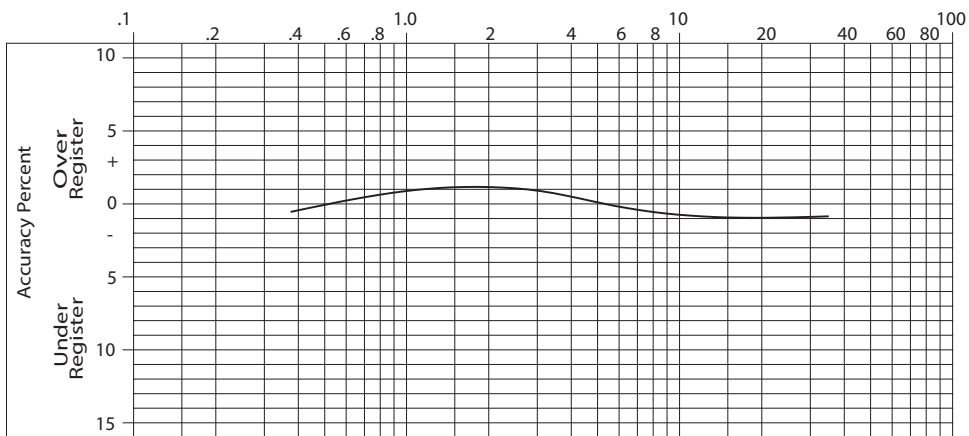
Model 25 5/8 in.



Model 25 5/8 x 3/4 in.

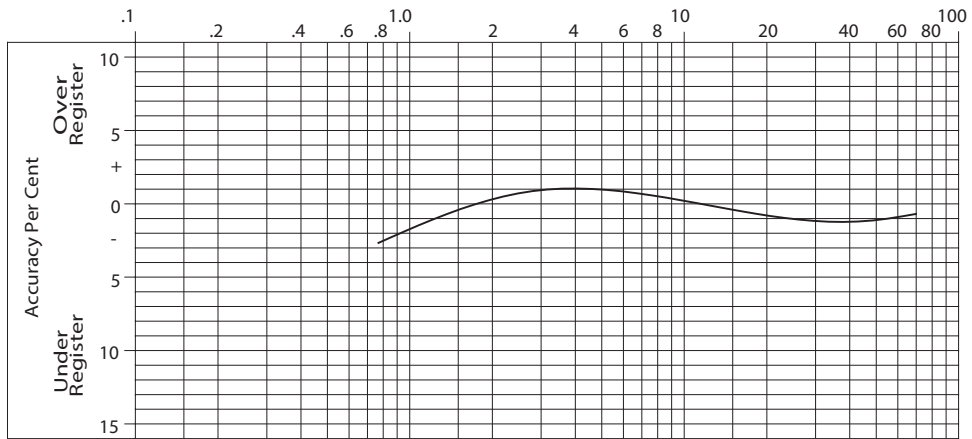


Model 35 3/4 in.

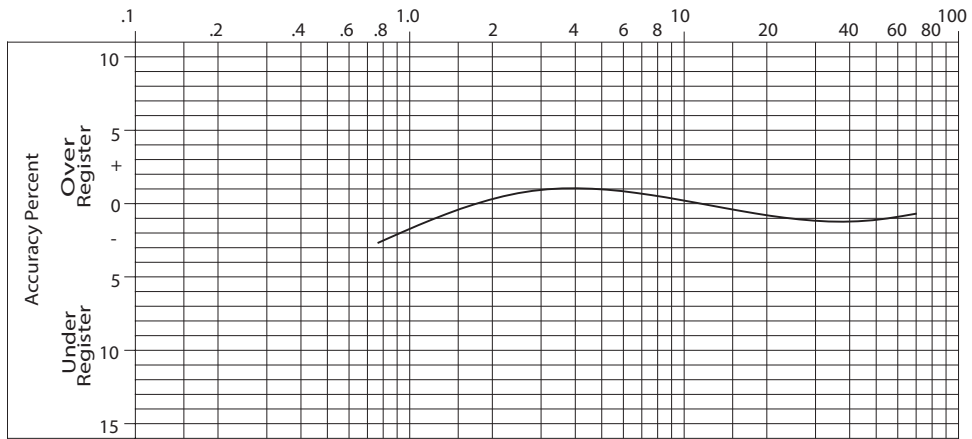


ACCURACY CHARTS (CONTINUED)

Model 55 1 in.



Model 70 1 in.



Recordall® Disc Meters

Lead-Free Bronze Alloy 120 & 170, Sizes 1-1/2 in. (40 mm) & 2 in. (50 mm), NSF/ANSI/CAN Standards 61 and 372 Certified

DESCRIPTION

Recordall Models 120 and 170 Disc Series meters meet or exceed the most recent revision of AWWA Standard C700 and are available in a lead-free bronze alloy. Both meters comply with the lead-free provisions of the Safe Drinking Water Act, are certified to NSF/ANSI/CAN Standards 61 and 372 (Trade Designations: M120-LL and M170LL) and carry the NSF-61 mark on the housing. All components of the lead-free bronze alloy meter (housing, measuring element, seals, and so on) comprise the certified system.

Applications: For use in measurement of potable cold water in residential, commercial and industrial services where flow is in one direction only.

Operation: Water flows through the meter's strainer and into the measuring chamber where it causes the disc to nutate. The disc, which moves freely, nutates on its own ball, guided by a thrust roller. A drive magnet transmits the motion of the disc to a follower magnet located within the permanently sealed register. The follower magnet is connected to the register gear train. The gear train reduces the disc nutations into volume totalization units displayed on the register or encoder face.

Operating Performance: The Recordall Disc Series meters meet or exceed registration accuracy for the low flow rates (95%), normal operating flow rates ($100 \pm 1.5\%$), and maximum continuous operation flow rates as specifically stated in AWWA Standard C700.

Construction: Recordall Disc meter construction, which complies with ANSI/AWWA standard C700, consists of three basic components: meter housing, measuring chamber, and permanently sealed register or encoder. The water meter is available in a lead-free bronze alloy. A corrosion-resistant engineered polymer material is used for the measuring chamber.

Magnetic Drive: Direct magnetic drive, through the use of high-strength magnets, provides positive, reliable and dependable register coupling for straight-reading or AMR/AMI meter reading options.

Tamper-Proof Features: Unauthorized removal of the register or encoder is inhibited by the option of a tamper detection seal wire screw, TORX® tamper-resistant seal screw or the proprietary tamper-resistant keyed seal screw. Each can be installed at the meter site or at the factory.

Maintenance: Badger Meter Recordall Disc Series meters are designed and manufactured to provide long-term service with minimal maintenance. When maintenance is required, it can be performed easily either at the meter installation or at any other convenient location.

To simplify maintenance, the register, measuring chamber, and strainer can be replaced without removing the meter housing from the installation. No change gears are required for accuracy calibration. Interchangeability of parts among like-sized meters minimizes spare parts inventory investment. The built-in strainer has an effective straining area of twice the inlet size.

Connections: Companion flanges in cast iron or NL bronze are available as options. Straight connection sets are available in NL bronze.



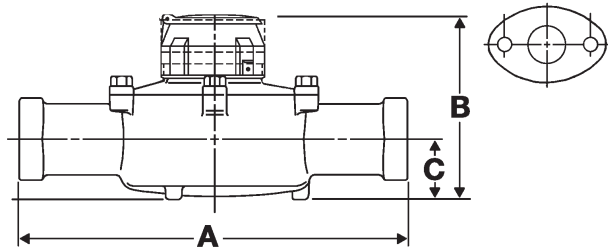
SPECIFICATIONS

Meter Model	M120	M170
Typical Operating Range (100% ± 1.5%)	2.5...120 gpm (0.57...27 m ³ /hr)	2.5...170 gpm (0.57...39 m ³ /hr)
Low Flow (Min. 95%)	1.25 gpm (0.28 m ³ /hr)	1.5 gpm (0.34 m ³ /hr)
Maximum Continuous Operation	80 gpm (18 m ³ /hr)	100 gpm (23 m ³ /hr)
Pressure Loss at Maximum Continuous Operation	4.8 psi at 80 gpm (0.33 bar at 18 m ³ /hr)	3.3 psi at 100 gpm (0.23 bar at 23 m ³ /hr)
Maximum Operating Temperature	80° F (26° C)	80° F (26° C)
Maximum Operating Pressure	150 psi (10 bar)	150 psi (10 bar)
Measuring Element	Nutating disc, positive displacement	Nutating disc, positive displacement
Meter Connections	1-1/2 in. AWWA two-bolt elliptical flange, drilled or 1-1/2...11-1/2 NPT internal pipe threads	2 in. AWWA two-bolt elliptical flange, drilled or 2...11-1/2 NPT internal pipe threads
Test Plugs	Optional 1 in. NPT test plug (TP)	Optional 1 in. NPT test plug (TP)

Materials

Meter Housing	Lead-free bronze alloy
Housing Top Plates	Lead-free bronze alloy
Measuring Chamber	Engineered polymer
Disc	Engineered polymer
Trim	Stainless steel
Strainer	Engineered polymer
Disc Spindle	Stainless steel
Magnet	Ceramic
Magnet Spindle	Stainless steel
Register Lid and Shroud	Engineered polymer, bronze

DIMENSIONS



Meter Size	Meter Model	A Laying Length	B Height Reg./RTR	C Centerline Base	Width	Approx. Shipping Weight
1-1/2 in. (40 mm)	120 EL, Hex 120 EL, TP	12-5/8 in. (321 mm)	7 in. (178 mm)	2-3/8 in. (60 mm)	8-3/4 in. (222 mm)	19 lb (8.6 kg)
1-1/2 in. (40 mm)	120 ELL, TP	13 in. (330 mm)	7 in. (178 mm)	2-3/8 in. (60 mm)	8-3/4 in. (222 mm)	19 lb (8.6 kg)
2 in. (50 mm)	170 EL, Hex 170 EL, TP	15-1/4 in. (387 mm)	8 in. (203 mm)	2-7/8 in. (73 mm)	9-1/2 in. (241 mm)	30 lb (13.6 kg)
2 in. (50 mm)	170 ELL, TP	17 in. (432 mm)	8 in. (203 mm)	2-7/8 in. (73 mm)	9-1/2 in. (241 mm)	30 lb (13.6 kg)

EL = Elliptical

ELL = Elliptical Long

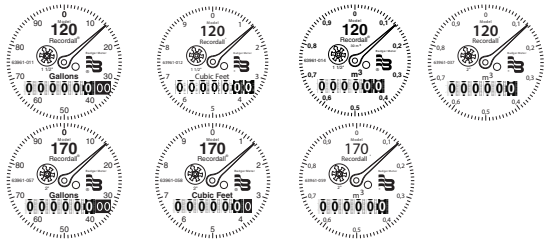
Hex = Hexagon, 1-1/2...11-1/2 in. NPT Thread

TP=Test Plug 1 in.

REGISTERS / ENCODERS

Standard—Sweep-Hand Registration

The standard register is a straight-reading, permanently sealed magnetic drive register. Dirt, moisture, tampering and lens fogging problems are eliminated. The register has a six-odometer wheel totalization display, 360° test circle with center sweep hand, and flow finder to detect leaks. Register gearing is made of self-lubricating engineered polymer, which minimizes friction and provides long life. The multi-position register simplifies meter installation and reading. The register capacity is 100,000,000 gallons (10,000,000 ft³, 1,000,000 m³).



Meter Model	Gallon	Cubic Feet	Cubic Meter
120	100	10	1/0.1
170	100	10	1

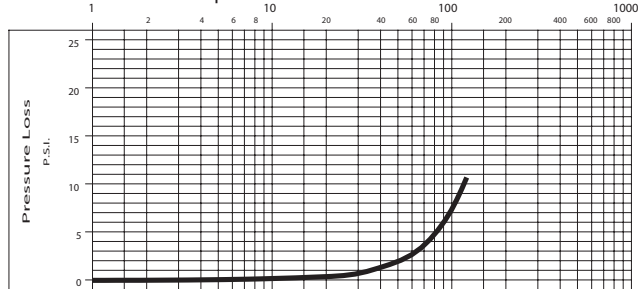
Optional—Encoders for AMR/AMI Reading Solutions

AMR/AMI solutions are available for all Recordall Disc Series meters. All reading options can be removed from the meter without disrupting water service. Badger Meter encoders provide years of reliable, accurate readings for a variety of applications and are also available pre-wired to Badger Meter approved AMR/AMI solutions. See details at badgermeter.com.

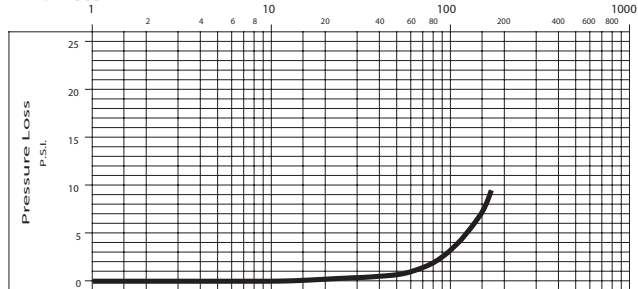
PRESSURE LOSS CHARTS

1-1/2 in. Meter

Rate of Flow in Gallons per Minute



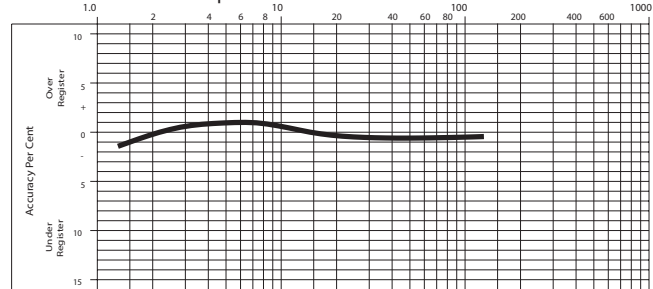
2 in. Meter



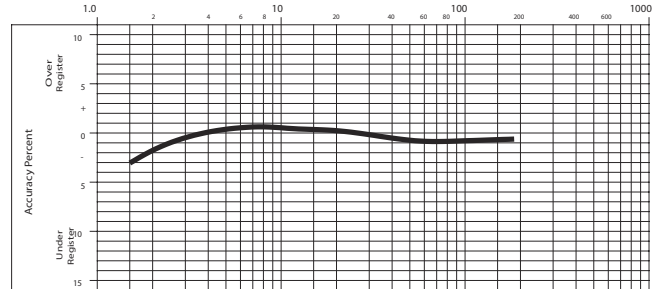
ACCURACY CHARTS

1-1/2 in. Meter

Rate of Flow in Gallons per Minute



2 in. Meter



SMART WATER IS BADGER METER

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www.badgermeter.com

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, 4-20 mA and BadgerTouch® (TRPL)

**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.



In the normal temperature range of 45...122° F (7...50° C), the “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

**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 suitable for non-potable, reclaimed irrigation water applications, and less-than-optimum water conditions where small particles exist. Additionally, select models are UL Listed for residential fire-service applications. The intended water application must be specified at time of order.

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.

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 does 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	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)	0.10...35 gpm (0.02...7.95 m ³ /hr)	0.10...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	3 psi @ 15 gpm (0.21 bar @ 3.4 m ³ /hr)	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)
Residential Fire Service Applications**	—	—	3/4 in. (7-1/2 in.)	3/4 in. (9 in.)	1 in.
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	3 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	3 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	4.1 psi @ 40 gpm (0.28 bar @ 9.1 m ³ /hr)
Normal Test Flow Limits	NA	NA	0.50...35 gpm (0.11...7.95 m ³ /hr)	0.50...35 gpm (0.11...7.95 m ³ /hr)	0.16...62 gpm (0.04...14.08 m ³ /hr)
Minimum Test Flow Limits	NA	NA	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)	NA	NA	35 gpm (7.95 m ³ /hr)	35 gpm (7.95 m ³ /hr)	62 gpm (14.08 m ³ /hr)

Meter Specifications

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

* “3/4 x 1 in. (9 in.)” follows the performance specifications of 3/4 x 9 in. meter

** Flow ranges for Fire Service meters are also applicable to Raw Water application meters

*** 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 and Raw Water meters do not have a Strainer

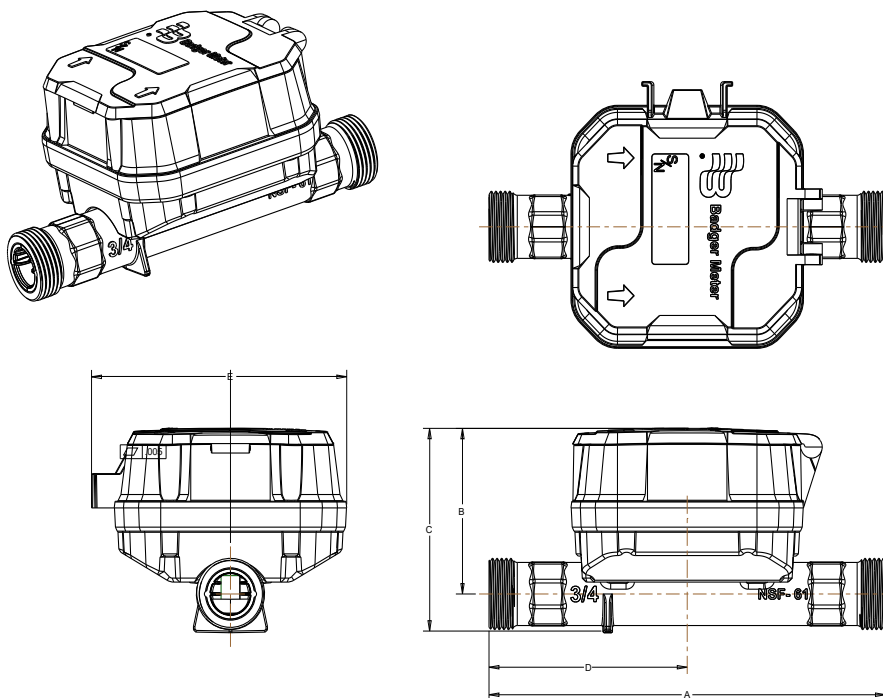
PHYSICAL DIMENSIONS

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.)	3/4 x 1 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)	3/4 x 1 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)	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. (25.4 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)	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)	1 in. (25 mm)
Weight (without AMR)	2.5 lb (1.13 kg)	2.7 lb (1.23 kg)	2.62 lb (1.19 kg)	2.86 lb (1.30 kg)	3.05 lb (1.38 kg)	4.02 lb (1.82 kg)

See illustration below for Measurement Designations

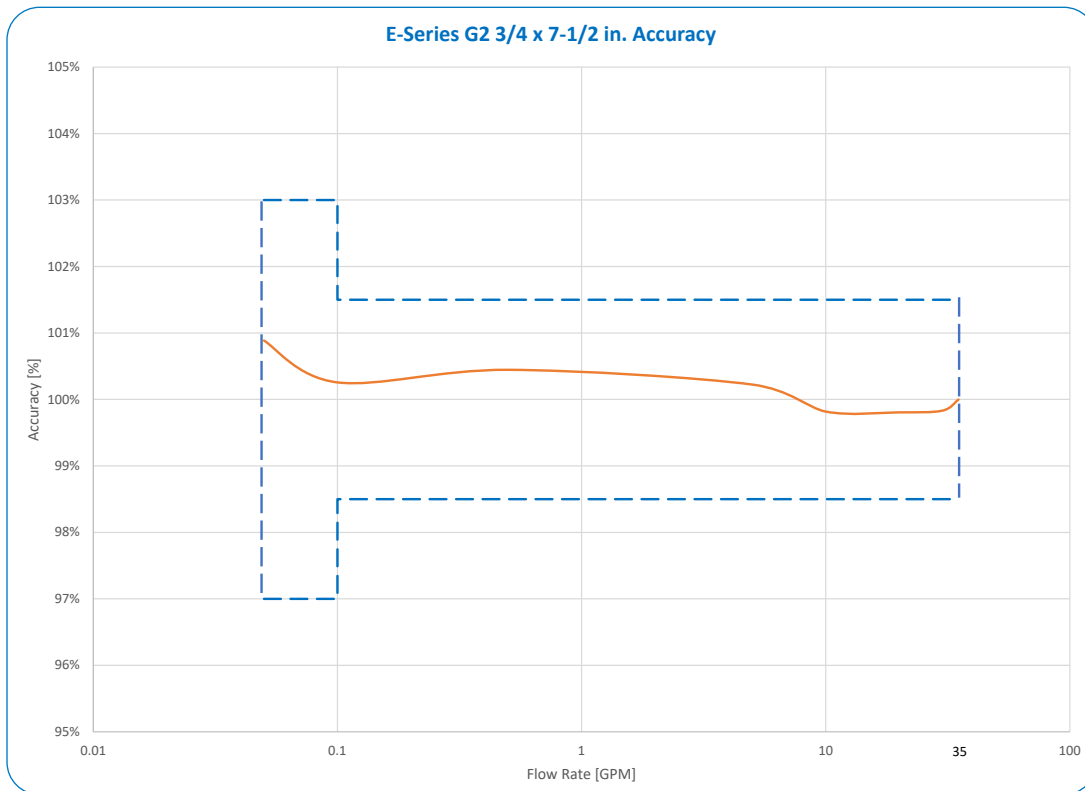
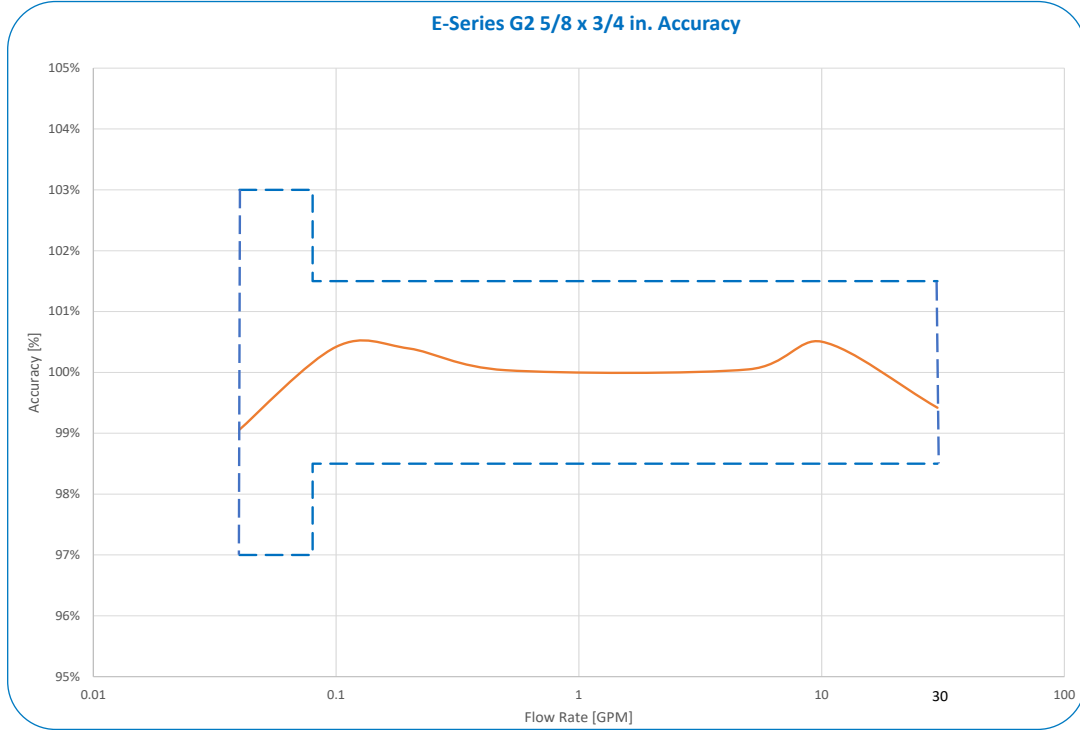
Length (A)	7.49 in. (190 mm)	7.46 in. (189 mm)	7.46 in. (189 mm)	8.93 in. (227 mm)	8.93 in. (227 mm)	10.75 in. (273 mm)
Height (B)	2.95 in. (75 mm)	2.99 in. (76 mm)	2.99 in. (76 mm)	2.99 in. (76 mm)	2.99 in. (76 mm)	3.19 in. (81 mm)
Height (C)	3.55 in. (90 mm)	3.66 in. (93 mm)	3.66 in. (93 mm)	3.69 in.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

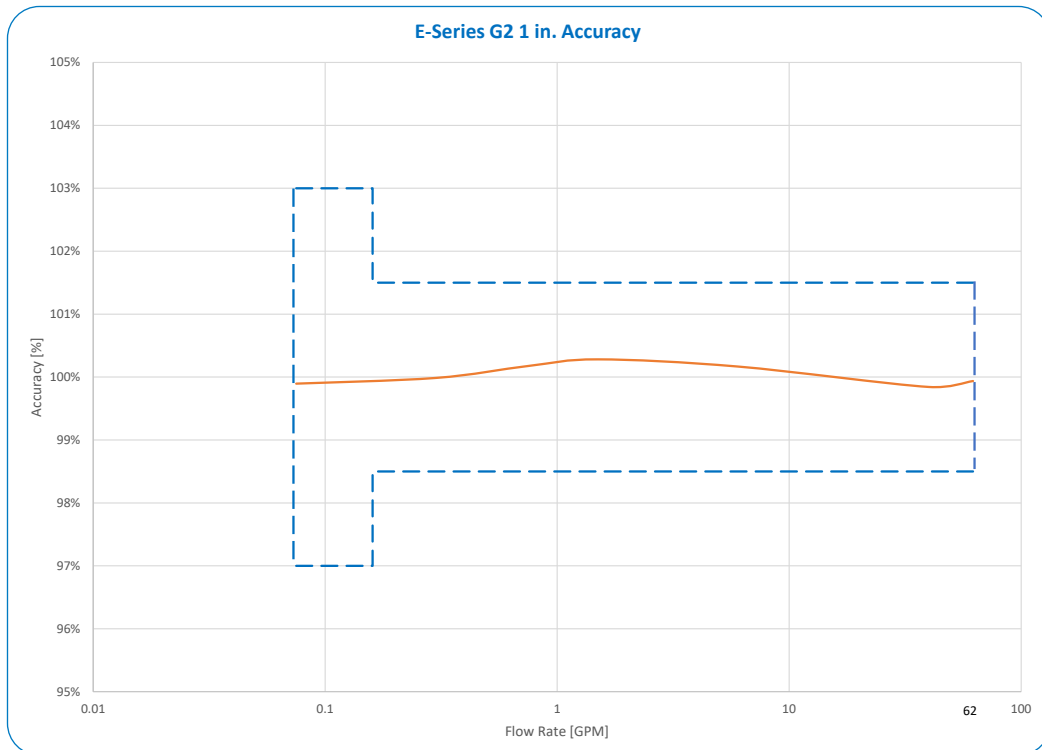
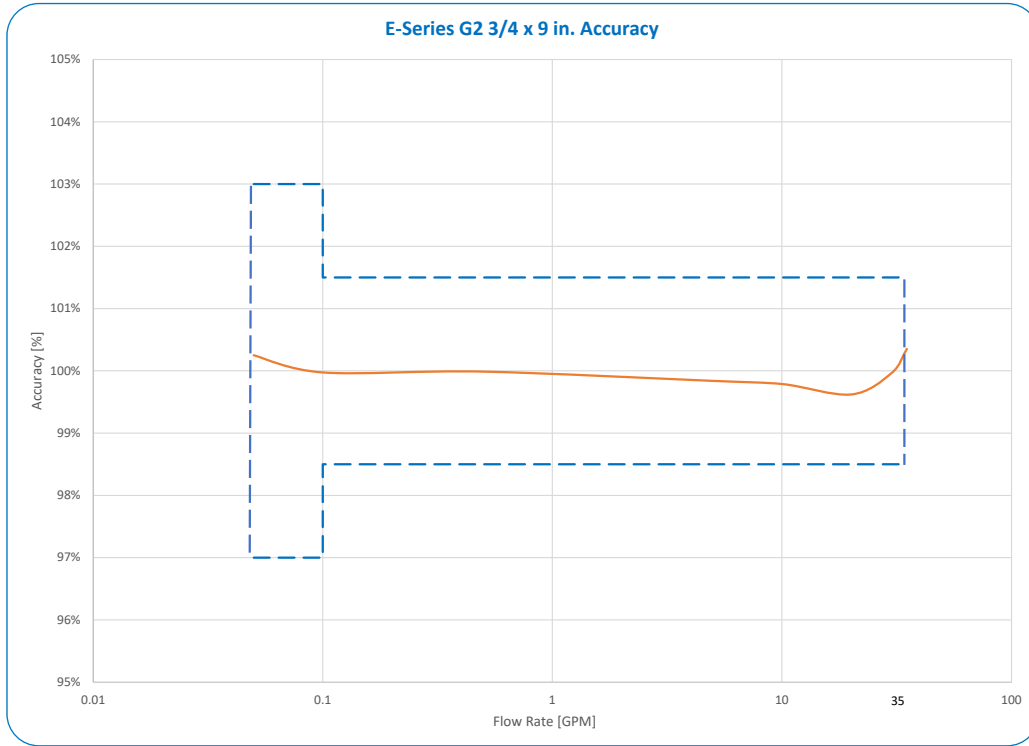
Measurement Designations



ACCURACY CHARTS

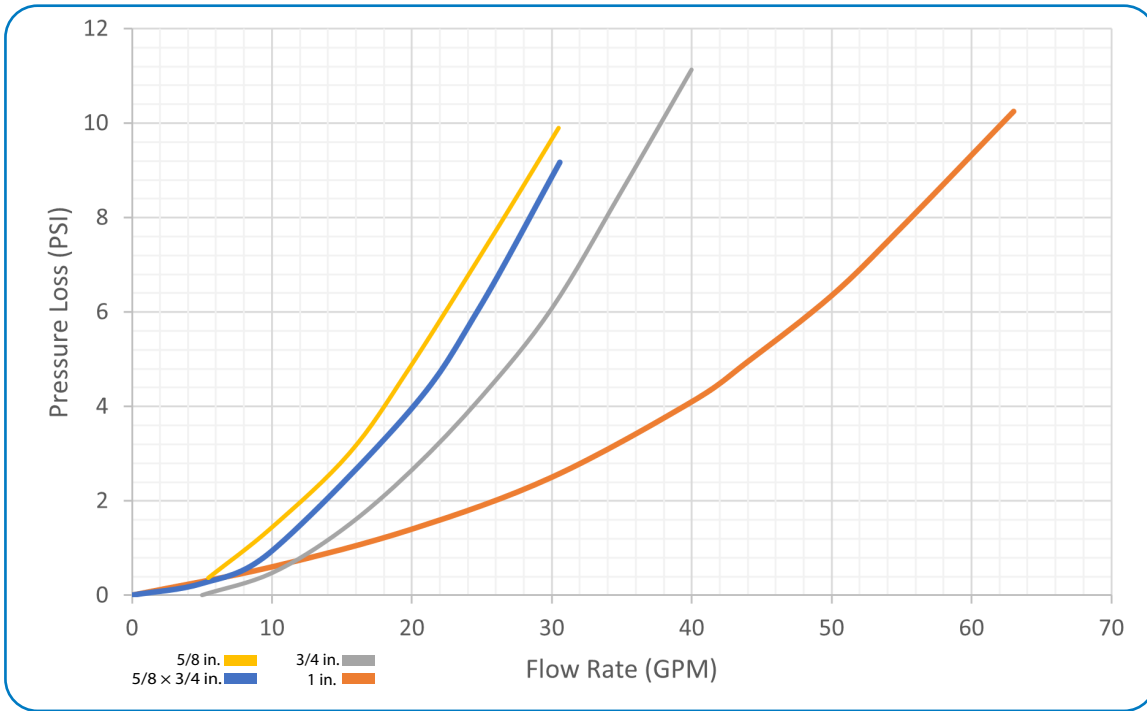
Each chart represents typical meter performance. Rate of flow in gallons per minute (gpm).





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

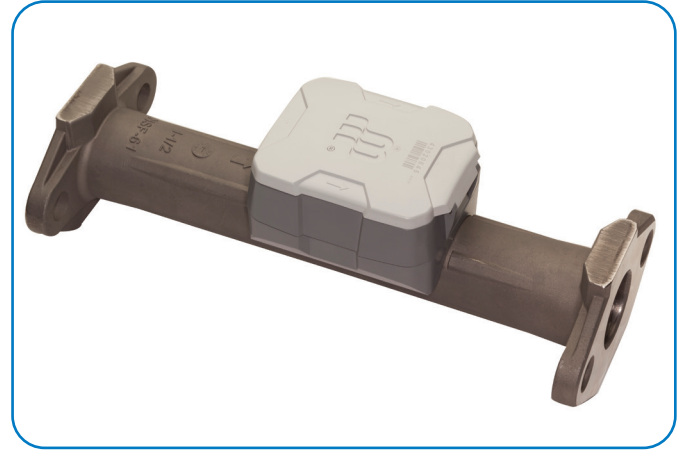
APPLICATIONS

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	

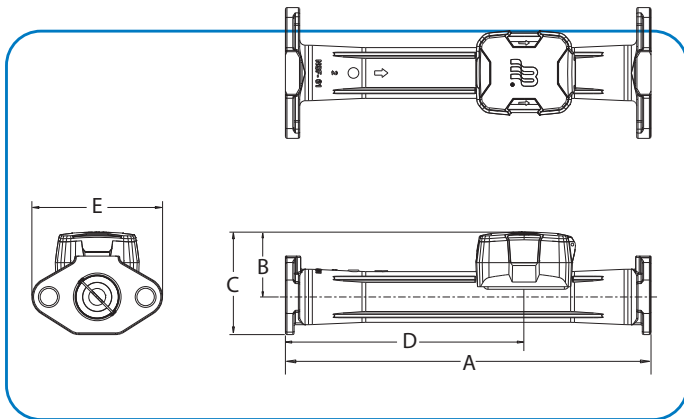
MATERIALS

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

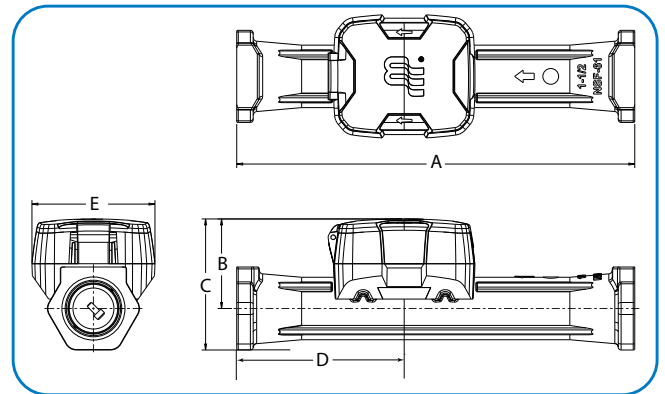
PHYSICAL DIMENSIONS

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

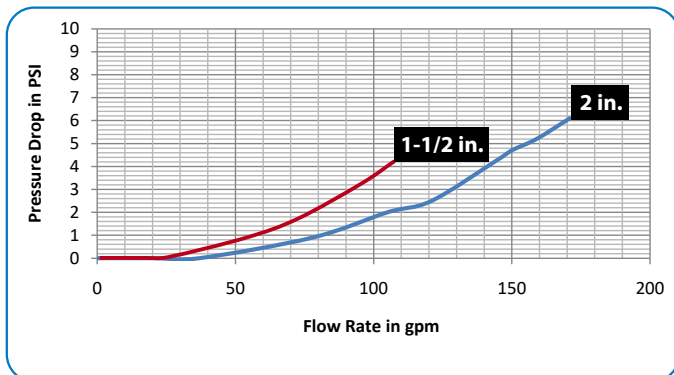


HEX Measurement Designations



PRESSURE LOSS CHART

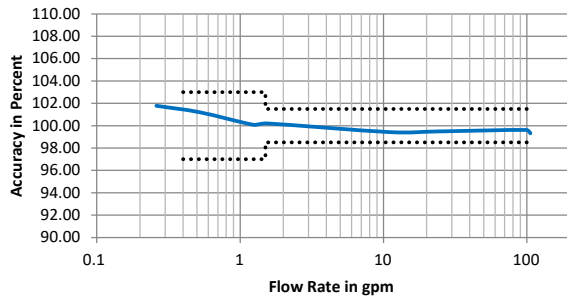
Flow rate in Gallons Per Minute (gpm)



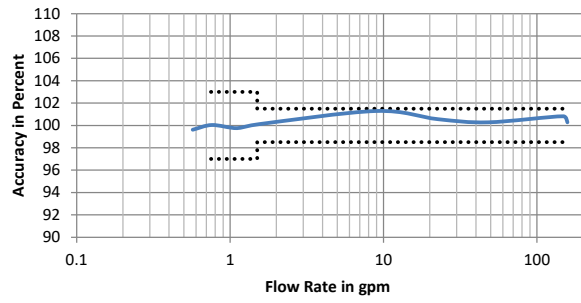
ACCURACY CHARTS

Rate of Flow in gallons per minute (gpm)

1-1/2 in. Meter



2 in. Meter



SMART WATER IS BADGER METER

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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 commercial 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 2, 3, 4, 6 and 8 inch Meter Features

- Open flow tube design prevents flow obstruction to reduce pressure loss
- Greater turn-down ratio for extended flow ranges and increased revenue
- Easy-to-read, 9-digit LCD display, which presents consumption, rate of flow, unit of measure, pressure, temperature, alarm conditions and firmware version
- Pressure* alarm and pressure and temperature data reported through ORION® Cellular endpoints and BEACON®
- Field programmable registration and maintains an hourly internal logging capacity of 160 days of data
- Single and dual outputs include high resolution industry standard ASCII encoder protocol, scaled/unscaled and 4-20 mA

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

**The 2-inch meter is available with optional pressure sensor. Pressure sensor is standard on 3-inch meter and larger.*

APPLICATIONS

Use the E-Series Ultrasonic meter for measuring potable cold water in 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. Additionally, the meters are available for commercial fire-service applications. The intended water application must be specified at time of order.

E-Series Ultrasonic meters meet and exceed the most recent version of 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. All commercial E-Series Ultrasonic meters conform to UL 327B (2-inch pending). E-Series Ultrasonic meters, sizes 3-inch and larger also conform to FM 1044 for fire service applications.

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 shows 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).

In normal temperature range of 45 to 122 °F (7 to 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

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. 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 open flow tube design prevents obstruction of flow to reduce pressure loss and provide long-term accuracy.

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

SPECIFICATIONS

E-Series G2 Ultrasonic Meter Size	2 in.		3 in.		4 in.		6 in.		8 in.
	2 × 10 in. (51 × 254 mm)	2 × 17 in. (51 × 432 mm)	3 × 12 in. (76 × 305 mm)	3 × 17 in. (76 × 432 mm)	4 × 14 in. (102 × 356 mm)	4 × 20 in. (102 × 508 mm)	6 × 18 in. (152 × 457 mm)	6 × 24 in. (152 × 610 mm)	8 × 20 in. (203 × 508 mm)
Normal Test Flow Limits	0.70–260 gpm		0.75–560 gpm		1.5–1100 gpm		2.2–2000 gpm		4–3500 gpm
Minimum Test Flow Limits	0.35 gpm		0.37 gpm		0.75 gpm		1.1 gpm		2.0 gpm
Safe Maximum Operating Condition (SMOC)	260 gpm		560 gpm		1100 gpm		2000 gpm		3500 gpm
Typical Pressure Loss	4 psi @ 220 gpm	4.8 psi @ 220 gpm	2.6 psi @ 350 gpm		2.1 psi @ 630 gpm		1.5 psi @ 1400 gpm	1.8 psi @ 1400 gpm	2.4 psi @ 2800 gpm
Totalization Display Resolution	2 inch, 3 inch, 4 inch meters <ul style="list-style-type: none"> Gallons: 0.1 Cubic feet: 0.01 Cubic meters: 0.001 						6 inch, 8 inch meters <ul style="list-style-type: none"> Gallons: 1.0 Cubic feet: 0.1 Cubic meters: 0.01 		
Operating Performance	In normal temperature range of 45 to 122 °F (7 to 50 °C), new meter consumption measurement is accurate to: <ul style="list-style-type: none"> 100% ±1.5% over the normal test flow limits 100% ±3.0% for the minimum test flow limits 								
Storage Temperature	–40 to 140 °F (–40 to 60 °C)								
Maximum Ambient Storage (Storage for One Hour)	150 °F (66 °C)								
Measured Fluid Temperature Range	34 to 140 °F (1 to 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"> Consumption (up to nine digits) Rate of flow Alarms Pressure 					<ul style="list-style-type: none"> Temperature Firmware version Unit of measure factory programmed for gallons, cubic feet and cubic meters 			
Scaled/Unscaled Output*	Solid-state relay with 4-20mA output; open drain MOSFET with encoder output								
Max. Voltage	30V DC								
Current	100 mA								
Pulse Width	50 ms (programmable 25–100 ms)								
Analog 4-20 mA Output*	Two-wire/passive								
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; 15-year battery life for dual output meters								

NOTE: See Pressure Loss Chart on [page 4](#) for typical pressure loss over complete UL 327B flow range.

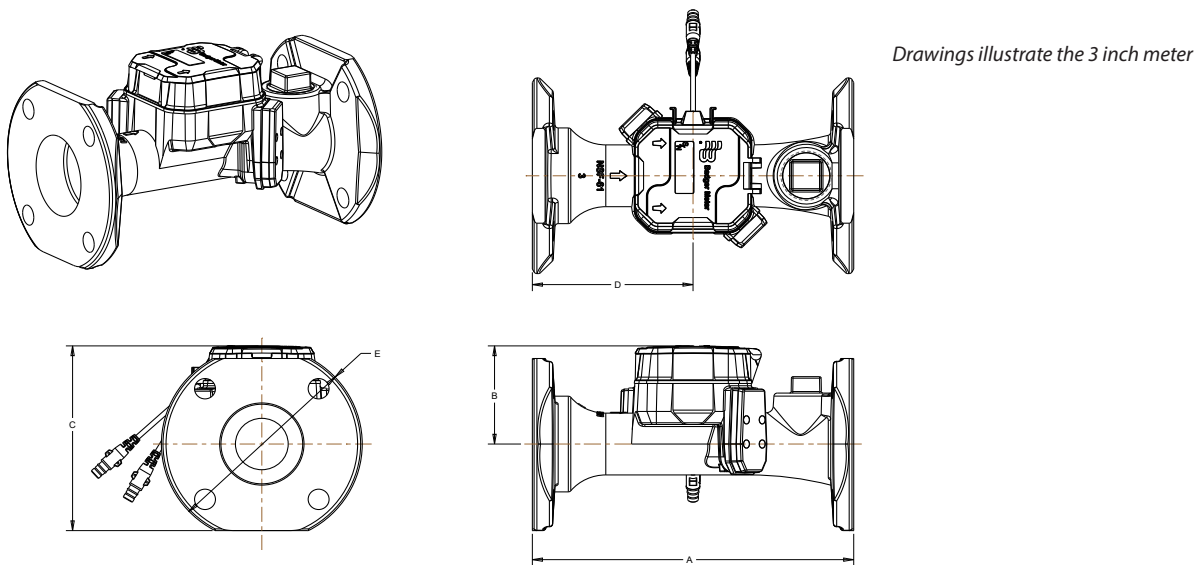
* Applicable to meters with dual output options



PHYSICAL DIMENSIONS

E-Series G2 Ultrasonic Meter Size	2 in.		3 in.		4 in.		6 in.		8 in.
Housing	Elliptical	Elliptical	Round	Round	Round	Round	Round	Round	Round
Size Designation × Lay Length	2 × 10 in. (51 × 254 mm)	2 × 17 in. (51 × 432 mm)	3 × 12 in. (76 × 305 mm)	3 × 17 in. (76 × 432 mm)	4 × 14 in. (102 × 356 mm)	4 × 20 in. (102 × 508 mm)	6 × 18 in. (152 × 457 mm)	6 × 24 in. (152 × 610 mm)	8 × 20 in. (203 × 508 mm)
Weight (without AMR)	10.2 lb (4.6 kg)	11.9 lb (5.4 kg)	26 lb (11.8 kg)	28.5 lb (12.9 kg)	38 lb (17.2 kg)	42 lb (19.1 kg)	59 lb (26.8 kg)	66 lb (29.9 kg)	96 lb (43.5 kg)
See illustrations below for "Measurement Designations"									
Length (A)	10 in. (254 mm)	17 in. (432 mm)	12 in. (305 mm)	17 in. (432 mm)	14 in. (356 mm)	20 in. (508 mm)	18 in. (457 mm)	24 in. (610 mm)	20 in. (508 mm)
Height (B)	3.73 in. (95 mm)		3.76 in. (95 mm)	3.76 in. (95 mm)	3.99 in. (101 mm)	3.99 in. (101 mm)	5.15 in. (131 mm)	5.15 in. (131 mm)	6.49 in. (165 mm)
Height (C)	5.54 in. (141 mm)		7.08 in. (180 mm)	7.08 in. (180 mm)	8.5 in. (216 mm)	8.5 in. (216 mm)	10.36 in. (263 mm)	10.36 in. (263 mm)	13.05 in. (331 mm)
Height with Lifting Ring	NA		NA	NA	NA	NA	12.96 in. (329 mm)	12.96 in. (329 mm)	15.65 in. (398 mm)
Length (D)	4.2 in. (107 mm)		6 in. (152 mm)	8.5 in. (216 mm)	7 in. (178 mm)	10 in. (254 mm)	8 in. (203 mm)	8 in. (203 mm)	9 in. (229 mm)
Width (E)	6.1 in. (155 mm)		7.5 in. (191 mm)	7.5 in. (191 mm)	9 in. (229 mm)	9 in. (229 mm)	11 in. (279 mm)	11 in. (279 mm)	13.50 in. (343 mm)
Number of Bolts	2	2	4	4	8	8	8	8	8
Bolt Hole Diameter	0.781 in. (19.84 mm)								
Companion Flange	2 in. (51 mm)		3 in. (76 mm)	3 in. (76 mm)	4 in. (102 mm)	4 in. (102 mm)	6 in. (152 mm)	6 in. (152 mm)	8 in. (203 mm)
NPT Test Port	1 in. (25 mm)		1.5 in. (38 mm)	1.5 in. (38 mm)	2 in. (51 mm)	2 in. (51 mm)	2 in. (51 mm)	2 in. (51 mm)	2 in. (51 mm)

Measurement Designations



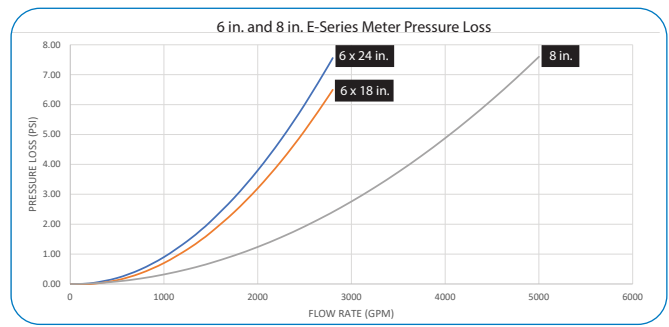
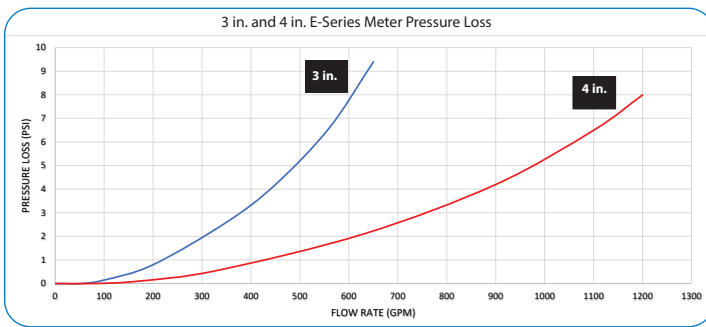
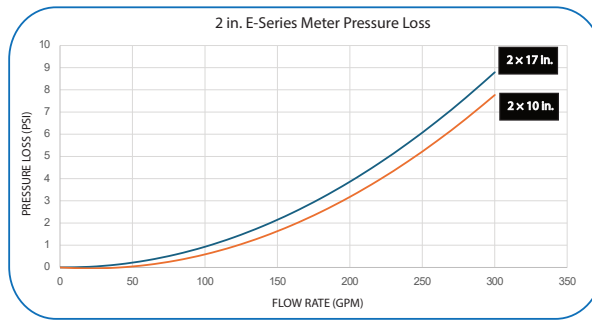
MATERIALS

Meter Housing	Lead-free bronze alloy
Measuring Section	Ultrasonic sensors located in the flow tube
Register Housing & Lid	Engineered polymer
Transducer Port Covers*	Engineered polymer

* No transducer port cover for 2 inch meters

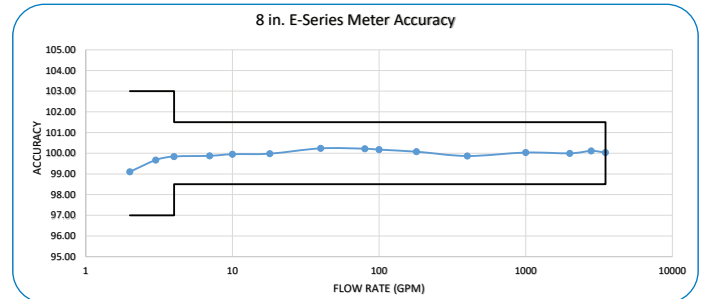
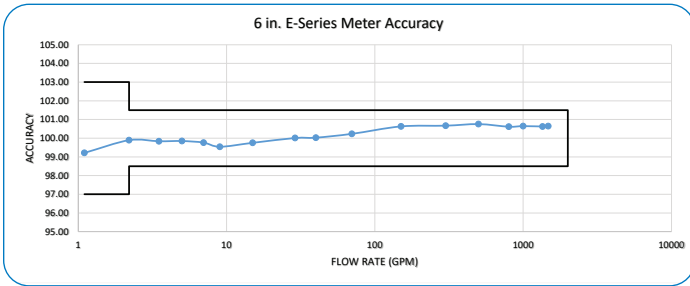
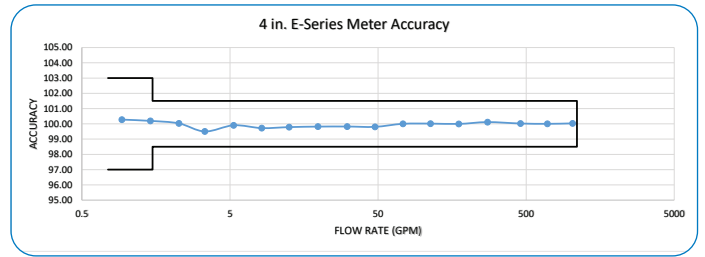
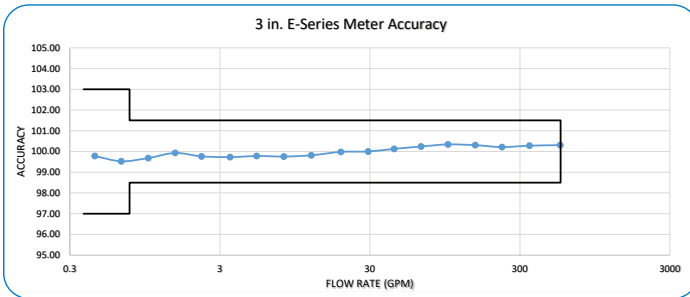
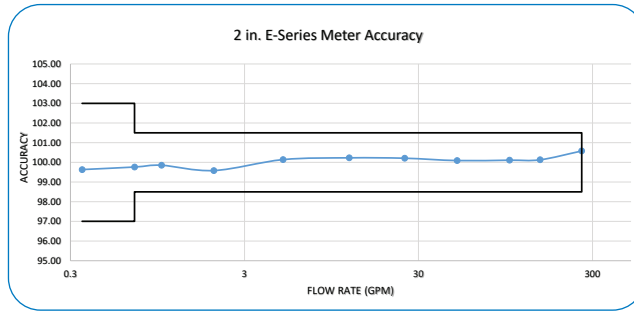
PRESSURE LOSS CHARTS

Charts represent typical meter performance. Rate of flow in gallons per minute (gpm).



ACCURACY CHARTS

Charts represent typical meter performance. Rate of flow in gallons per minute (gpm).



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DESCRIPTION

The Model 450 reduced pressure backflow preventer meter from Badger Meter is designed to protect the water system by preventing backflow through fire hydrants.

Applications

The meter is used in measuring cold water from a fire hydrant or other non-permanent installation where flow moves in one direction.

Operation

Water flows into the meter's measuring element where flow readings are obtained by rotor revolutions transmitted by magnetic drive coupling through the meter's cover plate to the sealed register. Magnetic drive is achieved by a right angle worm drive, coupling the rotor to the vertical transmission spindle. A ceramic magnet on the spindle rotates around the vertical axis. Through the magnetic coupling, rotor rotation is transmitted to a follower magnet which transmits rotation to the register gearing.

After being measured the water flows through the pretested double cam-check assembly. Both check valves open to allow full water flow. Any backflow or downstream pressure condition is prevented by the double check valves closing. Any pressure between these valves is vented to atmosphere through a third valve located between the main double check valves.

Operating Performance

The Model 450 meters meet or exceed registration accuracy for low flow rate, normal operating flow rate, and maximum continuous operation flow rate as specifically stated in AWWA Standard C701.

Contact the factory for specific approvals on the reduced pressure backflow preventer.

Construction

The Model 450 meter construction consists of four basic components: meter housing, measuring element, permanently sealed register, and reduced pressure backflow preventer. The housing is light-weight heat-treated aluminum alloy, compact and easy to handle. The measuring element consists of the transmission coupling, measuring element insert, rotor, straightening vane, and calibration vane assembly. The straightening vane minimizes swirl from piping arrangements upstream.

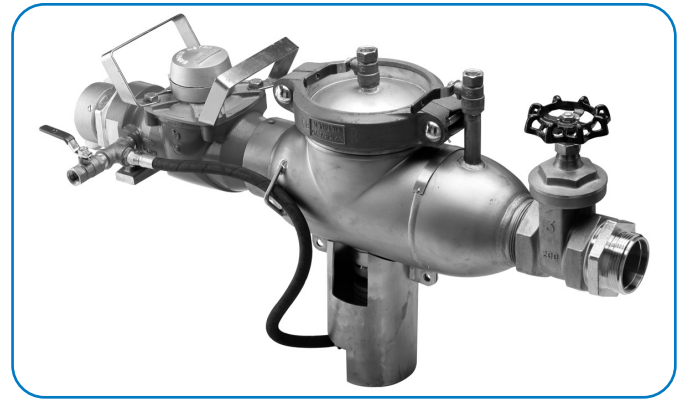
The reduced pressure double-check assembly consists of three independently operating valves mounted in a 300 series stainless steel housing. Two of the valves are cam checks, each internally loaded, providing a positive drip-tight closure against reverse flow. The cam checks include a stainless steel cam arm and spring, rubber faced disc, and a replaceable seat at the reduced-pressure zone between the two check valves. A differential pressure relief valve adds another level of backflow prevention. A stainless steel support strut is provided for installation against the base of any standard fire hydrant.

Magnetic Drive

Direct magnetic drive, through the use of high-strength magnets, provides positive, reliable and dependable register coupling.

**Badger Meter**

RTS-DS-02503-EN-05 (September 2021)



Restriction Plate

A permanent orifice, positioned in the outlet side of the meter housing, limits the maximum flow of water through the meter. This is provided to protect the measuring element from over speeding when the meter discharges to atmosphere.

Sealed Register

The standard register consists of a straight-reading odometer-type totalization display, 360° test circle with center sweep hand, and flow finder to detect leaks. Register gearing consists of self-lubricating thermoplastic gears to minimize friction and provide long life. Permanently sealed; dirt, moisture, tampering and lens fogging problems are eliminated. Multi-position register simplifies meter installation and reading.

Tamper-Resistant Features

Removal of the register to obtain free water is prevented when the tamper detection seal wire screw or TORX[®] tamper-resistant seal screw is added to the meter. A tamper-resistant calibration plug seal provides protection from unauthorized personnel use.

Strainer

A compression fit double layer stainless steel strainer is installed in the inlet housing tube. The strainer insures optimum long-term field performance.

Maintenance

The Model 450 meters are designed and manufactured to provide long-term service with minimal maintenance. When maintenance is required, it can be performed easily, either at the meter installation or at any other convenient location. As an alternative to repair by the utility, Badger Meter offers various maintenance and meter component exchange programs to fit the needs of the utility.

Hose Couplings

The meter is available with standard (2-1/2...7-1/2 in. NST) fire hose swivel couplings and a 3 in. gate valve as standard equipment, unless otherwise specified. Complete thread specifications (listed on the back page of this document) must be furnished for special fire hose fittings.

SPECIFICATIONS

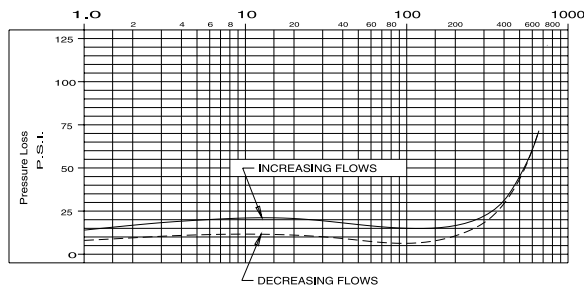
Typical Operating Range (100%±1.5%)	5...660 gpm (1.1...150 m ³ /hr)
Maximum Continuous Flow	500 gpm (102 m ³ /hr)
Maximum Intermittent Flow	660 gpm (150 m ³ /hr)
Typical Low Flow (Min. 95%)	4 gpm (0.9 m ³ /hr)
Pressure Loss at Max. Continuous Operation	37 psi @ 450 gpm (2.55 bar @ 102 m ³ /hr) (standard couplings with orifice and screen) Note: 27 psi @ 350 gpm
Maximum Operating Pressure	150 psi (10 bar)
Standard Hose Coupling	2-1/2...7-1/2 in. NST threads (78P-3.4 mm) (National standard fire hose coupling thread)
Register	Straight-reading, permanently sealed magnetic drive standard
Registration	100,000,000 gallons; 100 gallons/sweep hand revolution. 10,000,000 cubic feet; 10 cubic ft/sweep hand revolution. 1,000,000 m ³ ; 1 m ³ /sweep hand revolution.
Assembly Weight	62 lb

Materials

Housing	Heat treated aluminum alloy/stainless steel	Calibration Mechanism	Stainless steel and thermoplastic
Nose Cone and Straightening Vanes	Thermoplastic	Magnet	Ceramic
Rotor	Thermoplastic	Register Cover	Bronze
Rotor Radial Bearings	Lubricated thermoplastic	Trim	Stainless steel
Rotor Thrust Bearings	Sapphire jewels	Inlet Screen	Stainless steel with Elastomer
Rotor Bearing Pivots	Passivated 316 stainless steel		

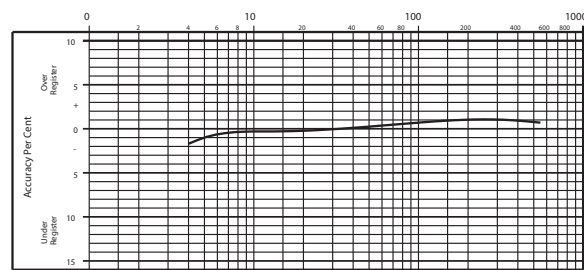
Pressure Loss Chart

Rate of flow in gallons per minute (gpm)

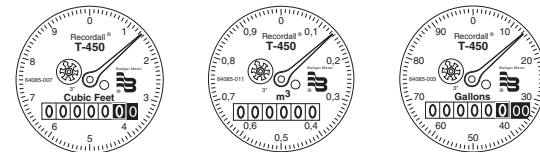


Accuracy Chart

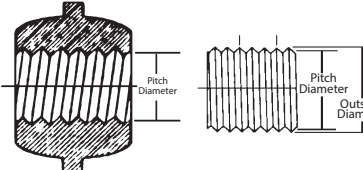
Rate of flow in gallons per minute (gpm)



TYPICAL INSTALLATION



Specifications for Special Fire Hose Coupling Threads



Required Information

- Number of threads per inch and thread form, if other than American National Standard.
- Outside diameter of male threads.
- Pitch diameter of male threads.
- Pitch diameter of female threads.

SMART WATER IS BADGER METER

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DESCRIPTION

Applications: The High Resolution encoder (HR-E LCD) is a fully electronic, solid-state encoder with no moving parts. It is designed for use with all current Badger Meter Recordall[®] Disc, Turbo Series, Compound Series, Combo Series and Fire Service meters and assemblies. The HR-E LCD provides connectivity with Badger Meter ORION[®] and GALAXY[®] AMR/AMI endpoints and other AMR/AMI technology solutions approved by Badger Meter.

NOTE: For more detailed information, refer to the document *HR-E LCD Encoder User Manual*, available at www.badgermeter.com.

Field Programmable: The HR-E LCD encoder comes standard as factory programmed to customer specifications, with the option for field programming the unit of measure, meter type, meter model, digit resolution from the encoder, billing units, and rate-of-flow time and units. Programming is performed through the IR port via a computer.

Electronic Resolution: Standard encoded output from the HR-E LCD is nine digits.

Status Indicators: Status indicators are sent as part of the encoder extended message to AMR/AMI systems such as ORION Cellular, Fixed Network and Migratable endpoints that are capable of receiving an extended message. The details can also be read through an IR interface.

Mounting: Icons on the HR-E LCD encoder face indicate encoder status and alarm conditions. The fully potted encoder assembly has a bayonet mount compatible with all Recordall Disc, Turbo Series, Compound Series, Combo Series and Fire Series meters and assemblies. The bayonet mount positions the encoder in any of four orientations for visual reading convenience. The HR-E LCD encoder can be removed from the meter without disrupting water service.

Magnetic Drive Communication: The HR-E LCD encoder detects movement of the wet side meter magnet with magnetic sensors to provide reliable and dependable encoded communication.

Tamper-resistant Features:

Unauthorized removal of the HR-E LCD encoder is inhibited by a tamper-resistant Torx[®] seal screw. Torx seal screws are provided as standard accessories. Optional proprietary tamper-proof screws are also available.

Magnetic sensors detect and report an attempted encoder removal. In addition, the HR-E LCD encoder is resistant to magnetic tampering. The encoder detects an attempted tamper—as well as encoder removal—and sends a tamper alarm in either situation. Approved endpoints capable of receiving the alarms, such as ORION Cellular, Fixed Network and Migratable endpoints, can then report the tamper condition to the meter reading software.



SPECIFICATIONS

Encoder type	Straight reading, permanently sealed, electronic LCD absolute encoder with field-programmable option
Encoder display	Status indicators, unit of measure, billing units, automatic toggle between 9-digit and 6-digit consumption (segmented leak detector in this mode), rate of flow, meter model
Unit of measure	U.S. gallons, Imperial gallons, cubic feet, cubic meters, and liters clearly identified on register face
Flow rate	Seconds, minutes, and hours
Numerals	7 mm (0.28 in.) high
Weight	11 ounces
Humidity	0...100% condensing
Temperature	Storage: -40...60° C (-40...140° F) Max. ambient for 1 hr: 70° C (158° F) Electronics & Display: -10...60° C (14...140° F)
Status indicators	Electronic and visual icons for: meter functioning correctly, meter alarm (indicates temperature limits exceeded, magnetic tamper or encoder removal), reverse flow, suspected leak, 30-day no usage, end of battery life
Signal output	Industry standard ASCII format
Signal type	Three-wire synchronous for AMR/AMI solutions Red = clock/power; Black = ground; Green = data
Battery	Lithium thionyl chloride AA cell, fully encapsulated within encoder housing
Battery Life	20 years (calculated)

Construction: The housing of the HR-E LCD encoder is constructed of an engineered polymer enclosure and a polycarbonate lens. For long-term performance, the enclosure is fully encapsulated, weatherproof, and UV-resistant to withstand harsh environments and to protect the electronics in flooded or submerged pit applications. An epoxy potting (patented design - 8,482,908) comprises the encoder bottom. Due to this unique sealing, the HR-E LCD exceeds all applicable requirements of AWWA Standard C706 and C707.

Wire Connections: The HR-E LCD encoder 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 a field splice connection, or fully prewired to an AMR/AMI endpoint.

Operating Characteristics: The HR-E LCD encoder is shipped in storage mode so a meter status alarm is not triggered. In storage mode, the meter model screen is displayed. Upon sensing two revolutions of the meter magnet, the encoder goes into normal operation mode. The display then automatically toggles between these four modes:

- 9-digit consumption displays for 45 seconds.
- 6-digit consumption (segmented leak detector in this mode) displays for 5 seconds.
- Rate of flow displays for 5 seconds.
- Meter model displays for 5 seconds.

DIMENSIONAL DRAWINGS

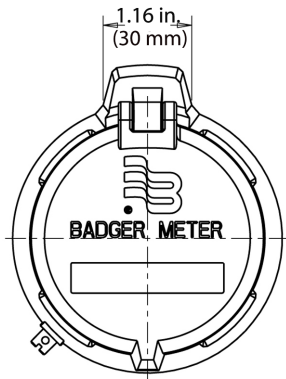


Figure 1: Top view

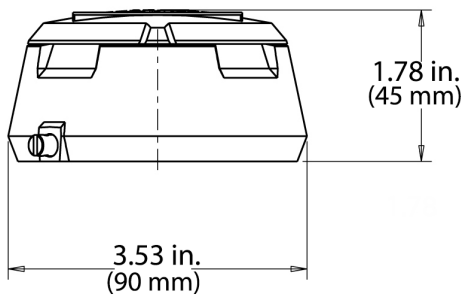


Figure 2: Front view

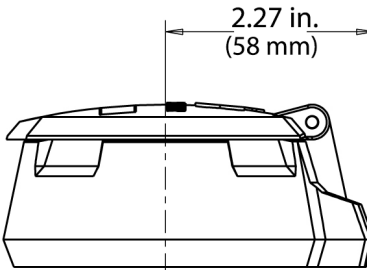


Figure 3: Left side view

MEASUREMENT RESOLUTION

The electronic encoder output resolution of the HR-E LCD is as noted below.

Recordall Disc Series	Size (in.)	9-dial encoder output (gal)	9-dial encoder output (ft³)	9-dial encoder output (m³)
LP	5/8, 5/8 x 3/4	0.01	0.001	0.0001
M25	5/8, 5/8 x 3/4	0.01	0.001	0.0001
M35	3/4	0.01	0.001	0.0001
M40	1	0.01	0.001	0.0001
M55	1	0.01	0.001	0.0001
M70	1	0.01	0.001	0.0001
M120	1-1/2	0.1	0.01	0.001
M170	2	0.1	0.01	0.001

Recordall Turbo Series	Size (in.)	9-dial encoder output (gal)	9-dial encoder output (ft³)	9-dial encoder output (m³)
T160	1-1/2	0.1	0.01	0.001
T200	2	0.1	0.01	0.001
T450	3	0.1	0.01	0.001
T1000	4	0.1	0.01	0.001
T2000	6	1	0.1	0.01
T3500	8	1	0.1	0.01
T5500	10	1	0.1	0.01
T6200	12	10	1	0.01
T6600	16	10	1	0.01
T10000	20	10	1	0.01

Recordall Compound Series	Size (in.)	9-dial encoder output (gal)	9-dial encoder output (ft³)	9-dial encoder output (m³)
High Side T200	2	0.1	0.01	0.001
Low Side M25	2	0.01	0.001	0.0001
High Side T450	3	0.1	0.01	0.001
Low Side M25	3	0.01	0.001	0.0001
High Side T1000	4	0.1	0.01	0.001
Low side M35	4	0.01	0.001	0.0001
High Side T2000	6	1	0.1	0.01
Low Side M35	6	0.01	0.001	0.0001
High Side T3500	8	1	0.1	0.01
Low side M120	8	0.1	0.01	0.001

NOTE: For Fire Service Meters and Assemblies, please refer to appropriate Disc and TSM information provided above.

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Badger Meter

Plate Strainers

Lead-Free Bronze Alloy, Sizes 2", 3", 4", and 6"

DESCRIPTION

Badger Meter® offers dual flange plate strainers, sizes 2...6", in a lead-free bronze alloy. Badger Meter plate strainers comply with the lead-free provisions of the Safe Drinking Water Act, are certified to NSF/ANSI Standards 61 and 372 (Trade Designation: Plate Strainer LL-NS) and carry the NSF-61 mark on the housing.

FEATURES

Badger Meter plate strainers exceed AWWA standards with an effective screening area to minimize flow restrictions to meters. The straining area is double the inlet to turbo and compound meter cases. These strainers also reduce turbine rotor bearing loading and resultant wear to maintain and extend accurate meter registration, by minimizing velocity profile distortion caused by changes in pipe direction or valving. For added flexibility, these strainers are compatible with all makes of meters. The rubber head O-Ring or gasket is reusable, which reduces replacement part costs. The screen is removable to clean the strainer in the service line. All sizes have a drain plug incorporated.

SCREENS

Made of non-corrosive 316 stainless steel with 3/16" or 1/4" perforations to effectively strain any larger foreign matter, and can be easily removed and cleaned.

HYDROSTATICALLY TESTED MATERIALS

Housings are designed and individually tested to withstand 150 psi maximum working pressure and 300 psi static pressure.

SPECIFICATIONS

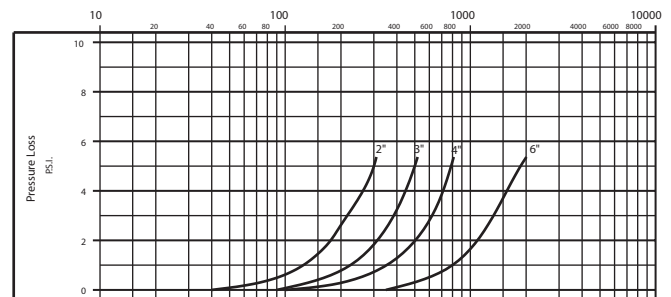
Sizes and Configurations	2" Dual elliptical flange 2" Dual round flange 3" Dual round flange 4" Dual round flange 6" Dual round flange Compatible WITH any ASA 125 flange
Maximum Working Pressure	150 psi (10 bar)
Static Test Pressure	300 psi (20 bar)
Screen Area Ratio	Minimum 2-to-1 ratio of meter inlet
Screen	Removable in-line service
Screen Perforations	3/16" holes for 2", 3" and 4" strainers 1/4" holes for 6" strainer
Drain Plug	1/2" or 3/4" – 14 NPT removable in-line service
Recommended Applications	Recordall Turbo Series, Recordall Compound Series, and other makes of meters



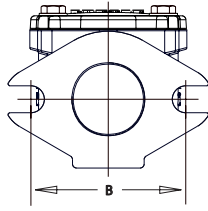
Materials

Strainer Housing	Lead-free bronze alloy
Housing Cover	Lead-free bronze alloy
Housing Cover Seal	Rubber
Strainer Screen	Stainless steel
Drain Plug	Lead-free bronze alloy
Housing Bolts	Stainless steel

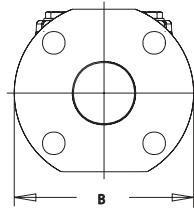
Flow Rate vs Pressure Loss



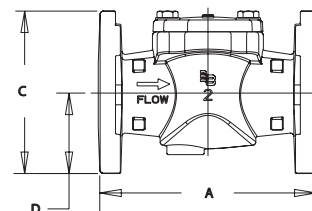
DIMENSIONS



Dual Elliptical Flange

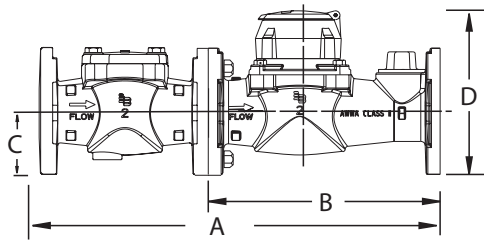


Dual Round Flange



Strainer Type	Nominal Size	Dimensions				Drain Plug (NPT)	Hsg. Bolt Dia.	Flange		Net Wt.
		A	B	C	D			No. Mtg. Holes	Hole Dia.	
Dual Ellip. Flange	2" (50 mm)	7" (178 mm)	4-1/2" (114 mm)	4-7/8" (122 mm)	1-7/8" (48 mm)	—	3/8-16	2	13/16" (21 mm)	11 lb (5.0 kg)
Dual Round Flange	2" (50 mm)	7" (178 mm)	6" (152 mm)	5-1/2" (140 mm)	2-5/8" (66 mm)	—	3/8-16	4	3/4" (19 mm)	14 lb (6.3 kg)
	3" (80 mm)	7" (178 mm)	7-1/2" (190 mm)	7-1/4" (184 mm)	3-5/8" (92 mm)	—	1/4-20	4	3/4" (19 mm)	22 lb (9.9 kg)
	4" (100 mm)	9" (229 mm)	9" (229 mm)	8-3/4" (223 mm)	4-3/8" (112 mm)	—	3/8-16	8	3/4" (19 mm)	35 lb (16 kg)
	6" (150 mm)	9" (229 mm)	11" (279 mm)	11" (279 mm)	5-1/2" (140 mm)	3/4"-14	3/8-16	8	7/8" (22mm)	59 lb (26.5 kg)

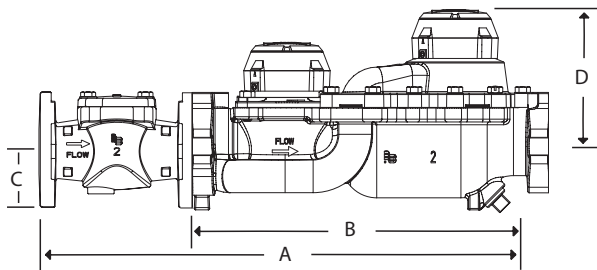
Recordall Turbo/Strainer **



Meter Size	Dimensions			
	A	B	C	D
2" (50 mm)	17" (432 mm)	10" (254 mm) RD	2-5/8" (66 mm) EL 2-1/16" (52 mm) RD	7-19/64" (185 mm) EL 6-23/32" (170 mm)
3" (80 mm)	19" (482 mm)	12" (305 mm)	3-5/8" (92 mm)	8-23/32" (221 mm)
4" (100 mm)	23" (584 mm)	14" (355 mm)	4-3/8" (112 mm)	9-21/32" (245 mm)
6" (150 mm)	27" (686 mm)	18" (457 mm)	5-1/2" (140 mm)	12-9/16" (319 mm)

** Badger Meter recommends a distance of five (5) pipe diameters between the strainer and the meter. (See individual meter Users manual.)

Recordall Compound/Strainer **



Meter Size	Dimensions			
	A	B	C	D
2" (50 mm)	22-1/4" (560 mm)	15-1/4" (387 mm)	2-5/8" (66 mm)	5-7/8" (149 mm)
3" (80 mm)	24" (609 mm)	17" (432 mm)	3-5/8" (92 mm)	6-5/8" (168 mm)
4" (100 mm)	29" (737 mm)	20" (508 mm)	4-3/8" (112 mm)	7-1/4" (184 mm)
6" (150 mm)	33" (838 mm)	24" (609 mm)	5-1/2" (140 mm)	8-7/8" (225 mm)

** Badger Meter recommends a distance of five (5) pipe diameters between the strainer and the meter. (See individual meter Users manual.)

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Legacy Document Number: PS-T-1



WARRANTY DOCUMENTATION





Badger Meter

Lead-Free Bronze Disc Meters

PRODUCTS COVERED

This warranty shall apply to all Recordall® Lead-Free Bronze Disc Meters, models 25 through 170, when used to measure potable water, including the registers used with these meters (collectively “Product”) sold on or after January 25, 2019. This warranty is extended only to utilities, municipalities, other commercial users and authorized Badger Meter, Inc. 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 warrants Product to be free from defects in materials and workmanship appearing within the following time frames and those listed in the table below:

Housings

Twenty-five (25) years and six (6) months after shipment from Badger Meter.

Local Registers Supplied with the Meters Listed Herein

Twenty-five (25) years and six (6) months after shipment from Badger Meter.

	AWWA New Meter Accuracy	AWWA Repaired Meter Accuracy (AWWA M6 Manual)	Badger Meter Extended Low Flow Meter Accuracy
Recordall Meter Model, Size	<i>The meter product will meet or exceed new meter accuracy standards set forth in AWWA Standard C700 for the following periods:</i>	<i>The meter product will meet or exceed repaired meter accuracy standards set forth in AWWA Manual M-6, Chapter 5, Table 5.3 for the following periods:</i>	<i>Badger Meter further warrants the meter product to meet or exceed the following extended low flow accuracies in excess of AWWA standard:</i>
Model 25, 5/8 in. and 5/8 x 3/4 in.	Five (5) years from date of shipment or registration of 750,000 gallons, whichever occurs first.	Fifteen (15) years from date of shipment or registration of 2,500,000 gallons, whichever occurs first, with a 25 gpm safe maximum operating capacity and a 15 gpm maximum rate for continuous operation.	Badger Meter warrants Product low flow accuracy of 98.5% at a rate of 1/4 gpm and low flow accuracy of 95.0% at a rate of 1/8 gpm for five (5) years from date of shipment or registration of 675,000 gallons, whichever occurs first.
Model 35, 3/4 in.	Five (5) years from date of shipment or registration of 750,000 gallons, whichever occurs first.	Fifteen (15) years from date of shipment or registration of 2,500,000 gallons, whichever occurs first, with a 35 gpm safe maximum operating capacity and a 25 gpm maximum rate for continuous operation.	Badger Meter warrants Product low flow accuracy of 97% at a rate of 3/8 gpm for five (5) years from date of shipment or registration of 675,000 gallons, whichever occurs first.
Model 55, 1 in.	Five (5) years from date of shipment or registration of 1,000,000 gallons, whichever occurs first.	Fifteen (15) years from date of shipment or registration of 3,000,000 gallons, whichever occurs first, with a 55 gpm safe maximum operating capacity and a 40 gpm maximum rate for continuous operation.	Badger Meter warrants Product low flow accuracy of 95% at a rate of 1/2 gpm for three (3) years from date of shipment or registration of 575,000 gallons, whichever occurs first.
Model 70, 1 in.	Five (5) years from date of shipment or registration of 1,100,000 gallons, whichever occurs first.	Fifteen (15) years from date of shipment or registration of 3,250,000 gallons, whichever occurs first, with a 70 gpm safe maximum operating capacity and a 50 gpm maximum rate for continuous operation.	Badger Meter warrants Product low flow accuracy of 95% at a rate of 3/4 gpm for three (3) years from date of shipment or registration of 1,100,000 gallons, whichever occurs first.
Model 120, 1-1/2 in.	Two (2) years from date of shipment or registration of 1,600,000 gallons, whichever occurs first.	Fifteen (15) years from date of shipment or registration of 5,600,000 gallons, whichever occurs first, with a 120 gpm safe maximum operating capacity and a 80 gpm maximum rate for continuous operation.	Badger Meter warrants Product low flow accuracy of 95% at a rate of 1-1/4 gpm for two (2) years from date of shipment or registration of 1,440,000 gallons, whichever occurs first.
Model 170, 2 in.	Two (2) years from date of shipment or registration of 2,100,000 gallons, whichever occurs first.	Fifteen (15) years from date of shipment or registration of 10,400,000 gallons, whichever occurs first, with a 170 gpm safe maximum operating capacity and a 100 gpm maximum rate for continuous operation.	Badger Meter warrants Product low flow accuracy of 95% at a rate of 1-1/2 gpm for two (2) years from date of shipment or registration of 1,890,000 gallons, whichever occurs first.

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. The foregoing warranty applies only to the extent that the Product is installed, serviced and operated strictly in accordance with AWWA Standard C700 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 have been exposed to adverse installation conditions, damaged by any water conditions and/or water quality, including but not limited to foreign matter in the water such as dirt, sand, minerals, debris, deposits, biofilms, extreme corrosivity, or other impurities, or which have been subject to passage of high-speed air slugs, vandalism, negligence, accident, acts of God, alteration, improper installation, operation or repair, or other circumstances which are beyond the reasonable control of Badger Meter. 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.

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.

Making Water Visible®

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Legacy Document Number: RD-W-4-AWWA-EN



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 DISCLAIM: (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

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.

SMART WATER IS BADGER METER

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Badger Meter

E-Series G2® Ultrasonic Meter

Lead-Free Bronze Alloy Meters, 2, 3, 4, 6, 8 inch

PRODUCTS

This warranty shall apply to all Badger Meter E-Series G2® Ultrasonic lead-free meters with bronze alloy housings, sizes 2 inch, 3 inch, 4 inch, 6 inch and 8 inch, and electronics (battery, registration, transducer) (collectively "Product"), when used to measure potable cold water, sold on or after January 20, 2026.

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 Bronze Alloy Housing

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

Electronics (Battery, Registration, Transducer)

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

Pressure Sensor

Five (5) 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 data sheet for ten (10) years from 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.



Badger Meter

Recordall® Turbo 450

Fire Hydrant Meter

PRODUCTS COVERED

This warranty shall apply to all Recordall® Turbo 450 fire hydrant meters and the registers and encoders used with these meters (collectively "Product") sold on or after September 15, 2017. This warranty is extended only to utilities, municipalities, other commercial users and authorized Badger Meter, Inc. 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 warrants Product to be free from defects in materials and workmanship appearing within one (1) year and six (6) months after shipment from Badger Meter.

Aluminum Housing

One (1) year and six (6) months after shipment from Badger Meter.

Local Registers Supplied with the Meters Listed Herein

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

METER ACCURACY

The meter Product will meet or exceed accuracy standards of AWWA Standard C701 for one (1) year and six (6) months after 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. The obligation hereunder of Badger Meter 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 original product and reinstalling the repaired or replacement Product.

LIMITS OF LIABILITY

This warranty shall not apply to 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 AWWA Standard C701 and the AWWA M6 Manual. The warranty shall not apply and shall be void with respect to Product exposed to conditions other than those detailed in Badger Meter 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 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.

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 Badger Meter 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 agents of Badger Meter 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.

Exclusion of Consequential Damages and Disclaimer of Other Liability

The liability of Badger Meter with respect to breaches of the foregoing warranty shall be limited as stated herein. The liability of Badger Meter 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.

Making Water Visible®

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Badger Meter

HR-E® LCD

High Resolution LCD Encoder

PRODUCTS COVERED

This Badger Meter warranty shall apply to the High Resolution LCD encoder (HR-E LCD) ("Product"), sold on or after June 23, 2021. The warranty is extended only to utilities, municipalities, or other commercial users, and authorized Badger Meter, Inc. (Badger Meter®) distributors, hereinafter 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 warrants the Product to be free from defects in materials and workmanship appearing within 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.

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. If the defect arises and a valid claim is received within the Warranty Period, at its option, Badger Meter will either (1) exchange the Product with a new, used or refurbished Product that is at least functionally equivalent to the original Product, or (2) refund the purchase price of the Product.

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. A replacement Product assumes the remaining warranty of the original Product, or ninety (90) days from the date of replacement, whichever provides longer coverage.

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 a Product exposed to conditions other than those detailed in applicable 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 a 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.

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 herein. 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

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Badger Meter Strainers

PRODUCTS

This warranty shall apply to all strainers, sizes 2" through 20", hereinafter referred to as "Product," sold by Badger Meter, Inc. on or after April 1, 2013. The warranty is extended only to utilities, municipalities, other commercial users and authorized distributors, hereinafter 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 equipment and parts manufactured by it and supplied hereunder to be free from defects in materials and workmanship for a period of 12 months from date of shipment when installed, serviced and operated according to Badger Meter instructions.

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. 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. The warranty shall not apply and shall be void with respect to Products exposed to conditions other than those detailed in the Badger Meter Product technical literature, or which have been subject to vandalism, negligence, accident, acts of God, alteration, improper installation, operation or repair, or other circumstances which are beyond the reasonable control of Badger Meter. 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.

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**). 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 Product or issue a credit to Customer within a reasonable time of proof to Badger Meter that a defect is involved.

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

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USER MANUALS AND INSTALLATION GUIDES





Badger Meter

Recordall® Disc Series Meters

Cold Water Disc Meters, 5/8 in. to 2 in.



SAFETY INFORMATION

The installation of the Recordall® Disc Series Meters must comply with all applicable federal, state, and local rules, regulations, and codes.

Failure to read and follow these instructions can lead to misapplication or misuse of the Recordall® Disc Series Meters, resulting in personal injury and damage to equipment.

PRODUCT UNPACKING AND INSPECTION

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

NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the purchaser.

METER PRE-INSTALLATION

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

- Inspect the piping around the meter for suitable conditions. The service line, valves, connections and meter must be watertight. Repair the piping system if pipes are corroded or damaged.
- Install the meter in the pipeline in a horizontal position so that the flow arrow on the meter housing points in the same direction as water flow. 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 (shutoff) 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.
- 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 POSITION. THIS COULD DAMAGE THE METER.**
- **DO NOT ATTEMPT TO INSTALL 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 POSITION.**

SPECIAL INSTRUCTIONS FOR REMOVING A METER

⚠ WARNING

DEPRESSURIZE THE LINE 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 in., 3/4 in. and 1 in. 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.

NL bronze connections are available from Badger Meter. To compensate for minor service pipe and setting misalignment for a 5/8 in., 3/4 in. and 1 in. meter, plastic swivel connections are also available.

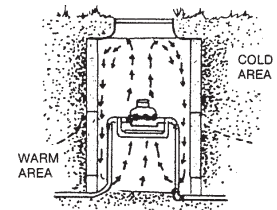
Cast iron or NL bronze companion flanges are available for a 1-1/2 in. and 2 in. meter.

INSTALLING RECORDALL DISC SERIES METERS

Outdoor Installations

When installed outdoors in a meter box, the disc 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.



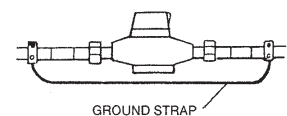
The service lines and the water meter must be protected from freezing. The earth covering the service line must be adequate to prevent frost penetration. Due to the smaller volume of water, service line pipes will freeze sooner than the main distribution line.

For those locations in which a remote possibility of freezing exists, thermoplastic or lead-free bronze alloy meters with cast iron bottoms are recommended.

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 meter.



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

INSTALLATION INSTRUCTIONS

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 or flange bolts and remove the meter and the old gaskets in the coupling nuts.

IMPORTANT

Replace the entire connection set when you replace the meter (or earlier, if necessary).

7. Clean the coupling nuts or flange ends, removing any pipe dope or dirt from the threads or flange ends.
8. Check the existing setting for proper alignment and spacing. Correct any misalignment and spacing in the setting.
9. Place the new connection gaskets inside the connection coupling nuts.
10. Install the meter in the pipeline in a horizontal position so that the flow arrow on the meter housing points in the same direction as water flow.

5/8 in. to 2 in. Threaded Ends

11. Start the coupling nuts at the threaded meter ends. Verify that the nuts are properly aligned to avoid cross-threading or damage to the meter ends. This is especially important for the engineered polymer 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 snug.
- d. With an open-end wrench, apply a partial turn. Do not over tighten. For plastic swivel connections, a one-quarter turn is usually sufficient.

1-1/2 in. to 2 in. Elliptical Flange Ends

12. With meter and gaskets in place, tighten the flange connection bolts. Verify 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.

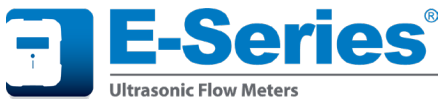
1. Shut off the valves on both the inlet and outlet sides of the meter.
2. Open the curb (shutoff) valve slowly to pressurize the service line to the meter.
3. Slowly open the meter's inlet-side valve to fill the meter.
4. Check for leaks around the meter and its connections.
5. Slowly open the meter's 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.

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E-Series G2® Ultrasonic Meters

Lead-Free Bronze Alloy, 5/8–8 inch



ESM-UM-04284-EN-10 (January 2026)

User Manual

CONTENTS

Scope of this Manual	3
Product Unpacking and Inspection	3
Safety Information.	3
About the E-Series Ultrasonic Meters	4
Operation	4
Meter Applications.	5
Endpoints and Software	6
BEACON First Time Setup	6
Meter Operating Modes	7
Removing a Meter	8
Installation.	8
Outdoor Installations	8
Indoor Installations	8
Installation: Residential Meters	9
Special Fittings and Accessories for Residential Meters.	9
Pre-Installation	9
Residential Meter Installation Instructions.	9
Installation: Commercial Meters	11
Pre-Installation	11
Commercial Meter Installation Instructions	12
Commercial Meter Accuracy Test.	13
Recommended Test Port Valve Assemblies for E-Series Meters	13
Operations.	14
Output	19
Encoder Output	19
Dual Output	19
Meter Alarms	22
Specifications: Residential Meters	24
Specifications: Commercial Meters	25
Troubleshooting	26
Continuous Flow Alarm.	26
Technical Support	26

SCOPE OF THIS MANUAL

This manual contains installation and operation procedures for the Badger Meter® E-Series G2® Ultrasonic residential (5/8–1 inch) and commercial (2–8 inch) water meters. Proper performance and reliability of the product depend upon installation in accordance with these instructions.

Additional Resources

Go to badgermeter.com to find the following related manuals:

For meter programming, refer to [Product Configuration Utility for E-Series G2 Ultrasonic Meters](#)

For connecting meters to ORION endpoints, refer to [ORION Water Endpoints Installation](#)

PRODUCT UNPACKING AND INSPECTION

To avoid damage in transit, E-Series Ultrasonic meters are shipped to the customer in special shipping containers. Upon receipt of shipment, be sure to follow these unpacking and inspection procedures:

If damage to a shipping container is evident upon receipt of a meter, request that a representative of the carrier be present when the meter is unpacked.

- Carefully open the shipping container, following any instructions that may be marked on the container. Remove all cushioning material surrounding the meter and carefully lift the meter from the container. Keep the container and all packing material for possible use in reshipment or storage.
- Visually inspect the meter and applicable accessory devices for any signs of damage such as scratches, loose or broken parts or other physical damage that may have occurred during shipment.

NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery. Then file a claim with the carrier. A claim for equipment damaged in transit is the responsibility of the customer.

Rigging, Lifting and Moving Large Commercial Meters

- DO NOT lift or move a meter using the electronics, lid or cables.
- Use a crane rigged with soft straps to lift and move the meters. Place the straps around the meter body, between the flanges, on each side of the electronics.
- Use the sling-rigged method to lift large meters into a vertical position while they are still crated. Use this method to position while they are still crated. Use this method to position large meters vertically into pipelines.
- DO NOT lift a meter with a forklift by positioning the meter body on the forks with the flanges extending beyond the lift. This could dent the housing or damage the internal components. NEVER place forklift forks, rigging chains, straps, slings, hooks or other lifting devices inside or through the meter flow tube to hoist the unit. This could damage the internal components.

SAFETY INFORMATION

The installation of the E-Series Ultrasonic meter must comply with all applicable federal, state and local rules, regulations and codes. Failure to read and follow these instructions can lead to misapplication or misuse of the meter, resulting in personal injury and damage to equipment.

ABOUT THE E-SERIES ULTRASONIC METERS

The E-Series Ultrasonic meter uses solid-state technology in a compact, tamper protected, weatherproof and UV-resistant housing, suitable for residential and commercial applications. The registration electronics and battery are encapsulated to withstand harsh environments and protect the electronics in flooded or submerged pit applications.

Electronic water metering provides information—such as rate of flow and status and alarm indication—and data not typically available through traditional mechanical meters and registers. The ultrasonic measurement system has no moving parts, provides long-term accuracy and minimizes measurement errors due to sand, suspended particles and pressure fluctuations.

Meters 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 that occurs when the flow sensors are not fully submerged.

Operation

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 display total volume and unit of measure, rate of flow, operating mode, firmware and alarm conditions (reverse-flow, no usage, empty pipe, exceeding max flow, suspected leak, pressure, temperature, end of life, and measurement error).

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, transducers and strainer, if equipped. 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.

Standards

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.

Meter Applications

Residential and commercial E-Series G2 Ultrasonic meters are available for potable water, reclaimed water and fire service applications. The water application must be specified at the time of order.

E-Series Ultrasonic meters can be used in potable cold water applications or in reclaimed irrigation or raw water applications, with less than optimum water conditions, where small particles exist. E-Series Ultrasonic meters for residential and commercial fire service applications in 3/4–8 inch sizes comply with the requirements of UL Subject 327B, ultrasonic and magnetic type water meters used in fire service applications. Meters in the 3–8 inch sizes further comply with the requirements of FM 1044 for commercial fire service applications. These applications are regulated by local codes and requirements established by the Authority Having Jurisdiction (AHJ).

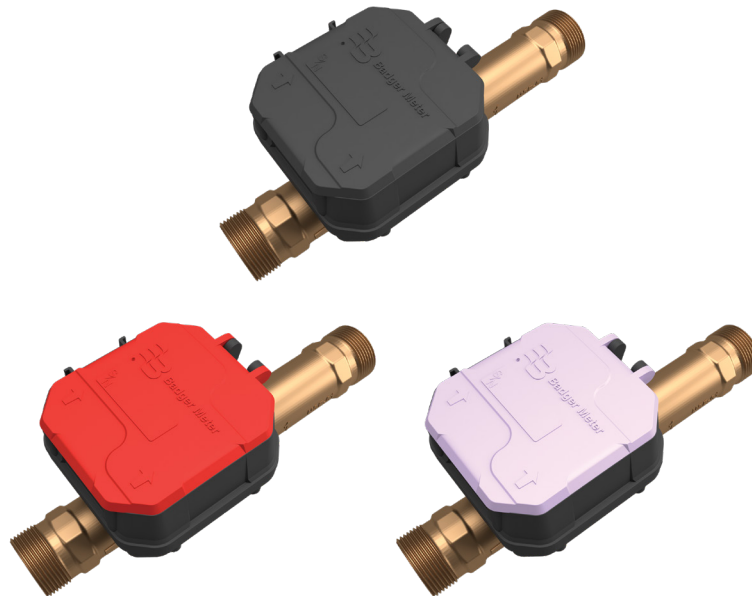


Figure 1: Lid colors indicate application type (charcoal gray: potable and raw water; red: fire service; lavender: reclaimed water)

E-Series G2 Ultrasonic Water Meters														
Size (Inches)	5/8	5/8×3/4	3/4		1	2		3	4		6		8	
Lay Length (Inches)	7-1/2	7-1/2	7-1/2	9	10-3/4	10	17	12	17	14	20	18	24	20
Fire Service	NA	NA	UL 327B		UL 327B	UL Listing Pending		UL 327B, FM 1044						
Reclaimed	Available in sizes shown above													
Raw	NA	NA	Available in sizes shown above											
NTEP (National Type Evaluation Program)	Cert 24-098				NTEP Pending			NA						

ENDPOINTS AND SOFTWARE

IMPORTANT

For proper handling of the higher reading resolution and the extended status indicator capabilities of the E-Series G2 Ultrasonic meter, we recommend ORION Cellular endpoints to support the full capabilities of the meter.

To support *pressure, temperature*, use the following:

- BEACON® Software as a Service (SaaS)
- ORION Cellular C, HLD, CS, LTE-M, LTE-MS, HLA endpoints, ORION Mobile M endpoint, any firmware version
- ORION Cellular LTE endpoints, firmware version 1.10.1193 or newer
- ORION ME, SE endpoints, firmware version X.19 (2.19 or 3.19)

NOTE: ORION ME, SE endpoints only transmit temperature and pressure alerts.

To support *maximum flow rate measurement*, use the following:

- BEACON® Software as a Service (SaaS)
- ORION Cellular C, HLD, CS, HLA endpoints, any firmware version
- ORION® Cellular LTE-M or LTE-MS, firmware version 2.0.445

NOTE: ORION Cellular LTE endpoints do not support maximum flow rate measurement.

BEACON FIRST TIME SETUP

For meters connected to ORION endpoints, perform these steps to make sure the E-Series Ultrasonic meter Sensor information is accessible in BEACON. See [“Endpoints and Software”](#) above on this page for detailed endpoint information.

1. In BEACON, select **Utility Settings > General Settings** from the menu on the left.
2. Scroll down to the *Monitor Page Settings* section, click *Select Filters* and find the *Sensors* section.
3. Select the **Water Pressure** and/or **Water Temperature** check boxes to turn on reporting for the temperature and/or pressure meter sensors.

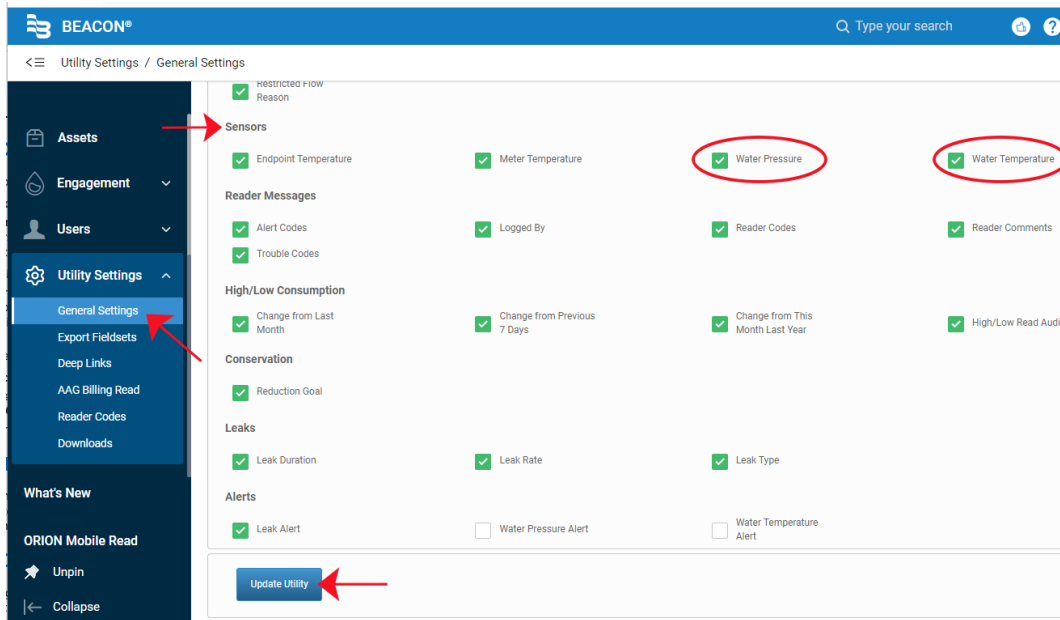


Figure 2: BEACON Utility Settings, Monitor Page Filters

4. Select **Update Utility** at the bottom of the page to save your changes.



Figure 3: Select to save changes

5. Select **At A Glance** from the menu on the left.
6. Select **Add/Remove** on the top right side.

On the window that opens, select **Add** for System Water Temperature and/or System Water Pressure. Then select **Done**. The System Water Pressure and/or System Water Temperature modules display, as selected, on the At A Glance page.

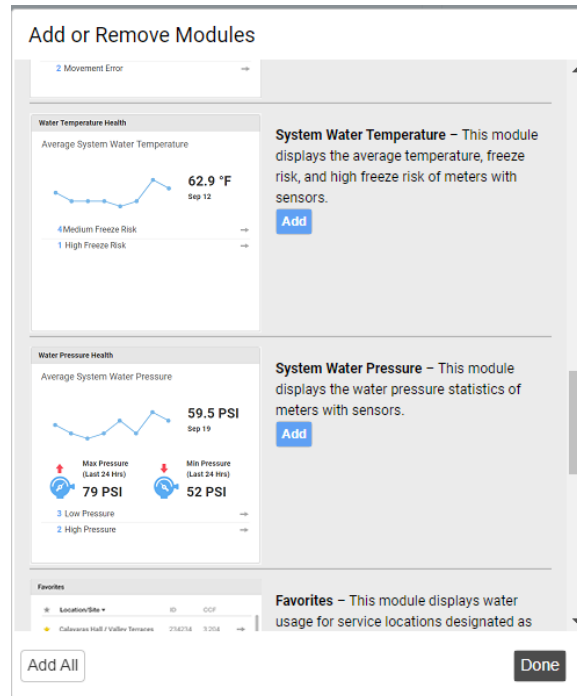



Figure 4: Add/Remove modules for At A Glance

BEACON setup is complete.

METER OPERATING MODES

The E-Series Ultrasonic meter automatically moves through storage and transition mode into active mode based on water flow:

- **Storage Mode**

E-Series Ultrasonic meters are delivered in storage mode so that a meter alarm is not triggered. In storage mode, the meter LCD displays the empty pipe icon  on the consumption screen, an empty pipe code on the alarm screen (but no alarm code is sent to the endpoint) and --- F (or --- C) on the temperature screen.

- **Transition Mode**

When the meter senses water in the pipe, it moves into transition mode. In transition mode, the meter displays water consumption and sends a reading to the endpoint, if connected. After sensing a full pipe for 24 hours, the meter transitions to active mode.

NOTE: If a meter senses an empty pipe in transition mode, the meter goes back into storage mode until water triggers the process to start again.

- **Active Mode**

Meter is operating normally. If the meter is in active mode and detects an empty pipe, water temperature displays **ErrF** (or **ErrC**).

For more information see [“Temperature Screen*” on page 17](#) and [“Alarm and Operating Mode Screen” on page 18](#).

REMOVING A METER

WARNING

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

INSTALLATION

Outdoor Installations

When installed outdoors in a meter box, the E-Series Ultrasonic meter should have a 2–3 inch clearance to avoid damage or strain to the service piping or meter and to accommodate any settling that may occur after installation.

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

Protect the service lines and the water meter 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.

Excavate the meter box pit 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, check indoor settings 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. You must use a permanent ground strap or metal setter if electrical grounding to water services is required in your community. See [Figure 5](#).

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

CAUTION

- **DO NOT ATTEMPT TO USE ANY METER AS A LEVER OR CROWBAR TO STRAIGHTEN A MISALIGNED METER POSITION. THIS COULD DAMAGE THE METER.**
- **TO AVOID POTENTIAL PROBLEMS, CORRECT ANY IRREGULARITIES IN PIPE SPACING AND MISALIGNMENT BEFORE PLACING THE METER INTO ITS POSITION.**
- **METERS MUST OPERATE IN A COMPLETELY FILLED LINE AT ALL TIMES. THE DOWNSTREAM PIPING MUST ALWAYS BE ARRANGED TO PROVIDE SUFFICIENT BACK PRESSURE TO MAINTAIN A FULL LINE AT THE METER. BY ELIMINATING AIR IN THE LINE, AS WELL AS SUDDEN FLOW SURGES, INACCURATE REGISTRATION AND DAMAGE TO THE METER CAN BE AVOIDED.**

INSTALLATION: RESIDENTIAL METERS

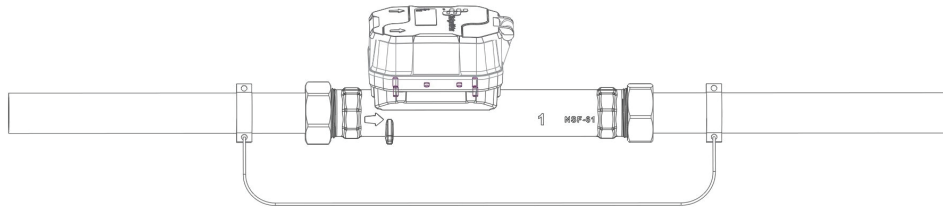


Figure 5: Recommended residential meter installation

Special Fittings and Accessories for Residential Meters

To accommodate 5/8–1 inch residential meter installations, special fittings and accessories may be needed. 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. Metal setters and meter yokes can provide an electrical continuity to protect meters and consumers from electrical shocks.

Pre-Installation

Consider the following before you begin a residential E-Series Ultrasonic meter installation:

- Inspect the piping around the meter for suitable conditions. The service line, valves, connections and meter must be watertight. Repair the piping system if pipes are corroded or damaged.
- Install the meter in the pipeline in a horizontal or vertical position so that the flow arrow on the meter housing points in the same direction as water flow. Registration should be upright and protected from damage, freezing and tampering.
- Verify meters are correctly programmed.
- Position the meter so it is accessible for installation, reading and removal.
- The line opening for the meter should match the lay length of the meter, allowing slight additional space for coupling gaskets. The inlet and outlet sides of the meter should be axially aligned to the pipe.
- The installed meter must not be an obstacle or a hazard to the customer or interfere with public safety.
- To avoid cavitation, always install control valves downstream of the meter. Never install the meter on a pump suction side.
- Consider maximum flow rates when sizing and selecting the appropriate meter for the application.
- Pump discharge should never be installed in proximity of the meter.
- Externally weighted check valves and pressure reducing devices should not be located in proximity of the meter.

Residential Meter Installation Instructions

1. Begin at this step when cutting in for new service. When cutting in is not required, begin at **step 2**.
 - Close the curb (shutoff) valve to relieve water pressure in the line before starting the cutting operation. Provide a high-quality upstream shutoff valve with a low pressure drop.
 - Flush the pipe to clear chips, pipe dope or other plumbing residue.
2. Close the meter inlet-side valve.
3. Open a faucet and wait until water flow stops to depressurize the system. Do not remove the meter until the flow stops.

⚠ WARNING

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

4. Check valves and make necessary repairs to the curb (shutoff) valve or inlet side valve if necessary.

5. Before installing or removing a meter, close the outlet-side valve to relieve pressure. Protect the area around the meter against potential spills or leaks that could occur.
6. To replace an existing meter continue with **step 7**. To install a new meter skip to **step 9**.
7. Loosen the meter coupling nuts or flange bolts, and remove the meter and old gaskets.
8. Clean the coupling nuts or flange bolts, removing any pipe dope or dirt.
9. Check the existing position for proper alignment and spacing. Correct any misalignment or spacing issues.
10. Place the connection gaskets inside the connection coupling nuts.
11. Install the meter in the pipeline in a horizontal or vertical position with the **flow arrow on the meter pointing in the direction of flow**. Registration should be upright.

For 5/8–1 in. Threaded Ends

- Start the coupling nuts at the threaded meter ends. Verify that the nuts are properly aligned to avoid cross-threading or damage to the meter ends.
 - 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 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.
12. After the meter is installed, slowly open the inlet shutoff valve until the meter is full of water and make sure there are no leaks. (The more flow you allow through the meter, appropriate for the meter size, the better.)

CAUTION Take caution when opening the inlet valve to avoid damage to the pressure sensor due to extreme water hammer.
 13. Slowly open the outlet valve until air is out of the meter and service line.
 14. Slowly open a service valve downstream of the meter and verify that no foreign debris in the water obstructs the operation of the system.
 15. Check the read on the meter to make sure it is registering a positive number. If it is not, make sure the meter is installed in the correct direction.
 - The meter is shipped in storage mode so that customers do not experience alarms during shipment or installation. After properly purged of air, and the meter senses a full pipe, it may take up to 30 seconds to begin measurement.
 - The meter itself does not require a quantity of flow to begin measurement. The meter just requires that the pipe is cleared of air and filled with water. If attempting to purge the meter at low flow rates, it would likely be more difficult and take longer.
 16. Meter installation is complete. When the meter starts recording positive flow, note the reading for your records.

NOTE: To complete the assembly, you can attach the meter encoder to an endpoint (optional). Refer to the *ORION Water Endpoints Installation Manual*, available at badgermeter.com, for endpoint installation information.

INSTALLATION: COMMERCIAL METERS

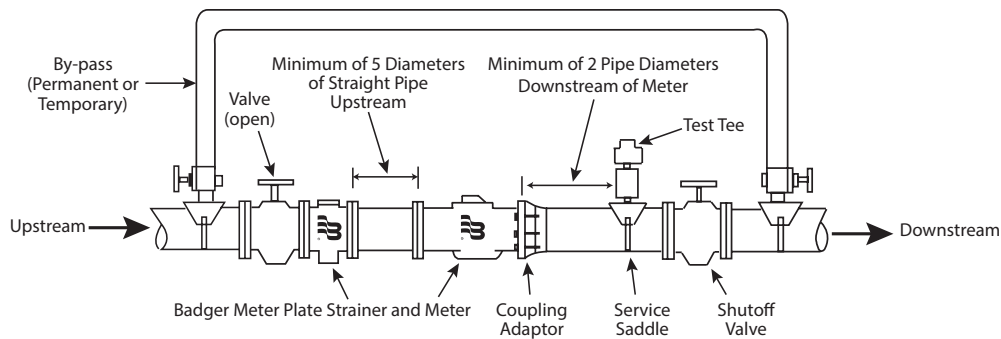


Figure 6: Recommended commercial meter installation

Pre-Installation

Consider the following before you begin a commercial E-Series Ultrasonic meter installation:

- Inspect the piping around the meter for suitable conditions. The service line, valves, connections and meter must be watertight. Repair the piping system if pipes are corroded or damaged.
 - Install the meter in the pipeline in a horizontal or vertical position so that the flow arrow on the meter housing points in the same direction as water flow. Registration should be upright and protected from damage, freezing and tampering.
 - Verify meters are correctly programmed.
 - Position the meter so it is accessible for installation, reading and removal.
 - The line opening for the meter should match the lay length of the meter, allowing slight additional space for coupling gaskets. The inlet and outlet sides of the meter should be axially aligned to the pipe.
 - The installed meter must not be an obstacle or a hazard to the customer or interfere with public safety.
 - To avoid cavitation, always install control valves downstream of the meter. Never install the meter on a pump suction side.
 - Consider maximum flow rates when sizing and selecting the appropriate meter for the application.
 - A minimum of five pipe diameters of straight, unobstructed pipe is recommended upstream of the meter for optimal performance. However, the 2-inch meter meets AWWA accuracy requirements without the need for straight pipe, including meter setters.
 - Pump discharge should never be installed in proximity of the meter.
 - Externally weighted check valves and pressure reducing devices should not be located in proximity of the meter.
 - Do not install check valves or pressure reducing devices within five pipe diameters upstream of the meter.
 - Only fully open gate or ball valves should be used immediately upstream of the meter. Butterfly valves must be five pipe diameters or more upstream of the meter. Fully open gate, ball or butterfly valves can be used downstream.
- NOTE:** A partially opened gate or ball valve, or butterfly valve installed immediately upstream of the meter could adversely affect meter accuracy.
- A service saddle (or reducing tee) should be at least two pipe diameters downstream of the meter outlet flange.
 - Unweighted check valves should not be located closer than three pipe diameters downstream of the meter.
 - Pump discharge should be installed at least five pipe diameters upstream of the meter.
 - Externally weighted check valves and pressure reducing devices should be located no closer than five pipe diameters of the meter.
 - The meter is designed so that a strainer is not required. If installing a strainer, it is recommended that it be installed a minimum of five pipe diameters upstream of the meter in order to maximize the accuracy of your measurements.

- During meter replacement, if there is already a strainer installed immediately upstream, to attain the highest accuracy capabilities, consider moving the strainer downstream of the meter or further upstream.
- If you are using a strainer that is a size smaller than the pipe installation, five diameters of pipe is required in order to reduce the effect of jetting caused by the increase in flow velocity. Additional length is required if a sharp contraction or an eccentric reducer is used, rather than a concentric, tapered reducer.
- To allow for the dampening of velocity profile distortions, elbow (90°) configurations should be installed a minimum of five pipe diameters upstream the meter and/or downstream the meter. Where spiral flows are created by three-dimensional elbows or rotary pumps, additional downstream distance is beneficial to dampen the effect.

Commercial Meter Installation Instructions

1. Begin at this step when cutting in for new service. When cutting in is not required, begin at **step 2**.
 - Close the curb (shutoff) valve to relieve water pressure in the line before starting the cutting operation. Provide a high-quality upstream shutoff valve with a low pressure drop.
 - Flush the pipe to clear chips, pipe dope or other plumbing residue.
2. Close the meter inlet-side valve.
3. Open a faucet and wait until water flow stops to depressurize the system. Do not remove the meter until the flow stops.

⚠ WARNING

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

4. Check valves and make necessary repairs to the curb (shutoff) valve or inlet side valve if necessary.
5. Before installing or removing a meter, close the outlet-side valve to relieve pressure. Protect the area around the meter against potential spills or leaks that could occur.
6. To replace an existing meter continue with **step 7**. To install a new meter skip to **step 9**.
7. Loosen the meter coupling nuts or flange bolts, and remove the meter and old gaskets.
8. Clean the coupling nuts or flange bolts, removing any pipe dope or dirt.
9. Check the existing position for proper alignment and spacing. Correct any misalignment or spacing issues.
10. Install the meter in the pipeline in a horizontal or vertical position with the **flow arrow on the meter pointing in the direction of flow**. Registration should be upright. A cross star torque pattern is recommended when installing the flange bolts.
11. After the meter is installed, slowly open the inlet shutoff valve until the meter is full of water and make sure there are no leaks. (The more flow you allow through the meter, appropriate for the meter size, the better.)

⚠ CAUTION

Use caution when opening the inlet valve to avoid damage to the pressure sensor due to extreme water hammer.

12. Slowly open the outlet valve until air is out of the meter and service line.
13. Slowly open a service valve downstream of the meter and verify that no foreign debris in the water obstructs the operation of the system.
14. Check the read on the meter to make sure it is registering a positive number. If it is not, make sure the meter is installed in the correct direction.
 - The meter is shipped in storage mode so that customers do not experience alarms during shipment or installation. After properly purged of air, and the meter senses a full pipe, it may take up to 30 seconds to begin measurement.
 - The meter itself does not require a quantity of flow to begin measurement. The meter just requires that the pipe is cleared of air and filled with water. If attempting to purge the meter at low flow rates, it would likely be more difficult and take longer.
15. Installation is complete. When the meter starts recording positive flow, note the reading for your records.

NOTE: To complete the assembly, you can attach the meter encoder to an endpoint (optional). Refer to the *ORION Water Endpoints Installation Manual*, available at badgermeter.com, for endpoint installation information.

Commercial Meter Accuracy Test

The E-Series Ultrasonic meters are accuracy tested at the factory before shipment. However, the meters can be tested for accuracy in the field using appropriate connections by running output flow through the NPT test port, if so equipped. Refer to the [Portable Large Meter Tester application data sheet](#) (TST-AS-01297-EN), available at badgermeter.com, for accuracy testing instructions using a test meter.

When sealing the test plug, hand tighten plus 7/8 to 1-1/2 turns. If further sealing is needed, tighten incrementally, but use caution to avoid over-tightening, which may result in damage to the test port.

⚠ WARNING

IF THE TEST PORT IS TO BE USED, SHUT OFF THE FLUID SUPPLY AND RELEASE PRESSURE BEFORE SERVICING OR MAKING A PLUMBING CONNECTION. FAILURE TO DO SO CAN LEAD TO PLUG BEING EJECTED FROM HOUSING, CAUSING PERSONAL INJURY AND/OR PROPERTY DAMAGE.

Recommended Test Port Valve Assemblies for E-Series Meters

Badger Meter offers recommended test port valve assemblies that include a pipe nipple and ball valve designed to control outlet water flow through the test port. The table below summarizes the appropriate nipple lengths and corresponding nipple/ball valve kits for each E-Series Ultrasonic meter size.

Meter Size	Test Port Size (NPT)	Minimum Recommended Nipple Length	Clearance Considerations	Recommended Kit Part Number
2 inch	1 in. NPT	2 in. nipple (2 × 10 in.)	—	63769-002 (2 in. nipple & ball valve)
		1 in. nipple (2 × 17 in.)		
3 inch	1-1/2 in. NPT	4 in. nipple minimum	—	63769-017 (6 in. nipple & ball valve)
4 inch	2 in. NPT	6 in. nipple	—	63769-012 (6 in. nipple & ball valve)
6 inch	2 in. NPT	6 in. nipple	Remove outlet-flange eye bolt before accessing port to avoid interference.	63769-012 (6 in. nipple & ball valve)
8 inch	2 in. NPT	6 in. nipple	Remove outlet-flange eye bolt before accessing port to avoid interference.	63769-012 (6 in. nipple & ball valve)

OPERATIONS

Display

E-Series Ultrasonic meters use a 9-digit Liquid Crystal Display (LCD) that toggles to show consumption, rate of flow, temperature,* pressure,* alarm and operating mode, and firmware version. Indicator and alarm icons appear in the display as symbols that illuminate when the condition is active. See [“Meter Alarms” on page 22](#) for alarm duration. Additional display screens can be programmed, including: six-digit display, reverse total flow and programmed date.

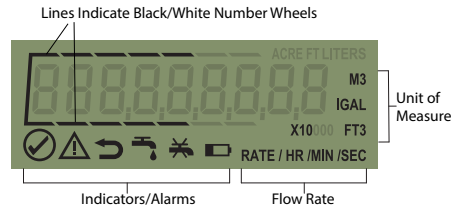


Figure 7: E-Series Ultrasonic Meter LCD

*Pressure monitoring is available when meter is equipped with the optional integrated pressure sensor. Pressure alarms, and temperature and pressure data, are sent as part of the encoder message and surfaced in BEACON SaaS when meter is used with applicable ORION endpoints. See [“Endpoints and Software” on page 6](#) for complete endpoint information.

Activating the Display

The E-Series Ultrasonic meter display illuminates when the register cover is opened. You can change the display screen by touching the optical communication port in the center of the register face or by closing and opening the meter lid. The display reverts to sleep mode after a period of inactivity.

See [“Display Screens” on page 15](#) for Information about each screen.

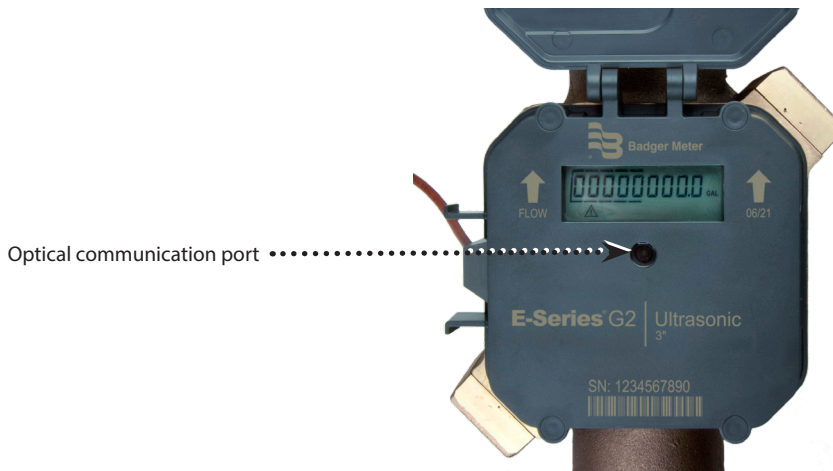


Figure 8: Meter, lid open, showing optical communication port

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

Display Screens

The total consumption screen shows all nine digits, including leading zeroes and a decimal point.

The displayed value is the sum of the forward flow minus the reverse flow. The display also includes indicator lines above and below the digits to represent the typical utility meter reading (electronic equivalent of white and black number wheels on mechanical registers).

Unit of measure and resolution are factory programmed for the meter. The examples show typical displays for the three different units of measure.

Total Consumption Screen: Residential Meters

Totalized flow displays up to 10 million gallons with a resolution of 0.01 gallons, 1 million cubic feet with a resolution of 0.001 cubic feet, or one thousand cubic meters with a resolution of 0.0001 cubic meters.

5/8, 5/8 × 3/4, 3/4, 1 inch

Gallons



Meter reading to the nearest?

100th gallon = 1234567.89
 10th gallon = 1234567.8
 1 gallons = 1234567
 10 gallons = 123456
 100 gallons = 12345

Typical Billing Units → 1000 gallons = 1234

Cubic Feet



Meter reading to the nearest?

1000th ft³ = 123456.789
 100th ft³ = 123456.78
 10 ft³ = 123456.7
 1 ft³ = 123456
 10 ft³ = 12345

Typical Billing Units → 100 ft³ 1234

Cubic Meters



Meter reading to the nearest?

10000th m³ = 12345.6789
 1000th m³ = 12345.678
 100th m³ = 12345.67
 10th m³ = 12345.6
 1 m³ = 12345
 10 m³ 1234

Typical Billing Units → 1 m³ 1234

Total Consumption Screen: Commercial Meters

2, 3, 4 inch meters: Totalized flow displays up to 100 million gallons with a resolution of 0.1 gallons, 10 million cubic feet with a resolution of 0.01 cubic feet, or one million cubic meters with a resolution of 0.001 cubic meter.

6, 8 inch meters: Totalized flow displays up to 1 billion gallons with a resolution of 1 gallon; 100 million cubic feet with a resolution of 0.1 cubic feet; or 10 million cubic meters with a resolution of 0.01 cubic meter.

2, 3, 4 inch **6, 8 inch**

Gallons



Meter reading to the nearest?

- 10th gallon = 12345678.9
- 1 gallon = 12345678
- 10 gallons = 1234567
- 100 gallons = 123456
- 1000 gallons = 12345

Typical Billing Units →



Meter reading to the nearest?

- 1 gallon = 123456789
- 10 gallons = 12345678
- 100 gallons = 1234567
- 1000 gallons = 123456

Typical Billing Units →

Cubic Feet



Meter reading to the nearest?

- 100th ft³ = 1234567.89
- 10th ft³ = 1234567.8
- 1 ft³ = 1234567
- 10 ft³ = 123456
- 100 ft³ = 12345

Typical Billing Units →

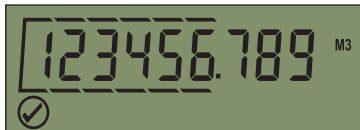


Meter reading to the nearest?

- 10th ft³ = 12345678.9
- 1 ft³ = 12345678
- 10 ft³ = 1234567
- 100 ft³ = 123456

Typical Billing Units →

Cubic Meters



Meter reading to the nearest?

- 1000th m³ = 123456.789
- 100th m³ = 123456.78
- 10th m³ = 123456.7
- 1 m³ = 123456
- 10 m³ = 12345

Typical Billing Units →



Meter reading to the nearest?

- 100th m³ = 1234567.89
- 10th m³ = 1234567.8
- 1 m³ = 1234567
- 10 m³ = 123456

Typical Billing Units →

Rate of Flow Screen

Rate of flow is factory programmed in gallons per minute. The LCD shows both the unit of measure and rate of flow. The rate of flow screen also serves as the flow indicator. The rate of flow display is shown without leading zeros. When the rate of flow screen is displayed, it is updated every two seconds.



Figure 9: Rate of flow screen

Pressure Screen*

Displays current water pressure. The pressure sensor is rated to a maximum psi of 150. If the maximum operating pressure is exceeded, **P 999 PSI** (or **P 99.9 bAr**) displays until pressure is back within the specified range. If the pressure sensor is damaged, **P Err PSI** (or **P Err bAr**) will display.

NOTE: Meters operating above 175 psi are operating outside approved specifications.

*When meter is equipped with optional integrated pressure sensor and used in conjunction with applicable ORION endpoints, pressure data and alarms are sent as part of the encoder message and surfaced in BEACON SaaS. See [“Endpoints and Software” on page 6](#) for complete endpoint information.



Figure 10: Pressure screen

Temperature Screen*

Displays current water and ambient temperature. If the meter is in active mode and detects an empty pipe, water temperature displays **ErrF** (or **ErrC**). If the meter is in storage mode and detects an empty pipe, water temperature displays **--- F** (or **--- C**). Ambient temperature is displayed in all modes. Water temperature is not reported in storage mode. Temperature data begins reporting in transition mode when there is a full pipe.

*When used in conjunction with applicable ORION endpoints, temperature data is sent as part of the encoder message and surfaced in BEACON SaaS. See [“Endpoints and Software” on page 6](#) for complete endpoint information.

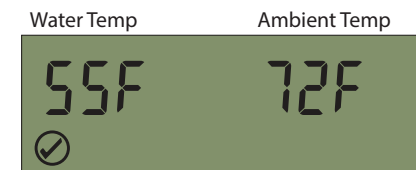


Figure 11: Temperature screen

Alarm and Operating Mode Screen

Displays alarm condition and meter operating mode. This screen is only visible in active mode if an alarm is detected. Screen is always visible in storage and transition mode.

Display format: **ErXXX.YYY.Z**

- XXX Position 1** First set of 3 characters displays an alarm code that has occurred. See duration of each individual alarm in alarms chart on [page 21](#).
- YYY Position 2** Second set of 3 characters displays an alarm code that is currently active. The alarm is stored in this position until reported to the endpoint.
 - Up to 15 min with ORION Cellular
 - Up to 1 hr with ORION SE/ME
 - Up to 35 days if not connected to an ORION endpoint
 Alarm code reappears if condition is still present or reoccurs and resends message to endpoint.
- Z Position 3** The character in the last position is the code for the meter operating mode. The meter has three operating modes: storage ([Figure 12](#)), transition ([Figure 13](#)) and active mode ([Figure 14](#)).

S Storage
 T Transition
 A Active

Also see [“Meter Operating Modes” on page 7](#).

Firmware Version Screen

Displays current meter firmware version.



Figure 12: Alarm and operating mode screen in storage mode



Figure 13: Alarm and operating mode screen in transition mode

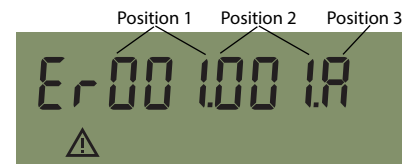


Figure 14: Alarm and operating mode screen in active mode

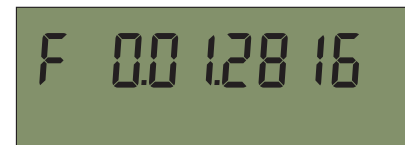


Figure 15: Firmware version screen

OUTPUT

Encoder Output

Programmed to the industry standard ASCII encoder protocol, E-Series Ultrasonic meters have the ability to transmit meter status indicators to applicable ORION endpoints as part of the extended encoder/meter reading message. The details can also be read through an IR interface.

Endpoint Reading Resolution

The standard electronic encoder output resolution of the E-Series Ultrasonic meter is 9 digits. Less than 9-digit output resolution is programmable upon request. Though the meter output is 9-digit resolution, the reading resolution sent to the reading software is dependent on the endpoint that the meter is connected to. Readings reported from the endpoints are the left-most significant digits of the encoder reading.

Endpoint Technology	Reading Resolution Reported to Reading Software
ORION Cellular, ORION Mobile M	9-digit reading, plus the extended message capability
ORION ME/ORION SE	8-digit reading, plus the extended message capability
ORION CE	7-digit reading
GALAXY	6-digit reading

Wire Connections

The E-Series Ultrasonic meter is available with a connector for easy connection and installation to AMR/AMI endpoints. It is also available with a flying lead for field splice connection. The inline connector is recommended for pit applications.

Dual Output

The E-Series Ultrasonic meter is also available with dual outputs. The following dual output options are available:

- Encoder and encoder
- Encoder and 4-20 mA
- Encoder and scaled/unscaled
- Scaled/unscaled and 4-20 mA

4-20 mA Set Point Screen

Displays for meters with 4-20 mA output. The default display value is equal to the safe maximum operating condition flow rate which is dependent on the size of the meter.



Figure 16: Analog output screen

Scaled Pulse Set Point Screen

Displays for meters with scaled pulse output. The display resolution presents the pulse weight for a given unit of measure. See the default pulse weight for each unit of measure in [Table 1](#).

The unscaled pulse output does not have a dedicated display screen. Default values are shown in [Table 2](#).



Figure 17: Scaled pulse screen

Scaled Output

- Scaled output is a switch closure output defined as: **red** wire = positive, **black** wire = negative.
- Scaled output from the register has a default resolution 1/10th of the register test circle (resolution may vary in some cases).
- The nominal pulse output width is programmable from 30–100 msec.
- This pulse output is compatible with most totalizers and batch controllers.

Unscaled Output

- Unscaled output is a switch closure output defined as: **green** wire = positive, **black** wire = negative
- This pulse output is compatible with most totalizers and batch controllers.

Analog Output

- The flow rate measurement is converted to a standard 4-20 mA control signal.
- This signal is proportional to the flow of fluid passing through the flow meter.
- The 4-20 mA output is isolated when paired with scaled/unscaled output.
- Power for the device can be obtained from a 9–50V DC control loop.

Meter Size (in.)	Pulse Weight					
	Scaled (units/pulse)			Unscaled (units/pulse)		
	gal	ft3	m3	gal	ft3	m3
5/8	1	0.1	0.01	0.02	0.002	0.00005
5/8 x 3/4	1	0.1	0.01	0.02	0.002	0.00005
3/4 x 7-1/2	1	0.1	0.01	0.02	0.0025	0.0001
3/4 x 9	1	0.1	0.01	0.02	0.0025	0.0001
1	1	0.1	0.01	0.025	0.004	0.0001
2	10	1	0.1	0.250	0.05	0.001
3	10	1	0.1	0.250	0.05	0.001
4	10	1	0.1	0.500	0.1	0.002
6	100	10	1	1.000	0.1	0.005
8	100	10	1	2.000	0.2	0.005

Table 1: Default pulse weights

Meter Size (in.)	Measurement Resolution						
	Scaled (pulse/unit)			Unscaled (pulse/unit)			Analog Output
	gal	ft3	m3	gal	ft3	m3	20 mA Set point (gpm)
5/8	1	10	100	50	500	20000	30
5/8 x 3/4	1	10	100	50	500	20000	30
3/4 x 7-1/2	1	10	100	50	400	10000	40
3/4 x 9	1	10	100	50	400	10000	40
1	1	10	100	40	250	10000	64
2	0.10	1	10.0	4	20	1000	560
3	0.10	1	10.0	4	20	1000	560
4	0.10	1	10.0	2	10	500	1100
6	0.01	0.1	1	1	10	200	2000
8	0.01	0.1	1	0.5	5	200	3500

Table 2: Measurement resolution

Wiring Connections

Encoder and Encoder

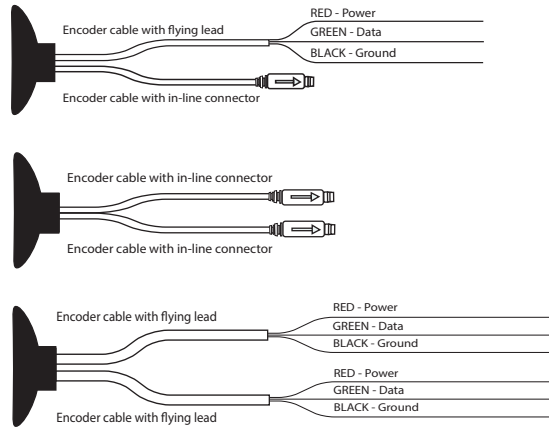


Figure 18: Encoder and encoder wiring options

Encoder and Scaled Unscaled

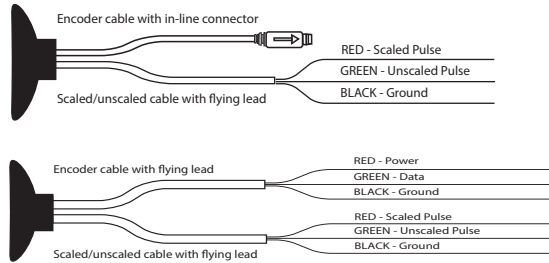


Figure 19: Encoder and scaled/unscaled output wiring options

Encoder and 4-20

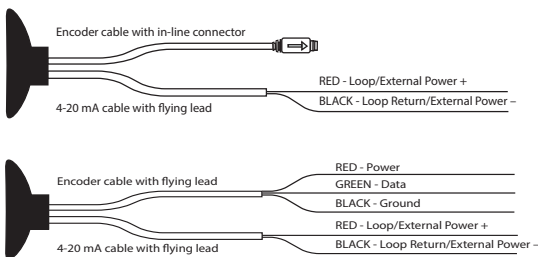


Figure 20: Encoder and 4-20 mA wiring options

Scaled/Unscaled and 4-20 mA

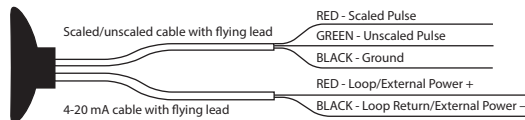










Figure 21: Scaled/unscaled and 4-20 mA wiring option

METER ALARMS

E-Series Ultrasonic meter alarms appear on the display as icons that illuminate when the condition occurs. Alarms are displayed for the number of days listed in the table below. Alarms also appear as 3-character codes on the alarm and operating mode screen. See [“Alarm and Operating Mode Screen” on page 18](#) and [“Alarm Codes” on page 23](#).

Alarms are sent as part of the encoder message to AMR/AMI systems that are capable of receiving an extended message, such as ORION Cellular, Mobile M, Fixed Network (SE) and ME endpoints. The details can also be read through an IR interface.

NOTE: Meters are delivered in storage mode so that an alarm is not triggered. In storage mode, the meter LCD displays an empty pipe icon, but no error code is sent to the endpoint. For alarms reported within BEACON, refer to BEACON Help at beaconama.net.

Alarms	Icon	Alarm Description	Number of Days Icon Displays	High Resolution with ORION Cellular, ORION Mobile M, ORION SE or ORION ME
Normal Meter Operation		Meter operating correctly	NA	NA
Temperature		Temperature outside limits: above 140° F or below 34° F. Meter continues to operate but is outside specified range.	Alarm clears after 35 days unless condition continues	Meter sends consumption and alarm to the endpoint once per occurrence
Pressure*		Pressure sensor is damaged, or pressure is outside specified threshold limits: above 130 psi or below 35 psi. If maximum operating pressure is exceeded, P 999 PSI (or P 99.9 bAr) displays until pressure is back within the specified range. If the pressure sensor is damaged, P Err PSI (or P Err bAr) will display.	Alarm clears after 35 days unless condition continues	
Empty Pipe		Empty or partially filled pipe. Last known good read is displayed. If the meter is active and detects an empty pipe, water temperature displays ErrF (or ErrC). If meter is in storage mode and detects an empty pipe, water temperature displays --- F (or --- C).	Alarm clears when pipe is filled	
Measurement Error		Interference of ultrasonic signal. Meter is not measuring properly. Meter continues to operate unless sensors are damaged.	Alarm clears after 35 days unless condition continues	
Exceeding Max Flow	 	Maximum flow rate exceeded. Meter continues to accumulate consumption outside of specified range.	Alarm clears after 35 days unless condition continues	Meter sends consumption and alarm to the endpoint once per occurrence
Reverse Flow		Meter detects reverse water flow (one (1) gal residential; ten (10) gal commercial), triggers the reverse flow alarm icon on the display and sends alarm message to the endpoint. Also see, “Continuous Flow Alarm” on page 26 .	Alarm clears after 35 days unless condition continues	Meter detects reverse flow and sends alarm to the endpoint once per occurrence
No Usage		Flow rate less than the low flow operating rate for 30 days.	Alarm clears automatically once flow occurs	Meter detects no usage and sends alarm to the endpoint once per occurrence
Suspected Leak		Flow rate more than the low flow operating rate for 24 hours. Also see, “Continuous Flow Alarm” on page 26 .	Alarm clears automatically when flow rate drops below low flow operating rate	Meter detects suspected leak and sends alarm to the endpoint once per occurrence
End of Life		Battery nearing end of life.	Alarm is activated after 19 years (14 years for scaled/unscaled dual output meters) and does not clear	Meter sends alarm message to the endpoint once per occurrence
Program Alert	NA	Meter has been programmed in last 35 days.	NA	Meter sends alarm message to the endpoint once per occurrence

*Pressure alarms are available with meters equipped with the integrated pressure sensor.

*When used in conjunction with applicable ORION endpoints, pressure data and alarms are sent as part of the encoder message and surfaced in BEACON SaaS. See [“Endpoints and Software” on page 6](#) for complete endpoint information.

Alarm Codes

Alarm codes are shown on the alarm and operating mode screen. See *“Alarm and Operating Mode Screen”* on page 18. Contact Badger Meter *“Technical Support”* for any codes not listed here.

NOTE: For alarms reported within BEACON, refer to BEACON Help at beaconama.net.

001	Empty pipe	010	Reverse flow	083	Empty pipe, Temperature, Measurement error
002	Temperature	011	Empty pipe, Reverse flow	089	Empty pipe, No usage, Measurement error
003	Empty pipe, Temperature	012	Temperature, Reverse flow	0C0	Program alert, Measurement error
004	End of life	013	Empty pipe, Temperature, Reverse flow	100	Pressure
008	No usage	018	No usage, Reverse flow	101	Empty pipe, Pressure
009	Empty pipe, No usage	020	Suspected leak	140	Program alert, Pressure
00A	Temperature, No usage	040	Program alert	150	Reverse flow, Program alert, Pressure
00B	Empty pipe, Temperature, No usage	080	Measurement error	200	Exceeding max flow
00C	End of life, No usage	081	Empty pipe, Measurement error	202	Temperature, Exceeding max flow
00D	Empty pipe, End of life, No usage	082	Temperature, Measurement error	204	End of life, Exceeding max flow
				300	Pressure, Exceeding max flow

SPECIFICATIONS: RESIDENTIAL METERS

E-Series G2 Ultrasonic	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)	0.10–35 gpm (0.02–7.95 m ³ /hr)	0.10–35 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	3 psi @ 15 gpm (0.21 bar @ 3.4 m ³ /hr)	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)
Residential Fire Service Applications**	—	—	3/4 in. (7-1/2 in.)	3/4 in. (9 in.)	1 in.
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	3 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	3 psi @ 25 gpm (0.29 bar @ 5.7 m ³ /hr)	4.1 psi @ 40 gpm (0.28 bar @ 9.1 m ³ /hr)
Normal Test Flow Limits	NA	NA	0.50–35 gpm (0.11–7.95 m ³ /hr)	0.50–35 gpm (0.11–7.95 m ³ /hr)	0.16–62 gpm (0.04–14.08 m ³ /hr)
Minimum Test Flow Limits	NA	NA	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)	NA	NA	35 gpm (7.95 m ³ /hr)	35 gpm (7.95 m ³ /hr)	62 gpm (14.08 m ³ /hr)

Meter Specifications

Operating Performance	In the normal temperature range of 45 to 122 °F (7 to 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 to 140° F (– 40 to 60° C)
Maximum Ambient Storage (Storage for One Hour)	150° F (66° C)
Measured Fluid Temperature Range	34 to 140° F (1 to 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

* 3/4 × 1 in. (9 in.) follows the performance specifications of 3/4 × 9 in. meter

** Flow ranges for Fire Service meters are also applicable to Raw Water application meters

*** Applicable to meters with dual output options

SPECIFICATIONS: COMMERCIAL METERS

E-Series G2 Ultrasonic Meter Size	2 in.		3 in.		4 in.		6 in.		8 in.
	2 × 10 in. (51 × 254 mm)	2 × 17 in. (51 × 432 mm)	3 × 12 in. (76 × 305 mm)	3 × 17 in. (76 × 432 mm)	4 × 14 in. (102 × 356 mm)	4 × 20 in. (102 × 508 mm)	6 × 18 in. (152 × 457 mm)	6 × 24 in. (152 × 610 mm)	8 × 20 in. (203 × 508 mm)
Normal Test Flow Limits	0.70–260 gpm		0.75–560 gpm		1.5–1100 gpm		2.2–2000 gpm		4–3500 gpm
Minimum Test Flow Limits	0.35 gpm		0.37 gpm		0.75 gpm		1.1 gpm		2.0 gpm
Safe Maximum Operating Condition (SMOC)	260 gpm		560 gpm		1100 gpm		2000 gpm		3500 gpm
Typical Pressure Loss	4 psi @ 220 gpm	4.8 psi @ 220 gpm	2.6 psi @ 350 gpm		2.1 psi @ 630 gpm		1.5 psi @ 1400 gpm	1.8 psi @ 1400 gpm	2.4 psi @ 2800 gpm
Totalization Display Resolution	2 inch, 3 inch, 4 inch meters • Gallons: 0.1 • Cubic feet: 0.01 • Cubic meters: 0.001						6 inch, 8 inch meters • Gallons: 1.0 • Cubic feet: 0.1 • Cubic meters: 0.01		
Operating Performance	In normal temperature range of 45 to 122° F (7 to 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 to 140° F (–40 to 60° C)								
Maximum Ambient Storage (Storage for One Hour)	150° F (66° C)								
Measured Fluid Temperature Range	34 to 140° F (1 to 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"> • Consumption (up to nine digits) • Rate of flow • Alarms • Pressure 					<ul style="list-style-type: none"> • Temperature • Firmware version • Unit of measure factory programmed for gallons, cubic feet and cubic meters 			
Scaled/Unscaled Output*	Solid-state relay with 4-20mA output; open drain MOSFET with encoder output								
Max. Voltage	30V DC								
Current	100 mA								
Pulse Width	50 ms (programmable 25–100 ms)								
Analog 4-20 mA Output*	Two-wire/passive								
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; 15-year battery life for dual output meters								

*Applicable to meters with dual output options.



TROUBLESHOOTING

Continuous Flow Alarm

If the meter LCD screen displays a *continuous flow alarm* for either forward or reverse flow, follow the troubleshooting steps below. A *continuous flow alarm* can be either a Reverse Flow alarm or Suspected Leak alarm. See “*Meter Alarms*” on page 22.

NOTE: Some *reverse flow* may be expected depending on the installation site.

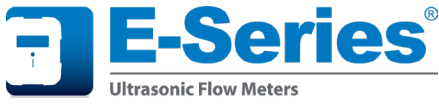
1. Verify the meter is installed correctly per installation instructions in this user manual.
 - If the meter is installed correctly, continue to step 2.
 - If the meter is not installed correctly, then reinstall per instructions in this user manual. See “*Installation*” on page 8.
 - a. If the LCD screen stops displaying a continuous flow alarm, then the meter is operating normally. Discontinue this procedure.
 - b. If the LCD screen continues to display a continuous flow alarm, then continue to step 2.
2. Turn off the valves upstream and downstream from the meter and verify the main water supply is turned off.
3. View the meter’s LCD screen.
 - If the flow rate is zero (0), the meter is operating normally and there is no indication of a leak, discontinue this procedure.

NOTE: The continuous flow alarm may take up to 30 minutes to clear after the water is turned off. It is important to view the actual flow rate on the screen and not just check the alarm icons.
 - If the meter registers flow with the valves closed, then the meter should be removed. Continue to step 4.
4. Follow the instructions for removing the meter in this user manual.
5. During removal, observe if water is flowing out of the upstream pipe.
 - If water is flowing, then the shutoff valve is not actually shutting off the flow.
6. Replace the shutoff valve. Once the valve is replaced, reinstall the meter per instructions in this user manual.
7. Once the meter is reinstalled, turn the shutoff valve off and note the meter reading.
 - If the flow rate is zero (0) with the valve off, the previous flow issue was most likely due to the shutoff valve. Discontinue this procedure.
 - If the meter display shows flow in either direction with the valve turned off, contact Technical Support.

TECHNICAL SUPPORT

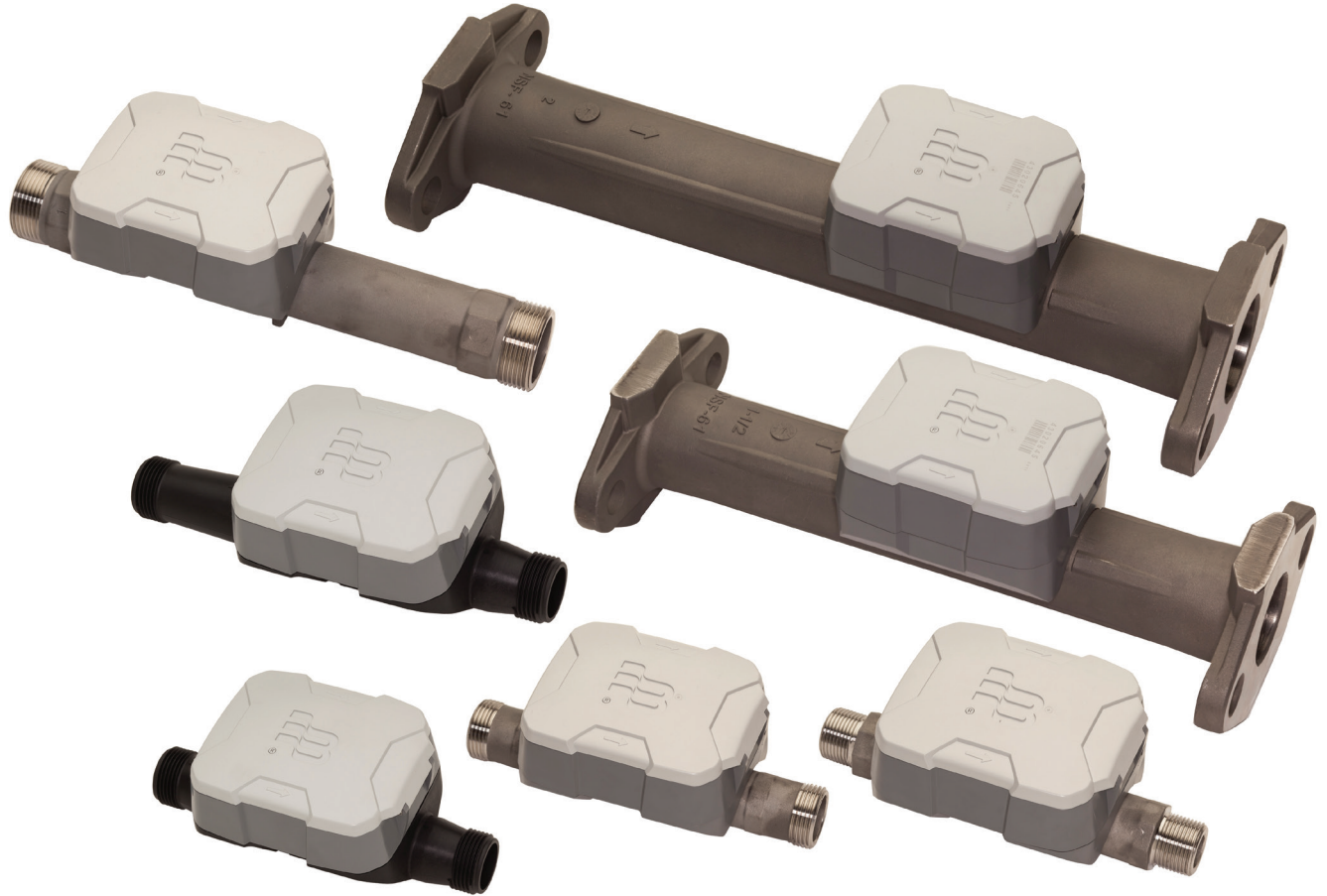
For further assistance, contact Badger Meter Technical Support at 800-616-3837.

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E-Series® Ultrasonic Meters

Cold Water Meters



CONTENTS

About the E-Series Ultrasonic Meter	3
Safety Information.	3
Product Unpacking and Inspection	3
Requirements.	3
Reading Data Management Software.	3
Mobile Reading Systems	3
Handheld Reading Systems	3
Meter Storage Mode	4
Meter Pre-Installation.	4
Special Instructions for Removing a Meter	5
Special Fittings and Accessories	5
Installing E-Series Ultrasonic Meters	5
Outdoor Installations	5
Indoor Installations	5
Installation Instructions.	6
Protect Against Leakage	7
E-Series Ultrasonic Meter Operations	7
Meter Display	7
Activating the Display.	7
Unit of Measure.	7
Rate of Flow	8
Flow Direction	8
Consumption	8
AMR/AMI Output.	9
Status Indicators	9
Specifications.	11
5/8 in., 5/8 in. x 3/4 in., 3/4 in. and 1 in. Meters	11
1-1/2 in. and 2 in. Meters	12
Maintenance	12

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.

SAFETY INFORMATION

The installation of the E-Series Ultrasonic meter must comply with all applicable federal, state and local rules, regulations and codes.

Failure to read and follow these instructions can lead to misapplication or misuse of the E-Series Ultrasonic meter, resulting in personal injury and damage to equipment.

PRODUCT UNPACKING AND INSPECTION

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

NOTE: If damage is found, request an inspection by the carrier’s agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the purchaser.

REQUIREMENTS

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*
- *ReadCenter Analytics Pro and ReadCenter Analytics+: Version 1.0.0 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 800-876-3837 or the appropriate endpoint provider.

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 for suitable conditions. The service line, valves, connections and meter must be watertight. Repair the piping system if pipes are corroded or damaged.
- Install the meter in the pipeline in a horizontal or vertical position so that the flow arrow on the meter housing points in the same direction as water flow. 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 (shutoff) valve to relieve water pressure in the line before starting the cutting operation. Provide a high-quality upstream shutoff 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 in. to 1 in. meters, the line opening for the meter should match the laying length of the meter, allowing slight additional space for coupling gaskets. The inlet and outlet sides of the meter should be axially aligned to the pipe.
- For the 1-1/2 in. and 2 in. meters, the line opening for the meter should match the laying length of the meter. For optimal performance and accuracy, it is also recommended that a minimum of five diameters of straight pipe be installed upstream of the meter. Using a meter setter for the 1-1/2 in. and 2 in. is possible—however, be aware that the setter may affect the accuracy 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 POSITION. THIS COULD DAMAGE THE METER.**
- **DO NOT ATTEMPT TO INSTALL 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 POSITION.**

SPECIAL INSTRUCTIONS FOR REMOVING A METER

⚠ WARNING

DEPRESSURIZE THE LINE 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 in. to 1 in. 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. Metal setters and meter yokes can provide an electrical continuity to protect meters and consumers from electrical shocks.

INSTALLING E-SERIES ULTRASONIC METERS

Outdoor Installations

When installed outdoors in a meter box, the E-Series Ultrasonic meter should have a 2...3 in. 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.

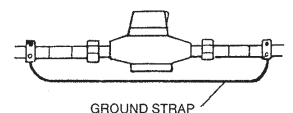
The service lines and the water meter must be protected from freezing. The earth covering the service line must be adequate to prevent frost penetration. Due to the smaller volume of water, service line pipes will freeze sooner than the main distribution line.

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.



Installation Instructions

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 (shutoff) valve or inlet side valve if necessary.
4. Before installing or removing a meter, close the outlet-side valve to relieve pressure. Protect the area around 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 the meter couplings or flange bolts and remove the meter and old gaskets in the coupling nuts. We recommend replacing the old gaskets with the provided thick rubber gaskets (**5/8 in.** PN:34819-037; **3/4 in.** PN:34819-038; **1 in.** PN:34819-039).
7. Clean the coupling nuts or flange bolts, removing any pipe dope or dirt from the threads or flange bolts.
8. Check the existing position for proper alignment and spacing. Correct any misalignment or spacing issues.
9. Place the connection gaskets inside the connection coupling nuts.
10. Install the meter in the pipeline in a horizontal or vertical position so that the flow arrow on the meter housing points in the same direction as water flow. Registration should be upright.

11. For 5/8 in. to 1 in. Threaded Ends

- a. Start the coupling nuts at the threaded meter ends. Verify that the nuts are properly aligned to avoid cross-threading or damage to the meter ends. This is especially important for the engineered polymer meter.
- b. An effective method for starting a coupling nut is:
 - i. Position the nut squarely against the meter's spud end.
 - ii. 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.
 - iii. Tighten the nut by hand until it is "hand-tight".
 - iv. 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.

For 1-1/2 in. to 2 in. Elliptical Flange Ends

- a. For the 1-1/2 in. and 2 in. meters, the line opening for the meter should match the laying length of the meter. For optimal performance and accuracy, it is also recommended that a minimum of five diameters of straight pipe be installed upstream of the meter.
 - b. With meter and gaskets in place, tighten the flange connection bolts. Verify the nuts are properly aligned to avoid damage to the flanged ends.
12. After the meter is installed, slowly open the inlet shutoff valve until the meter is full of water and ensure that there are no leaks. (The more water you allow to flow through the meter, appropriate for the meter size, the better.)
 13. Slowly open the outlet valve until air is out of the meter and service line.
 14. Slowly open a valve downstream of the meter and verify that no foreign debris in the water obstructs system operations.
 15. Make sure the meter is installed with the *flow arrow on the meter pointing in the direction of flow*. Check the read on the meter to make sure it is registering a positive number. If it is not, make sure the meter is installed in the correct direction.
 - a. The meter is sent in Storage mode so that customers do not experience alarms during shipment or installation. In general, a meter may take up to 2 minutes to begin measurement once the meter senses a full pipe.
 - b. The meter itself does not require a quantity of flow to begin measurement, the meter just requires that the pipe is cleared of air and filled with water. If the customer is attempting to purge the meter at low flow rates, it would likely be more difficult and take longer.
 16. When the meter starts recording positive flow, note the meter read for your records.

Protect Against Leakage

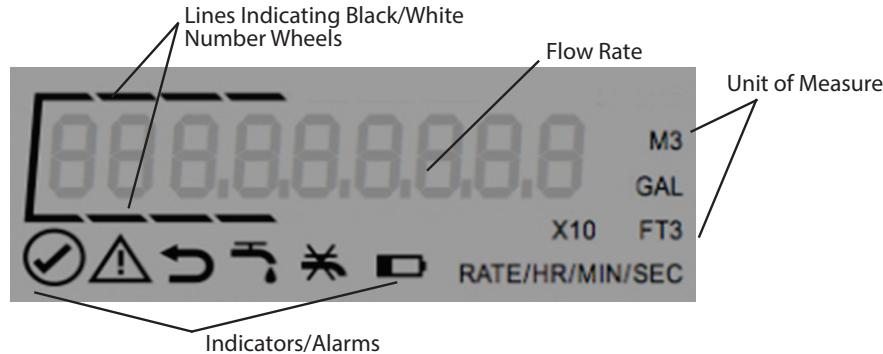
Before turning on the service water, use care to protect against potential leakage.

1. Shut off the valves on both the inlet and outlet sides of the meter.
2. Open the curb (shutoff) 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

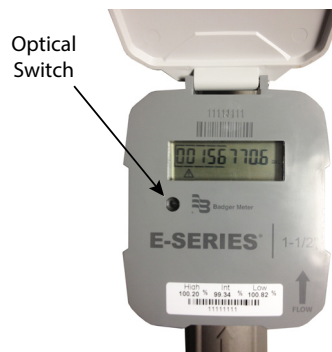
Meter Display

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 10](#) 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...1 in. meters, totalized flow displays up to 10 million gallons with a resolution of 0.01 gallons, one million cubic feet with a resolution of 0.001 cubic feet or 100 thousand cubic meters with a resolution of 0.0001 cubic meters.

For the 1-1/2 in. and 2 in. meters, totalized flow displays up to 100 million gallons with a resolution of 0.1 gallons, 10 million cubic feet with a resolution of 0.01 cubic feet or one million 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, depending on the unit of measure selected. 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.

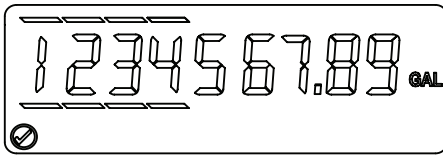
Flow Direction

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 in., 3/4 in. and 1 in. Meters

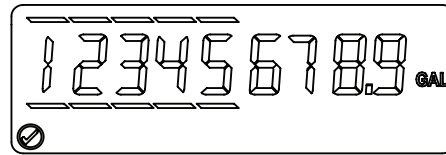


Meter reading to the nearest?

100th gallon =	1234567.89
10th gallon =	1234567.8
1 gallon =	1234567
10 gallons =	123456
100 gallons =	12345
1000 gallons =	1234

Typical Billing Units →

1-1/2 in. and 2 in. Meters



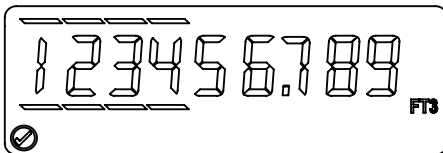
Meter reading to the nearest?

10th gallon =	12345678.9
1 gallon =	12345678
10 gallons =	1234567
100 gallons =	123456
1000 gallons =	12345

Typical Billing Units →

Gallons

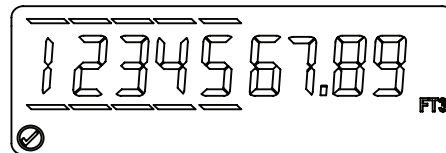
Cubic Feet



Meter reading to the nearest?

1000th ft ³ =	123456.789
100th ft ³ =	123456.78
10th ft ³ =	123456.7
1 ft ³ =	123456
10 ft ³ =	12345
100 ft ³ =	1234

Typical Billing Units →



Meter reading to the nearest?

100th ft ³ =	1234567.89
10th ft ³ =	1234567.8
1 ft ³ =	1234567
10 ft ³ =	123456
100 ft ³ =	12345

Typical Billing Units →

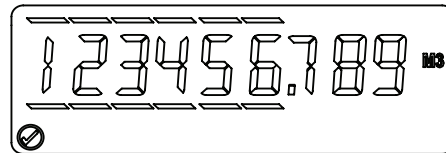
Cubic Meters



Meter reading to the nearest?

10000th m ³ =	12345.6789
1000th m ³ =	12345.678
100th m ³ =	12345.67
10th m ³ =	12345.6
1 m ³ =	12345
10 m ³ =	1234

Typical Billing Units →



Meter reading to the nearest?

1000th m ³ =	1234567.89
100th m ³ =	1234567.8
10th m ³ =	1234567
1 m ³ =	123456
10 m ³ =	12345

Typical Billing Units →

AMR/AMI Output

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

Programmed to the high resolution industry standard ASCII encoder protocol, the Ultrasonic meters have the ability to transmit meter status indicators to ORION Cellular, ORION Mobile M, ORION Fixed Network (SE) and ORION ME 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.

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.

Endpoint Reading Resolution

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

Technology	High Res E-Series ADE	E-Series ADE *	E-Series RTR *
ORION Cellular, ORION Mobile M	9 digit reading	6 digit reading	—
ORION Fixed Network (SE)	8 digit reading	6 digit reading	7 digit reading
ORION ME	8 digit reading	6 digit reading	7 digit reading
ORION Classic (CE)	7 digit reading	6 digit reading	7 digit reading
GALAXY	6 digit reading	6 digit reading	7 digit reading
Itron 100W	8/9 digit reading **	6 digit reading	7 digit reading
Itron 100W +	9 digit reading	6 digit reading	7 digit reading

* No longer for sale.

** 100W will transmit 9 digits through Itron's fixed network, but will truncate to the 8 left-most significant digits for standard mobile and handheld readings.

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. See the chart on the next page for the list of status indicators.

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

The following chart lists the possible E-Series Ultrasonic meter conditions when connected to Badger Meter ORION Cellular and ORION SE, ME, and Mobile M AMR/AMI endpoints.

The chart does *not* apply to ORION Classic (CE) or GALAXY endpoints. The E-Series will display the status indicators, but *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 Cellular, SE, ME or Mobile M endpoints	Encoder Protocol with ORION Cellular, SE, ME or Mobile M endpoints	RTR with ORION SE, ME or Mobile M endpoints
Meter functioning correctly		Meter operating correctly.	Normal operation. Indicator not sent to endpoint.		
Meter alarm		Several potential conditions may exist, including: <ul style="list-style-type: none"> • Empty pipe: "err" displays on LCD. Last known good read is displayed. Alarm clears when pipe is filled. • Temperature limits exceeded: meter continues to operate but outside specified accuracy range. Alarm clears after 60 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. Alarms clear after 60 days unless alarm condition continues. • Other meter or sensor issue: interference of ultrasonic signal. Meter continues to operate unless sensors are damaged. Alarm clears after 60 days unless alarm condition continues. 	Consumption is sent to the endpoint. Meter alarm is also sent.	Meter alarm is sent to the endpoint. NOTE: No consumption is sent to endpoint when the alarm is active.	Consumption is sent to the endpoint, except when Exceeding Max Flow alarm is set.
Reverse flow		The meter detects reverse flow and triggers the reverse flow alarm icon on the E-Series display. The alarm remains active for 60 days. The alarm automatically clears after 60 days if the condition has not recurred.	Meter detects reverse flow and sends alarm message to the endpoint.	Meter does not send the alarm. The endpoint detects and reports the reverse flow and will report the read exactly how it is received.	No alarm condition reported by the endpoint will only record positive, forward flow.
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 the endpoint.	Meter does not send the alarm. The endpoint detects continuous consumption over a 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 the endpoint.	Meter does not send the alarm. The endpoint detects no change in consumption over a 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 does not clear.	Meter sends alarm to the endpoint.	Meter does not send the alarm.	

NOTE: For meters manufactured prior to 5/2017, the meter alarms and reverse flow alarm were set to 35 days.

SPECIFICATIONS

5/8 in., 5/8 in. x 3/4 in., 3/4 in. and 1 in. Meters

E-Series Ultrasonic Meter Size	5/8 in. (15 mm)	5/8 in. 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 @ 15 gpm (0.3 bar @ 3.4 m ³ /hr)	2.3 psi @ 15 gpm (0.16 bar @ 3.4 m ³ /hr)	2.0 psi @ 15 gpm (0.14 bar @ 3.4 m ³ /hr)	1.8 psi @ 25 gpm (0.12 bar @ 5.7 m ³ /hr)
Reverse Flow – Maximum Rate	4 gpm (0.9 m ³ /hr)	4 gpm (0.9 m ³ /hr)	4 gpm (0.9 m ³ /hr)	7.5 gpm (1.7 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 • 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 in. and 2 in. Meters

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 at Maximum Flow	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 • 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

The 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.

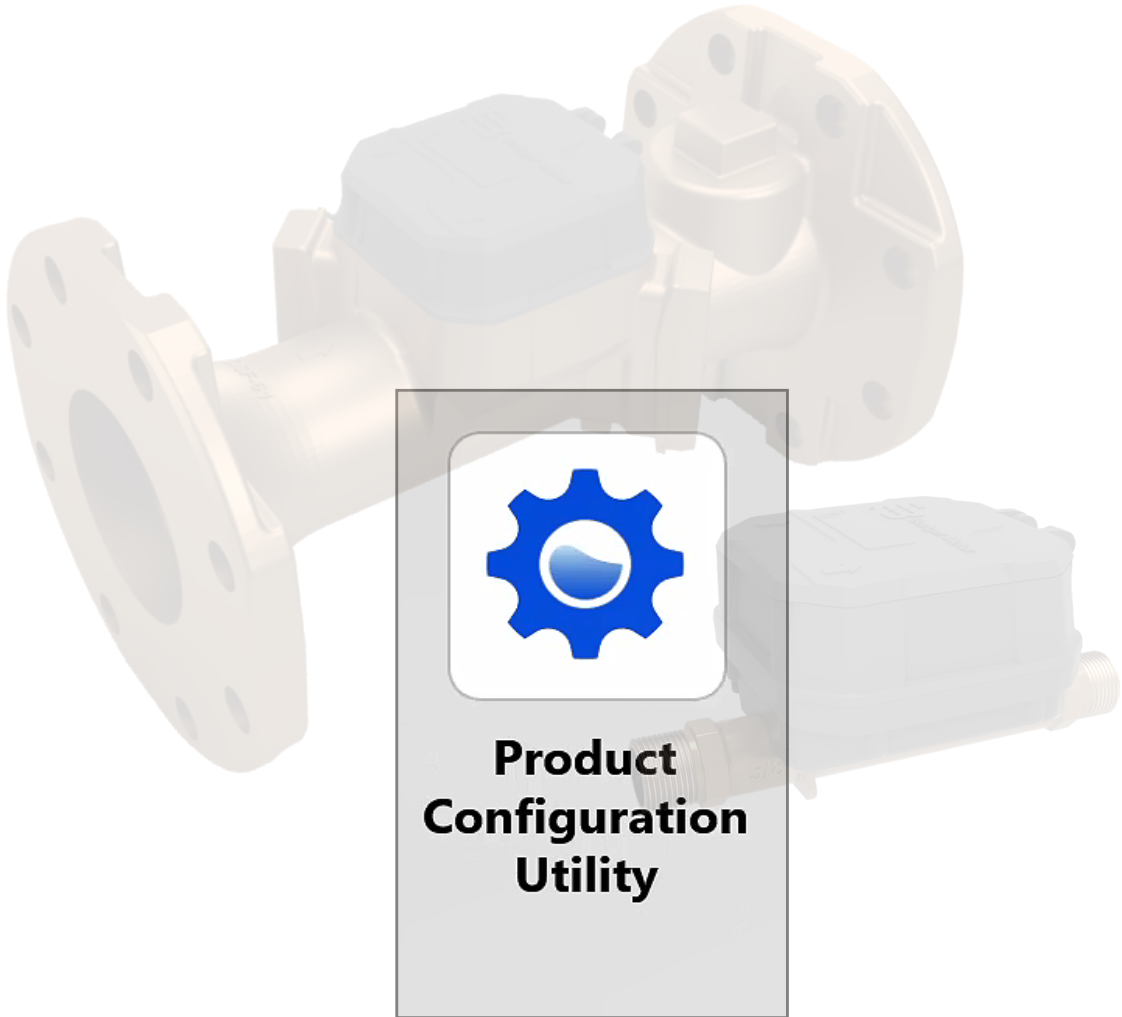
SMART WATER IS BADGER METER

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Badger Meter

**Product Configuration Utility
for E-Series G2® Ultrasonic Meters**



CONTENTS

Overview	3
IR Programming Device - Required	3
Additional Resources	3
Minimum System Requirements	3
Parts List	4
IR Alignment Tools	5
IR Programming Cable Driver	5
Accessing the PCU Software	6
Getting Started	8
Sign In	8
Exiting the Software.	8
Software Menu	9
Configuring the Settings	9
Setting the COM Ports	9
Configuring the Download Folder	10
Main Screen	11
E-Series G2 Screen Functions	11
Read Device	12
Pressure, Temperature Threshold	14
Dual Output Read	15
Program Device	16
Pressure, Temperature Alarm Programming.	17
Dual Output Programming	18
Dual Encoder Output.	18
4–20 mA Output Maximum Measurement	18
Scaled/Unscaled Output	19
Extract Data	20
Storage Mode	21
Placing Active Meter into Storage Mode	21
Activating a Meter in Storage Mode.	22
Troubleshooting	23

OVERVIEW

The Badger Meter Product Configuration Utility (PCU) is a field deployment and programming application developed by Badger Meter to install, read, program and extract data from Badger Meter devices.

This manual provides instructions for using the PCU software with E-Series G2[®] Ultrasonic meters. This manual is based on PCU version 1.9.X.

The PCU is intended for use with E-Series G2 Ultrasonic meters only. It is *not* for use with generation one E-Series Ultrasonic meters.

NOTE: To provide the best solution for our customers, Badger Meter continually improves software programs and periodically updates this manual to reflect upgrades. Therefore, there may be some differences between the installed software and this manual.

IR Programming Device - Required

The software communicates via infrared (IR) with the E-Series G2 Ultrasonic meters. An IR programming device (IR device), either the ACTiSYS[®] ACT-IR224UN-L+ USB IR programming cable (IR cable) or the Badger Meter IR Communication Device, is required for IR reading and programming using the PCU. See "[Parts List](#)" on page 4.

NOTE: When used with a micro USB cable, the IR Communication Device can perform all the functions of an IR programming cable.

Additional Resources

In addition to this document, see other E-Series Ultrasonic meter documents at badgermeter.com, including the following:

[E-Series G2 Ultrasonic Meter User Manual](#)

[Product Configuration Utility for E-Series[®] Ultrasonic Plus Meter Manual](#)

[IR Programming Cable, Update for Windows[®] 11](#)

MINIMUM SYSTEM REQUIREMENTS

BEACON[®] SaaS

Download the PCU software from BEACON Software as a Service (SaaS) as described in "[Accessing the PCU Software](#)" on page 6. Sign in to the PCU software using your BEACON SaaS sign in and password.

Windows[®] Device

The PCU software is designed to run on a computing device (PC, laptop, tablet) with a Windows 10 operating system, version 1909 or higher.

Windows[®] Updates

Make sure the device on which the software is installed always has the most recent Windows updates.

To check for updates on your device, go to **Settings**> **Windows Update**. Then select **Check for Updates**. Install all updates, if needed, and restart the device before using the PCU.

PARTS LIST

Part Number	Description/Photo	Part Name
64436-041		ACTiSYS IR Programming Cable, USB
64436-042		Rugged Serial IR programming and data profile cable
64436-029		(Optional) Serial-to-USB Adapter (For use with Rugged Serial IR programming cable 64436-042)
68891-001		Badger Meter IR Communication Device Used with a customer-supplied micro USB cable (not shown) can perform as an IR programming cable
68877-001		IR Bracket alignment tool (Recommended) for E-Series G2 Ultrasonic meters

IR ALIGNMENT TOOLS

To use the PCU software, connect an IR device—either the ACTiSYS® IR programming cable (*Figure 1*) or the IR Communication Device with micro USB cable (*Figure 2*)—to your Windows device. See "*Setting the COM Ports*" on page 9 for instructions on setting the correct COM port for the IR device.



Figure 1: ACTiSYS IR programming cable



Figure 2: IR Communication Device with micro USB cable

IR Programming Cable Driver

After upgrading to a newer operating system such as Windows 11, an issue may sometimes occur with the driver on the ACTiSYS IR programming cable. If you experience a driver issue, refer to the *IR Programming Cable Update for Windows 11* application data sheet available at badgermeter.com for instructions on updating the driver.

Using the IR Alignment Tools

This step for using the IR alignment tools is optional but recommended when reading or programming E-Series Ultrasonic meters. The IR bracket is designed for using an IR device while leaving your hands free. Using the bracket also keeps the IR device at the correct distance from the meter optical communication port.

If you are programming multiple meters, you can move the IR bracket with the IR device from meter to meter.

Using the IR Bracket with the E-Series G2 Ultrasonic Meter

1. Open the meter lid.
2. Position the bracket over the E-Series G2 Ultrasonic meter as shown in *Figure 3*, with the opening directly over the meter optical communication port. Push down gently at both ends so the four (4) corners clip over the edges of the meter.

Make sure the bracket is seated against the meter face so you can see the optical communication port through the opening.

3. Place the head of the IR device into the holder.

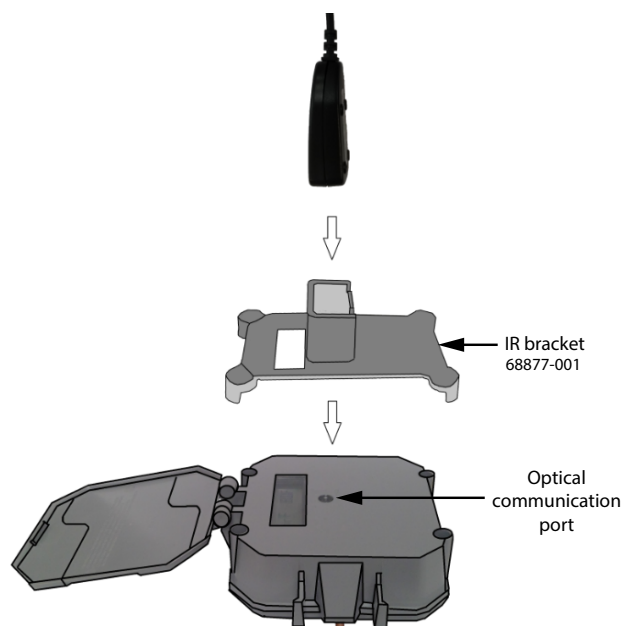


Figure 3: IR bracket for E-Series G2 Ultrasonic meter

ACCESSING THE PCU SOFTWARE

Downloading the Software

1. On the BEACON SaaS website, go to **Utility Settings**> **Downloads** and select **Download** for the *Badger Meter Product Configuration Utility (PCU)*.

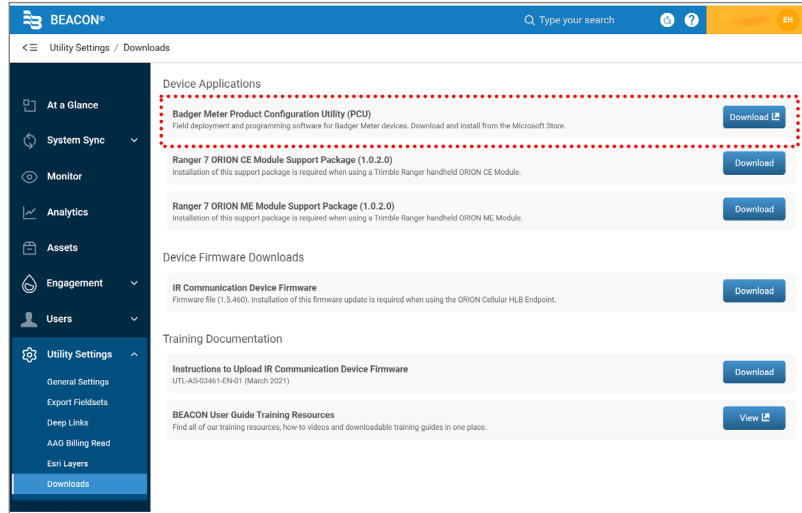


Figure 4: BEACON Downloads

NOTE: The screens shown here are examples of what to look for. Your screens may look slightly different based on your version of Windows and experience with the Microsoft® Store.

2. In the window that opens, select **Get**.

The installation window opens.



Figure 5: PCU in Microsoft Store

3. Select **Install**.



Figure 6: Install

4. A progress bar displays during the download process.

At the end of the process, select **Launch**.

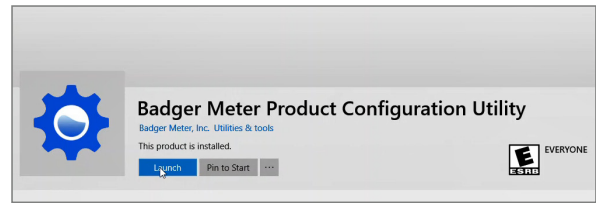


Figure 7: Select Launch

5. The *Sign In* window opens. Enter your BEACON email and password and click **Sign In**.

NOTE: If you close the PCU, you can get back to it by opening the Windows **Start** menu, and selecting **Badger Meter Product Configuration Utility**. See [Figure 9](#).

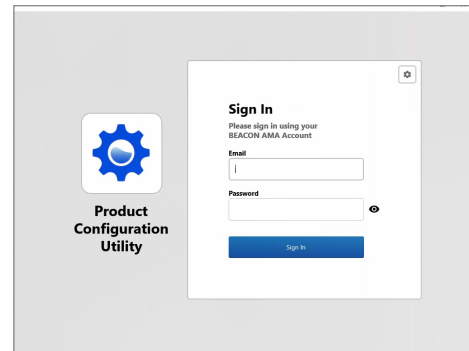


Figure 8: PCU Sign In

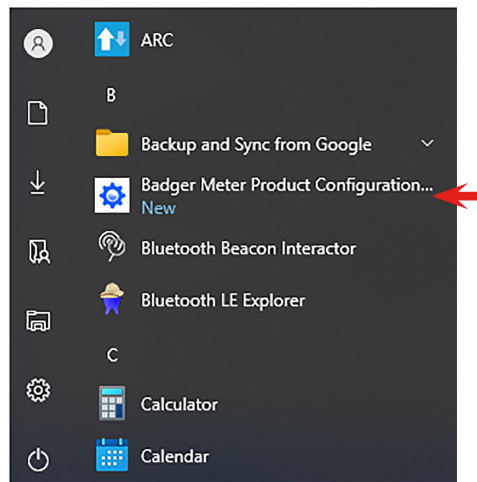


Figure 9: Windows Start menu showing *Product Configuration Utility*

Software Updates

If you launch the PCU application and there is an update available, a notification icon displays at the top right of the main screen ([Figure 10](#)).

Click the icon to go to the notifications page to access a new PCU version.

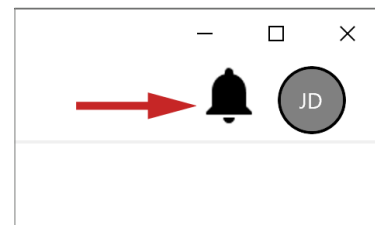


Figure 10: Software update notification icon

GETTING STARTED

1. Connect your IR device to a USB port on your Windows device.

Connect the IR device *before* you start the software to make sure the software recognizes the connection.

NOTE: If you are using an IR device with a serial port connector and your Windows device does not have a serial port, use a serial-to-USB adapter. See the ["Parts List" on page 4](#).

Sign In

2. Select **Badger Meter Product Configuration Utility** from the Windows **Start** menu. Alternatively, you can also open PCU by clicking on the shortcut icon that displays in the **Start** menu ([Figure 11](#)).

The PCU Sign In window displays ([Figure 12](#)).

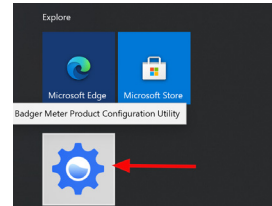


Figure 11: Software shortcut

3. Sign in with your BEACON email and password. Then click **Sign In**. The software Product Selector main default screen opens ([Figure 13](#)).

NOTE: You must be connected to the internet to sign in. Once you are signed in, you do *not* need an internet connection to use the PCU software.

If you do *not* logout, you can return to the PCU anytime without signing in and without an internet connection.

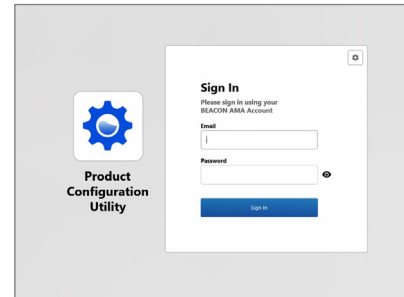


Figure 12: Sign In window

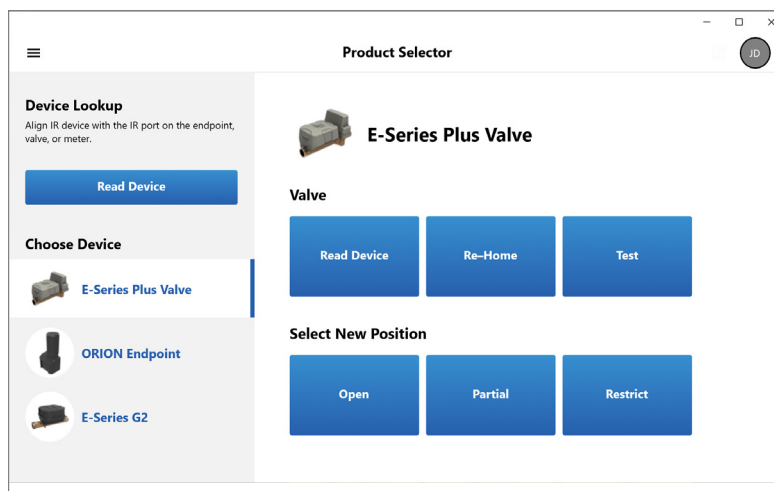


Figure 13: PCU Product Selector default screen

Exiting the Software

To exit the software, click the **X** in the top right corner of the screen. You can return to the software anytime by selecting the PCU icon from the Windows **Start** menu. See [Figure 9](#) if you need help.

You can also logout by clicking the circled initials in the top right corner of the screen and selecting **Logout**. If you logout, you will be required to Sign In the next time you access the PCU.

Software Menu

Click ☰ in the top left corner of any screen to access the menu.

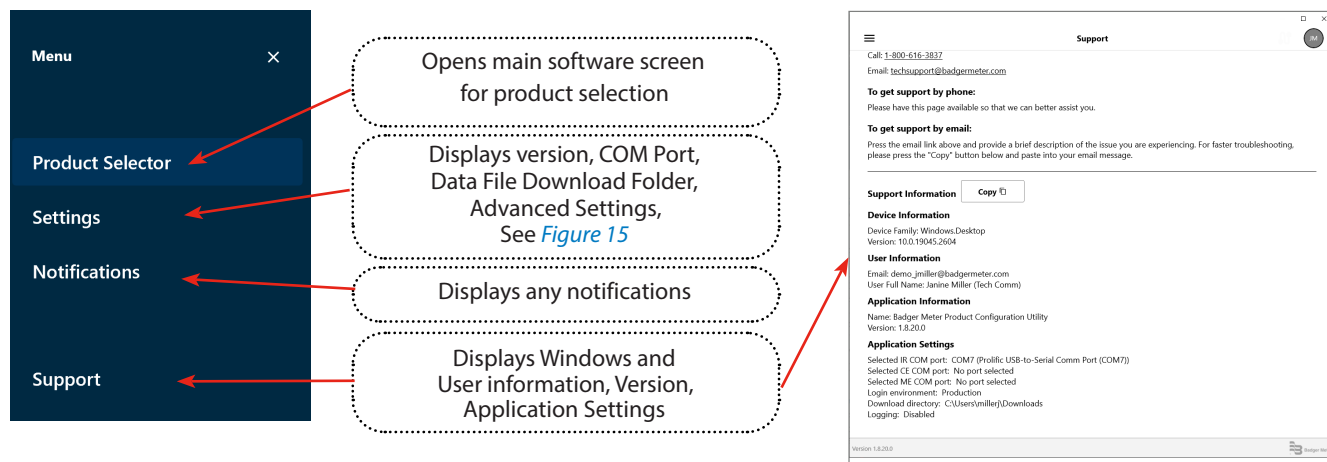


Figure 14: Menu options

Settings

Click ☰ at the top left corner of any screen and select **Settings**.

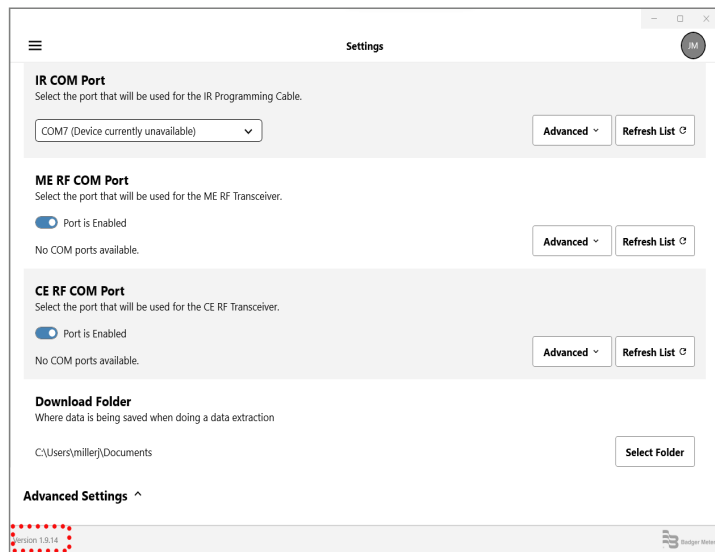


Figure 15: PCU Settings

Setting	Description
COM Port(s)	Displays the COM port(s) for connected device(s). See " Setting the COM Ports " below.
Download Folder	Select a folder where your data files will be saved. See " Configuring the Download Folder " on page 10.
Advanced Settings	Displays <i>Logging</i> option.
Logging	Enable Logging only when working with Badger Meter Technical Support to diagnose a software problem. If you enable logging, a warning message opens. See Figure 16 below.
PCU Version	Displays the current software version in lower left corner of the screen.

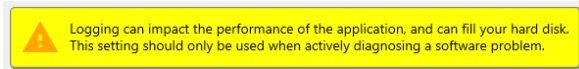


Figure 16: Logging warning message

Setting the COM Ports

You must set the communication (COM) port for the IR programming cable and any other devices attached to your Windows device. When connected, the PCU will automatically detect the connected devices.

1. Click ☰ at the top left corner of the screen and select **Settings**.

- Use the drop-down menu to select the correct COM port(s) for the IR programming cable and any other connected device(s). Click **Refresh List** if the device is connected but does not display.

NOTE: **Advanced** COM Port Configuration options are available, if needed, but are not required.

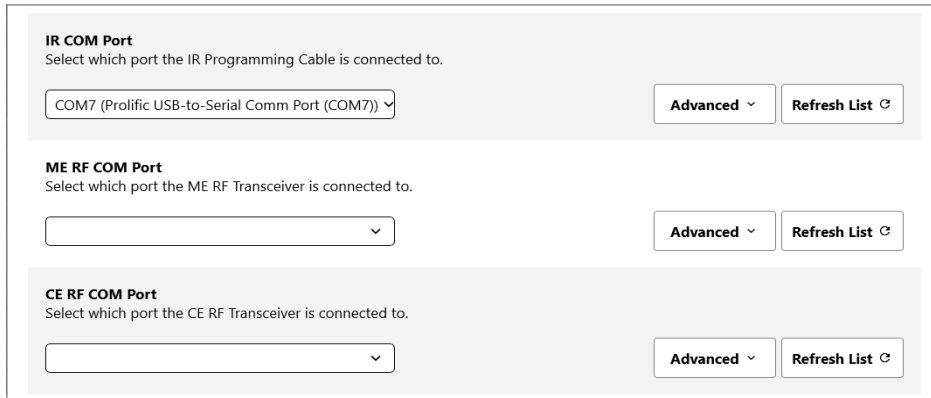


Figure 17: COM port list

- Click at the top left corner of the screen and click **Product Selector** to return to the main screen.

NOTE: Clicking the **X** at the top right corner of the *Settings* window closes the software application.

Configuring the Download Folder

The *Download Folder* is a file you choose for storing data files such as historical data extracted from an endpoint or any log files created by the software. To save time, set up the folder before you start using the software.

- Click at the top left corner of the screen and select **Settings**.
- Under *Download Folder*, click **Select Folder**.
- In the window that opens, select the folder to which you want to save your downloaded files.

The folder location you select will display on the *Settings* screen. Any data or log files created in the PCU will be downloaded to the folder.

The software notifies you whenever a file is downloaded (Figure 19).

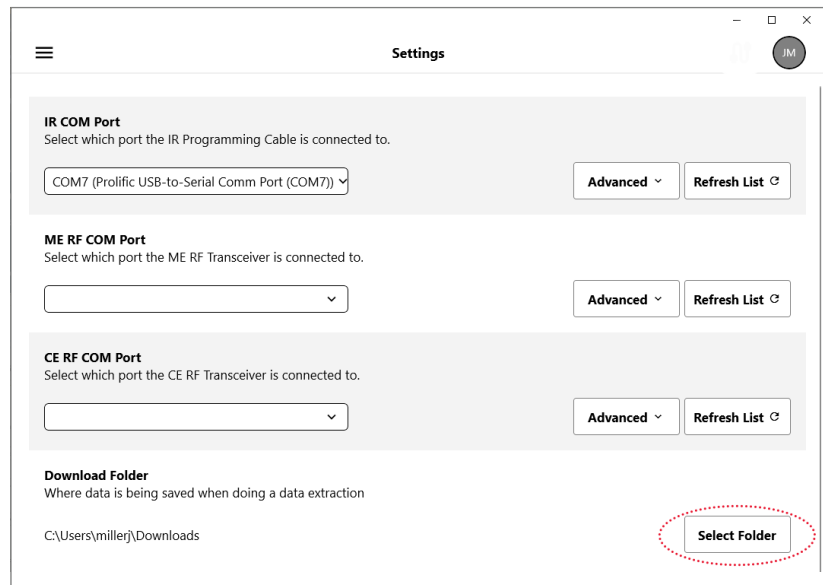


Figure 18: Select Download Folder

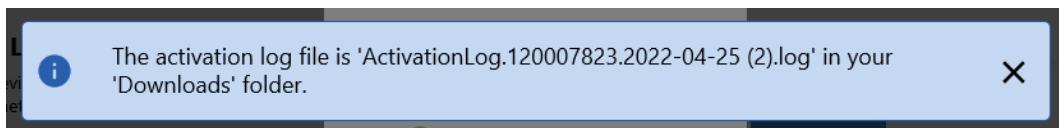


Figure 19: Example of download notification

MAIN SCREEN

The software screen changes based on the device you select. Select **E-Series G2** in the navigation menu on the left side of the screen. The screen for the E-Series G2 Ultrasonic meter displays.

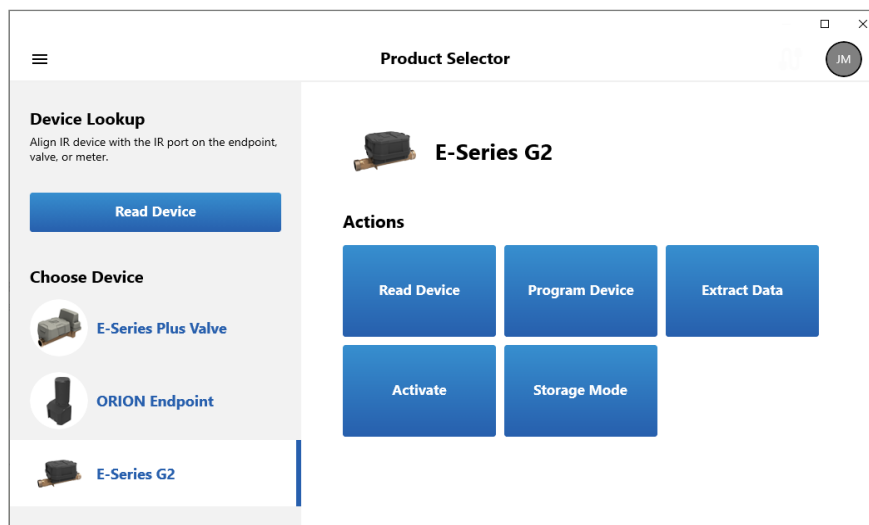


Figure 20: PCU main screen functions for E-Series G2 Ultrasonic meter

E-Series G2 Screen Functions

NAVIGATION MENU

Field	Description
☰	Access to COM port Settings, Support information, and software version. See "Settings" on page 9 .
Read Device*	Select Read Device and the software detects and reads the connected device.
Choose Device	Select the meter to see options.

RIGHT SIDE OF SCREEN

Function*	Description
Read Device	Software identifies and reads the meter. Details of the device are displayed. (See "Read Device" on page 12)
Program Device	Used to program settings for the meter, encoder and alarms. (See "Program Device" on page 16)
Extract Data	Extract historical data from 1, 7, 30, or 90 days, or extract all available data (up to 160 days of data). Data can be exported to a spreadsheet file, if required. (See "Extract Data" on page 20)
Activate	Activates a meter in storage mode. (See "Activating a Meter in Storage Mode" on page 22)
Storage Mode	Places active meter into storage mode. (See "Storage Mode" on page 21)

* When performing any PCU function, make sure the IR device is connected and aligned with the optical communication port (IR port) on the meter until the function is completed. See [Figure 3](#) for correct positioning of the IR device.

READ DEVICE

IMPORTANT

Make sure the IR device is connected and aligned with the meter optical communication port throughout the process. Using the IR bracket is recommended. See [Figure 3](#) if you need help.

1. Holding the IR device steady, select **E-Series G2** and then select **Read Device** on the main PCU screen.
2. Scroll down to see all the results. See examples of the screen sections in [Figure 21](#), below. See field descriptions on the next page. Screen results may vary based on your meter configuration.

E-Series

Ambient Temperature	75.3 °F
Current Device Time	01/24/2023 12:51
Firmware Version	ARM 1.0.4051 ASIC 1.0.3970
Meter Size	3" or 75mm
Operating Mode	Storage
Pressure	0.0 PSI
Screens	Flow - Total Consumption Rate of Flow Pressure Temperature Alarm & Operating Mode Firmware Version
Serial Number	200200928
Status Indicators	▲
Visual Reading	00000000.0

Encoder

Billing Unit	1,000
Digits from Encoder	9
Encoder Output	00000000
Rate of Flow Time	Minutes
Rate of Flow Unit	Gallons
Unit of Measure	Gallons

Alarms

Empty Pipe	<input checked="" type="checkbox"/> Enabled
End Of Life	<input checked="" type="checkbox"/> Enabled
Exceeding Max Flow	⌚ 35 days
Measurement Error	⌚ 35 days
No Usage	<input checked="" type="checkbox"/> Enabled
Pressure	⌚ 35 days ⬇ 14.5038 PSI ⬆ 130.5340 PSI Enabled Duration: 35 High Limit: 130.5340 Low Limit: 14.5038 Unit: PSI
Program Alert	⌚ 35 days
Reverse Flow	⌚ 35 days
Suspected Leak	<input checked="" type="checkbox"/> Enabled
Temperature	⌚ 35 days ⬇ 33.8 °F ⬆ 140.0 °F Enabled Duration: 35 High Limit: 140.0 Low Limit: 33.8 Unit: °F

Actions

Program Device

Extract Data

Activate

Storage Mode 🔒

Zero Totalizer

Clear Alarms

Figure 21: E-Series G2 Meter Reading

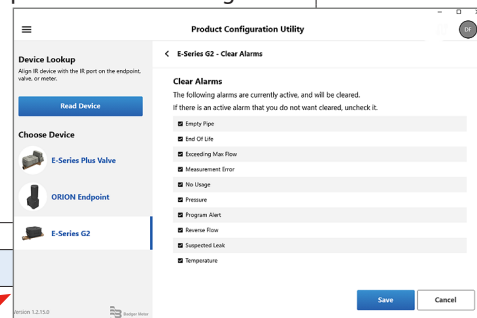
Select < **E-Series G2** to go back to E-Series G2 main screen

Meter Fields	Description
Ambient Temperature	Air temperature of meter location
Current Device Time	Date and time from the meter
Firmware Version	Firmware version of the meter
Meter Size	Meter pipe diameter
Operating Mode	Active or Storage
Pressure	Pressure reading for meters with integrated pressure sensor
Screens	Screens that are programmed to display on meter—see "Program Device" on page 16
Serial Number	Serial number of the meter
Status Indicators	Displays active alarms—click the icon to see a description of the condition
Visual Reading	Reading displayed on meter

Meter Encoder Fields	Description
Billing Unit	Billing unit is based on <i>Unit of Measure</i>
Digits from Encoder	Number of programmed digits
Encoder Output	Reading resolution sent to the software depends on the endpoint connected to the meter
Rate of Flow Time*	Flow time programmed into meter
Rate of Flow Unit*	Gallons, cubic feet, cubic meters, liters, imperial gallons
Unit of Measure	Gallons, cubic feet, cubic meters, liters, imperial gallons, acre feet

* Resolution on the rate of flow screen is fixed to a resolution of 0.01 regardless of the rate of flow unit or rate of flow time.

Meter Alarm Fields	Description
Empty Pipe	Click on meter alarm parameters on the right side of the screen to expand the view. The high and low limits for pressure and temperature are displayed. Refer to the <i>E-Series G2 Ultrasonic Meter User Manual</i> available at badgermeter.com for complete alarm information.
End of Life	
Exceeding Max Flow	
Measurement Error	
No Usage	
Pressure	
Program Alert	
Reverse Flow	
Suspected Leak	
Temperature	



Actions	Description
Program Device	Opens programming screens
Zero Totalizer	Sets the forward and reverse totalizers to 0 (zero) and zeros out the meter reading
Extract Data	Extracts up to 160 days of meter data
Activate	Used to activate a meter in storage mode (button is grayed out/locked when meter is active)
Storage Mode	Places active meter into storage mode
Clear Alarms	Opens the Clear Alarms screen which shows any active alarms. Click SAVE to clear any alarms that are checked. If you clear the alarm but don't fix the cause, the alarm will reset.

NOTE: See ["Program Device" on page 16](#) for programming options.

Pressure, Temperature Threshold

Pressure and temperature are shown in the Alarms section. When you click the parameters on the right side of the screen, an expanded view opens showing the threshold limits as shown in [Figure 22](#).

The screenshot displays the 'Alarms' section of a device interface. It lists several alarm types with their status and duration. Two specific alarms, 'Pressure' and 'Temperature', are highlighted with red dotted boxes to show their expanded configuration details.

Alarm Type	Status	Duration	Low Limit	High Limit	Unit
Empty Pipe	Enabled				
End Of Life	Enabled				
Exceeding Max Flow		35 days			
Measurement Error		35 days			
No Usage	Enabled				
Pressure	Enabled	35	14.5038	130.5340	PSI
Program Alert		35 days			
Reverse Flow		35 days			
Temperature	Enabled	35	33.8	140.0	°F
Suspected Leak	Enabled				

Actions

- Program Device
- Extract Data
- Activate
- Storage Mode (locked)
- Zero Totalizer
- Clear Alarms

Figure 22: Pressure and temperature expanded view

Dual Output Read

When you read a meter that is factory configured for 4-20 mA, scaled, unscaled or encoder dual output, the software displays the dual output parameters in addition to the Meter, Encoder and Alarms parameters. Examples of all dual output fields are shown in [Figure 23](#).

NOTE: Screen results may vary based on your meter configuration.

Encoder	
Billing Unit	1,000
Digits from Encoder	8
Digits from Encoder – Dual	9
Encoder Output	00000000
Encoder Output – Dual	00000000
Rate of Flow Time	Minutes
Rate of Flow Unit	Gallons
Unit of Measure	Gallons

4–20mA	
Maximum Measurement	30 Gallons per minute
Scaled Output	
Number of Pulses	30 per Gallon
Pulse Width	25 ms
Unscaled Output	
Unscaled Number of Pulses	20000 per Gallon

Figure 23: Dual output fields

Dual Output Fields	Description	Programmable Yes/No
Dual Encoder		
<i>Digits from Encoder</i>	Number of digits programmed for first encoder	Yes
<i>Digits from Encoder Dual</i>	Number of digits programmed for second encoder	Yes
NOTE: To confirm the encoder digits programmed, perform a Meter Force Read with the PCU on the ORION endpoint connected to the appropriate meter encoder output. The ORION endpoint must be in active mode.		
4–20 mA		
<i>Maximum Measurement</i>	Maximum flow rate based on the meter size	Yes
Scaled Output		
<i>Number of Pulses</i>	Displays the number of scaled output pulses and unit of measure from the register	Yes
<i>Pulse Width</i>	Determines the time the output is switched on	Yes
Unscaled Output		
<i>Unscaled Number of Pulses</i>	Displays the number of unscaled output pulses and unit of measure from the register	No

NOTE: See "[Dual Output Programming](#)" on [page 18](#) for programming options. Refer to the *E-Series G2 Ultrasonic Meter User Manual* available at badgermeter.com for detailed dual output information.

PROGRAM DEVICE

IMPORTANT

Make sure the IR device is connected and aligned with the meter optical communication port throughout the process. Using the IR bracket is recommended. See [Figure 3](#) if you need help.

1. Holding the IR device steady, select **Read Device** on the main PCU screen.
2. Scroll down to the bottom of the Read screen to select **Program Device**. The programming screen opens.
3. Scroll down to see all the options. The programming screen has three sections: *Screens*, *Encoder*, and *Alarms*. Examples are shown in [Figure 25](#).
4. Select the **Flow** checkbox to choose either *Forward Flow Total* or *Total Consumption* (Net total, forward minus reverse). Both options cannot be programmed at the same time.
Reverse Flow Total can be programmed at any time.
5. Select from the available options to make any other changes you want applied to the meter. Select a checkbox or use the drop-down menu to make a selection. If you make a change, the **Save** button at the bottom of the screen is activated.
6. To save any programming changes for the meter, click



After saving the changes, PCU automatically performs a reading and updates the meter with the changes you made.

If you made changes but want to leave the screen without saving changes, click



The software returns to the Read screen.

NOTE: All options may not be available for programming. Programming options vary depending on meter configuration.

If you see a lock symbol as shown in [Figure 24](#), the option cannot be programmed.

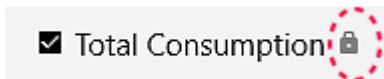


Figure 24: Programming option is not available

Also see "[Pressure, Temperature Alarm Programming](#)" on [page 17](#) for details about changing those parameters.

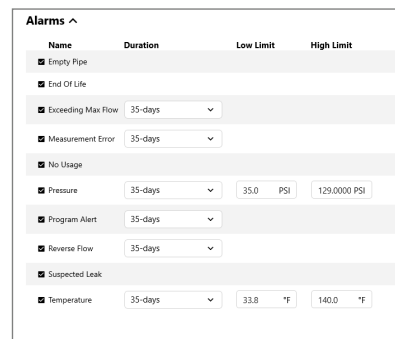
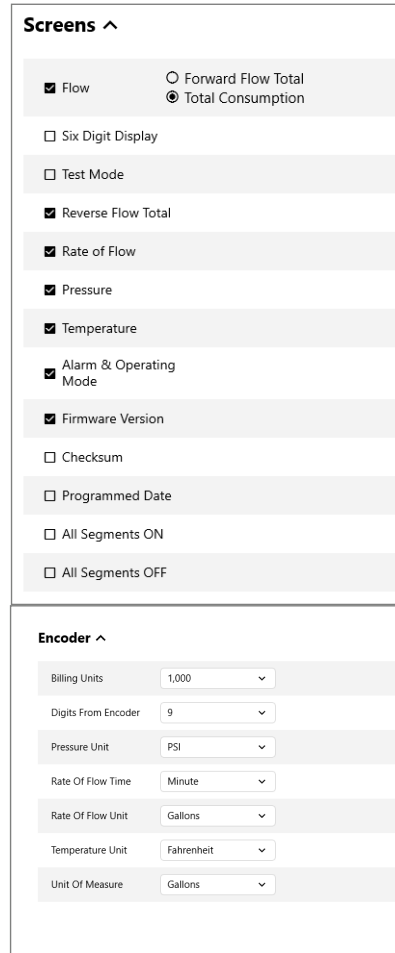


Figure 25: E-Series G2 Programming screens

Pressure, Temperature Alarm Programming

The table below shows the high and low limits for pressure and temperature to which the meter can be programmed. These limits are displayed in the Alarms section when you Read or Program the meter.

Thresholds for E-Series G2 Ultrasonic Meters—All Sizes	
Pressure	Temperature
Low: 14.0 psi (1.0 bar)	Low: 33.8 °F (1.0 °C)
High: 130.0 psi (9.0 bar)	High: 140.0 °F (60.0 °C)

Programming Alarm Duration, Pressure or Temperature

1. Use the drop-down menu to select the number of days for the alarm.
2. Select the *Low Limit* value and enter a new value. An error message displays if you enter a value that is out of range.
3. Select the *High Limit* value and enter a new value. An error message displays if you enter a value that is out of range.
4. Click **Save**. After saving the changes, PCU automatically performs a reading and updates the meter with the changes you made.

If you made changes but want to leave the screen without saving changes, click **Cancel**.

Alarms ^

Name	Duration	Low Limit	High Limit
<input checked="" type="checkbox"/> Empty Pipe			
<input checked="" type="checkbox"/> End Of Life			
<input checked="" type="checkbox"/> Exceeding Max Flow	35-days		
<input checked="" type="checkbox"/> Measurement Error	35-days		
<input checked="" type="checkbox"/> No Usage			
<input checked="" type="checkbox"/> Pressure	35-days	14 PSI	130.0000 PSI
<input checked="" type="checkbox"/> Program Alert	35-days		
<input checked="" type="checkbox"/> Reverse Flow	35-days		
<input checked="" type="checkbox"/> Suspected Leak			
<input checked="" type="checkbox"/> Temperature	35-days	33.8 °F	140.0 °F

Figure 26: Pressure, temperature programming

Dual Output Programming

When a meter is factory configured for dual output, the software displays the 4-20 mA, scaled, unscaled or dual encoder parameters in addition to the Meter, Encoder and Alarms parameters. Examples of the dual output programming screens are shown below. Follow the instructions below for programming. For complete information, follow the directions at "[Program Device](#)" on page 16 .

IMPORTANT

Make sure the IR device is connected and aligned with the meter optical communication port throughout the process. Using the IR bracket is recommended. See [Figure 3](#) if you need help.

Dual Encoder Output

1. To program the Encoder values, use the drop-down menus to select a new value for Digits From Encoder and/or Digits from Encoder Dual.
2. Click **Save**. After saving the changes, PCU automatically performs a reading and updates the meter with the changes you made.

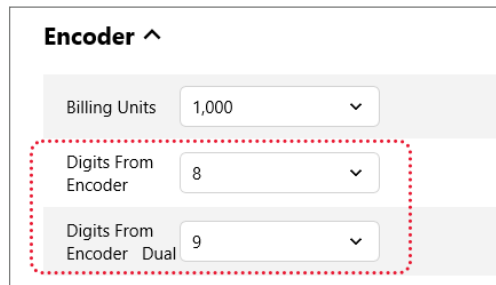


Figure 27: Dual encoder output programming screen

NOTE: To confirm the encoder digits programmed, perform a **Meter Force Read** with the PCU on the ORION endpoint connected to the appropriate meter encoder output. The ORION endpoint must be in active mode.

4–20 mA Output Maximum Measurement

The default Maximum Measurement is set to the maximum flow rate based on the meter size.

1. To program the Maximum Measurement, select the current number value and enter a new value. As you enter the new Maximum Measurement, the valid value range automatically displays on the screen.

NOTE: You must enter a value within the valid value range as shown on the screen. Entering a value outside the range will trigger an error.

2. Click **Save**. After saving the changes, PCU automatically performs a reading and updates the meter with the changes you made.

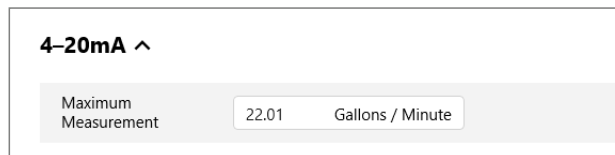


Figure 28: 4-20 mA scaled dual output programming screen

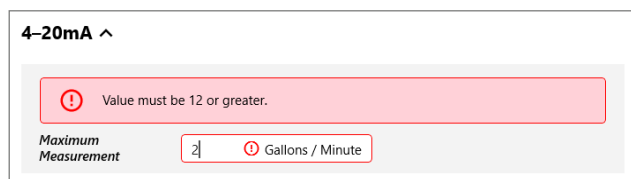


Figure 29: Maximum Measurement programming

20 mA Maximum Measurement Limit

- **4 mA:** The 4 mA field is always set to zero (0). The register produces a 4 mA signal at zero flow.
- **20 mA:** The 20 mA field displays the flow rate. Set this parameter to the flow rate at which the output should generate to maximum signal. In most cases, this is the maximum flow rate of the meter.

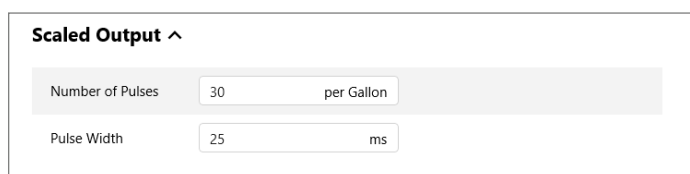
PCU limits the programming of a 20 mA parameter to nothing less than half of the maximum flow of the meter to optimize meter performance.

Scaled/Unscaled Output

To program the Scaled Output, select the current value and enter a new value in the field.

NOTE: You must enter a value within the valid value range as shown on the screen. Entering a value outside the range will trigger an error.

1. Select the current *Number of Pulses* value and enter a new value.
2. Select the current *Pulse Width* value and enter a new value.
3. Click **Save**. After saving the changes, PCU automatically performs a reading and updates the meter with the changes you made.



The screenshot shows a window titled "Scaled Output ^". Inside the window, there are two rows of input fields. The first row is labeled "Number of Pulses" and has a text box containing the number "30" followed by the text "per Gallon". The second row is labeled "Pulse Width" and has a text box containing the number "25" followed by the text "ms".

Figure 30: Scaled output programming screen

NOTE: Unscaled output is not programmable.

EXTRACT DATA

With the PCU, you can extract hourly historical data at the meter, on demand, up to the last 160 days.

NOTE: Make sure the IR device is connected and aligned with the meter optical communication port throughout the process. Using the IR bracket is recommended. See [Figure 3](#) if you need help.

1. Select the **E-Series G2** device on the main PCU screen.
2. Select the **Extract Data** button. The data selection window opens ([Figure 31](#)).
3. Choose the number of days for data extraction. *All Available Data* lets you extract up to 160 days of data.

Then click **Begin**.

The extracted data results display ([Figure 32](#)) based on the days selected.

NOTE: Results may vary based on your meter configuration.

4. Select **Export to File** to save the information.

NOTE: If you configured a folder in **Settings**> **Download Folder**, the data will be saved in the folder you selected. See "[Configuring the Download Folder](#)" on page 10 for more information.



Figure 31: Select number of days

< E-Series G2 - Extract Data

Properties

Serial Number	200621415
Interval Size	3600 sec
Consumption Units	Gallons
Temperature Units	Fahrenheit
Oldest Date Retrieved	02/24/2022 16:00
Newest Date Retrieved	03/03/2022 15:00
Intervals Extracted	168
Exception Events	168

Export to File

Extracted Data

Date	Exceptions	Intervals	Consumption (Gallons)
02/24/2022	8	8	0 ▾
02/25/2022	24	24	0 ▾
02/26/2022	24	24	0 ▾
02/27/2022	24	24	0 ▾
02/28/2022	24	24	0 ▾
03/01/2022	24	24	0 ▾
03/02/2022	24	24	0 ▾
03/03/2022	16	16	0 ▾

Figure 32: Extracted data

STORAGE MODE

NOTE: Make sure the IR device is connected and aligned with the meter optical communication port throughout this process. Using the IR bracket is recommended. See [Figure 3](#) if you need help.

Placing Active Meter into Storage Mode

1. To place an active meter into *Storage* mode, select the **E-Series G2** on the main PCU screen, and then select **Read Device** to confirm the meter is in *Active* mode.

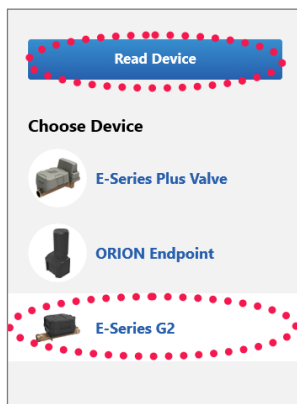


Figure 33: Read Device

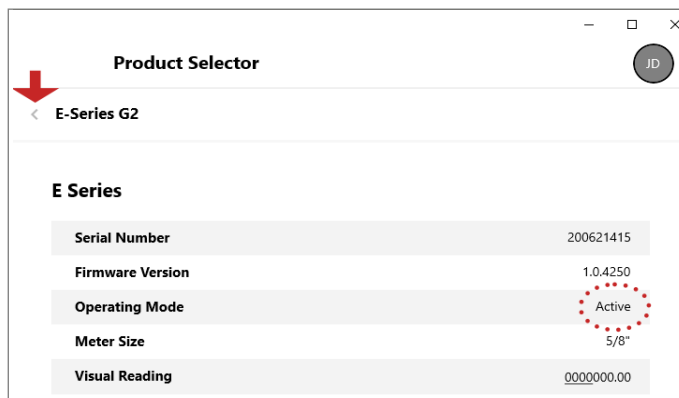


Figure 34: Click arrow to return to the main screen

The Operating Mode is *Active* as shown in [Figure 34](#).

2. Select the **Storage Mode** button ([Figure 35](#)) to place the meter into *Storage* mode.

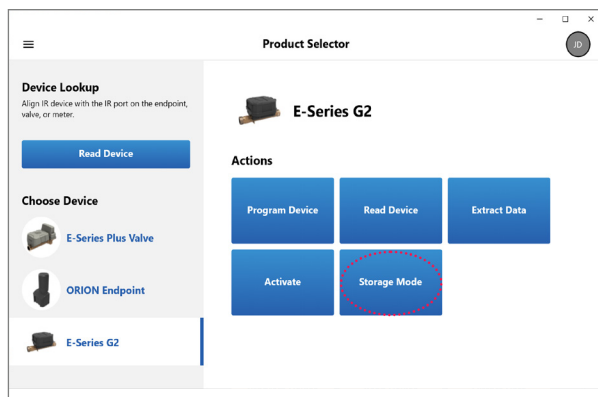


Figure 35: Select Storage Mode

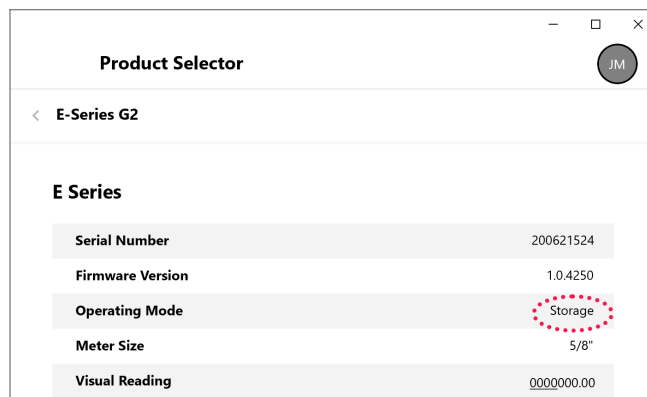


Figure 36: Meter in Storage operating mode

The results screen refreshes ([Figure 36](#)), confirming the meter is in *Storage* mode.

Activating a Meter in Storage Mode

NOTE: Make sure the IR device is connected and aligned with the meter optical communication port throughout this process. Using the IR bracket is recommended. See [Figure 3](#) if you need help.

1. To change a meter from *Storage* mode into *Active* mode, select the **E-Series G2** on the main PCU screen, and then select **Read Device** to confirm the meter is in *Storage* mode.



Figure 37: Read Device

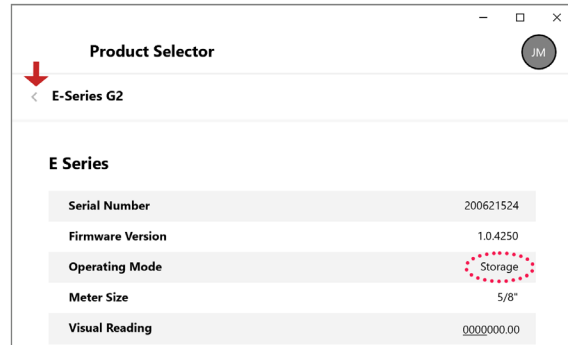


Figure 38: Return to main screen

The Operating Mode is *Storage* as shown in [Figure 38](#).

2. Select the **Activate** button to place the meter into Active mode.

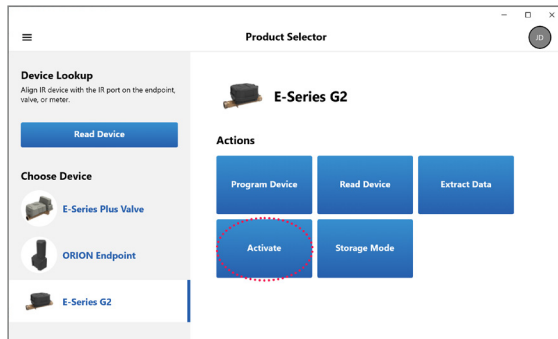


Figure 39: Activate

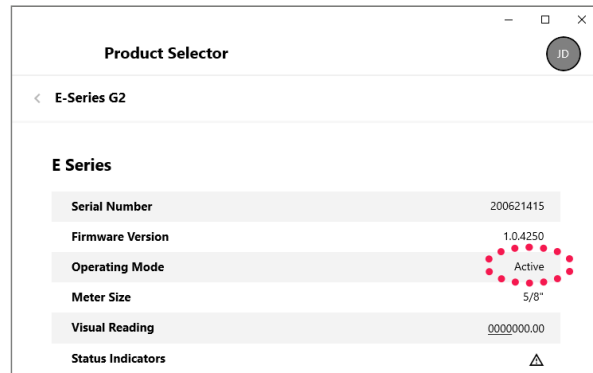


Figure 40: Meter in Active mode

3. The results screen refreshes ([Figure 40](#)), confirming the meter is in *Active* mode.

TROUBLESHOOTING

Issue	Possible Cause	Solution
Error when trying to set the COM port.	Bluetooth enabled	Disable Bluetooth while selecting the COM port.
PCU software will not install.	OS; VPN	Check the operating system on your Windows 10 device. It must be 1909 or newer. If you have a VPN (virtual private network) enabled on your device, disable the VPN and reconnect after installation.
Unable to sign in to software.	No internet connection	You must be connected to the internet to sign in. Once you are signed in, you do not need an internet connection to use the PCU software.
<p>Error Message: <i>Communication timed out. Please ensure that the IR head is properly aligned. If aligned properly, check that you are using the correct COM port.</i></p>	COM port not set or wrong COM port set	Go to Settings to set the COM port. Make sure it is set correctly. See " Setting the COM Ports " on page 9 if you need help.
	<p>IR device not aligned with IR port on meter</p> <p>IR device too close or too far from IR port on meter</p>	<ul style="list-style-type: none"> • Retry your command, making sure the IR device is 1/2...1-1/2 inches from the product IR port. Hold the device steady while reading. • Use the IR bracket for best results.
<p>Error Message: <i>Unsupported device detected. Please ensure that device is compatible with software.</i></p>	Possible firmware issue	Occurs when trying to read a device that is either not yet supported or does not have the correct firmware version. Close the error message and check device firmware version.

Contact Badger Meter Technical Support (800-616-3837) for any additional issues.



IMPORTANT

For proper handling of the higher reading resolution and the extended status indicator capabilities of the HR-E LCD encoder, the following software versions, if applicable, 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 Meter 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
- Please contact Badger Meter Technical Support at 1-800-456-5023 or the appropriate endpoint provider if you need assistance.

CONTENTS

Introduction	3
Audience and Purpose	3
Product Unpacking and Inspection	3
License Requirements.	3
Description	3
HR-E LCD	3
HR-E LCD 4-20.	3
Product Overview	4
LCD Display	4
Multiplier Value.	4
Visual Display	4
Units of Measure	4
9-Digit Totalization	4
6-Digit Totalization	5
Rate of Flow	5
Meter Model Information	5
Installing the Encoder	6
Bayonet Mount	6
Wire Connections	6
HR-E LCD	6
HR-E LCD 4-20	6
HR-E LCD	7
Measurement Resolution	7
Endpoint Reading Resolution.	7
Status Indicators	8
HR-E LCD 4-20	9
Measurement Resolution	9
Analog Output	10
Endpoint Reading Resolution.	10
Status Indicators	11

INTRODUCTION

This is the user manual for the High Resolution (HR) LCD encoders.

Audience and Purpose

This manual is intended to be used by utilities for installing and using HR-E LCD and HR-E LCD 4-20 encoders.

Product Unpacking and Inspection

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

NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the purchaser.

License Requirements

This device complies with Part 15 of the FCC Rules. Operation of this device is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes made by the user not approved by Badger Meter can void the user's authority to operate the equipment.

DESCRIPTION

High resolution encoders are fully electronic, solid-state devices with no moving parts. The devices come standard as factory programmed, with the option for programming in the field. Programming is performed through the device IR port via a computer.

NOTE: Refer to the document, *High Resolution LCD Encoder Programmer Manual*, available at www.badgermeter.com, for programming instructions.

HR-E LCD

The HR-E LCD is a permanently sealed, electronic LCD absolute encoder with field-programmable options that produces an industry standard ASCII encoded output. HR-E LCD encoders are designed for use with all current Badger Meter Recordall® Disc, Turbo Series, Compound Series, Combo Series and Fire Service meters and assemblies. The encoders provide connectivity with Badger Meter ORION® and GALAXY® AMR/AMI endpoints and other AMR/AMI technology solutions approved by Badger Meter.

HR-E LCD 4-20

The HR-E LCD 4-20 is a permanently sealed, electronic LCD absolute encoder that produces an industry standard ASCII encoded output as well as an analog 4-20 mA DC output signal with a dual output wire design. HR-E LCD 4-20 encoders are designed for use with all current Badger Meter Recordall® Disc, Turbo Series, Compound Series, Combo Series and Fire Service meters and assemblies. The encoders provide connectivity with Badger Meter ORION AMR/AMI endpoints and other AMR/AMI technology solutions approved by Badger Meter.

PRODUCT OVERVIEW

LCD Display

HR-LCD encoders have a nine-digit Liquid Crystal Display (LCD) to show consumption, flow and alarm information.

There is no need to activate the display. The display automatically toggles between consumption (segmented leak detector in this mode), rate of flow and meter model.

NOTE: Devices are shipped in storage mode so that a meter status alarm is not triggered. In storage mode, the meter model screen is displayed.

Multiplier Value

Depending on the meter model, size and unit of measure, a multiplier value may also be shown. Multiply the displayed value by the multiplier value to calculate the reading to the nearest gallon, cubic foot, or cubic meter.

Example: 123456 (displayed value) x 10 (multiplier value) = 1234560

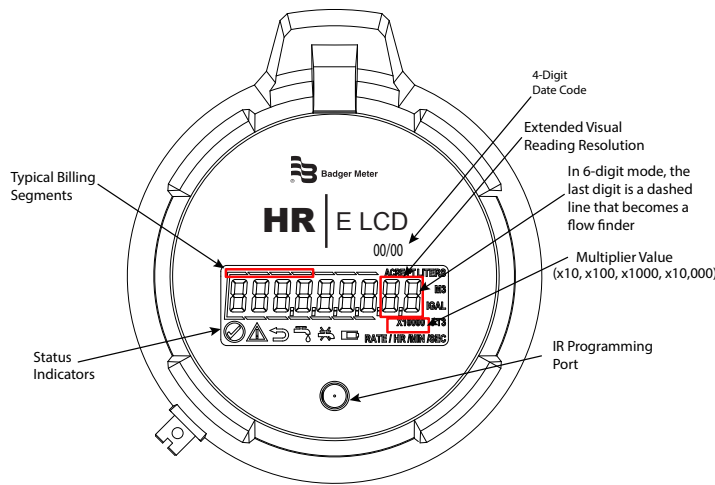


Figure 1: HR-E LCD encoder face

Visual Display

Units of Measure

The units of measure are factory-programmed and user-programmable. Options include U.S. gallons, Imperial gallons, cubic feet, cubic meters and liters.

9-Digit Totalization

The consumption display includes all nine digits and a decimal point (based on meter model, size and unit of measure). The displayed value is the sum of the forward flow minus any reverse flow. This screen displays for 45 seconds.

Model 25 Disc Series Meter Calibrated in Gallons



6-Digit Totalization

6-digit totalization mode is used to represent the typical 6 wheel odometer registration as seen on a mechanical encoder. When water is flowing through the meter, the display includes a series of moving segments to represent a flow finder. This screen displays for 5 seconds. 6-digit totalization mode is active on the HR-E LCD and HR-E LCD 4-20 encoders.

Model 25 Disc Series Meter Calibrated in Gallons



In 9- and 6-digit totalization mode, the display also includes indicator lines above and below the digits to provide the electronic equivalent of the white and black number wheels on a mechanical encoder. The segmented lines above and below the numbers represent what the white number wheels do for mechanical encoders—typical utility standard billing units.

For more detailed information on the visual totalizer displays, see the application brief, *How to Read an Encoder*, available at www.badgermeter.com.

Rate of Flow

The rate of flow is factory programmed to gallons per minute. The device displays both the unit of measure and rate of flow. The rate of flow display is shown without leading zeros. A reverse flow is indicated by a minus sign before the flow rate. The displayed rate will be based on the average flow rate for the prior minute (since the last time the flow rate was displayed). This screen displays for 5 seconds.

Model 25 Disc Series Meter Calibrated in Gallons



Meter Model Information

The meter model information screen identifies the meter for which the encoder was programmed and displays for 5 seconds. The display shows the meter type (turbo, disc, compound), the meter model, digit resolution from the device, and the unit of measure (gal, ft³, m³, imp, liter). Disc meters are indicated by a **d**, Turbo meters are indicated by a stylized **T** (only the right half of the horizontal line appears) and Compound meters are indicated by a **C**. See examples below:

Model 25 Disc Series Meter Calibrated in Gallons



Model 450 Turbo Series Meter Calibrated in Gallons



2 in. Low Side Compound Series Meter Calibrated in Cubic Feet



The meter model information screen also displays the digit resolution sent from the encoder.

NOTE: Resolution sent to the reading data management software is dependent on the endpoint connected to the device. See "[Endpoint Reading Resolution](#)" on [page 7](#) and [page 10](#) for more information.

INSTALLING THE ENCODER

Bayonet Mount

The fully potted assembly has a bayonet mount compatible with all Recordall Disc, Turbo Series, Compound Series, Combo Series and Fire Series meters and assemblies.

The bayonet mount positions the encoder in any of four orientations for visual reading convenience. The device can be removed from the meter without disrupting water service.

The device 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.

Install the device on the water meter and secure it using the tamper-proof screw provided.

Wire Connections

The following connection options are available. For more information on in-line connectors, refer to the document, *ORION Water Endpoints Installation Manual*, available at www.badgermeter.com.

HR-E LCD

The HR-E LCD encoder has a single cable, available with three different wiring options. Refer to [Figure 2](#).

- In-line connector
- Flying lead for field splice connection
- Prewired to an AMR/AMI endpoint

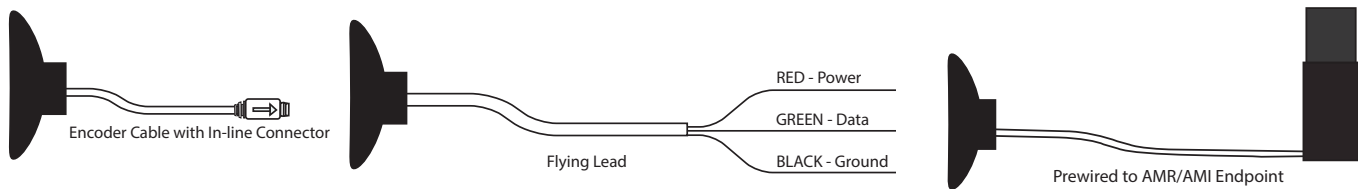


Figure 2: HR-E LCD wiring options

HR-E LCD 4-20

The HR-E LCD 4-20 encoder is available with dual output wire connections. Refer to [Figure 3](#).

Encoder side cable

- In-line connector
- Flying lead for field splice connection

4-20 side cable

- Flying lead for field splice connection



Figure 3: HR-E LCD 4-20 wiring options

HR-E LCD

The HR-E LCD is a permanently sealed, electronic LCD absolute encoder which produces an industry standard ASCII encoded output.

Measurement Resolution

Recordall Disc Series	Size (in.)	9-Digit Encoder		
		Gallons	Cubic Feet	Cubic Meters
LP	5/8, 5/8 x 3/4	0.01	0.001	0.0001
M25	5/8, 5/8 x 3/4	0.01	0.001	0.0001
M35	3/4	0.01	0.001	0.0001
M40	1	0.01	0.001	0.0001
M55	1	0.01	0.001	0.0001
M70	1	0.01	0.001	0.0001
M120	1-1/2	0.1	0.01	0.001
M170	2	0.1	0.01	0.001

Recordall Turbo Series	Size (in.)	9-Digit Encoder		
		Gallons	Cubic Feet	Cubic Meters
T160	1-1/2	0.1	0.01	0.001
T200	2	0.1	0.01	0.001
T450	3	0.1	0.01	0.001
T1000	4	0.1	0.01	0.001
T2000	6	1	0.1	0.01
T3500	8	1	0.1	0.01
T5500	10	1	0.1	0.01
T6200	12	10	1	0.01
T6600	16	10	1	0.01
T10000	20	10	1	0.01

Recordall Compound Series	Size (in.)	9-Digit Encoder		
		Gallons	Cubic Feet	Cubic Meters
High Side T200	2	0.1	0.01	0.001
Low Side M25	2	0.01	0.001	0.0001
High Side T450	3	0.1	0.01	0.001
Low Side M25	3	0.01	0.001	0.0001
High Side T1000	4	0.1	0.01	0.001
Low side M35	4	0.01	0.001	0.0001
High Side T2000	6	1	0.1	0.01
Low Side M35	6	0.01	0.001	0.0001
High Side T3500	8	1	0.1	0.01
Low side M120	8	0.1	0.01	0.001

Endpoint Reading Resolution

IMPORTANT

The standard electronic encoder output resolution of the HR-E LCD encoder is 9 digits. Though the encoder output is 9-digit resolution, the reading resolution sent to the reading software is dependent on the endpoint that the encoder is connected to. Readings reported from the endpoints are the left-most significant digits of the encoder reading.

Endpoint Technology	Reading Resolution Reported to Reading Software
ORION Cellular, ORION Mobile M	9-digit reading, plus the extended message capability
ORION ME/ORION SE	8-digit reading, plus the extended message capability
ORION Classic (CE)	7-digit reading
GALAXY	6-digit reading

See the application brief, [HR-E LCD Encoder Test Circle Codes](#), available at www.badgermeter.com, for the appropriate test circle code/reading resolutions for the HR-E LCD encoder with ORION or GALAXY endpoints. Other output options are available for certain applications.







Status Indicators

Status indicators are sent as part of the encoder message to AMR/AMI systems that are capable of receiving an extended message, such as ORION Cellular, ORION Mobile M, ORION SE and ORION ME endpoints. The details can also be read through an IR interface.

Status indicators appear in the display as symbols that illuminate when the condition is active and dim when the condition is eliminated.

All HR-E LCD encoders are delivered in storage mode so that a meter alarm is not triggered. During storage mode, the meter model displays on the encoder. As water begins to flow through the meter, the encoder switches from storage mode to normal operation upon sensing two (2) revolutions of the meter magnet.

The following chart indicates the HR-E LCD encoder conditions when connected to an appropriate Badger Meter ORION endpoint. The chart does *not* apply to ORION Classic (CE) or GALAXY endpoints, or HR-E LCD encoders programmed to a resolution lower than a 9-digit output. The HR-E LCD encoder displays the information, but the extra information is not reported through the endpoints.

Status Indicator	Icon	Status Description	HR-E LCD Display	HR-E LCD with ORION Cellular, ORION Mobile M or ORION SE* and ORION ME* Endpoints <small>*Firmware version 1.8 or higher required</small>
Meter functioning correctly		Encoder operating correctly.	Continuous display on encoder as long as no other status indicators are triggered.	Indicator status not sent to the endpoint.
Encoder alarm		Several potential conditions may exist, including: Encoder removal Temperature limit exceeded (34...140° F) Magnetic tamper	Encoder alarm remains active for 35 days. The alarm automatically clears after 35 days if any of the 3 conditions has not recurred.	Encoder alarm sent to the endpoint until resolved.
Reverse flow		Encoder detects reverse flow.	Reverse flow alarm remains active for 35 days. The alarm automatically clears after 35 days if reverse flow condition has not recurred.	Encoder detects reverse flow and sends alarm message to the endpoint until resolved.
Suspected leak		Encoder detects 24 hours without one 15-minute interval of no flow.	The alarm clears automatically when a 15-minute no-flow interval occurs.	Encoder detects suspected leak and sends alarm message to the endpoint. If condition clears before message is sent to the endpoint, it is not reported.
30 day no usage		No measured flow in past 30 days.	The alarm is automatically cleared once flow occurs.	Encoder detects 30 days no usage and sends alarm to the endpoint. If condition clears before message is sent to the endpoint, it is not reported.
End of life battery indicator		Indicated battery life based on pre-calculated consumption.	Alarm activated at 19 years and does not clear.	Encoder sends alarm to the endpoint indefinitely. Permanent alarm after 19 years.

HR-E LCD 4-20

The HR-E LCD 4-20 is a permanently sealed, electronic LCD absolute encoder which produces an industry standard ASCII encoded output as well as a 4-20 mA DC output signal through a dual output wire design.

Measurement Resolution

Standard encoded output is 9 digits. The 4-20 signal from the encoder is proportional to the flow of fluid passing through the meter. Power for the 4-20 output signal device can be obtained from a 9...50V DC control loop. The default 20 mA setting of the signal is defined in the resolution chart.

Recordall Disc Series	Size (in.)	Encoder Output			Analog Output
		9-dial (gal)	9-dial (ft ³)	9-dial (m ³)	20 mA Set point (gpm)
LP	5/8, 5/8 x 3/4	0.01	0.001	0.0001	20
M25	5/8, 5/8 x 3/4	0.01	0.001	0.0001	25
M35	3/4	0.01	0.001	0.0001	35
M40	1	0.01	0.001	0.0001	40
M55	1	0.01	0.001	0.0001	55
M70	1	0.01	0.001	0.0001	70
M120	1-1/2	0.1	0.01	0.001	120
M170	2	0.1	0.01	0.001	170

Recordall Turbo Series	Size (in.)	Encoder Output			Analog Output
		9-dial (gal)	9-dial (ft ³)	9-dial (m ³)	20 mA Set point (gpm)
T160	1-1/2	0.1	0.01	0.001	200
T200	2	0.1	0.01	0.001	310
T450	3	0.1	0.01	0.001	550
T1000	4	0.1	0.01	0.001	1250
T2000	6	1	0.1	0.01	2500
T3500	8	1	0.1	0.01	4500
T5500	10	1	0.1	0.01	7000
T6200	12	10	1	0.01	8800
T6600	16	10	1	0.01	13200
T10000	20	10	1	0.01	19800

Recordall Compound Series	Size (in.)	Encoder Output			Analog Output
		9-dial (gal)	9-dial (ft ³)	9-dial (m ³)	20 mA Set point (gpm)
High Side T200	2	0.1	0.01	0.001	200
Low Side M25	2	0.01	0.001	0.0001	25
High Side T450	3	0.1	0.01	0.001	450
Low Side M25	3	0.01	0.001	0.0001	25
High Side T1000	4	0.1	0.01	0.001	1000
Low side M35	4	0.01	0.001	0.0001	35
High Side T2000	6	1	0.1	0.01	2000
Low Side M35	6	0.01	0.001	0.0001	35
High Side T3500	8	1	0.1	0.01	—
Low side M120	8	0.1	0.01	0.001	—

Analog Output

- The input pulses generated within the transmitter assembly are converted to a standard 4-20 mA control signal.
- This signal is proportional to the flow of fluid passing through the flow meter.
- Power for the device can be obtained from a 9...50V DC control loop.
- The default 20mA setting of the signal is defined in the registration section.

Endpoint Reading Resolution

IMPORTANT

The standard electronic encoder output resolution of the HR-E LCD 4-20 encoder is 9 digits. Though the encoder output is 9-digit resolution, the reading resolution sent to the reading software is dependent on the endpoint that the encoder is connected to. Readings reported from the endpoints are the left-most significant digits of the encoder reading.

Endpoint Technology	Reading Resolution Reported to Reading Software
ORION Cellular, ORION Mobile M	9-digit reading, plus the extended message capability
ORION ME/ORION SE	8-digit reading, plus the extended message capability
ORION Classic (CE)	7-digit reading

See the application brief, *HR-E LCD Encoder Test Circle Codes*, available at www.badgermeter.com, for the appropriate test circle code/reading resolutions for the encoder with ORION endpoints. Other output options are available for certain applications.







Status Indicators

Status indicators are sent as part of the encoder message to AMR/AMI systems that are capable of receiving an extended message, such as ORION Cellular, ORION Mobile M, ORION SE and ORION ME endpoints. The details can also be read through an IR interface.

Status indicators appear in the display as symbols that illuminate when the condition is active and dim when the condition is eliminated.

All HR-E LCD 4-20 encoders are delivered in storage mode so that a meter alarm is not triggered. During storage mode, the meter model displays on the encoder. As water begins to flow through the meter, the encoder switches from storage mode to normal operation upon sensing two (2) revolutions of the meter magnet.

The following chart indicates the HR-E LCD 4-20 encoder conditions when connected to an appropriate Badger Meter ORION endpoint. The chart does *not* apply to ORION Classic (CE) or GALAXY endpoints, or HR-E LCD 4-20 encoders programmed to a resolution lower than a 9-digit output. The HR-E LCD 4-20 encoder displays the information, but the extra information is not reported through the endpoints.

Status Indicator	Icon	Status Description	HR-E LCD 4-20 Display	HR-E LCD 4-20 with ORION Cellular, ORION Mobile M or ORION SE* and ORION ME* Endpoints <small>*Firmware version 1.8 or higher required</small>
Meter functioning correctly		Encoder operating correctly.	Continuous display on encoder as long as no other status indicators are triggered.	Indicator status not sent to the endpoint.
Encoder alarm		Several potential conditions may exist, including: Encoder removal Temperature limit exceeded (34...140° F) Magnetic tamper	Encoder alarm remains active for 35 days. The alarm automatically clears after 35 days if any of the 3 conditions has not recurred.	Encoder alarm sent to the endpoint until resolved.
Reverse flow		Encoder detects reverse flow.	Reverse flow alarm remains active for 35 days. The alarm automatically clears after 35 days if reverse flow condition has not recurred.	Encoder detects reverse flow and sends alarm message to the endpoint until resolved.
Suspected leak		Encoder detects 24 hours without one 15-minute interval of no flow.	The alarm clears automatically when a 15-minute no-flow interval occurs.	Encoder detects suspected leak and sends alarm message to the endpoint. If condition clears before message is sent to the endpoint, it is not reported.
30 day no usage		No measured flow in past 30 days.	The alarm is automatically cleared once flow occurs.	Encoder detects 30 days no usage and sends alarm to the endpoint. If condition clears before message is sent to the endpoint, it is not reported.
End of life battery indicator		Indicated battery life based on pre-calculated consumption.	Alarm activated at 19 years and does not clear.	Encoder sends alarm to the endpoint indefinitely. Permanent alarm after 19 years.



City of Fullerton, RFP #2526-RFP-007 WATER METERS Request for Proposal (RFP) 2526-RFP-007, February 23, 2026

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