NEW YORK
AMERICAN WATER

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April 22, 2016

Hon. Kathleen H. Burgess
Secretary to the Commission
State of New York Public Service Commission
Building 3, Empire State Plaza
Albany, New York 12223

Re: Petition of NEW YORK AMERICAN WATER COMPANY, INC. for Approval to use Badger Meter HR E LCD Encoder Registers

Case No. 16-W-____

Dear Secretary Burgess:

Please accept this letter petition in lieu of a more formal filing. For the reasons set out below, New York American Water Company, Inc. ("NYAW" or the "Company") respectfully requests that the New York State Public Service Commission ("Commission") approve, pursuant to 16 NYCRR § 500.3(c), the Company's use of Badger Meter HR E LCD High Resolution E Series LCD display Encoder Registers to be used on already approved Badger Recordall Disc Series – Positive Displacement Meters. The use of this technology will allow NYAW to migrate to Automatic Meter Reading (AMR)/Advanced Metering Information (AMI), and has the following benefits and features:

BENEFITS

High resolution helps provide leak detection, resulting in improved customer service, reduced water loss (and therefore better conservation of water resources), and ultimately lower customer bills as a result of more timely leak detection and subsequent plumbing repairs.

- Encoder generated information can be used to manage customer service issues associated with high water usage.

- Ultimately, conversion to AMI will allow NYAW to better interact with its customers to explain their water usage patterns and allow the customers to monitor these patterns themselves, which can encourage wise water use. This type of information would also allow NYAW to better monitor usage to ensure proper metering has been installed, as well as provide the Company with information that it would utilize for water supply management and conservation.

- The encoder register's 20-year battery life helps provide reliable metering service. This encoder register is compatible with NYAW's ITRON technology that is already deployed within its service territory, and so can be transitioned into the field immediately, resulting in efficiency of operations.

FEATURES

Below is a summary of the meter's features, as also provided in the attachments to this letter petition:

- Factory programmed to customer specifications with field programming capabilities
- LCD display is customer friendly and automatically toggles between nine- and six-digit visual resolution, rate of flow, leak detection and meter model
- Built to withstand harsh environments, including flooded pits, through unique adhesive sealing technology.

Attached hereto is the manufacturer's information as required under 16 NYCRR § 500.3(c), including the name and address of the manufacturer, product description and performance data, photographs of the meter, general customer categories (referred to by meter sizes referenced in the attached materials), for which the utility intends to use these meters, and referrals to NSF/ANSI 61 AWWA Standards C-700 and C-707. See Attachment 1. Also attached is verification by NYAW's Manager of Field Operations that the information contained herein is complete.

Based on the data and information attached, Badger Meter equipment has proven to be a reliable and cost effective brand. NYAW is able to leverage economies of scale by purchasing these new type of encoder registers with prior approved meters through American Water.[1]

The Company will update this filing as necessary and appropriate, including the additional provision of information as required under 16 NYCRR § 500.3(c)(v).

Please do not hesitate to contact me should you require additional information or have any questions about this matter.

Respectfully submitted,

/s/ Suzana Duby

Suzana Duby

SD:dlc
Enc.

c: Kenneth Resca, NYSPSC
Ben Claase, NYAW

[1] Pricing information will be submitted to Staff under separate cover and pursuant to a claim for confidential treatment as NYAW considers this information to be commercially sensitive, pursuant to 16 NYCRR, Sections 5.8(e), 6-1.3 and 6-1.4.

State of New York

Public Service Commission

In the Matter of the Petition of NEW YORK AMERICAN WATER COMPANY, INC. for Approval to use Badger Meter HR E LCD Encoder Registers

VERIFICATION

Case 16-W-____

STATE OF NEW YORK)
ss.:
COUNTY OF NASSAU)

BEN J.M. CLAASE, being duly sworn, deposes and says:

I am Ben J.M. Claase, Manager of Field Operations for New York American Water Company, Inc. I am fully familiar with the facts presented in the Petition for approval to use Badger Meter HR E LCD Encoder Registers.

I have read the foregoing Petition and know the contents thereof. The facts asserted in the above-referenced Petition are true to the best of my knowledge.

Ben J.M. Claase, P.E.
Manager of Field Operations

Sworn to before me this
22 day of April, 2016

(Notary Public)

ROSE M. SIMPSON
Notary Public, State of New York
No. 01SI5031048
Qualified in Nassau County
Commission Expires July 25, 2018

Badger Meter | Making Water Visible®



Comprehensive Metering Line
Proven AMR/AMI Technology
Powerful Analytics

Water Utility Solutions

Today's Demanding Water Utility Management Challenges

Today's business environment demands informed decision making and control over your water utility management. It's essential you efficiently manage your operations, conserve water and energy, provide superior customer service, and achieve regulatory compliance—all while continuing to control revenue and resources.

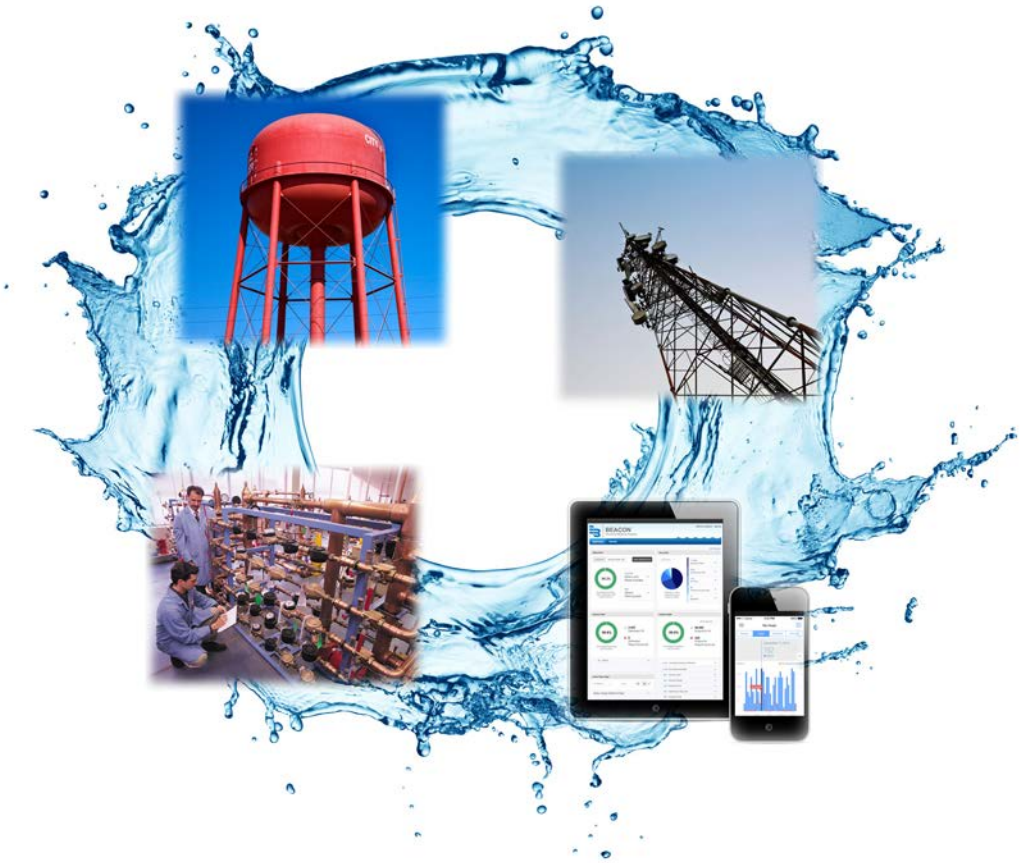
The more challenges you face, the more you need a reliable and knowledgeable partner who can supply you with durable and accurate metering hardware, and powerful yet adaptable technology solutions that give you greater visibility to timely, meaningful information.



All the Products, Technology and Expertise You Need in a Water Metering Partner

A leader in flow measurement technology since 1905, Badger Meter continues to be a key partner in helping public and private utilities and municipalities with their water management initiatives. Because we understand the challenges utilities encounter, we can provide the tools that help communities generate needed revenue, monitor and conserve their precious resources and serve their valued end water customers.

Today, our water utility solutions are top-rated and industry-leading. We offer a comprehensive metering line, proven AMR/AMI technology and the powerful analytics tools that truly help in Making Water Visible® for thousands of water utilities.



Choice Matters—Choose From Our Comprehensive Metering Solutions

We offer a comprehensive water meter product line for residential, commercial and fire service applications. All of our meters are regulation compliant and are available in a range of metering technologies, materials and sizes. Choose between our families of Recordall®, E-Series® or ModMAG® M-Series® meters. Choices include BiAlloy, Engineered Polymer or Stainless Steel in a wide range of sizing options. Your choice in a water metering solution counts—choose from the many Badger Meter offerings to find a solution that meets your specific needs.

Electronic Meters

For the latest in innovative metering technology, choose an electronic meter from Badger Meter. With no moving parts to impede the flow stream, electronic meters improve reliability, have greater extended low flow accuracy and keep maintenance to a minimum.

- E-Series Ultrasonic Meters
- ModMAG M-Series Electromagnetic Meters



Electronic Meters



Mechanical Meters

For an accurate, cost-effective solution for your residential, commercial or fire service metering needs, choose one of our Recordall® mechanical meters. These time-tested meters are an ideal solution for measuring flow in a wide variety of applications.

- Recordall Disc Series Meters
- Recordall Compound Series Meters
- Recordall Turbo Series Meters
- Recordall Fire Service Meters and Assemblies
- Recordall Fire Hydrant Meters

Mechanical Meters



Encoders

Badger Meter high resolution encoders (HR-E® LCD and HR-E®) provide utilities with more than just a reading. Whether you choose the 9 digit LCD or the 8-dial HR-E encoder, the high resolution encoded output provides leak detection and other critical information to help utilities manage their water. High resolution encoders utilize the industry standard communication protocol, do not require programming or setting adjustments during installation or wire repair. And, through a unique sealing process that eliminates gaskets, Badger Meter encoders are built to withstand harsh environments including flooded pits.

- High Resolution LCD Encoders
- High Resolution Encoders

Encoders



All of our meters and encoders are compatible with Badger Meter AMR/AMI systems as well as other approved technologies.

Our Comprehensive Metering Lines

E-Series® Ultrasonic Meters

E-Series Ultrasonic meters are designed to reduce maintenance, improve accuracy and durability, lower operating costs, and minimize water loss.



- Available in both a stainless steel (5/8…2 in.) and engineered polymer (5/8 in., 5/8 x 3/4 in., 1 in.).
- Simplified one-piece electronic meter and register integral to the meter body eliminates tampering.
- No moving parts eliminates mechanical wear.
- Delivers long-term sustained accuracy within ±1.5%.
- Complies with the lead-free provisions of the Safe Drinking Water Act.
- NSF/ANSI standards 61 and 372 certified.

ModMAG® M-Series® Electromagnetic Meters

ModMAG M-Series meters improve accuracy, decrease system maintenance and help meet the demands of challenging fluid conditions.



- Non-intrusive, completely open-flow tube design virtually eliminates pressure loss.
- No moving parts to impede the flow stream; maintenance is kept to a minimum—even in less-than ideal fluid conditions.
- Complies with the lead-free provisions of the Safe Drinking Water Act.
- NSF/ANSI standards 61 and 372 certified.





Recordall® Disc Series Meters

Recordall Disc Series meters are an accurate, cost-effective solution for your residential metering needs. Our positive displacement meters utilize the industry-leading accuracy of nutating disc technology to drive revenue and reliability.*

- Available in both a lead-free bronze alloy (5/8…2 in.) and engineered polymer (5/8 in., 5/8 x 3/4 in., 1 in.).
- Delivers precision accuracy with extended flow ranges from 1/8…170 GPM.
- Exceeds AWWA C700 and C710 standards and complies with the lead-free provisions of the Safe Drinking Water Act.
- NSF/ANSI standards 61 and 372 certified.



Recordall® Compound Series Meters

Recordall Compound Series meters combine two metering technologies in one innovative package. A positive displacement chamber measures low flow, while a turbine chamber records high flow.

- High crossover accuracy.
- Extended flow range from 1/4...4500 GPM.
- Floating rotor design reduces friction and wear.
- Features a "screw-in" valve assembly for easy field maintenance.
- Exceeds AWWA C702 standards and complies with the lead-free provisions of the Safe Drinking Water Act.
- NSF/ANSI standards 61 and 372 certified.



** As referenced by the Water Research Foundation.*

Our Comprehensive Metering Lines

Recordall® Turbo Series Meters

Recordall Turbo Series meters are the smart choice for larger facilities.

- Low pressure loss for improved efficiency.
- Extended flow range from 2-1/2...8,800 GPM.
- Floating rotor design reduces friction and wear.
- Exceeds AWWA C701 standards and complies with the lead-free provisions of the Safe Drinking Water Act.
- NSF/ANSI standards 61 and 372 certified in sizes 1-1/2...10 in.



Recordall® Fire Hydrant Meters

Recordall Fire Hydrant meters are ideal for a temporary source of water.

- Rugged stainless steel screen.
- Optional check valve and flow rate control valve.



Recordall® Fire Service Assemblies

Recordall Fire Series meters (FSMA) and assemblies (FSAA) are ideal for dedicated and multi-use fire service applications.

- FSMA – Ideal for measuring high volume through a single supply line.
- FSAA – Ideal for when the fire service main also supplies water for secondary services.
- Complies with the lead-free provisions of the Safe Drinking Water Act.
- NSF/ANSI standards 61 and 372 certified.







High Resolution LCD Encoder (HR-E® LCD)

High Resolution LCD encoders are fully electronic, solid-state, field programmable and utilize industry standard ASCII-communication protocol to provide high resolution encoded output. Status indicators/alarms can also be sent as part of the encoded output to endpoints capable of receiving extended messages. In addition, the HR-E LCD offers tamper resistant features such as encoder removal and magnetic tamper indicators to provide utilities with increased security.

- Factory programmed to customer specifications with field programming capabilities.
- LCD display automatically toggles between nine-and six-digit visual resolution, rate of flow and meter model.



High Resolution Encoder (HR-E®)

The HR-E 8-dial encoder utilizes a non-contact field-proven light emitting diode technology to provide a high resolution 8-digit reading while at the same time eliminating friction and wear of traditional mechanical encoders. The HR-E communicates using the industry standard ASCII-communication protocol to provide high resolution encoded output.

- High resolution 8-dial encoded output.
- Frictionless, non-contact wheel position encoding.



Turn Your Data into Proactive Intelligence

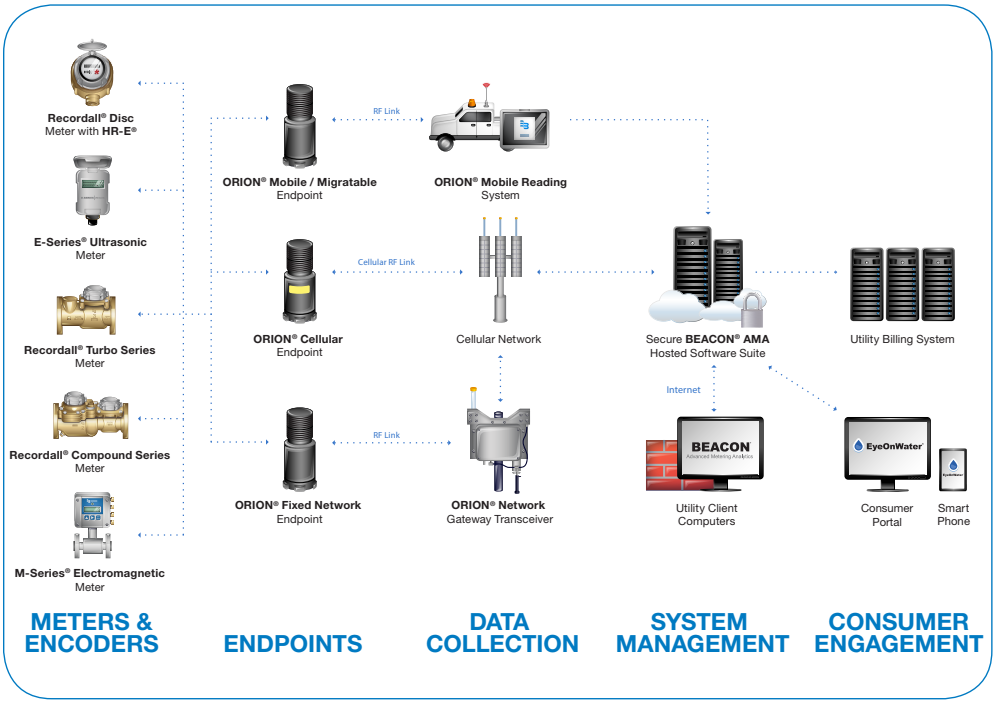
Fast, easy access to powerful information is imperative for utilities. You need it. Your customers expect it. And increasing government regulations demand it.

BEACON® Advanced Metering Analytics (AMA) puts your meter reading data to work to address your demands for actionable intelligence—and improve your water utility operations.

The Badger Meter managed, traditional fixed network, and mobile solutions all combine our comprehensive meter and encoder lines with proven ORION® communication technology and the robust BEACON AMA software suite to provide your utility management with greater visibility and control.

Your clear path to better utility management begins today with BEACON AMA.

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



BEACON Advanced Metering Analytics (AMA)

Analytics Made Easy

Built on a century of water metering experience and the latest technology, the cloud-based BEACON AMA software suite and proven ORION® family of endpoints bring a new level of utility-optimizing information to light. BEACON AMA provides valuable benefits:

The BEACON AMA software suite and ORION family of endpoints bring utility-optimizing information to light

Increased Visibility Through Analytics

- Customizable dashboards to deliver system-wide information to your desktop or device.
- The ability to set unique alert conditions to define and proactively monitor exceptions.
- Secure, hosted platform—ISO 27001 and SOC 2 certified for data security.
- Automatic software upgrades keep your system up to date without discs or downloads.
- Integration with your utility systems: billing, work order, inventory, Customer Relationship Management (CRM), and Geographic Information System (GIS).

Enhanced Customer Service

- Consumption graphs with temperature and precipitation overlays provide an easy-to-understand picture of how water is being used by each customer.
- Consumer engagement website and smartphone/tablet app provide your end water customers with easy access to their usage activity to gain a greater understanding and control of their consumption patterns.

Focus on Water Management

- All BEACON AMA solutions provide the hosted software platform, system maintenance, software support, and management information that allow you to focus your time and resources on managing your water delivery system.

Future-Proof Technology

- With a BEACON AMA solution, you receive the hosted BEACON AMA software suite with regular updates and the latest ORION communication technology to future-proof your investment and keep your system in step with changes in technology.



Customizable Solutions to Fit Your Needs

Badger Meter offers a choice of managed, traditional fixed network, mobile, and consumer engagement solutions to meet your system management, water meter reading, reporting and outreach needs. Select the solution that is right for your utility:

Managed, Traditional Fixed Network, Mobile, and Consumer Engagement Solutions

- **Managed Solution**: Configured by Badger Meter for your utility, the managed solution approach provides built-in infrastructure management services and a system design that keeps you in step with technology.
- **Traditional Fixed Network Solution**: Our traditional point-to-point fixed network system combines smart meter endpoints with fixed network gateway transceiver technology.
- **Mobile Solution:** A comprehensive end-to-end solution for drive-by or walk-by meter reading, including migratable endpoints that are easily upgraded from mobile to fixed network data collection without rolling a truck or reprogramming the endpoint.
- **EyeOnWater® Consumer Engagement**: Powered by the hourly reads of a fixed network system, web portal and smartphone apps provide utility customers with access to their water consumption data, allowing them to view their usage activity and gain a greater understanding and control of the water they consume.

ORION® Endpoints

The BEACON AMA solutions utilize our time-tested ORION family of endpoints to capture interval meter reading data through cellular, fixed network, or mobile communication technologies.

ORION Cellular, Fixed Network (SE) and Migratable (ME) Endpoints

- **ORION Cellular:** Designed for maximum flexibility and rapid deployment, our water endpoint eliminates utility-owned infrastructure by utilizing existing cellular networks.
- **ORION Fixed Network (SE):** This system collects meter readings and enhances operations via a fixed network (AMI) system of gateways and endpoints.
- **ORION Migratable (ME):** This migratable mobile (AMR) system can be easily upgraded to a fixed network (AMI) system to evolve with your needs.



BEACON® Advanced Metering Analytics Software Suite

The BEACON AMA software suite is designed to transform your data into proactive intelligence and enhance your overall operations. Here are a few examples of the benefits you can expect:

Enhanced Customer Service

With access to timely information, respond to customer needs more effectively—and resolve billing issues quickly.

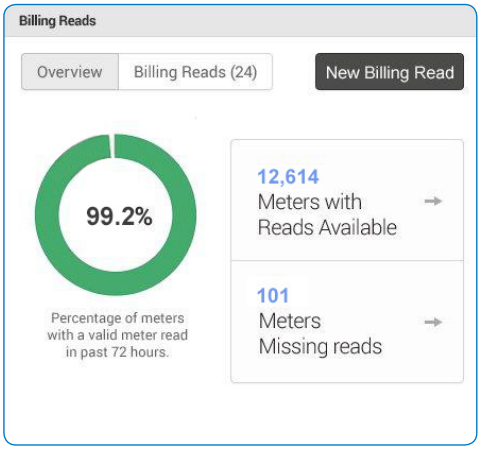
Analyze a consumption profile over selected time periods and rapidly respond to customer inquiries.



Simplified Revenue Management

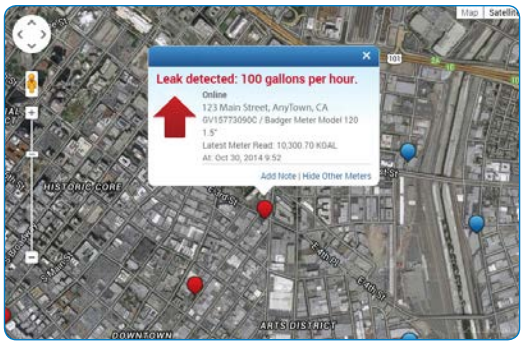
The system supports increased profitability by efficiently importing and exporting billing data.

Improve your process—and access information easily on user-friendly, intuitive screens.



Faster Leak Detection

Set leak detection alerts and thresholds to quickly understand where problems are occurring.



Set threshold and leak detection alerts to monitor water use.

Making Water Visible to Utilities and End Water Customers

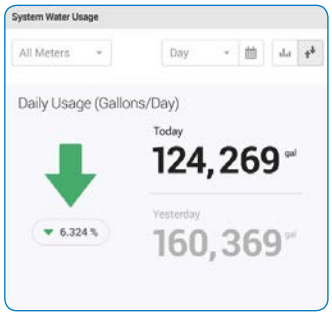
Allow end water customers to view and understand their usage profile through an easy-to-use consumer engagement website or smartphone/tablet app.



Consumers can use EyeOnWater Online or the EyeOnWater App to easily gain access to their water usage data.

Better Tools for Government Regulation Compliance

Streamline regulatory compliance by configuring a variety of reports within the BEACON AMA software suite.



Easily compile data for ever-changing compliance reporting.

Backed by World-Class Service & Support

To protect your investments, Badger Meter offers the service and support you need to keep your utility operations running smoothly and efficiently. Our team of experts is ready to assist you.

Customer Service & Technical Support | 800-616-3837

From general product applications to order placement, our friendly and knowledgeable Customer Service team supports you every step of the way during the ordering process. And, our Technical Support team provides you with the resources and technical assistance necessary to maximize your Badger Meter investments. Assistance is available 24 hours a day, seven days a week.

Field Support

When you need installation and project management for your meters or metering infrastructure, discover what Badger Meter Field Support has to offer. An accomplished team of experts is ready to assist you. We specialize in project management to help you get the most from your Badger Meter system.

Training Support

Maximize your utility operations with the wide range of learning opportunities offered by Badger Meter. Courses are designed to arm you and your team with the skills and best practices needed to maintain and promote successful operations.

Website

For more information, visit our website at www.badgermeter.com.



One drop at a time.

At Badger Meter, we know it all adds up. That's why we continually improve our products to be even more accurate, more efficient and more effective at measuring and tracking your water flow. With industry-leading initiatives like Advanced Metering Analytics (AMA), Badger Meter provides the solutions you need to help boost profitability and conservation efforts.

When every drop counts, choose Badger Meter. We focus on **Making Water Visible** so you can optimize your operation.



Making Water Visible®

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www.badgermeter.com

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INC-BR-00625-EN-06 (March 2016)

Badger Meter | HR-E® LCD Encoder



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 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.

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INTRODUCTION

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.

Audience and Purpose

This manual is intended to be used by utilities for installing and programming the HR-E® LCD Encoder.

PRODUCT OVERVIEW

Description

The HR-E LCD Encoder is a fully electronic, solid-state encoder with no moving parts.

Compatibility

The HR-E LCD Encoder 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 Encoder provides connectivity with Badger Meter ORION® and GALAXY® AMR/AMI endpoints and other AMR/AMI technology solutions approved by Badger Meter.

LCD Display

The HR-E LCD Encoder has 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 9-digit and 6-digit consumption (segmented leak detector in this mode), rate of flow and meter model.

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. Ex: 123456 with factor of x10 equals 1234560.

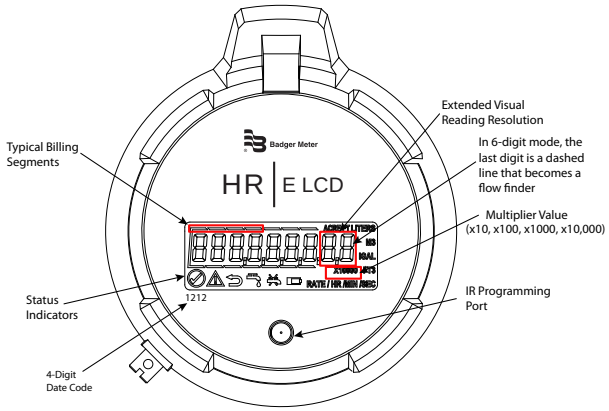


Figure 1: HR-E LCD Encoder face

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 30 seconds.

Model 25 Disc Series Meter Calibrated in Gallons



6-Digit Totalization

This mode is used to represent the typical 6 wheel odometer registration as seen on a mechanical encoder. When water is flowing through the meter, this display will include a series of moving segments to represent a flow finder. This screen displays for 20 seconds.

Model 25 Disc Series Meter Calibrated in Gallons



In 9- and 6-digit totalizer mode, the display also includes indicator lines above and below the digits to provide the electronic equivalent of the white and black number wheels seen on a mechanical encoder. The segmented lines above and below the numbers represent what the white number wheels do for the 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 encoder 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

This 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, and the unit of measure (gal, ft^3, m^3, 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" 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 HR-E LCD Encoder. See *"Endpoint Reading Resolution" on page 8 for more information.*

Visual Measurement Resolution

Recordall Disc Series	Size	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	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	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 HR-E LCD 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	9-digit reading, plus the extended message capability
ORION Migratable (ME)/Fixed Network (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. Optional 4-, 5- or 6-digit output is 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, Fixed Network (SE) and Migratable (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 a 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.

The following chart indicates the HR-E LCD Encoder conditions when connected to a Badger Meter ORION Cellular, Fixed Network or Migratable endpoint. The chart does *not* apply to ORION Classic (CE) or GALAXY endpoints, or HR-E LCD encoders programmed to 4.5- or 6-digit output. The HR-E LCD 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 or Fixed Network* and Migratable* Endpoints *Firmware version 1.8 or higher required**
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.
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.
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.
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.

INSTALLING THE HR-E LCD ENCODER

Bayonet Mount

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.

The HR-E LCD Encoder is available factory pre-wired to Badger Meter AMR/AMI products. The HR-E LCD Encoder 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 encoder on the water meter and secure it using the tamper-proof screw provided.

Wire Connections

The HR-E LCD is provided as either a factory-wired assembly or as an encoder with pre-sized wire harness available for connection in the field. Standardized lead lengths are 3, 10, 25 and 75 feet.

In-Line Connector

The In-line connector is an optional feature that allows connectivity to AMR/AMI devices without the need for a field splice kit.

INSTALLING THE PROGRAMMER SOFTWARE

Follow these steps for installing the HR-E LCD Encoder programmer software.

1. Double-click the **setup.exe** file to begin installation. The *Welcome* screen displays.

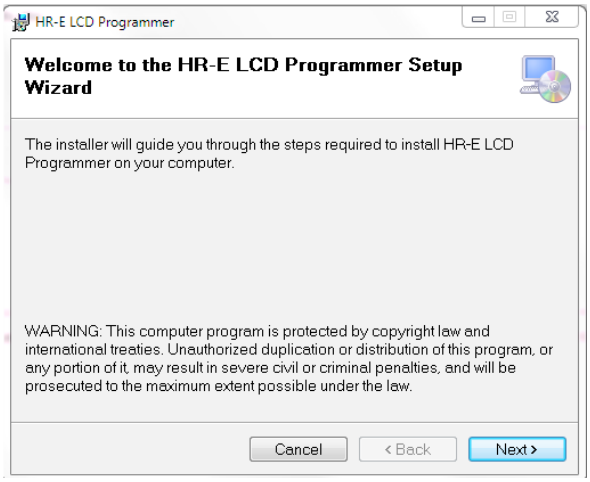


Figure 2: Software Installer Wizard Welcome screen

2. Click **Next**. The *Select Installation Folder* screen displays.

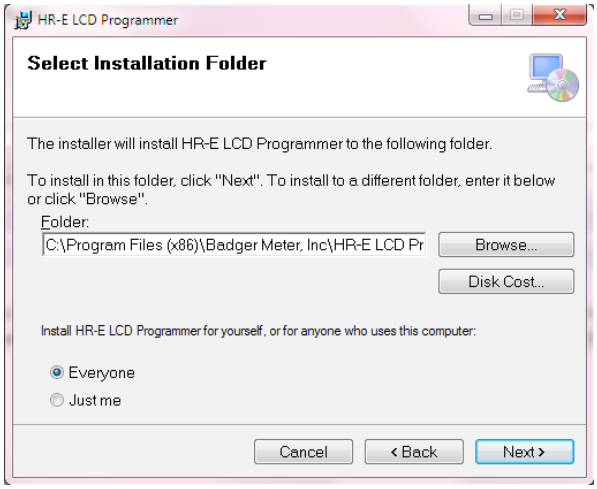


Figure 3: Software files location

3. Click **Next** to choose *Program Files,* the default location folder, or click **Browse** to choose another location.

The confirmation screen displays.

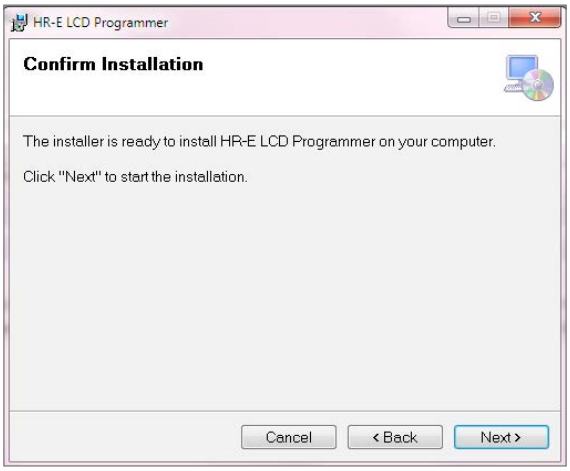


Figure 4: Ready to install

4. Click **Next** to start installation. A progress bar displays briefly. Then the *Installation Complete* screen displays.

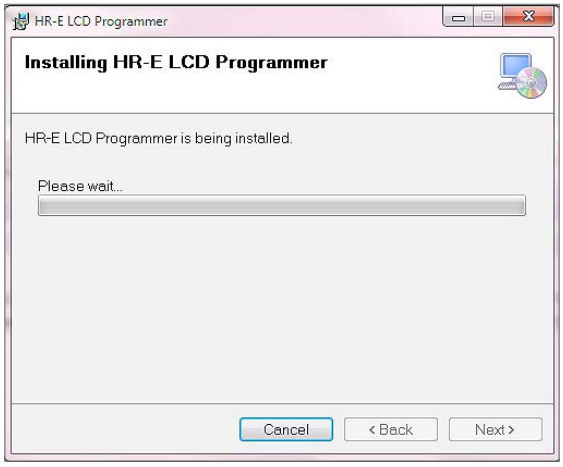


Figure 5: Progress bar shows installation in progress

5. At the *Installation Complete* screen, click **Close** to exit the installer. The HR-E LCD Programmer icon displays on the computer desktop.

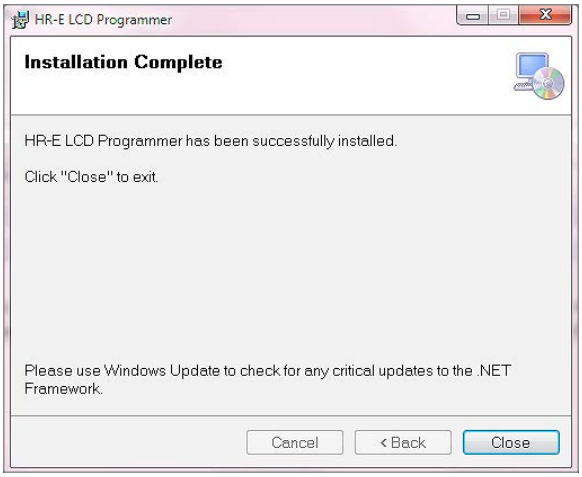


Figure 6: Installation complete

CONNECTING THE HR-E LCD ENCODER

To use the programming software, you must connect the IR programming and data profile cable (IR cable) to your computer serial port. If the computer does not have a serial port, you can use a serial-to-USB adapter.

Follow the steps below to connect the IR cable to the computer and the HR-E LCD Encoder.

Connecting the IR Cable to the Encoder

1. Plug the serial connector end of the IR cable into the computer serial port.

   NOTE: If using an adapter, plug the serial connector of the IR cable into the serial-to-USB adapter, then plug the USB adapter into the computer USB port.
2. Open the encoder lid.
3. Mount the IR head bracket onto the encoder, aligning the hole in the holder with the IR port on the encoder.
4. Place the IR head in the bracket with the nubs on the back of the IR head seated in the slots of the bracket. This placement facilitates correct alignment between the IR head and the encoder IR port. The connection is complete.

Parts List

67451-001	IR head bracket *(**Included** in the 67660-001 kit)*	
67572-009	HR-E LCD programmer software *(**Included** in the 67660-001 kit)*	(not shown)
64436-023	IR programming and data profile cable *(**Required**, but **not included** in the 67660-001 kit)*	
64436-029	Serial-to-USB adapter *(Optional)*	

STARTING THE SOFTWARE APPLICATION

1. Double-click the **HR-E LCD Programmer** desktop icon.

   The License Agreement displays the first time you access the software.

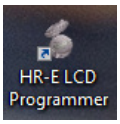


Figure 7: Desktop icon

   Read the License Agreement. If you agree, click **Accept License**.

   NOTE: The License Agreement must be accepted by an authorized representative of the customer/licensee. If you select **Decline License**, the program will not start.

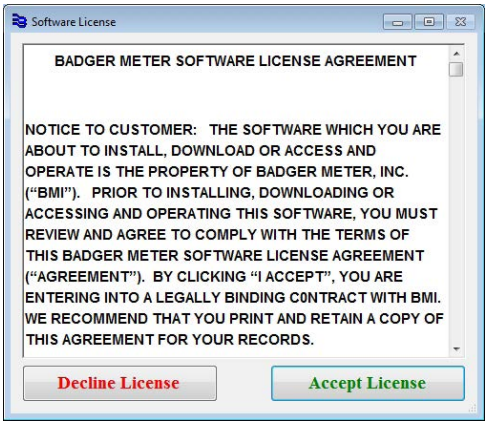


Figure 8: Software license agreement

   The *Splash* screen displays.

   The *Splash* screen includes the software version, and access to the license and trademarks information.

2. On the *Splash* screen, enter your initials in the *UserID/Initials* field.

   The field requires a user ID of three to five characters to activate the **OK** button.

   NOTE: Your sign-in initials are used in the product's log file to record any changes you make to the HR-E LCD Encoder.

   After you enter your *User ID*, click **OK** to display the *Programmer* screen.

   The programmer software is ready to use.

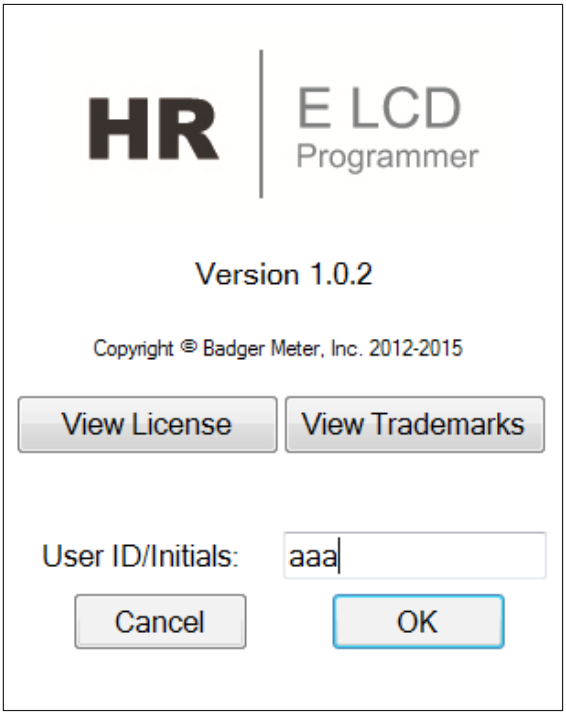


Figure 10: Splash screen

PROGRAMMING THE HR-E LCD ENCODER

From the software *Programmer* screen, you can view and change the parameters that are currently programmed into the HR-E LCD Encoder, as well as program new parameters into the HR-E LCD Encoder. You can also clear the encoder's reading.

Select the COM Port

The software communicates to the HR-E LCD Encoder via the selected *IR Port*.

NOTE: Make sure the IR cable is connected. See *"CONNECTING THE HR-E LCD ENCODER" on page 13* for additional information.

From the **IR Port** drop-down menu, select the COM port for the IR cable connected to the encoder.

The example in *Figure 11* shows **COM1** is selected.

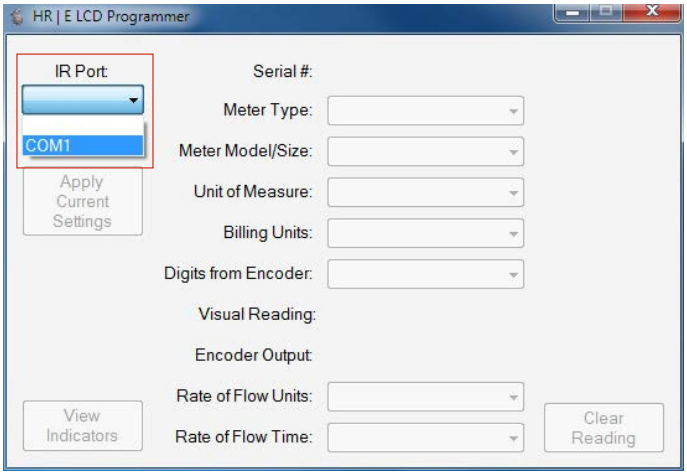


Figure 11: Select the COM port

Perform a Read

With the IR head aligned, click the **Read** button.

If the correct COM port is selected and a good response is received, the software populates the *Programmer* screen data fields with the encoder information as shown in *Figure 12*.

If the encoder is programmed the way you want, disconnect it from the IR bracket. If not, see *"Change Current Settings" on page 17*.

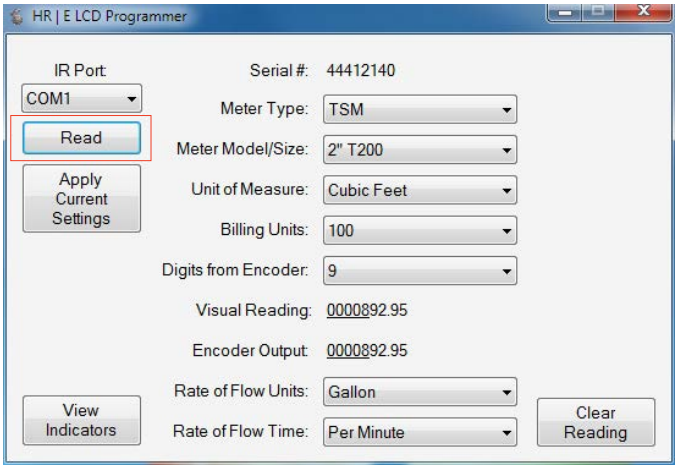


Figure 12: Encoder Read

Read Errors

If *no* COM port is selected, the error message in *Figure 13* displays. Click **OK**, select the correct COM port, and click **Read** again.

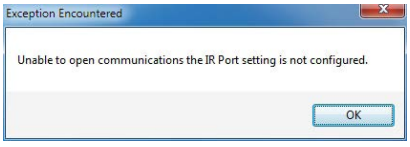


Figure 13: No COM port selected

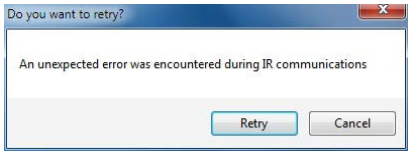


Figure 14: Wrong COM port selected

If the *wrong* COM port is selected, the error message in *Figure 14* displays. Click **Cancel**, select the correct COM port, and click **Read** again.

Change Current Settings

If you need to change the settings for the encoder, follow this procedure.

To set a new default value for any of the data fields:

1. Click the drop-down menu to the right of the field to display a list of values.
2. Click the value you want to set as the default for that field.

NOTE: The field label changes to **bold** text, indicating a new, unprogrammed value is selected. See the first four fields in *Figure 15*.

NOTE: You must set the default value for the *Meter Type* field before you set the *Meter Model / Size* field. The *Unit of Measure* value does not have to be the same as the *Rate of Flow Units* (even in a cubic foot meter, the flow rate can be gallons per minute).

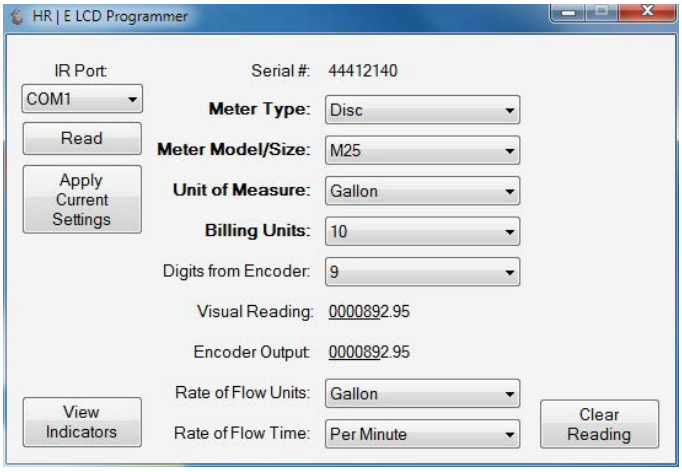


Figure 15: Unprogrammed values

Apply Current Settings

With the IR head aligned, click **Apply Current Settings** to program the new values to the encoder.

The new values display on the *Programmer* screen and the field labels are no longer bold. The encoder also goes into storage mode. In storage mode, the encoder displays the *Meter Type* and *Unit of Measure*. This is an example of an encoder display of a Model 25 Disc Meter measured in gallons:



Figure 16: Meter Type and Unit of Measure

If you have multiple encoders to program with the same settings, attach the IR head bracket with the IR cable to each encoder, one at a time, and click **Apply Current Settings** to program each encoder with the same settings.

HR-E LCD PROGRAMMER PARAMETERS

The HR-E LCD Programmer fields are described in this section.

Serial # Field

The *Serial* number field is a read-only field that displays the HR-E LCD Encoder factory-assigned serial number. You cannot change this number.

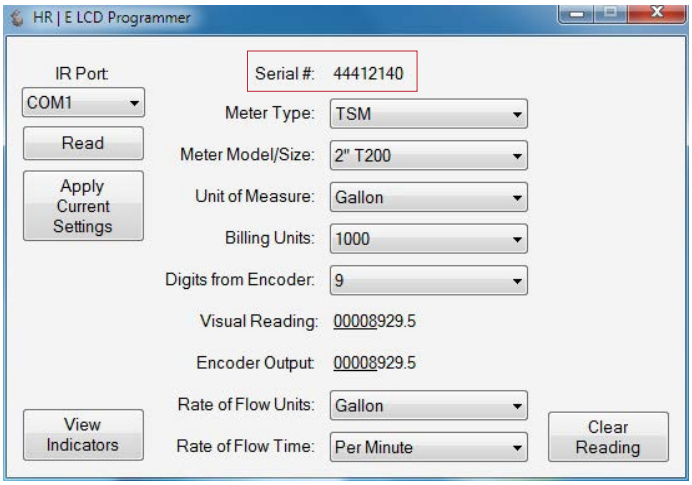


Figure 17: Encoder serial number

Meter Type Field

The *Meter Type* field displays the type of meter to which the encoder will connect.

Click the drop-down menu to the right of the data field to select the Meter Type. Available options are Disc, Compound (CSM), and Turbo (TSM).

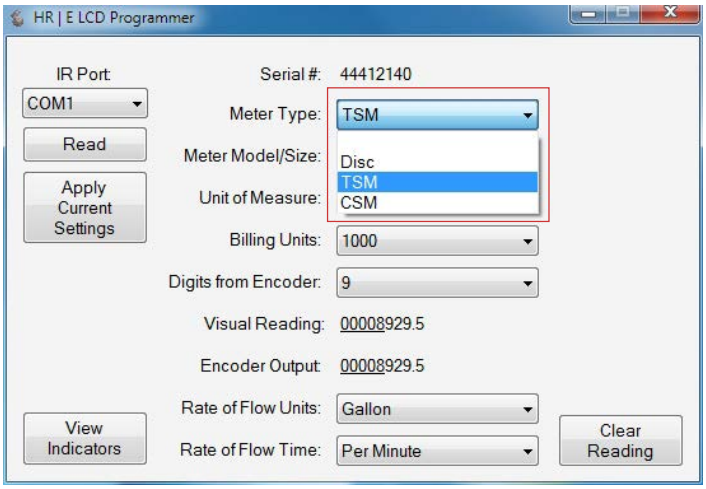


Figure 18: Meter Types

Meter Model/Size Field

The *Meter Model/Size* field auto-populates based on the *Meter Type* selected.

Click the drop-down menu to the right of the data field to select a Meter Model. Meter Sizes corresponding to the Meter Models in the drop-down menu are described in the table below.

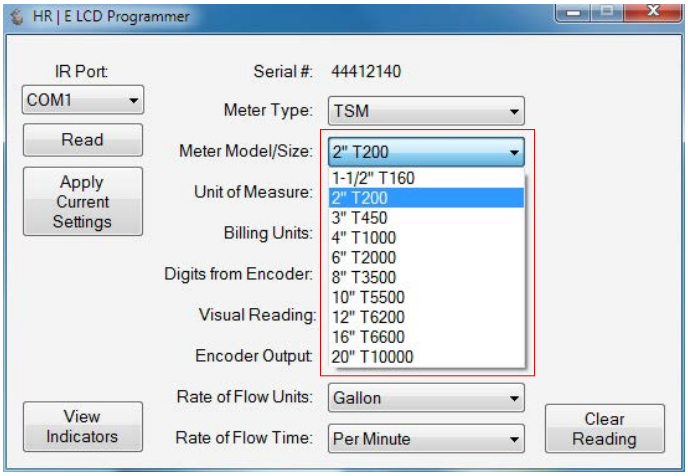


Figure 19: Meter Model and Size

For Recordall Combination Fire Service meters and assemblies, refer to the **Disc** and **TSM** columns of the table.

Disc	Model	CSM	Model	TSM	Model
5/8", 5/8"x 3/4"	LP	2"	High Side	1-1/2"	T160
5/8", 5/8"x 3/4"	M25	2"	Low Side	2"	T200
3/4"	M35	3"	High Side	3"	T450
1"	M40	3"	Low Side	4"	T1000
1"	M55	4"	High Side	6"	T2000
1"	M70	4"	Low Side	8"	T3500
1-1/2"	M120	6"	High Side	10"	T5500
2"	M170	6"	Low Side	12"	T6200
				16"	T6600
				20"	T10000

Unit of Measure Field

The *Unit of Measure* field displays the unit selected to measure the flow.

Click the drop-down menu to the right of the data field to select a Unit of Measure. The options are gallon, cubic meter, liters, cubic feet and Imperial gallon.

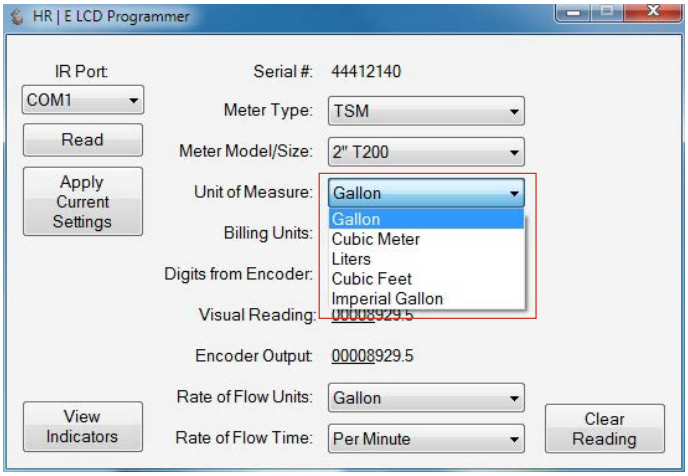


Figure 21: Unit of Measure

Billing Units Field

The *Billing Units* field displays the default usage units for which the customer is billed. The default is based on the Unit of Measure selected:

Unit of Measure	Default Billing Unit
Gallons, liters, imperial gallons	1000
Cubic feet	100
Cubic meters	1

Click the drop-down menu to the right of the data field to select a Billing Unit.

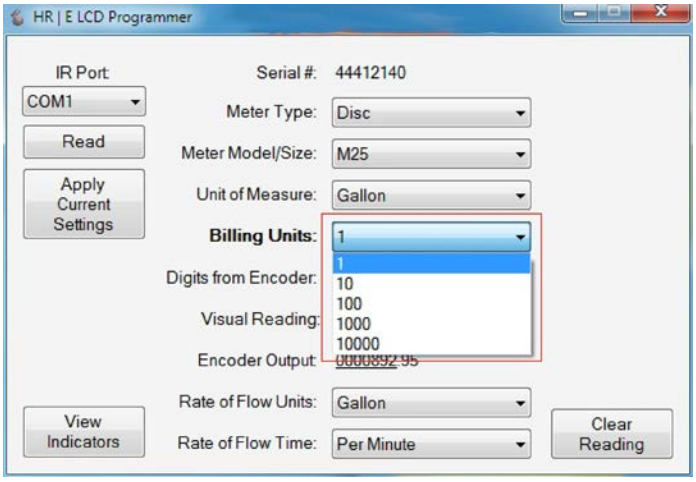


Figure 22: Billing Units

Digits from Encoder Field

The *Digits from Encoder* field displays the number of digits the encoder is programmed to send to the endpoint. These options include 4, 5, 6 and 9 digits. Readings reported from an encoder programmed to 4, 5 and 6 digits are the left-most significant digits. Changing this value affects the *Encoder Output* field.

Click the drop-down menu to the right of the data field to select a different encoder output resolution.

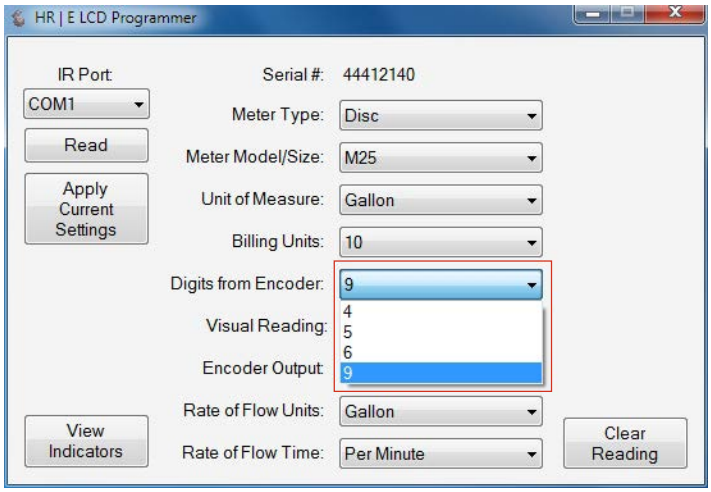


Figure 23: Encoder digits

IMPORTANT

Be very careful with the Digits from Encoder feature! Changes will affect the reading resolution sent to the endpoint and in your reading data management system.

Visual Reading and Encoder Output Fields

The *Visual Reading* field is a read-only field that displays the current meter reading as a real number. The number of decimal places is determined by the units and meter size. You cannot change this number.

The *Encoder Output* field is a read-only field that displays the reading resolution being sent from the encoder. Changing the *Digits from Encoder* field affects the *Encoder Output* field.

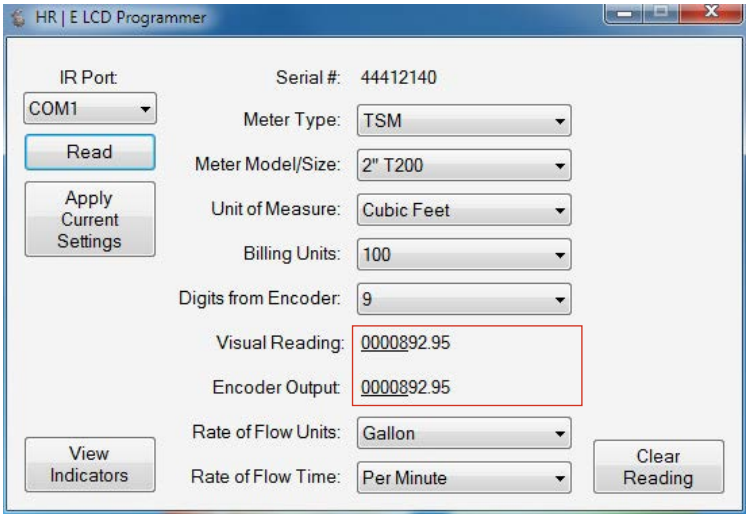


Figure 24: Visual Reading and Encoder Output

Rate of Flow Units Field

The *Rate of Flow Units* field displays the unit by which the rate of flow is measured. The factory-programmed default is *Gallon*.

Click the drop-down menu to the right of the data field to select a Rate of Flow Units. The options are gallons, cubic meter, liter, cubic feet and Imperial gallons.

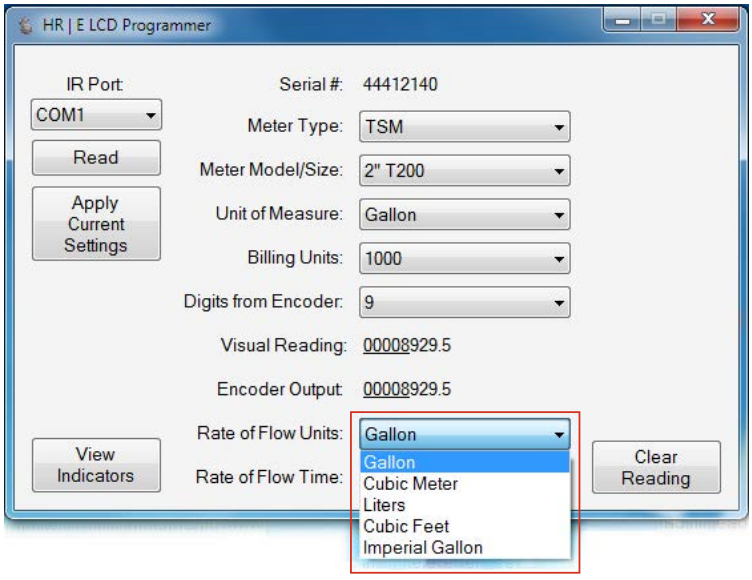


Figure 25: Rate of Flow Units

Rate of Flow Time Field

The *Rate of Flow Time* field displays the time unit set for the rate of flow. The factory-programmed default is *Per Minute*.

Click the drop-down menu to the right of the data field to select a Rate of Flow Time. The options are seconds, minutes or hours.

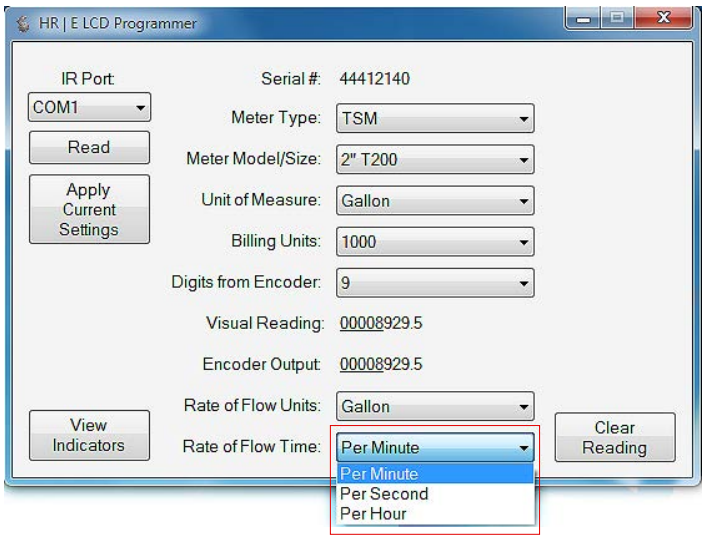


Figure 26: Rate of Flow Time

View Indicators

The **View Indicators** button displays the current status indicators for the selected meter.

Status indicator options are Encoder Removal, 30 Day No Usage, Suspected Leak, Programmed, End of Battery Life, Reverse Flow, Magnetic Tamper and Temperature Limit Exceeded. For descriptions of these indicators, see *"Status Indicators" on page 9*.

1. With the IR head aligned, click **View Indicators**. The Status Indicators pop-up window displays.
2. To clear the indicators, click **Clear Indicators** in the pop-up window.

   NOTE: The **Clear Indicators** button does NOT clear the *Programmed* indicator.
3. Click **Close** to exit the window.

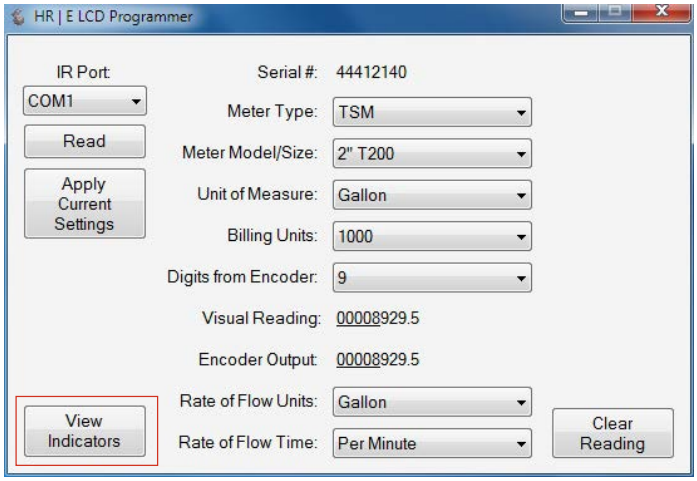


Figure 27: View Indicators

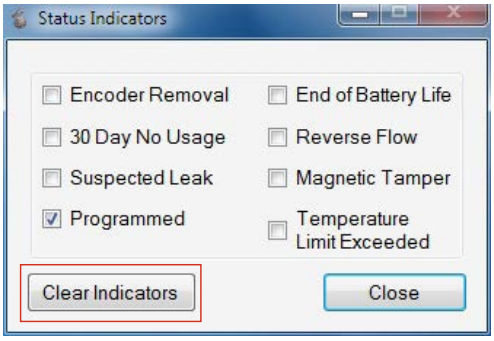


Figure 28: Status Indicators

Clear Reading

The **Clear Reading** button deletes ALL readings for the selected meter.

IMPORTANT

*Be very careful with the **Clear Reading** feature! If you select this option, a pop-up message displays, asking you to enter a password to confirm the deletion. Contact Badger Meter Technical Support for the password.*

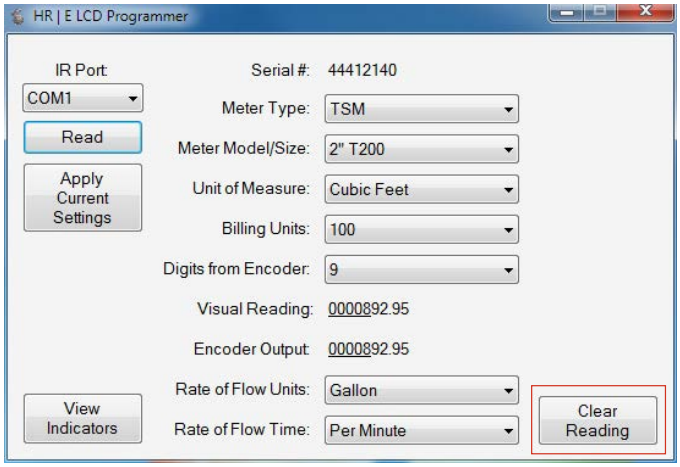


Figure 29: Clear all readings



Figure 30: Password required

Exiting the Software Application

To exit and close the software application, click the X in the top right corner of the software screen.

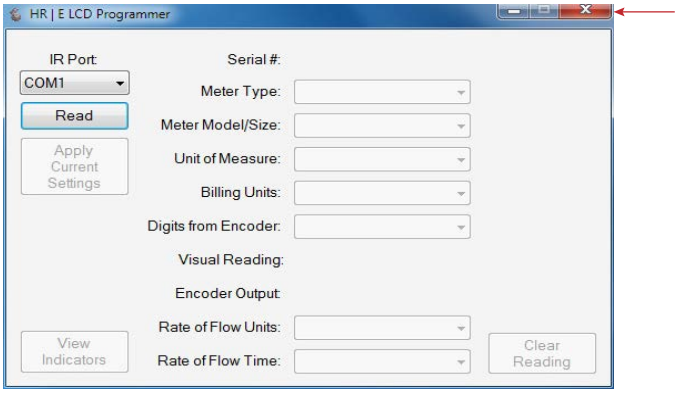


Figure 31: Programmer screen

TROUBLESHOOTING

Issue	Probable Cause	Solution
Programmer screen is blank after a Read.	Bad connection.	Check for damaged or broken wires.
	COM Port not specified.	Select a COM Port from the IR Port drop-down menu.
Error message displayed after clicking an option on the programmer screen.	IR head not aligned with encoder.	Align the IR head with the IR port on the encoder.
Encoder alarm	While in regular operational mode, the encoder is tilted or removed from the meter.	Align the IR head with the IR port on the encoder. Keep the encoder still.

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Legacy Document Number: LCD-IOM-01-EN

Badger Meter | HR-E® LCD Encoder

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") high
Weight	11 ounces
Humidity	0…100% condensing
Temperature	Storage: – 40…60° C (– 40…140° F) Max. ambient for 1 hr: 72° C (150° 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 (patent pending) 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 30 seconds.
- 6-digit consumption (segmented leak detector in this mode) displays for 20 seconds.
- Rate of flow displays for 5 seconds.
- Meter model displays for 5 seconds.

DIMENSIONAL DRAWINGS

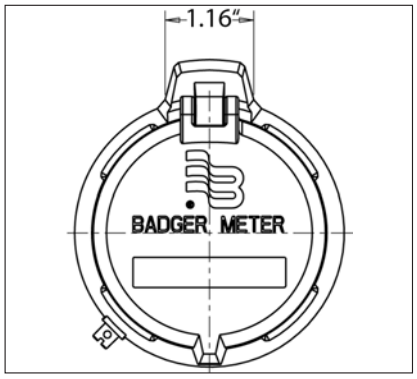


Figure 1: Top view

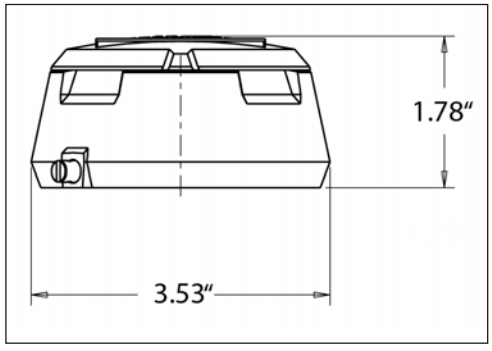


Figure 2: Front view

MEASUREMENT RESOLUTION

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

Recordall Disc Series	Size	9-dial encoder output (gal)	9-dial encoder output (ft^3)	9-dial encoder output (m^3)
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	9-dial encoder output (gal)	9-dial encoder output (ft^3)	9-dial encoder output (m^3)
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	9-dial encoder output (gal)	9-dial encoder output (ft^3)	9-dial encoder output (m^3)
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.

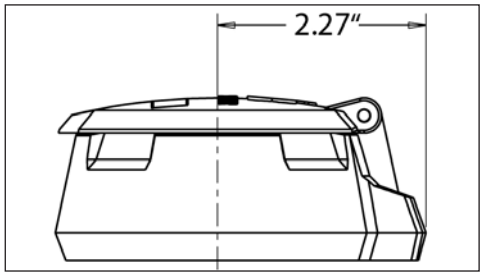


Figure 3: Left side view

Making Water Visible®

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Badger Meter

How to Read an Encoder

HR | E LCD Encoder and E-Series® Meters with High Resolution Protocol

The HR-E LCD encoder has a 9-digit Liquid Crystal Display (LCD) to show consumption, flow and alarm information. The display automatically toggles between 9-digit and 6-digit consumption, rate of flow and meter model.

VISUAL READING DISPLAYS

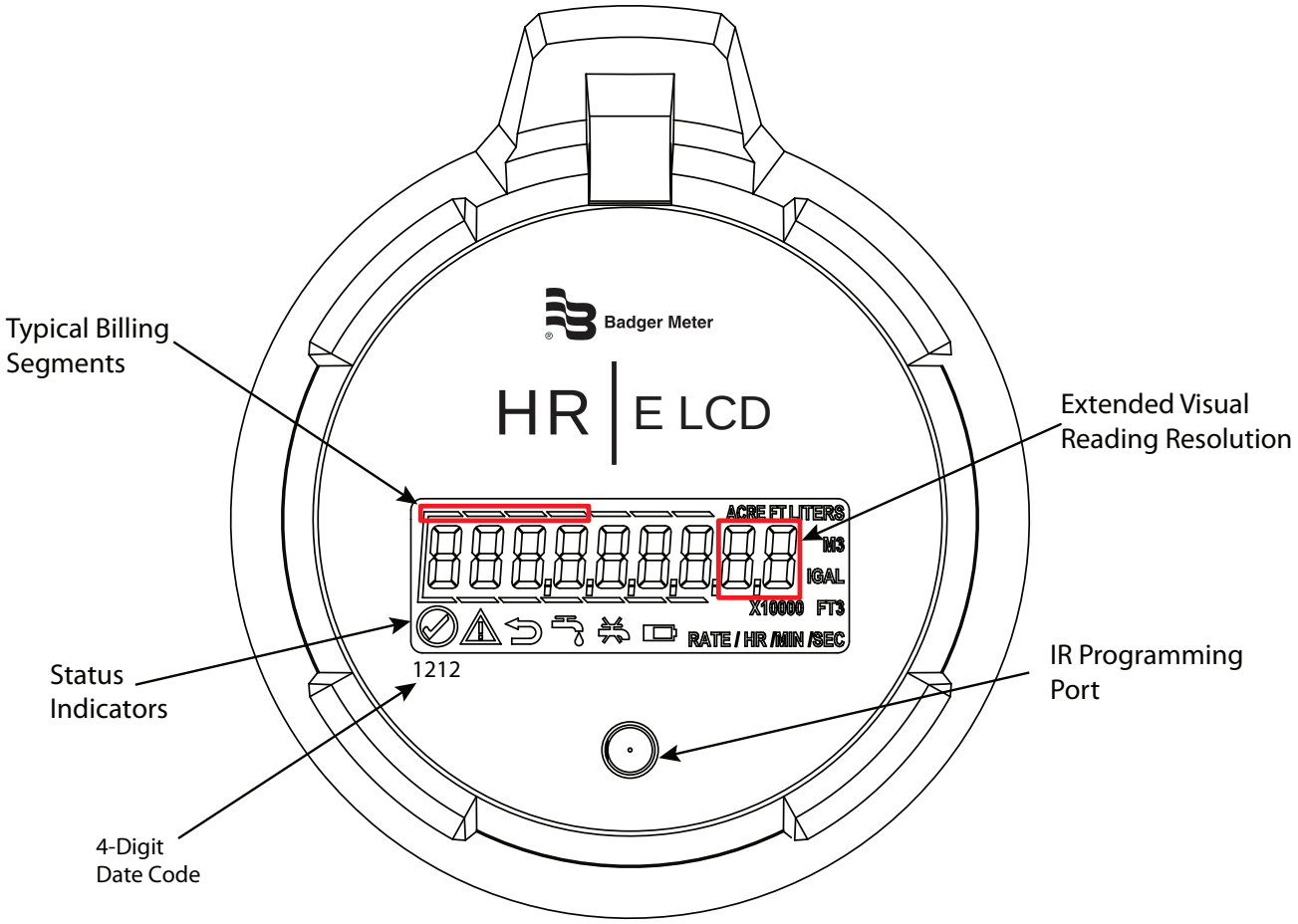
- The 9-digit display provides your utility with the finest reading resolution.
- The 6-digit display represents the equivalent of the moveable number wheels on a 6-dial mechanical encoder.

UTILITY BILLING STANDARDS FOR METER READING

Typical 6-wheel odometer registration is designed with white and black number wheels for local readability with the white number wheels corresponding to the "typical" utility standard meter reading units:

- Gallons – reading to the nearest 1000 gallons
- Cubic Feet – reading to the nearest 100 ft^3
- Cubic Meters – reading to the nearest 10 m^3

The HR-E LCD encoder is designed with segmented lines above the numeric dials. The segmented lines above the numbers on the LCD display represent what the white numbers wheels do for the mechanical encoders—the typical utility standard meter reading.



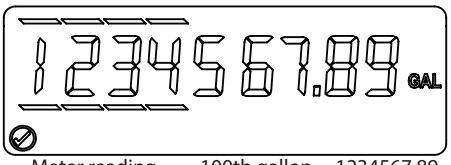
GALLONS

Typical Billing Unit of 1000 Gallons

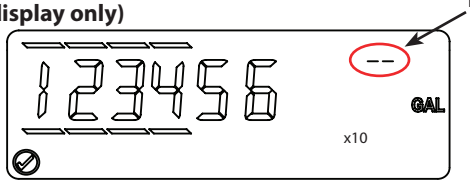
9-DIGIT VISUAL DISPLAY

6-DIGIT VISUAL DISPLAY

Recordall Disc LP, M25, M35, M40, M55, M70, Recordall CSM 2", 3", 4", 6" Low Side, E-Series E-25, E-35, E-55 (9-digit display only)

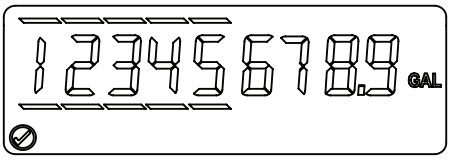


Meter reading to the nearest?
100th gallon = 1234567.89
10th gallon = 1234567.8
1 gallon = 1234567
10 gallons = 123456
100 gallons = 12345
Typical Billing Units → 1000 gallons = 1234

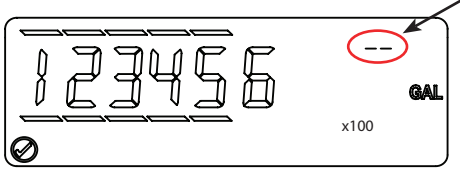


Meter reading to the nearest?
1 gallon = 1234560
10 gallons = 123456
100 gallons = 12345
Typical Billing Units → 1000 gallons = 1234

Recordall Disc M120 & M170, Recordall TSM 1-1/2", 2", 3" & 4", Recordall CSM 2", 3" & 4 High Side, Recordall Combo 8" Low Side, E-Series E-1-1/2" & E-2" (9-digit display only)

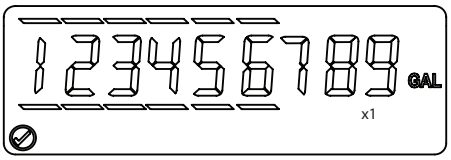


Meter reading to the nearest?
10th gallon = 12345678.9
1 gallon = 12345678
10 gallons = 1234567
100 gallons = 123456
Typical Billing Units → 1000 gallons = 12345

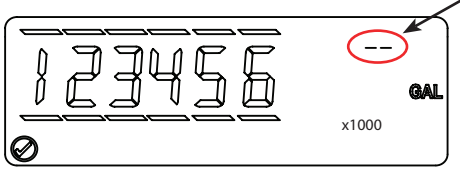


Meter reading to the nearest?
1 gallon = 12345600
10 gallons = 1234560
100 gallons = 123456
Typical Billing Units → 1000 gallons = 12345

Recordall TSM 6", 8" & 10", Recordall CSM 6" High Side, Recordall Combo 8" High Side

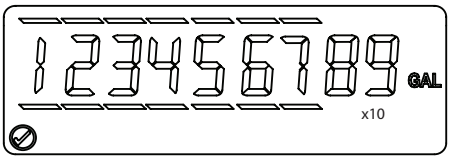


Meter reading to the nearest?
1 gallon = 123456789
10 gallons = 12345678
100 gallons = 1234567
Typical Billing Units → 1000 gallons = 123456

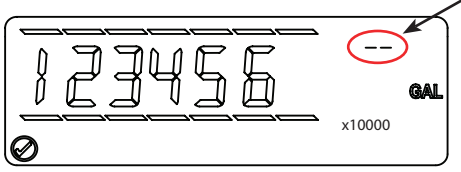


Meter reading to the nearest?
1 gallon = 123456000
10 gallons = 12345600
100 gallons = 1234560
Typical Billing Units → 1000 gallons = 123456

Recordall TSM 12", 16" and 20"



Meter reading to the nearest?
1 gallon = 1234567890
10 gallons = 123456789
100 gallons = 12345678
Typical Billing Units → 1000 gallons = 1234567
10000 gallons = 123456



Meter reading to the nearest?
1 gallon = 1234560000
10 gallons = 123456000
100 gallons = 12345600
Typical Billing Units → 1000 gallons = 1234560
10000 gallons = 123456

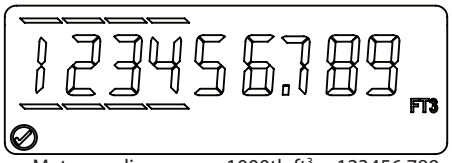
CUBIC FEET

Typical Billing Unit of 100 Cubic Feet

9-DIGIT VISUAL DISPLAY

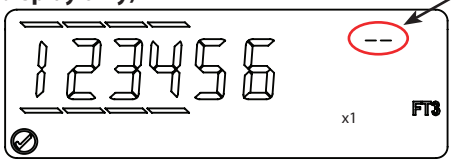
6-DIGIT VISUAL DISPLAY

Recordall Disc LP, M25, M35, M40, M55, M70, Recordall CSM 2", 3", 4", 6" Low Side, E-Series E-25, E-35, E-55 (9-digit display only)



Meter reading to the nearest?
Typical Billing Units →

1000th ft³ = 123456.789
100th ft³ = 123456.78
10th ft³ = 123456.7
1 ft³ = 123456
10 ft³ = 12345
100 ft³ = 1234

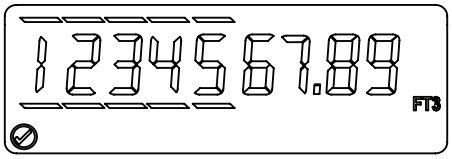


Flow Finder in this view

Meter reading to the nearest?
Typical Billing Units →

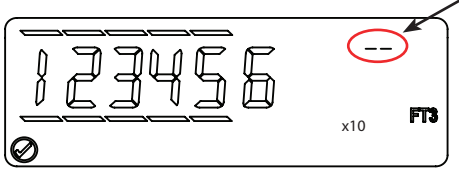
1 ft³ = 123456
10 ft³ = 12345
100 ft³ = 1234

Recordall Disc M120 & M170, Recordall TSM 1-1/2", 2", 3" & 4", Recordall CSM 2", 3" & 4" High Side, Recordall Combo 8" Low Side, E-Series E-1-1/2" & E-2" (9-digit display only)



Meter reading to the nearest?
Typical Billing Units →

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

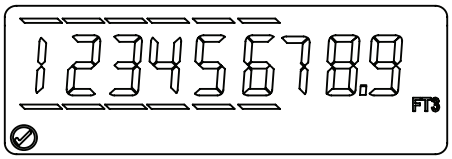


Flow Finder in this view

Meter reading to the nearest?
Typical Billing Units →

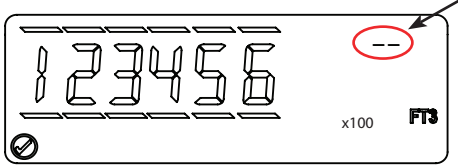
1 ft³ = 1234560
10 ft³ = 123456
100 ft³ = 12345

Recordall TSM 6", 8" & 10", Recordall CSM 6" High Side, Recordall Combo 8" High Side



Meter reading to the nearest?
Typical Billing Units →

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

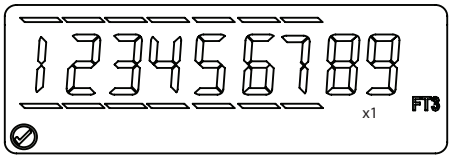


Flow Finder in this view

Meter reading to the nearest?
Typical Billing Units →

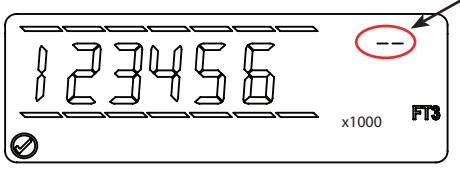
1 ft³ = 12345600
10 ft³ = 1234560
100 ft³ = 123456

Recordall TSM 12", 16" and 20"



Meter reading to the nearest?
Typical Billing Units →

1 ft³ = 123456789
10 ft³ = 12345678
100 ft³ = 1234567



Flow Finder in this view

Meter reading to the nearest?
Typical Billing Units →

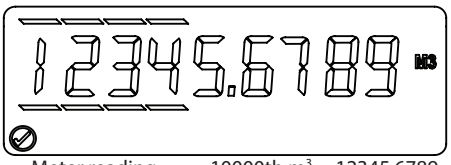
1 ft³ = 123456000
10 ft³ = 12345600
100 ft³ = 1234560

CUBIC METERS

Typical Billing Unit of 10 Cubic Meters

9-DIGIT VISUAL DISPLAY

Recordall Disc LP, M25, M35, M40, M55, M70, Recordall CSM 2", 3", 4", 6" Low Side, E-Series E-25, E-35, E-55 (9-digit display only)



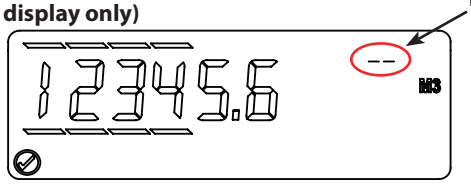
Meter reading to the nearest?
- 10000th m³ = 12345.6789
- 1000th m³ = 12345.678
- 100th m³ = 12345.67
- 10th m³ = 12345.6
- 1 m³ = 12345
- 10 m³ = 1234

Typical Billing Units →

6-DIGIT VISUAL DISPLAY

Recordall Disc LP, M25, M35, M40, M55, M70, Recordall CSM 2", 3", 4", 6" Low Side, E-Series E-25, E-35, E-55 (9-digit display only)

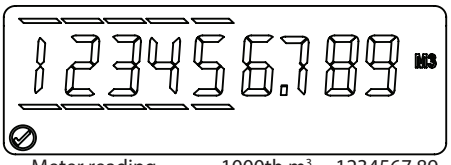
Flow Finder in this view



Meter reading to the nearest?
- 10th m³ = 123456
- 1 m³ = 12345
- 10 m³ = 1234

Typical Billing Units →

Recordall Disc M120 & M170, Recordall TSM 1-1/2", 2", 3" & 4", Recordall CSM 2", 3" & 4" High Side, Recordall Combo 8" Low Side, E-Series E-1-1/2" & E-2" (9-digit display only)

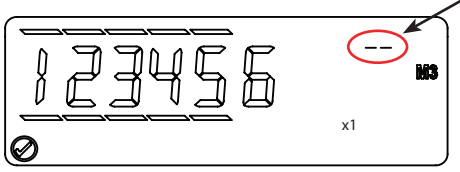


Meter reading to the nearest?
- 1000th m³ = 1234567.89
- 100th m³ = 1234567.8
- 10th m³ = 1234567
- 1 m³ = 123456
- 10 m³ = 12345

Typical Billing Units →

Recordall Disc M120 & M170, Recordall TSM 1-1/2", 2", 3" & 4", Recordall CSM 2", 3" & 4" High Side, Recordall Combo 8" Low Side, E-Series E-1-1/2" & E-2" (9-digit display only)

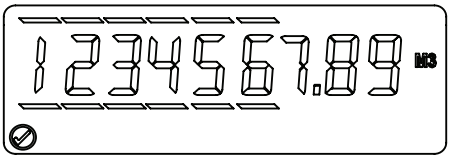
Flow Finder in this view



Meter reading to the nearest?
- 1 m³ = 123456
- 10 m³ = 12345

Typical Billing Units →

Recordall TSM 6", 8" & 10", Recordall CSM 6" High Side, Recordall Combo 8" High Side

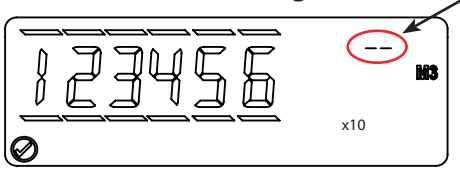


Meter reading to the nearest?
- 100th m³ = 1234567.89
- 10th m³ = 1234567.8
- 1 m³ = 1234567
- 10 m³ = 123456

Typical Billing Units →

Recordall TSM 6", 8" & 10", Recordall CSM 6" High Side, Recordall Combo 8" High Side

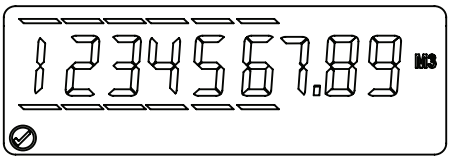
Flow Finder in this view



Meter reading to the nearest?
- 1 m³ = 1234560
- 10 m³ = 123456

Typical Billing Units →

Recordall TSM 12", 16" and 20"

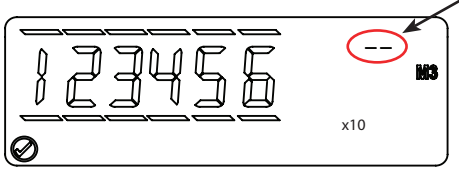


Meter reading to the nearest?
- 100th m³ = 1234567.89
- 10th m³ = 1234567.8
- 1 m³ = 1234567
- 10 m³ = 123456

Typical Billing Units →

Recordall TSM 12", 16" and 20"

Flow Finder in this view



Meter reading to the nearest?
- 1 m³ = 1234560
- 10 m³ = 123456

Typical Billing Units →

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Badger Meter, Inc.

Test Circle Codes

For HR-E® LCD Encoders

OVERVIEW

To convert an endpoint field reading into billing units, the reading data management software uses a Test Circle Code to identify the appropriate reading resolution to be applied to the endpoint meter reading. The Test Circle Code for high resolution encoders is based on the meter model and size, encoder type, unit of measure, and the Badger Meter® endpoint that is attached to the encoder.

A multiplier has also been provided for instances where test circle codes are not used, such as BEACON® AMA Software and partner connectivity. The multiplier calculates the decimal place and appropriate reading resolution.

For additional information, contact Badger Meter Technical Support.

TEST CIRCLE CODES FOR HR-E LCD AND E-SERIES® PROGRAMMED TO 9 DIGITS

9-Digit Gallons

Meter Model	Size	Encoder Resolution (9 Digits)	ORION® Cellular	ORION Fixed Network or Migratable Endpoints		ORION Classic Endpoints		GALAXY® Endpoints	
			Resolution Code (Multiplier)	Test Circle Code	Multiplier	Test Circle Code	Multiplier	Test Circle Code	Multiplier
Recordall Disc Series and E-Series									
LP	5/8", 5/8" x 3/4"	0.01	0.01	54	0.1	55	1	56	10
M25	5/8", 5/8" x 3/4"	0.01	0.01	54	0.1	55	1	56	10
M35	3/4"	0.01	0.01	54	0.1	55	1	56	10
M40	1"	0.01	0.01	54	0.1	55	1	56	10
M55	1"	0.01	0.01	54	0.1	55	1	56	10
M70	1"	0.01	0.01	54	0.1	55	1	56	10
E-Series	5/8…1"	0.01	0.01	54	0.1	55	1	56	10
M120	1-1/2"	0.1	0.1	55	1	56	10	57	100
M170	2"	0.1	0.1	55	1	56	10	57	100
E-Series	1-1/2", 2"	0.1	0.1	55	1	56	10	57	100
Recordall Turbo Series									
T160	1-1/2"	0.1	0.1	55	1	56	10	57	100
T200	2"	0.1	0.1	55	1	56	10	57	100
T450	3"	0.1	0.1	55	1	56	10	57	100
T1000	4"	0.1	0.1	55	1	56	10	57	100
T2000	6"	1	1	56	10	57	100	58	1000
T3500	8"	1	1	56	10	57	100	58	1000
T5500	10"	1	1	56	10	57	100	58	1000
T6200	12"	10	10	57	100	58	1000	59	10000
T6600	16"	10	10	57	100	58	1000	59	10000
T10000	20"	10	10	57	100	58	1000	59	10000
Recordall Compound Series									
High Side T200	2"	0.1	0.1	55	1	56	10	57	100
Low Side M25	2"	0.01	0.01	54	0.1	55	1	56	10
High Side T450	3"	0.1	0.1	55	1	56	10	57	100
Low Side M25	3"	0.01	0.01	54	0.1	55	1	56	10
High Side T1000	4"	0.1	0.1	55	1	56	10	57	100
Low Side M35	4"	0.01	0.01	54	0.1	55	1	56	10
High Side T2000	6"	1	1	56	10	57	100	58	1000
Low Side M35	6"	0.01	0.01	54	0.1	55	1	56	10
High Side T3500	8"	1	1	56	10	57	100	58	1000
Low Side M120	8"	0.1	0.1	55	1	56	10	57	100

9-Digit Cubic Feet

Meter Model	Size	Encoder Resolution (9 Digits)	ORION Cellular	ORION Fixed Network or Migratable Endpoints		ORION Classic Endpoints		GALAXY Endpoints	
			Resolution Code (Multiplier)	Test Circle Code	Multiplier	Test Circle Code	Multiplier	Test Circle Code	Multiplier
Recordall Disc Series and E-Series									
LP	5/8", 5/8" x 3/4"	0.001	0.001	53	0.01	54	0.1	55	1
M25	5/8", 5/8" x 3/4"	0.001	0.001	53	0.01	54	0.1	55	1
M35	3/4"	0.001	0.001	53	0.01	54	0.1	55	1
M40	1"	0.001	0.001	53	0.01	54	0.1	55	1
M55	1"	0.001	0.001	53	0.01	54	0.1	55	1
M70	1"	0.001	0.001	53	0.01	54	0.1	55	1
E-Series	5/8…1"	0.001	0.001	53	0.01	54	0.1	55	1
M120	1-1/2"	0.01	0.01	54	0.1	55	1	56	10
M170	2"	0.01	0.01	54	0.1	55	1	56	10
E-Series	1-1/2", 2"	0.01	0.01	54	0.1	55	1	56	10
Recordall Turbo Series									
T160	1-1/2"	0.01	0.01	54	0.1	55	1	56	10
T200	2"	0.01	0.01	54	0.1	55	1	56	10
T450	3"	0.01	0.01	54	0.1	55	1	56	10
T1000	4"	0.01	0.01	54	0.1	55	1	56	10
T2000	6"	0.1	0.1	55	1	56	10	57	100
T3500	8"	0.1	0.1	55	1	56	10	57	100
T5500	10"	0.1	0.1	55	1	56	10	57	100
T6200	12"	1	1	56	10	57	100	58	1000
T6600	16"	1	1	56	10	57	100	58	1000
T10000	20"	1	1	56	10	57	100	58	1000
Recordall Compound Series									
High Side T200	2"	0.01	0.01	54	0.1	55	1	56	10
Low Side M25	2"	0.001	0.001	53	0.01	54	0.1	55	1
High Side T450	3"	0.01	0.01	54	0.1	55	1	56	10
Low Side M25	3"	0.001	0.001	53	0.01	54	0.1	55	1
High Side T1000	4"	0.01	0.01	54	0.1	55	1	56	10
Low Side M35	4"	0.001	0.001	53	0.01	54	0.1	55	1
High Side T2000	6"	0.1	0.1	55	1	56	10	57	100
Low Side M35	6"	0.001	0.001	53	0.01	54	0.1	55	1
High Side T3500	8"	0.1	0.1	55	1	56	10	57	100
Low Side M120	8"	0.01	0.01	54	0.1	55	1	56	10

9-Digit Cubic Meter

Meter Model	Size	Encoder Resolution (9 Digits)	ORION Cellular	ORION Fixed Network or Migratable Endpoints		ORION Classic Endpoints		GALAXY Endpoints	
			Resolution Code (Multiplier)	Test Circle Code	Multiplier	Test Circle Code	Multiplier	Test Circle Code	Multiplier
Recordall Disc Series and E-Series									
LP	5/8", 5/8" x 3/4"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
M25	5/8", 5/8" x 3/4"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
M35	3/4"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
M40	1"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
M55	1"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
M70	1"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
E-Series	5/8…1"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
M120	1-1/2"	0.001	0.001	53	0.01	54	0.1	55	1
M170	2"	0.001	0.001	53	0.01	54	0.1	55	1
E-Series	1-1/2", 2"	0.001	0.001	53	0.01	54	0.1	55	1
Recordall Turbo Series									
T160	1-1/2"	0.001	0.001	53	0.01	54	0.1	55	1
T200	2"	0.001	0.001	53	0.01	54	0.1	55	1
T450	3"	0.001	0.001	53	0.01	54	0.1	55	1
T1000	4"	0.001	0.001	53	0.01	54	0.1	55	1
T2000	6"	0.01	0.01	54	0.1	55	1	56	10
T3500	8"	0.01	0.01	54	0.1	55	1	56	10
T5500	10"	0.01	0.01	54	0.1	55	1	56	10
T6200	12"	0.01	0.01	54	0.1	55	1	56	10
T6600	16"	0.01	0.01	54	0.1	55	1	56	10
T10000	20"	0.01	0.01	54	0.1	55	1	56	10
Recordall Compound Series									
High Side T200	2"	0.001	0.001	53	0.01	54	0.1	55	1
Low Side M25	2"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
High Side T450	3"	0.001	0.001	53	0.01	54	0.1	55	1
Low Side M25	3"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
High Side T1000	4"	0.001	0.001	53	0.01	54	0.1	55	1
Low side M35	4"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
High Side T2000	6"	0.01	0.01	54	0.1	55	1	56	10
Low Side M35	6"	0.0001	0.0001	52	0.001	53	0.01	54	0.1
High Side T3500	8"	0.01	0.01	54	0.1	55	1	56	10
Low side M120	8"	0.001	0.001	53	0.01	54	0.1	55	1

TEST CIRCLE CODES FOR HR-E LCD PROGRAMMED TO 6 DIGITS

An HR-E LCD encoder can be ordered in four, five or six-digit resolutions for certain applications. However, the following charts represent only the six-dial resolution. A "-1" Test Circle Code is used for all four or five-digit resolution HR-E LCD encoders.

6-Digit Gallons

Meter Model	Size	Encoder Resolution (6 Digits)	ORION Classic Endpoints	
			Test Circle Code	Multiplier
Recordall Disc Series				
LP	5/8", 5/8" x 3/4"	10	48	10
M25	5/8", 5/8" x 3/4"	10	48	10
M35	3/4"	10	48	10
M40	1"	10	48	10
M55	1"	10	48	10
M70	1"	10	48	10
M120	1-1/2"	100	49	100
M170	2"	100	49	100
Recordall Turbo Series				
T160	1-1/2"	100	49	100
T200	2"	100	49	100
T450	3"	100	49	100
T1000	4"	100	49	100
T2000	6"	1000	50	1000
T3500	8"	1000	50	1000
T5500	10"	1000	50	1000
T6200	12"	10000	51	10000
T6600	16"	10000	51	10000
T10000	20"	10000	51	10000
Recordall Compound Series				
High Side T200	2"	100	49	100
Low Side M25	2"	10	48	10
High Side T450	3"	100	49	100
Low Side M25	3"	10	48	10
High Side T1000	4"	100	49	100
Low side M35	4"	10	48	10
High Side T2000	6"	1000	50	1000
Low Side M35	6"	10	48	10
High Side T3500	8"	1000	50	1000
Low side M120	8"	100	49	100

6-Digit Cubic Feet

Meter Model	Size	Encoder Resolution (6 Digits)	ORION Classic Endpoints	
			Test Circle Code	Multiplier
Recordall Disc Series				
LP	5/8", 5/8" x 3/4"	1	65	1
M25	5/8", 5/8" x 3/4"	1	65	1
M35	3/4"	1	65	1
M40	1"	1	65	1
M55	1"	1	65	1
M70	1"	1	65	1
M120	1-1/2"	10	66	10
M170	2"	10	66	10
Recordall Turbo Series				
T160	1-1/2"	10	66	10
T200	2"	10	66	10
T450	3"	10	66	10
T1000	4"	10	66	10
T2000	6"	100	67	100
T3500	8"	100	67	100
T5500	10"	100	67	100
T6200	12"	1000	68	1000
T6600	16"	1000	68	1000
T10000	20"	10000	*	10000
Recordall Compound Series				
High Side T200	2"	10	66	10
Low Side M25	2"	1	65	1
High Side T450	3"	10	66	10
Low Side M25	3"	1	65	1
High Side T1000	4"	10	66	10
Low side M35	4"	1	65	1
High Side T2000	6"	100	67	100
Low Side M35	6"	1	65	1
High Side T3500	8"	100	67	100
Low side M120	8"	10	66	10

* For additional test circle information, contact Badger Meter Technical Support.

6-Digit Cubic Meter

Meter Model	Size	Encoder Resolution (6 Digits)	ORION Classic Endpoints	
			Test Circle Code	Multiplier
Recordall Disc Series				
LP	5/8", 5/8" x 3/4"	0.1	96	0.1
M25	5/8", 5/8" x 3/4"	0.1	96	0.1
M35	3/4"	0.1	96	0.1
M40	1"	0.1	96	0.1
M55	1"	0.1	96	0.1
M70	1"	0.1	96	0.1
M120	1-1/2"	1	97	1
M170	2"	1	97	1
Recordall Turbo Series				
T160	1-1/2"	1	97	1
T200	2"	1	97	1
T450	3"	1	97	1
T1000	4"	1	97	1
T2000	6"	10	98	10
T3500	8"	10	98	10
T5500	10"	10	98	10
T6200	12"	10	98	10
T6600	16"	10	98	10
T10000	20"	10	98	10
Recordall Compound Series				
High Side T200	2"	1	97	1
Low Side M25	2"	0.1	96	0.1
High Side T450	3"	1	97	1
Low Side M25	3"	0.1	96	0.1
High Side T1000	4"	1	97	1
Low side M35	4"	0.1	96	0.1
High Side T2000	6"	10	98	10
Low Side M35	6"	0.1	96	0.1
High Side T3500	8"	10	98	10
Low side M120	8"	1	97	1

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