Encoders
High Resolution Encoders

High Resolution LCD Encoders

HR-E® LCD, HR-E® LCD 4-20

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.

Badger Meter

LCD-UM-01482-EN-09 (April 2025)

User Manual

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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

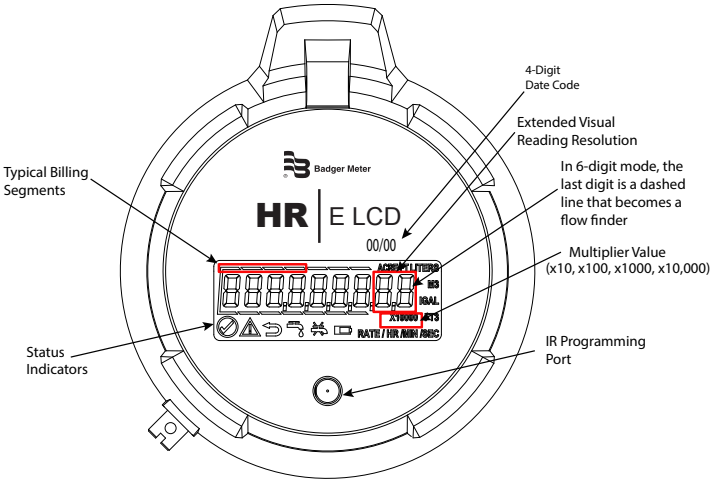

Figure 1: HR-E LCD encoder face

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, 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 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

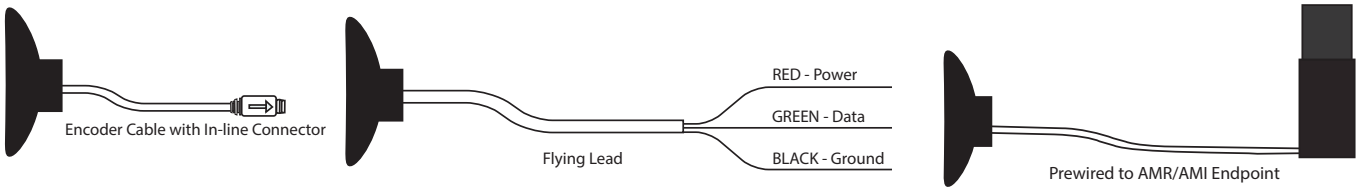

Figure 2: HR-E LCD wiring options

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 *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 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 *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 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.

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