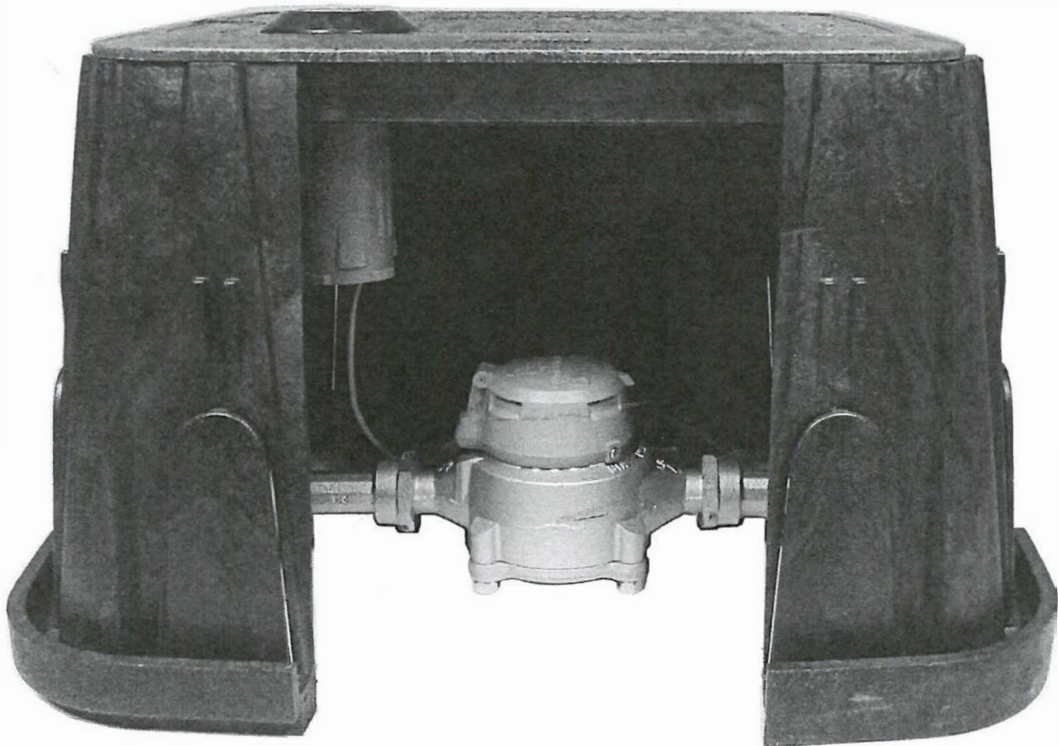




Badger Meter

ORION® Water Endpoints



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OVERVIEW

This manual contains installation instructions for ORION® water endpoints.

- Installation of ORION endpoints must comply with all applicable federal, state and local rules, regulations and codes.
- Failure to read and follow these instructions can lead to misapplication or misuse of this product, resulting in personal injury and damage to equipment.
- Proper performance and reliability of ORION endpoints depend upon installation in accordance with these instructions.

PRODUCT UNPACKING AND INSPECTION

Upon receipt of the product, perform the following unpacking and inspection procedures.

NOTE: If damage to the shipping container is evident upon receipt, request the carrier to be present when the product is unpacked.

Carefully open the shipping package, follow any instructions that may be marked on the exterior. Remove all cushioning material surrounding the product and carefully lift the product from the package.

Retain the package and all packing material for possible use in reshipment or storage.

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.

Carefully remove the pre-wired ORION endpoint and encoder assembly or ORION endpoint from the shipping carton and inspect for damage. Retain the contents of the installation kit for use in mounting the endpoint in the field.

LICENSE REQUIREMENTS

ORION Fixed Network, Migratable and Classic endpoints comply with Part 15 of FCC Rules. ORION Cellular endpoints comply with Part 15, Part 22 and Part 24 of FCC Rules. Operation is subject to the following 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 of the device.

In accordance with FCC Regulations, "Code of Federal Regulations" Title 47, Part 2, Subpart J, Section 1091, transmitters pass the requirements pertaining to radiation exposure. However, to avoid public exposure in excess of limits for general population (uncontrolled exposure), a 20 centimeter distance between the transmitter and the body of the user must be maintained during operation.

No FCC license is required by a utility to operate an ORION meter reading system.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IMPORTANT

Transportation: The Federal Aviation Administration prohibits operating endpoints and receivers on all commercial aircraft. The ORION endpoint is considered an operating transmitter and cannot be shipped by air.

ENDPOINT INSTALLATION GUIDELINES

ORION endpoints can be installed indoors or outdoors, observing these guidelines:

Meter Indoor Installation

- The wired radio endpoint should be mounted outside the building, or in the floor joist near an outside wall, and away from large metal objects for maximum propagation of the radio signal.

Meter Pit Installation

- Cellular endpoints:** Mounting through a nonmetal pit lid is **required**. Deploying Cellular endpoints in applications that are not recommended, such as *through* or *below* metal lids, obstructs radio frequency (RF) performance, increases call-in attempts, and extends RF communication time for the endpoint. Endpoints that are not properly installed may not be covered under warranty.
- Fixed Network endpoints:** Mounting through a nonmetal pit lid is **required** for maximum propagation of the radio signal.
- Migratable and Classic endpoints:** Mounting through a nonmetal pit lid is **recommended** for maximum propagation of the radio signal.

Endpoint/Encoder Connections

ORION endpoints are three-wire metering devices that require connection to an encoder to complete the assembly. Available configurations and the encoder connection methods are listed here, based on the endpoint type.

ORION Cellular Endpoint Configurations

ORION Cellular endpoints are available in the following configurations that can be deployed in indoor, outdoor and pit applications.

Endpoint Configurations

- Prewired endpoint/encoder assembly with or without connector
- Endpoint only with in-line connector (308 or Nicor®)
- Endpoint only with flying lead for field splice

Encoder Connection

- Factory prewired ORION endpoints are shipped connected to a Badger Meter encoder, ready for installation and require no splicing. See *"Endpoint Installation Kits"* on page 17.
- Connect the endpoint to an encoder using the in-line connector. See *"In-line Connectors"* on page 8, *"Outdoor Installation for Endpoint with Nicor Connector"* on page 9, and *"Endpoint Installation Kits"* on page 17.
- See *"ORION Cellular Endpoints"* on page 10 for field wiring information.

ORION Fixed Network, Migratable and Classic Endpoint Configurations

ORION Fixed Network, Migratable and Classic endpoints are available in the following configurations that can be deployed in indoor, outdoor and pit applications.

Endpoint Configurations

- Prewired endpoint/encoder assembly with or without connector
- Prewired integral endpoint/encoder assembly
- Endpoint only with in-line connector (308 or Nicor®)
- Endpoint only with flying lead for field splice

Encoder Connection

- Factory prewired ORION endpoints are shipped connected to a Badger Meter encoder, ready for installation and require no splicing. See *"Endpoint Installation Kits"* on page 17.
- Mount the assembly on the bayonet of the meter. See *"Integral Endpoint Installation"* on page 29 for details.
- Connect the endpoint to an encoder using the in-line connector. See *"In-line Connectors"* on page 8 and *"Endpoint Installation Kits"* on page 17.
- See *"ORION Fixed Network and Migratable Endpoints"* on page 11 and *"ORION Classic Endpoints"* on page 11 for field wiring information.

Outdoor Installation for Endpoint with Nicor Connector

For an outdoor installation of an endpoint with a Nicor connector harness, follow the recommended installation steps below and refer to the image in *Figure 4*.

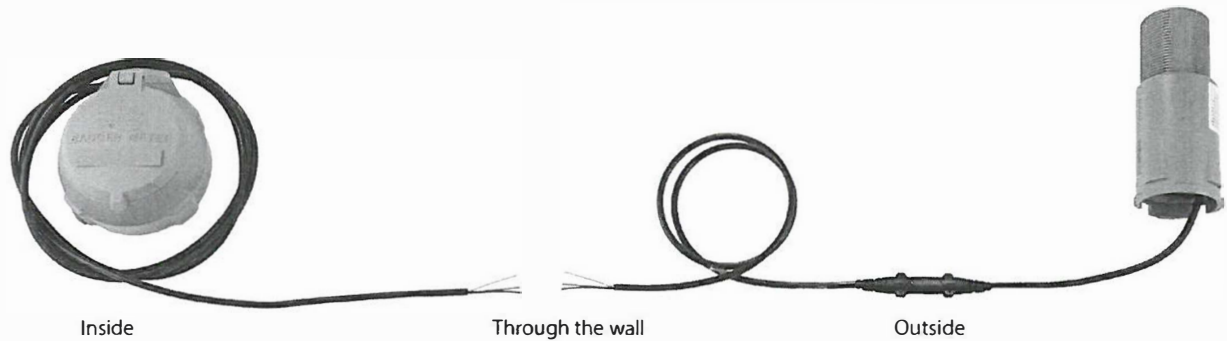


Figure 4: Outdoor endpoint installation

1. Mount the endpoint in an appropriate outdoor location, within the limits of the Nicor connector harness.

NOTE: If using a remote enclosure box (*Figure 5*), see "Remote Installation" on page 21 for additional information on mounting.

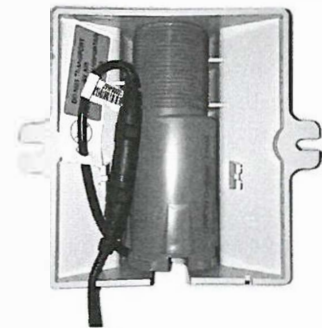


Figure 5: Endpoint with Nicor connection in remote enclosure box

2. Join the Nicor connector of the endpoint with the Nicor connector mate of the encoder. See "Joining the Connectors" on page 8 for details.
3. Drill a small hole in the wall of the structure to accommodate the endpoint cable.
4. Pass the cable end with the flying leads through the wall of the structure.
5. Connect the cable to the encoder inside the structure. Depending on the encoder connection, either field splice the wires or connect the wires directly to the encoder terminal screws.

NOTE: Refer to the Field Splice Kit Application Data Sheet, available at www.badgermeter.com, for field splice instructions.

Nicor Harness

For available lead lengths and part numbers of the Nicor harness, refer to the document, *Recommended Installation Ordering Guide*, available at www.badgermeter.com.

ORION FIXED NETWORK AND MIGRATABLE ENDPOINTS

This section contains information regarding identification and encoder compatibility for field wiring and activation of ORION Fixed Network and Migratable endpoints. ORION Fixed Network and Migratable endpoints have a serial number range of 30000000 to 599999999.

Field Wiring, Encoder Connectivity and Read Resolution

ORION Fixed Network and Migratable endpoints with flying leads are available for connectivity to Badger Meter encoders and E-Series Ultrasonic meters as well as a number of competitive encoders as shown in chart below.

Endpoints are shipped from the factory pre-programmed and are available in an indoor/outdoor, three-wire configuration for connection to the encoders listed. See also "Endpoint Installation Kits" on page 17.

All three wires must be connected to complete an installation. The ORION endpoint connection can be made to either existing wires from the encoder or directly to the terminal screws of the encoder, depending on the application and manufacturer. Follow the manufacturer's installation kit instructions provided with the gel splice or field splice kit you are using.

NOTE: For instructions on field wiring using gel connectors, see "Using Gel Caps to Connect an Encoder" on page 15.

ORION endpoint wires: Red = Power/Clock; Black = Ground; Green = Data

Endpoint Label	Encoder Connectivity	Endpoint Wire Colors			Reading Resolution
		Red	Black	Green	
ELCD or ENC	Badger Meter HR-E LCD or HR-E encoders, or E-Series Ultrasonic Meter with High Res output	Red	Black	Green	Up to eight (8) most significant digits
ADE or ENC	Badger Meter ADE or E-Series Ultrasonic Meter with ADE output	Red	Black	Green	Up to six (6) most significant digits
RTR	Badger Meter RTR or E-Series Ultrasonic Meter with RTR output	Red	Black	Green	Up to seven (7) most significant digits
ADE or ENC	Elster/AMCo ScanCoder or Invision* Elster evoQ4 meter (encoder output)*	Green	Black	Red	Up to eight (8) most significant digits
C700D	Elster/AMCo C700 Digital*	Red	Black	Not used – cut green wire flush with outer sheath	Up to seven (7) most significant digits
ADE or ENC	Master Meter Octave Ultrasonic meter (encoder output)*	Red	Black	Green	Up to eight (8) most significant digits
ADE or ENC	Metron Hawkeye*	Red	Black	Green	Up to eight (8) most significant digits
ADE or ENC	Mueller Systems 420 Solid State Register (SSR) LCD*	Red	Black	Green	Up to eight (8) most significant digits
ADE or ENC	Neptune ProRead, E-coder or ARB-V*	Black	Green	Red	Up to eight (8) most significant digits
ADE or ENC	Sensus Electronic Register encoder (ECR) or ICE*	Red	Black	Green	Up to eight (8) most significant digits
ADE or ENC	Hersey Translator*	Due to the customized, factory wire configurations of the Hersey Translator, the terminal posts may not match the ORION endpoint wire colors. Please contact Hersey for the terminal post wiring schematic of your encoders to determine how the posts correspond to ORION endpoint wires.			

Encoder Wire/Termination Colors

NOTE: Competitive encoder output is determined by the encoder configuration.

*ORION Fixed Network and Migratable ADE or ENC endpoints are compatible with the encoders/meters noted above with a manufacture date of 2000 or newer as long as the encoder is programmed into the three-wire output mode for AMR/AMI and has three wires connected to it. Encoder registers that are currently in two-wire mode of operation require programming by the Utility, including registers that support auto two- or three-wire detection systems that do not automatically switch to three-wire mode of operation once a compatible endpoint is connected for ORION connectivity.

ORION CLASSIC ENDPOINTS

This section contains information regarding identification and encoder compatibility for field wiring and activation of ORION Classic endpoints. ORION Classic endpoints have a serial number range of 70000000 to 199999999.

Field Wiring, Encoder Connectivity and Read Resolution

ORION Classic endpoints with flying leads are available for connectivity to Badger Meter encoders and E-Series Ultrasonic meters as well as a number of competitive encoders as shown in chart below.

Endpoints are shipped from the factory pre-programmed and are available in an indoor/outdoor, three-wire configuration for connection to the encoders listed. See also "Endpoint Installation Kits" on page 17.

All three wires must be connected to complete an installation. The ORION endpoint connection can be made to either existing wires from the encoder or directly to the terminal screws of the encoder, depending on the application and manufacturer. Follow the manufacturer's installation kit instructions provided with the gel splice or field splice kit you are using.

NOTE: For instructions on field wiring using gel connectors, see "Using Gel Caps to Connect an Encoder" on page 15.

ORION endpoint wires: Red = Power/Clock; Black = Ground; Green = Data

Endpoint Label	Encoder Connectivity	Endpoint Wire Colors			Reading Resolution
		Red	Black	Green	
ADE	Badger Meter ADE, HR-E LCD or HR-E encoders, or E-Series Ultrasonic Meter with High Res or ADE output	Red	Black	Green	Up to seven (7) most significant digits
RTR	Badger Meter RTR or E-Series Ultrasonic Meter with RTR output	Red	Black	Green	Up to seven (7) most significant digits
UNIV*	Elster/AMCo ScanCoder or Invision	Green	Black	Red	Up to seven (7) most significant digits
UNIV*	Master Meter Octave Ultrasonic meter (encoder output)	Red	Black	Green	Up to seven (7) most significant digits
UNIV*	Metron Hawkeye	Red	Black	Green	Up to seven (7) most significant digits
UNIV*	Mueller Systems 420 Solid State Register (SSR) LCD	Red	Black	Green	Up to seven (7) most significant digits
ARB-V/**	Neptune ARB-V for connectivity to ORION endpoint > serial number 80000000	Black	Green	Red	Up to seven (7) most significant digits
ARB-V/**	Neptune ARB-V for connectivity to ORION endpoint < serial number 79999999	Red	Black	Green	Up to seven (7) most significant digits
UNIV*	Neptune ProRead or E-coder	Black	Green	Red	Up to seven (7) most significant digits
UNIV*	Sensus Electronic Register Encoder (ECR) or ICE	Red	Black	Green	Up to seven (7) most significant digits
UNIV*	Hersey Translator	Due to the customized, factory wire configurations of the Hersey Translator, the terminal posts may not match the ORION endpoint wire colors. Please contact Hersey for the terminal post wiring schematic of your encoders to determine how the posts correspond to ORION endpoint wires.			

NOTE: Competitive encoder output is determined by the encoder configuration.

*ORION Classic UNIV and ARB-V endpoints are compatible with the encoders/meters noted above with a manufacture date of 2000 or newer as long as the encoder is programmed into the three-wire output mode for AMR/AMI and has three wires connected to it. Encoder registers that are currently in two-wire mode of operation require programming by the Utility, including registers that support auto two- or three-wire detection systems that do not automatically switch to three-wire mode of operation once a compatible endpoint is connected for ORION connectivity.

**A separate ORION CE Universal endpoint is available for connectivity to the Neptune ARB-V encoder. Make sure the ORION Classic endpoint has "ARB-V" on the harness label when wiring to an ARB-V encoder. Wiring differs depending on the serial number of the ORION endpoint you are connecting to the ARB-V encoder, so make sure to verify wiring is correct per the above chart.

USING GEL CAPS TO CONNECT AN ENCODER

For those connections that are not factory wired or equipped with in-line connectors, follow these guidelines for using gel caps when splicing is required, either for installation or to fix a repair after a tamper.

Refer to the wiring charts starting on *page 10*.

NOTE:

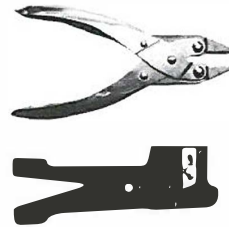
- For pit environments, splice connections require a field splice kit (PN: 62084-001), which can be ordered separately. Refer to the instructions found in the document, *Field Splice Kit for Badger Meter AMR/AMI Products*, which is available at www.badgermeter.com.
- For all installations, excess wire should be coiled and cable tied to avoid any damage.
- Required splicing tools are shown here.

Splice Tools (Customer Supplied)

- Parallel Pliers
- Coax Wire Stripper
- Diagonal Cutting Pliers

Badger Meter Part Number

- 59983-001
- 59989-001
- n/a



Using Gel Caps to Connect an Encoder

Follow these steps when using Badger Meter supplied gel caps.

1. To connect an encoder with existing wires to an ORION endpoint, strip approximately 1-1/2 inches of outer insulation sheath from the encoder and endpoint cables using a coax wire stripping tool. We recommend using the Badger Meter Coax Wire Stripper (59989-001).

CAUTION

USE CAUTION WHEN REMOVING THE OUTER SHEATH SO THAT THE INNER SIGNAL WIRE INSULATION IS NOT NICKED OR DAMAGED.

2. Unwind the outer foil shield from the endpoint cable and cut it off even with the outer sheath using diagonal cutting pliers.
3. Connect the ORION endpoint to an approved encoder. Verify the endpoint serial number prior to completing the wiring setup.
 - Connect the encoder cable wires to the ORION endpoint wires using the insulation gel caps provided in the installation kit. Refer to the charts starting on *page 10* for the endpoint type and determine which wires need to be connected to complete an installation.

NOTE: The terminal posts and wire colors may not match.

CAUTION

DO NOT STRIP ANY INSULATION FROM THE ENDS OF THE WIRES BEFORE YOU PUSH THEM INTO THE GEL CAP.

- Insert the wires from each cable end as far as possible into the gel cap. See *Figure 6: Wires in gel cap*.

ENDPOINT INSTALLATION KITS

The following kits are available for pit, vault and remote endpoint installations. Instructions for using the kits are included in this section.

TYPE	DESCRIPTION	KIT PART NUMBER
PIT	<i>ADA-compliant Through-the-Lid Installation Kit</i>	64394-030
	<i>Below-the-Lid with Knuckles Installation Kit</i>	64394-003
	<i>Integrated Pit Lid Hanger Installation Kit</i>	64394-009
VAULT	<i>Vault Installation</i>	64394-008
REMOTE	<i>Remote Wall Mount Box Enclosure</i>	66009-004
	<i>IR Programming Bracket (Optional)</i>	67625-001
	<i>Remote Installation Bracket Kit</i>	64394-029
	<i>Mounting Bracket for Remote Endpoints</i>	64394-023

NOTE: Refer to the *ORION Water Endpoint Parts List*, available at www.badgermeter.com for individual endpoint kit components.

Below-the-Lid with Knuckles Installation Kit

For below the lid installations, a special **Below-the-Lid with Knuckles Installation Kit (PN: 64394-003)** with mounting bracket (*Figure 12*) is available. This mounting support bracket is designed for use with a 3/8, 5/8 and 1/2 inch rebar or 1/2 inch schedule 40 PVC pipe.

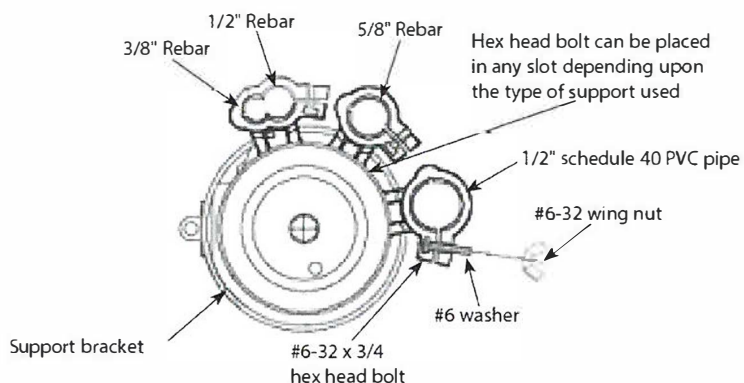


Figure 12: Pit support bracket (knuckles) - top view

To install an ORION endpoint below a meter pit lid, follow these steps and see *Figure 13*.

1. Drive rebar or stake into the ground.

CAUTION

DRIVE REBAR OR STAKE INTO THE GROUND PRIOR TO ATTACHING THE ENDPOINT TO AVOID DAMAGE.

2. Once in the ground, secure the mounting bracket on the appropriate rebar or pipe using the enclosed washer, wing nut and hex head bolt provided with the bracket.
3. Insert the endpoint through the bottom of the bracket and thread the lock nut onto the top of the endpoint. For best results, mount the endpoint a maximum of one to two inches below the underside of the lid.

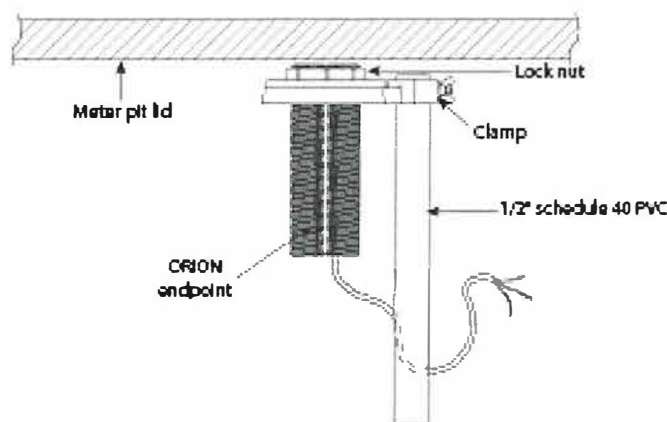


Figure 13: Pit ORION beneath lid installation

REMOTE INSTALLATION

Remote Wall Mount Box Enclosure

The ORION **Remote Wall Mount Box Enclosure Kit (PN: 66009-004)** can be used for endpoint remote mounting applications. The wall mounted enclosure is designed for mounting ORION endpoints in indoor or outdoor environments, and also provides an environmentally protected area for gel splice connections (if needed).

The ORION Remote Wall Mount Box Enclosure Kit is recommended for proper mounting of the ORION endpoint in remote applications.

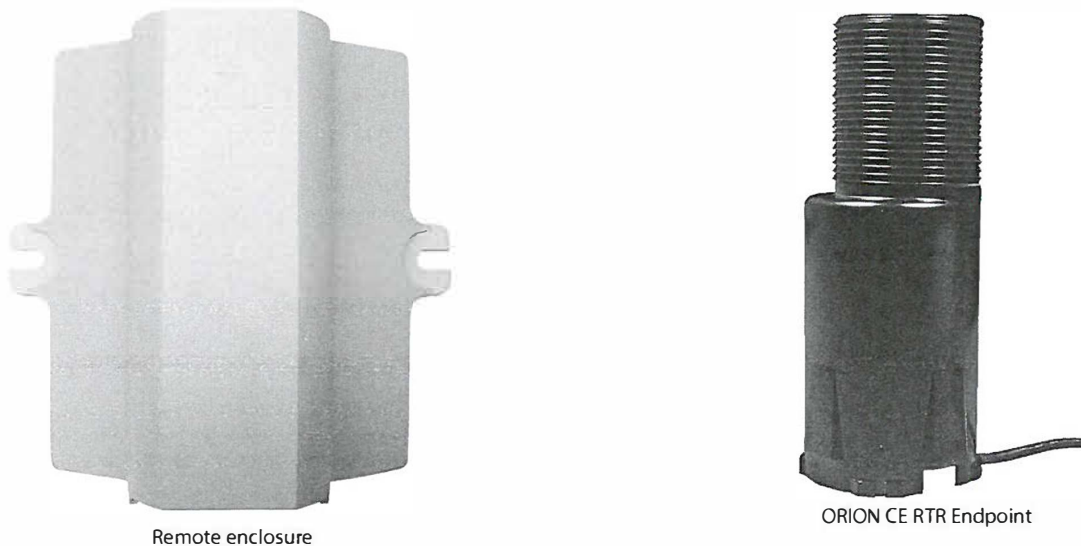


Figure 16: Enclosure and endpoint

To install an ORION endpoint using the enclosure, follow these steps.

1. Flip over the enclosure and look inside to verify the proper orientation. The bottom is identified by the IR head holder rails and an opening that allows access to the endpoint IR communication port without having to disassemble the unit (Figure 17).

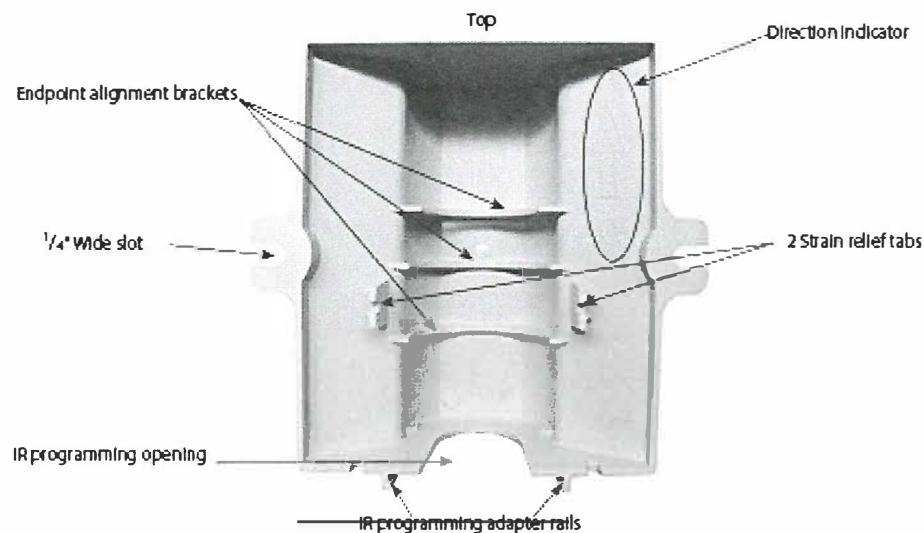


Figure 17: Enclosure orientation

- Verify that the enclosure is properly positioned with the endpoint antenna up and the endpoint IR port facing down. Secure the enclosure to the wall using customer-supplied screws.



Figure 21: Enclosure positioning

IR Programming Bracket (Optional)

To hold the IR programming head in place while performing IR functions on ORION endpoints, an optional **IR Programming Bracket (PN: 67625-001)** is available for use with the remote enclosure box. The programming bracket slides into the adapter rails on the bottom of the remote enclosure box to correctly align the optical head of the IR programming cable with the endpoint LED port.

- Slip the optical head of the IR programming cable into the top of the bracket with the nubs on the head fitted into the cutouts on the bracket.



Optical head of the IR programming cable



Bracket (PN: 67625-001) for the optical head



Optical head inserted into bracket

Figure 22: Optical head and bracket

- Slide the bracket into the adapter rails at the bottom of the enclosure.



Figure 23: IR programming bracket inserted into the adapter rails

- Connect the IR programming cable to a Badger Meter ORION handheld or mobile reading device and refer to the IR Programming software instructions in the user manuals for those devices.

2. Locate the small triangle aligned with the small hole on the bottom of the installation bracket. This triangle is used to properly align the endpoint to the installation bracket.

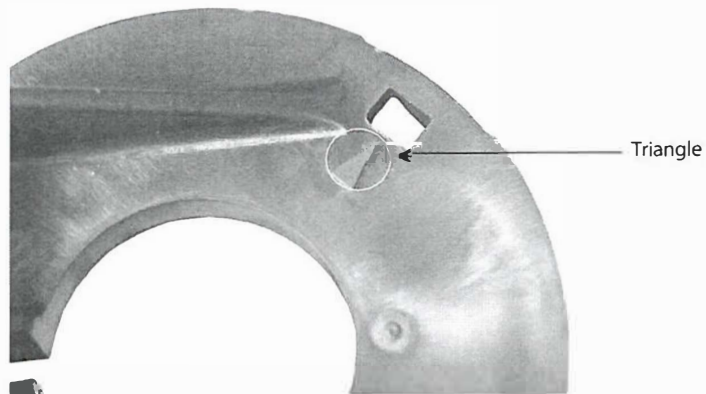


Figure 26: Aligning triangle

On the ORION endpoint, there is a small raised triangle on the lower side of the housing.



Figure 27: Housing triangle

3. Align the two triangles and push the bracket and endpoint together.

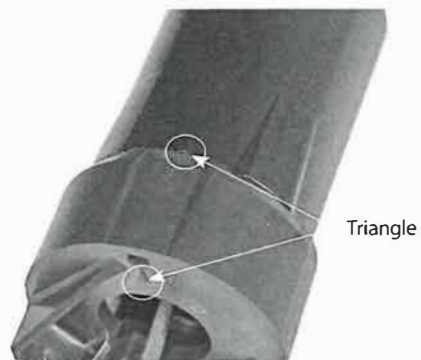


Figure 28: Align both triangles

Mounting Bracket for Remote Endpoints

The **Commercial Meter Mounting Bracket Kit (PN: 64394-023)** is designed for use with most Badger Meter Turbo, Compound Series and Fire Service Disc bypass meter lines. The mounting bracket kit allows you to securely mount an ORION remote endpoint to a meter.

Before you begin the installation, you will need a torque wrench set and the mounting bracket kit. The kit components are:

Stainless steel mounting bracket PN: 66360-001

Lock nut PN: 62825-001

To install the bracket, follow these steps:

1. Verify that the water is turned off.
2. Slip the mounting bracket over the top of the ORION endpoint, as shown below.



Figure 31: Stainless steel mounting bracket

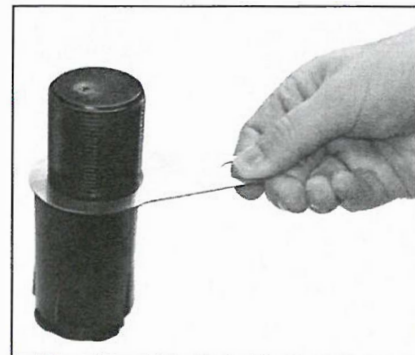


Figure 32: Mounting bracket over endpoint

3. Remove the lock nut from the kit packaging and screw it on the top of the endpoint.

Hand tighten the lock nut. Verify that the bracket is secure.

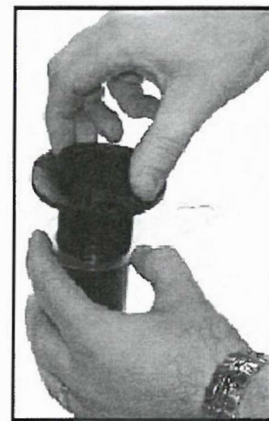


Figure 33: Tighten lock nut

INTEGRAL ENDPOINT INSTALLATION

ORION Fixed Network, Migratable and Classic endpoints are available in an integral configuration, in which the endpoint and encoder are connected in one assembly.

Mounting an Integral Endpoint on the Meter

An integral endpoint can be installed on any Badger Meter disc, turbo or compound meter by mounting the assembly onto the bayonet of the meter and rotating it into its locking position. See *Figure 36*.

1. Loosen the security screw on the endpoint encoder assembly prior to mounting the assembly on the meter.
2. Mount the assembly housing on the meter bayonet.
3. Turn the assembly clockwise 1/4 turn to lock the assembly into place on the meter.
4. After the assembly is mounted on the meter, tighten the security screw to secure the assembly to the register.

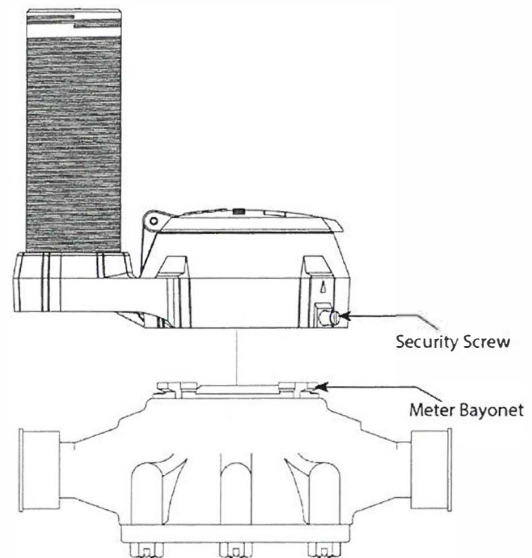


Figure 36: Integral assembly on meter

Integral Endpoint with Three Feet of Wire

An integral endpoint can be ordered with three feet of wire inside the assembly housing. Units with additional wire are marked "3 Ft Wire" on the the serial number label on the side of the integral bracket. With this option, the endpoint can be removed from the housing and mounted remote from the encoder. See "Removing an Integral Endpoint from the Assembly Housing" on page 30.



Figure 37: Additional wire noted on label

3. Rotate the endpoint counter-clockwise 1/4 turn and pull the endpoint and endpoint wire out from the assembly base.



Figure 40: Rotate endpoint clockwise

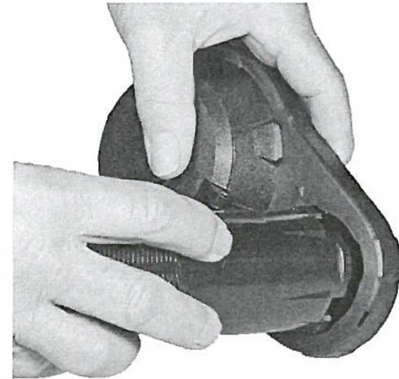


Figure 41: Pull endpoint away from base

4. Mount the endpoint according to recommended installation guidelines using the three feet of wire. See "Endpoint Installation Guidelines" on page 7.

NOTE: The encoder cannot be removed from the assembly housing.

5. Remount the encoder in the assembly housing onto the meter bayonet.
 - Turn the assembly clockwise 1/4 turn so it locks in place.
 - Replace and tighten the security screw.