Badger Meter

ORION® SE II

Network Gateway Transceiver

Installation Manual

ORI-UM-00205-EN-01 (October 2013)

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OVERVIEW

This manual contains installation instructions for the ORION® SE II network gateway transceiver.

Proper performance and reliability of the gateway depends upon installation in accordance with these instructions.

NOTE: Refer to the Gateway Configuration Software manual available at www.badgermeter.com for programming instructions.

Product Description

The ORION SE II network gateway transceiver ("gateway") is an easy-to-install, easy-to-deploy unit that collects metering data from the ORION SE meter endpoints in the area. The gateway is available with a dual GPRS (cellular)/LAN network backhaul and LAN only (with power and PoE).

The network backhaul is used to send the requested metering data back to the utility where the data can be used to better manage utility operations and provide improved customer service. ReadCenter® reading data management software manages this data transfer process and includes myriad tools and standard reports, as well as the ability to create any user-defined reports.

NOTE: Actual product markings may vary slightly from the images shown in this manual.

License Requirements

This device complies with Part 15 of FCC rules. Operation of this device 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 RF 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 testing.

No FCC license is required by a utility to operate an ORION SE 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 transmitters and receivers on all commercial aircraft. The ORION SE II network gateway transceiver is considered an operating transmitter and cannot be shipped by air.*

Changes*: Changes or modifications to the equipment that are not expressly approved by Badger Meter could void the user's authority to operate the equipment. Only properly trained and authorized personnel should install and/or maintain this equipment.*

Product Unpacking and Inspection

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

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

SPECIFICATIONS

Size/Weight/Wind Loading Area

		Height	Width	Depth	Weight	Wind Loading Area
Direct Mount Antennas						
	Assembly (includes network gateway transceiver enclosure, TX/RX antennas, backhaul antenna and mounting brackets)	43.8"	15.5"	6.5"	23.2 lb	1.5 ft^2
Remote Mount Antennas						
	Network gateway transceiver enclosure with mounting bracket	10.3"	14.5"	6.5"	17.5 lb	1.0 ft^2
	TX/RX antennas with mounting bracket	21.3"	15.5"	2.9"	4.8 lb	0.8 ft^2
	Backhaul antenna with mounting bracket	16.6"	4.2"	2.1"	0.9 lb	0.2 ft^2
Mounting Hardware						
	V-Block mounting 1.25…2.5" outside diameter pole mount: aluminum V-blocks				1.6 lb	
	Banding mounting 2.5…24" outside diameter pole mount: BAND-IT® mounting bands				1.0 lb	

Enclosure Sealed, metallized fiberglass reinforced polyester (FRP)

Color Silver/gray

Operating Temperature –30…60° C (–22…140° F)

Storage Temperature –40…60° C (–40…140° F)

Backhaul Options GPRS with LAN 802.3
LAN 802.3
LAN PoE 802.3af and 802.3at

Battery Backup 5 hours of receive operation

Data Storage 60 days of hourly metering and exception data for up to 3600 endpoints

Power Supply DC voltage, 24V DC (AC adapter provided)
PoE alternative available for LAN
Solar can be used if it meets DC requirements

Programming Local via programming harness

Approvals FCC certified
IC certified

MOUNTING THE GATEWAY

IMPORTANT

Professional installation of the ORION SE II Network Gateway Transceiver per Badger Meter installation instructions is required. Installation, mounting and disposal shall be in accordance with all local, state and federal regulations. When installing the network gateway transceiver, the customer is responsible for complying with local, state and federal codes and guidelines as well as applicable industry standards, such as ANSI/TIA/EIA 222 (structural standards for steel antenna towers and antenna supporting structures) and the National Electrical Code (NEC). Proper grounding is necessary, and in the case of a wooden pole, a dedicated copper ground wire should be used for lightning protection.

NOTE: The ORION SE II Network Gateway Installation Form in this manual must be completed for each installation and returned to Badger Meter. The three-page form starts on page 43.

Direct and Remote Antenna Mounting

The ORION SE II network gateway transceiver ("gateway") is designed to allow direct and remote mounting of the TX/RX and backhaul antennas. The gateway ships in a direct mount configuration but the antennas can be separated from the enclosure assembly and remotely mounted using the antenna mounting bracket and antenna cables and connectors as defined in the Badger Meter specifications. Refer to "Remote Antenna Installation" on page 34 for complete information.

Gateway Location

The utility is responsible for properly positioning the gateway. For optimal reception and transmission, locate the gateway and antennas in line-of-sight view of the desired endpoints. The gateway should be positioned no closer than 25 feet from the nearest endpoint.

To help maximize the performance of your ORION SE fixed network system, the following installation guidelines and recommendations should be considered when selecting mounting locations for the gateway.

- Avoid installing the gateway next to or between objects such as tall buildings, towers, bridges, highway overpasses or signs that obstruct line of sight with the endpoints.
- Avoid installing the gateway near RF transmitters or other sources of RF radiation including high-power in band and near-power sources such as pagers, cellular 900 MHz transmitters and communications transmitters. Other potential sources of RF radiation include power line transformers, neon or fluorescent signs, RADAR transmitters and SCADA systems. If the gateway is to be located near other RF radiators, a minimum distance of 100 feet horizontal separation and 10 feet vertical separation must be maintained between the gateway and the source of RF radiation.
- Mount the gateway as high as possible above average terrain, within the limits of the 300-foot power cable, and maintain a 360-degree view of the horizon.
- Minimum standoff distance of 2 feet from any structure is required.
- The ORION SE II network gateway should be positioned no closer than 25 feet from the nearest endpoint.
- Avoid installing the gateway antennas inside metal enclosures or inside of a building as the antennas cannot communicate if surrounded by metal.

⚠WARNING

FAILURE TO READ AND FOLLOW THE INSTRUCTIONS IN THIS MANUAL CAN LEAD TO MISAPPLICATION OR MISUSE OF THE ORION SE NETWORK GATEWAY TRANSCEIVER, RESULTING IN PERSONAL INJURY AND DAMAGE TO THE EQUIPMENT.

Standard Components

- One (1) ORION SE II network gateway transceiver assembly with attached mounting backplate and TX/RX fiberglass antennas
- One (1) GPRS backhaul antenna (GPRS gateway units only)
- V-block clamps or banding and locking equipment for attaching the gateway to a pole
- 100-foot or 300-foot power cable, M12 plug (not included with LAN configuration if Ethernet (PoE) is used for power), RJ45 plug assembly for LAN configuration, AC-to-DC power supply and power cord
- Extra locknuts (replacements)

NOTE: Refer to the packing list, shipped with the gateway, for the complete list of gateway components.

Figure 1: ORION SE II components

Tools and Materials (Customer-supplied)

- Phillips #2 screwdriver
- Precision slotted screwdriver with a 2.0 millimeter (0.079 inch) blade size
- Two 9/16 inch or adjustable wrenches for mounting V-block clamps (standard mounting)
- BAND-IT® tool (refer to "Banding Mounting" on page 15) and instructions, a 1/2 inch wrench and a hammer for large diameter pole mounting
- Wrench (for 1-1/16 inch gland nut and 1-1/16 inch dome nut)
- Pliers or strap wrench (for tightening the 15/16 inch OD backhaul antenna and other Type N connectors)
- 7/16 inch socket wrench for all other bolts and nuts
- Cat5e Ethernet cable (outdoor-rated) and RJ45 jack for LAN connection

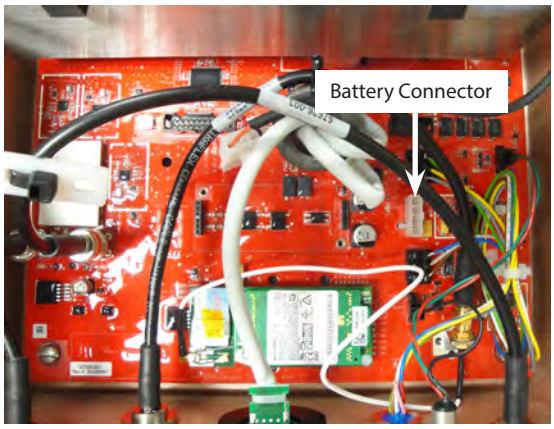
Connecting the Battery Backup

The ORION SE II network gateway transceiver contains an onboard battery backup. The battery must be connected before the gateway is installed and powered. Follow these steps to connect the battery backup.

NOTE: Refer to "Battery Backup Replacement" on page 32 for details on replacing the battery.

1. Using a #2 slotted or Phillips screwdriver, remove the enclosure cover by unscrewing the four corner-cover screws.

   NOTE: The battery is held in place by the enclosure cover only. No other adhesive or locking mechanism is used.



2. Carefully install the battery connector onto the circuit board. Insert the connector only far enough so that the connector latch engages. Verify that proper connector polarity is observed.
3. Replace the enclosure cover. Tighten each of the four cover screws to 16 inch-pounds, maximum. Be careful not to overtighten any of the screws.

⚠CAUTION

BE CAREFUL NOT TO CRIMP THE BATTERY CONNECTOR CABLE WHEN REPLACING THE ENCLOSURE COVER.

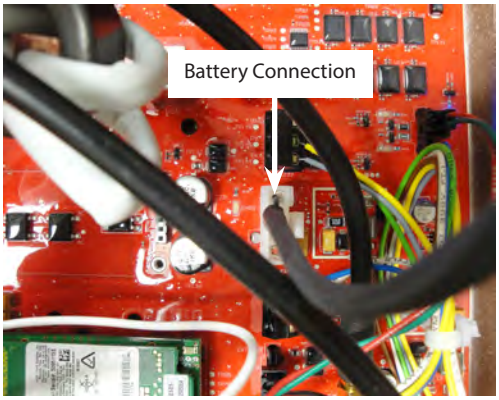


Figure 2: Battery connection

Installing the SIM Card (Customer-supplied)

A SIM card provides access to the cellular provider network for the GPRS backhaul.

To install, slip the SIM card into the slot on the green GPRS module, inside the enclosure, on the gateway transceiver circuit board. An outline of the SIM card is shown above the slot (*Figure 3*). The outline shows the SIM card notch on the left side.

Push the card into the slot (with the notch on the left side) as far down as it will go. The SIM card should look like the photo in the inset circle when installed correctly.

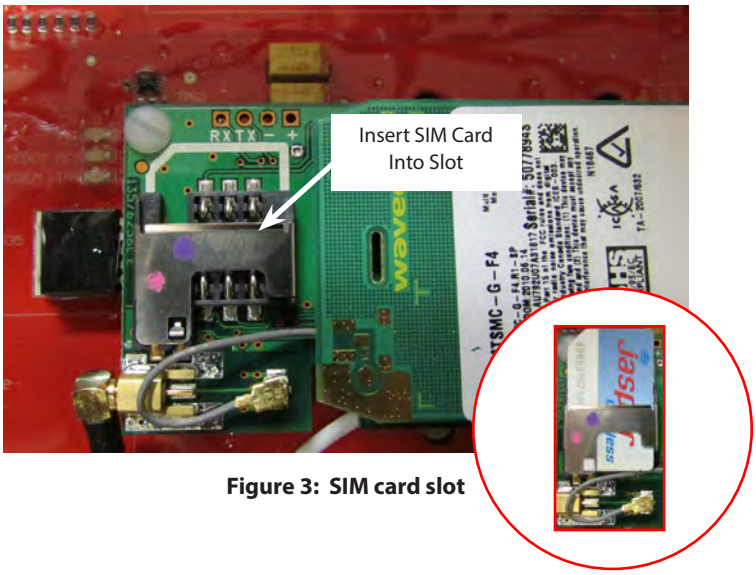


Figure 3: SIM card slot

Attaching the GPRS Antenna

1. Remove the plastic cover from the Type N female connector on the backhaul antenna bracket.
2. Remove the backhaul antenna from the carton.
3. Thread the Type N male connector (antenna) onto the Type N female connector on the backhaul antenna bracket.

   NOTE: Refer to "Backhaul Antenna Bracket" on page 13 for additional mounting information.
4. Hand tighten until finger tight. Then use pliers or a strap wrench to tighten an additional 1/16 inch turn (maximum). Do not over-tighten or the connector can be damaged.

Gateway Mounting Backplate and Brackets

The gateway enclosure is permanently mounted to a bracket (PN: 67537-001) which is used to attach the gateway enclosure to the backplate. When shipped, the gateway enclosure bracket is attached securely to the backplate.

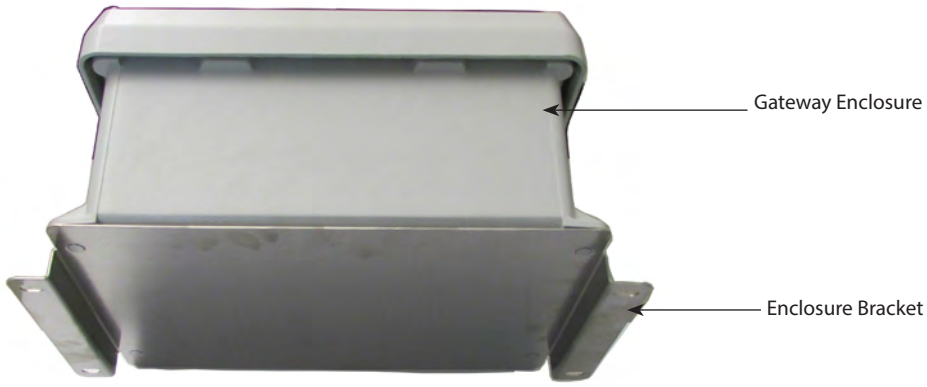


Figure 4: ORION SE II gateway transceiver with enclosure bracket

The backplate of the ORION SE II network gateway transceiver has a modular design consisting of three brackets joined together. The brackets can be removed to provide additional mounting options. A description of each bracket starts on the next page.

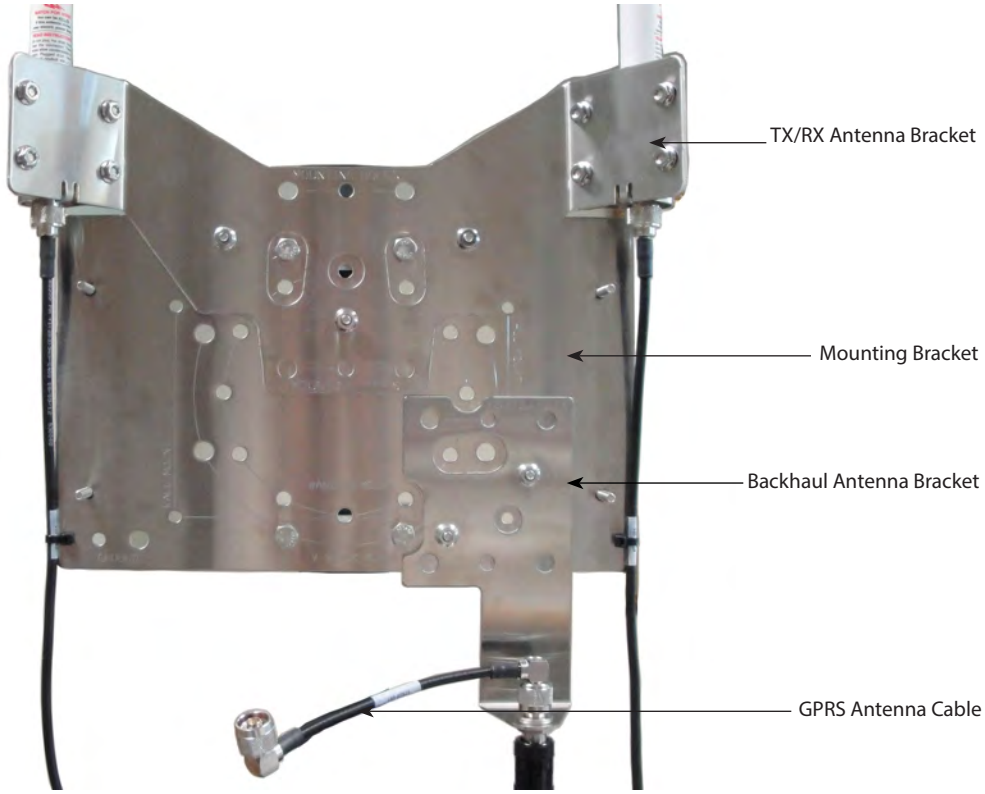


Figure 5: ORION SE II gateway backplate

Mounting Bracket

The mounting bracket is machined with multiple holes to accommodate different mounting options. Mounting holes and the V-Block, banding and wall mounting options are labeled on the bracket. The bracket also has 1/4 inch and 3/8 inch grounding points (see *Figure 6*) which can be used if needed. When shipped, the mounting bracket, TX/RX antenna bracket and backhaul antenna bracket are attached. Together they make up the backplate which is attached to the gateway enclosure bracket.

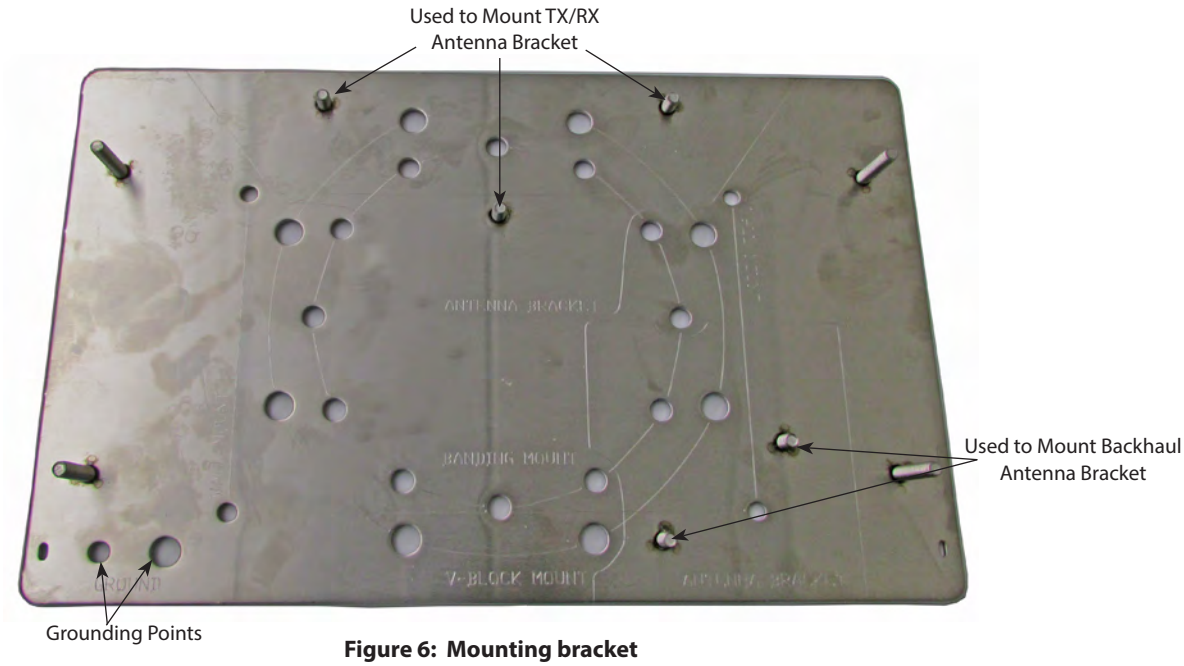


Figure 6: Mounting bracket

Mounting Options

The circular hole pattern on the mounting bracket can be used to accommodate mounting the gateway on an angled beam or pole, if necessary.

The gateway can also be mounted on a wall. The mounting bracket has four .28 inch holes marked for this option.

NOTE: For a wall mount, customers must supply mounting hardware suitable for the substructure on which the gateway is mounted.

For all mounting options, all gateway installation considerations must be observed. Refer to "Specifications" on page 6.

TX/RX Antenna Bracket

When shipped, the TX/RX antenna bracket is mounted to the top of the mounting bracket with three locknuts (PN: 67624-001). The mounting holes are indicated in *Figure 7*.

Other holes on the bracket can be used to accommodate remote installation. For more information, refer to "Remote Antenna Installation" on page 34 in the Appendix.

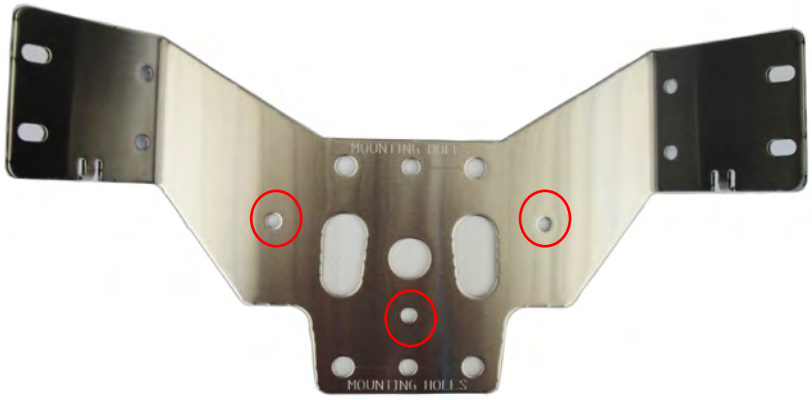


Figure 7: TX/RX antenna bracket

Backhaul Antenna Bracket

When shipped, the backhaul antenna bracket (PN: 67536-001) is mounted to the bottom of the mounting bracket with two locknuts (PN: 67624-001). The mounting holes are indicated in *Figure 8*.

Other holes on the bracket can be used to accommodate remote installation. For more information, refer to "Remote Antenna Installation" on page 34 in the Appendix.

A backhaul antenna can be connected to the bracket with either end up. However, the antenna must always be connected at the narrow end, hanging *away* from the bracket as shown in *Figure 9*.

Figure 8: Backhaul antenna bracket

Correct Antenna Mount

Correct Antenna Mount

Incorrect Antenna Mount

Figure 9: Backhaul antenna mounting

Using the V-block Clamps Mounting Hardware

The V-block mounting hardware is sized to mount the gateway on a vertical or horizontal pole with outer diameters ranging from 1-1/4 inches to 2-1/2 inches. For mounting on poles larger than 2-1/2 inches, refer to "Banding Mounting" on page 15.

1. Open the bag of mounting equipment.
2. Place two bolts (3/8-16 x 5 inches) through the holes in the top of the gateway mounting backplate (*Figure 10*). Use the backplate circular pattern holes for horizontal installation.
3. Place a clamp onto the bolts, as shown below.
4. Place a lock washer and nut onto each bolt, as shown below.

NOTE: The lock washer and nut nearest the enclosure mounting bracket can be omitted when mounting on smaller diameter poles to provide additional clamping distance.

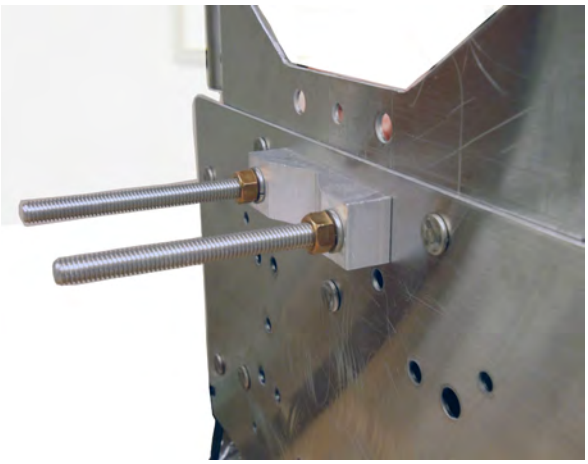


Figure 10: Attach hardware

5. Tighten the two nuts with a 9/16-inch or adjustable wrench so that each lock washer is fully compressed and flat.
6. Repeat Steps 2 through 5, attaching a clamp to the bottom of the gateway mounting backplate. Position the gateway on the pole and place a clamp on the top bolts.

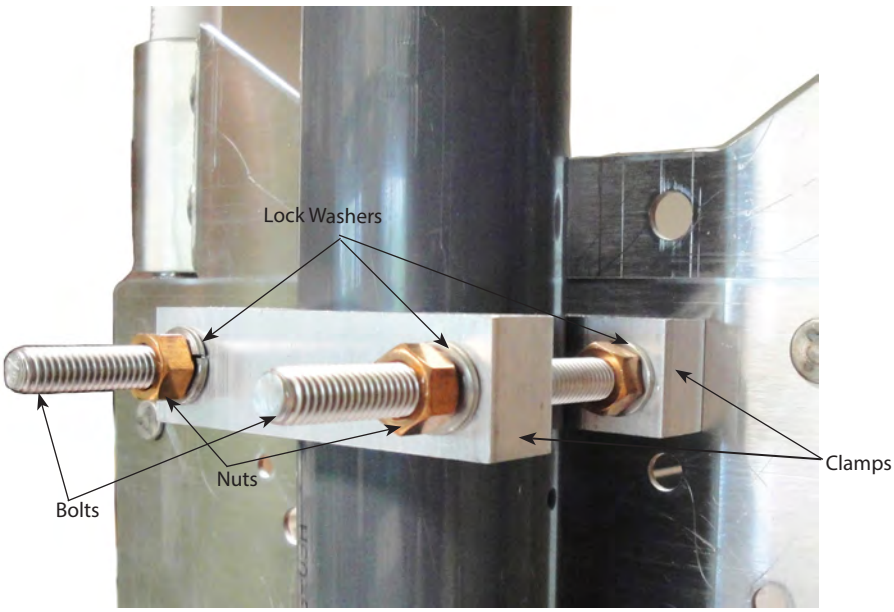
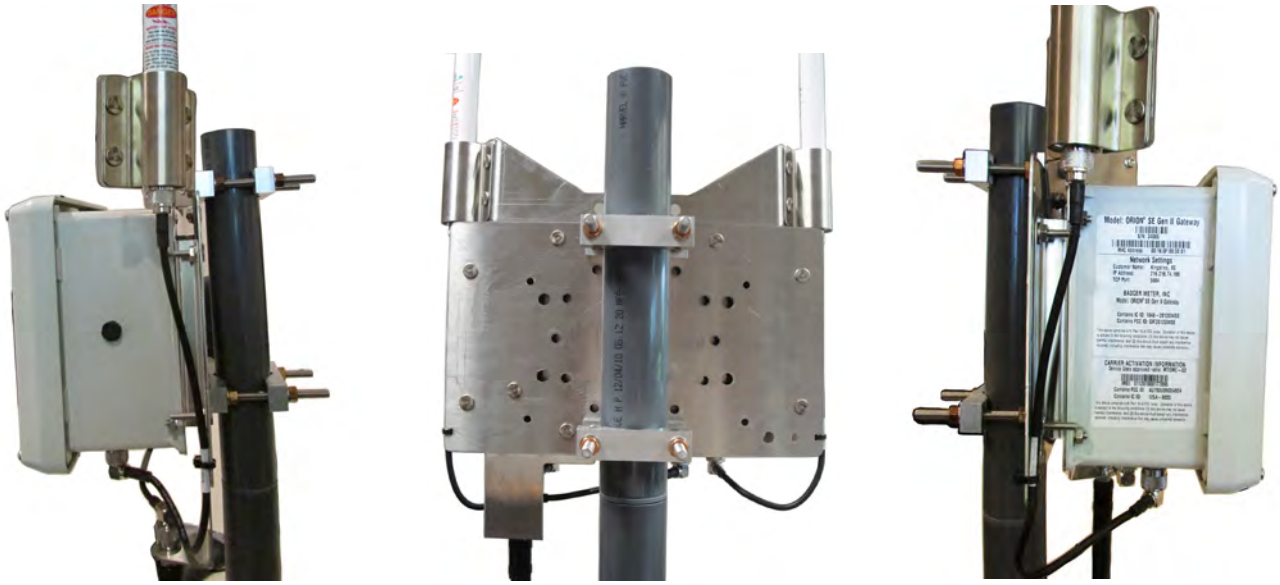


Figure 11: Transceiver positioning and clamps

7. Place a lock washer and nut on each bolt and tighten the nuts 100…150 inch-pounds to ensure the gateway is sufficiently secured to the pole.
8. Repeat Steps 7 and 8 for attaching the V-block clamp mounting hardware to the bottom bolts of the mounting backplate.



Side View | Back View | Side View

Figure 12: Completed gateway mounting

Banding Mounting

This mounting equipment is sized to mount the gateway on a 2-1/2…24-inch outer diameter pole.

IMPORTANT

When using the banding mounting kit for the gateway, use BAND-IT Idex installation practices. Refer to www.band-it-idex.com/en/Literature/Tool_Instructions/P05886.pdf for more information. This is especially applicable when mounting on a non-tapered vertical pole, as the banding could loosen over time resulting in the unit sliding down the pole.

To mount the gateway on a pole, gather the banding and locking equipment.

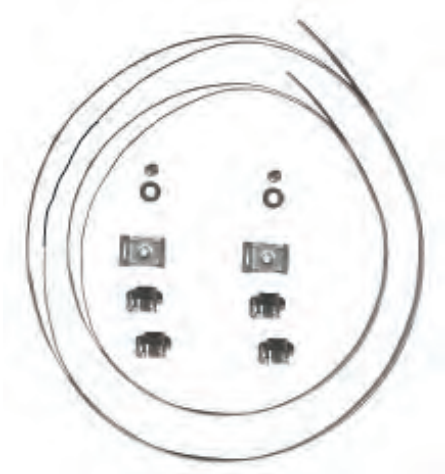


Figure 13: Banding and locking equipment

NOTE: Installation of banding mounting requires the use of the BAND-IT tool shown below (PN: 66042-006) or equivalent BAND-IT tool as recommended by BAND-IT.

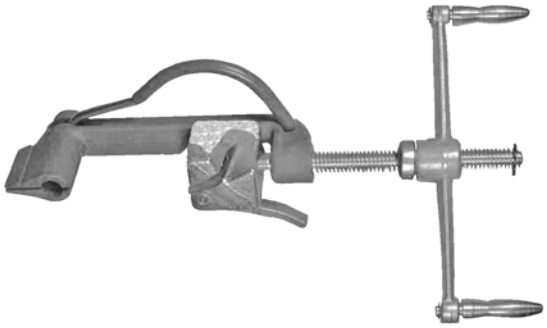


Figure 14: BAND-IT tool

1. Locate the BAND-IT tool and supplied installation instructions.
2. Follow the BAND-IT-supplied installation instructions enclosed with the BAND-IT tool for attaching the gateway transceiver to a pole.
3. Using a 1/2 inch wrench, apply the recommended torque for the 5/16-24 screw that attaches the gateway bracket to the BAND-IT banding. The recommended torque is 144…168 inch-pounds (12…14 foot-pounds).

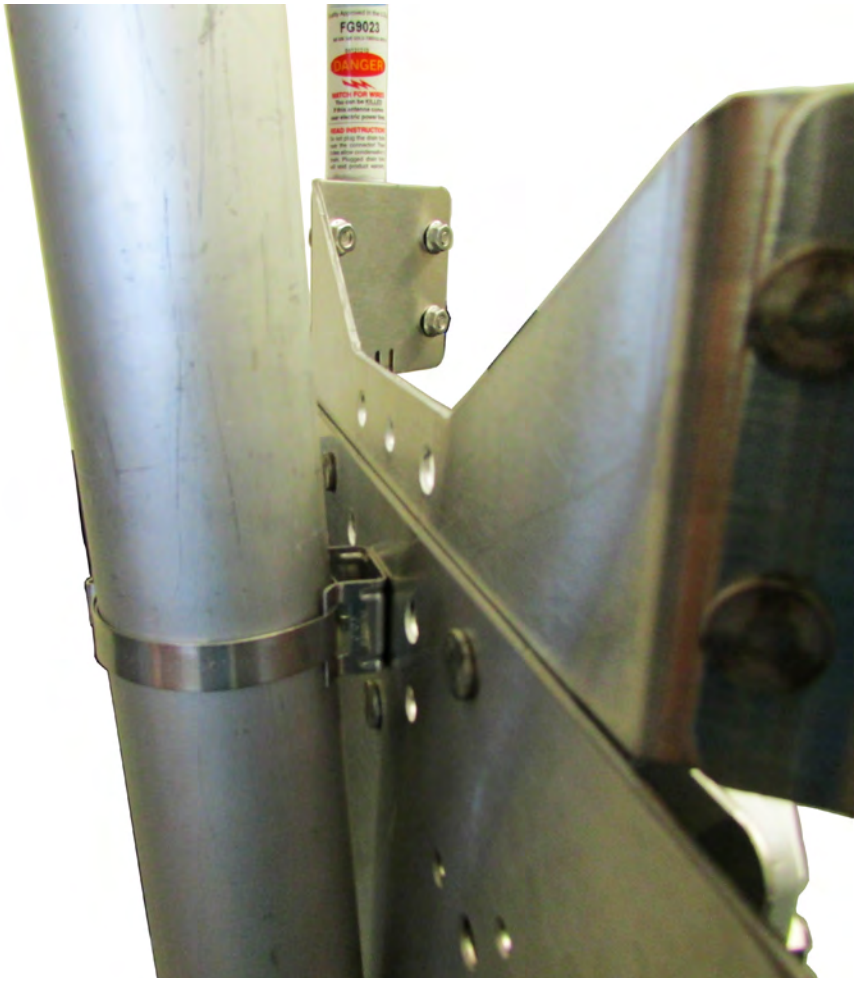


Figure 15: Gateway shown with BAND-IT mounting hardware

POWER SOURCE CONFIGURATIONS

Access to Power

- The ORION SE II network gateway transceiver requires access to power. The gateway can use a 120V AC grounded outlet for use with the AC-to-DC power supply and power cord (PN: 66528-002), or a DC power source for use with the DC power source cable with 308 in-line connector (PN: 66233-020). For a gateway with a LAN PoE configuration, a Power over Ethernet connection is required. Diagrams of each power source configuration start on page 18.
- Outlet and enclosure (if required) should be mounted for easy accessibility by authorized utility personnel at the installation site.
- Consult the appropriate electrical, building and industry codes, regulations and standards for accepted installation practices for use of the AC-to-DC power supply and outlet in environmentally controlled indoor locations.

Use of a NEMA 4 Enclosure

AC-to-DC power supply used outdoors or in a non-environmentally controlled indoor location requires a customer-supplied NEMA 4 enclosure, or equivalent, installed in accordance with appropriate electrical codes, building codes, industry codes, regulations and standards.

Recommended Installation Configurations

These are the standard recommended installation configurations with various combinations of backhaul and power source:

- GPRS with 120V AC power source
- LAN with 120V AC power source
- GPRS with DC power source
- LAN with DC power source
- LAN with PoE power source

Diagrams of the above configurations are shown on the pages that follow. Consult the diagram for your installation configuration.

GPRS or LAN with 120V AC Power Source

Configurations for a 120V AC grounded outlet with GRPS and LAN are shown here.

GPRS Connection with 120V AC Power Source

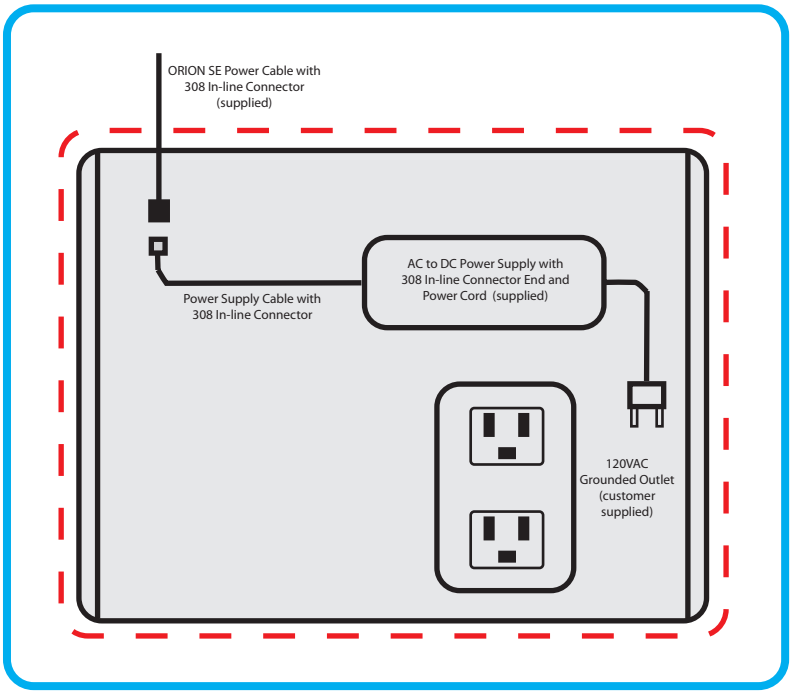


Figure 16: GPRS connection with AC power source (*Shown with NEMA 4 enclosure)

*An enclosure may be recommended but is not included. If NEMA 4 enclosure or equivalent is required, as in an outdoor installation, the minimum enclosure size is 12 inch x 10 inch x 6 inch (H x W x D).

LAN with 120V AC Power Source

NOTE: Consult the manufacturer's installation and usage recommendations as well as appropriate codes, regulations and standards for the LAN RJ45 Ethernet connection.

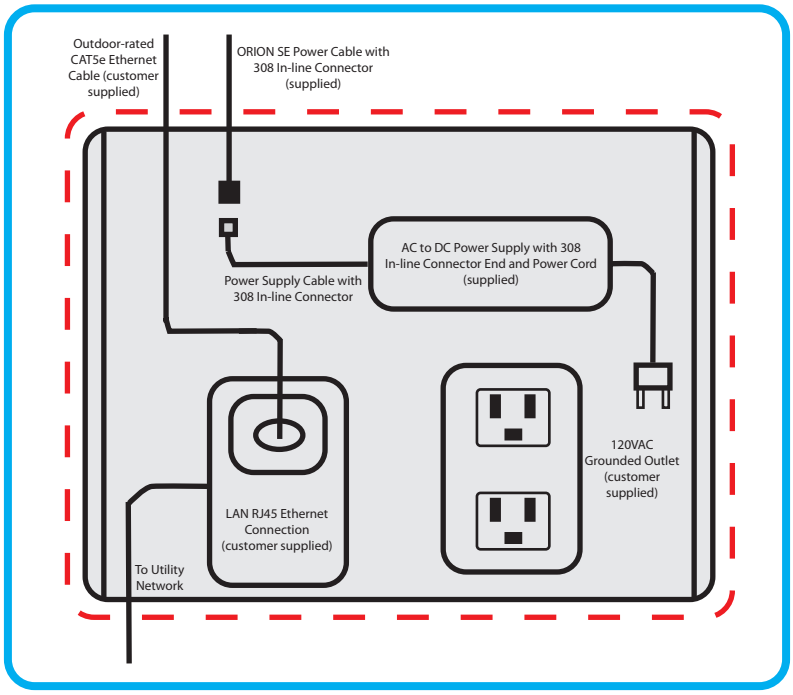


Figure 17: LAN connection with AC power source (*Shown with NEMA 4 enclosure)

*An enclosure may be recommended but is not included. If NEMA 4 enclosure or equivalent is required, as in an outdoor installation, the minimum enclosure size is 12 inch x 10 inch x 6 inch (H x W x D).

GPRS or LAN with DC Power Source

The ORION SE II network gateway transceiver can be ordered with a 10-foot DC power source cable (PN: 66233-020) for direct connection with a customer-supplied DC power source. The gateway requires about 6W average power and 12W peak power. When connecting an AC-to-DC power supply, the recommendation is to use a power supply rated at 1 A (minimum) at 24V DC.

NOTE: Consult the appropriate electrical, building and industry codes, regulations and standards for accepted installation practices when attaching the cable to a DC power source.

Figure 18: 10' DC power cable

Absolute Requirements

The gateway can be powered by a DC voltage source between 12…30V. Cable length must be reduced to 100 feet, or less, if less than a 24V source is being used. For reference, when connecting directly to batteries, as in a solar assembly (not supplied), the average electrical load is 12V DC @ 0.5 A continuous. Cables, fuses and/or circuit breakers **MUST** be capable of handling at least 1A peak currents.

External DC Power Source Connections

Wire Color for 66233-020	External DC Power Source
Drain (no insulation)	Negative (–)
Black	Negative (–)
Brown	Negative (–)
Red	Positive (+)
Light Blue	Positive (+)

GPRS Connection with DC Power Source

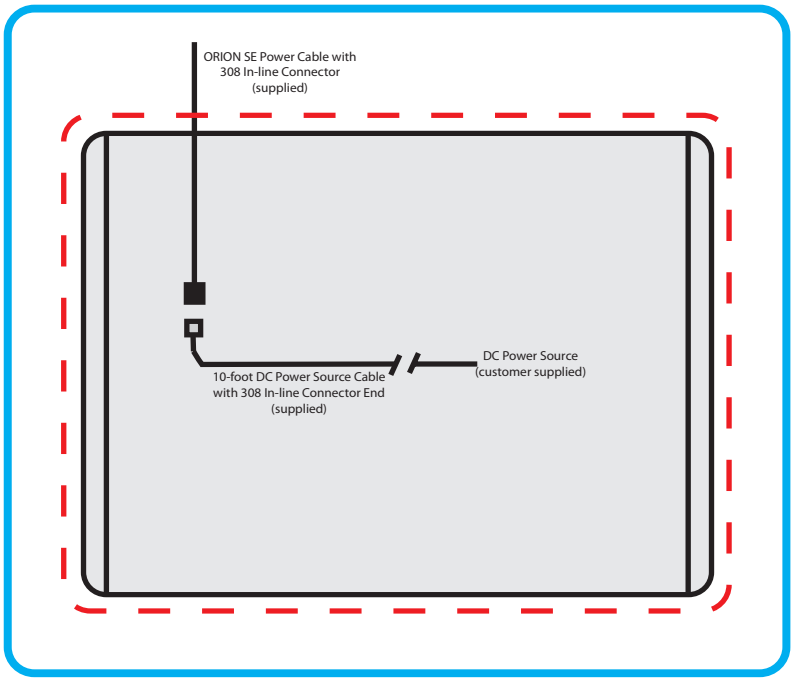


Figure 19: GPRS connection with DC power source (*Shown with NEMA 4 enclosure)

LAN Connection with DC Power Source

NOTE: Consult the manufacturer's installation and usage recommendations as well as appropriate codes, regulations and standards for the LAN RJ45 Ethernet connection.

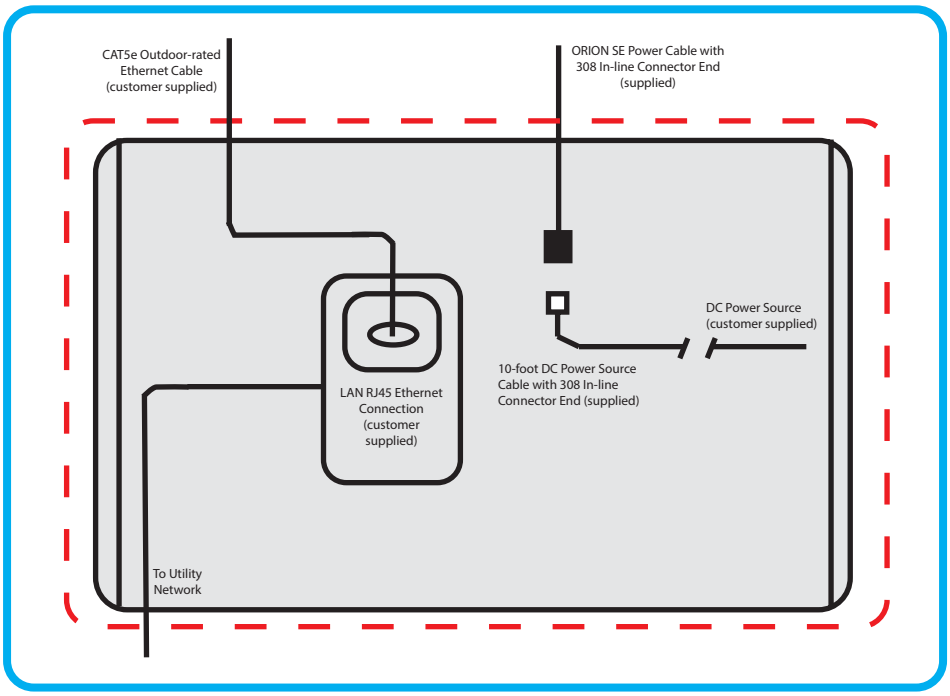


Figure 20: LAN connection with DC power source (*Shown with NEMA 4 enclosure)

*The enclosure may be recommended but is not included. If NEMA 4 enclosure or equivalent is required, as in an outdoor installation, the minimum enclosure size is 12 inch x 10 inch x 6 inch (H x W x D).

LAN with Power Over Ethernet (PoE) Power Source

NOTE: Consult the manufacturer's installation and usage recommendations as well as appropriate codes, regulations and/or standards for the LAN RJ45 Ethernet connection.

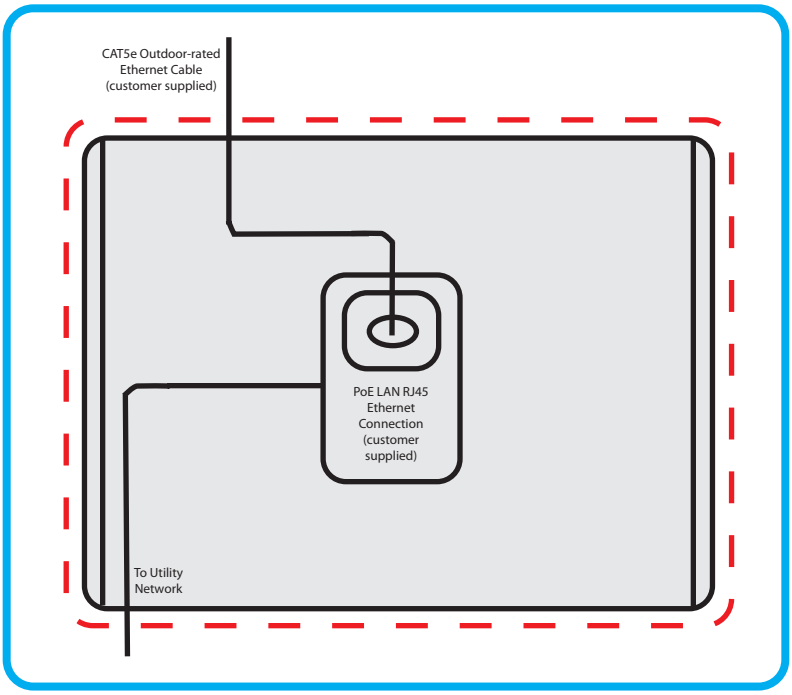


Figure 21: LAN with PoE power source connection (*Shown with NEMA 4 enclosure)

*An enclosure may be recommended but is not included. If NEMA 4 enclosure or equivalent is required, as in an outdoor installation, the minimum enclosure size is 12 inch x 10 inch x 6 inch (H x W x D).

ELECTRICAL CONNECTIONS

M12 Connector Assembly

The M12 connector assembly is required for all power source configurations except LAN with PoE.

NOTE: Use only approved Badger Meter power cable, 100-foot (PN: 66233-015) or 300-foot (PN: 66233-017), for this assembly.

Tools and Materials

Included with gateway:

- M12 plug, 8-conductor connector (PN: 66525-002)
- Badger Meter power cable, 100-foot or 300-foot, with 308 in-line connector end
- 308 in-line connector anti-tamper collar

Customer-supplied:

- Coax stripper (customer-supplied)
- Wire stripper for 22 AWG wires (customer-supplied)
- Precision slotted screwdriver with blade size of 2.0 millimeter (0.079 inch) (customer-supplied)

M12 Plug Connector Part Names

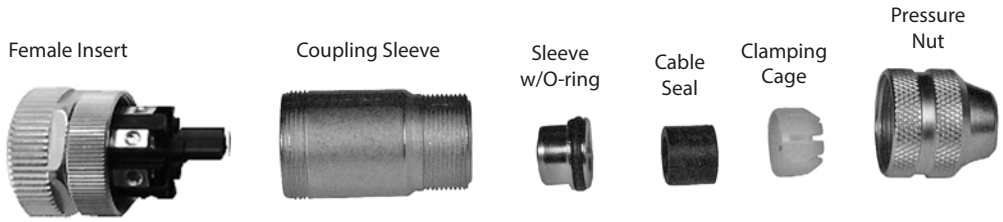


Figure 22: M12 plug connector parts

1. Push the connector parts onto the power cable in the following order: pressure nut, clamping cage, cable seal, sleeve with O-ring and finally, the coupling sleeve.
2. Strip the cable outer jacket to a maximum length of 1.1 inches.

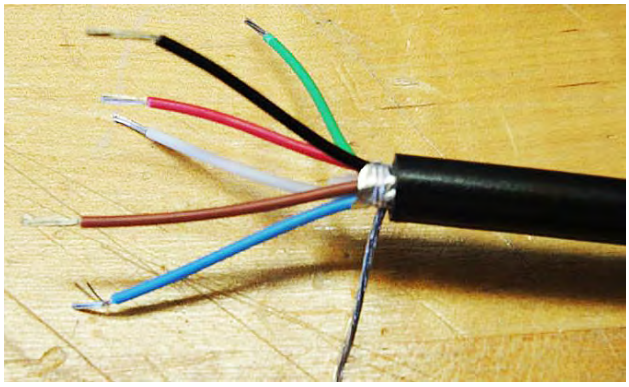


Figure 23: Stripped cable wires

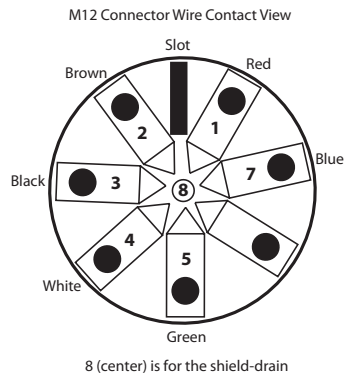
3. Shorten the foil shield flush with the outer jacket.

4. Strip the ends of the six (6) colored wires to a length of 1/8 inch. Twist the conductors on each wire.
5. Shorten the drain/bare wire (no insulation) to 11/16 inch.
6. Loosen each screw (about 2…3 turns) on the female insert and attach the wires to the female insert using the chart below. Retighten each screw after the wire has been connected.

⚠CAUTION

BE CAREFUL NOT TO BACK THE SCREWS OUT TOO FAR. THE SCREWS ARE SMALL AND CAN EASILY BE LOST IF THEY ARE DROPPED.

Wire	Female insert connector
White	4
Drain	8 (Center)
Black	3
Blue	7
Red	1
Green	5
Brown	2



7. Assemble the female insert to the coupling sleeve by aligning the female insert tab slot with the notch in the coupling sleeve.

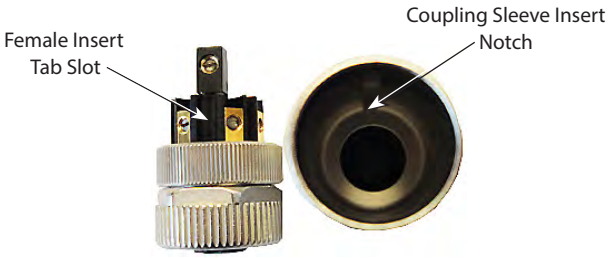


Figure 24: Slot alignment

8. Remove and discard the cap from the M12 receptacle on the bottom of the gateway transceiver.

Figure 25: Bottom of gateway transceiver

9. Connect the M12 plug connector assembly to the M12 receptacle and tighten the locking ring in a clockwise direction until finger tight.
10. Connect the 308 connector on the other end of the power cable to the 308 connector of the AC-to-DC power supply and snap the anti-tamper collar over the connection.
11. Connect the power cord to the power supply and then plug the three-prong male end of the power cord into a 120V AC power source. The LED indicator above the M12 connection turns on with a steady green light, indicating the gateway is being AC powered (*Figure 26*).

    NOTE: A red blinking light indicates the gateway is being powered only by the internal backup battery. No light indicates the gateway is not receiving AC or backup battery power.

Figure 26: Gateway on AC power

The M12 connection is complete.

AC Power

Badger Meter provides an AC-to-DC power supply with cord (PN: 66528-002) that plugs into a standard three-prong 120V AC outlet.

Figure 27: 120V AC power supply with power cord

NOTE: If you are powering the gateway directly via DC power, refer to "GPRS or LAN with DC Power Source" on page 20 .

Lightning Arrestors

Lightning arrestors are recommended for all standard and remote antenna installations. If lightning arrestors are used, they should be placed directly between the gateway enclosure and the antenna cable connector and grounded per code. One lightning arrestor is shown in *Figure 28*. Arrows indicate where other lightning arrestors should be attached.

Lightning arrestors for both the TX/RX antennas as well as the GPRS backhaul antenna (if applicable), should meet the following specifications:

- Operating bandwidth: 800…2400 MHz
- Impedance: 50 ohms
- Power handling (average): 2 watts, minimum
- Environmental/weather rating suitable for the location
- N male connector on the protected side; N female connector on the surge side

Figure 28: One attached lightning arrestor (Ground is not pictured). Arrows indicate where additional lightning arrestors should be attached.

RJ45 Plug Assembly for LAN Connectivity

Use this procedure to connect an Ethernet cable to the gateway for a LAN backhaul or any PoE connection.

Required Supplies:

- RJ45 Plug Assembly (PN: 66527-001) as shown in *Figure 29*
- Cat5e Ethernet cable (limited to 300 feet of outdoor-rated cable) and available LAN connection (customer-supplied)
- Wrenches – 1-1/16 inch (customer-supplied)

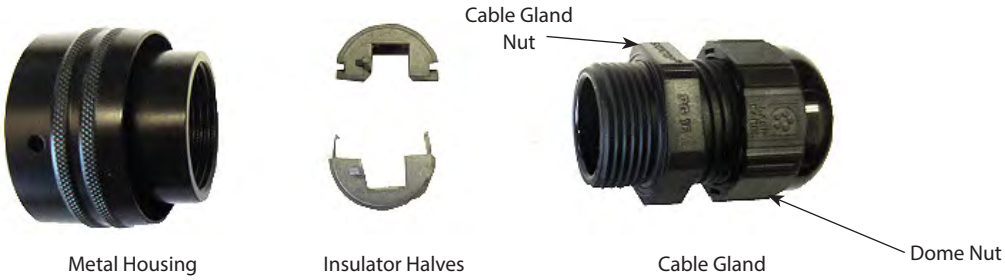


Figure 29: RJ45 plug components

1. Separate the RJ45 plug pieces:
   - Unscrew the cable gland from the metal housing and put the metal housing aside for use in step 4.
   - For ease of installation, remove the gray seal from inside the cable gland body as shown in *Figure 30*.

Figure 30: Remove gray seal

2. In the following order, thread the dome nut, gray seal and cable gland body onto the Ethernet cable as shown in *Figure 31*.

3. Reassemble the parts on the Ethernet cable by reinserting the gray seal into the cable gland body and loosely screwing the dome nut onto the cable gland body.

   NOTE: Do not screw together tightly at this time.

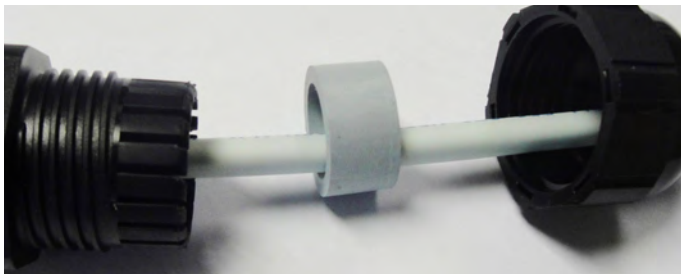


Figure 31: Thread nut, seal and cable gland

4. Attach the metal housing to the RJ45 receptacle on the gateway:

   - Remove the RJ45 receptacle bayonet lock cap from the gateway by turning the cap 1/4 turn counter clockwise.

NOTE: The RJ45 receptacle cap should be saved so it can be replaced if the Ethernet cable is removed later.

   - Place the metal housing on the RJ45 receptacle and turn it until you feel the metal housing align with the keys on the RJ45 receptacle (*Figure 33*).

     Once aligned, tighten the outer sleeve on the metal housing 1/4 turn clockwise.

NOTE: The metal housing fits on the RJ45 receptacle correctly when it is aligned with the keys on the RJ45 receptacle.

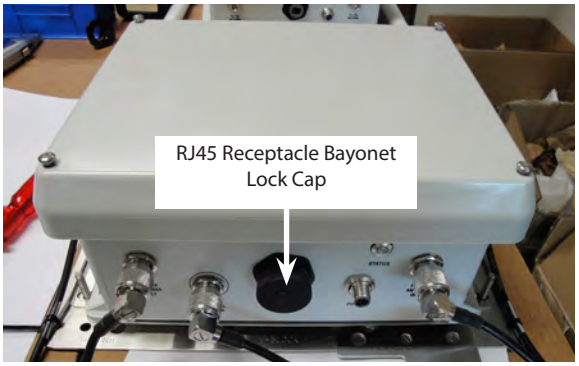


Figure 32: Bayonet lock cap

Figure 33: Remove bayonet lock cap

5. Attach the half insulators to the RJ45 modular plug on the Ethernet cable connector:

   - Hold down the plug latch and slide one of the half insulators over the latch. Make sure the half insulator prong is aligned next to the plug latch as shown in *Figure 35*.
   - Slide the other half insulator over the other side of the latch while holding the half insulator you just attached, again making sure the prong is aligned next to the plug latch.
   - Squeeze both insulators together to connect. You will hear a "click" when the connection is made. The plug with both half insulators is shown in *Figure 36*.

Figure 34: Plug latch

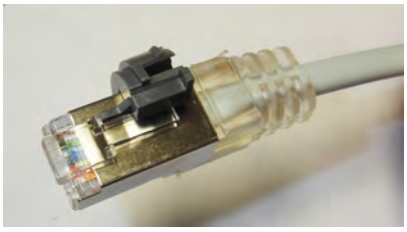


Figure 35: Half insulator over latch

Figure 36: Half insulators connected

6. Insert the Ethernet cable connector into the RJ45 receptacle. Push the connector in firmly.

   The plug latch of the connector fits into the recessed key section of the RJ45 receptacle. A close-up view from the front is shown in *Figure 37*.

   An audible click confirms a complete connection.

NOTE: Once assembled, RJ45 plugs cannot be disassembled from the metal housing without a special tool (PN: 67163-001).

Figure 37: RJ45 receptacle close up

7. Screw the cable gland onto the metal housing on the RJ45 receptacle and tighten the cable gland nut. See *Figures 38* and *39*. *Recommended: Use a torque wrench to tighten to 30…45 inch-pounds.*
8. Tighten the dome nut on the cable gland (*Figure 39*). *Recommended: Use a torque wrench to tighten to 20 inch-pounds.*

NOTE: The gray seal inside the dome nut must be in firm contact with the Ethernet cable. As the dome nut is tightened, the seal should fill the open end of the dome nut without popping out the front and should be in firm contact with the outer jacket of the Ethernet cable. See *Figures 40* and *41*.

Figure 38: Screw cable gland onto metal housing

Figure 39: Tighten the cable gland nut

Figure 40: Gray seal before dome nut is tightened

Figure 41: Gray seal after dome nut is tightened

Assembly is complete. For additional information, refer to http://www.rjfield.com/Ethernet_connectors_rjf_en.htm.

GPRS DUAL BACKHAUL CONFIGURATION

ORION SE II network gateway transceivers are configured to allow a dual backhaul connection so you can switch from GPRS to an alternative LAN backhaul, if necessary, using the RJ45 plug assembly included with the transceiver.

The GPRS connection can remain in place when the LAN connection is set up. Refer to "LAN with 120V AC Power Source" on page 19 for the LAN installation diagram.

NOTE: The gateway will need to be reprogrammed for a LAN connection. Refer to the Gateway Configuration Software manual available at www.badgermeter.com, for programming instructions.

APPENDIX

BATTERY BACKUP REPLACEMENT

If a battery replacement is required, complete the installation steps as detailed below in the order presented.

NOTE: It is not necessary to disconnect AC power from the gateway before removing the cover and replacing the battery.

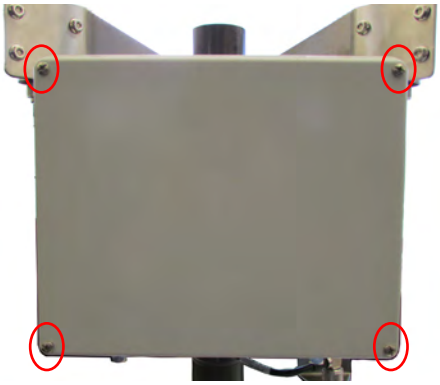
Tools and Materials

- Rechargeable battery pack kit with enclosure cover (PN: 67018-001)
- #2 slotted or Phillips screwdriver (customer-supplied)

IMPORTANT

Working with electronics requires the use of proper electrostatic discharge (ESD) protection. Grounded wrist straps are recommended when working inside the enclosure.

1. Using a #2 slotted or Phillips screwdriver, remove the enclosure cover by unscrewing four corner-cover screws (*Figure 42*). The cover will not be used again and can be discarded.



Remove Four Corner Screws

Cover Removed

Figure 42: Enclosure cover removal

2. Squeeze the connector latch (*Figure 43*) of the battery connector on the circuit board and carefully pull on the connector to remove it from the circuit board pin contacts. Do NOT pull on the connector wires. If the connector is stuck, it can need to be gently rocked back and forth while pulling.

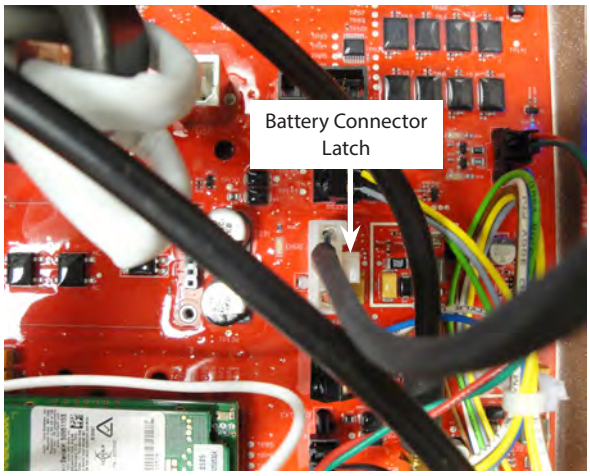


Figure 43: Battery connector

NOTE: The battery is held in place by the enclosure cover only. No other adhesive or locking mechanism is used.

3. Grasp and pull to remove the battery from the unit (*Figure 44*) and safely discard the battery (see "Battery Disposal" on page 33).

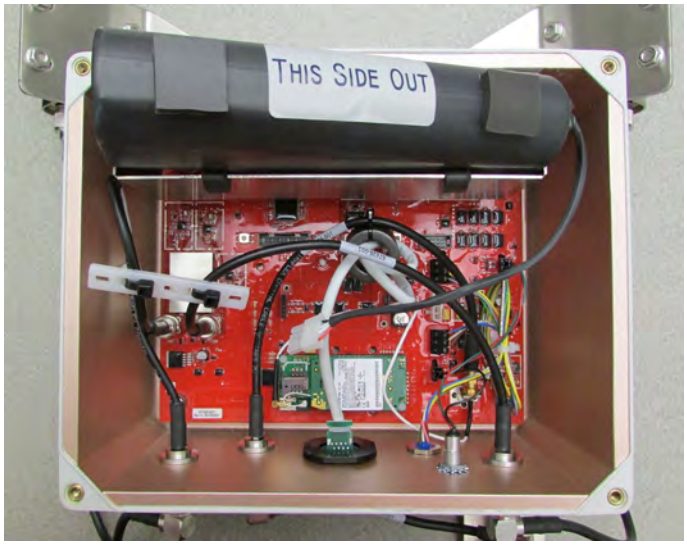


Figure 44: Battery removal

4. Place the new battery into the enclosure with the battery label "This Side Out" visible, as shown.
5. Carefully install the battery connector onto the circuit board. Insert the connector only far enough so that the connector latch engages. Verify that proper connector polarity is observed.
6. Install the new enclosure cover provided with the battery kit. Tighten each of the four cover screws to 16 inch-pounds, maximum, being careful to not overtighten any of the screws.

Battery Disposal

The battery contains lead and should be handled and disposed of in accordance with local, state and federal regulations. Refer to Badger Meter Battery Handling Safety Guide MRT-SG-02, available at www.badgermeter.com, for more information.

⚠CAUTION

FAILURE TO PROPERLY DISPOSE OF A LEAD ACID BATTERY MAY RESULT IN BODILY HARM AND/OR PROPERTY DAMAGE FROM ACID BURNS.

REMOTE ANTENNA INSTALLATION

This section provides instructions for installing the TX/RX antennas and/or the backhaul antenna separately from the ORION SE II network gateway transceiver.

The ORION SE II network gateway transceiver ("gateway") is designed to allow remote antenna mounting. The gateway ships in a direct mount configuration but the antennas can be separated from the enclosure assembly and remotely mounted using the antenna mounting bracket and antenna cables and connectors as defined in the Badger Meter specifications. Antenna cables and cable connectors are to be installed and mounted per cable and connector manufacturer instructions.

IMPORTANT

Professional installation of the ORION SE II Network Gateway Transceiver per Badger Meter installation instructions is required. Installation, mounting and disposal shall be in accordance with all local, state and federal regulations. When installing the network gateway transceiver, the customer is responsible for complying with local, state and federal codes and guidelines as well as applicable industry standards, such as ANSI/TIA/EIA 222 (structural standards for steel antenna towers and antenna supporting structures) and the National Electrical Code (NEC). Proper grounding is necessary, and in the case of a wooden pole, a dedicated copper ground wire should be used for lightning protection.

NOTE: The ORION SE II Network Gateway Installation Form in this manual must be completed for each installation and returned to Badger Meter. The three-page form starts on page 43.

Antenna Maximum Distance

- **Distance maximum for remote TX/RX antennas** — Up to *200 feet* maximum from the gateway enclosure
- **Distance maximum for remote backhaul antenna** — Up to *100 feet* maximum from the gateway enclosure

Remote Installation Additional Parts

The following parts have been approved by Badger Meter and are required for remote antenna installations at the distances indicated. Make sure all required parts are ready to use before starting a remote installation. Substitutions are not allowed.

NOTE: Parts are supplied by the installation contractor unless otherwise marked.

Antenna	Distance (feet)	Antenna Coaxial Cable	Cable Connectors	Remote Flex Cable	Remote Antenna Mounting Bracket Kits (One kit required per antenna bracket)
TX/RX	0…60'	Times Microwave LMR-400-DB (2 per gateway)	Times Microwave EZ-400-NMH-X (4 per gateway)	N/A	V-block Mounting Kit (PN: 66681-001*) Banding Mounting Kit (PN: 66042-004*)
TX/RX	61…200'	CommScope® AVA6-50 (2 per gateway)	CommScope 114EZNF (4 per gateway)	Coax cables kit P/N: 67809-001* (1 kit with 4 cables per gateway)	
Backhaul (GPRS)	0…100'	Times Microwave LMR-400-DB (1 per gateway)	Times Microwave EZ-400-NMH-X (2 per gateway)	N/A	

*Order part/kit from Badger Meter

Assembly Size, Weight, Wind Loading

Refer to "Specifications" on page 6 for the complete specifications list.

		Height	Width	Depth	Weight	Wind Loading Area
Direct Mount Antennas	Assembly (includes gateway enclosure, TX/RX antennas, backhaul antenna and mounting brackets)	43.8"	15.5"	6.5"	23.2 lb	1.5 ft^2
Remote Mount Antennas						
	Gateway enclosure with mounting bracket	10.3"	14.5"	6.5"	17.5 lb	1.0 ft^2
	TX/RX antennas with mounting bracket	21.3"	15.5"	2.9"	4.8 lb	0.8 ft^2
	Backhaul antenna with mounting bracket	16.6"	4.2"	2.1"	0.9 lb	0.2 ft^2
Mounting Hardware						
	V-Block mounting kit				1.6 lb	
	Banding mounting kit				1.0 lb	

Weatherproofing for Connector/Cable Connections

Weatherproofing material should be provided by the installation contractor. Badger Meter recommends weatherproofing for all connections according to cable and connector manufacturer recommendations. Weatherproofing provides additional moisture protection and will prevent the connections from loosening due to vibrations.

IMPORTANT

All external antennas are designed with vent holes. Any weatherproofing applied to the Type N connectors must ***not*** *obstruct this venting or the antenna can be damaged.*

- On the TX/RX antennas, small vent holes are located at the bottom end of the antenna, next to the Type N female connector as shown in *Figure 45*.

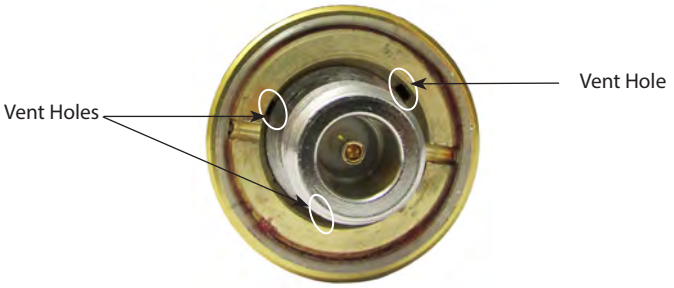


Figure 45: Vent holes at bottom of TX/RX antenna

- On the backhaul antenna, the vent holes are located at each end (*Figure 46*). At the bottom end with the Type N male connector, the vent holes are on the outside, on the metal section. At the top, the holes are incorporated into the cap.

Figure 46: Vent holes at bottom and top of backhaul antenna

Installation Considerations

To help maximize the performance of the ORION SE fixed network system, the following installation guidelines and recommendations should be considered when selecting mounting locations for gateways.

The utility is responsible for properly positioning the gateway. For optimal reception and transmission, locate the gateway transceiver and antennas in line-of-sight view of the desired endpoints.

- Avoid installing the gateway or remotely mounted antennas next to or between objects such as tall buildings, towers, bridges, highway overpasses or signs that obstruct line of sight with the endpoints.
- Avoid installing the gateway or remotely mounted antennas near RF transmitters or other sources of RF radiation including high-power in band and near-power sources such as pagers, cellular 900 MHz transmitters and communications transmitters. Other potential sources of RF radiation include power line transformers, neon or fluorescent signs, RADAR transmitters and SCADA systems. If the gateway is to be located near other RF radiators, a minimum distance of 100 feet horizontal separation and 10 feet vertical separation must be maintained between the gateway and the source of RF radiation.
- Mount the gateway as high as possible above average terrain, within the limits of the 300-foot power cable, and maintain a 360 degree view of the horizon.
- Minimum standoff distance of two (2) feet from any structure is required.
- The gateway transceiver or remotely mounted antennas should be positioned no closer than 25 feet from the nearest endpoint.
- Avoid installing the gateway transceiver antennas inside metal enclosures or inside of a building as the antennas cannot communicate if surrounded by metal.

Required Antenna Tests

Once the antennas have been installed, but prior to attaching the antenna assembly to the gateway enclosure, the installation contractor must take a VSWR reading on the remotely mounted antenna system. The actual measurement should be recorded and provided to Badger Meter as part of the installation information for each gateway.

- For the TX/RX antennas, the VSWR meter should be set to ***915 MHz***.
- For the backhaul antenna, the VSWR meter should be set to ***900 MHz***.
- VSWR measurement ***1:1…2:1*** (for example, 1.2:1, 1.5:1 or 1.9:1) is acceptable.

Any objects that come into contact with the antenna during this test will affect the outcome of the VSWR measurement. In order to properly make this measurement, the antenna must be located in free space (holding the antenna by the cable below the Type N connection is acceptable), away from any metallic objects.

NOTE: All installation cables and devices (for example, lightning arrestor) must be included for the VSWR measurement.

Report the VSWR reading to Badger Meter for each installation using the ORION SE II Network Gateway Installation Form. The three-page form starts on page 43.

Required Installation Pictures

The installation contractor is required to provide electronic images of each gateway installation to Badger Meter as follows.

- View from the ground to the remote antennas
- 360-degree view (north/south/east/west-facing) from the antenna mounting structure and from the gateway enclosure
- Pictures showing any other antennas in the proximity of the gateway antennas as well as potential obstructions

Refer to the ORION SE II Network Gateway Installation Form for a complete list of required photos. The three-page form starts on page 43.

Remote Antenna Installation Instructions

Remote antenna installations must be performed by a professional installation contractor to ensure compliance with FCC regulations.

⚠WARNING

FAILURE TO READ AND FOLLOW THE INSTRUCTIONS PROVIDED CAN LEAD TO MISAPPLICATION OR MISUSE OF THE ORION SE II NETWORK GATEWAY TRANSCEIVER, RESULTING IN PERSONAL INJURY AND DAMAGE TO THE EQUIPMENT.

1. Unpack the ORION SE gateway assembly from the box. Locate and retain any accessories packaged with the gateway.

   NOTE: The GPRS backhaul antenna is not connected when shipped.

Figure 47: Gateway assembly with GPRS antenna

2. For each TX/RX antenna, cut and remove the cable ties holding the antenna cable to the gateway enclosure.

   Disconnect the TX/RX antenna cable/connector assembly from connectors located on the enclosure and base of each antenna (*Figure 48*).

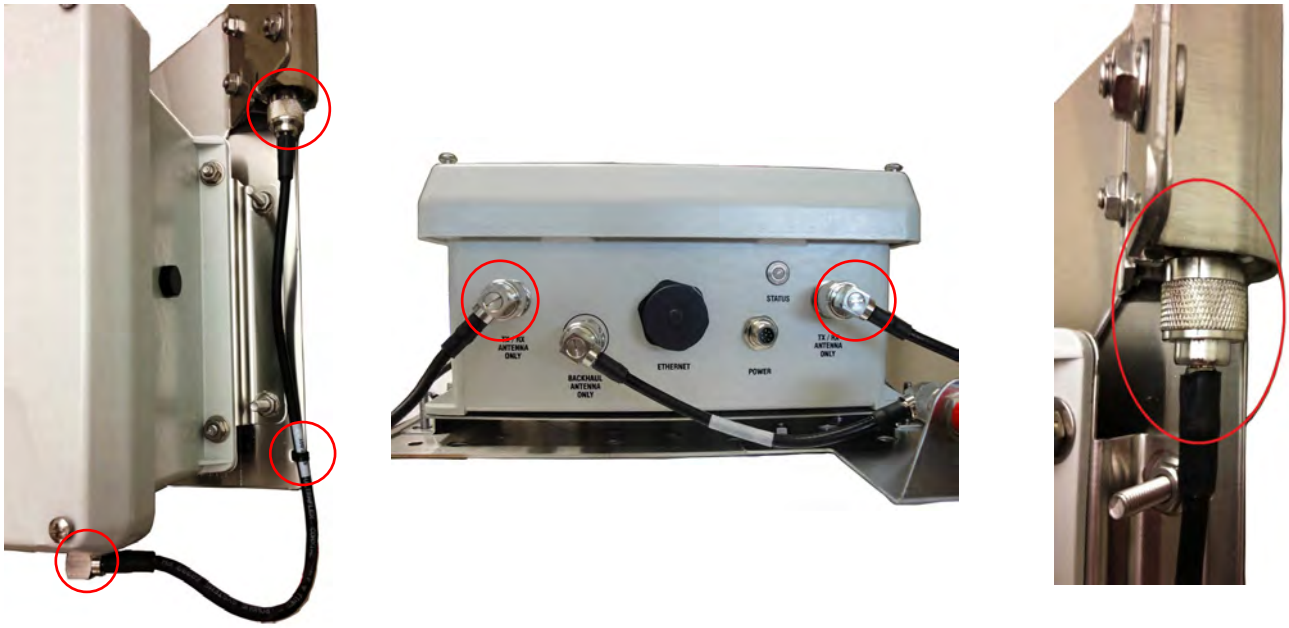


Figure 48: Disconnect cables and connector assemblies

3. Remove the antenna cable/connector assemblies but retain for future use should direct connection of the antennas be required in the future.

4. Disconnect the enclosure from the backplate by removing the two (2) locknuts from each side of the enclosure (*Figure 49*). Retain the locknuts as they will be used later to reattach the enclosure to the backplate.
5. Carefully lift the enclosure off of the backplate using caution to not damage the backhaul antenna cable.

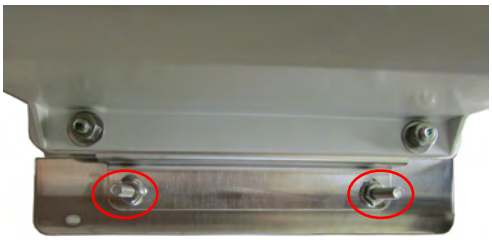


Figure 49: Disconnect enclosure from backplate

6. There are three locknuts holding the TX/RX antenna mounting bracket on the enclosure backplate (*Figure 50*). Remove those and separate the antenna bracket and antennas from the enclosure backplate.

Figure 50: Remove antenna mounting bracket locknuts

7. Once the antenna mounting bracket is removed, reattach the enclosure to the mounting backplate.
8. Attach the antenna bracket to the remote mounting structure using either V-block mounting hardware or Band-IT banding, depending on the structure. The example shown in *Figure 51* is using V-block mounting hardware. A side view of the mounting hardware is shown in *Figure 52*.

Figure 51: Antenna bracket attached with V-block mounting hardware

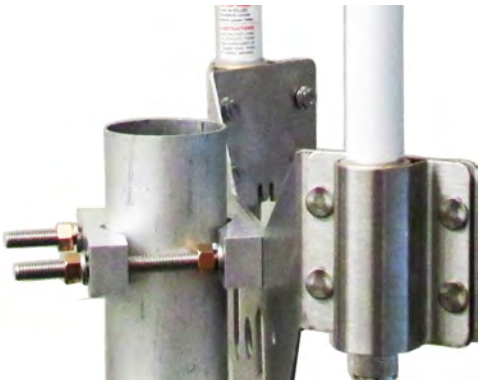


Figure 52: V-block mounting hardware side view

9. Prepare each of the antenna cables and connectors per manufacturer's instructions and connect to the Type N female connector at the bottom of each antenna.

   Tighten each Type N connector to 8…12 inch-pounds. To approximate this measurement without a torque wrench, finger tighten the Type N connector and then tighten an additional 1/16 inch turn with pliers.

   NOTE: A lightning arrestor is recommended for all remote antenna installations. Refer to "Lightning Arrestors" on page 26 for additional information.

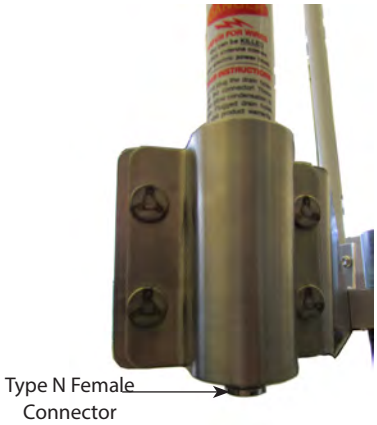


Figure 53: Type N female connector

10. Collect the required VSWR readings after the antennas are installed in their final locations. Record the information on the form provided by Badger Meter. Refer to "Required Antenna Tests" on page 36.
11. After the antenna tests are completed, connect the TX/RX antenna to the Type N female connector on the gateway enclosure (marked "TX/RX Antenna").

    The antenna cable can be connected directly to the enclosure. If needed, a 3-foot coaxial cable with Type N male connectors (PN: 67628-001) can be used to transition from the antenna connector to the Type N female connector on the enclosure.

Figure 54: TX/RX Antenna connector

12. Loosen the four (4) captive screws on the gateway enclosure cover. Remove the cover, attach the internal backup battery and reattach the cover. Refer to "Connecting the Battery Backup" on page 9 if you need help.
13. Wire the M12 connector according to the instructions provided and attach the power cable to the gateway enclosure.
14. Mount the gateway enclosure and backplate using V-block mounting hardware or Band-IT banding kit as appropriate. Refer to "Using the V-block Clamps Mounting Hardware" on page 14 for details.

15. Connect the AC adapter and power cord to the gateway power cable using the attached 308 connector and verify the LED indicator on the bottom of the enclosure is on with a steady green light, indicating the gateway is being AC powered as shown in *Figure 55*.

    NOTE: A red blinking light indicates the gateway is being powered only by the internal backup battery. No light indicates the gateway is not receiving AC or backup battery power.

Figure 55: Gateway on AC power

Figure 56: Gateway on battery power

16. Complete the ORION SE II Network Gateway Installation Form and send the completed form to Badger Meter with any attachments. The three-page form starts on page 43.

    The remote TX/RX antenna connection is complete.

Remote Backhaul Antenna Installation

Before installing the backhaul antenna in a remote location, first determine if a remote installation is needed.

In the location selected for the gateway, test the GPRS backhaul connection while the backhaul antenna is still connected to the gateway by doing the following.

NOTE: For testing the backhaul connection, make sure the gateway ReadCenter® Monitor server is running, the enclosure cover is off the gateway so the circuit board is visible, the backhaul antenna is connected to the gateway and AC power is available for the gateway.

1. Turn on the gateway AC power. On the circuit board in the lower left quadrant, next to the SIM card slot, look for the LED labeled "TCP" (*Figure 57*).

   The TCP LED will light when the backhaul links with the server, signifying a connection.

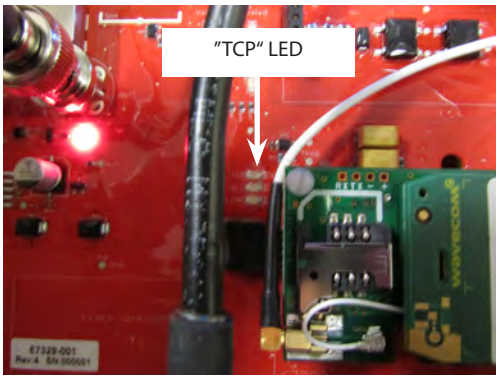


Figure 57: Backhaul antenna LED

2. If there is a connection, the backhaul antenna bracket and antenna can remain connected to the gateway. Remote installation is *not* required for the backhaul antenna.

   If there is no connection, remove the backhaul antenna bracket from the gateway.

   There are two locknuts holding the backhaul antenna mounting bracket on the enclosure backplate. Remove those to separate the antenna bracket and GPRS antenna from the enclosure backplate.
3. Move the antenna bracket with the GPRS antenna to the nearest outdoor location and test again.
4. If there is a connection, mount the backhaul antenna bracket.

   If there is still no connection to the gateway, move the antenna bracket and GPRS antenna to the highest location available, up to 100 feet away from the gateway enclosure.
5. Mount the backhaul antenna bracket using either V-block mounting hardware or Band-IT banding, depending on the structure.

   NOTE: The antenna can be inverted as shown in *Figure 58* for easier mounting.

Figure 58: Inverted backhaul antenna bracket

6. Prepare the cable and connector per manufacturer's instructions and connect to the Type N male connector at the bottom of the backhaul antenna.

   NOTE: A lightning arrestor is recommended for all remote antenna installations. Refer to "Lightning Arrestors" on page 26 for additional information.
7. Collect the required VSWR readings after the antenna is installed in its final location. Record the information on the form provided by Badger Meter. Refer to "Required Antenna Tests" on page 36.
8. Connect the backhaul antenna to the Type N female connector on the gateway enclosure (marked "Backhaul Antenna Only").

   The backhaul antenna cable can be connected directly to the enclosure.

   If needed, a 3-foot coaxial cable with Type N male connectors (PN: 67628-001) can be used to transition from the backhaul antenna connector to the Type N female connector on the enclosure.

Figure 59: Backhaul Antenna connector

9. Complete the ORION SE II Network Gateway Installation Form and send the completed form to Badger Meter with any attachments. The three-page form starts on page 43.

   The remote backhaul antenna connection is complete.

Badger Meter

ORION®SE II Network Gateway

Installation Form

Instructions: Complete a separate form for each gateway installation. *Return completed form(s) and attachments according to the instructions on the last page of the form.*

If you have questions about this form, contact Badger Meter Technical Support, ***TechSupport@BadgerMeter.com*** *or call* ***800-876-3837****.*

ORION SE Network Gateway Transceiver Information

All installations *– Complete table below.*

Gateway Serial Number	
Installation Date	
Location (street address or cross streets)	
Gateway Power Source (location and description)	
Mounting Structure (description of the structure the transceiver and antenna(s) are mounted on, including brackets)	
Actual Installed Height (above ground level)	
GPS Latitude	
GPS Longitude	
Location Comments	

Cables & Connectors

Remote antenna installations only –

Antenna cables and connectors are not included and are to be supplied by the professional installation contractor. Exact parts specified in Badger Meter installation documentation must be used. Substitutions are not allowed. Confirm parts used by completing table below.

	TX/RX Antenna Left	TX/RX Antenna Right	Backhaul Antenna
Cable Part Number			
Cable Length			
Connector Part Number			
Flex Cable Kit Used?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
VSWR Measurement			
Connection Waterproofing Method			
Grounding Method			
Lightning Arrestor (manufacturer and model/part number)			

Confirmation Photographs

All installations *– Photographs of the installation are required as outlined. Confirm photos taken by completing table.*

Installation Pictures	☐ Ground level view of antenna assembly ☐ Antenna cable connections (provide all) ☐ Other antennas in proximity ☐ East-facing line-of-sight from antenna assembly ☐ West-facing line-of-sight from antenna assembly ☐ North-facing line-of-sight from antenna assembly ☐ South-facing line-of-sight from antenna assembly	☐ Installed gateway enclosure and power source ☐ Potential obstructions ☐ Lightning arrestor with ground connections ☐ Other _____ ☐ Other _____ ☐ Other _____

Comments

Installation Comments *Attach additional pages as needed*	

I certify the ORION SE Network Gateway Transceiver and any remote antenna installations, if applicable, have been completed per Badger Meter documentation and instructions.

Installer Name (print): _____

Title: _____

Installation Company: _____

Date: _____

Signature: _____

Instructions for Returning the Form

Return this form and attachments to Badger Meter by one of the following methods.

Email:

TechSupport@BadgerMeter.com

Subject Line: Gateway Installation

Mail:

Badger Meter Inc.
Attn: Gateway Installation
P.O. Box 245036
Milwaukee, WI 53224-9536

Fax:

888-371-5982
Attn: Gateway Installation

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