NEPTUNE
TECHNOLOGY GROUP

Cellular Endpoint
Wall and Pit Installation and Maintenance Guide

Cellular Endpoint
Wall and Pit Installation and Maintenance Guide

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FCC Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

RF Exposure Information

This equipment complies with the FCC RF radiation requirements for uncontrolled environments. To maintain compliance with these requirements, the antenna and any radiating elements should be installed to ensure that a minimum separation distance of 20 cm is maintained from the general population.

Changes or modifications not expressly approved by the party responsible for compliance could void the users' authority to operate the equipment.

Professional Installation

In accordance with section 15.203 of the FCC rules and regulations, the R900® cellular endpoint must be professionally installed by trained meter installers. Changes or modifications not expressly approved by the party responsible for compliance void the user's authority to operate the equipment.

ISED Statement (Canada)

This device complies with Industry Canada license-exempt RSS standards. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.
- The device has been designed to comply with safety standards for exposure to radio waves (SAR) in accordance to RSS-102.
- The device should be installed and operated with a minimum distance of 20 cm between the equipment and the user's body.

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'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet artifice a été conçu pour se plier à la sécurité les exigences pour l'exposition aux ondes radioélectriques (SAR) dans conformité avec RSS-102. Cet artifice devrait être installé et fait marcher avec la distance minimale 20 centimètres entre l'équipement et votre corps.

Cellular Endpoint Wall and Pit
Installation and Maintenance Guide
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Chapter 1: Product Description

This chapter provides a general description of the Neptune® cellular endpoint for wall and pit applications.

The cellular endpoint is a compact electronic device that collects meter reading data from an encoder register at 15-minute intervals, and then transmits the data for collection using LTE-M cellular technology. The endpoint has an R900® mobile backup message that is transmitted every 30 seconds in the event the cellular network is unavailable.

The cellular endpoint is easily installed in wall or pit applications. It operates on the LTE-M cellular networks. The cellular endpoint stops transmissions when the battery discharges below the normal operating voltage.

Figure 1 – Cellular Endpoint – Wall

Figure 2 – Cellular Endpoint – Pit with External Antenna

Figure 3 – Cellular Endpoint – Pit with Internal Antenna

Chapter 2: Specifications

This chapter covers the specifications for the cellular endpoint.

Electrical Specifications

A lithium battery supplies the power.

Transmitter

The following table defines the cellular endpoint transmitter specifications.

Table 1 – Transmitter Specifications

Specification	Description
Transmit Period	Fifteen-minute data delivered four times per day. R900 mobile backup message transmitted every 60 minutes. If there are 72 consecutive hours of data delivery failure over the cellular network, the transmit frequency is increased to every 30 seconds.
Encoder Reading	Register interrogated every 15 minutes.
Transmitter Channel	50 (R900 mobile backup).
Transmitter Frequency	902–928 MHz (R900 mobile backup).
Output Power	Meets FCC Part 15.247 and FCC Part 27.
FCC Verification	Part 15.247.

Encoder Register Interface

The following table provides information on the maximum cable lengths required for different registers.

Table 2 – Supported Encoder Maximum Cable Length

Cable Brand	Length
Neptune® ARB® V	300 feet (91 meters). Meets manufacturer's published specifications for wire length between the encoder and the remote receptacle. The length is based on solid three conductor wire, 22 AWG.
Neptune® ProRead™, ProCoder™, MACH 10®, E-CODER®	500 feet (152 meters).
Sensus Protocol registers	200 feet (61 meters).

Environmental

The following table provides the environmental specifications of the cellular endpoint.

Table 3 – Environmental Conditions

Condition	Description
Operating Temperature	–22° to 149°F (–30° to 65°C).
Storage Temperature	–40° to 158°F (–40° to 70°C).
Operating Humidity	0 to 100% condensing.

Functional

The following table provides the functional specifications of the cellular endpoint.

Table 4 – Functional Specifications

Specification	Description
Register Reading	Eight digits.
Endpoint ID	Nine digits.

Dimensions and Weight

This section provides the dimensions and weight of the cellular endpoint.

Specification	Definition
Weight	1.0 lbs (454 grams).
Dimensions, Pit model with Internal Antenna	See "Pit Cellular Endpoint " Pit with Internal Antenna – Dimensions Front and Side in the following image.
Dimensions Wall model with External Antenna	See Wall Cellular Endpoint with External Antenna – Dimensions Front and Side on the following page.
Dimensions front and side	See Cellular endpoint – Dimensions Front and Side on the following page.

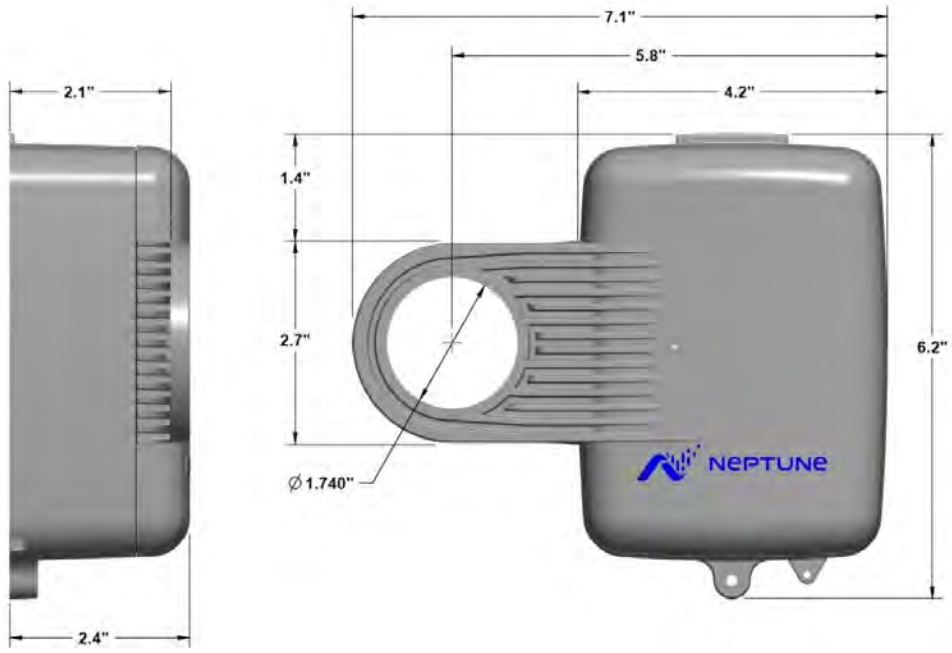

Figure 4 – Pit Cellular Endpoint with Internal Antenna – Dimensions Front and Side

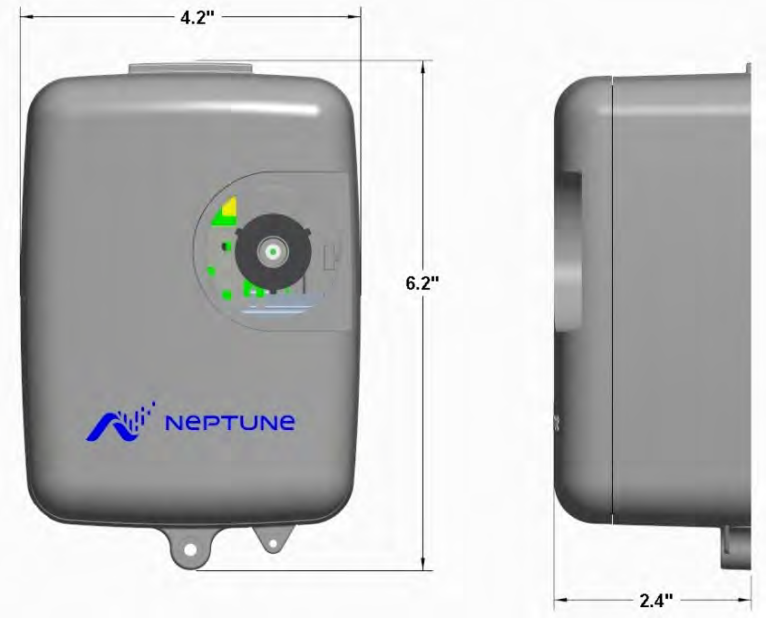

Figure 5 – Wall Cellular Endpoint with External Antenna – Dimensions Front and Side

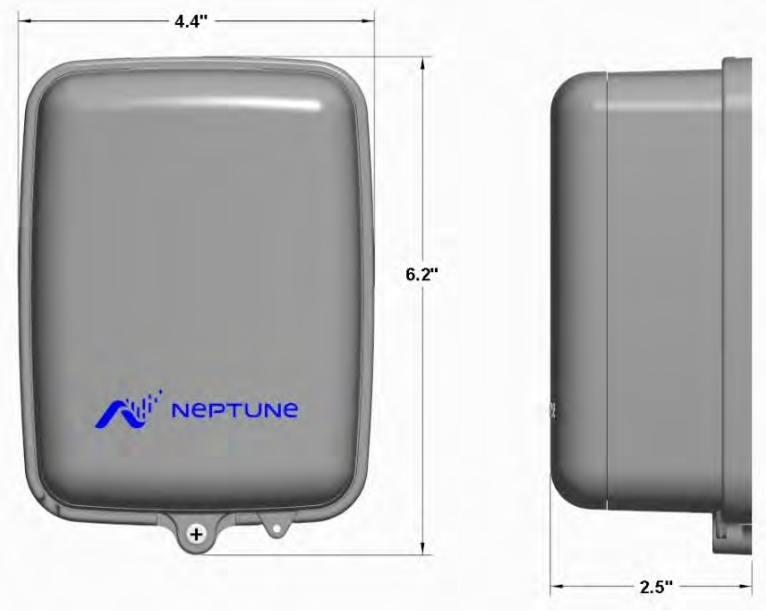

Figure 6 – Cellular Endpoint – Dimensions Front and Side

Chapter 3: General Installation Guidelines

This chapter describes tools, materials, and general installation guidelines for the cellular endpoint

Tools and Materials

Chapter 3 defines the recommended tools and materials needed to successfully install the cellular endpoint.

Some items may not apply to your specific installation, or the list may not contain all required tools or materials.

Recommended Tools

The following table defines the tools recommended to install the cellular endpoint.

Table 5 – Recommended Tools

Tool	Description	Use
Tool Kit	Contains standard tools including: • Assorted screwdrivers. • Needle-nose pliers. • Wire stripper. • Diagonal cutters. • Electrician's knife. • Hammer. • Crimping tool (part # 5500-158).	Perform various installation procedures.
Magnet	6 lb. force (part # 12287-001).	Activating the cellular endpoint.

Recommended Materials

The following table defines the materials recommended to install the cellular endpoint.

Table 6 – Recommended Materials

Material	Description	Use
Cable	Solid 3 Conductor #22 AWG (black / green / red) (part # 6431-352).	Connect the cellular endpoint to encoder register.
Moisture Protection Compound	Novagard® sealant (part# 96018-072).	Cover exposed wires and terminal screws on register and cellular endpoint.
Scotchloks	Part# 8138-125.	Connect wall cellular endpoint or replacement pit cellular endpoint to encoder register.
Site Work Order	Documentation provided by your utility.	Receive and record information about the work site.

Safety and Preliminary Checks

Observe the following safety and preliminary checks before and during each installation:

- Verify that you are at the location specified on the site work order.
- Verify that the site is safe for you and your equipment.
- Notify the customer of your presence and tell the customer that you need access to the water meter.
- Write the ID numbers of the cellular endpoint you are installing, if the site work order does not include the numbers.
- Verify that the ID numbers match the ID numbers on the cellular endpoint you are installing, if the site work order already includes them.

Verifying and Preparing the Encoder Register

The cellular endpoint is designed for use with the following encoder registers:

- ARB® V.
- ProRead™.
- ProRead™ AutoDetect.
- E-CODER®.
- ProCoder™.
- MACH 10®.

The cellular endpoint also operates with competitor registers using Sensus UI-1203 protocol which include:

- Sensus ECRIII.
- ICE.
- iPerl.
- OMNI, and electronic registers.
- Hersey/Mueller Translator.
- Badger ADE.
- HR-E® LCD.

Before installing the cellular endpoint, the encoder register must be correctly wired and programmed to work with the cellular endpoint. E-CODER and ProCoder registers do not require programming.

When using a ProRead encoder register, the non-AutoDetect ProRead register must be programmed for three-wire mode.

If connecting the cellular endpoint to a new ProRead encoder register, or if a three-conductor cable is already connected to a ProRead encoder register, ensure that the ProRead register:

- Is programmed for three-wire mode using the field programmer
- Format is set to (NTG) RF MIU Transport Driver Interface format (TDI). You can accomplish this through the ProRead receptacle before removing the receptacle.

Storage

After receipt, inspect the shipping containers for damage, and inspect the contents for damage prior to storage. After completing the inspection, store the cartons in a clean, dry environment.

The cellular endpoint has an internal battery and storing it for more than one year can affect product life. Be sure to use a first-in, first-out inventory control system. For more information, see "Environmental" on page 4.

Unpacking

Handle the cellular endpoint carefully; however, no additional special handling is required.

After unpacking the cellular endpoint, inspect it for damage. If the cellular endpoint appears to be damaged or proves to be defective upon installation, notify your Neptune sales representative. If one or more items requires reshipment, use the original cardboard box and packing material.

Installing a Register (Non Pre-Wired or Potted Only)

Prior to installing the cellular endpoint, ensure the meter register is wired. If it is not already pre-wired or potted, complete the following steps:

1. Make sure the cable is long enough before wiring the pit encoder register.
2. Use only 22 American Wire Gauge (AWG) cable to make the connection from the encoder register to the cellular endpoint.
3. Remove the terminal screw from the encoder register.
4. Strip off ¾ inch of the jacket from the cable, leaving only the three insulated wires. Take precautions not to nick or cut the insulation on the three wires.
5. Strip off 1/2 inch of insulation from each of the three wires.

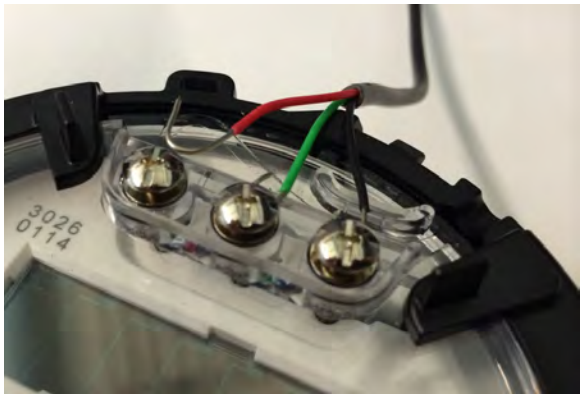

Figure 7 – Wiring a Neptune Encoder Register

6. If required, connect the three conductor wires to the encoder register's terminal per the manufacturer's instructions.

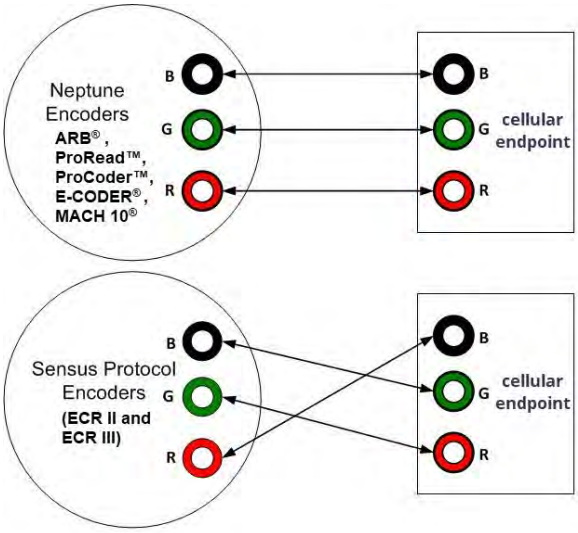

Figure 8 – Color Code for Wires

7. Thread the cable around the strain relief posts of the encoder.

Figure 9 – Cable Threaded Around Strain Relief Posts

8. Apply sealant liberally and ensure that it encapsulates the terminal screws and exposed wires.

Neptune requires Novagard® G661 sealant or Dow® compound 4.

Figure 10 – Application of the Sealant

9. Snap the cover onto the encoder register.

Figure 11 – Covering the Terminal Screws

Connecting the Endpoint Wires Together

If the endpoint is not purchased as potted and wired directly to a register, the endpoint's cable must be connected to the register's cable with either the standard 22 AWG pigtail cable or the connector cable.

When connecting with the standard 22 AWG pigtail cable, Scotchlok gel cap connectors are recommended.

The following sections are the different instructions for how to connect the register and endpoint cables together. These sections are referenced in the later installation procedures.

Connecting the Register and Endpoint Wires using Scotchlok™ Gel Cap Connectors

Follow these steps to connect the Scotchlok™ Gel Cap Connector.

1. Pair the colored wires appropriately according to the color diagram.

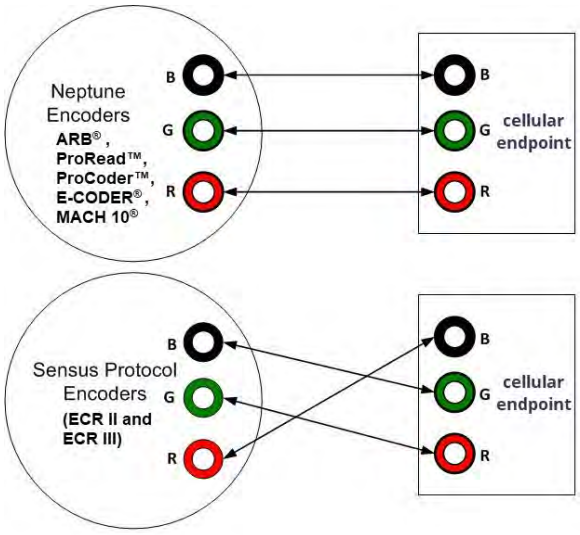

Figure 12 – Color Code for Wires

2. Hold the Scotchlok connector between the index finger and thumb with the red cap facing down.

Figure 13 – Scotchlok™ Connector

3. Slide a set of paired wires into the groove until they seat into the back of the gel cap.

Do not strip colored insulation from the wires, or strip and twist bare wires prior to inserting into a connector. Insert the insulated colored wires directly into the Scotchlok connector.

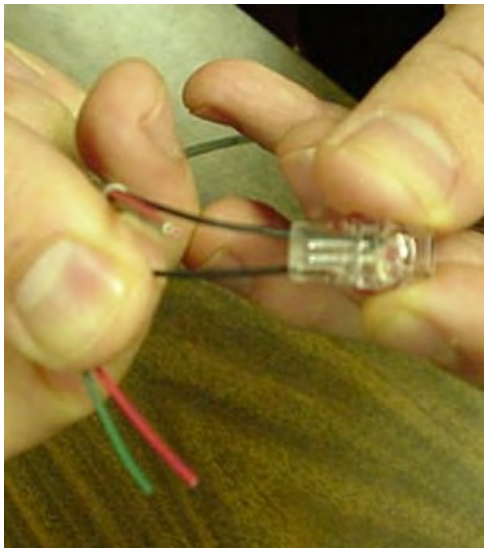

Figure 14 – Sliding Paired Wires into the Groove

4. Place the connector (red cap side down) between the jaws of the crimping tool.

Figure 15 – Crimping the Connector

5. Check to ensure the wires are still fully seated before crimping the connector. The following image illustrates improper connections due to wires not being fully seated.

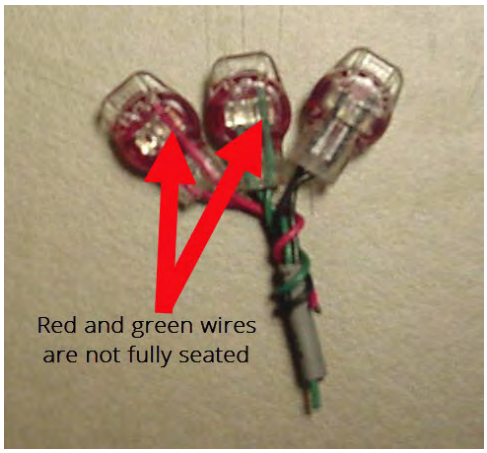

Figure 16 – Checking the Wire Seating

6. Squeeze the gel cap firmly using the appropriate crimping tool to ensure a good connection. You may hear a popping sound and gel may leak from the end of the connector.
7. Repeat steps 2 through 6 until you complete all connections.

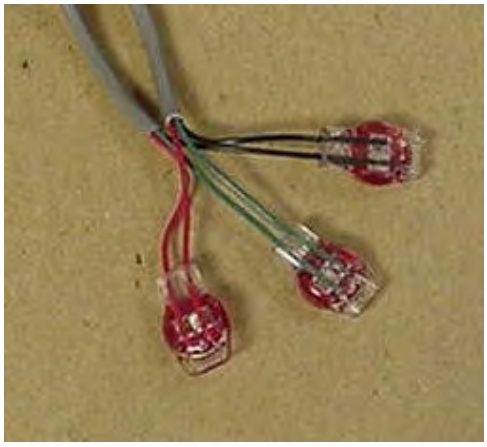

Figure 17 – Completing All Connections

8. Take all three connected Scotchloks and push them into the connector king splice tube until the silicone grease fully encapsulates it.

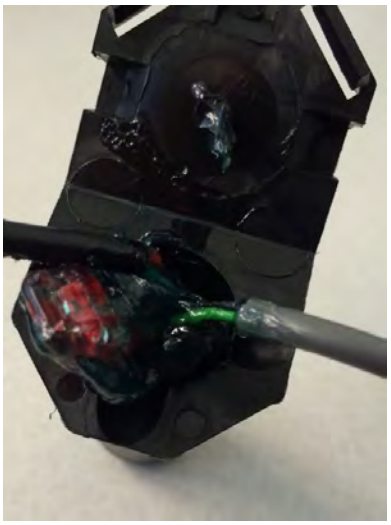

Figure 18 – Seating the Wires into the King Splice Tube

9. Separate each gray wire and place them in the slots on each side.

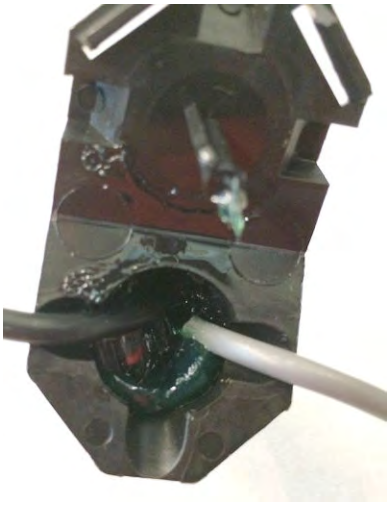

Figure 19 – Slotting the Wires

10. Snap the cover closed.

Connecting the Register and Endpoint Wires Using Quick Connectors

Follow these steps to connect the register and endpoint wires.

1. Align the connectors with arrows pointing toward each other.

Figure 20 – Lining up Connectors

2. Press the connectors firmly together, ensuring the arrows still line up. Take care not to twist.

Figure 21 – Connectors in Place

Figure 22 – Connector Ends Fully Connected

Chapter 4: Wall Installation

This chapter describes the site selection and the wall installation procedure for the cellular endpoint.

The cellular endpoint for wall application can be ordered as one of the following configurations:

- Potted with a standard 22 AWG pigtail cable.
- Potted with a connector cable.

Any existing network registers must be reprogrammed.

The cellular endpoint does not have networking capability.

Site Selection

Always follow your company's safety practices, and installation guidelines when installing a cellular endpoint. Never perform an installation during a lightning storm or under excessively wet conditions.

Installation and operation in moderate temperatures increase reliability and product life. For more information, see "Environmental" on page 4.

Follow these guidelines when selecting a location to install the cellular endpoint.

- Mount the cellular endpoint on the outside of the building.
- Install the cellular endpoint approximately 5 feet above the ground.
- Install the cellular endpoint in a vertical and upright position.
- Mount the cellular endpoint on a flat surface like a wall, but it can also be mounted on a pipe.
- Clear the selected location of all obstructions.
- Avoid installing the cellular endpoint behind metal fences or walls.

The maximum cable length between the encoder register and cellular endpoint depends on the register's manufacturer and model. See the following table for the maximum cable lengths.

Table 7 – Maximum Cable Lengths

Encoder Register	Maximum Cable Lengths
Neptune ARB® V. Meets manufacturer's published specification for wire length to the encoder.	300 feet (91 meters).
Neptune ProRead™, E-CODER®, ProCoder™, MACH 10®.	500 feet (152 meters).
Sensus Protocol registers.	200 feet (61 meters).

Installing the Cellular Endpoint

This section defines the procedure to install the wall cellular endpoint.

Complete the following steps to install the wall cellular endpoint.

1. Remove the main housing from the back plate.

Figure 23 – Cellular Endpoint Main Housing

The Hi-Lo fastener for securing the main cellular endpoint housing to the back plate is shipped separately.

2. Study "Site Selection" on page 19 and then decide how to install the cellular endpoint.
   - You can insert the cable through any of the entry holes in the back plate. The variety of holes allows for quick and easy installation.

Figure 24 – Cellular Endpoint Back Plate

   - When the cellular endpoint replaces a receptacle, use the appropriate hole to allow reuse of the receptacle's original mounting holes.
   - When mounting the cellular endpoint to a pipe, use the pipe clamp holes to secure the mounting adapter to a pipe.

3. Mount the back plate.
4. Connect the cellular endpoint's cable to the meter register or register cable. If connecting to a register that does not have a wired cable, following the instructions in "Installing a Register (Non Pre-Wired or Potted Only)" on page 10. If the register is already wired, follow the instructions in steps 1 through 7 for "Connecting the Register and Endpoint Wires using Scotchlok™ Gel Cap Connectors " on page 14 if using a standard cable, or "General Installation Guidelines" on page 7 if using a connector cable.

5. Store excess wire and Scotchloks (if applicable) in the hollow cavity in the back of the cellular endpoint using the strain relief guides.

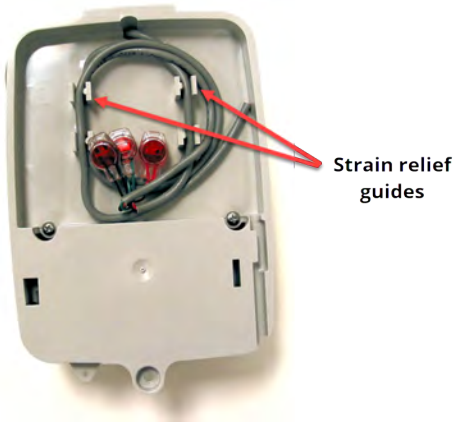

Figure 25 – Cable in Back of Cellular Endpoint

6. Continue to guide the remaining wire through the cable exit notch at the bottom right side of the cellular endpoint.

Figure 26 – Cable Exit Notch

7. Slide the tongue on the top of the cellular endpoint into the groove on the top of the back plate.
8. Secure the cellular endpoint to the back plate using the set screw.

9. Activate the endpoint by positioning the magnet against the left side of the cellular endpoint directly in line with the Neptune® logo.

Figure 27 – Securing the Mounting Adapter

10. Move the magnet up and over the top left corner of the cellular endpoint.

Figure 28 – Swiping the Cellular Endpoint

11. Install a seal wire or seal clip through the seal hole at the bottom of the cellular endpoint's main housing.

Figure 29 – Installing the Seal Wire

12. Verify that the requirements of the site work order have been met and that all information is recorded.
13. Clean up the installation site before leaving.

Testing the Installation

You can use the Neptune® 360™ Field Manager app to verify cellular connectivity and meter reading, to ensure the cellular endpoint is installed correctly.

To test the installation, complete the following steps.

1. Be sure the endpoint has been activated.

2. Open the **Endpoint Manager** section in the Neptune® 360™ Field Manager app on an Android™* or IOS® device.

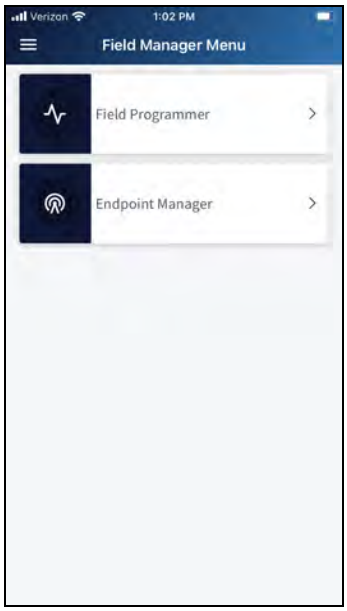

Figure 30 – Field Manager Options

3. Select **Search Cellular Endpoint**.

*Android is a trademark of Google LLC.

4. In the **Endpoint** field, enter the ID of the endpoint.

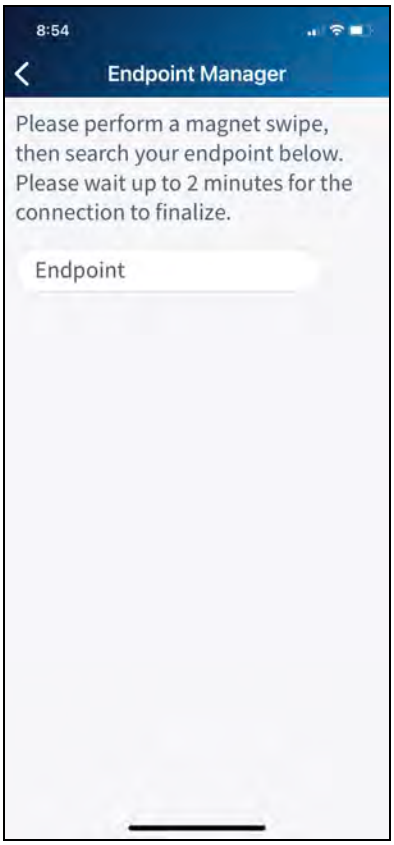

Figure 31 – Entering the Cellular Endpoint ID

It can take up to two minutes for information to be retrieved after performing the search. Please note that if the endpoint was not previously activated by swiping a magnet across its housing cover, you must complete this prior to searching for the endpoint in the Field Manager app.

5. When the system finds the endpoint ID, the Signal Quality and other data are displayed.

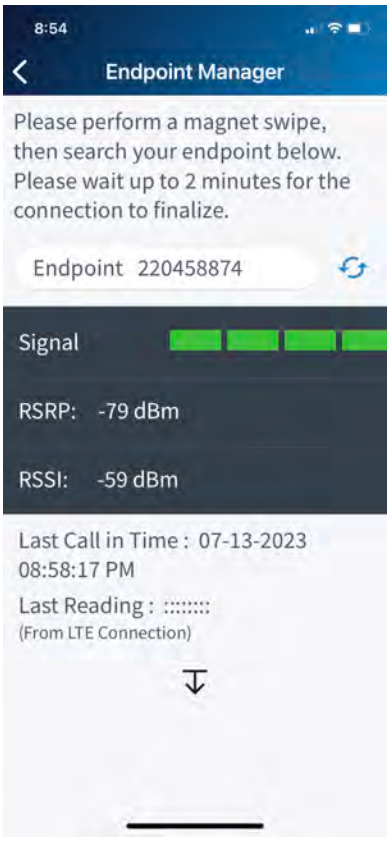

Figure 32 – Connection Status

6. Tap ↧ to reveal additional information for the endpoint .

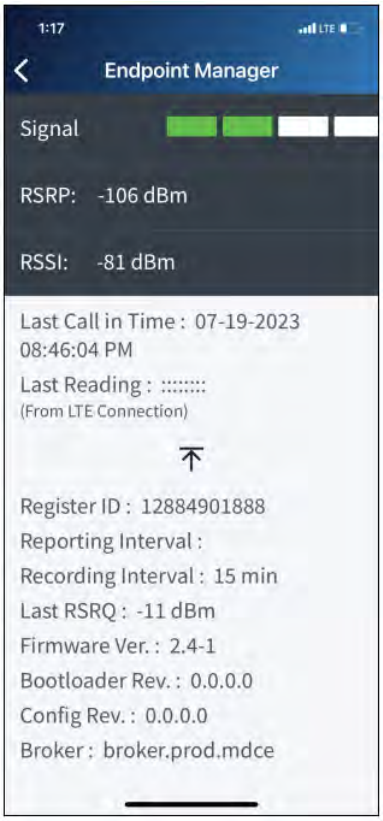

Figure 33 – Connection Status and Detail

7. If the system cannot find the endpoint ID or the LTE-M connection has not occurred after installation, it displays an alert.

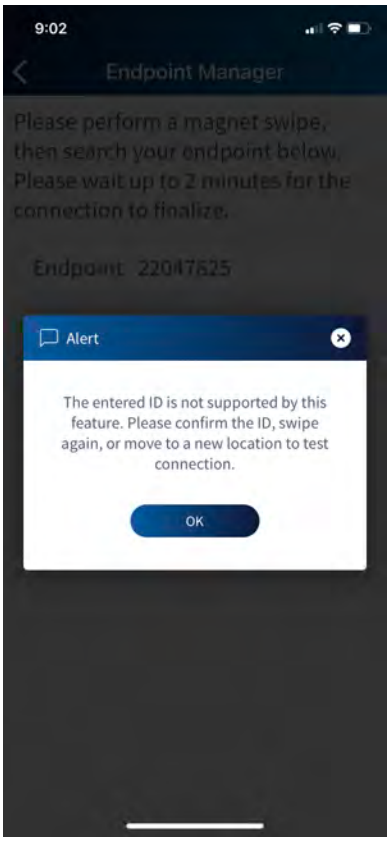

Figure 34 – Endpoint Alert

8. If the LTE-M connection has not occurred or if the signal strength is poor, the system displays the following disclaimer message: **"To improve the signal, Neptune recommends moving the endpoint to another location or utilizing a pit antenna (pit units only)"**. The following table describes the signal quality.

Table 8 – Signal Strength

LTE-M Signal Quality	RSRP (dBm)	RSRQ (dB)
Excellent	> –84	> –5
Good	–85 to –102	–9 to –5
Fair	–103 to –111	–12 to –9
Poor	< –111	< –12

If the signal strength displayed is Excellent or Good, the cellular coverage is adequate. If the signal strength is Fair or Poor, cellular connectivity may be impacted.

Chapter 5: Pit Installation

This chapter describes the site selection and the pit installation of the cellular endpoint.

The endpoint for installation in a pit can be purchased in two form factors (with or without an external antenna) and with one of the following configurations:

- Potted and wired directly to the register.
- Potted with a standard 22 AWG cable.
- Potted with a connector cable.

Be sure to select the appropriate version based on the recommendations in "Site Selection" on the next page.

Figure 35 – Pit Cellular Endpoint – with Internal Antenna

Figure 36 – Pit Cellular Endpoint – with External Antenna

Site Selection

Installation and operation in moderate temperatures increase reliability and product life. For more information, see "Environmental" on page 4.

Always follow your company's safety practices and installation guidelines when installing a cellular endpoint. Never perform an installation during a lightning storm or under excessively wet conditions.

Follow these guidelines when selecting a location and the endpoint type (with or without an external antenna) to install the cellular endpoint.

- Select a location where there is no chance that another object can be set over an antenna.
- Avoid installing the cellular endpoint behind metal fences or walls.
- Consider the following clearances for the pit cellular endpoint – with an internal antenna only.

Table 9 – Required Clearances for the Pit Cellular Endpoint – with Internal Antenna

Requirement	Minimum	Recommend	Notes
Vertical clearance from pit lid to meter / register	2½"	3"	N/A
Antenna hole distance from pit lid edge	2 3/16"	3 3/16"	Recommended distance (3-3/16") is needed to support the external cellular antenna if desired in the future.
Pit Lid Length	11″	13″	For smaller pits, utilize the cellular endpoint with external antenna.
Pit Lid Width	9″	11″	For smaller pits, utilize the cellular endpoint with external antenna.
Pit Lid Material	Plastic / Composite Only		Lid material must be non-metal and non-metallic. Pits with metal pit lids require the cellular endpoint with an external antenna.

Figure 37 – Pit Cellular Endpoint with Vertical Antenna Clearance

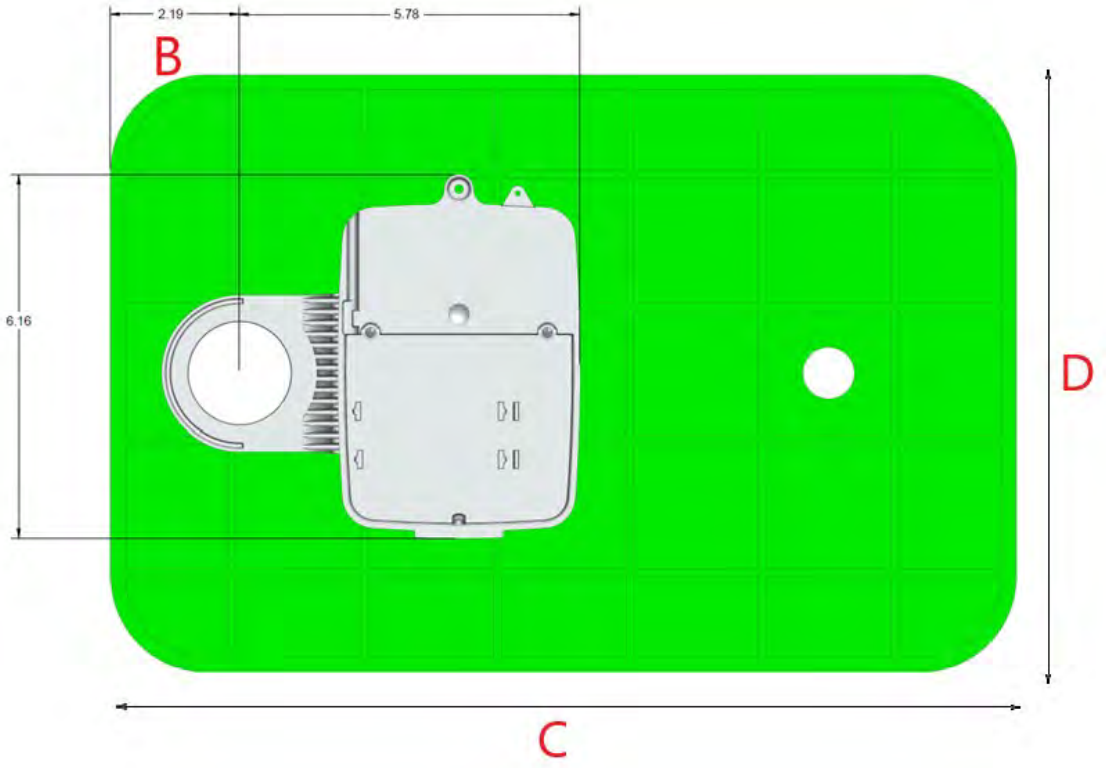

Figure 38 – Pit Cellular Endpoint with Internal Antenna Clearances

- For pit endpoints with the internal antenna, the meter pit must use a plastic polymer lid. Pits with metal lids require the pit endpoint with an external antenna.
- Make sure the pit location gives adequate room for installing both the cellular endpoint and the flange or TTL pit external antenna (if used).
- Install the pit external antenna above the lid in low traffic areas, as illustrated below, for maximum performance.

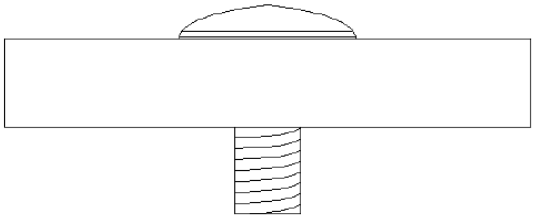

Figure 39 – Flange or Antenna Placement for Low Traffic Areas

- When installing in a high traffic area, Neptune® recommends that the dome of the flange or pit antenna be recessed in the pit lid as shown in "Flange or Antenna Placement for High Traffic Areas" on the facing page.
- Recessing the installation reduces the range of the antenna.

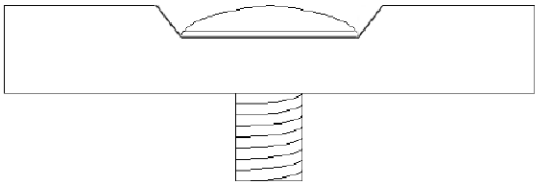

Figure 40 – Flange or Antenna Placement for High Traffic Areas

Although the cellular endpoint has a cable already attached (2 feet or 6 feet), some installations can require additional cable. In these cases, the maximum cable length between the encoder register and the cellular endpoint depends on the register's manufacturer and model. For more information, see "Specifications" on page 3.

Table 10 – Cable Length and Manufacturer

Encoder Register	Maximum Cable Length
Neptune® ARB® V Meets manufacturer's published specification for wire length between encoder and remote receptacle.	300 feet (91 meters).
Neptune ProRead™, E-CODER®, ProCoder™, MACH 10®.	500 feet (152 meters).
Sensus Protocol Register.	200 feet (61 meters).

Pit Cellular Endpoint Installation

The following section describes how to install a single cellular endpoint in a pit location. Be sure to select the appropriate version based on the recommendations in "Site Selection" on page 32.

Installing the Pit Cellular Endpoint with Internal Antenna

Follow this procedure to install the pit endpoint with an internal antenna.

1. Remove the pit lid.
2. Connect the endpoint to the meter / register (if endpoint is not potted to register) using the appropriate three-wire connection type. See "Connecting the Register and Endpoint Wires using Scotchlok™ Gel Cap Connectors " on page 14 or "General Installation Guidelines" on page 7.
3. Using a magnet, swipe clockwise around the top left corner of the endpoint, starting at the middle of the endpoint's longer side and ending at the middle of the short side.

Figure 41 – Swipe with the Magnet

Figure 42 – Magnet Swipe Direction

4. Insert the flange tube through the 1¾ inch hole in the meter pit lid.

Figure 43 – Insert the Flange Tube

5. Slide the endpoint housing onto the flange tube with the face of the endpoint housing toward the pit lid, until the face of the endpoint is touching the underside of the lid.

   Some pit lids may have a recessed underside which may cause the endpoint to not sit flush against the pit lid, forcing the flange to protrude, as illustrated in the following images.

Figure 44 – Recessed Underside - Cellular Endpoint not Flush

Figure 45 – Protruding Flange

In these cases, you can use an additional locking nut.

Figure 46 – Locking Nut Example One

Figure 47 – Locking Nut Example Two

Figure 48 – Locking Nut Example Three

6. After step 4 and before sliding the endpoint housing onto the flange tube, thread a locking nut onto the flange tube, with the unthreaded end toward the lid, until the nut is at an appropriate distance that allows the endpoint to sit flush, as illustrated.

Figure 49 – Slide the Endpoint Housing

7. Thread a locking nut onto the flange tube, with the unthreaded end toward the lid, until it loosely touches the endpoint housing.
8. Rotate the endpoint horizontally as needed to fit into the meter pit and finish tightening the locking nut to secure the endpoint in place.

Figure 50 – Rotate the Endpoint

9. Put the meter pit lid back in place ensuring a snug fit with the meter pit.

Figure 51 – Replace the Meter Lid

Installing the Pit Cellular Endpoint with External Antenna

Complete these steps to install the endpoint with an external antenna in a pit.

1. Insert the antenna cable and housing through the 1¾ inch hole in the meter pit lid.

Figure 52 – Inserting the Antenna into the Pit Lid

2. Thread the locking nut onto the antenna, with the unthreaded end toward the lid.

Figure 53 – Locking the Nut on the Antenna

Figure 54 – Antenna Installation Complete

3. Remove the protective cap from the antenna connector by pushing down and twisting the protective cap counterclockwise.

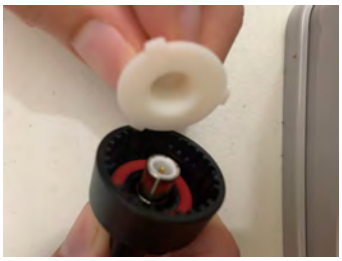

Figure 55 – Removing the Protective Cap

Make sure there is a red, O-ring gasket in the connector and there is Novagard® gel in the connector cavity.

4. Remove the protective cap from the antenna connection on the endpoint.
5. Connect the antenna to the endpoint ensuring that the center conductor pin inside the connector lines up with the hole in the center of the connector on the endpoint.

Figure 56 – Cellular Endpoint Conductor Pin

6. When the pin is properly aligned, push the antenna connection down fully onto the connection of the endpoint, so that the latch plate is engaged on all three posts.

Figure 57 – Aligning the Pin

7. Turn the antenna clockwise until it locks into place.

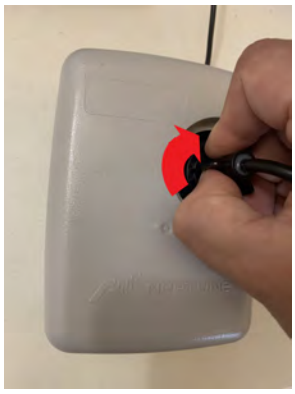

Figure 58 – Locking the Antenna into Place

8. Connect the endpoint to the meter/register (if endpoint is not potted to register) using the appropriate connection method (see "Connecting the Register and Endpoint Wires using Scotchlok™ Gel Cap Connectors " on page 14, or "General Installation Guidelines" on page 7.
   After the endpoint and register are connected you can activate the cellular endpoint.

9. Using a magnet, swipe clockwise around the top left corner of the endpoint, starting halfway down the long side of the endpoint and finishing at the middle of the shorter side.

Figure 59 – Swiping the Cellular Endpoint

10. Place the cellular endpoint in the pit:
    - In a shallow pit application, you can place the cellular endpoint beside the meter.
    - In deep pit applications, use a cable tie to suspend the cellular endpoint from the antenna shaft "Attaching the Cellular Endpoint to the Antenna Shaft" on the facing page.
    - Do not lodge the cellular endpoint between the meter box and any components inside the box.
    - Place the cellular endpoint in such a way that it does not lodge itself when the pit lid is removed.

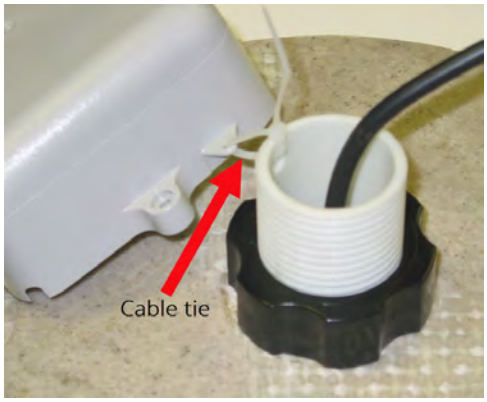

Figure 60 – Attaching the Cellular Endpoint to the Antenna Shaft

Testing the Installation

To test the installation, follow the steps in "Wall Installation" on page 19.

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Chapter 6: Maintenance and Troubleshooting

This chapter takes you through maintenance and troubleshooting procedures for the cellular endpoint.

Six- Wheel Encoders

If the odometer reads 123456, the Endpoint Manager should show 1 2 3 4 5 5 0 0.

The sixth digit displayed is a five, if the last digit on the odometer is five through nine. The sixth digit is a zero, if the last digit on the odometer is zero through four.
The cellular endpoint adds two zeros on the end to provide an eight-digit reading to the host software.

Four-Wheel Encoders

If the odometer reads 1234, the Endpoint Manager shows 1 2 3 4 0 0 0 0.

The cellular endpoint adds four zeros on the end to provide an eight-digit reading to the host software.

Troubleshooting

This section provides examples of possible reading values and what they indicate.

The following table includes various reading values and steps you can perform to troubleshoot issues. Many of the issues display the same reading value, so be sure to review the definitions of the reading value to determine the most appropriate troubleshooting steps.

Table 11 – Example Reading Values

Reading Value	Definition	Troubleshooting
::::::::	Indicates a timeout / failure to retrieve a reading	This value usually indicates a bad connection, no connection, or a cut wire between the endpoint and the meter register. Check the connection between the register and cellular endpoint.
????????	Indicates a non-numeric reading	Indicates the data received from the meter register is valid but contains a non-numeric value. For example: When the register wheel is in transition from one number to the next. This might be a temporary condition if an old register is present. If the condition persists, investigate the register.
MMMMMMMMM	Indicates the meter read history is not available	This reading can happen on R900 and LoRaWAN (v4 and v5) endpoints for the first 12 hours, and whenever the endpoint resets. The condition clears after 12 hours. If the condition persists, investigate the endpoint and register.
UUUUUUUUU	Indicates a parity check	This reading can indicate an endpoint-to-register communication error, which is usually temporary.
UUUUUUUUU	Indicates the Checksum failed	This reading can indicate an endpoint-to-register communication error which is usually temporary. If the error is consistent, verify the register configuration.
UUUUUUUUU	Indicates a format error	This reading can indicate an endpoint-to-register communication error. If certain delimiters are missing from the packet, this error can occur. The error can also indicate a possible programming / configuration register issue. If the condition does not clear, investigate the register.

Table 11 – Example Reading Values (continued)

Reading Value	Definition	Troubleshooting
UUUUUUUUU	Indicates an unknown register	This reading can indicate an auto-detection failure with no error found, or an incompatible register. The condition can also occur If the system receives a packet back from the register that the endpoint does not recognize.
UUUUUUUUU	Indicates a mismatched register type	This reading can indicate a register type has changed or the register was replaced (mismatched register protocol), or the register is replaced (moved from E-CODER to MACH 10 or ProCoder). If the condition occurs without replacing or swapping the register type, the endpoint receives a response from the register that does not match the expected response.
UUUUUUUUU	Indicates a mismatched register ID	This reading indicates a register ID was changed or replaced. This c occur with an E-CODER replacement. If the error persists, investigate the register.
UUUUUUUUU	Indicates a message timeout	This reading indicates the endpoint timed out and the register stopped responding to the endpoint interrogations. This condition is temporary.

Contact Information

Neptune Customer Support is available in the United States Monday through Friday, 7:00 A.M. to 5:00 P.M. Central Time by telephone or email.

By Phone

To contact Neptune Customer Support by phone, call (800) 647-4832 and complete the following steps.

Press one of the following:

- 1 for Customer Service.
- 2 for System Support.
- 3 for Return Material Authorizations (RMAs)
- 4 for Subscriptions or Renewals
- 5 for Customer Success and Onboarding

For System Support or Customer Success and Onboarding, press one of the following:

- 1 if you know your site ID.
- 2 to input your PIN or if you do not have a PIN.

For RMAs, press one of the following:

- 1 for reading device support.
- 2 for meter, endpoint, and register support.

Neptune Customer Support Specialists are dedicated to you until the issue is resolved to your satisfaction. When you call, please be prepared to give the following information:

- Your name and utility or company name.
- A description of what occurred and what you were doing at the time.
- A description of any actions taken to correct the issue.

By Email

To contact Neptune Support by email, send your message to support@neptunetg.com.

Appendix A: Endpoint Modes

There is a single mode of operation for the cellular endpoint, which provides 15-minute register interrogations with readings and flags delivered to Neptune® 360™ every six hours.

Table 12 – Leak Status Flag Descriptions

Leak Status Flag (Resets After 35 Days)	
Based on total number of 15-minute periods recorded in the previous 24-hour period.	
Leak icon off	Eighth digit incremented less than 50 of the 96 days of 15-minute intervals.
Flashing leak icon	Eighth digit incremented in 50-95 of the 96 days of 15-minute intervals.
Solid leak icon	Eighth digit incremented in all of the 96 days 15-minute intervals.
Consecutive Days with Zero Consumption Flag (Resets After 35 Days).	
Number of days the "leak status" was at a minimum value.	

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Appendix B: Field Manager

Neptune® 360™ Field Manager is an Android and iOS application that can communicate with a cellular endpoint during the installation, troubleshooting, and maintenance of the endpoint. The Field Manager checks the LTE Connection of the endpoint.

Field Manager is compatible with the following Android operating systems:

- 7.0.X Nougat.
- 7.1.X Nougat.
- 8.1.X Oreo.
- 9.0.X Pie.
- 10.0.X.

Field Manager is also compatible with the following iOS operating systems **antenna (pit)**[1] using either an iPhone or iPad:

- 10.3.1 and higher.
- 11.
- 12.
- 13.
- 14.

Cellular Endpoint Status

The Cellular Endpoint Status screen provides a snapshot of the current configuration of the cellular endpoint that the system is searching. This information is:

- Endpoint Status (four possible states based on signal quality: Excellent, Good, Fair, Poor).
- Signal quality (RSRP and RSRQ).
- Last meter reading.
- Last call in time.

Additionally, you can open a collapsible section and review additional information for the cellular endpoint including:

- Reporting Interval.
- Recording Interval.
- Last RSRP.
- Last RSRQ.
- Firmware Rev.
- Bootloader Rev.
- Config Rev.

[1] Cellular endpoint antenna used for pit installations.

Error Messaging

If a user attempts to search for a cellular endpoint, but cannot return details, there are two possible error scenarios:

1. If your mobile device does not have service at the time you search, you see the message: "No network connection. Try again later."
2. If you search for an endpoint and nothing is returned, you see the message: "Cannot find Endpoint. Please try swiping again or moving to a new location to try connection again."

Meter Reading

You can use the Endpoint Manager to verify a valid installation of a cellular endpoint with a connected register. By accessing the Endpoint Manager section of the Field Manager app and searching an endpoint, you have access to the last meter reading and last call in time.

Glossary

A

antenna (pit)

Cellular endpoint antenna used for pit installations.

AWG

American Wire Gauge.

F

FCC

Federal Communications Commission.

L

Liquid Crystal Display (LCD)

Component where the meter-reading and value-added icons are displayed.

M

MIU

Meter Interface Unit, which is also called an endpoint.

R

register read time

The default time is 15 minutes for all registers. Custom time is not available.

S

seal pin

Small, black plastic nail used to secure the E-CODER®)R900*i* to the meter.

serial number

Unique identification number given to each endpoint / MIU at the factory. The default value is the last programmed, plus one. Custom serial numbers are not available.

T

TDI

Transport Driver Interface format.

transmission time

The time between endpoint transmissions.

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