



Cellular ProCoder™) R900i™  
Installation and Maintenance Guide





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## FCC Conformity

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**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.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

## 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.



**Caution! Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

## Professional Installation

In accordance with Section 15.203 of the FCC rules and regulations, the Cellular ProCoder must be professionally installed by trained utility meter installers. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## Industry Canada

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Cet appareillage numérique de la classe B répond à toutes les exigences de l'interférence canadienne causant des règlements d'équipement. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.

## ISED Statement (Canada)

This device complies with Industry Canada license-exempt RSS standards. Operation is subject to the following 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 with 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 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.
- (3) l'appareil a été conçu pour être conforme aux normes de sécurité relatives à l'exposition aux ondes radio (SAR) conformément à RSS-102.
- (4) l'appareil doit être installé et utilisé avec une distance minimale de 20 cm entre l'équipement et le corps de l'utilisateur.

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 ProCoder™)R900i™*  
*Installation and Maintenance Guide*  
Literature No. Cellular ProCoder)R900i IM 07.2024

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### Overview

This chapter provides a general description of the cellular ProCoder™)R900i™ register. The Neptune® cellular ProCoder)R900i is an integrated meter-reading register that contains both the ProCoder™ and R900® cellular technologies in one register that transmits the meter reading data over the cellular network.

The cellular ProCoder)R900i is easily installed and operates within a radio frequency (RF) band which does not require an operating license. The cellular ProCoder)R900i meets Federal Communications Commission (FCC) regulations Part 15.247 allowing higher output power and greater range. The transmitted data is updated at 15-minute intervals and transmitted over the cellular network every 6 hours.

The cellular ProCoder)R900i offers advantages to utility organizations of all sizes:

- Increases meter reading accuracy.
- Eliminates hard-to-read meters.
- Protects utility liability by increasing meter reader safety.
- Requires no external wiring or programming.
- Provides proactive customer service benefits (leak, tamper, and backflow detection).



Figure 1 – Cellular ProCoder™)R900i™

## Cellular ProCoder™)R900i™ Programming

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The cellular ProCoder)R900i does NOT require field programming. At the factory, each of the following items is programmed into the endpoint (MIU):

- Serial number – Each endpoint is given a unique serial number / identification number.
- Meter size and change gear information.

This chapter provides the specifications for the cellular ProCoder™)R900i™.

### Electrical Specifications

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The cellular ProCoder)R900i is powered by a lithium battery.

### Transmitter Specifications

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The following table defines the transmitter specifications for the cellular ProCoder)R900i.

**Table 1 – Transmitter Specifications**

Specification	Description
Transmit Period	<ul style="list-style-type: none"><li>Fifteen-minute data delivered four times per day.</li><li>R900 mobile backup message transmitted every 60 minutes. If there are 24 consecutive hours of data delivery failure over the cellular network, the transmit frequency is increased to every 30 seconds.</li></ul>
Encoder Reading	Register interrogated every 15 minutes.
Transmitter Channels	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.

### Environmental Conditions

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The following table provides the environmental specifications for the cellular ProCoder)R900i.

**Table 2 – 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 (pit only).

## Functional Specifications

The following table provides the functional specifications of the cellular ProCoder)R900i.

**Table 3 – Functional Specifications**

Specification	Description
Register Reading	<ul style="list-style-type: none"> <li>• Eight digits.</li> </ul>
Endpoint ID	<ul style="list-style-type: none"> <li>• Nine digits.</li> </ul>

## Dimensions and Weight

This section provides the dimensions and weight of the cellular ProCoder)R900i.

**Table 4 – Dimensions and Weight**

Measurement	Description
Weight	1.0 lbs (454 grams).
Dimensions front and side	<ul style="list-style-type: none"> <li>• 5.75 inches wide.</li> <li>• 4.63 inches long front to back, excluding antenna connection dust cover.</li> <li>• 5.36 inches long front to back, including antenna connection dust cover.</li> <li>• 2.74 inches high.</li> </ul>
Offset through-the-lid antenna dimensions	<ul style="list-style-type: none"> <li>• 4.5 inches wide.</li> <li>• .50 inches high, antenna only without screw and nut.</li> <li>• 3.54 inches high, antenna with screw and nut.</li> <li>• 1.72 inches wide screw only.</li> </ul>
Standard through-the-lid antenna dimensions	<ul style="list-style-type: none"> <li>• 5.7 inches wide.</li> <li>• 0.4 inches high, antenna only without screw and nut.</li> <li>• 3.52 inches high, antenna with screw and nut.</li> <li>• 1.7 inches wide screw only.</li> </ul>



## Cellular ProCoder™)R900i™ Dimensions

The following are photos of the unit with antennas and both the inside and pit dimension diagrams for the cellular ProCoder)R900i .



Figure 2 – Cellular ProCoder™)R900i™ Top View with Open Lid



Figure 3 – Cellular ProCoder™)R900i™ Angled View with Offset Antenna

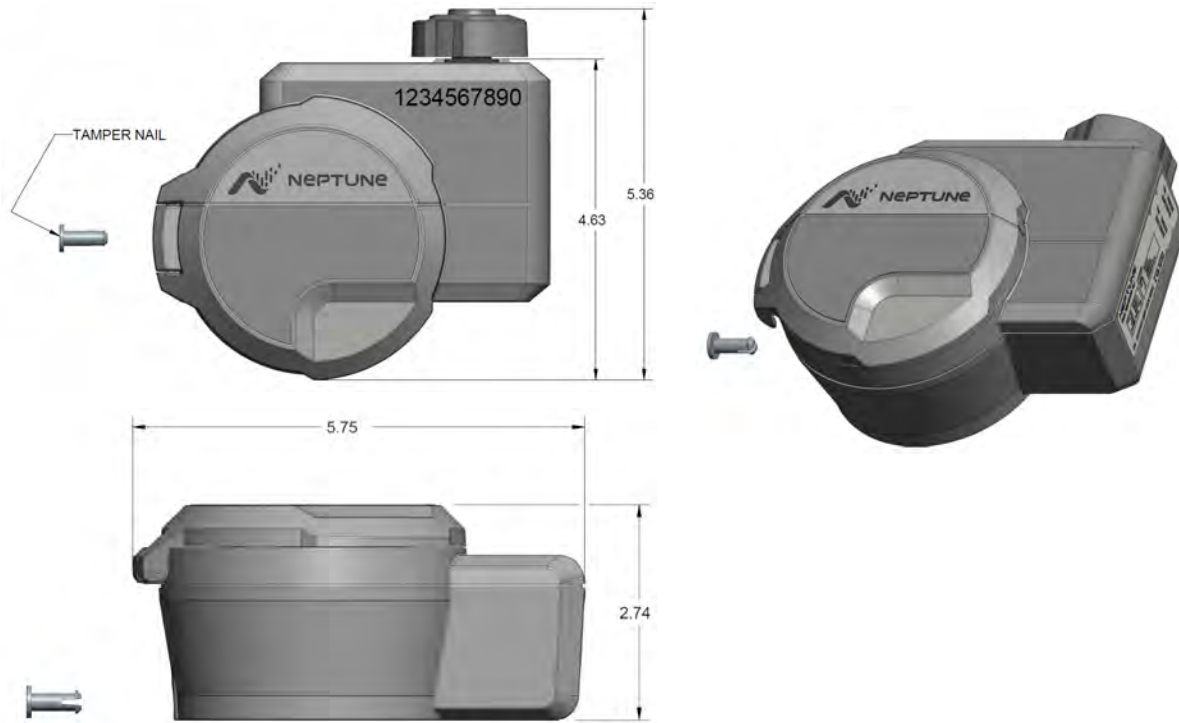


Figure 4 – Cellular ProCoder™)R900™ Dimensions

The following are photos of the offset and Standard antennas and dimension diagrams for the antennas.



Figure 5 – Offset Through-the-Lid Antenna – Front View



Figure 6 – Offset Through-the-Lid Antenna – Side View



Figure 7 – Standard Through-the-Lid Antenna – Front View



Figure 8 – Standard Through-The-Lid Antenna – Side View

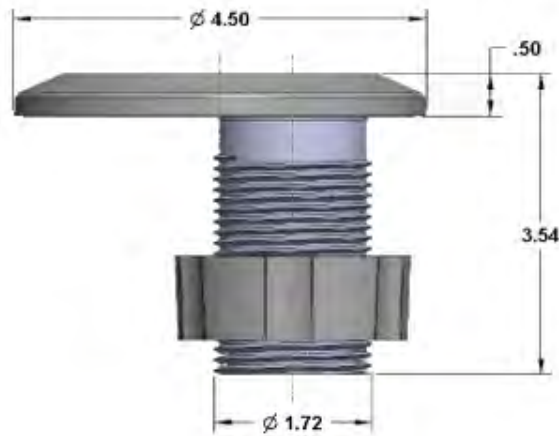


Figure 9 – Offset Through-the-Lid Antenna Dimensions

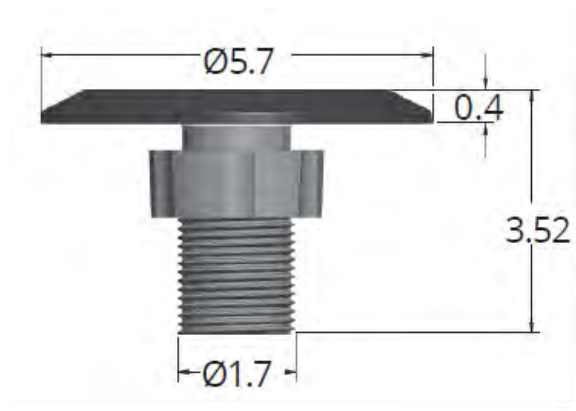


Figure 10 – Standard Through-the-Lid Antenna Dimensions

## Chapter 3: Reading the Cellular ProCoder™)R900j™

This chapter provides information on reading the cellular ProCoder™)R900j™.

### How to Read

Become familiar with the information available from the meter.

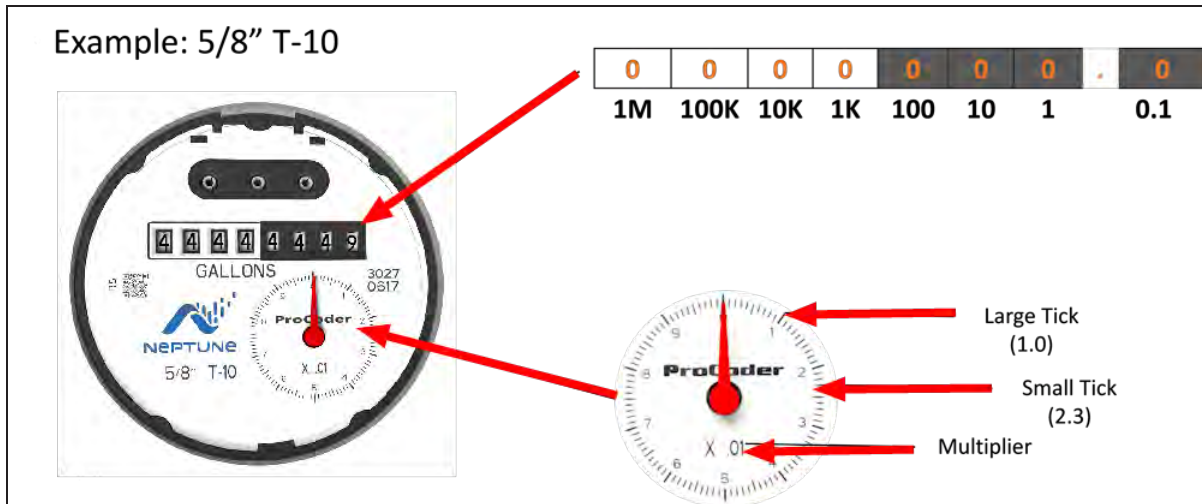


Figure 11 – Cellular ProCoder™)R900j™ Face and Sweep Hand

The sensitive sweep hand provides a visual representation of extreme low flows as well as reverse flows. Depending on the size and type of ProCoder register, a specific multiplier is present. This multiplier, along with the current position of the sweep hand, provides additional digits of resolution that are especially useful for testing.



Important! For further information on reading the ProCoder sweep hand, see the Product Support Document *How to Read the Neptune® ProCoder™ Register*.

## Common Causes of Leaks

Leaks can result from various circumstances. The following table contains some common causes of leaks.

Table 5 – Possible Leaks

Possible Cause of Leak	Intermittent Leak	Continuous Leak
Outside faucet, garden, or sprinkler system leaking	✓	✓
Toilet valve not sealed properly	✓	✓
Toilet running	-	✓
Faucet in kitchen or bathrooms leaking	✓	✓
Ice maker leaking	-	✓
Soaker hose in use	-	✓
Leak between the water meter and the house	-	✓
Washing machine leaking	✓	✓
Dishwasher leaking	✓	✓
Hot water heater leaking	-	✓
Watering yard for more than eight hours	✓	✓
Continuous pet water device in use	-	✓
Water-cooled air conditioner or heat pump	✓	✓
Swimming pool filled	-	✓
Any continuous use of water for 24 hours	-	✓

Check all equipment that uses water to determine where the leak originates.

## How to Tell if Water is in Use

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To determine if water is in use, complete the following steps:

1. View the mechanical sweep hand.
2. Determine the following conditions. If the sweep hand is:
  - Moving slowly in a clockwise direction, water is running very slowly.
  - Moving quickly, water is running.
  - Not moving, water is not in use.
  - Moving in a counter-clockwise direction, backflow is occurring.

## If Continuous Leak is Repaired

---

If you find and repair a continuous leak, complete the following steps:

1. Use no water for at least **15 minutes**.
2. Check the sweep hand.

If the sweep hand is not moving, there is no longer a continuous leak.

## If Intermittent Leak is Repaired

---

If you find and repair an intermittent leak, check the sweep hand after at least **24 hours**.

If the sweep hand is not moving, there is no longer an intermittent leak.

## Communication Schedule

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R900® cellular endpoints are delivered with a predefined reading communication schedule set up at the factory. Each reading is scheduled to occur within a two-hour time period.

- Monday through Friday readings – four transmissions daily beginning at midnight local time, occurring every six hours.
- Saturday and Sunday readings – one transmission daily, beginning 24 hours after the last transmission the previous Friday.

## Example Schedule

The default weekday communications settings include four transmissions in the 24-hour period beginning at midnight:

- Transmission 1 – 12:00 AM to 2:00 AM.
- Transmission 2 – 6:00 AM to 8:00 AM.
- Transmission 3 - 12:00 PM to 2:00 PM.
- Transmission 4 – 6:00 PM to 8:00 PM.

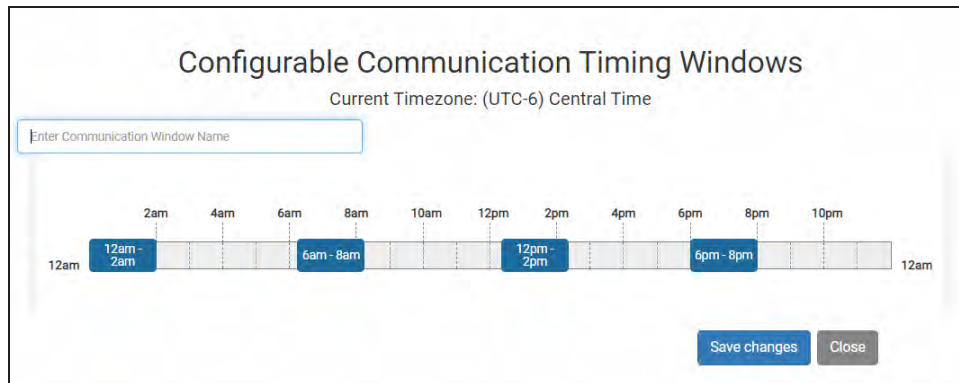


Figure 12 – Configurable Communication Timing Windows

The Saturday and Sunday transmissions occur once each day beginning approximately 24 hours after the last transmission on Friday. For example, if Friday's last transmission occurs at 7:30 PM, then Saturday's and Sunday's transmissions occur at approximately 7:30 PM.



**Important!** Limiting the number of weekend transmissions to only two plays a key role maximizing the lifespan of your R900 endpoint and maintaining the stated warranty.



With the correct permissions, you can override the predefined schedule to accommodate your specific utility's needs and billing schedule. The default schedule contains all R900 cellular devices that the utility purchased / claimed. This feature is not available to any other type of endpoint (R450™, R900®, LoRaWAN®). The following guidelines apply to any communication schedule changes.

- You cannot increase or decrease the number of readings in any given 24-hour period, you can only change the timing of the readings.
- You must allot at least one hour between readings.
- If you reschedule a reading and then delete the rescheduled reading, the endpoint resumes the original schedule.

See the Neptune® 360™ online Help for the step-by-step procedure to customize the communication schedule fro your cellular R900.

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## Chapter 4: Installing the Cellular ProCoder™)R900i™

This chapter describes the installation process for the cellular ProCoder™)R900i™.

### Prior to Installation

This section provides information on the procedures to complete before you install the unit:

- Storing and unpacking the cellular ProCoder)R900i.
- Site selection.
- Preliminary tests, tools, and materials needed for installation.

### Storage

Upon receipt, inspect the shipping containers for damage, and inspect the contents of any damaged cartons prior to storage. After you inspect the cartons, store them in a clean, dry environment.

### Unpacking

Handle the cellular ProCoder)R900i carefully; however, no additional special handling is required. When shipped, the assembly is lying on its side. Lift the assembly out of the box by the meter maincase. After unpacking the cellular ProCoder)R900i, inspect it for damage. If the unit appears to be damaged or proves to be defective upon installation, notify your Neptune Territory Manager or Distributor. If one or more items requires reshipment, use the original cardboard box and packing material.



Figure 13 – Cellular ProCoder™)R900i Top View with Register Lid Open

## Site Selection

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Installation and operation in moderate temperatures increases reliability and product life. See "Specifications" on page 3.

Follow these guidelines when selecting a location to install the cellular ProCoder)R900i:

- Install the cellular ProCoder)R900i in a horizontal position.
- Clear the selected location of all obstructions.



**Important!** Always follow your company's safety practices and installation guidelines when installing a cellular ProCoder)R900i. Never perform an installation during a lightning storm or under excessively wet conditions.

## Recommended Tools

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

Table 6 – Recommended Tools

Tool	Description	Use
Tool Kit	Contains standard tools including: <ul style="list-style-type: none"><li>• Assorted screwdrivers.</li><li>• Needle-nose pliers.</li><li>• Diagonal cutters.</li><li>• Electricians knife.</li><li>• Hammer.</li></ul>	Perform various installation procedures.
Magnet	Neptune magnet (part number 12287-0001)	Activating the cellular endpoint.

## Installing the Cellular ProCoder™)R900i™

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Follow the steps in this section to install the cellular ProCoder)R900i.

## New Meter Installation

1. Flush the service line prior to installing the meter to remove debris in the line.
2. Place an electrical grounding strap on the service line if required, connecting the inlet and outlet service lines on either side of the meter setting.



**Important!** You must install the inlet and outlet meter valves and couplings / setters, if they are not already present. Allow appropriate space in the line for the meter laying length and two coupling gaskets. Align the pipe ends so that the coupling and meter threads can engage without binding or cross-threading.

3. Before installing the meter, remove the thread protectors and spud caps. Be sure that no debris enters the meter during installation.



**Caution!** The meter threads are sharp.

4. Place the coupling gaskets inside the coupling nuts and set the meter in the line. Align the meter in a horizontal position with the register dial facing upward. The direction of flow marked on the meter must agree with the direction of actual water flow.
5. Tighten the coupling nuts by hand then use a wrench and tighten sufficiently to prevent leakage. Be careful not to cross-thread the connections.
6. Open the meter outlet valve slowly. Open a downstream faucet and run enough water to dissipate entrained air and flush the line. While the faucet is open, verify the meter is operating correctly.
7. Turn off the faucet and check the meter installation for leaks. See "Reading the Cellular ProCoder™)R900i™" on page 9

## Retrofit Meter Installation

1. Use a punch / screwdriver and hammer to punch out the tamper-proof seal pin on the existing register head.
2. Remove the existing register by twisting counter-clockwise.
3. Install the new cellular ProCoder)R900i register head onto the meter body in the desired orientation by twisting clockwise.
4. Snap the new tamper-proof seal pin to secure the register to the meter body.

## Connecting the Cellular ProCoder™)R900i™ Through-the-Lid (TTL) Antenna

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The cellular ProCoder)R900i unit includes a standard 2-foot external antenna cable length along with the TTL antenna.



Figure 14 – Offset TTL Antenna



Figure 15 – Standard TTL Antenna

## Installing the Antenna

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To install the antenna, complete the following steps.

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



Figure 16 – Through-the-Lid Antenna

2. Thread the locking nut onto the antenna (smooth end toward lid).



Figure 17 – Locking the Nut on the Antenna

3. Hand tighten the nut securely to the lid.



Figure 18 – Securing the Locking Nut

Figure 19 shows a completed installation of the antenna.



Figure 19 – Installation Complete

## Attaching the Antenna to the Endpoint

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1. Remove the protective dust cover from the antenna port.



Important! If you are replacing an existing antenna, remove the existing antenna connection. Clean any dirt, debris, or dielectric grease from the connector on the endpoint housing.



Figure 20 – Removing the Dust Cover

2. Carefully align the connector center conductor, and insert the antenna connector into the three-lobed black plastic latch plate on the housing.



Figure 21 – Aligning the Connector



3. Push in and turn clockwise until the antenna connector is properly seated on the three-lobed black plastic latch plate.



Figure 22 – Connecting the Coaxial Cable

### Testing the Installation

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You can use the Neptune® 360™ Field Manager application to verify cellular connectivity and meter reading, to ensure the cellular endpoint is installed correctly. To test the installation, complete the following steps.

1. Activate the endpoint by swiping the Neptune magnet from left to right beginning at the left of the antenna connection, and extending across the unit and around beyond the point where the lip of the endpoint housing meets the curve.



Figure 23 – Cellular ProCoder™)R900i™ with Arrow Showing Direction of Magnet

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

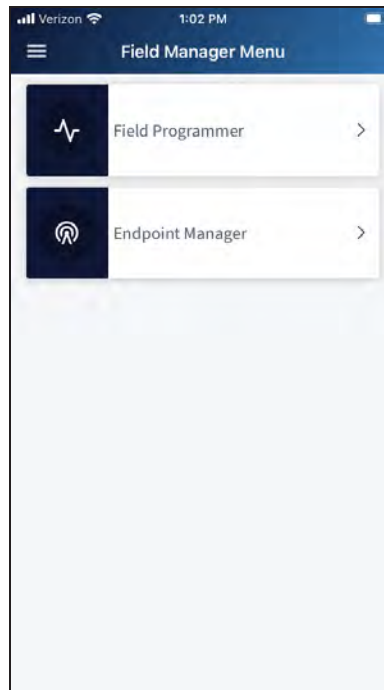


Figure 24 – Field Manager Options

3. Select **Search Cellular Endpoint**.

\*Android is a trademark of Google LLC.

4. In the **Endpoint** field, enter the radio serial number from the front of the unit.

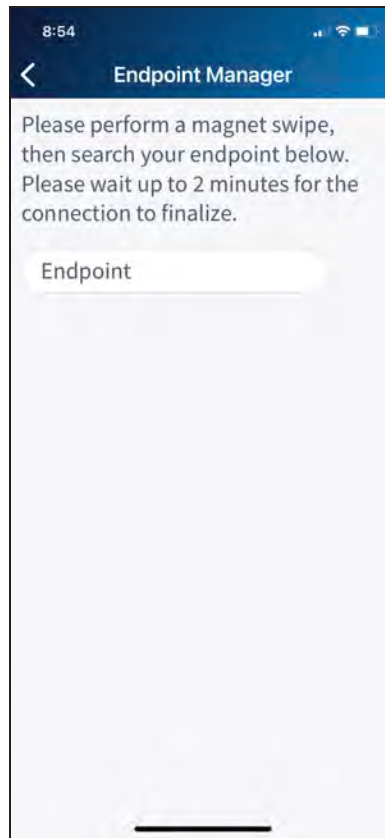


Figure 25 – Entering the Cellular Endpoint ID

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 the top of the unit, you must complete this prior to searching for the endpoint in the Field Manager application.

5. When the system finds the endpoint ID, the signal quality, last call-in time, last reading, and firmware version are displayed.

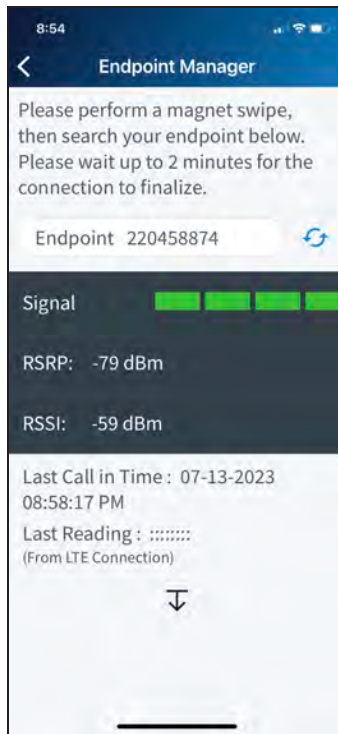


Figure 26 – Connection Status and Detail

6. If the system cannot find the serial number or the cellular connection has not occurred after installation, it displays an alert.

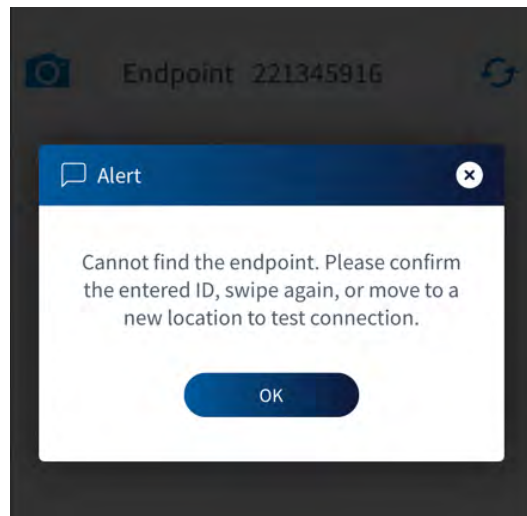


Figure 27 – Endpoint Alert

7. The following table describes the signal quality as displayed in the Field Manager application.

Table 7 – 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



Important! 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.

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This chapter takes you through troubleshooting procedures for the Cellular ProCoder™)R900/™.

### Possible Reading Values

This section provides possible reading values and what they indicate.

**Table 8 – Reading Value Examples**

Reading Value	Definition	Troubleshooting
????????	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.
UUUUUUUU	Indicates a parity check	This reading indicates an endpoint-to-register communication error, which is usually temporary.
A series of eight U characters can indicate any of conditions in the definitions.	Checksum failed	This reading indicates an endpoint-to-register communication error which is usually temporary. If the error is consistent, verify the register configuration.
	Format error	This reading indicates an endpoint-to-register communication error, or when certain delimiters are missing from the packet. The error also indicates a possible programming / configuration register issue. If the condition does not clear, investigate the register.
	Message timeout	This reading indicates the endpoint timed out and the register stopped responding to the endpoint interrogations. This condition is temporary.

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### Contact Information

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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

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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, be prepared to provide the following information:

- Your name and a callback number.
- Your utility name, company name, or site ID / PIN.
- 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

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To contact Neptune Customer Support by email, send your message to [support@neptunetg.com](mailto:support@neptunetg.com).

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## Appendix A: Cellular ProCoder™)R900i™ Flags

This appendix describes the flags associated with the cellular ProCoder™)R900i™.

### Description of Flags

The tables in this appendix describe the volume represented by the eighth digit by meter size, and the flags the cellular ProCoder)R900i uses.

**Table 9 – Eighth-Digit Resolution by Meter Size**

Register Size	Eighth-Digit Resolution - Least Significant Digit
<b>Residential</b> (5/8" - 1" T-10®)	1/10 Gallon or 1/100 Cubic foot
<b>Light Commercial and Industrial</b> (1-1/2" and 2" T-10, 1-1/2" - 4" HP Turbine)	1 Gallon or 1/10 Cubic foot
<b>Large Commercial and Industrial</b> (6" - 10" HP Turbine, HP PROTECTUS® III and TRU/FLO®)	10 Gallons or 1 Cubic foot

**Table 10 – Backflow Flag**

Backflow Flag (resets after 35 days)	
Based on reverse movement of the eighth digit. The eighth digit is variable based on the meter size.	
No backflow event	Eighth digit reversed less than one digit.
Minor backflow event	Eighth digit reversed more than one digit, up to 100 times the eighth digit.
Major backflow event	Eighth digit reversed greater than 100 times the eighth digit.

Table 11 – 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.	
No Leak	Eighth digit incremented fewer than 50 of the 96 days of 15-minute intervals.
Intermittent Leak	Eighth digit incremented in 50-95 of the 96 days of 15-minute intervals.
Continuous Leak	Eighth digit incremented in all of the 96 days 15-minute intervals.

## Zero Consumption Flag

The consecutive days with Zero Consumption Flag (out of rolling 35 days) is the number of days the leak status was at a minimum value.

### A

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#### AMI

Automated Metering Infrastructure.

#### AMR

Automated Meter Reading.

#### antenna (pit)

The external antenna used for pit installations.

### P

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#### PIN

Personal Identification Number for technical support.

#### pit version

The ProCoder)R900*i* pit version has a roll-sealed metal body.

### R

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#### register read time

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

#### RMA

Return Material Authorization.

## S

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### seal pin

The small black plastic nail used to secure the ProCoder)R900*i* to the meter.

### serial number

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

### spud cap

Orange caps that are placed on the ends of a meter when shipping.

### sweep hand

A sensitive dial on the face of the ProCoder register that provides a visual representation of extreme low flows as well as reverse flows.

## T

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### TTL

Through-the-Lid.

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hose, leaks 10  
hot water, leaks 10

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    retrofit meter 17  
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    found 11  
    garden 10

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- heating 10
- hose 10
- hot water 10
- ice-maker 10
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- repaired 11
- sprinkler system 10
- swimming pool 10
- toilet 10
- washing machine 10

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  - reading 9
  - serial number 2
  - specification 3
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