NEPTUNE
TECHNOLOGY GROUP

Cellular E-CODER**®**)R900*i*™
Installation and Maintenance Guide

Cellular E-CODER®)R900*i*™
Installation and Maintenance Guide

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 Meter Interface Unit (MIU) 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.

Industry Canada

The term "IC" before the radio certification number only signifies that Industry Canada technical specifications were met.

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. 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.

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.

Contents

Contents

This page intentionally left blank.

Tables

This page intentionally left blank.

This chapter provides a general description of the Neptune® cellular E-CODER®)R900*i*™ register. The cellular E-CODER)R900*i* is an integrated register containing both the E-CODER® and R900® technologies in one register that collects meter data. It then transmits the data that a meter reader collects.

The cellular E-CODER)R900*i* is easily installed and operates within a radio frequency (RF) band, which does not require an operating license. The cellular E-CODER)R900*i* 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 six hours.

The cellular E-CODER)R900*i* is designed to offer 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 enhanced eight-digit AMI meter reading
- Provides proactive customer service benefits (leak, tamper, and backflow detection)

Figure 1 – Cellular E-CODER®)R900*i*™

Cellular E-CODER®)R900*i*™ Programming

The cellular E-CODER)R900*i* is NOT field-programmable. At the factory, each of the following items is programmed into the Meter Interface Unit (MIU):

- Serial number - each MIU is given a unique serial number / identification number
- Meter size and change gear information

This page intentionally left blank.

Chapter 2: Specifications

This chapter defines the specifications for the cellular E-CODER®)R900*i*™.

Electrical Specifications

The cellular E-CODER)R900*i* is powered by a lithium battery.

Transmitter Specifications

The following table defines the transmitter specifications for the cellular E-CODER R900*i*.

Table 1 – Cellular E-CODER®)R900*i*™ Transmitter Specifications

Specification	Description
Transmit Period	For R900 mobile backup
Channel Frequency	902-928 MHz
Output Power	Meets FCC Part 15.247
FCC Verification	Part 15.247

Environmental Specifications

The following table provides the environmental specifications for the cellular E-CODER R900*i*.

Table 2 – Cellular E-CODER®)R900*i*™ Environmental Specifications

Specification	Description
Operating Temperature	–22º to 149ºF (–30º to 65ºC)
Storage Temperature	–40º to 158ºF (–40º to 70ºC)
Operating Humidity	0 to 100% Condensing (pit only)

Functional Specifications

The following table defines the functional specifications for the cellular E-CODER R900*i*.

Table 3 – Cellular E-CODER®)R900*i*™ Functional Specifications

Specification	Description
Register Reading	Eight digits.
Endpoint (MIU) ID	Nine digits.

Dimensions and Weight Specifications

The following table defines the dimensions and weight specifications for the cellular E-CODER R900*i*.

Table 4 – Cellular E-CODER®)R900*i*™ Dimensions and Weight Specifications

Specification	Description
Dimensions	Refer to the figures on the following page.
Weight	Pit – 1.62 lbs. (734.8) grams)

Cellular E-CODER®)R900*i*™ Dimensions

The following diagrams show both the inside and antenna dimensions for the cellular E-CODER)R900*i*.
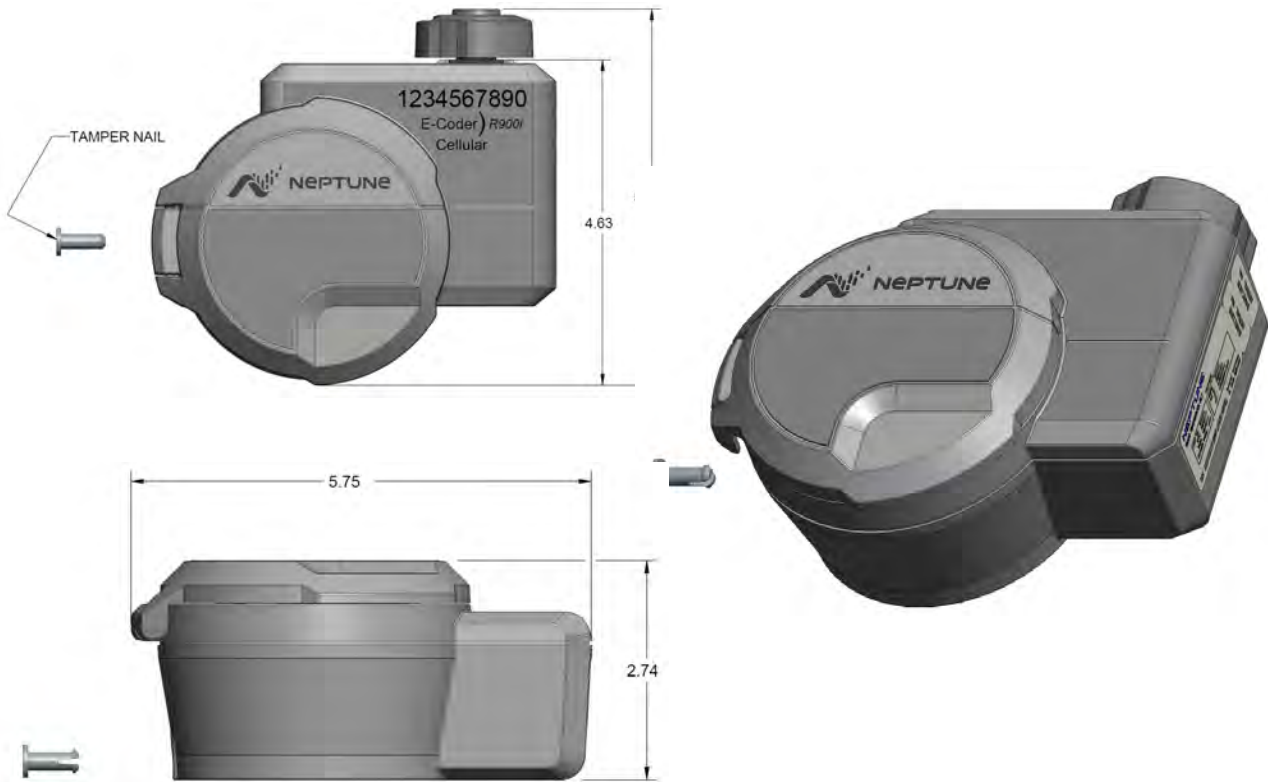
Figure 2 – Inside Dimensions
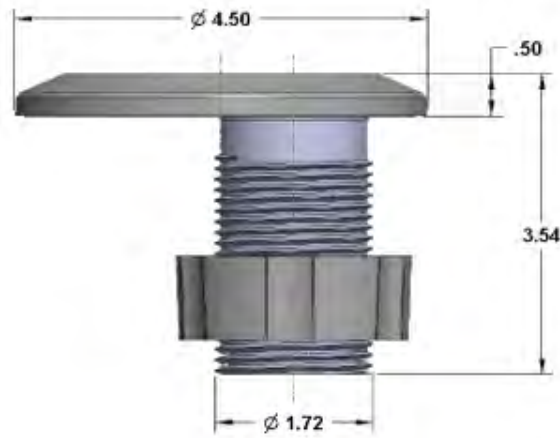
Figure 3 – Offset Through-the-Lid Antenna Dimensions
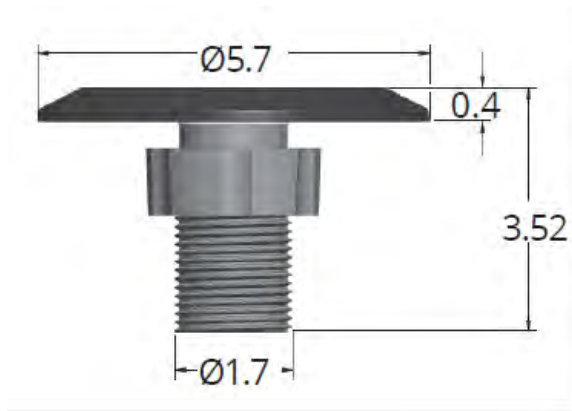
Figure 4 – Standard Through-the-Lid Antenna Dimensions

This chapter provides installation instructions for:

- Storing and unpacking the cellular E-CODER®)R900*i*™
- Performing preliminary tests
- Verifying materials
- Selecting a site
- Installing the unit

Prior to Installation

This section defines how to unpack and store the cellular E-CODER)R900*i* prior to installing it.

Storage

After receipt, inspect all shipping containers for damage, and inspect the contents of any damaged cartons prior to storage.

After completing the inspection, store the cartons in a clean, dry environment. The unit remains in sleep mode until it is exposed to light.

Unpacking

As with all precision electronic instruments, handle the cellular E-CODER)R900*i* carefully; however, no additional special handling is required. When shipped, the assembly is lying on its side. You should lift the assembly out of the box by the meter main case.

After unpacking the cellular E-CODER)R900*i*, inspect it for damage. If the cellular E-CODER)R900*i* 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.

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.
- If the site work order does not have an endpoint ID number on it, write in the ID number of the endpoint you are about to install. If the site work order already has an endpoint ID number on it, verify that it matches the ID number on the endpoint you are about to install.

Site Selection

Installation and operation in moderate temperatures increase reliability and product life. See "Environmental Conditions" on page 3.

Follow these guidelines when selecting a location to install the cellular E-CODER)R900*i*:

- Install the unit in a vertical and upright position.
- Clear all obstructions from the installation location.

> **Always follow your company's safety practices and installation guidelines when installing a cellular E-CODER. Never install a unit during a lightning storm or under excessively wet conditions.**

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. • Diagonal cutters. • Electricians knife. • Hammer.	Perform various installation procedures.
Magnet	Neptune magnet (part number 12287-0001)	Activating the cellular endpoint.

Installing the Cellular E-CODER®)R900*i*™

Follow the steps in this section for a new or retrofit installation.

New Meter Installation

Follow these steps to perform a new meter installation.

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

> **You must install 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.

> **Use caution; the meter threads are sharp.**

4. Place the coupling gaskets inside the coupling nuts and set the meter in the line. Position the meter horizontally with the register dial facing up. The direction of flow marked on the meter must agree with the direction of water flow.
5. Start 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 down stream 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 "Activating and Reading the Cellular E-CODER®)R900*i*™" on page 19.

Retrofit Meter Installation

Follow these steps to perform a 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. Twist the new cellular E-CODER)R900*i* register head clockwise onto the meter body to install it.
4. Snap the new tamper-proof seal pin to secure the register to the meter body.

Connecting the Cellular E-CODER®)R900*i*™ Through-the-Lid (TTL) Antenna

The cellular E-CODER R900*i* unit includes a standard TTL antenna with a 6-foot length of cable.

Figure 5 – Offset TTL Antenna   Figure 6 – Standard TTL Antenna

Installing the Antenna

Follow these steps to install the antenna for the cellular E-CODER)R900*i*.

1. Insert the antenna cable and housing through the 1-3/4" hole in the meter pit lid.

Figure 7 – Insert the Antenna into the Pit Lid

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

Figure 8 – Locking Nut on Antenna

3. Hand tighten the nut securely to the lid.

Figure 9 – Secure the Locking Nut

This figure shows a completed installation of the antenna.

Figure 10 – Installation Complete

Attaching the Antenna to the Endpoint

Follow these steps to attach the antenna to the endpoint (MIU).

1. Remove the protective cap and gasket. If you are replacing an existing antenna, remove the existing antenna connection and clean any dirt or debris from the connector on the endpoint housing.

Figure 11 – Remove the Protective Cap

2. Carefully align the connector center conductor and insert the quick connect cable connector into the connector on the endpoint housing.

Figure 12 – Align the Connector

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

Figure 13 – Seat the Connection

Testing the Installation

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 14 – Cellular E-CODER®)R900*i*™ 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.
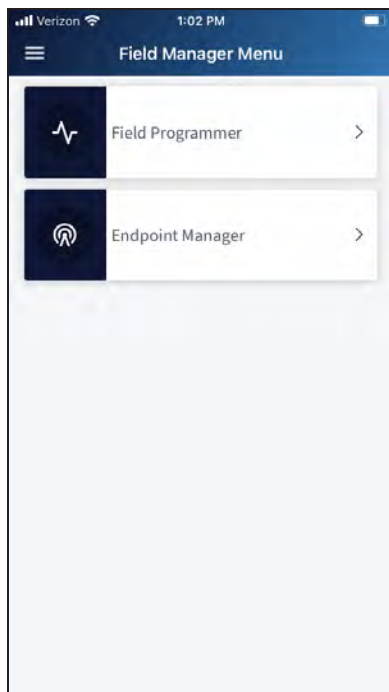
Figure 15 – Field Manager Options

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 16 – 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.

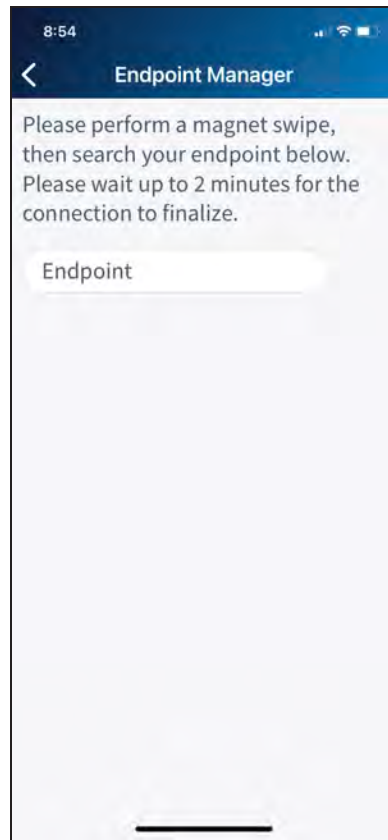5. When the system finds the endpoint ID, the signal quality, last call-in time, last reading, and firmware version are displayed.
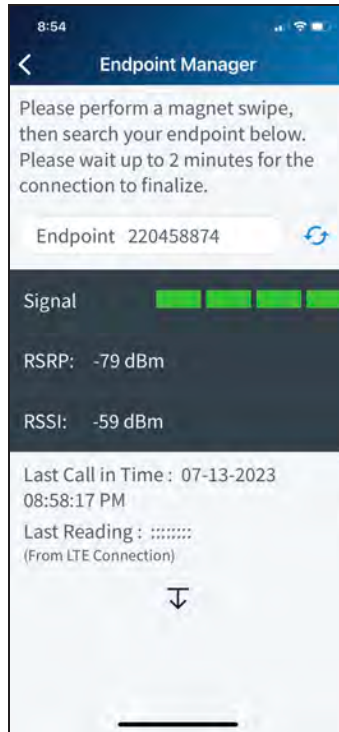

Figure 17 – Connection Status and Detail

6. If the system cannot find the serial number or the cellular connection has not occurred after installation, it displays an alert.
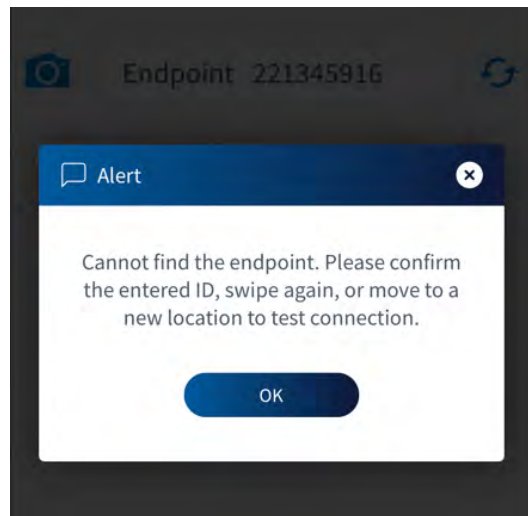
Figure 18 – Endpoint Alert

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

Table 6 – 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.

This page intentionally left blank.

This chapter defines how to read the cellular E-CODER®)R900*i*™ to identify water leaks.

Activating the LCD Using the Solar Panel

The cellular E-CODER has a solar panel to power the Liquid Crystal Display (LCD).

Figure 19 – Solar Panel for the Cellular E-CODER®

The solar panel activates the LCD display when the unit is exposed to a light source. For a unit mounted in an inside location, the LCD is activated when the room light is turned on. For a unit mounted in an outside pit, the LCD is activated when the pit lid is opened exposing the unit to daylight. If the LCD is currently off, it may be reactivated by covering the dial plate with your hand for about two seconds (in bright sunlight, it may be necessary to close the cover or the pit lid momentarily). If the LCD does not reactivate as expected, shine a flashlight on the light sensor.

If the LCD can power on, but there is insufficient light to read, the panel displays LO LIGHT.
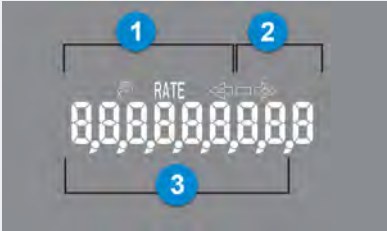

Figure 20 – LED Panel

Reading the Meter

The following table defines the information the meter presents.

Table 7 – Icons and Displays

Icon	Description
	Flow / Leak Indicator shows the direction of flow through the meter:
	ON Water in use.
	OFF Water not in use.
	Flashing Water is running slowly / low flow indicator.
	Leak indicator displays a possible leak:
	OFF No leak indicated.
	Flashing Intermittent leak indicated. Water used during at least 50 of the 96 days of 15-minute intervals, during the previous 24-hour period.
	Continuous ON Continuous leak indicated. Water used during all 96 days of 15-minute intervals, during the previous 24-hour period.
	Nine-digit LCD displays the meter reading in billing units of measure: • Cellular E-CODER basic Reading Customary 6-digit remote reading • Customary sweep hand digits • Cellular E-CoderPLUS Reading (6-digit remote reading)

Common Causes of Leaks

If the cellular E-CODER)R900*i* leak indicator is flashing or continuously on, it indicates a possible leak. The following table defines common causes of leaks.

Table 8 – Causes of 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

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

1. Check the flow indicator ⬅☐➡ by closely watching it for two minutes.
2. Determine the following conditions. If the arrow is:

- Flashing, then water is running very slowly.
- Continuously ON, water is running.
- Not flashing, water is not running.

What to Do if There is a Leak

If the cellular E-CODER)R900*i* detects a leak, check the following to identify the leak source:

- All faucets
- Toilets and valves
- Ice maker and water dispenser
- Yard sand surrounding grounds for a wet spot indicating a leaking pipe

If a Continuous Leak is Repaired

If a continuous leak is found and repaired, complete the following steps.

1. Do not use any water for at least 15 minutes.

2. Check the leak icon 🚰.

   If the leak indicator changes from continuous ON to flashing, then a continuous leak is no longer indicated.

If an Intermittent Leak is Repaired

If an intermittent leak is found and repaired, check the leak icon 🚰 after at least 24 hours.

If the leak has been correctly repaired, the leak icon changes from flashing to OFF.

Communication Schedule

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.
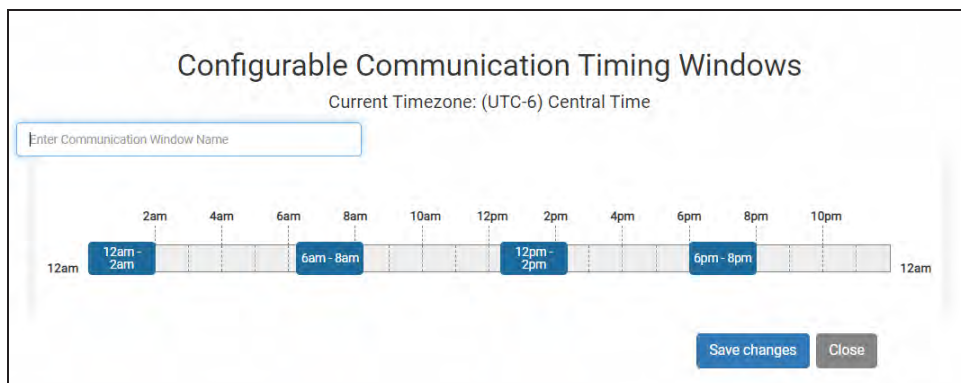- Transmission 4 – 6:00 PM to 8:00 PM.

Figure 21 – 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 for your cellular R900.

Chapter 5: Maintenance and Troubleshooting

This chapter defines maintenance and troubleshooting procedures for the cellular E-CODER®)R900*i*™.

Six-Wheel Encoder Normal Operation

If the odometer reads 123456, the display shows 1 2 3 4 5 5 0 0.

> Note that the sixth digit displayed is a five, if the last digit on the odometer is five through nine. The sixth digit is zero if the last digit on the odometer is zero through four. The R900 endpoint adds two zeros on the end to provide an eight-digit reading to the host software.

Four-Wheel Encoder Normal Operation

If the odometer reads 123456, the display shows 1 2 3 4 0 0 0 0.

> The R900 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.

Table 9 – Example Reading Values

Reading Value	Definition	Troubleshooting
::::::::	Failure to retrieve reading	• Usually indicates a cut wire. Check the connection between the register and endpoint. • If using a non-autodetect ProRead™ register, verify that it is programmed for three-wire mode.
????????	Indicates an ambiguous, bad read, replaces ------- and HHHHHHHH	N/A
MMMMMMMM	Indicates an out-of-range reading (>99999999), diagnostic code from the endpoint	• Indicates that no meter reading history is available. • Swipe the endpoint with a magnet to force the endpoint to read the register.
UUUUUUUU	Indicates an undefined out of range reading or corrupt valve	N/A

Contact Information

Within North America, Neptune Customer Support is available Monday through Friday, 7:00 A.M. to 5:00 P.M. Central Standard Time, by telephone or email.

By Phone

To contact Neptune Customer Support by phone, complete the following steps.

1. Call **(800) 647-4832**.
2. Select one of the following options:

   • **1** if you have a Technical Support Personal Identification Number (PIN).
   • **2** if you do not have a Technical Support PIN.

3. Enter the six-digit PIN and press #.
4. Select one of the following options.

   • **2** for Technical Support
   • **3** for maintenance contracts or renewals
   • **4** for Return Material Authorization (RMA) for Canadian Accounts

You are directed to the appropriate team of Customer Support Specialists. The specialists are dedicated to you until the issue is resolved to your satisfaction. When you call, 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.

This page intentionally left blank.

Description of Flags

The tables in this appendix describe the volume represented by the eighth digit by meter size, and the flags used the by the cellular E-CODER®)R900*i*™.

Table 10 – Eighth Digit Resolution by Meter Size

Register Size	Eighth Digit Resolution – Least Significant Digit
Residential (5/8" - 1" T-10)	1/10 Gallon or 1/100 Cubic foot.
Light Commercial and Industrial (1-1/2" and 2" T-10; 1-1/2" - 4" HPT)	1 Gallon or 1/10 Cubic foot.
Large Commercial and Industrial (6" - 12" HPT, HPPII and TRU/FLO®)	10 Gallons or 1 Cubic foot.
Large Commercial and Industrial (16" - 20" HPT)	100 Gallons or 10 Cubic feet.

Table 11 – Cellular E-CODER®)R900*i*™ Flags

Backflow Flag (Resets After 35 Days)	
Based on reverse movement of the eighth digit. 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.

Leak Status Flag (Resets After 35 Days)	
Based on total amount 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.	

A

AMI

Automated Metering Infrastructure.

AMR

Automated Meter Reading.

antenna (pit)

The external antenna used for pit installations.

P

PIN

Personal Identification Number for technical support.

pit version

The cellular E-CODER pit version has a roll-sealed metal body.

R

register read time

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

RMA

Return Material Authorization.

S

seal pin

The small black plastic nail used to secure the E-CODER®)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 E-CODER register that provides a visual representation of extreme low flows as well as reverse flows.

T

TTL

Through-the-Lid.

W

washing machine, leak 21

water in use, determine 22

Neptune Technology Group Inc.
1600 Alabama Highway 229
Tallassee, AL 36078
USA Tel: (800) 633-8754
Fax: (334) 283-7293

Neptune Technology Group Canada Co.
7275 West Credit Avenue
Mississauga, Ontario L5N 5M9
Canada Tel: (905) 858-4211
Fax: (905) 858-0428

Neptune Technology Group Inc.
Avenida Ejercito Nacional No 418
Piso 12, Despacho 1203
Colonia Polanco V Sección
C.P. 11560 Delegación, Miguel Hidalgo
Mexico D.F.
Tel: (55) 5203-5708, (55) 5203-4032,
    (55) 5203-5294

Online
www.neptunetg.com