ProCoder™)R450™
Installation and Maintenance Guide
ProCoder™)R450/™
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 condition: this device may not cause harmful interference.

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 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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 MIU must be professionally installed by trained utility meter installers.

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: (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.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the antennas listed below, and having a maximum gain of 0dB. Antennas not included in this list or having a gain greater than 0dB are strictly prohibited for use with this device. The required antenna impedance is 75 ohms.

- R450 Wall MIU Antenna (Neptune Technology Group Inc. model number 12795-000)
- R450 Wall MIU High Gain Antenna (Neptune Technology Group Inc. model number 12986-000)
- R450 Pit MIU Lid Mount Antenna (Neptune Technology Group Inc. model number 12796-100, 6 ft., 12796-200, 25 ft.)
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<th>Page</th>
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<td>12</td>
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<td>31</td>
</tr>
<tr>
<td>16</td>
<td>ProCoder™ R450™ Leak Status Flag</td>
<td>32</td>
</tr>
</tbody>
</table>
Chapter 1: Product Description

This chapter provides a general description of the ProCoder™R450™ register. The Neptune ProCoder™R450/™ is an integrated register that contains both the ProCoder™ and R450™ technologies in one register that collects meter reading data. It then transmits the data the meter reader collects. A Neptune fixed network data collector receives the data and stores it to download into the utility billing system for processing. The ProCoder™R450/™ can be upgraded and configured. At the factory, serial numbers are programmed into the ProCoder™R450/™. Each device has a unique serial number / identification number. Custom serial numbers are not available.

RF Protocol Error Detection

The RF protocol is comprised of a header, data packet, and an error detection mechanism that reduces the erroneous data.

Low Battery RF Emissions

The ProCoder™R450/™ does not produce out-of-band emissions under low battery conditions. It is easy to install and requires a Federal Communications Commission (FCC) license to operate. For information on obtaining an FCC license, refer to “FCC Licensing,” in the R450™ System New Customer Guide.
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Chapter 2: Specifications

This chapter provides the specifications for the ProCoder™R450™.

Specifications - ProCoder™R450™

The following tables give the environmental and functional specifications of the ProCoder™R450, including the dimensions and weight.

Environmental Specifications

Table 1 – Environmental Specifications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-10° to 149°F (-23° to 65°C)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40° to 185°F (-40° to 70°C)</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>0 to 100% condensing</td>
</tr>
</tbody>
</table>

Functional Specifications

Table 2 – Functional Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register Reading</td>
<td>Three to eight digits</td>
</tr>
<tr>
<td>ProCoder™R450™ ID</td>
<td>9 digits</td>
</tr>
</tbody>
</table>

Dimensions and Weight

Table 3 – Dimensions and Weight

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>Refer to Figure 2 on page 4.</td>
</tr>
<tr>
<td>Weight</td>
<td>1.57 lbs. (712.14 grams)</td>
</tr>
</tbody>
</table>
Chapter 2: Specifications

ProCoder™)R450™ Dimensions

Figure 2 – ProCoder™)R450™ Dimensions

Figure 3 – ProCoder™)R450™ Antenna Dimensions
Chapter 3: General Installation Guidelines

This chapter describes tools, materials, and general installation information for the ProCoder™)R450™.

Tools and Materials

“Recommended Tools” below show the recommended tools and materials you may need to successfully install the ProCoder)R450i.

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

Table 4 – Recommended Tools

<table>
<thead>
<tr>
<th>Item</th>
<th>Description / Recommendation</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tool Kit</td>
<td>Contains standard tools including:</td>
<td>Various installation procedures performed by the utility</td>
</tr>
<tr>
<td></td>
<td>• Screwdrivers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hammer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pliers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 7/16 wrench (for the F connector)</td>
<td></td>
</tr>
<tr>
<td>Magnet</td>
<td>6 lbs. force</td>
<td>Activating the ProCoder™)R450/™</td>
</tr>
<tr>
<td></td>
<td>Part No: 12287-001</td>
<td></td>
</tr>
<tr>
<td>Installation Tool</td>
<td>Smart phone or cellular phone</td>
<td>To receive emails</td>
</tr>
</tbody>
</table>

Table 5 – Recommended Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Protection Compound</td>
<td>Novagard sealant (Part No: 96018-072)</td>
<td>Connecting the pit antenna to the ProCoder™)R450/™</td>
</tr>
<tr>
<td>Site Work Order</td>
<td>Documentation provided by your utility</td>
<td>Receiving and recording information about the work site</td>
</tr>
</tbody>
</table>
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 MIU ID number on it, write in the ID numbers of the MIU you are about to install.
- If the Site Work Order already has an MIU ID number on it, verify that it matches the ID numbers on the MIU you are about to install.
Chapter 4: Reading the ProCoder™ R450/i™

This chapter provides information on reading the ProCoder™ R450/i™.

How to Read

It is important to become familiar with the information available from the register.

Example: 5/8” T-10

The sensitive sweep hand provides a visual representation of extreme low flows as well as reverse flow. 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.

For further information on reading the ProCoder sweep hand, see the Product Support Document entitled "How to Read the Neptune ProCoder™ Register."
Common Causes of Leaks

If the leak indicator is flashing or continuously on, a possible leak may exist. Leaks can result from various circumstances. To better help you identify a possible leak, the following table contains some common causes of leaks.

Table 6 – Possible Causes of Leaks

<table>
<thead>
<tr>
<th>Possible Causes of Leaks</th>
<th>Intermittent Leak</th>
<th>Continuous Leak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside faucet, garden or sprinkler system leaking</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Toilet valve not sealed properly</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Toilet running</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Faucet in kitchen or bathroom leaking</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Ice maker leaking</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Soaker hose in use</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Leak between the water meter and the house</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Washing machine leaking</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dishwasher leaking</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Hot water heater leaking</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Watering yard for more than eight hours</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Continuous pet feeder</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Water-cooled air conditioner or heat pump</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Filling a swimming pool</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Any continuous use of water for 24 hours</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
How to Tell if Water is in Use

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.

What to Do if There is a Leak

The following checklist can be helpful if the ProCoder™ R450/i leak indicator shows a possible leak.

<table>
<thead>
<tr>
<th>Table 7 – Checklist for Leaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Check all faucets for possible leaks.</td>
</tr>
<tr>
<td>✓ Check all toilets and toilet valves.</td>
</tr>
<tr>
<td>✓ Check the ice maker and water dispenser.</td>
</tr>
<tr>
<td>✓ Check the yard and surrounding grounds for a wet spot or indication of a leaking pipe.</td>
</tr>
</tbody>
</table>

If a 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 an Intermittent Leak is Repaired

If you find and repair an intermittent leak, check the sweep hand after at least 24 hours. If you correctly repaired the leak, the sweep hand is not moving.
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Chapter 5: Installing the ProCoder™ R450™

This chapter describes storage and unpacking instructions, preliminary tests, tools, materials, site selection, and inside installation of the ProCoder™ R450™.

Prior to Installation

This section discusses what to do before installing the ProCoder.

Storage

After receiving the shipment, inspect the shipping containers for damage. If any containers are damaged, inspect the contents prior to storage.

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

Unpacking

As with all precision electronic instruments, handle the ProCoder™ R450™ carefully; however, no additional special handling is required. When shipped, the assembly is lying on its side. Lift the assembly out by the meter maincase.

After unpacking the ProCoder™ R450™, inspect it for damage. If the ProCoder™ R450™ appears to be damaged or proves to be defective upon installation, notify your Neptune Territory Manager or Distributor. If one or more items require reshipment, use the original cardboard box and packing material.

Figure 5 – ProCoder™ R450™ Installation
Chapter 5: Installing the ProCoder™)R450i™

Tools Needed

"Recommended Tools" on page 5 shows the recommended tools you need to successfully install the ProCoder)R450i.

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

Site Selection

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 ProCoder)R450i.

- Install the ProCoder)R450i in a vertical and upright position.
- Clear the location of all obstructions.

Always follow your company's safety practices and installation guidelines when installing the ProCoder)R450i. Never perform an installation during a lightning storm or under excessively wet conditions.

Installing the ProCoder™)R450i™

This section provides information on installing the ProCoder)R450i.

New Meter Installation

Complete the following steps to install a new meter.

1. Flush the service line prior to meter 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.
Install suitable 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 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. The meter should be in the horizontal position 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 downstream faucet and run enough water to dissipate entrained air and flush the line. While the faucet is open, check to see if the meter is operating correctly.
7. Turn off the faucet and check the meter installation for leaks.
8. Connect the antenna as described in "Connecting the ProCoder™ R450™ Antenna" on the next page.

Retrofit Meter Installation

To retrofit a meter, complete the following steps.

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 ProCoder™ R450™ register head onto the meter body and twist it clockwise to the desired orientation.
4. Activate the ProCoder™ R450™ as described in "Activating the ProCoder™ R450™" on page 19.
5. Test the ProCoder™ R450™ as described in "Testing the ProCoder™ R450™" on page 21.
6. Snap the new tamper proof seal pin to secure the register to the meter body.
Connecting the ProCoder™ R450™ Antenna

When ordering an external antenna for the ProCoder™ R450™ unit, Neptune recommends at least a 6-foot cable to allow for easy removal of the pit lid when necessary.

Installing the Antenna

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

![Figure 8 – Locking the Nut on the Antenna](image)

3. Hand tighten the nut securely to the lid.

![Figure 9 – Securing the Locking Nut](image)

The following image shows a completed installation of the antenna.

![Figure 10 – Installation Complete](image)
Chapter 5: Installing the ProCoder™ R450™

Attaching the Antenna to the MIU

1. Remove the protective cap and gasket.

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

   Figure 11 – Removing the Dust Cover

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

   Figure 12 – Aligning the F Connector
3. Push the antenna connector in and turn clockwise until it is properly seated on the three-lobed black plastic latch plate.

Figure 13 – Connecting the Coaxial Cable
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Chapter 6: Activating and Testing the ProCoder™ R450™

This chapter provides information on activating and testing the ProCoder™ R450™.

Activating the ProCoder™ R450™

To activate the ProCoder™ R450™, position the magnet over the magnetic area on the ProCoder™ R450™. Start at the bottom of the register box and bring the magnet up toward the top.

![Figure 14 – Magnet Activation](image)

During the 30 seconds before the configuration transmission, the ProCoder™ R450™ acquires the strongest R450™ Data Collector (R450 DC) for that location.

- The ProCoder™ R450™ transmits the configuration packet to the collector approximately 30 seconds following the magnet swipe.
- The ProCoder™ R450™ sends the register reading to the collector approximately 15 seconds following the configuration packet.
- When the collector receives the configuration packet, the host sends an email or Short Message Service (SMS) confirmation to the installer to allow for verification of proper installation and ProCoder™ R450™ location. See "ProCoder™ R450™ Config Email" on the next page for an example of the email text.
Subject: 1224/G/-89/US 29/MIU Config
MIU RSSI.................Pass[-93]
Collector RSSI..........Pass[-89]
Register.................Valid Read
Collector...............US 29
Signal/Noise............37
Noise....................126
MIU ID..................110001224

Figure 15 – ProCoder™)R450/i™Config Email

The subject line provides a quick summary of the detailed information included in the email. "Config Email Subject Line Breakdown" below provides a breakdown of the highlights of the email.

Table 8 – Config Email Subject Line Breakdown

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1224</td>
<td>Last four digits of the MIU ID</td>
</tr>
<tr>
<td>G</td>
<td>Valid read. There are three types of reads:</td>
</tr>
<tr>
<td></td>
<td>• G = Valid read</td>
</tr>
<tr>
<td></td>
<td>• B = Bad read</td>
</tr>
<tr>
<td></td>
<td>• N = No register</td>
</tr>
<tr>
<td>-89</td>
<td>R450 DC Received Signal Strength Indicator (RSSI)</td>
</tr>
<tr>
<td>US 29</td>
<td>Data Collector Name</td>
</tr>
</tbody>
</table>
Testing the ProCoder™)R450i™

This section provides information on testing the ProCoder)R450i.

RSSI Values and R450™ System Capabilities

RSSI values are a key indicator of the R450™ System health as well as the communication capabilities of the ProCoder)R450i to and from the R450™ DC. These values are associated with the:

- **Uplink** the ability of the R450 DC to hear reading information from the ProCoder)R450i.
- **Downlink** the ability of the ProCoder)R450i to hear instructions from the R450 DC.

The ProCoder)R450i Config email provides feedback on the RSSI values between the ProCoder)R450i and the collector following MIU activation. Depending on the RSSI values recorded, the system indicates the following values:

- Pass
- Marginal
- Fail

It is important to note the RSSI values in the Pass range are required for both the Uplink and the Downlink to ensure full, two-way capabilities of the ProCoder)R450i as part of the R450 System.

<table>
<thead>
<tr>
<th>RSSI Description</th>
<th>RSSI Values</th>
<th>Result in Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>RSSI &gt;= –105</td>
<td>Reliable daily readings and profile data</td>
</tr>
<tr>
<td>Marginal</td>
<td>–115 &lt;= RSSI &lt; –105</td>
<td>Occasionally missed daily readings and profile data</td>
</tr>
<tr>
<td>Fail</td>
<td>RSSI &lt; –115</td>
<td>Very poor readings performance</td>
</tr>
</tbody>
</table>
### Table 10 – ProCoder™)R450/™ RSSI Downlink

<table>
<thead>
<tr>
<th>RSSI Description</th>
<th>RSSI Values</th>
<th>Result in Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>RSSI &gt;= -95</td>
<td>Full capability</td>
</tr>
<tr>
<td>Marginal</td>
<td>-105 &lt;= RSSI &lt; -95</td>
<td>Occasional two-way capability - not reliable</td>
</tr>
<tr>
<td>Fail</td>
<td>RSSI &lt; -105</td>
<td>ProCoder)R450/ not capable of two-way</td>
</tr>
</tbody>
</table>

### RSSI Validation Test Failed

If a ProCoder)R450/ fails the validation test for RSSI during the installation process, you receive an email or SMS showing a Marginal or Failed RSSI value. In the following example email, note the Failed downlink value [-107] as well as the Marginal uplink value [-107].

The system sends the email if the configuration has failed.

```
Subject: 0042/G/-107/ Collector One/MIU
Config
MIU <- Coll........... Failed[-107]
Coll <- MIU............ Marginal[-107]
Register............. Valid Read
Collector............. Collector One
Signal/Noise......... 23
Noise............... 130
MIU id............... 110500042

================================
```

**Figure 16 – RSSI Validation Test Failed Email**
Register Test Failed

If a ProCoder)R450/i fails the error-check test on the register read during the installation process, an installer receives the email below. This indicates that there is a problem with the wiring to the register.

Subject: 1776/B/-117/Collector Four/MIU
Config
MIU <- Coll............. Failed[-109]
Coll <- MIU............. Failed[-117]
Register.............. Register Connectivity
Problem
Collector.............. Collector Four
Signal/Noise........... 13
Noise................... 130
MIU id.................. 110181776

Figure 17 – Register Test Failed Email

Completing the Activation

To complete the activation, do one of the following. If:

- A valid register connection and acceptable RSSI values are reported, then proceed to “Completing the ProCoder™)R450/i™ Installation” on page 25.
- The ProCoder)R450/i does not report acceptable RSSI values, check the antenna.
- The register connection is returned as invalid, then proceed to the ”Checklist” on page 25
Chapter 7: Completing the ProCoder™ R450™ Installation

This chapter provides a checklist for completing the installation process.

Checklist

Before leaving the installation site, be sure to do the following.

- Record the ProCoder™ R450™ ID for each register.
- Verify that you have followed all requirements of this Installation and Maintenance Guide.
- Verify that you have recorded all required information.
- Clean up any installation debris.
- Verify that the requirements of the Site Work Order have been completed.
- Inform the customer that you have completed your work. If you were unable to finish, inform the customer when you will be back to complete the project.
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Chapter 8: Troubleshooting

This chapter provides information on replacement parts, contact information, and how to troubleshoot low Received Signal Strength Indicator (RSSI) values for new and existing installations.

Troubleshooting Low RSSI for New Installations

RSSI is a measurement of the power present in a received radio signal. Neptune uses this measurement during the installation process to determine if a collector is receiving a strong signal from the ProCoder™)R450™. The following table lists the values that Neptune considers acceptable, marginal, or failed.

Table 11 – ProCoder™)R450™ RSSI Downlink

<table>
<thead>
<tr>
<th>RSSI Description</th>
<th>RSSI Values</th>
<th>Result in Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>RSSI &gt;= –95</td>
<td>Full capability</td>
</tr>
<tr>
<td>Marginal</td>
<td>–105 &lt;= RSSI &lt; –95</td>
<td>Occasional two-way capability – not reliable</td>
</tr>
<tr>
<td>Fail</td>
<td>RSSI &lt; –105</td>
<td>ProCoder™)R450™ not capable of two-way communications</td>
</tr>
</tbody>
</table>

Table 12 – Collector RSSI Uplink

<table>
<thead>
<tr>
<th>RSSI Description</th>
<th>RSSI Values</th>
<th>Result in Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>RSSI &gt;= –105</td>
<td>Reliable daily readings and profile data</td>
</tr>
<tr>
<td>Marginal</td>
<td>–115 &lt;= RSSI &lt; –105</td>
<td>Occasionally missed daily readings and profile data</td>
</tr>
<tr>
<td>Fail</td>
<td>RSSI &lt; –115</td>
<td>Poor readings</td>
</tr>
</tbody>
</table>

During the installation process, you receive an email with the RSSI value to determine if the location of the ProCoder™)R450™ is acceptable. If the RSSI value is either at the upper limit of the marginal range or is a failed RSSI, try the tips and techniques in the following sections.
ProCoder™)R450™ Pit Installation

For a new pit installation, consider the following:

- Reorient the pit antenna.
- Check the antenna connection to the ProCoder)R450i.

Troubleshooting Low RSSI for Existing Installations

Refer to the following sections to troubleshoot low RSSI for existing installations.

ProCoder™)R450™ Pit Installations

For existing pit installations, consider the following:

- Check the RSSI values and reorient the pit antenna.
- Check the antenna connection to the ProCoder)R450i.
- Replace the pit antenna.
- Replace the ProCoder)R450i, if necessary.

Replacement Parts

"Available Replacement Parts" below lists the available replacement parts for the ProCoder)R450i.

Table 13 – Available Replacement Parts

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dow® Corning #4 compound (5.3 oz. tube)</td>
<td>96018-064</td>
</tr>
<tr>
<td>Novagard® (4cc Packet)</td>
<td>96018-072</td>
</tr>
<tr>
<td>Magnet</td>
<td>12287-001</td>
</tr>
<tr>
<td>Antenna assembly</td>
<td>12926-000</td>
</tr>
<tr>
<td>Black rubber washer</td>
<td>8340-054</td>
</tr>
<tr>
<td>Lockwire screw</td>
<td>8460-015</td>
</tr>
<tr>
<td>Seal pin</td>
<td>9106-001</td>
</tr>
<tr>
<td>Lid, register</td>
<td>13199-003</td>
</tr>
</tbody>
</table>
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:
   - Press 1 if you have a Technical Support Personal Identification Number (PIN).
   - Press 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.
   - Press 2 for Technical Support.
   - Press 3 for maintenance contracts or renewals.
   - Press 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 Customer Support by email, send your message to support@neptunetg.com.
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Appendix A: ProCoder™)R450/™ Flags

This appendix provides information on the flags the ProCoder™)R450/™ uses.

Description of Flags

This section provides information on the flags the ProCoder™)R450/™ uses. "Eighth-Digit Resolution by Register Size" below describes the volume represented by the eighth digit for different register sizes.

**Table 14 – Eighth-Digit Resolution by Register Size**

<table>
<thead>
<tr>
<th>Register Size</th>
<th>Eighth-Digit Resolution - Least Significant Digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential (5/8-inch - 1-inch T-10®)</td>
<td>1/10 Gallon or 1/100 cubic foot</td>
</tr>
<tr>
<td>Light Commercial and Industrial (1½-inch and 2-inch T-10; 1½-inch to 4-inch HP Turbine)</td>
<td>1 Gallon or 1/10 cubic foot</td>
</tr>
<tr>
<td>Large Commercial and Industrial (6-inch – 10-inch HP Turbine, HP PROTECTUS® III, and TRU/FLO®)</td>
<td>10 Gallons or 1 cubic foot</td>
</tr>
</tbody>
</table>

**Backflow Flags**

This section provides information on backflow flags.

**Table 15 – ProCoder™)R450/™ Backflow Flags**

<table>
<thead>
<tr>
<th>Backflow Flag (Resets after 35 Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on reverse movement of the eighth digit. The eighth digit is variable based on the meter size.</td>
</tr>
<tr>
<td>No backflow event</td>
</tr>
<tr>
<td>Minor backflow event</td>
</tr>
<tr>
<td>Major backflow event</td>
</tr>
</tbody>
</table>
Leak Status Flags

This section provides information on leak status flags.

Table 16 – ProCoder™ R450™ Leak Status Flag

<table>
<thead>
<tr>
<th>Leak Status Flag ( Resets after 35 Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on total number of 15-minute periods recorded in the previous 24 hours</td>
</tr>
<tr>
<td>No leak</td>
</tr>
<tr>
<td>Intermittent leak</td>
</tr>
<tr>
<td>Continuous leak</td>
</tr>
</tbody>
</table>

Zero Consumption Flag

The consecutive days with Zero Consumption Flag (out of rolling 35 days) is defined as the number of days the "leak status" was at a minimum value.
antenna (pit)
MIU antenna used for pit installations.

conical-shaped gasket
Cone-shaped rubber gasket on the antenna cable used to seal the cable at the top of the connector housing.

connector housing
Black plastic 1/4-turn connector used to waterproof the antenna cable connection to the pit MIU.

connector nut
Black plastic nut used to depress the conical-shaped gasket and seal the antenna cable at the top of the connector housing.

downlink
Ability of the ProCoder™ R450i to hear instructions from the R450 DC.

email
Used to receive messages from the collector.
## Glossary

### F

**FCC**
Federal Communications Commission.

**flat rubber washer**
Washer used to seal the antenna cable connector housing to the ProCoder™R450i.

### L

**LCD**
Liquid crystal display (LCD). The component where the meter reading and value-added icons are displayed.

### M

**MIU**
Meter Interface Unit.

### P

**PIN**
Personal Identification Number for Technical Support.

### R

**RMA**
Return Material Authorization (RMA) for Canadian accounts.

**RSSI**
Received Signal Strength Indicator. It is a measurement of the power present in a received radio signal.
serial number

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

signal strength

See RSSI.

SMS

Short Message Service.

sweep hand

A sensitive dial that provides a visual representation of extreme low flows as well as reverse flows.

uplink

Ability of the R450 DC to hear reading information from the ProCoder™ R450i.
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<td>serial number 1</td>
</tr>
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<td>service line 12</td>
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<td>T</td>
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<tr>
<td>testing 19</td>
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<td>thread protectors 13</td>
</tr>
<tr>
<td>tool</td>
</tr>
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<td>kit 5</td>
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<td>uplink 21, 27</td>
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<td>Z</td>
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<td>zero consumption flag 32</td>
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