



R450™ Quick Install Guide



R450™ QUICK INSTALL GUIDE

1 General Instructions

The R450™ Meter Interface Unit (MIU) is designed for use with multiple types of approved encoder registers:

- Neptune ARB® III, IV, V
- ProRead™ and E-Coder®
- Sensus (Invensys) ECR® II, and ECR® III

Before installing a MIU, the encoder register must be correctly wired and programmed to work with the MIU.

Notes:

- When using a ProRead encoder register (Rev. E or earlier), the ProRead register must be programmed for three-wire mode.
- If using a new ProRead register (Rev. F or later), Auto Detect can recognize it, and it does not need to be programmed.
- If using an existing register, make sure all three wires are connected, and it is programmed in three-wire mode.

To ensure that the ProRead register is programmed for three-wire mode, use the ProRead programmer and its RF/MIU 6, 8, or 10 ID TDI format. You can accomplish this using the ProRead receptacle before removing the receptacle or three bare wires.



For greater detailed information and installation instructions, refer to the *R450 MIU Wall and Pit Installation and Maintenance Guide* (Part No. 12857-001).

2 Safety & Preliminary Checks

Read the following notes before proceeding.

- 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 must have access to the water meter.
- Confirm or update the MIU ID number on the Site Work Order.



When installing meters, follow any guidelines issued by your company in addition to those given in this guide. Never perform an installation during a lightning storm or under excessively wet conditions.

3 Pit & Wall Site Selection

R450 Wall MIU

- For best results, Neptune recommends mounting the MIU on the outside of the building approximately 5 feet above ground.



Install the MIU in a vertical and upright position.

- The preferred mounting surface for the MIU would be a flat wall, but the unit can also be mounted to a pipe or wood post if a flat wall is not available.
- If the MIU is to be installed inside a basement or building, Neptune highly recommends testing the Received Signal Strength Indicator (RSSI) reception of various locations inside the basement prior to finalizing the location. The RSSI is the strength of the radio signal when it is received by the R450 Data Collector (R450 DC). See “Activating and Testing the R450 MIU” on page 14.
- Avoid installing the MIU behind metal fences or walls.
- The maximum cable length between the encoder register and MIU depends on the register’s manufacturer and model. Refer to Table 1 on page 3 for maximum cable lengths.

R450 Pit MIU

- For best results, Neptune recommends placing the antenna through a hole in the pit lid.
- Avoid installing the MIU behind metal fences or walls.
- Make sure there is enough room in the pit for the MIU. Because the meter position is fixed, the antenna is usually installed off-center.
- The MIU comes with an attached cable, but in some instances, additional cable is required. The maximum cable length between the encoder register and MIU depends on the register’s manufacturer and model. Refer to Table 1 on page 3 for maximum cable lengths.

Table 1 Maximum Cable Lengths

Approved Encoder Register	Maximum Cable Length	Wire Gauge
Neptune ARB III, IV, V	300 feet (91 meters)	22 AWG*
Neptune ProRead/ E-Coder	500 feet (152 meters)	22 AWG*
Networked Neptune ProRead/E-Coder	250 feet (76 meters)	22 AWG*
Sensus (Invensys) ECR II ECR III	200 feet (61 meters)	22 AWG*

* American Wire Gauge (AWG)

** Meets manufacturer's published specification for wire length between encoder and remote receptacle.

4 Preparing the Encoder Register

Read the following notes before proceeding.



- When a ProRead encoder register (Rev. E or earlier) is used, the ProRead register must be programmed for three-wire mode. If two ProRead registers are connected to one MIU, the encoder registers **must** be programmed in Network Mode: one in RF compound register Hi and the other in RF compound register Lo.
- If a register is removed, the MIU will revert to a single register installation and send the Hi side reading.

If the MIU is connected to a new ProRead encoder register, or if a three-conductor cable is already connected to a ProRead encoder register, ensure that the ProRead register is programmed for three-wire mode using the ProRead programmer and its RF/MIU 6, 8, or 10 ID TDI format. This can be accomplished through the ProRead receptacle before removing the receptacle.



Before wiring the encoder register, make sure the cable is long enough so the pit lid can be removed easily after the installation. This will prevent straining the cable.

5 Wiring the Encoder Register



For more detailed instructions, refer to Neptune's *Encoder Quick Install Guide* (Part #: 12572-001).

22 American Wire Gauge (AWG) three-conductor cable must be used from the encoder register to the MIU. Refer to the following steps.

- 1 Connect the three-conductor wire to the encoder register's terminals per the manufacturer's instructions. See Neptune's *Encoder Quick Install Guide*, (Part #: 12572-001), using the color code in Figure 1.

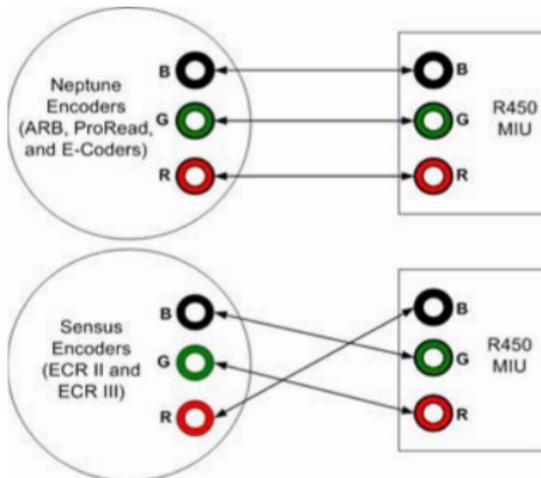


Figure 1 Encoder Wiring

- 2 Thread the cable around the strain relief posts of the encoder.
- 3 Apply sealant liberally and ensure that it encapsulates the terminal screws and exposed wires



All encoder terminal connections that are not pre-wired and potted must be covered with Novagard (G661) or Dow[®] Corning Compound 4.

- 4 Snap the cover onto the encoder register.
- 5 Proceed to the section specified for either wall or pit installation.

6 Installing the R450 Wall MIU



For greater detailed information and installation instructions, refer to the *R450 MIU Wall and Pit Installation and Maintenance Guide* (Part #: 12587-001).

Complete the following steps to install the wall MIU.

- 1 Remove the main housing from the mounting adapter.

(The Hi-Lo fastener for securing the main MIU housing to the adapter plate is shipped separately in box.)

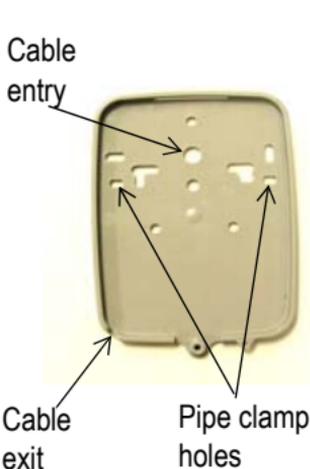


Figure 2 Wall MIU Main Housing

A variety of holes in the mounting adapter allows for a quick and easy installation.



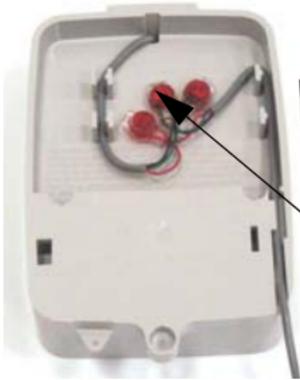
- The cable enters through the bottom or rear cable entry of the mounting adapter.
- When the MIU replaces a receptacle, use the appropriate holes to allow reuse of the receptacle's original mounting holes. See mounting hole configuration in Figure 3.
- When mounting the MIU to a pipe, use the bolt hole for pipe mounting.



- 2 Study Figure 3 and the location requirements, then decide how to install the MIU and mount adapter with the set screw positioned at the bottom.

Figure 3 Mounting Adapter

- 3 Connect each individual colored wire from the wall MIU with the appropriate colored wire from the approved encoder per the encoder wiring. See Figure 1 on page 4. Repeat this step for each colored wire.



- 4 For rear cable entry, store excess wire and Scotchloks™ in the hollow cavity in the back of the MIU using the strain relief guides as shown in Figure 4.

Figure 4 Back of MIU

- 5 For bottom cable exit, store Scotchloks in the hollow cavity in the back of the MIU. Then, guide the remaining wire through the cable exit notch at the bottom right side of the MIU as shown in Figure 5.



Figure 5 Cable Exit Notch



- **Connection from the MIU to the approved encoder should be made using 22AWG three-conductor wire.**
- **Neptune requires that you use either type UR or UY Scotchlok gel caps to connect the pigtail from the MIU to the register wire. (Refer to Neptune's *Encoder Quick Install Guide* (Part No: 12572-001) for proper Scotchlok techniques.**

When using the Scotchlok gelcaps:

- Pair the wires according to the color chart in Figure 1 on page 4.

- Slide the ends of the pair of colored wires into the gel caps as far as they can go. **Do not strip individual colored wires.**
- Then, firmly squeeze the gel cap with the appropriate crimping tool (Eclipse Tools Part No. 100-008 or Neptune Part No. 5500-158). One gel cap is used for each colored wire pair. See Figure 6.

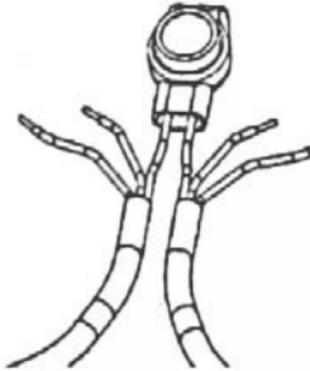


Figure 6 Gel Cap Connections



Figure 7 MIU Back Plate

- 6 Slide the tongue on the top of the MIU into the groove on the top of the MIU Mounting Adapter. See Figure 7.

- 7 Secure the MIU to the Mounting Adapter using the Hi-Lo Fastener provided. See Figure 8.



Figure 8 Hi-Lo Fastener

- 8 Activate the MIU per the section entitled “Activating and Testing the R450 MIU” on page 14.

7 Installing the R450 Pit MIU



- For greater detailed information and installation instructions refer to the *R450 MIU Wall and Pit Installation and Maintenance Guide* (Part No. 12857-001).
- Before wiring the encoder register, make sure the cable is long enough so that when the installation is complete, the pit lid (with MIU attached) can be removed easily without straining the cable.

Connecting the Antenna



Figure 9 Pit Antenna Cable and Housing

- 1 Install the housing through the 1 3/4" hole in the meter pit lid. Slip the large plastic nut over the antenna cable and thread it into the antenna assembly to secure it to the pit lid. Make sure the smooth side at top of the threads on the nut is facing upward. See Figure 9.

- 2 Place the flat black rubber washer on MIU around the male coax connection. See Figure 10.
- 3 Apply a coating of Nova-guard around the base of the "F" connector and on the flat rubber washer.
- 4 Connect the coaxial cable connector to the "F" connector on the transmitter housing. Tighten the connector with a 7/16" wrench to a torque of approximately 30 in-lbs. See Figure 10.



Figure 10 Coax Connection



Figure 11 Latch Plate

- 6 Slide the black conical-shaped gasket down the cable until it engages the connector housing. See Figure 12.



Figure 12 Rubber Seal



Figure 13 Connector Housing

- 5 Make sure the washer is properly seated. Connect the plastic connector housing to the three-lobed black plastic latch plate. See Figure 11.
- 7 Tighten the connector nut onto the threaded portion of the connector housing. This connection should be hand-tight. Do not use pliers. See Figure 13.

- 8 Do one of the following:
- For flooded pit or deep vault installations, use the included cable tie to hang the MIU from the antenna tube. See Figure 14.

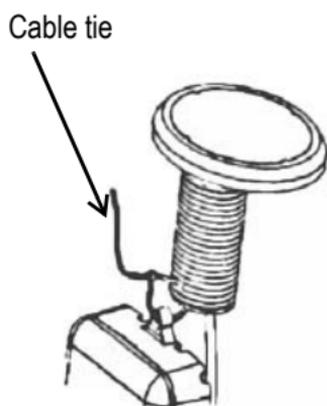
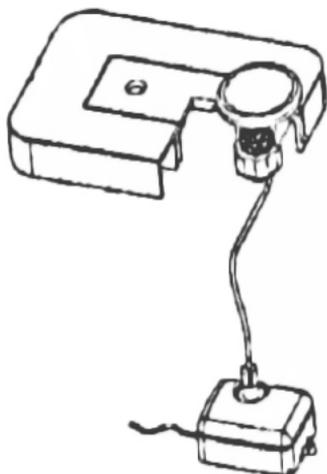


Figure 14 Cable Tie



- For shallow residential pits, position the MIU in the base of the meter box as shown for the shallow residential pit settings. See Figure 15.
- Carefully coil the pit antenna cable in the pit prior to reinstalling the pit lid.

Figure 15 Pit Installation

Be careful not to lodge the MIU between the meter box and any components inside the box.



When connecting an R450 MIU to a Permalog unit, be sure to use the supplied cable tie to hang the MIU from the antenna shaft.

- 9 Proceed to “Activating and Testing the R450 MIU” on page 14.

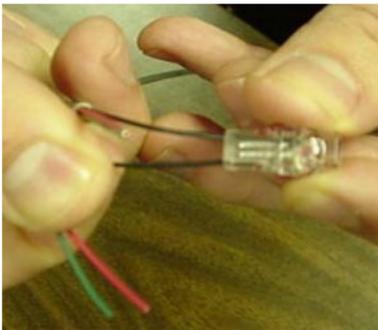
8 PIT MIU Installation - Retrofit Applications Only

- 1 Complete steps 1 through 9 outlined in “Installing the R450 Pit MIU” on page 8 to install the MIU through the lid.
- 2 Use a 3M Scotchlok Type UR connector to connect the MIU wires to the encoder wires.

- 3 Hold the Scotchlok connector between index finger and thumb with the red cap facing down. See Figure 16.



Figure 16 Scotchlok Connector



- 4 Take a non-stripped black wire from the pigtail and a non-stripped black wire from the receptacle/MIU and insert the wires into the Scotchlok connector until fully seated in the connector. See Figure 17.

Figure 17 Seating Connector Wires



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

- 5 Place the connector red cap side down between the jaws of the UR crimping tool (Neptune Part No. 5500-158), as shown in Figure 18.

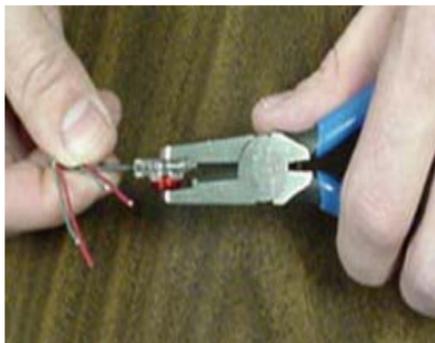


Figure 18 UR Crimping Tool



Red and green wires

Figure 19 Improper Connections

- 6 Check to ensure that the wires are still fully seated in the connector before crimping the connector. Figure 19 illustrates improper connections due to the wires not being fully seated.
- 7 Squeeze the connector firmly with the proper crimping tool until you hear a pop and gel seeps out the end of the connector.
- 8 Repeat steps 2 through 6 for each color wire. See Figure 21.
- 9 Once all three color wires have been connected, read the encoder register to ensure proper connections and the receptacle/MIU is functioning properly. See Figure 20.

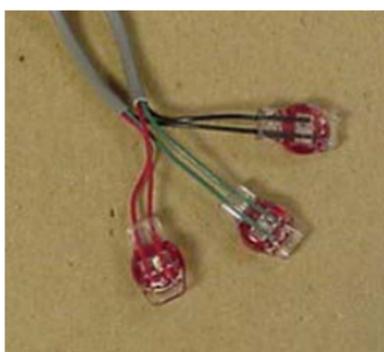


Figure 20 Three Color Wires Connected

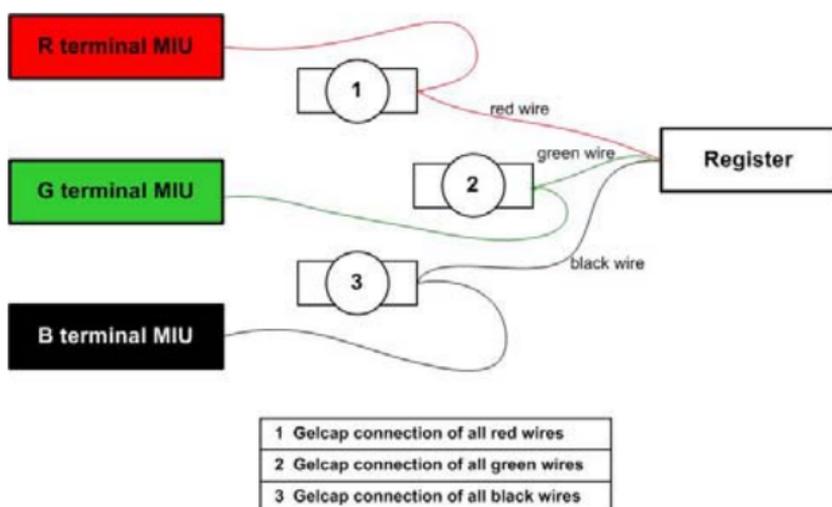


Figure 21 Color Code for Wires

Connecting the Splice Tube

To complete the installation of the Scotchloks, complete the following steps to install the Connector King Splice Tube.



- 1 Take all three connected Scotchlok's and push into the splice tube until fully encapsulated by the silicone grease. See Figure 22.

Figure 22 Splice Tube

- 2 Separate each black/gray wire and place in the slots on each side as shown in Figure 23.

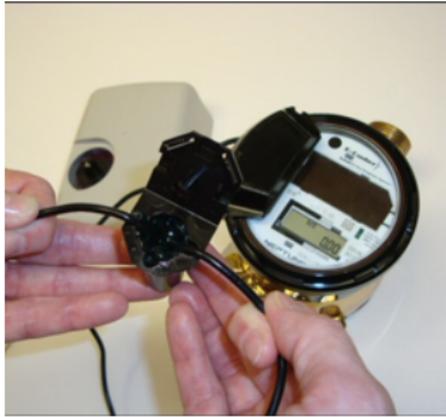


Figure 23 Black/Gray Wires in Slots

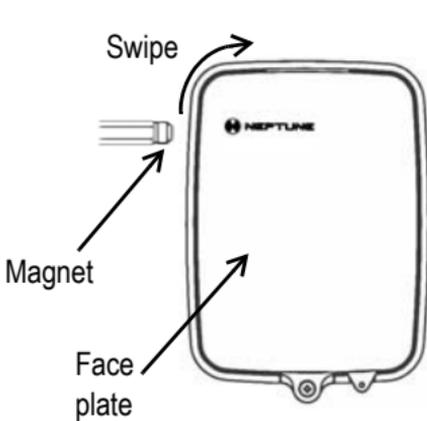


Figure 24 Cover in Place

- 3 Snap the cover closed to finish the installation as shown in Figure 24.

9 Activating and Testing the R450 MIU

MIU Activation



- 1 Position the magnet against the left side of the MIU directly in line with the Neptune logo, as shown. Swipe it bringing it from the side and around the corner to the top to activate the MIU. See Figure 25.

Figure 25 Activation Magnet

- 2 The MIU will transmit its configuration packet to the R450 DC approximately 30 seconds following the magnet swipe.
- 3 The MIU will send the register reading to the R450 DC approximately 15 seconds following the configuration packet.
- 4 Once the R450 DC receives the configuration packet and meter reading, the R450 DC will send out an email confirmation to the installer to allow for verification of proper installation and MIU location. (email text shown below).

Example of MIU Config Email

```
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
=====
```

RSSI Values and ARB N_SIGHT AMI System Capabilities

Signal Strength, RSSI values, is a key indicator of the ARB N_SIGHT AMI System health as well as the communication capabilities of the MIU to and with the R450 DC.

These values are associated with *Uplink*, the ability of the R450 DC to hear reading information from the MIU, and *Downlink*, the ability of the MIU to hear instructions from the R450 DC.

The MIU Config Email provides feedback on the RSSI values between the MIU and the R450 DC following MIU Activation. Depending on the RSSI values recorded, the System indicates the values as:

- Pass
- Marginal
- Fail (should they fail)

It is important to note that RSSI values in the Pass range are required for both the Downlink and the Uplink to ensure full, two-way capabilities of the MIU as part of the ARB N_SIGHT AMI System. See Table 2 which follows and Table 3 on page 16.

Table 2 MIU RSSI Downlink

RSSI Description	RSSI Values	Result in Performance
Pass	RSSI >= -95	Full capability
Marginal	-105 <+ RSSI < -95	Occasional two-way capability — not reliable
Fail	RSSI <= -105	MIU not capable of two-way communications

Table 3 Collector RSSI Uplink

RSSI Description	RSSI Values	Result in Performance
Pass	RSSI >= -105	Reliable daily readings and profile data
Marginal	-115 <+ RSSI < -105	Reliable daily readings and profile data
Fail	RSSI <= -115	Very poor readings performance

Other Sample Configuration Emails

RSSI Validation Test Failed

If an MIU fails the validation test for RSSI during the installation process, the installer will 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].

```
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
=====
```

Register Test Failed

If an MIU 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 Con-
nectivity Problem
Collector..... Collector Four
Signal/Noise..... 13
Noise..... 130
MIU id..... 110181776
=====
```

Table 4 Config Email Subject Line Breakdown

Value	Description
1776	Last 4 digits of MIU ID
B	Valid read. There are three types of reads: <ul style="list-style-type: none">• G = Valid read• B = Bad read• N = No register
-117	R450 DC Received Signal Strength Indicator (RSSI)
Collector Four	R450 DC Name

- 5 Do one of the following:
- If a valid register connection and acceptable RSSI values are reported, then proceed to “Completing the R450 Wall MIU Installation” .
 - If register connection is returned as invalid, then proceed to “Troubleshooting” on page 18.

10 Completing the R450 Wall MIU Installation

- 1 Install a seal wire or seal clip through the seal holes, if desired.

- 2 Make sure the appropriate ID# on the MIU has been assigned to the meter setting.
 - For single register applications, use the bold-faced ID#.
 - For two register configuration, assign the (HI S/N) to one register and the (LO S/N) to the second register.



All tags are provided to aid in the elimination of transcription errors.

11 Troubleshooting

After the MIU has been wired, follow these steps to troubleshoot an invalid register reading or connection, for example **B** or **N** in the MIU Config email.

- 1 Check the wiring connections, that is, terminal screws and Scotchloks, to ensure they are connected properly.
- 2 If the register is a non-prewired and pitted register, check that the silicone is applied correctly.
- 3 If the register is a Rev. E or older, check to ensure it is programmed in a rewire RF format using a field programmer.
- 4 If the problem continues to exist, replace the register.

Troubleshooting Low RSSI: Tips and Techniques for New Installations

Received Signal Strength Indicator (RSSI) is a measurement of the power present in a received radio signal. Neptune uses this measurement during the installation process to determine if an R450 DC is strongly receiving for an MIU. Refer to Table 2 MIU RSSI Downlink on page 15 and Table 3 Collector RSSI Uplink on page 16 for the values that Neptune considers acceptable, marginal, or failed.

During the installation process, an installer receives an email with the RSSI value to determine if the location of the MIU is acceptable or not. If the RSSI value is either at the upper limit of the marginal range or is a failed RSSI, the installer should try these tips and techniques.

Outside Wall MIU Installation

- Relocate the MIU to a higher installation level (i.e. higher than 4 feet above ground level).
- Relocate the MIU near the corner of a house or building.

Inside Wall MIU Installation (Basement or Other Area)

- Check the RSSI value at the meter location.
- Check the RSSI value at or near a basement window, if available.
- Check the RSSI value in the floor joist.
- Choose the best RSSI value for installing the MIU.
- If no RSSI value is acceptable, relocate the MIU outside if possible.

Pit MIU Installation

- Re-orient the pit antenna.
- Check antenna connection to the MIU.

Troubleshooting Low RSSI: Tips and Techniques for Existing Installations

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

Outside Wall or Basement MIU Installations

- Check RSSI values and try to relocate MIU to a better location
- Replace MIU if necessary

Pit MIU Installations

- Check RSSI values and re-orient pit antenna
- Check antenna connection to the MIU
- Replace pit antenna
- Replace MIU if necessary

12 Checklist

Before leaving the installation site, be sure to:

- Record MIU ID for each register.
- Verify that you have followed all requirements of this Quick Install 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.



NEPTUNE
TECHNOLOGY GROUP

Take Control

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