R450™ Data Collector Installation and Maintenance Guide
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FCC Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (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 A 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 100 cm is maintained from the general population.
Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient faire perdre à l’utilisateur son droit à utiliser cet équipement.

Professional Installation

In accordance with Section 15.203 of the FCC rules and regulations, the R450 Data Collector 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 A 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 A 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.
Important Safety Precautions

Review the following precautionary measures prior to installation.

- Refer installation and service to qualified service personnel only.

Important Safety Precautions

- Review the following precautionary measures prior to installation.
- Connections to the AC mains must be performed by a licensed electrician. No user-installable parts inside.
- Installation must be done in accordance with the instructions contained in this manual.
- Installation must be done in accordance with the National Electrical Code (NEC), NFPA 70 or Canadian Electrical Code (CEC), CSA C22.2, No. 1.
- In particular, installation must be done in accordance with N.E.C. Article 810 or C.E.C Section 54.
- This unit is not intended to be powered directly from the Mains Distribution System.

Mesures de sécurité importantes

- Examinez les mesures de précaution suivantes avant l’installation.
- Examinez les mesures de précaution suivantes avant l’installation. Les raccordements au secteur alternatif doivent être effectués par un électricien qualifié. Aucune pièce ne peut être installée par l’utilisateur à l’intérieur.
- L’installation doit être effectuée conformément aux instructions contenues dans le présent manuel.
- Plus précisément, l’installation doit être faite conformément à l’article 810 du N.E.C. ou la section 54 du C.C.E.
- Cet appareil n’a pas été conçu pour être alimenté directement par le réseau de distribution principal.
CAUTION: Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the manufacturer’s instructions.

MISE EN GARDE : Risque d'explosion si la batterie est remplacée par un type de batterie inapproprié. Disposez des batteries usagées conformément aux instructions du fabricant.

Double Pole / Neutral Fusing.

Fusible bipolaire/neutre.
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# Contents

**Chapter 1: Product Description** ................................................................. 1
- General Product Overview ................................................................. 1
- Four Types of R450 DC Installations .................................................. 2
- Determining How to Install the R450 DC ............................................. 3
- Mounting Components ........................................................................ 4
  - Wall Mount ...................................................................................... 4
  - R450 DC Stand .............................................................................. 5
  - Pole Installation ............................................................................ 5
- Performance Issues with the R450 System .......................................... 6
  - Optimizing the Performance of a New System ................................. 6
  - Maintaining the Performance of the R450 System ............................ 8
- R450 DC Kits .................................................................................... 8
  - GPRS Modem ............................................................................... 8
  - Wi-Fi Modem .............................................................................. 9
  - Ethernet ...................................................................................... 9
  - CDMA Modem ........................................................................... 10

**Chapter 2: General Installation Guidelines** ........................................ 11
- R450 DC Specifications ..................................................................... 11
  - Electrical Specifications ............................................................... 11
  - Environmental Conditions ........................................................... 11
  - Mechanical Specifications ............................................................ 11
  - R450 DC Footprint ....................................................................... 11
  - Safety Approval ........................................................................ 11
- Storage ............................................................................................. 12
- Unpacking ........................................................................................ 12
- R450 DC Installation Kits .................................................................. 12
- Tools and Materials ......................................................................... 13
  - R450 MIU and Magnet ................................................................. 14

**Chapter 3: Installation of the R450 DC** ............................................. 15
- Mounting the R450 DC to a Pole ....................................................... 15
- Locating the Site ............................................................................... 15
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seating the Pole</td>
<td>16</td>
</tr>
<tr>
<td>Mounting the R450 DC to the Pole</td>
<td>16</td>
</tr>
<tr>
<td>Attaching Cables for the R450 DC</td>
<td>18</td>
</tr>
<tr>
<td>Attach the RF 450 MHz Antenna Cable</td>
<td>19</td>
</tr>
<tr>
<td>Connecting the Ground Wire</td>
<td>20</td>
</tr>
<tr>
<td>Mounting the GPRS or Wi-Fi Antenna</td>
<td>20</td>
</tr>
<tr>
<td>Weatherizing the Cable Connections</td>
<td>23</td>
</tr>
<tr>
<td>Connecting AC Power to the R450 DC (120V AC)</td>
<td>24</td>
</tr>
<tr>
<td>Connecting the AC-Power Wires</td>
<td>25</td>
</tr>
<tr>
<td>Configuring the GPRS Modem</td>
<td>26</td>
</tr>
<tr>
<td>Configuring the CDMA Modem</td>
<td>27</td>
</tr>
<tr>
<td>Configuring the Collector with the USB Flash Drive</td>
<td>27</td>
</tr>
<tr>
<td>Activating the Power</td>
<td>28</td>
</tr>
<tr>
<td>Completing the Installation</td>
<td>29</td>
</tr>
<tr>
<td>Testing the Connections</td>
<td>29</td>
</tr>
<tr>
<td>Swiping the MIU</td>
<td>30</td>
</tr>
<tr>
<td>If No Email is Received</td>
<td>31</td>
</tr>
<tr>
<td>Manually Configuring the GPRS Modem</td>
<td>32</td>
</tr>
<tr>
<td>Required Equipment</td>
<td>32</td>
</tr>
<tr>
<td>Configuring the GPRS Modem</td>
<td>33</td>
</tr>
<tr>
<td>Securing the R450 DC</td>
<td>33</td>
</tr>
<tr>
<td>Installing a Wall Mount System</td>
<td>34</td>
</tr>
<tr>
<td>Mounting the R450 DC to a Wall</td>
<td>35</td>
</tr>
<tr>
<td>Connecting the Cables to the R450 DC</td>
<td>36</td>
</tr>
<tr>
<td>Mounting the Antennas and Antenna Mast</td>
<td>36</td>
</tr>
<tr>
<td>Mounting the Antenna Mast to the Building</td>
<td>37</td>
</tr>
<tr>
<td>Mounting the Appropriate Communications Antenna</td>
<td>38</td>
</tr>
<tr>
<td>Mounting the GPRS or Wi-Fi Antenna</td>
<td>38</td>
</tr>
<tr>
<td>Attaching the Horizontal Crossbar</td>
<td>38</td>
</tr>
<tr>
<td>Attaching the Antenna</td>
<td>39</td>
</tr>
</tbody>
</table>
Connecting the Ethernet Cable .................................................. 40
Connecting the Cables to the R450 DC ...................................... 42

Chapter 4: Uninterruptible Power Supply ....................................... 43
UPS Specifications ..................................................................... 43
   Mechanical Specifications ..................................................... 43
   Regulatory Specifications ..................................................... 44
   Electrical Specifications ...................................................... 45
   Output ............................................................................. 45
Safety Checklists ...................................................................... 46
   UPS Safety Checklists ........................................................ 46
   Battery Safety Checklist ..................................................... 49
   Unpacking and Inspection Checklist ..................................... 52
      Save the Shipping Container ......................................... 52
      Read This Manual ......................................................... 52
The Novus Micro Secure ........................................................... 53
Site Preparation Checklist ......................................................... 55
   Grounding ........................................................................ 55
   Branch Circuit Breaker Protection ...................................... 55
   Disconnects ...................................................................... 56
   Site Requirements ............................................................ 56
Mounting the UPS .................................................................... 57
   Wall Mounting .................................................................. 57
   Pole Mounting .................................................................. 57
      Steel or Concrete Pole Mounting .................................... 57
      Wooden Pole Mounting ................................................. 58
Connecting the UPS .................................................................. 58
   Tools and Materials Required ............................................ 58
   Procedure ........................................................................ 59
      Step 1: Wiring the Input and Output Connectors ............... 59
      Step 2: Installing and Wiring the Batteries ....................... 60
   Connection Finished ......................................................... 61
Powering ON the UPS .............................................................. 61

   Tools and Materials Required ............................................ 58
   Procedure ........................................................................ 59
   Step 1: Wiring the Input and Output Connectors ............... 59
   Step 2: Installing and Wiring the Batteries ....................... 60
   Connection Finished ......................................................... 61
   Powering ON the UPS ....................................................... 61

   Contents

R450 Data Collector Installation and Maintenance Guide
# Installation and Powering On Finished

## Chapter 5: CDMA Modem Conversion Kit Installation

<table>
<thead>
<tr>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
</tr>
<tr>
<td>Tools Needed</td>
</tr>
<tr>
<td>Parts Included</td>
</tr>
<tr>
<td>Switching Modems Using the Conversion Kits</td>
</tr>
<tr>
<td>GPRS/Ethernet Connection</td>
</tr>
<tr>
<td>Serial Connection</td>
</tr>
<tr>
<td>Serial to Ethernet Connection (Sierra Wireless Modems Model 775 and 875)</td>
</tr>
<tr>
<td>Activating the CDMA Modem</td>
</tr>
<tr>
<td>Accessing the Modem's Homepage</td>
</tr>
<tr>
<td>Setting the Auto Connect Option</td>
</tr>
<tr>
<td>Sprint Modem</td>
</tr>
<tr>
<td>Verizon Modems</td>
</tr>
</tbody>
</table>

## Chapter 6: Troubleshooting

<table>
<thead>
<tr>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Required</td>
</tr>
<tr>
<td>PC Notebook Configuration</td>
</tr>
<tr>
<td>Additional Equipment Required for the Computer</td>
</tr>
<tr>
<td>Potential R450 DC Problems</td>
</tr>
<tr>
<td>Multiple R450 DCs Not Syncing with Host Database</td>
</tr>
<tr>
<td>Storm Damage Affecting Multiple Sites</td>
</tr>
<tr>
<td>First Steps</td>
</tr>
<tr>
<td>Initial Site Activities</td>
</tr>
<tr>
<td>Checking the General Health of Each of the Modules</td>
</tr>
<tr>
<td>Visual Check of CPU Board Power</td>
</tr>
<tr>
<td>Visual Check of Radio Power</td>
</tr>
<tr>
<td>Visual Check of Backhaul Modem Power and Connectivity</td>
</tr>
<tr>
<td>Cal Amp LandCell Modem</td>
</tr>
<tr>
<td>Wi-Fi Modem</td>
</tr>
<tr>
<td>Additional Detail Checks</td>
</tr>
<tr>
<td>Verify Main Power</td>
</tr>
</tbody>
</table>
Verifying CPU Board Power ........................................78
Verifying Radio Power ............................................79
Verifying Backhaul Modem Power ................................79
  Cal Amp LandCell Modem ........................................79
Verifying Backhaul Modem Connectivity ..........................80
  Cal Amp LandCell Modem ........................................80
Ethernet .....................................................................80
Wi-Fi Modem ............................................................80
Verifying Radio Functionality Using an MIU .......................80
R450 DC is Syncing but Not Supplying MIU Data .................81
Initial Observations ....................................................81
Transmitter Transmits but ALM Indicator Flashes ................82
Measuring the VSWR ..................................................82
The Radio Never Transmits ..........................................83
Reduction in Amount of Data Collected ..............................83
Contacting Customer Support .......................................84
  By Phone .............................................................84
  By Email .............................................................84

Appendix A: RF Antenna Installation ..................................85
RF Antenna Overview ................................................85
  Mounting the Antennas ...........................................85
Site Recommendations ...............................................85
Feed Line and Antenna Recommendations .........................86
  Feed Line ..........................................................86
    Feed Line Requirements ......................................86
    Neptune Part Numbers .......................................87
Antenna .....................................................................89
  Requirements .......................................................89
System Certification ..................................................90
Power Measurement ....................................................90
Coax Cable Loss .......................................................94
VSWR Calculation .....................................................95
  Using a Wattmeter and a Handheld 450MHz Radio ............95
Figures

Figure 1 – R450 Data Collector .................................................. 1
Figure 2 – Site Selection .......................................................... 3
Figure 3 – Wall-Mount Installation ............................................. 4
Figure 4 – Stand Installation ..................................................... 5
Figure 5 – Pole Installation ....................................................... 5
Figure 6 – R450 DC ................................................................. 12
Figure 7 – R450 MHz Antenna P/N 12896-001 .......................... 12
Figure 8 – RF 450 MHz Antenna Cable and Trench ..................... 15
Figure 9 – Pole Seated in Ground .............................................. 16
Figure 10 – Assembling Strut Channels ....................................... 17
Figure 11 – Mounting Hardware Stack Detail .............................. 17
Figure 12 – Positioning the Strut Channel .................................. 17
Figure 13 – Tightening the Bolts of the Strut Clamps ..................... 18
Figure 14 – RF 450 MHz Antenna Connection ............................ 18
Figure 15 – Antenna Connections ............................................. 19
Figure 16 – Ground Wire ......................................................... 20
Figure 17 – Items for GPRS or Wi-Fi Antenna ............................. 20
Figure 18 – Attaching the GPRS or Wi-Fi Antenna ....................... 21
Figure 19 – Tighten Bolt for GPRS Antenna ............................... 21
Figure 20 – Cable to GPRS Antenna .......................................... 22
Figure 21 – GPRS Antenna Connection at Base ........................... 22
Figure 22 – Weatherizing Connections ...................................... 23
Figure 23 – Weatherizing the Base Connection ........................... 23
Figure 24 – Weatherizing the Antenna Connection ....................... 24
Figure 25 – AC Wiring Threaded Through Base (120V AC Installation) ................................................ 25
Figure 26 – Attaching the Black Wire ........................................ 25
Figure 27 – Attaching White Wire ............................................. 26
Figure 28 – R450 DC Wiring Diagram (120V AC Illustration) ........ 26
Figure 29 – USB Port on CPU Board ........................................ 27
Figure 30 – Main Disconnect Breaker Switch .............................. 28
Figure 62 – Verizon Provisioning via OTASP ................................................. 70
Figure 63 – Verizon CDMA Connection Status after Provisioning .................. 71
Figure 64 – Verizon Cell Connection Tab ..................................................... 71
Figure 65 – PPP Status .............................................................................. 72
Figure 66 – Ethernet Status LED ................................................................. 76
Figure 67 – Radio LEDs on Front Panel ...................................................... 76
Figure 68 – Modem Power Indicator ............................................................ 77
Figure 69 – Red and Black Leads ................................................................. 78
Figure 70 – Positive and Negative Pins ....................................................... 79
Figure 71 – CalAmp Modem with RSSI LED ............................................... 80
Figure 72 – RF 450 MHz Antenna ............................................................... 97
Figure 73 – RF 450 MHz Antenna Cable and Trench ................................. 99
Figure 74 – RF 450 MHz Antenna to be Mounted .................................... 100
Figure 75 – RF 450 MHz Antenna Connection ......................................... 101
Figure 76 – Antenna Connections .............................................................. 101
Figure 77 – Weatherizing the RF Antenna Connection ............................. 102
Figure 78 – Create a New Collector Window ............................................. 105
Figure 79 – Collector Network Setting Tab ................................................ 107
Figure 80 – Delete Confirmation Dialog Box .......................................... 108
Figure 81 – Collector Search .................................................................. 109
Figure 82 – Collector Search Results ....................................................... 110
Figure 83 – Straight-Through Ethernet Cable .......................................... 111
Figure 84 – RJ-45 Crossover Ethernet Cable ............................................ 111
This page intentionally left blank.
Tables

Table 1 – GPRS Modem Parts List 12799-000 ................................................................. 8
Table 2 – Wi-Fi Modem Parts List 12799-200 ............................................................... 9
Table 3 – Ethernet Parts List 12799-300 .................................................................. 9
Table 4 – CDMA Modem Parts List - 12799-010 (Verizon), 12799-020 (Sprint) ........ 10
Table 5 – Recommended Tools and Materials ............................................................. 13
Table 6 – AC Wiring (120V AC) ................................................................................. 24
Table 7 – Lights on the CPU Board ........................................................................... 30
Table 8 – Installing a Wall Mount System ................................................................. 34
Table 9 – UPS Safety Checklist (Liste de vérification de sécurité de l’ASI) ............... 47
Table 10 – Battery Safety Checklist .......................................................................... 50
Table 11 – UPS LED Descriptions ............................................................................ 62
Table 12 – UPS Troubleshooting ............................................................................... 62
Table 13 – Neptune Part Numbers for Cable and Connectors ................................... 87
Table 14 – Connectors and Accessories .................................................................... 88
Table 15 – Power Measurement to Return Loss and VSWR Conversion Table -Part I ... 90
Table 16 – Power Measurement to Return Loss and VSWR Conversion Table -Part II ... 91
Table 17 – Coax Cable Loss Table ............................................................................ 94
Table 18 – Recommended Tools and Materials ......................................................... 98
Table 19 – Collector Details ..................................................................................... 106
Table 20 – Collector Network Settings ...................................................................... 107
Table 21 – Cable Color Code Table .......................................................................... 112
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Chapter 1: Product Description

This chapter is designed to provide you with an introduction to the installation process. It explains the focus of the guide, the pre-installation personnel responsibilities, and general information on technical support.

General Product Overview

This section provides a general description of the R450™ Data Collector (R450 DC), Model 450C.

The R450 DC receives, stores, and communicates meter reading data to the host software, N_SIGHT™ PLUS in the host computer. The R450 DC collects meter reading data from Neptune’s R450 Meter Interface Unit (MIU) interfacing with Neptune’s absolute encoder register. This data can later be uploaded to the Customer Information System (CIS) and sent to the utility billing system for processing.

Figure 1 – R450 Data Collector
The R450 DC utilizes frequencies in the 450-470 MHz licensed band. A Federal Communications Commission (FCC) license is required prior to installation of the system.

Before you begin to install the R450 DC, it is important to become familiar with the unit and its components. This guide is intended for use by installers and is designed to help in the installation process. This guide contains information on the components and specifications, the site selection, and the actual installation of the unit.

Four Types of R450 DC Installations

There are four R450 DC variants depending on the backhaul communications required. Each type is powered by single phase AC main power 120V, 60 Hz.

Neptune provides an installation kit for each type of installation. The standard configuration of the R450 DC backhaul is a General Packet Radio Service (GPRS) modem. Other available backhaul options include using an Ethernet connection, a Wireless Fidelity (Wi-Fi) modem, or a Code Division Multiple Access (CDMA) modem.

**Backhaul Type**

- GPRS modem (standard configuration)
- Ethernet
- Wi-Fi modem
- CDMA modem

The R450 DC can be mounted on a wall, a pole, or a stand as shown in the following illustrations.
Determining How to Install the R450 DC

Consider the following.

**WARNING:** Do not mount the R450 DC, antenna mast, or antenna to a pole or similar structure carrying open electric light, power wires, or trolley wires over 250 volts. See NEC, Article 810.

**AVERTISSEMENT:** N'installez pas l'enregistreur de données R450 DC, le mât d’antenne ou l’antenne d’un poteau ou d’une structure semblable amenant un éclairage électrique ouvert, des fils électriques ou des fils de prise de courant de plus de 250 volts. Voir l’article 810 du N.E.C.

Figure 2 on page 3 illustrates how the R450 DC can be installed.

---

**Site Selection**

![Site Selection Diagram]

Figure 2 – Site Selection
Depending upon the availability of communications, GPRS, Wi-Fi, Ethernet, or CDMA modems can be used. Use with the selection checklist before installing the R450 DC.

Mounting Components

This section describes the various mounting components for the R450 DC.

Wall Mount

A wall-mounted R450 DC can be installed indoors; however, because the unit uses an external antenna, an antenna mast is needed. Refer to Figure 3 for how to mount the R450 DC to a wall.

![Wall Mount Diagram]

**Figure 3 – Wall-Mount Installation**

Depending upon the availability of communications, GPRS, Wi-Fi, Ethernet, or CDMA modems can be used.
R450 DC Stand

The R450 DC can be mounted on a stand. Refer to Figure 4 for how to mount the R450 DC on a stand.

Figure 4 – Stand Installation

Depending upon the availability of communications, GPRS, Wi-Fi, Ethernet, or CDMA modems can be used.

Pole Installation

The pole installation is used for an outdoor free-standing pole. Refer to Figure 5 for how to install the R450 DC on a pole.

Figure 5 – Pole Installation

Depending upon the availability of communications, GPRS, Wi-Fi, Ethernet, or CDMA modems can be used.
Performance Issues with the R450 System

This section addresses situations where the system is functioning but the R450 DC or MIU communication is not performing as expected.

This discussion covers two situations.

- The first is getting the newly installed system to perform per specification.
- The second covers an installed system where the performance degrades suddenly or over time.

Optimizing the Performance of a New System

Before you install the system, Neptune uses computer software and other resources to predict the performance of the system and recommends a minimum number of R450 DCs to provide the desired performance. Each site has a survey performed that provides recommendations on antenna placement and looks for potential radio interference problems. These steps can identify many of the potential problems but may not be able to identify all the problems encountered during installation and maintaining the system. Neptune provides a propagation model which uses sophisticated software to predict the system performance. If you place an R450 DC somewhere else, it may not perform well.

CAUTION: If Neptune's propagation model is not followed, then inadequate performance can occur.

Owners of both licensed and unlicensed equipment are responsible for the proper operation of their equipment. If it is not operating within specifications, the owner is required to bring the system into compliance or stop using it. This can be beyond the capability of most homeowners and small businesses, requiring a cooperative effort to solve.

It is possible for a piece of equipment to be functioning totally within its required specifications and still cause interference with the R450 System. The collaborative effort of all the affected parties is required to solve this type of problem.

During the initial installation of a site, Neptune advises using a receiver or high quality spectrum analyzer connected to the antenna to assure that the transmit and receive frequencies are free from
interference. Additionally, be sure that there are no potentially interfering signals around the frequencies used by the R450 DC, both transmit or receive. The overall noise level could potentially reduce the sensitivity of the R450 DC or MIU receivers. A recommended receiver is the Icom ICPCR1500 which includes a PC interface. A Rohde & Schwarz FSH3.03 or FSH3.23 spectrum analyzer is also acceptable.

Problems can occur from a number of sources. Some common problems include the following:

- Improper installation, for example, loose connectors. Refer to "RF Antenna Installation" in Appendix A to confirm the correct installation procedures.

**CAUTION: You must provide Appendix A to antenna contractors prior to installation. Failure to follow these procedures can result in poor system performance.**

- Local cable systems having leaks in the cables and amplifiers can degrade the performance of the R450 System.
- Local businesses and factories can have equipment that raises the ambient noise level, reducing the ability of the R450 DC to hear MIUs.
- Local residences and businesses can have equipment that interferes with the R450 System.

Site surveys often find these problems but cannot detect intermittent, factory shift-related, or other time-specific sources of interference.

Being in close proximity to a high-power commercial broadcast antenna produces a unique set of problems. Loose or badly corroded hardware on or near the site can cause signals from the R450 DC or other transmitters near the site to combine with the broadcast signal and produce interfering signals. Incorrectly installed antennas and feed lines can also cause similar problems. The R450 DC and other local transmitters themselves can also be a source of re-radiated interference. Additional equipment that your installer can recommend can help control these issues.

Terrain and the types of buildings in the area can affect the performance of the R450 System. Hilly or rolling terrain as well as tall buildings can make it difficult to receive even local MIUs. Placement of the MIUs (wall mount and pit style) can be critical in some areas. Additional R450 DCs that can supplement the problem areas can be the best solution in these situations.
Maintaining the Performance of the R450 System

The first major activity is to be sure that you have properly installed all the R450 MIUs so that the R450 System can reliably receive their transmissions.

The troubleshooting section of this guide includes recommendations on how to verify that the R450 DC and antenna system are performing up to specification.

Storm activity can degrade the performance of the R450 DCs. If this happens, the lightning arrestors should be checked and replaced if defective. Inspect the small ceramic disk located inside the arrestor under the 9/16 inch cap. A new disk is white with silver ends. If there are black traces or the disk is totally black, it should be replaced. If the disk shows severe damage, the entire arrestor should be replaced.

Running the surveys again using the radio receiver can identify new sources of interference. Problems related to specific time windows should have the surveys performed during those time periods.

R450 DC Kits

The following section describes the components for each of the four R450 DC kits.

GPRS Modem

The R450 DC is mounted on either a pole, wall, or a stand. The following list includes the parts needed for the R450 DC – GPRS modem kit.

Table 1 – GPRS Modem Parts List 12799-000

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>12799-000</td>
<td>R450 DC (AC-power supply, GPRS modem)</td>
<td>1</td>
</tr>
<tr>
<td>N/A</td>
<td>450 C Assembly Accessories (reference Part # 12799-000)</td>
<td>A/R</td>
</tr>
<tr>
<td>12564-002</td>
<td>Antenna, GPRS (included with the R450 DC)</td>
<td>1</td>
</tr>
<tr>
<td>10046-112</td>
<td>Coax Cable, six-foot, GPRS antenna (included with the R450 DC)</td>
<td>1</td>
</tr>
<tr>
<td>12842-001</td>
<td>Strut clamp, one-inch, Stainless Steel (included with R450 DC)</td>
<td>1</td>
</tr>
<tr>
<td>N/A</td>
<td>Hardware kit (bolts, washers, nuts) included with R450 DC (Adalet, M10292)</td>
<td>1</td>
</tr>
<tr>
<td>12835-001</td>
<td>R450 DC Installation and Maintenance Guide</td>
<td>1</td>
</tr>
</tbody>
</table>
The GPRS modem requires a System Information Manager (SIM) card which must be ordered separately. To obtain a SIM card, contact your preferred GPRS service provider.

**Wi-Fi Modem**

The R450 DC is mounted on either a pole, wall, or a stand. The following list includes the parts needed for the R450 DC – Wi-Fi modem kit.

**Table 2 – Wi-Fi Modem Parts List 12799-200**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>12799-200</td>
<td>R450 DC (AC-power supply, W-iFi modem)</td>
<td>1</td>
</tr>
<tr>
<td>N/A</td>
<td>450 C Assembly Accessories (reference Part #12799-200)</td>
<td>A/R</td>
</tr>
<tr>
<td>12819-001</td>
<td>Antenna, Wi-Fi (included with R450 DC)</td>
<td>1</td>
</tr>
<tr>
<td>10046-112</td>
<td>Coax cable, six-foot, Wi-Fi antenna (included with the R450 DC)</td>
<td>1</td>
</tr>
<tr>
<td>12842-001</td>
<td>Strut clamp, one-inch, Stainless Steel (included with the R450 DC)</td>
<td>1</td>
</tr>
<tr>
<td>N/A</td>
<td>Hardware kit (bolts, washers, nuts) included with the R450 DC (Adalet, M10292)</td>
<td>1</td>
</tr>
<tr>
<td>12835-001</td>
<td><em>R450 DC Installation and Maintenance Guide</em></td>
<td>1</td>
</tr>
</tbody>
</table>

**Ethernet**

The following list includes the parts needed for the R450 DC – Ethernet kit.

**Table 3 – Ethernet Parts List 12799-300**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>12799-300</td>
<td>R450 DC (AC-power supply, Ethernet modem)</td>
<td>1</td>
</tr>
<tr>
<td>N/A</td>
<td>450 C Assembly Accessories (reference Part #12799-300)</td>
<td>A/R</td>
</tr>
<tr>
<td>N/A</td>
<td>Hardware kit (bolts, washers, nuts) included with the R450 DC (Adalet, M10292)</td>
<td>1</td>
</tr>
<tr>
<td>12835-001</td>
<td><em>R450 DC Installation and Maintenance Guide</em></td>
<td>1</td>
</tr>
</tbody>
</table>
CDMA Modem

The following list includes the parts needed for the R450 DC – CDMA modem kit.

Table 4 – CDMA Modem Parts List - 12799-010 (Verizon), 12799-020 (Sprint)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>12799-010</td>
<td>R450 DC (AC-power supply, CDMA modem - Verizon)</td>
<td>1</td>
</tr>
<tr>
<td>12799-020</td>
<td>450 C Assembly Accessories (reference Part #12799-200)</td>
<td>1</td>
</tr>
<tr>
<td>12564-002</td>
<td>Antenna, GPRS (included with the R450 DC)</td>
<td>1</td>
</tr>
<tr>
<td>10046-112</td>
<td>Coax cable, six-foot, GPRS antenna (included with the R450 DC)</td>
<td>1</td>
</tr>
<tr>
<td>12842-001</td>
<td>Strut clamp, one-inch, Stainless Steel (included with the R450 DC)</td>
<td>1</td>
</tr>
<tr>
<td>N/A</td>
<td>Hardware kit (bolts, washers, nuts) included with the R450 DC (Adalet, M10292)</td>
<td>1</td>
</tr>
<tr>
<td>12835-001</td>
<td>R450 DC Installation and Maintenance Guide</td>
<td>1</td>
</tr>
<tr>
<td>13163-010</td>
<td>Conversion Kit Assembly, CalAmp CDMA modem - Verizon</td>
<td>1</td>
</tr>
<tr>
<td>13163-010</td>
<td>Conversion Kit Assembly, CalAmp CDMA modem - Sprint</td>
<td>1</td>
</tr>
</tbody>
</table>

CDMA modems do not require a SIM card.
Chapter 2: General Installation Guidelines

This chapter describes the specifications for the R450 Data Collector (R450 DC), storage, unpacking instructions, preliminary tests, tools, materials, site selection, and installation of the R450 DC.

R450 DC Specifications

This section provides the specifications of the R450 DC.

**Electrical Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Power</td>
<td>120 AC, 1.0A, 60Hz</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>50 Watts</td>
</tr>
</tbody>
</table>

**Environmental Conditions**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-22° to 140°F (-30° to 60°C)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40° to 185°F (-40° to 85°C)</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>0 to 95% Non-condensing</td>
</tr>
<tr>
<td>Environmental Rating</td>
<td>UL50E Type 4X</td>
</tr>
<tr>
<td>Operating Altitude</td>
<td>Less than 6561 feet (2000 meters)</td>
</tr>
</tbody>
</table>

1 For installations that have ambient temperatures that exceed 110°F (43.3°C), the R450 DC must be installed in a well-ventilated, shaded location.

**Mechanical Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Weight</td>
<td>71.5 lbs (32.5 kg)</td>
</tr>
</tbody>
</table>

**R450 DC Footprint**

<table>
<thead>
<tr>
<th>Component</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>R450 DC</td>
<td>8’ x 8’ Triangle</td>
</tr>
<tr>
<td>Stand (Valmont)</td>
<td>2.4M x 2.4M Triangle</td>
</tr>
</tbody>
</table>

**Safety Approval**

<table>
<thead>
<tr>
<th>Approval</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL Listed</td>
<td>Per 60959-1</td>
</tr>
<tr>
<td>CSA c222</td>
<td>No. 60950-1</td>
</tr>
</tbody>
</table>
Storage

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

After the inspection is complete, store the cartons in a clean, dry environment. The temperature should remain between -40° and 185°F (-40° and 85°C).

Unpacking

As with all precision electronic instruments, the R450 DC should be handled with care; however, no special handling is required.

After unpacking the R450 DC, inspect it for damage. If any parts of the R450 DC appear to be damaged or prove to be defective upon installation, notify your Neptune sales representative. If the unit or item requires reshipment, use the original cardboard box and packing material.

R450 DC Installation Kits

The RF 450 MHz antenna and accessories are now ordered separately from the R450 DC. The RF 450 MHz antenna, coax cables, and coax connectors must be ordered as accessories. See "RF Antenna Installation" in Appendix A for a list of the antenna accessories and cables.
Tools and Materials

Table 5 shows the recommended tools and materials you need to successfully install the R450 DC.

Some items may not apply to your specific installation or the list may not contain all tools or materials depending on which installation method you use.

<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 installer</td>
</tr>
<tr>
<td></td>
<td>• Assorted screwdrivers (medium, Phillips head)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cordless electric drill/assorted bits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Adjustable wrench</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Standard socket wrench set</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Standard box-end wrench set</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hammer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Channel locks</td>
<td></td>
</tr>
<tr>
<td>UV-Stable Ties</td>
<td>8” and 12” (20.32 cm and 30.48 cm)</td>
<td>Securing coax cable</td>
</tr>
<tr>
<td>Cable Clips</td>
<td>Various sizes</td>
<td>Securing coax cable</td>
</tr>
<tr>
<td>R450 DC Key</td>
<td>Key for lock on unit</td>
<td>Securing the unit</td>
</tr>
<tr>
<td>Concrete Blocks</td>
<td>8” x 8” x 16” (20.32cm x 20.32cm x 40.64cm)</td>
<td>Ballast for the R450 DC stand</td>
</tr>
<tr>
<td>Weatherizing Kit</td>
<td>PolyPhasor P/N: WK-1 or Times Microwave P/N: WK-S-2</td>
<td>Weatherproofing coax cable connections</td>
</tr>
<tr>
<td>Electrical Tape</td>
<td>3M Super 88 or equivalent tape</td>
<td>Weatherproofing coax cable connections</td>
</tr>
</tbody>
</table>
Chapter 2: General Installation Guidelines

R450 MIU and Magnet

If you have R450 MIUs already installed, you can use these to test if the R450 DC is receiving readings. However, it is recommended that you take an R450 MIU and Neptune magnet with you when you install the R450 DC. These items are needed to test the unit. See “Swiping the MIU” on page 27.

Be sure that the N_SIGHT R450 Host Software is running and that you have an R450 MIU and magnet with you when you install the R450 DC. You will use the R450 MIU to test the unit.
Chapter 3: Installation of the R450 DC

This chapter contains sections detailing the installation instructions for the following R450 Data Collector (R450 DC) installation options:

- "Mounting the R450 DC to the Pole" on the next page
- "Mounting the R450 DC to a Wall" on page 35
- "Testing the Connections" on page 29

Mounting the R450 DC to a Pole

Locating the Site

Choose a location that does not interfere with any other wiring and is easily accessible. After selecting a site, complete the following procedures.

The first step in securing the R450 DC pole in the ground is to locate where the RF 450 MHz Antenna has been seated. Complete these instructions to locate the site for the pole.

1. Locate the conduit for the RF 450 MHz antenna cable and the trench where the cable for the RF 450 MHz antenna has been buried. See Chapter 3.

2. Find a suitable spot close in this location to seat the R450 DC pole.

Figure 8 – RF 450 MHz Antenna Cable and Trench
Seating the Pole

When selecting the pole for the R450 DC, it should be a 2-inch round SCH40 galvanized steel pole.

To seat the pole for the R450 DC, complete the following steps.

1. Choose a spot for the R450 DC pole as close as possible to the RF 450 MHz antenna cable. See Figure 9.
2. Dig a hole at least 6 inches (15.24 cm) below the frost line.
3. Seat pole against a firm, crushed stone base, on firm, compacted soil a minimum of 6 inches below the front line encased in reinforced concrete per ASTM standards. The pole is to be level and plumb.

Figure 9 – Pole Seated in Ground

CAUTION: Be sure not to dig this hole in the antenna cable trench.

Mounting the R450 DC to the Pole

To mount the R450 DC to the pole, complete the steps on following page.

Strut channels and two-inch strut clamps are ordered as accessories.
1. Assemble the 16-inch strut channels to the back of the box as shown in Figure 10. Use the supplied 3/8-inch nuts and bolts with the seal washers on the inside of the box to seal from moisture. See Figure 11.

2. Torque the mounting bolt to 65 in-lb. (7.34 Nm).

3. Position the R450 DC so that the top of the box is 4 to 6 inches below the top of the pole.

4. Attach the box to the pole using 2" strut clamps. Beginning with the top strut channel.

5. Attach the top part of the unit to the top of the pole. See Figure 12.

6. Tighten the bolts with a wrench, as illustrated in Figure 13.

7. Attach the bottom part of the unit to the pole using 2" strut clamps.

---

**Figure 10 – Assembling Strut Channels**

**Figure 11 – Mounting Hardware Stack Detail**

**Figure 12 – Positioning the Strut Channel**
7. Tighten the bolt on the strut clamp, as illustrated in Figure 13.

Figure 13 – Tightening the Bolts of the Strut Clamps

When replacing an R450 DC, always use new seal washers.

Attaching Cables for the R450 DC

The corresponding sections detail how to attach the following components:

- RF 450 MHz Antenna Cable
- Ground wire
- AC Power source

Refer to the following sections for the steps to attach these items.

Figure 14 – RF 450 MHz Antenna Connection
Attaching the RF 450 MHz Antenna Cable

To attach the RF 450 MHz Antenna cable, complete the following steps.

1. Locate the RF 450 MHz antenna cable that extends from the RF 450 MHz Antenna cable conduit. See Figure 9 on page 16.

2. Connect the RF 450 MHz Antenna cable to the RF 450 MHz Antenna connector located on the bottom of the R450 DC. See Figure 14. Tighten the coaxial connector to 14 in-lb. (1.58 Nm)

WARNING: Give special consideration when installing the R450 DC is installed inside a building.

The screen (shield) of the coaxial cable must be connected to earth (grounded) at the entrance to the building. Do this in accordance with applicable national electrical installation codes (Section 820.93 of the National Electrical Code, ANSI/NFPA 70).

Connecting the Ground Wire

To attach the ground wire, complete the following steps.

1. Locate the lightning protection system ground for the site.
2. Connect the external ground lug of the R450 DC to the lightning protection system ground for that site, as illustrated in Figure 16. User #4 American Wire Gauge (AWG) copper wire with a minimum temperature rating of 75°C.
3. Tighten with a flathead screwdriver. Torque to 35 in-lb. (4.0 Nm).

Mounting the GPRS or Wi-Fi Antenna

To mount the GPRS or Wi-Fi antenna, complete the following steps.

1. Locate all six of the items for the GPRS antenna illustrated in Figure 17.
2. Using the one inch (1”) strut clamp, attach only the black band of the GPRS or Wi-Fi antenna to one side of the top strut channel connected to the back of the R450 DC, as illustrated in Figure 18.

![Figure 18 – Attaching the GPRS or Wi-Fi Antenna](image)

**WARNING:** It is important to secure the clamp around the black band of the GPRS or Wi-Fi antenna only. Damage can occur if any other part of the antenna is used.

![Figure 19 – Tighten Bolt for GPRS Antenna](image)

3. Using a 3/8-inch socket wrench, tighten the bolt for the strut clamp around the GPRS or Wi-Fi antenna with a wrench, as illustrated in Figure 19.
4. Connect the cable to the GPRS or Wi-Fi antenna before connecting it to the base of the R450 DC. See Figure 20.

5. Tighten the coaxial cable connection to 14 in-lb. (1.58 NM).

6. Connect the GPRS antenna cable to the base of R450 DC. See Figure 21.

7. Tighten to 14 in-lb. (158 Nm).

Figure 20 – Cable to GPRS Antenna

Figure 21 – GPRS Antenna Connection at Base

WARNING: Give special consideration when installing the R450 DC is installed inside a building.

The screen (shield) of the coaxial cable must be connected to earth (grounded) at the entrance to the building. Do this in accordance with applicable national electrical installation codes (Section 820.93 of the National Electrical Code, ANSI/NFPA 70).

Weatherizing the Cable Connections

Complete the following instructions to weatherproof the cables with the black tape.

1. Using the weatherizing kit, start the tape at the top of the GPRS antenna connection as illustrated in Figure 22.

2. Wrap the tape around the connection several times; slowly work your way downward to weatherize your connection at the base.

3. Repeat steps one and two to weatherize the GPRS or Wi-Fi connection at the base of the R450 DC, as illustrated in Figure 23.
4. Repeat steps one and two to weatherize the RF 450 MHz Antenna feed-in connection at the base of the R450 DC, as illustrated in Figure 24.

Figure 24 – Weatherizing the Antenna Connection

Connecting AC Power to the R450 DC (120V AC)

The following section contains the instructions for connecting the AC power (120V AC) to the R450 DC. Refer to Table 6.

CAUTION: Connections for the wiring for the R450 DC should be done per the following table. Use 12 AWG single insulated copper wire with a minimum temperature range of 167°F (75°C). Refer to NEC table 310.17.

MISE en GARDE: Les connexions pour le câblage de l’enregistreur de données R450 doivent être effectuées selon le tableau suivant. Utilisez un fil de cuivre isolé de calibre 12 AWG (calibrage américain normalisé des fils) avec une plage de température minimale de 75 °C (167 °C). Voir le tableau 310.17 du N.E.C.

Table 6 – AC Wiring (120V AC)

<table>
<thead>
<tr>
<th>R450 DC Termination</th>
<th>120V AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaker - Left</td>
<td>Line</td>
</tr>
<tr>
<td>Breaker - Right</td>
<td>Neutral</td>
</tr>
<tr>
<td>Internal ground lug</td>
<td>Earth Ground</td>
</tr>
</tbody>
</table>
CAUTION: Wiring the AC-power for the R450 DC must be done by a licensed electrician. Install in accordance with the National Electrical Code, Canadian Electrical Code, and local electrical codes.


To connect the AC power to the R450 DC, complete the following steps.

1. With the key, open the door to the R450 DC.
2. Use a listed UL or CSA Type 4x conduit connector to thread the AC cable through the bottom of the R450 DC unit as illustrated in Figure 25.

Figure 25 – AC Wiring Threaded Through Base (120V AC Installation)

Connecting the AC-Power Wires

Connect the wiring for the AC-power in the R450 DC by completing the following steps.

1. Attach the black (L) wire to the left breaker switch as illustrated in Figure 26.
2. Torque the breaker screw terminal to 22 in-lb. (2.48Nm).

Figure 26 – Attaching the Black Wire
3. Attach the white (N) wire to the right breaker switch as illustrated in Figure 27.

4. Torque the breaker screw terminal to 22 in-lb. (2.48 Nm).

5. Attach the ground wire to the internal ground lug. See Chapter 3.

6. Torque the lug to 35 in-lb. (4.0 Nm).

7. Secure the black and white wire (line and neutral) to the plastic anchor just below the breaker using a wire tie.

**Figure 27 – Attaching White Wire**

**Figure 28 – R450 DC Wiring Diagram (120V AC Illustration)**

**Configuring the GPRS Modem**

Complete the following steps to configure the GPRS modem.

1. Turn the power off for the R450 DC.
2. Insert SIM card in the GPRS modem.
3. Connect the GPRS modem to the laptop using the Ethernet cable.
4. Turn the power on for the R450 DC.
5. Run the online configuration application. Refer to the GPRS modem's *Quick Start Guide*.

6. Verify the service is operational by opening the browser on the laptop. If the service is not operational, contact the service provider.

Be sure to maintain the user name, password, and APN information supplied by the GPRS service provider.

**Configuring the CDMA Modem**

After the CDMA modem is provisioned and installed, you will need to activate it. Please refer to “Activating the CDMA Modem” on page 55.

**Configuring the Collector with the USB Flash Drive**

Complete the following steps to configure the R450 DC with the USB flash drive.

1. Configure the USB flash drive as described in "USB Flash Drive Configuration for R450 Data Collection" on page 87.

2. Insert the USB flash drive (included with R450 DC) into either one of the two available USB ports on the CPU board.

**Figure 29 – USB Port on CPU Board**

**WARNING:** Ensure the integrity of the protective earthing when installed.

**AVERTISSEMENT:** Assurez l'intégrité de la mise à la terre pour des raisons de protection une fois installée.
Activating the Power

To activate the R450 DC, complete the following steps.

1. Open the door of the power box at the AC-power source.
2. Apply power from the main disconnect breaker switch as illustrated in Figure 30.
3. Close the door of the AC-power box.

4. Push the main breaker switch in the R450 DC up to activate power to the unit.
5. Wait five minutes for the R450 DC to complete the configuration sequence.
6. Remove the USB flash drive.
Completing the Installation

After completing the wiring for the R450 DC, you must verify that the unit has been activated by completing the following:

- Testing the connections - lights and audible sounds. See "Testing the Connections" below.
- Swiping an MIU and receiving the email sent automatically to the installer by the host software. See “Swiping the MIU” on page 27.

Testing the Connections

Complete the following instructions to test the connections.

1. Approximately five seconds after you activate the R450 DC, listen for the audible sounds.
   - There will be one audible beep approximately five seconds after activating the unit.
   - A second beep should occur approximately 45 seconds after the first beep.
   - There should be no other audible beeps after the second beep.

2. Check to be sure the power light is on at the bottom of the Midland Radio. See "R450 DC" on page 12.

3. Check to see if the power light is on for the modem.

<table>
<thead>
<tr>
<th>Modem Type</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPRS</td>
<td>The power light is solid if a network is found.</td>
</tr>
<tr>
<td></td>
<td>For further details, refer to the GPRS user's manual.</td>
</tr>
<tr>
<td>Wi-Fi</td>
<td>The Wi-Fi modem power light should be ON.</td>
</tr>
<tr>
<td></td>
<td>For further details, refer to the user's guide for the Wi-Fi modem.</td>
</tr>
</tbody>
</table>
4. If Ethernet backhaul is used, check the status of the three lights on the CPU board adjacent to the Ethernet connector.

These lights provide a visual indication of the link status, network activity, and network speed.

- The green Link Integrity light is lit when there is a valid connection detected.
- The yellow Activity light blinks on and off when activity is detected on the wire.
- The red light is on if a 100BASE-T link is detected and off if a 10BASE-T link is detected.

Refer to Table 7.

<table>
<thead>
<tr>
<th>Designator</th>
<th>Light Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D4</td>
<td>Green</td>
<td>Link Integrity</td>
</tr>
<tr>
<td>D5</td>
<td>Yellow</td>
<td>Activity</td>
</tr>
<tr>
<td>D6</td>
<td>Red</td>
<td>10/100</td>
</tr>
</tbody>
</table>

5. After the R450 DC has been powered up for five minutes, remove the USB flash drive from the CPU board.

**Swiping the MIU**

Before you can proceed with these steps, the R450 DC must be set up in the N_SIGHT PLUS host software. See "Creating a Collector" on page 87 and "Building a USB Drive for Collector Configuration" on page 93 for instructions on setting up the R450 DC in the host software.

To verify that the R450 DC can receive readings from MIUs and can synchronize with the N_SIGHT PLUS host software, complete the steps on the following page.
1. Wait about five minutes after you have powered on the R450 DC.

2. With an R450 MIU, position the Neptune magnet against the left side of the MIU directly in line with the Neptune logo, as shown in Figure 32.

3. Swipe the MIU bringing the magnet from the side and around the corner to the top. See Figure 32.

4. When swiped, an email will be sent to the email address that is set up in the host software. See the following example.

   | MIU RSSI          | Pass [-68] |
   | Collector RSSI    | Pass [-77] |
   | Register collector| Valid Read  |
   | Signal/Noise      | Morris Ave.|
   | Noise             | 49         |
   | MIU id.           | 126        |
   |                   | 110182462  |

   **Figure 33 – Email Sent from R450 DC**

   - Make sure the email comes from the R450 DC that you are installing.
   - If you do receive an email, continue to the instructions outlined in "Securing the R450 DC" on page 29.
   - If you do not receive an email, continue to the instructions outlined in "If No Email is Received”.

**If No Email is Received**

If you do not receive an email, do the following

1. Check to see if the Midland Radio is getting power by verifying that the **POW** light is on.
2. Check to see if the red TX light at the bottom of the Midland Radio is flashing every 10 seconds. Refer to Figure 67 on page 62.

- If red TX light is not flashing every 10 seconds, call Neptune Customer Support. Refer to "Contacting Customer Support" on page 69.
- If the red TX light at the bottom of the Midland Radio is flashing every 10 seconds and you do not receive readings, there is either a problem with the network connection or a problem with the N_SIGHT PLUS host software.
- Check that N_SIGHT PLUS host software is configured to send emails to the correct email address.
- Check the host software to ensure that the R450 DC is synchronizing.

If you have a GPRS modem, proceed to the next section, "Manually Configuring the GPRS Modem". If you have an Ethernet connection, consult with your utility network IT group.

Your GPRS service provider will need to manually set up the GPRS modem. To manually set up an account, your service provider will require the necessary information: username, password, and APN (Access Point Name). Refer to the setup guide included with the modem.

Manually Configuring the GPRS Modem

To manually configure the GPRS modem, you must have the required equipment prior to completing the steps for configuration.

**Required Equipment**

The following equipment is needed to configure the GPRS modem.

- Laptop or PC with Ethernet network
- Modem *Quick Start Guide*
- Ethernet cable
- GPRS service provider, APN, and password (supplied by the service provider)
- Nutdriver, 3/16 inch (Wiha P/N 265) or consult www.wihatools.com
Configuring the GPRS Modem

Complete the following steps to configure the GPRS modem.

1. Ensure the SIM card is located in the modem.
2. Connect the modem to the laptop using the Ethernet cable.
3. Turn the power on for the R450 DC.
4. Run the online configuration application. Refer to your modem's *Quick Start Guide*.
5. Verify the service is operational by opening the browser on the laptop.

   If the service is not operational, contact the service provider.
6. On the R450 DC, perform a power cycle and follow the startup procedures.

Securing the R450 DC

After you finish the configuration, complete the following steps to lock the R450 DC.

1. Close the door of the R450 DC.
2. Using the key that is supplied with the unit, secure the bottom lock of the R450 DC, as illustrated in Figure 34.

   ![Figure 34 – Bottom Lock of Unit](image)

3. Use a flathead screwdriver to secure the top lock of the R450 DC as illustrated in Figure 35.

   ![Figure 35 – Top Lock of Unit](image)
Installing a Wall Mount System

The following section contains the instructions needed to install a wall mounted system.

Table 8 – Installing a Wall Mount System

<table>
<thead>
<tr>
<th>Complete</th>
<th>Instructions</th>
<th>GPRS, CDMA, or Wi-Fi</th>
<th>Ethernet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&quot;Mounting the R450 DC to a Wall&quot; on page 1</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>&quot;Connecting the Cables to the R450 DC&quot; on page 1</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>&quot;Mounting the GPRS or Wi-Fi Antenna&quot; on page 1</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&quot;Attaching the Horizontal Crossbar&quot; on page 1</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>&quot;Attaching the Antenna&quot; on page 1</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>&quot;Mounting the Antenna Mast to the Building&quot; on page 1</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>&quot;Connecting the Cables to the R450 DC&quot; on page 1</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>8</td>
<td>&quot;Testing the Connections&quot; on page 1</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Mounting the R450 DC to a Wall

Choose a location that does not interfere with any other wiring and is easily accessible. After a location is selected, complete the following procedures.

To mount the R450 DC to a wall, as illustrated in Figure 36, complete the following.

Using the seal washers on the inside of the box, secure the box to the wall in one of the following ways:

- If mounting to wood studs, use the supplied seal washer and 3" long, 3/8-inch lag bolts.
- If mounting to masonry, use the supplied seal washer and 3 " long, 3/8-inch lag bolts.

**Figure 36 – R450 DC Mounted on Wall**
Connecting the Cables to the R450 DC

The RF 450 MHz Antenna and the communications antenna connect on the outside of the building to the R450 DC inside the building.

1. Locate an area behind the wall where the cables can thread through to the outside of the building.
2. Secure cables to the bottom of the R450 DC as illustrated in Figure 37.
3. Thread the cables through to the R450 DC antenna and mast.
4. Continue to work with the cables on the outside of the building.

Figure 37 – Adding Cables to the R450 DC

Mounting the Antennas and Antenna Mast

Consider the following.

**CAUTION:** The antenna mast and stand must be grounded to the same grounding electrode used for the building's electrical system to ensure that all exposed, non-current-carrying metal parts are the same potential. Refer to NEC Article 810.

**MISE en GARDE:** Le mât et le support de l'antenne doivent être mis à la terre avec la même électrode de mise à la terre que celle utilisée pour le système électrique du bâtiment, afin de garantir que toutes les pièces métalliques exposées qui ne transportent pas de courant sont au même potentiel. Consulter l'article 810 du N.E.C.

When mounting the antennas and antenna mast, it is important to maximize the line-of-sight relationship between the RF 450 MHz Antenna and R450 MIUs for optimum RF communications.
Mounting the Antenna Mast to the Building

With a wall-mount installation, it is necessary to mount the antenna for the GRPS or Wi-Fi modem on the exterior of the building. Complete the following steps to mount the antenna mast to the building.
1. Use antenna pole brackets to install the pole to the building. See .
2. With a drill, pre-drill your holes for the first pole bracket.
3. Secure the pole bracket in one of the following ways:
   - If mounting to a wood-constructed wall, use wood screws rated at minimum of 20 pounds loading.
   - If mounting to sheet metal or masonry, use appropriate sheet metal screws or masonry anchors rated at a minimum of 20 pounds loading.

**Figure 38 – Securing the Pole Bracket**

4. Place the antenna mast pole within the bracket.
5. Using a level to make sure the pole is vertical, line up a second bracket a minimum of 2 feet (2') from the bracket you just installed.
6. Secure the second bracket similarly to the first one, following steps 2 and 3.
7. Line up the pole in the two brackets. See .
8. Secure the pole with the bolts provided.

**Figure 39 – Lining Up Second Bracket**

**Mounting the Appropriate Communications Antenna**

Depending upon the type of modem you are using for communications with your R450 DC, refer to the following instructions for installing the appropriate antenna.

**Mounting the GPRS or Wi-Fi Antenna**

This step is only for kits using a GPRS modem and antenna or Wi-Fi modem and antenna. If you are using an Ethernet modem, refer to "Connecting the Ethernet Cable" on page 35.

Mounting the GPRS or Wi-Fi antenna involves attaching the horizontal crossbar to the pole prior to mounting the antenna.

**Attaching the Horizontal Crossbar**

**WARNING:** Antenna contact with high voltage wires may result in death. Watch for overhead electric power lines when erecting the antenna and mast.
To mount the crossbar, complete the following steps.

1. Locate a position for the crossbar approximately 5 feet from the base of the pole.
2. Attach the horizontal crossbar so that there is some overhang past the end of the pole.
3. Using a 2-inch strut clamp, secure one end of the crossbar to the vertical pole making sure the crossbar is perpendicular to the pole. See Figure 40.

**Figure 40 – Securing the Crossbar**

**Attaching the Antenna**

After mounting the horizontal crossbar, you can mount the GPRS or Wi-Fi antenna.

To mount the GPRS or Wi-Fi antenna, complete the following steps.

1. Locate a position on the crossbar approximately 2 inches from the end. See Figure 41.
2. Using the 1-inch strut clamp, attach only the black band of the modem antenna to the crossbar.

**Figure 41 – Mounting the GPRS or Wi-Fi Antenna**
3. Locate the supplied cable for the GPRS or Wi-Fi antenna.
4. Attach the cable to the base of the GPRS or Wi-Fi antenna.
5. Weatherproof the antenna connection using the weatherizing kit.
6. After the antenna is mounted, it is important to secure the cable, using Ultra-Violet (UV) approved cable ties or clips, as illustrated in Figure 42.

![Cable ties](image)

Figure 42 – Securing the Wiring

Connecting the Ethernet Cable

This step is only for kits using a Ethernet modem. If you are using a GPRS or Wi-Fi modem and antenna, refer to "Mounting the GPRS or Wi-Fi Antenna" on page 1.

Prior to connecting the Ethernet modem, an Ethernet cable must be run to the location of the R450 DC.

To connect the Ethernet modem, complete the following steps.
1. Locate the Ethernet port at the bottom of the R450 DC. See Figure 43. Refer to Appendix C "Ethernet Termination" on page 111 for more information.

![Figure 43 – Ethernet Port Connection](image)

2. Unscrew the entire feed-through assembly as illustrated in Figure 44.

3. After you remove all the pieces, insert the RJ45 connector through the endcap, then through the stain-relief section, and then into the feed-through assembly.

![Figure 44 – Ethernet Feed-Through Assembly](image)

4. Tighten the feed-through assembly to create a seal.

5. Tighten the compression nut loosely.

6. Screw the entire feed-through assembly into the RJ45 Ethernet housing which is already mounted at the bottom of the R450 DC. Refer to Figure 45.

   There should be a rubber gasket between the two assemblies.

8. Tighten the compression nut until the gaskets are tight around the RJ45 cable.

![Figure 45 – RJ45 Ethernet Housing](image)

Always push the cable toward the connector while tightening to ensure good strain relief of cable to connector.
Connecting the Cables to the R450 DC

Connect the cables to the R450 DC by completing the following steps.

1. Locate where the cables connect on the bottom of the R450 DC.
2. Secure the cables to the bottom of the R450 DC as illustrated in Figure 46.

Figure 46 – Connecting the R450 DC

3. Thread the cables through to the RF 450 MHz Antenna.
4. Wire the AC-power as described in "Installation of the R450 DC" on page 15.
5. Weatherproof all coax cables using the weatherizing kit.
6. Verify all the connections as described in "Testing the Connections" on page 29.
Chapter 4: I Uninterruptible Power Supply

This chapter describes the specifications for the Uninterruptible Power Supply (UPS) or backup power solution. It also includes storage, unpacking and inspecting instructions, tools, materials, installation, and connection of the UPS.

Save the Operator's Manual that was packed with the UPS. It contains important installation and operating instructions. Keep it in a safe place.


CAUTION: The emergency shutdown procedure is on the inside rear cover of the Operator's Manual.


UPS Specifications

This section provides information on the mechanical, regulatory, electrical, output specifications of the UPS.

Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions, in (mm) H x W x D</td>
<td>15 x 12 x 6 (381 x 305 x 153)</td>
</tr>
<tr>
<td>Weight, lb. (kg)</td>
<td>• 50 (22.7) with 4 batteries</td>
</tr>
<tr>
<td></td>
<td>• 25 (11.3) without batteries</td>
</tr>
<tr>
<td>Mounting</td>
<td>• Wall</td>
</tr>
<tr>
<td></td>
<td>• Pole (with optional bracket)</td>
</tr>
</tbody>
</table>
### Specification Description

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity (operating)</td>
<td>Up to 95% (non-condensing)</td>
</tr>
<tr>
<td>Temperature Range, °F (°C)</td>
<td>• Operating: -40 to 122 (-40 to 50)</td>
</tr>
<tr>
<td></td>
<td>• Storage: -40 to 167 (-40 to 75)</td>
</tr>
<tr>
<td>Altitude, ft (m)</td>
<td>• Operating: up to 12,000 (3658)</td>
</tr>
<tr>
<td></td>
<td>• Storage: up to 15,000 (4572)</td>
</tr>
<tr>
<td>AC Input and Output Connectors</td>
<td>Three-position terminal block (maximum 10 AWG)</td>
</tr>
<tr>
<td>RS232 Connector</td>
<td>• <strong>Surveillance version:</strong> DB-9, female</td>
</tr>
<tr>
<td></td>
<td>• <strong>Cable version:</strong> None</td>
</tr>
</tbody>
</table>
| Dry Contacts                       | • **Surveillance version:** two programmable dry, single pole double-throw relays. Contacts are rated at 120VAC, 1A. The factory default settings are:  
|                                    | • C1: On battery                                                           |
|                                    | • C2: Low battery                                                          |
|                                    | • **Cable Version:** None                                                  |
| Display                            | • **Surveillance version:** two LEDs (1 red and 1 green) via communication board.  
|                                    | • **Cable version:** two LEDs (1 red and 1 green) mounted on the enclosure visible from the outside.  |

### Regulatory Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Safety</td>
<td>UL 1778, CSA 22.2 #107.1, EN50091-2, EN60950</td>
</tr>
<tr>
<td>Emission</td>
<td>FCC subpart J, level A for conducted and radiated EMI; CISPR 22, EN55022 level A for conducted and radiated EMI.</td>
</tr>
<tr>
<td>Packaging</td>
<td>Designed to meet requirements for ISTA program.</td>
</tr>
</tbody>
</table>
### Electrical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage (nominal, VAC)</td>
<td>120 or 230 (optional 220)</td>
</tr>
<tr>
<td>Frequency, HZ ±5%</td>
<td>60/50</td>
</tr>
<tr>
<td>Current, A</td>
<td>• 2.0 @ 120VAC&lt;br&gt;• 1.0 @ 220/230VAC</td>
</tr>
</tbody>
</table>

### Output

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage (nominal, VAC)</td>
<td>Surveillance version:&lt;br&gt;• 120 or 230 ±10%&lt;br&gt;• 24, -5% to +20%&lt;br&gt;Cable version:&lt;br&gt;• 63 - 10/+ 13%</td>
</tr>
<tr>
<td>Frequency, Hz ±5%</td>
<td>60/50 (auto-frequency detection)</td>
</tr>
<tr>
<td>Current, A</td>
<td>• 4.20 @ 24VAC&lt;br&gt;• 1.59 @ 63VAC&lt;br&gt;• 0.83 @ 120VAC&lt;br&gt;• 0.43 @ 230VAC</td>
</tr>
<tr>
<td>Power, W/VA</td>
<td>100 total including auxiliary output</td>
</tr>
<tr>
<td>Waveform</td>
<td>Sine wave</td>
</tr>
<tr>
<td>Load Crest Factor</td>
<td>3:1 (load dependent)</td>
</tr>
<tr>
<td>Output Voltage Distortion</td>
<td>&lt; 3% THD (resistive load)</td>
</tr>
<tr>
<td>Efficiency (typical)&lt;br&gt;(backup)</td>
<td>&gt;85%&lt;br&gt; &gt;75%</td>
</tr>
<tr>
<td>Transfer Time, mS</td>
<td>• AVR to Backup - 5 (typical)&lt;br&gt;• Backup to AVR - 3 (typical)</td>
</tr>
<tr>
<td>Line Qualifications Time, seconds</td>
<td>3</td>
</tr>
<tr>
<td>Battery String Voltage, VDC</td>
<td>24</td>
</tr>
<tr>
<td>Battery Charger Current, A</td>
<td>3.0</td>
</tr>
<tr>
<td>Battery Charger Temperature&lt;br&gt;Compensation</td>
<td>-5mV/°C/Cell default (user selectable @ -2.5, -4, -5 and -6mV/°C/Cell via RS232 connection)</td>
</tr>
</tbody>
</table>
Safety Checklists

This section provides safety checklists for handling the UPS and battery, and unpacking and inspecting the UPS.

UPS Safety Checklists

CAUTION: This Uninterruptible Power Supply (UPS) is to be installed by people trained in the safe use of high-energy power supplies and their batteries. Also assumed is knowledge of the local electrical codes and their safe application.

AVERTISSEMENT: Ce système d’alimentation sans interruption (ASI) doit être installé par des personnes formées à l’utilisation sécuritaire d’alimentations électriques à haute énergie et de leurs batteries. Elles sont également censées connaître les codes électriques locaux et leur application sécuritaire.

DANGER: Never let water from rain, a hose, tap or a sprinkler’s output, road splash, or other water sources enter the UPS to prevent accidental shorts, shocks, or electrocutions.

DANGER: Ne laissez jamais l’eau de la pluie, d’un tuyau, d’un robinet ou de la sortie d’un arroseur, d’une éclaboussure de la route ou d’autres sources d’eau entrer dans l’ASI pour éviter les courts-circuits, les chocs ou les électrocutions accidentels.
**DANGER:** This unit does not have an on/off switch. Whenever it is connected to line or battery power, power is present at the output. Use extreme caution at all times.

**DANGER:** Cet appareil n'est pas muni d'un interrupteur marche/arrêt. Chaque fois qu'il est connecté à une alimentation électrique ou à une batterie, le courant se trouve à la sortie. Faites preuve d'une extrême prudence en tout temps.

Table 9 – UPS Safety Checklist (Liste de vérification de sécurité de l’ASI)

<table>
<thead>
<tr>
<th>Consider the following…</th>
<th></th>
</tr>
</thead>
</table>
| Do not work alone under hazardous conditions.  
Ne travaillez pas seul dans des conditions dangereuses. | ✓ |
| Read this manual. If you have questions about safe installation, operation or maintenance, contact Alpha Technologies's customer service department.  
Lisez le présent manuel. Si vous avez des questions au sujet de l'installation sécuritaire, du fonctionnement ou de l'entretien, communquez avec le service clientèle d’Alpha Technologies. | ✓ |
| Carefully unpack the components. Report any shipping or other damage immediately.  
Déballez soigneusement les composants. Signalez immédiatement tout dommage dû au transport ou tout autre dommage en même temps. | ✓ |
| Always assume electrical connections or conductors are live. Turn off all circuit breakers and double-check with a voltmeter before performing installation or maintenance.  
Il faut toujours supposer que les connexions électriques ou les conducteurs sont sous tension. Coupez tous les disjoncteurs et vérifiez-les avec un voltmètre avant de procéder à l’installation ou à l’entretien. | ✓ |
| Before installation, verify the input voltage and current requirements of the load are met by the UPS's output (see specifications). Verify the line voltage and current meet the UPS's input requirements.  
Avant l’installation, vérifiez que la tension d’entrée et les besoins en matière de courant de la charge sont satisfaits par la sortie de l’ASI (voir les spécifications). Vérifiez que la tension composée et le courant de phase répondent aux exigences d’entrée de l’ASI. | ✓ |
Table 9 – UPS Safety Checklist (Liste de vérification de sécurité de l’ASI) (continued)

<table>
<thead>
<tr>
<th>Consider the following...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place a warning label on the utility panel to tell emergency personnel a UPS is installed.</td>
</tr>
<tr>
<td>Placez une étiquette d’avertissement sur le panneau d’alimentation pour indiquer au personnel d’urgence qu’une ASI est installée. •</td>
</tr>
<tr>
<td>Use proper lifting techniques when lifting or moving the UPS or its components.</td>
</tr>
<tr>
<td>Utilisez des techniques de levage appropriées lorsque vous soulevez ou déplacez l’ASI ou ses composants.</td>
</tr>
<tr>
<td>This UPS has more than one live circuit. AC power may be present at the outputs even if the UPS is disconnected from line or battery power.</td>
</tr>
<tr>
<td>Cette ASI possède plus d’un circuit sous tension. Le courant alternatif peut être présent aux sorties même si l’ASI est déconnectée de la ligne ou de la batterie.</td>
</tr>
<tr>
<td>This UPS can be operated to a maximum operating temperature of 50°C. Also see the specifications section for temperature ratings.</td>
</tr>
<tr>
<td>Cette ASI peut fonctionner à une température maximale de 50 °C. Voir également la section des spécifications pour les températures nominales.</td>
</tr>
<tr>
<td>At high ambient temperature conditions, the UPS's surface can be very hot to the touch.</td>
</tr>
<tr>
<td>Dans des conditions de température ambienne élevée, la surface de l’ASI peut être très chaude au toucher.</td>
</tr>
<tr>
<td>There is a Lithium battery inside the UPS. There is a danger of an explosion if it is incorrectly replaced. Replace it only with the same type or an equivalent battery as recommended by the manufacturer. Dispose of the old battery as instructed by the manufacturer.</td>
</tr>
<tr>
<td>Il y a une batterie au lithium à l’intérieur de l’ASI. Il y a un risque d’explosion si elle est remplacée de façon inadéquate. Ne la remplacez que par une batterie du même type ou d’un type équivalent, comme le recommande le fabricant. Jetez la vieille batterie selon les instructions du fabricant.</td>
</tr>
</tbody>
</table>
Battery Safety Checklist

CAUTION: Battery Emergency Procedures

- If electrolyte splashes on your skin, immediately wash the affected area with water.
- If electrolyte gets into your eyes, wash them for at least 10 minutes with clean running water or a special neutralizing eye wash solution. Seek medical attention at once.
- Neutralize spilled electrolyte with special neutralizing solutions in a "spill kit" or a solution of 1 lb. (0.45 kg) of baking soda (bicarbonate of soda) in 1 gallon (3.9 L.) of water.

MISE en GARDE: Procédures d'urgence concernant la batterie:

- Si des éclaboussures d'électrolyte touchent votre peau, lavez immédiatement la zone affectée avec de l'eau.
- Si de l'électrolyte entre en contact avec vos yeux, lavez-les pendant au moins 10 minutes sous l'eau courante ou avec une solution de lavage oculaire neutralisante spéciale. Consultez immédiatement un médecin.
- Neutralisez l'électrolyte déversé avec des solutions neutralisantes spéciales dans une "trousse de lutte contre les déversements" ou une solution de 1 lb (0.45 kg) de bicarbonate de soude dans 1 gallon (3.9 L.) d'eau.
Consider the following.....

<table>
<thead>
<tr>
<th>Checkmark</th>
<th>Battery installation and servicing should be done or supervised by personnel knowledgeable about batteries and the required precautions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checkmark</td>
<td><strong>Always</strong> replace batteries with the same type, numbers, and ratings. Never install old or untested batteries. One sealed lead-acid battery is rated to a maximum voltage of 12VDC.</td>
</tr>
</tbody>
</table>

**CAUTION:** A battery presents a risk of electrical shock and high short-circuit current. Observe the following precautions:

- Remove watches, rings, or other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.
- Do not lay tools or metal parts on top of the batteries.
- Disconnect charging source prior to connecting or disconnecting battery terminals.
- Determine if the battery is inadvertently grounded. If so, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such a shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).

**MISE en GARDE**

- L’installation et l’entretien de la batterie doivent être effectués ou supervisés par une personne qui connaît les batteries et les précautions requises.
- Remplacez toujours les batteries par le même type de batterie, les mêmes chiffres et les mêmes indices. N’installez jamais de vieilles batteries ou des batteries non testées. Une batterie scellée au plomb est conçue pour une tension maximale de 12 Vcc.
- Une batterie peut présenter un risque de décharge électrique et de courant de court-circuit élevé. Prenez les précautions suivantes lorsque vous travaillez sur des batteries.
  - Retirez les montres, les bagues ou les autres objets métalliques.
  - Utilisez des outils avec des poignées isolées.
  - Portez des gants et des bottes en caoutchouc.
  - Ne posez pas d’outils ou de pièces métalliques sur les batteries.
Table 10 – Battery Safety Checklist (continued)

<table>
<thead>
<tr>
<th>Consider the following.....</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Débranchez la source de charge avant de connecter ou de déconnecter les bornes de la batterie.</td>
</tr>
<tr>
<td>• Déterminez si la batterie est mise à la terre par inadvertance. Si c’est le cas, retirez la source du sol. Tout contact avec une partie quelconque d’une batterie mise à la terre peut entraîner une décharge électrique. La probabilité qu’un tel choc survienne peut être réduite si vous supprimez ces mises à la terre lors de l’installation et de l’entretien (applicable à l’équipement et aux alimentations à distance par batterie qui ne disposent pas d’un circuit d’alimentation mis à la terre).</td>
</tr>
<tr>
<td><strong>CAUTION:</strong> Never dispose of batteries in a fire. The batteries may explode. Follow the manufacturer’s directions for safe battery disposal.</td>
</tr>
<tr>
<td>Ne jamais jeter les batteries dans un feu. Elles peuvent exploser. Suivez les instructions du fabricant pour disposer des batteries en toute sécurité.</td>
</tr>
<tr>
<td><strong>CAUTION:</strong> Never open or damage the batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic and hazardous to the environment.</td>
</tr>
<tr>
<td>Ne jamais ouvrir ou endommager les batteries. L’électrolyte libéré est nocif pour la peau et les yeux. Il peut être toxique et dangereux pour l’environnement.</td>
</tr>
<tr>
<td>✔ Never let live battery wires touch the UPS, the enclosure, or any other metal objects. This can cause a fire or explosion.</td>
</tr>
<tr>
<td>Ne laissez jamais des fils de batterie sous tension toucher l’ASI, le boîtier ou tout autre objet métallique. Cela peut provoquer un incendie ou une explosion.</td>
</tr>
<tr>
<td>✔ Lead-acid batteries can release Hydrogen gas. Never expose the UPS or enclosure to open flames or sparks to prevent a fire or explosion.</td>
</tr>
<tr>
<td>Les batteries au plomb peuvent libérer de l’hydrogène gazeux. N’exposez jamais l’ASI ou l’enceinte à des flammes nues ou à des étincelles pour éviter un incendie ou une explosion.</td>
</tr>
<tr>
<td>✔ Inspect the batteries once a year for signs of cracks, leaks, or swells. Replace as needed.</td>
</tr>
<tr>
<td>Inspectez les batteries une fois par an pour détecter des signes de fissures, de fuites ou de gonflements. Remplacez-les selon les besoins.</td>
</tr>
<tr>
<td>✔ If you have batteries in storage, charge them at least once every three months for optimum performance and to extend their lifetime.</td>
</tr>
</tbody>
</table>
Table 10 – Battery Safety Checklist (continued)

<table>
<thead>
<tr>
<th>Consider the following.....</th>
</tr>
</thead>
<tbody>
<tr>
<td>Si vous avez des batteries en réserve, chargez-les au moins une fois tous les trois mois pour obtenir un rendement optimal et prolonger leur durée de vie.</td>
</tr>
</tbody>
</table>

Unpacking and Inspection Checklist

CAUTION: If items are missing or damaged, contact Alpha Technologies and the shipping company at once. Most shippers have a short claim period.

Carefully remove the UPS from the shipping container. Inspect the contents and make sure the following items are included:

- One Micro Secure UPS
- Four Phillips-head wood screws
- Two or four batteries as ordered
- One battery fuse (Standard 30A automotive fuse)
- Any ordered options

Save the Shipping Container

To return the Micro Secure for servicing, pack it in the original shipping container. Alpha Technologies is not responsible for any damages caused by improper packaging of returned products.

Read This Manual

Before installation, become familiar with the Novus Micro Secure by reviewing the procedures and drawings in this manual. See "The Novus Micro Secure" on the facing page.

If you have any questions about the safe installation, operation, or maintenance of this UPS, contact Alpha’s customer service department at www.alpha.com.
The Novus Micro Secure

This section provides information on the Novus Micro Secure.

Figure 47 – Novus Micro Secure - Cable Version

For more information on the LED, see Table 11 on page 62

Figure 48 – Novus Micro Secure - Surveillance Version
The surveillance version of the Novus Micro Secure has a bar with monitoring LEDs, an RS232 connector and dry contacts for attachment of an external monitoring panel.

Figure 49 – Output Connectors and Monitoring LEDs
Site Preparation Checklist

Grounding

CAUTION: Ensure the UPS must be correctly grounded for proper operation. Older facilities may have inadequate electrical grounding. Inspection must be performed by a qualified electrician before installation to ensure that grounding meets the local electrical code.

MISE en GARDE: Assurez-vous que l’ASI est convenablement mise à la terre pour un bon fonctionnement. Les plus vieilles installations peuvent avoir une mise à la terre électrique inappropriée. Un électricien qualifié doit faire une inspection avant l’installation pour s’assurer que la mise à la terre est conforme au code local d’électricité.

Branch Circuit Breaker Protection

CAUTION: To provide branch circuit protection, the utility line attached to the UPS’s input must be protected by a circuit breaker certified for this use as per the local electrical code. The breaker’s minimum size is calculated by the following formula:

Minimum Breaker Size = UPS’s maximum input current / 0.8

The UPS’s maximum input current is read off the UPS’s nameplate. For example, if the nameplate gives the maximum input current as 20A, the circuit breaker should be rated at least 25A.
MISE en GARDE: Pour assurer la protection des circuits de dérivation, la ligne d'alimentation électrique attachée à l'entrée de l'ASI doit être protégée par un disjoncteur attesté pour cette utilisation selon le code électrique local. La taille minimale du disjoncteur est calculée à l'aide de la formule suivante :

\[
\text{Taille minimale du disjoncteur} = \text{Courant d'entrée maximal de l'ASI}/0,8
\]

Le courant d'entrée maximal est indiqué sur la plaque signalétique de l'ASI. Par exemple, si la plaque signalétique indique que le courant d'entrée maximum est de 20 A, le disjoncteur doit être d'au moins 25 A.

**Disconnects**

CAUTION: The input and output lines to and from the UPS must have disconnect devices attached.

MISE en GARDE: Les lignes d'entrée et de sortie de l'ASI doivent être munies de dispositifs déconnectés.

**Site Requirements**

CAUTION: Install the UPS and batteries on a surface that supports a minimum weight of 45.0 lbs. (20.4 kg). The input wiring must reach a suitably grounded power outlet and the load wiring must reach the UPS's output terminal block.

MISE en GARDE: Installez l'ASI et les batteries sur une surface qui supporte un poids minimum de 45 lb (20,4 kg). Le câblage d'entrée doit atteindre une prise de courant convenablement mise à la terre et le câblage de charge doit atteindre la borne de sortie de l'ASI.
Mounting the UPS

Wall Mounting

The UPS’s maximum input current is read off the UPS’s nameplate. For example, if the nameplate gives the maximum input current as 20A, the circuit breaker should be rated at least 25A.

Using the case as a template, secure the case to the wall with the four Phillips-head wood screws supplied with the unit.

Figure 50 – Wall Mounting

Pole Mounting

The Novus Micro Secure can be pole mounted with the optional mounting bracket (Alpha Kit# 740-751-21). It allows you to mount to either a vertical or horizontal, steel, concrete, or wooden pole.

Steel or Concrete Pole Mounting

To strap mount the UPS to the pole, you need the optional mounting bracket and two ½-inch straps (Band-It #C20499 straps, #C00369 Tool and #C25499 Buckle or equivalent).

1. Attach the straps to the mounting bracket.
2. Attach the bracket to the pole.
3. Secure the UPS enclosure to the mounting bracket with the two mounting screws and two nuts provided with the kit.

Figure 51 – Steel or Concrete Pole Mounting
Wooden Pole Mounting

To bolt the UPS to the pole, you need the optional mounting bracket and two ½-inch bolts (not provided) to fit the pole.

1. Drill holes into the pole to fit the bolts.
2. Attach the bracket to the pole.
3. Secure the UPS enclosure to the mounting bracket with the two mounting screws and two nuts provided with the kit.

Figure 52 – Wooden Pole Mounting

Connecting the UPS

DANGER: This UPS does not have an on/off switch. Whenever the UPS senses battery or line power, it is active and power is present.

DANGER: Cette ASI n’est pas munie d’un interrupteur marche/arrêt. Chaque fois que l’ASI détecte la présence d’une batterie ou d’une ligne électrique, il est actif et le courant est présent.

Tools and Materials Required

This section provides a list of tools and materials needed to connect the UPS.

- Slotted-tip screwdrivers for tightening screws on terminal blocks.
- DC voltmeter.
- Maximum of 12 AWG wire for wiring the input and output terminal blocks.
- If used, maximum of 16 AWG wire for wiring the dry contact terminal blocks.
Procedure

There are two different versions of the Novus Micro Secure. See Figure 47 and Figure 48 on page 43 for the differences. For the surveillance version, you may have to connect the dry contact terminal block outputs and the RS232 connector depending on your requirements.

Step 1: Wiring the Input and Output Connectors

1. Connect the load wiring to the output terminal block (surveillance version) as labeled. Torque to 7.0 lb-in (0.8 Nm).

Figure 53 – Wire Input and Output Connectors

For the cable TV version, connect the load cable to the output cable connector.

2. On the surveillance version, if used, connect the dry contact terminal blocks and the RS232 or Ethernet connectors (also, see the Appendix) according to Figure 68 on page 77.

If using a conduit, drill a 1/2-in. hole to attach a matching conduit.

3. Wire the input terminal block according to its label. Torque to 7.0 lb in. (0.8 Nm).

The Cable version has a 6-ft (2 m) permanently connected input power cable with a NEMA 5-15P plug for 120V application. For 230V application, connect the line power to the input terminal block through the provided 1/2-in. knockout hole.
Step 2: Installing and Wiring the Batteries

WARNING: Before proceeding, verify the line wire is attached to the line terminal block, the ground wire is attached to the ground terminal block, and the neutral wire is attached to the neutral terminal block to prevent accidental shocks or electrocutions.

AVERTISSEMENT: Avant de poursuivre, vérifiez que le fil de ligne est bien fixé à la borne de ligne, que le conducteur de terre est bien fixé à la borne de terre et que le fil neutre est bien fixé à la borne neutre pour éviter les décharges ou les électrocutions accidentelles.

1. Install the four batteries and wire them up as shown in Figure 54 and Figure 54 and Figure 55.
If using only two batteries, install them in the Battery #1 and Battery #2 positions. Wire them as shown in Figure 55, except the wires to Battery #3 and #4.

2. Use a DC voltmeter to verify the battery string's polarity and voltage (24VDC). Perform troubleshooting if necessary.

**Connection Finished**

![Figure 55 – Battery Wiring Diagram](image)

---

**Powering ON the UPS**

This procedure assumes the line is qualified and the batteries are fully charged.

1. Install the battery fuse by snapping it quickly into its fuse holder. Make sure it is firmly secured in the mount.

![Figure 56 – Battery Fuse](image)
You may hear a buzzing sound or see sparks when installing the fuse. This is normal and will not damage the UPS.

2. Turn on the Line power.

3. Ensure the LEDs operate (see LED Descriptions in Table 11).

When power is first applied, both LEDs light up and then only the green light remains on if the UPS is in Line mode.

Installation and Powering On Finished

This section provides information on the various LED lights and troubleshooting the UPS.

Table 11 – UPS LED Descriptions

<table>
<thead>
<tr>
<th>LED</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green OFF</td>
<td>The UPS's inverter is turned off. Line power goes straight to the load.</td>
</tr>
<tr>
<td>Green ON</td>
<td>The UPS is turned on. Line power is provided to the load.</td>
</tr>
<tr>
<td>Green Flashing</td>
<td>The UPS's inverter is on. Backup battery power is provided to the load.</td>
</tr>
<tr>
<td>Red ON or Flashing</td>
<td>The UPS has a malfunction. See the following troubleshooting table.</td>
</tr>
</tbody>
</table>

Table 12 – UPS Troubleshooting

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Check the following...</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Output Power</td>
<td>Is utility power connected?</td>
</tr>
<tr>
<td></td>
<td>Is the battery fuse installed?</td>
</tr>
<tr>
<td></td>
<td>Are the batteries discharged?</td>
</tr>
<tr>
<td></td>
<td>Is the input circuit breaker open?</td>
</tr>
<tr>
<td>No Battery Backup Power</td>
<td>Is the battery fuse connected or is it blown?</td>
</tr>
<tr>
<td></td>
<td>Are the batteries discharged?</td>
</tr>
<tr>
<td>No Power to Load</td>
<td>Is the UPS's output properly connected to the load?</td>
</tr>
</tbody>
</table>
Table 12 – UPS Troubleshooting (continued)

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Check the following....</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Is the battery fuse connected?</td>
</tr>
<tr>
<td></td>
<td>• Is utility power connected to the UPS's input connector?</td>
</tr>
</tbody>
</table>

If you have the RS232 computer communication enabled (see Appendix Section A1 of the Operator's Manual 017-220-B0 Rev. .01), then you can do additional troubleshooting as outlined in Section A2 and A6 of the appendix.
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Chapter 5: CDMA Modem Conversion Kit Installation

Overview

You have the option of ordering the R450 Data Collector (R450 DC) with a CDMA modem compatible with Sprint or Verizon service. For the R450 DCs that currently have a Sierra Wireless or a CalAmp GPRS/Ethernet modem, CDMA conversion kits are available. Part numbers for ordering new R450 DCs with the CDMA modem and conversion kits are also included in the guide.

Tools Needed

The tools needed include the following:

- Phillips head screw driver.
- Hex head screw driver.
- Allen wrench.
- Two zip ties - to attach the modem power cable to the mounting plate, so it is out of the way. See Figure 57 on page 66.

Parts Included

The parts included in the conversion kit include the following:

- CDMA modem
- Ethernet cable
- Mounting bracket
- Antenna cable
- New FCC label

Switching Modems Using the Conversion Kits

GPRS/Ethernet Connection

Complete the following steps to switch modems using the conversion kits via GPRS/Ethernet connection.

1. Ground yourself to the outside of the R450 DC using a wrist strap.
2. Power off the R450 DC.
3. Disconnect the Ethernet or serial cable.
4. Disconnect the antenna cable.
5. Disconnect the power cable from the modem.
6. Remove the four screws from the mounting plate (this will remove the mounting plate as well as the modem).

7. Attach the new mounting plate with the four new screws.

8. Attach the new modem to the new mounting plate with the modem oriented so that the Ethernet cable port is on the left.

9. Reconnect the Ethernet cable, antenna cable, and the power cable. See Figure 57.
It is helpful to attach the power cable for the CDMA modem to the new mounting plate with a zip tie as shown in the photo.

10. Power on the R450 DC.

**Serial Connection**

Complete the following steps to switch modems using the conversion kits via serial connection.

**Serial to Ethernet Connection (Sierra Wireless Modems Model 775 and 875)**

If currently using a serial connection to connect the modem, you will need a new USB flash drive provided for the installation of the new CDMA modem. With the correct USB flash drive provided by Neptune Customer Support, the CDMA modem must be reconfigured when powering on the R450 DC. To receive a new flash drive that is configured correctly for the CDMA modem please contact Neptune Customer Support at (800) 647-4832. Request that Customer Support send you a newly configured flash drive for a CDMA modem for the R450 DC.

1. Ground yourself to the outside of the R450 DC using a wrist strap.
2. Power down the R450 DC.
3. Disconnect the Ethernet or serial cable.
4. Disconnect the antenna cable.
5. Disconnect the power cable from the modem.
6. Remove the four screws from the mounting plate (this will remove the mounting plate as well as the modem).
7. Attach the new mounting plate with the four new screws.
8. Attach the new modem to the new mounting plate with the modem oriented so that the Ethernet cable port is on the left.
9. Replace the serial cable with the new Ethernet cable that comes in the conversion kit.
10. Attach the Ethernet cable from the Ethernet port on the processor board to the Ethernet port on the modem.
11. After the modem is installed, insert the new thumb drive into the processor board before powering up the R450 DC.

12. After the thumb drive is inserted, power on the R450 DC. After 5 minutes, the R450 DC should complete the booting process with the new configuration.

13. Remove the thumb drive and close the R450 DC.

Activating the CDMA Modem

Once the CalAmp CDMA modem is provisioned and installed, you need to activate it. A Quick Start Guide comes in the box with each CDMA modem. The steps to activate the modem are in the Quick Start Guide; however, use the following instructions.

Accessing the Modem’s Homepage

Complete the following steps to activate the modem.

1. Approximately one minute after applying power to the unit, open your Web browser.

2. In the address bar, enter 192.168.1.150. A log on dialog similar to Figure 58 appears.

Figure 58 – Browser Connection Log on Dialog

3. In the Username field, enter admin.

4. In the Password field, enter password.

5. Click OK.

Setting the Auto Connect Option

CalAmp CDMA modems are shipped with Cell Connection (Auto Connect) Disabled. You must enable the modem to connect to the Internet by completing the following steps.
Complete the following steps to enable Auto Connect for the cell connection.

1. On the Dial Settings tab of the EVDO Cellular Data Modem screen, click **Cell Connection**. See Figure 59.

![Figure 59 – Auto Connect Option](image)

7. Select **Enable** and click **Save**.

8. After the screen refreshes, click **Reset**.

**Sprint Modem**

Sprint modem users complete the following steps.

1. Click **Provisioning**.

Under **Enable/Disable OMA-DM Activation**, the status is set as **Enable**. See Figure 60.

![Figure 60 – Provisioning Tab](image)

After the modem is provisioned and the cell connection is enabled, the PPP Status changes to UP on the Home screen. See Figure 61.

![Figure 61 – PPP Status](image)

**Verizon Modems**

Verizon modem users complete the following steps.

1. Click Provisioning.

2. Type *22899 in the Command (OTASP only) field under the Carrier-assisted Activation section.

3. Click OTASP. See Figure 62.

![Figure 62 – Verizon Provisioning via OTASP](image)
2. Verify that the **MDN/MTN** and **MSID/IMSI** fields are populated on the modem home screen under **CDMA Connection Status**. See Figure 63.

**Figure 63 – Verizon CDMA Connection Status after Provisioning**

<table>
<thead>
<tr>
<th>Service Type</th>
<th>CDMA EVDO Rev A Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESN</td>
<td>60B4BF5D</td>
</tr>
<tr>
<td><strong>MDN/MTN</strong></td>
<td>61029:9629</td>
</tr>
<tr>
<td><strong>MSID/IMSI</strong></td>
<td>61029:9629</td>
</tr>
<tr>
<td>PRL</td>
<td>52337</td>
</tr>
<tr>
<td>SID</td>
<td>329</td>
</tr>
<tr>
<td>NID</td>
<td>6</td>
</tr>
<tr>
<td><strong>Channel</strong></td>
<td>242</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>800 MHz Cellular</td>
</tr>
<tr>
<td><strong>Roaming</strong></td>
<td>Not Roaming</td>
</tr>
<tr>
<td><strong>Signal Strength (dBm)</strong></td>
<td>-67 (strong)</td>
</tr>
<tr>
<td><strong>Diagnostic</strong></td>
<td>128</td>
</tr>
</tbody>
</table>

3. Click **Cell Connection**.

4. Type **ATD#777** in the **Dial Number Field**, under **Dial Settings** and leave the **User** and **Password** fields blank.

5. Click **Save**. See Figure 64.

**Figure 64 – Verizon Cell Connection Tab**
6. Click **OMA-DM** to activate provisioning, under **Manual Initiation of OMA-DM Provisioning**.

After the modem is provisioned and the cell connection is enabled, the **PPP Status** changes to **UP** on the Home screen. See Figure 65.

![Figure 65 – PPP Status](image)
Chapter 6: Troubleshooting

This section provides information for possible symptoms, areas of focus, and actions that can be taken to resolve problems that could arise with your R450 Data Collector (R450 DC).

Equipment Required

The following items are required in order to troubleshoot the R450 DC:

- Keys to access the site and open the R450 DC cabinet.
- Digital volt - Ohm multimeter
- Voltage Standing Wave Ration (VSWR) meter
- Socket and open-end wrenches to install/remove the R450 DC
- Small, medium, and large slot style screw drivers
- #1 and #2 Phillips Head screw drivers
- Electrical tape and wire ties
- Backup R450 DC, if one fails
- R450 DC configuration USB flash drive

The USB flash drive must be configured for the specific R450 DC.

- Anti-static wrist strap and ground lead with alligator clip for attaching wrist strap to the R450 DC cabinet
- MIU configured for site
- Magnet to swipe MIU
- R450 System Field Service Tool, when available
PC Notebook Configuration

In order to use a notebook computer, consider the following.

- The CalAmp modem requires an Ethernet cable to connect to the network port of the computer. It does not require the laptop to have a serial port.
- The CalAmp modem uses an online application for configuration. It does not require software to be installed to configure the modem.
- The Wi-Fi Modem configuration software is used if you are using a Wi-Fi modem.

Additional Equipment Required for the Computer

In addition to the previously stated required items, the following are also required.

- An Ethernet cable to go between the computer and the GPRS modem.
- Neptune recommends that a CalAmp LandCell or similar product be installed on the computer so that it can received emails generated by the system during testing. Otherwise, a Blackberry or an equivalent cell phone that can receive configuration packet emails is required.

**WARNING:** Neptune does not recommend servicing an R450 DC during inclement weather.

**AVERTISSEMENT:** Neptune ne recommande pas l’entretien d’un enregistreur de données R450 en cas de mauvais temps.

Potential R450 DC Problems

The following sections describe problems that can arise and how to handle these potential problems.

Multiple R450 DCs Not Syncing with Host Database

Consider the following.

- Host database server is down or not connected to the Internet.
- Remote Internet, phone, cable, or cell service provider is either down or experiencing degraded service.
- Multiple power outages affecting several sites.
Storm Damage Affecting Multiple Sites

One R450 DC is not syncing with the host database.

Troubleshooting this problem requires going to the R450 DC site.

First Steps

Before leaving for the site, assess the health of the R450 DC using the host system.

For instructions on how to assess the health of the R450 DC, refer to "Using System Health" in the "System Health" chapter of the N_SIGHT® R450 Online Help.

- If the R450 DC is offline, this indicates that they power, power supply, CPU, or backhaul modem may not be functioning.
- Some sites are configured so that an operator can log on the R450 DC remotely and look at the logs and watch the system activity. If the R450 DC is offline but it is still possible to log on the system, this indicates that the computer and backhaul modem are both functional.

Initial Site Activities

- Open the R450 DC and inspect the equipment.
- Make sure that there is no obvious physical damage to the system, such as evidence of burned components or wires, which may indicate a lightning strike. If there is any evidence of physical damage, the R450 DC should be replaced with the spare and returned to Neptune's repair facility.

CAUTION: The ground wrist strap must be clipped to the box. Do not touch the computer circuit board or any of the components if you are not wearing the wrist strap. Failure to use the strap could cause damage to the computer due to static electricity.

MISE en GARDE: Fixez le bracelet de mise à la terre à la boîte. Ne touchez pas la carte de circuit imprimé de l’ordinateur ni aucun de ses composants si vous ne portez pas le bracelet. Si vous n’utilisez pas le bracelet, l’électricité statique pourrait endommager l’ordinateur.
Checking the General Health of Each of the Modules

Visual Check of CPU Board Power

There are three Ethernet Status Light Emitting Diodes (LEDs) to the left of the Ethernet RJ45 connector. The red LED closest to the connector should be lit if there is power being supplied to the CPU board. See Figure 66.

![Image](image1.png)

Figure 66 – Ethernet Status LED

Visual Check of Radio Power

The radio has several indicator LEDs on the front panel. The green Power indicator should be on. See Figure 67. If the amber ALM LED is on, the radio is malfunctioning.

![Image](image2.png)

Figure 67 – Radio LEDs on Front Panel

Visual Check of Backhaul Modem Power and Connectivity

Cal Amp LandCell Modem

Look at the indicator lights on the modem. The power indicator is on the right of the modem. See Figure 68.
• If it is on, this indicates that the modem is connected.

• If it is off, this indicates that there is a power problem with the modem. Verify that the main power is on.

Figure 68 – Modem Power Indicator

Wi-Fi Modem

Refer to the user’s guide for the Wi-Fi modem.

Additional Detail Checks

If any of the previous checks failed, the following detail checks should be performed.

Power supply voltage checks should be made one at a time so that a load remains on the power supply. This is especially true of the CPU and modem voltage checks. With no load on the power supply, erroneous values may be measured.

Verify Main Power

Usually, it is a good practice to check the main power and make sure it is within specification. If there are no power indications on in the R450 DC, this must be checked.

• The circuit breaker should be in the ON position. Verify that it has not tripped.

• Using the voltmeter, verify that there is 120V AC on both the AC feed and the power supply sides of the circuit breaker.

• If voltage is not present on the AC feed side of the circuit breaker or is less than 110V, there is something wrong with the supply voltage. Repairing this is outside of the scope of this manual.

The R450 DC is capable of functioning on voltages as low as 90V.
If voltage is not present on the power supply side of the circuit breaker and the circuit breaker is not tripped, the breaker is damaged. If the circuit breaker is damaged, it is recommended that the R450 DC be returned for repair.

**Verifying CPU Board Power**

Neptune recommends checking the voltage levels going to the computer.

1. Put on your wrist strap and attach the alligator clip to the cabinet.
2. Turn off the circuit breaker.
3. Remove the 10-pin connector located in the upper left corner of the CPU Board. There is a locking tab on the bottom side of the connector.
4. Turn the circuit breaker back on.

![Figure 69 – Red and Black Leads](image-url)
5. Use the Digital Volt-Ohm-Multimeter to measure the voltage. The red leads are positive; the black leads are negative.

6. The voltage must be between 4.9V and 5.2V. Turn off the R450 DC circuit breaker.

If the voltage is above or below these values, it indicates that the power supply is defective. Return the R450 DC to Neptune's repair facility.

7. Reconnect CPU power.

**Verifying Radio Power**

1. Turn off the circuit breaker if it is not already off.

2. Remove the BATT connector on the radio. The locking ring unscrews.

3. Turn the circuit breaker back on.

4. On the power cable connector, measure the voltage across pins X and Y as shown.

5. The voltage should be between 14.5V and 15.5V. If the voltage is above or below these values, the power supply is defective and the R450 DC should be returned to Neptune's repair facility.

6. If the voltage is within specifications, turn the circuit breaker off and replace the connector. Make sure that the connector locking ring is finger tight.

**Verifying Backhaul Modem Power**

**Cal Amp LandCell Modem**

Approximately 12.0 V should be present between the two pins shown as illustrated in the following figure.
Verifying Backhaul Modem Connectivity

**Cal Amp LandCell Modem**

To verify connectivity and signal levels, complete the following.

1. Locate the RSSI LED light on the modem.
2. Identify how the light is lit.
   - Solid = indicates signal strength is strong
   - Blinking = indicates signal strength is medium
   - Off = indicates signal strength is poor or no signal at all

![Figure 71 – CalAmp Modem with RSSI LED](image)

3. If the signal strength is poor or if there is no signal at all, there is something wrong with the antenna, or it is possible that the local cell service is not working.

For more detailed information on your wireless connection status, connect to the modems configuration application. Refer to "Manually Configuring the GPRS Modem" on page 32.

**Ethernet**

If Ethernet backhaul is used, then check the status lights on the CPU board. Refer to "Testing the Connections" on page 29.

**Wi-Fi Modem**

Refer to the user's guide for the Wi-Fi modem.

**Verifying Radio Functionality Using an MIU**

To verify that the system is functioning properly, complete the following steps.
For this test to be valid, there must be regular time beacon transmissions sent by the R450 DC. This is indicated by the TX indicator flashing every ten seconds. See Figure 67 on page 76. If the R450 DC is not sending out time beacons, this test will automatically fail.

1. Obtain a magnet and an MIU.

2. Swipe the MIU with a magnet so that it will send out a configuration packet.

3. Watch for the radio's Busy light to turn on. This should happen within a minute of swiping the MIU.
   - If the Busy light turns on, it should be followed by an immediate flash of the TX indicator. See Figure 71 on page 80.
   - If the Busy indicator is not immediately followed by a flash of the TX indicator, then there is an internal problem with the R450 DC that may include its configuration, the radio, NTG modem, or the computer.

**R450 DC is Syncing but Not Supplying MIU Data**

If the R450 DC is online, this indicates that the computer and the backhaul modem are both working. If no readings are being collected by the R450 DC, this indicates that there is a potential problem with the radio and modem.

Troubleshooting this problem requires going to the R450 DC site.

**Initial Observations**

After opening the cabinet, assess the following.

- The R450 DC sends out a time beacon every 10 seconds. The transmit light on the radio should flash every 10 seconds. See Figure 67 on page 76. Only the red transmit light should turn on. If the amber ALM indicator turns on at the same time, this indicates that there is a problem between the transmitter and the antenna.

- If the transmit indicator does not flash, this indicates that there is a potential problem with the modem or possibly the computer's serial port.
Transmitter Transmits but ALM Indicator Flashes

This requires measuring the Voltage Standing Wave Ratio of the antenna system. If the VSWR is greater than 1.5:1, that indicates that there is a problem with the feed line or the antenna.

Measuring the VSWR

To measure the VSWR (MFJ-269 SWR Analyzer), complete the following steps.

1. Make sure the red **Power** button is off. The red button is extended outward.

2. Press the **UHF** button to be sure it is extended outward.

3. Turn the **Frequency** knob fully counter-clockwise. This knob points to 114-170/UHF.

4. Connect the 2-inch long attenuator pad to the **Antenna Connector**. Leave the other end open.

5. Press and lock the red **Power** button and the black **UHF** button.

6. Adjust the Tune knob for desired frequencies. Sweep the entire 450 - 470 MHz range.

7. Observe the indicated VSWR. It should read 3.0 ± 0.2

   This indicates that the unit is calibrated correctly and the batteries are good.

   - If the reading is outside this range, then try replacing the batteries (eight AA batteries).
   - If this does not improve the readings, the unit needs to be recalibrated.

8. Power off the unit.

9. Remove the attenuator pad and connect the antenna from the bottom of the collector.

10. Press and lock the red **Power** button and the black **UHF** button.

11. Adjust the **Tune** knob for desired frequencies. Look at both the collector receive and transmit frequencies.

12. Observe the indicated VSWR. The value should be 1.5 or less.

   A value of 1.0 is ideal but not practical. Usually values are 1.1 or 1.2.

If a flashing SLP indication appears in the bottom-right corner of the display, this indicates **Sleep** mode. Simply turn the unit off and then on again.
13. When finished, power off the unit.

**The Radio Never Transmits**

The simplest test is to cycle power on the R450 DC to see if the radio starts transmitting.

It can take up to 10 minutes for the R450 DC to be fully functional.

- If radio starts transmitting, this indicates that there was a soft failure in one of the serial ports possibly related to the side effects of a storm.
- If this does not fix the problem, then the R450 DC has an internal problem, either with the computer or the Neptune modem. It is recommended that you return the R450 DC for repair.

**Reduction in Amount of Data Collected**

If the R450 DC is not collecting as much data as before, but it is still collecting some MIU data, this usually indicates that there is a problem with the antenna and feedline system or possibly an internal problem. To determine the cause of the problem, complete the following steps.

1. Check all the system voltages as outlined above.
2. Check the VSWR of the system using the technique previously described.
   
   If the VSWR is high, the feedline and antenna should be checked out and certified by qualified radio personnel.
3. Check the VSWR again, if the power output is low, by placing the wattmeter between the duplexer and the surge protector.
   
   If the VSWR measures much higher before the surge suppressor, the suppressor may be damaged.

If the above tests pass, most likely there is a problem with the duplexer or radio, and it is recommended that you contact Customer Support.
Contacting Customer Support

Within North America, Neptune Customer Support is available Monday through Friday, 7:00 AM to 5:00 PM 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 number.

3. Enter the six-digit PIN number 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.
Appendix A: RF Antenna Installation

RF Antenna Overview

There are a number of critical items you must consider when placing and installing antennas. The following list contains items that can influence the antenna placement and installation.

Mounting the Antennas

Consider the following when mounting the antennas.

1. Mount antennas as high as possible with an unobstructed view of the coverage area.
   - The supporting structure, if the antenna is not mounted above it, can cause specific areas of limited coverage.
   - Water towers in particular can severely limit coverage where the signal must pass directly through the tank. When mounting antennas on a water tower, it is recommended that they be mounted on top as close to the center as possible.
   - When mounting the antenna on a traditional three-leg or four-leg tower, the standoff mount for the antenna must position the antenna at least five feet away from the tower to minimize coverage area problems.

2. Avoid making the R450 Data Collector's (R450 DC) antenna the tallest point in the surrounding area. This may be unavoidable but it increases the potential of the antenna being damaged by lightning.

Site Recommendations

The following are recommendations for sites with multiple transmitters, receivers, and antennas. These sites require extra care when determining a location to install the antenna.

- Avoid mounting the R450 DC antenna so that it is at the same height as another antenna on the site, regardless of the frequencies.
- For sites that have multiple antennas, if possible, mount the antennas one above the other, separating each by at least 10 feet. This will minimize the interference between the systems.
- The exception to the previous rule is for cellular antennas. As long as the R450 DC antenna is either above, below, or in the middle of the ring of cell antennas, the two systems can coexist without interference.
- Antenna sites that must share space with multiple transmitting systems may require additional equipment to protect the systems from interfering with each other. These sites may also require additional engineering to make them perform well.
• If there are radio systems at the site that are already operating on the 450 - 470 MHz band, it may be advantageous to combine the signals into one antenna system using the appropriate equipment. This often works better than attempting to protect the individual systems from interfering with each other.

• Managed antenna sites may require additional equipment and may dictate how an installation is to be performed. As long as the installation meets Neptune's minimum requirements, following the site's requirements is recommended.

**Feed Line and Antenna Recommendations**

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**CAUTION:** Neptune recommends that you consult with a qualified installer on the design and installation of the antenna systems. If the installer is already familiar with the sites and the existing equipment, this can make the installation go more smoothly.

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**MISE en GARDE:** Neptune vous recommande de consulter un installateur qualifié pour la conception et l’installation des systèmes d’antennes. Si l’installateur connaîtra déjà les sites et les équipements existants, cela peut faciliter le déroulement de l’installation.

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**Feed Line**

The feed line is a significant contributor to both good and poor system performance. A properly installed feed line is critical to optimal system performance. Testing the antenna while it is on the ground can ensure the system is working properly.

Installation of the connectors is best done with the proper tools and a trained installer. With the proper tools and jigs, installing coaxial (coax) connectors takes only a few minutes each. Not using the proper tools as recommended by the manufacturer could potentially cause problems, either immediately or after several years of apparently proper operation.

**Feed Line Requirements**

Consider the following.

- The antenna and feed line system installation must be certified by the installer after it is completed to perform according to specifications.
- Maximum loss for the feed line and connectors must be less than 3 dB.
- It may be necessary to use more than one type of coax in an installation. The FSJ4-50B cable is very flexible and may be used for the last section of a coax run to the R450 DC if the additional flexibility is required.
- The feed line must be bonded at the top of the tower and at the base of the tower. Andrew bonding kits and procedures should be used for all bonds.
- For towers over 150 feet tall, the feed line should be bonded at regular intervals down the tower. The general recommendation is that the feed line be bounded by a minimum of 200 feet. Site requirements and standard practices should dictate the configuration.
- An optional surge protector may be installed on the tower near the antenna to help protect the feed line but is not required.
- For the AVA5-50B cable or larger, jumpers should be used to go between the larger cable and the R450 DC and antenna connectors.

Neptune Part Numbers

The following tables provides Neptune part numbers for cable and connectors.

### Table 13 – Neptune Part Numbers for Cable and Connectors

<table>
<thead>
<tr>
<th>Neptune Part Number</th>
<th>Andrew Part Number</th>
<th>Coax Diameter</th>
<th>Loss per 100'</th>
<th>Minimum Bend Radius</th>
<th>Weight per Foot</th>
<th>Maximum Length</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10046-116</td>
<td>FSJ4-50B</td>
<td>1/2&quot;</td>
<td>2.31 dB</td>
<td>1.25&quot;</td>
<td>0.14</td>
<td>100'</td>
<td>Should only be used for jumpers and short cable runs</td>
</tr>
<tr>
<td>10046-119</td>
<td>LDF4-50A</td>
<td>1/2&quot;</td>
<td>1.45 dB</td>
<td>5&quot;</td>
<td>0.15</td>
<td>150'</td>
<td>Recommended antenna cable for 150' cable runs or less</td>
</tr>
<tr>
<td>10046-118</td>
<td>AVA5-50</td>
<td>7/8&quot;</td>
<td>0.74 dB</td>
<td>10&quot;</td>
<td>0.30</td>
<td>400'</td>
<td>Recommended antenna cable for runs over 150'</td>
</tr>
</tbody>
</table>
The following tables contain the Neptune part numbers for connectors and accessories.

**Table 14 – Connectors and Accessories**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Neptune Part Number</th>
<th>Andrew Part Number</th>
<th>Coax Diameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSJ4-50B</td>
<td>10046-117</td>
<td>F4A-PNMDM-6-USA</td>
<td>Pre-made Coax 6’ Jumper DIN Male on one end, N Male on the other</td>
<td>Used as jumper from feed line to R450 DC or antenna</td>
</tr>
<tr>
<td></td>
<td>8138-198</td>
<td>F4PDMV2</td>
<td>Coax Connector, 7/16” DIN Male</td>
<td>Used to make a custom jumper cable using FSJ4 cable</td>
</tr>
<tr>
<td></td>
<td>8138-189</td>
<td>F4PNMV2-HC</td>
<td>Coax Connector, N Male</td>
<td>Used to make a custom jumper cable using FSJ4 cable</td>
</tr>
<tr>
<td>LDF4-50A</td>
<td>8138-199</td>
<td>L4TDF-PS</td>
<td>Coax Connector, 7/16” DIN Female</td>
<td>Used to connect to FSJ4 jumper cable</td>
</tr>
<tr>
<td></td>
<td>8138-200</td>
<td>L4TNM-PS</td>
<td>Coax Connector, N Male</td>
<td>Mates with R450 DC and antenna connectors</td>
</tr>
<tr>
<td></td>
<td>13014-001</td>
<td>SG12-12B2U</td>
<td>SureGround Grounding Kit for 1/2 &quot; coax</td>
<td></td>
</tr>
<tr>
<td>AVA5-50</td>
<td>8138-190</td>
<td>ALDF-PS</td>
<td>Coax Connector, 7/16” DIN Female</td>
<td>Used to connect to FSJ4 jumper cable</td>
</tr>
</tbody>
</table>

For the long-term protection of all RF connections, use the appropriate Andrews weatherproofing kit (Andrews P/N 245171) on all coaxial connectors.
### Antenna

General specifications for the supplied antenna are shown in the table below.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neptune P/N</td>
<td>12896-001</td>
</tr>
<tr>
<td>Andrew P/N</td>
<td>DB636-C</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>450-482MHz</td>
</tr>
<tr>
<td>Maximum Input Power (Watts)</td>
<td>500</td>
</tr>
<tr>
<td>Gain</td>
<td>6 dB</td>
</tr>
<tr>
<td>Bandwidth &gt; 1.5VSWR</td>
<td>32 MHz</td>
</tr>
<tr>
<td>Vertical Beam Width (-3 db)</td>
<td>20 Degrees</td>
</tr>
<tr>
<td>Lightning Protection</td>
<td>Direct Ground</td>
</tr>
<tr>
<td>Termination</td>
<td>N Female</td>
</tr>
<tr>
<td>Overall Length</td>
<td>9.3 Feet</td>
</tr>
<tr>
<td>Element Housing Length</td>
<td>6.8 Feet</td>
</tr>
<tr>
<td>Support Pipe Diameter</td>
<td>2.5 inches</td>
</tr>
<tr>
<td>Support Pipe Length</td>
<td>26 Inches</td>
</tr>
<tr>
<td>Wind Load</td>
<td>1.61 Square Feet</td>
</tr>
<tr>
<td>Rated Wind Velocity</td>
<td>225 MPH</td>
</tr>
<tr>
<td>Weight</td>
<td>30 lbs</td>
</tr>
<tr>
<td>Mounting Hardware Included</td>
<td>DB365 Clamps</td>
</tr>
</tbody>
</table>

### Requirements

- The antenna, if mounted on the side of a tower or other supporting structure, must be mounted so that it is at least five feet away from the structure. The components to offset the antenna are specific to the installation and are not included by Neptune with the R450 DC package.

- The antenna is large and care must be taken when hoisting it up a tower so that it is not damaged.

- The feed line should not be attached to the antenna while it is being hoisted up the tower or other supporting structure. The feed line should be attached after the antenna is in place.

- There have been reports of damage to the antenna's N connector where the center pin has become bent and shorts out the antenna system. Care must be taken not to damage the connector.
System Certification

The Andrews antenna supplied with the R450 DC is specified as having a VSWR of 1.5:1 or better over the 450 - 470 MHz range.

Measuring VSWR at the R450 DC must take into account losses in the feed line. For instructions, see “Measuring the VSWR” on page 68. The easiest approach is to use return loss instead of VSWR. The 1.5:1 VSWR translates into a return loss of 13.98dB. Refer to Table 15 below, Table 16 on the facing page and Table 18 on page 98 to assist with the calculation.

It is recommended that the feed line be certified as a separate step. This is best performed by putting a known amount of power into one end of the cable and verifying that, after correcting for the cable losses, the correct amount of power is coming out the other end.

Power Measurement

Table 15 – Power Measurement to Return Loss and VSWR Conversion Table -Part I

<table>
<thead>
<tr>
<th>Input Power</th>
<th>Reflected Power Reading</th>
<th>Return Loss</th>
<th>VSWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1W</td>
<td>0.001</td>
<td>0.005</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>0.002</td>
<td>0.010</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>0.003</td>
<td>0.015</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>0.004</td>
<td>0.020</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>0.005</td>
<td>0.025</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>0.006</td>
<td>0.030</td>
<td>0.06</td>
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<tr>
<td></td>
<td>0.007</td>
<td>0.035</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>0.008</td>
<td>0.040</td>
<td>0.08</td>
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<tr>
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<td>0.009</td>
<td>0.045</td>
<td>0.09</td>
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<tr>
<td></td>
<td>0.010</td>
<td>0.050</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>0.020</td>
<td>0.100</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>0.030</td>
<td>0.150</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>0.040</td>
<td>0.200</td>
<td>0.40</td>
</tr>
</tbody>
</table>
Table 15 – Power Measurement to Return Loss and VSWR Conversion Table -Part I (continued)

<table>
<thead>
<tr>
<th>Input Power</th>
<th>Reflected Power Reading</th>
<th>Return Loss</th>
<th>VSWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1W</td>
<td>5W</td>
<td>10W</td>
<td></td>
</tr>
<tr>
<td>0.050</td>
<td>0.250</td>
<td>0.50</td>
<td>13.0</td>
</tr>
<tr>
<td>0.060</td>
<td>0.300</td>
<td>0.60</td>
<td>12.2</td>
</tr>
<tr>
<td>0.070</td>
<td>0.350</td>
<td>0.70</td>
<td>11.5</td>
</tr>
<tr>
<td>0.080</td>
<td>0.400</td>
<td>0.80</td>
<td>11.0</td>
</tr>
<tr>
<td>0.090</td>
<td>0.450</td>
<td>0.90</td>
<td>10.5</td>
</tr>
<tr>
<td>0.100</td>
<td>0.500</td>
<td>1.00</td>
<td>10.0</td>
</tr>
<tr>
<td>0.110</td>
<td>0.550</td>
<td>1.10</td>
<td>9.59</td>
</tr>
<tr>
<td>0.120</td>
<td>0.600</td>
<td>1.20</td>
<td>9.21</td>
</tr>
<tr>
<td>0.130</td>
<td>0.650</td>
<td>1.30</td>
<td>8.86</td>
</tr>
<tr>
<td>0.140</td>
<td>0.700</td>
<td>1.40</td>
<td>8.54</td>
</tr>
<tr>
<td>0.150</td>
<td>0.750</td>
<td>1.50</td>
<td>8.24</td>
</tr>
<tr>
<td>0.160</td>
<td>0.800</td>
<td>1.60</td>
<td>7.96</td>
</tr>
<tr>
<td>0.170</td>
<td>0.850</td>
<td>1.70</td>
<td>7.70</td>
</tr>
<tr>
<td>0.180</td>
<td>0.900</td>
<td>1.80</td>
<td>7.45</td>
</tr>
<tr>
<td>0.190</td>
<td>0.950</td>
<td>1.90</td>
<td>7.21</td>
</tr>
<tr>
<td>0.200</td>
<td>1.000</td>
<td>2.00</td>
<td>6.99</td>
</tr>
</tbody>
</table>

Table 16 – Power Measurement to Return Loss and VSWR Conversion Table -Part II

<table>
<thead>
<tr>
<th>Input Power</th>
<th>Reflected Power Reading</th>
<th>Return Loss</th>
<th>VSWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1W</td>
<td>5W</td>
<td>10W</td>
<td></td>
</tr>
<tr>
<td>0.20</td>
<td>1.05</td>
<td>2.10</td>
<td>6.78</td>
</tr>
<tr>
<td>0.22</td>
<td>1.10</td>
<td>2.20</td>
<td>6.58</td>
</tr>
</tbody>
</table>
### Table 16 – Power Measurement to Return Loss and VSWR Conversion Table - Part II (continued)

<table>
<thead>
<tr>
<th>Input Power</th>
<th>1W</th>
<th>5W</th>
<th>10W</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.23</td>
<td>1.15</td>
<td>2.30</td>
</tr>
<tr>
<td></td>
<td>0.24</td>
<td>1.20</td>
<td>2.40</td>
</tr>
<tr>
<td></td>
<td>0.25</td>
<td>1.25</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td>0.26</td>
<td>1.30</td>
<td>2.60</td>
</tr>
<tr>
<td></td>
<td>0.27</td>
<td>1.35</td>
<td>2.70</td>
</tr>
<tr>
<td></td>
<td>0.28</td>
<td>1.40</td>
<td>2.80</td>
</tr>
<tr>
<td></td>
<td>0.29</td>
<td>1.45</td>
<td>2.90</td>
</tr>
<tr>
<td></td>
<td>0.30</td>
<td>1.50</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>0.31</td>
<td>1.55</td>
<td>3.10</td>
</tr>
<tr>
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<td>0.32</td>
<td>1.60</td>
<td>3.20</td>
</tr>
<tr>
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<td>0.33</td>
<td>1.65</td>
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<td></td>
<td>0.34</td>
<td>1.70</td>
<td>3.40</td>
</tr>
<tr>
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<td>0.35</td>
<td>1.75</td>
<td>3.50</td>
</tr>
<tr>
<td></td>
<td>0.36</td>
<td>1.80</td>
<td>3.60</td>
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<td></td>
<td>0.37</td>
<td>1.85</td>
<td>3.70</td>
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<td>0.38</td>
<td>1.90</td>
<td>3.80</td>
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<td>0.39</td>
<td>1.95</td>
<td>3.90</td>
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<td></td>
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<td>2.00</td>
<td>4.00</td>
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<td>0.41</td>
<td>2.05</td>
<td>4.10</td>
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<td></td>
<td>0.42</td>
<td>2.10</td>
<td>4.20</td>
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<td>4.50</td>
</tr>
<tr>
<td></td>
<td>0.46</td>
<td>2.30</td>
<td>4.60</td>
</tr>
<tr>
<td></td>
<td>0.47</td>
<td>2.35</td>
<td>4.70</td>
</tr>
</tbody>
</table>
Table 16 – Power Measurement to Return Loss and VSWR Conversion Table -Part II (continued)

<table>
<thead>
<tr>
<th>Input Power</th>
<th>Reflected Power Reading</th>
<th>Return Loss</th>
<th>VSWR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1W</td>
<td>5W</td>
<td>10W</td>
<td></td>
</tr>
<tr>
<td>0.48</td>
<td>2.40</td>
<td>4.80</td>
<td>3.19</td>
</tr>
<tr>
<td>0.49</td>
<td>2.45</td>
<td>4.90</td>
<td>3.10</td>
</tr>
</tbody>
</table>
## Coax Cable Loss

### Table 17 – Coax Cable Loss Table

<table>
<thead>
<tr>
<th>Coax Type</th>
<th>FSJ4-50B</th>
<th>LDF4-50A</th>
<th>AVA5-50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss 100 ft.</td>
<td>2.31 dB</td>
<td>1.45 dB</td>
<td>0.744 dB</td>
</tr>
<tr>
<td><strong>Length (ft.)</strong></td>
<td><strong>Loss in dB</strong></td>
<td><strong>Length (ft.)</strong></td>
<td><strong>Loss in dB</strong></td>
</tr>
<tr>
<td>10</td>
<td>0.231</td>
<td>0.145</td>
<td>0.074</td>
</tr>
<tr>
<td>20</td>
<td>0.462</td>
<td>0.290</td>
<td>0.149</td>
</tr>
<tr>
<td>30</td>
<td>0.693</td>
<td>0.435</td>
<td>1.223</td>
</tr>
<tr>
<td>40</td>
<td>0.924</td>
<td>0.580</td>
<td>0.298</td>
</tr>
<tr>
<td>50</td>
<td>1.155</td>
<td>0.725</td>
<td>0.372</td>
</tr>
<tr>
<td>60*</td>
<td>1.386</td>
<td>0.870</td>
<td>0.446</td>
</tr>
<tr>
<td>70*</td>
<td>1.617</td>
<td>1.015</td>
<td>0.521</td>
</tr>
<tr>
<td>80*</td>
<td>1.848</td>
<td>1.160</td>
<td>0.595</td>
</tr>
<tr>
<td>90*</td>
<td>2.079</td>
<td>1.305</td>
<td>0.670</td>
</tr>
<tr>
<td>100*</td>
<td>2.310</td>
<td>1.450</td>
<td>0.744</td>
</tr>
<tr>
<td>110</td>
<td>2.541</td>
<td>1.595</td>
<td>0.818</td>
</tr>
<tr>
<td>120</td>
<td>2.772</td>
<td>1.740</td>
<td>0.893</td>
</tr>
<tr>
<td>130</td>
<td>3.003</td>
<td>1.885</td>
<td>0.967</td>
</tr>
<tr>
<td>140</td>
<td>3.234</td>
<td>2.030</td>
<td>1.042</td>
</tr>
<tr>
<td>150</td>
<td>3.465</td>
<td>2.175</td>
<td>1.116</td>
</tr>
<tr>
<td>160</td>
<td>3.696</td>
<td>2.320</td>
<td>1.190</td>
</tr>
<tr>
<td>170</td>
<td>3.927</td>
<td>2.465</td>
<td>1.265</td>
</tr>
<tr>
<td>180</td>
<td>4.158</td>
<td>2.610</td>
<td>1.339</td>
</tr>
<tr>
<td>190</td>
<td>4.389</td>
<td>2.755</td>
<td>1.414</td>
</tr>
<tr>
<td>200</td>
<td>4.620</td>
<td>2.900</td>
<td>1.488</td>
</tr>
</tbody>
</table>

* Acceptable Range
VSWR Calculation

Neptune recommends the following method of computing VSWR. Taking the reading at the R450 DC end of the feed line without compensating for cabling losses may give a false impression of the antenna and feed line performance.

Using a Wattmeter and a Handheld 450MHz Radio

The recommended procedure is to use a handheld commercial grade transceiver that is tuned to the R450 DC's transmitter frequency and an inline wattmeter, such as a Bird Model 43 Wattmeter with the appropriate element (slug) for the frequency range and power output of the transceiver.

The Bird Model 43 Wattmeter uses elements to set the frequency and power ranges that the meter will read. The wattmeter element should be a 400 - 1000 MHz model sized so that the forward power reading is close to full scale. For a 5W output handheld, the Bird 5E element is recommended. If the radio puts out more than 5W, a Bird 10E or higher power element may be required.

Complete the following steps to use a Wattmeter and handheld to calculate VSWR.

1. Connect the wattmeter and transceiver to the feed line in place of the R450 DC.

2. Measure both the forward and reflected power.

3. Find the return loss value using Table 15 on page 90 and Table 16 on page 91.

4. Find the loss attributed to the coax using Table 17 on the previous page based on the coax type and feed line length.

   The adjusted return loss is calculated by the following formula.

   \[
   \text{Return Loss (from Table)} - (2 \times \text{Cable Loss}) = \text{Corrected Return Loss}
   \]

5. Find the VSWR using Table 15 on page 90 and Table 16 on page 91 using the Corrected Return Loss value.

6. Change the frequency on the handheld transceiver to the R450 DC's receive frequency.

7. Measure the power and calculate VSWR using the procedure just used for calculating transmitter VSWR.

8. Record both transmit and receive frequencies' VSWR values. In order for the antenna system to pass, both readings must be less than 1.5.
Using the AEA 140-525 Antenna Analyzer

Complete the following steps to configure the analyzer.

This procedure assumes that the analyzer has not been configured prior to use.

1. Turn the analyzer ON.
2. Type the frequency: 46000.
3. Press Enter.
4. Set the value next to WID on the screen to 20 using the width buttons.
5. Set the reading to return loss by pressing F1 three times. (Press it slowly; the unit should beep each time.)

Taking the Reading and Calculating VSWR

1. Connect the analyzer to the feed line in place of the R450 DC.
2. Configure the analyzer using the preceding procedure.

Be sure that there is not a vertical line running through the display in the plot area. If there is, press EXAM PLOT and it should go away.

3. Allow the analyzer reading to stabilize, between 10 and 20 seconds.
4. Press EXAM PLOT to freeze the display.
5. Move the cursor (the vertical line in the middle of the screen) using the FREQ arrows to approximately the R450 DC's frequency. (It moves to within 100KHz of a frequency.)
6. Read the value next to RETL on the display. This is the return loss value.
7. Find the loss attributed to the coax (based on the coax type and feed line length) using Table 17 on page 94.
8. Calculate the adjusted return loss using the following formula.

\[
\text{Return Loss (from Table 5)} - (2 \times \text{Cable Loss}) = \text{Corrected Return Loss}.
\]

9. Find the VSWR (using the Corrected Return Loss value) Table 15 on page 90 or Table 16 on page 91.
10. Move the cursor to within 100KHz of the R450 DC’s receive frequency.

11. Calculate VSWR using the new return loss value.

12. Record both values. They must be less than 1.5.1 for the antenna and feed line to pass the test.

**General Installation Guidelines**

**Unpacking**

As with all precision electronic instruments, the RF 450 MHz antenna should be handled with care; however, no additional special handling is required.

After unpacking the RF 450 MHz antenna, inspect it for damage. If any parts of the R450 MHz antenna appear to be damaged or prove to be defective upon installation, notify your Neptune sales representative. If the unit or item requires reshipment, use the original cardboard box and packing material.

In particular, check to be sure that the N connector at the base of the antenna is not damaged. This is much easier to check while the antenna is on the ground than after it is installed.

**RF Antenna Installation Kit**

The RF 450 MHz antenna and the basic accessories are included with the R450 DC. The mounting brackets that are included are designed to mount on the top of a mast or similar structure. If the installation requires offsetting the antenna from the supporting structure, this must be ordered separately. Neptune does not sell it.
Tools and Materials

Table 18 shows the recommended tools and materials you need to successfully install the RF antenna.

Table 18 – Recommended Tools and Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Description/Recommendation</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Took Kit</td>
<td>Contains standard tools including:</td>
<td>Various installation procedures performed by the installer</td>
</tr>
<tr>
<td></td>
<td>• Assorted screwdrivers (medium, flat head)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cordless electric drill/assorted bits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Adjustable wrench</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Standard socket wrench set</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Standard box-end wrench set</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hammer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Channel locks</td>
<td></td>
</tr>
<tr>
<td>UV-Stable Cable Ties</td>
<td>8&quot; and 12&quot; (20.32 cm and 30.48 cm)</td>
<td>Secure coax cable</td>
</tr>
<tr>
<td>Cable Clips</td>
<td>Various sizes</td>
<td>Securing coax cable</td>
</tr>
<tr>
<td>Concrete Blocks</td>
<td>8&quot; X 8&quot; X 16&quot; (20.32cm X 20.32cm X 40.64cm)</td>
<td>Ballast for the R450 DC Stand</td>
</tr>
<tr>
<td>Weatherizing Kit</td>
<td>PolyPhasor P/N: WK-1 - or Times Microwave P/N: WK-S-2 - or Andrews P/N: 245171</td>
<td>Weatherproofing coax cable connections</td>
</tr>
<tr>
<td>Electrical Tape</td>
<td>Scotch® Heavy Duty Vinyl Electrical Tape 22 -or Scotch® Super 88</td>
<td>Weatherproofing coax cable connections and other connections as required</td>
</tr>
</tbody>
</table>
Installing the RF Antenna

This section contains the instructions for the RF antenna installation.

Locating the Site

Choose a location that does not interfere with any other wiring and is easily accessible.

The first step in securing the R450 DC pole in the ground is to locate where the RF 450 MHz antenna will be seated. Complete these instructions to locate the site for the pole.

1. Locate the conduit for the RF 450 MHz antenna cable and the trench where the cable for the RF 450 MHz antenna will be buried.

2. Find a suitable spot close in this location to seat the RF antenna. See Figure 73.

![Figure 73 – RF 450 MHz Antenna Cable and Trench](image)
Mounting the RF 450 Antenna

The RF 450 MHz antenna must be installed by professionals in accordance with the FCC site license before you begin the installation of the R450 DC.

**WARNING:** Mounting and wiring the RF 450 MHz antenna must be done by a trained professional. Be sure to subcontract this work, so it is completed properly.

**AVERTISSEMENT:** L’installation et le câblage de l’antenne RF 450 MHz doivent être effectués par un professionnel qualifié. Veillez à donner cette tâche en sous-traitance pour la mener à bien convenablement.

**CAUTION:** Check the cable, connectors, and the antenna installation with the VSWR meter.

**MISE en GARDE:** Vérifiez l’installation du câble, des connecteurs et de l’antenne à l’aide du rapport de tensions des ondes stationnaires.

To mount the RF 450 MHz antenna, complete these steps.

1. Assemble the RF 450 MHz antenna, per the instructions included with the antenna kit. See Figure 74.
2. Use the mounting hardware included with the antenna to mount the antenna per the supplied instructions.
3. Install the antenna in accordance with the FCC site license (per the antenna mounting instructions contained in this appendix).
4. Weatherize the antenna coaxial connector using the weatherizing kit. See Table 18 on page 98.

Figure 74 – RF 450 MHz Antenna to be Mounted
Attaching the RF 450 MHz Antenna Cable

To attach the RF 450 MHz antenna cable to the RF antenna R450 DC, complete the following steps.

1. Locate the RF 450 MHz antenna cable that extends from the RF 450 MHz antenna cable conduit. See Figure 75.

2. Connect the RF 450 MHz antenna cable to the RF 450 MHz antenna connector located on the bottom of the R450 DC. See Figure 76. Tighten the coaxial connector to 14 in-lb. (1.58 Nm).

Figure 75 – RF 450 MHz Antenna Connection

Figure 76 – Antenna Connections

WARNING: Give special consideration when the RF antenna R450 DC is installed inside a building.

The screen (shield) of the coaxial cable must be connected to the earth (grounded) at the entrance to the building. This should be done in accordance with applicable national electrical installation codes (Section 820.93 of the National Electrical Code, ANSI/NFPA 70).

Weatherizing the Cable Connections

Complete the following instructions to weatherproof the cables with the black tape.

1. Using the weatherizing kit, start the tape at the top of the RF antenna connection as illustrated in Figure 77.

2. Wrap the tape around the connection several times; slowly work your way downward to weatherize your connection at the base.

Figure 77 – Weatherizing the RF Antenna Connection

Troubleshooting the RF Antenna

This section provides a table of possible symptoms, areas of focus, and actions that can be taken to try to resolve problems that could arise with your RF antenna.

Equipment Required

The following items are required in order to troubleshoot the R450 DC.

- Keys to access the site and open the R450 DC cabinet
- Digital volt - Ohm multimeter
- Socket and open-end wrenches to install and remove the R450 DC
- Small, medium, and large slot-style screw drivers
- #1 and #2 Phillips head screw drivers
- Electrical tape and wire ties
- Spare R450 DC in order to swap if one fails
- R450 DC configuration memory stick
- Anti-static wrist strap and ground lead with alligator clip for attaching wrist strap to the R450 DC cabinet
• MIU configured for the site
• Magnet to swipe the MIU

Conduct a test by hooking up the wattmeter to the coaxial connector at the R450 DC end to measure the VSWR for the antenna and feed line combined.

The R450 DC's transmitter cannot be used to certify the antenna system. The transmitter only transmits short packets approximately 50ms in length, so taking an accurate reading of forward or reflected power cannot be done with standard equipment.
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Appendix B: Flash Drive Configuration for R450 DC

Overview

This appendix provides information and the steps for creating an R450 Data Collector (R450 DC) and configuring the USB flash drive using the N_SIGHT R450 Host Software.

Creating a Collector

The Collector tab in the N_SIGHT R450 Host Software provides valuable information about the R450 DCs in your R450 System. On this tab you can search for an R450 DC or create an R450 DC.

Using the Collector tab, you can do the following:

- Create collector
- Search collectors

Creating a New Collector

To create a new R450 DC, complete the following steps.

1. Open the N_SIGHT R450 Host Software on the PC.
2. Select the Collector tab, and click Create Collector.

   The Create a New Collector window appears similar to Figure 78. All required fields display a red *.

![Figure 78 – Create a New Collector Window](image)

---

R450 Data Collector Installation and Maintenance Guide 105
### Table 19 – Collector Details

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector ID</td>
<td>Indicates the unique identifier for the data collector which can be a street, location, or a neighborhood.</td>
</tr>
<tr>
<td>Collector Name</td>
<td>Indicates the name of the data collector, for example the street, neighborhood, tower name, and so forth.</td>
</tr>
<tr>
<td>Host IP Address</td>
<td>Displays the static IP address for the host database.</td>
</tr>
<tr>
<td>Time Zone</td>
<td>Indicates the unique identifier for the time zone in which the R450 DC is located; offset is from UTC: Atlantic Time is -4; Eastern Time is -5; and so forth.</td>
</tr>
<tr>
<td>Sync Interval (minutes)</td>
<td>Indicates, in number of minutes, the time between synchronizations between the collector and the database. Usually it is 60 minutes for GPRS system, and 30 minutes for an Ethernet system.</td>
</tr>
<tr>
<td>Transmit Frequency</td>
<td>Indicates the frequency used to transmit data.</td>
</tr>
<tr>
<td>Receive Frequency</td>
<td>Indicates the frequency used to receive data.</td>
</tr>
<tr>
<td>Latitude</td>
<td>Indicates the actual latitude of the R450 DC.</td>
</tr>
<tr>
<td>Longitude</td>
<td>Indicates the actual longitude of the R450 DC.</td>
</tr>
<tr>
<td>Power</td>
<td>Indicates the power used by the R450 DC.</td>
</tr>
<tr>
<td>Antenna Height</td>
<td>Indicates the actual height of the RF antenna.</td>
</tr>
<tr>
<td>Daily Reboot</td>
<td>Indicates if the R450 DC requires a daily reboot.</td>
</tr>
<tr>
<td>Start Time</td>
<td>Displays the beginning time in hh:mm format for the quiet time period when the R450 DC is not transmitting or receiving.</td>
</tr>
<tr>
<td>End Time</td>
<td>Displays the ending time in hh:mm format for the quiet time period when the R450 DC is not transmitting or receiving.</td>
</tr>
</tbody>
</table>

On this tab, remember the following:

- All fields with an * are required.
- All white fields are available fields.
- All fields with gray text are read-only fields.
3. Complete all the required and available information that applies, and click **Save**.

The Collector Network Settings tab appears similar to Figure 79.

![Collector Network Setting Tab](image)

**Figure 79 – Collector Network Setting Tab**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAN Connection Type</td>
<td>Indicates the type of Wide Area Network (WAN) used by the R450 DC. The options include the following:</td>
</tr>
<tr>
<td></td>
<td>- GPRS</td>
</tr>
<tr>
<td></td>
<td>- GPRS_Ethernet</td>
</tr>
<tr>
<td></td>
<td>- Network_DHCP</td>
</tr>
<tr>
<td></td>
<td>- Network_Static_IP</td>
</tr>
<tr>
<td></td>
<td>- Mobile</td>
</tr>
<tr>
<td>NTP Server</td>
<td>Indicates a server that uses NTP (Network Time protocol). Its purpose is to keep the clock accurate.</td>
</tr>
<tr>
<td>Primary DNS Server</td>
<td>Indicates the primary server, the first DNS (Domain Name System) server queried when trying to resolve a server name. You can supply the name</td>
</tr>
<tr>
<td></td>
<td>rather than the IP address, for example, Chicago rather than 10.10.10.10.</td>
</tr>
<tr>
<td>Secondary DNS Server</td>
<td>Indicates the secondary server, the second DNS (Domain Name System) server.</td>
</tr>
</tbody>
</table>
On this tab, remember the following:

- All fields with an * are required.
- All white fields are available fields.
- All fields with gray text are read-only fields.

4. Complete all the required and available information that applies, and click **Save**.

The R450 DC just created appears in the list of R450 DCs on the Collector tab, and the detail appears in the lower half of the page.

**Editing Collector Information**

To edit information for an R450 DC, complete the following steps.

1. On the **Collector** tab, select the R450 DC for which you want to edit the information.

   The **Edit Collector** window appears with the existing information for the collector.

2. Edit and change the appropriate information on both the **Collector Details** tab and the **Collector Network Settings** tab.

3. When complete, click **Save** to display the new information for the collector.

   The changes you made are saved for the selected collector.

**Deleting a Collector**

To delete a collector, complete the following steps.

1. On the **Collector** tab, select the collector you want to delete.

2. Click **Delete**.

   A delete confirmation message appears similar to the following.

   ![Delete Confirmation Dialog Box](image)

   **Figure 80 – Delete Confirmation Dialog Box**

3. Click **OK**.

   The R450 DC is now deleted from the list of collectors on the **Collector** tab.
Using Collector Search

To use the Search function to locate an R450 DC, complete the following steps.

1. Click **Search Collectors** on the **Collector** tab.

   The following page appears.

   ![](image)

   **Figure 81 — Collector Search**

   On this page, there is a drop-down selection list for you to select how you want to search for the R450 DC.

   - **Collector Name**
   - **Synchro User**
   - **Collector ID**

2. Type all or part of the search criteria you selected in the previous step in the search area provided. See Figure 81.

   Everything matching your search criteria appears in the collector list on the **Collector** tab with the detailed information for the collector appearing in the lower-half of the page. See Figure 82 on page 110.
Figure 82 – Collector Search Results

3. Select one of the following options.
   - Create another R450 DC.
   - Edit information for the selected R450 DC.
   - Delete the selected R450 DC.
   - Build a USB drive for the R450 DC.

Building a USB Drive for Collector Configuration

This feature adds the ability to build a USB drive that can be inserted into a replacement collector for automatic configuration in order to mimic an old collector.

Complete the following steps to add an USB drive.

1. Select the R450 DC to upload data to the USB drive from the Collector tab
2. Click Build USB.
   A confirmation message appears similar to the following.

   ![Delete Confirmation](image)

3. Click OK to build the drive.
Appendix C: Ethernet Termination

Straight-Through Ethernet Cable

For most installations, the Straight-Through Ethernet Cable is used. Terminate the Ethernet cable according to the diagram below using the T-568B wiring standard for both ends. One end should already be pre-terminated to the switch or hub.

![Diagram of Straight-Through Ethernet Cable]

**Figure 83 – Straight-Through Ethernet Cable**

### RJ-45 Crossover Ethernet Cable

On some occasions, a Crossover Ethernet Cable is required. If you require a cable to connect two Ethernet devices directly together without a hub or when you connect two hubs together, you will need to use a crossover cable instead.

![Diagram of RJ-45 Crossover Ethernet Cable]

**Figure 84 – RJ-45 Crossover Ethernet Cable**
Determining if You Need a Crossover Cable

One method of determining if you need a crossover cable is to plug the Ethernet cable from the hub or modem into your laptop computer's Ethernet port. If the laptop computer can communicate through the Ethernet port, then the site probably requires a Crossover Ethernet Cable to be compatible with the R450 Data Collector (R450 DC).

Table 21 – Cable Color Code Table

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>o</td>
<td>White with orange stripe</td>
</tr>
<tr>
<td>O</td>
<td>Solid orange</td>
</tr>
<tr>
<td>g</td>
<td>White with green stripe</td>
</tr>
<tr>
<td>B</td>
<td>Solid blue</td>
</tr>
<tr>
<td>b</td>
<td>White with blue</td>
</tr>
<tr>
<td>G</td>
<td>Solid green</td>
</tr>
<tr>
<td>br</td>
<td>White with brown stripe</td>
</tr>
<tr>
<td>BR</td>
<td>Solid brown</td>
</tr>
</tbody>
</table>
Glossary

A

ALM
Alarm indicator.

AMI
Advance Metering Infrastructure. System that captures, stores, and provides to the utility at frequent intervals detailed consumption and other information, such as usage, leak, and flow status, in order to support advanced applications. The data can then be used to support a consumer portal. Furthermore, the mass of data generated by the system can feed an advanced analytics system to convert it into actionable information that supports the efficient management of the utility.

AMR
Automatic Meter Reading. The automated process of reading meters.

APN
Access Point Name.

AWG
American Wire Gauge.

B

ballast
Heavy material used to secure the stability of the equipment stand. For the R450 System, concrete blocks are used for the ballast.

C

CDMA
Code Division Multiple Access. A channel-access method used by various radio communication technologies that allows multiple users to be connected over the same channel.
CEC

Canadian Electrical Code.

CIS

Customer Information System.

CSA

Canadian Standards Association.

Data Collector

R450 Data Collector (R450 DC). The physical equipment that houses Neptune’s N_SIGHT PLUS host software. The R450 DC is a device that collects meter reading data from Neptune’s absolute encoder register interfacing with Neptune’s new R450 MIU and transmits the data for collection. This unit receives the data and stores data to be downloaded through the host software.

DHCP

Dynamic Host Configuration Protocol.

FCC

Federal Communication Commission.

GPRS

General Packet Radio Service modem.
Glossary

L

LED
Light Emitting Diode.

M

MHz
Abbreviation for megahertz. One MHz represents one million cycles per second.

MIU
Meter Interface Unit.

N

NEC
National Electrical Code.

R

R450 System
R450 System is a fixed network AMI system for targeted applications Allows a utility to conduct meter reading operations automatically ensuring maximum collection of the data.

S

serial number
A unique identification number given to each product at the factory.

SIM
System Information Manager.
Glossary

**U**

**UL**

Underwriters Laboratory.

**UPS**

Uninterruptible Power Supply.

**USB**

Universal Serial Bus, is an industry standard that defines cables, connectors, and communications protocols for connection, communication, and power supply between computers and devices.

**UV**

Ultraviolet.

**V**

**voltmeter**

An instrument used for measuring electrical potential difference between two points in an electric circuit.

**VSWR**

Voltage Standing Wave Ratio. The ratio of the amplitude of a partial standing wave at an antinode (maximum) to the amplitude at an adjacent node (minimum) in an electrical transmission line.

**WiFi**

Wireless Fidelity modem.
A

AC
  power box 28
  power source 28
  wiring 24
activating light 30
activating, R450 DC 28
ALM
  indicator 81
  LED 76
antenna 89
  accessories 12
  analyzer 96
  attaching 19, 21
  cable 18-19, 65
  commercial broadcast 7
  connection 18
  external 4
GPRS 8
  installing 99
  mast 3
  placement 6
RF 85
WiFi 9
APN 32
assembly accessories
  CDMA 10
  Ethernet 9

B

backhaul
  modem 76
  modem connectivity 80
  type 2
ballast 98
battery 46
  fuse 61
  installing and wiring 60
  safety checklist 49
  spill kit 49
bonded 87
branch circuit breaker 55
breaker switch 25, 28

C

cable
  antenna 15, 65
  clips 13
  Ethernet 65-66, 111
  serial 67
Cal Amp, landcell modem 76, 79
calculating VSWR 96
CDMA
  activating 68
configuring, modem 27
conversion kit 65-66
conversion kit assembly 10
modem 10, 65
parts list 10

cellular antenna 85
certification 90
circuit breaker 77
CIS 1
coax cable 8-10, 12-13, 87
coax cable loss 94
collector
  building USB drive 110
  create 105
  deleting 108
  details 106
  edit information 108
  network settings 107
  using search 109
concrete blocks 98
configuring
  collector, USB flash drive 27
  GPRS modem 32
connectivity 80
connectors 88
conversion table 90-91
CPU board 27, 30, 76, 78
creating collector 105
customer support 84

D
Digital Volt-Ohm-Multimeter 79
disconnects 56

E
electrical codes 25
encoder register 1
Ethernet 2, 9
  backhaul 30
cable 26, 32
cable, RJ-45 crossover 111
cable, straight-through 111
connection 65
hardware kit 9
kit 9
parts list 9
port 67, 112
termination 111
external ground lug 20

F
FCC 2
FCC label 65
feed line 86
flash drive
  configuration 105
frequencies 2
G

GPRS
  configuring, modem 26
  connection 65
  modem 2
  parts list 8
ground wire 20
  component 18
  connecting 20
grounding 55

H

hardware kit 8-10
host software 30

I

installation
  common problems 7
  completing 29
  four types 2
  instructions 15
  kits 12
  pole 5
  R450 DC 3
  site selection 3
interference 6
internal ground lug 24, 26
inverter 62

L

LED 62
lightning arrestors 8
link integrity light 30

M

magnet 14, 31, 81
materials 13
MIU 1
  placement 7
  swipe 30
modem
  Cal Amp 74
  CDMA 2, 10
  EVDO 69
  GPRS 2, 8
  homepage 68
  Sierra Wireless 67
  Sprint 69
  Verizon 70
  WiFi 2, 9
monitoring LEDs 54
mounting
  antenna 20, 85
  bracket 65
  plate 66-67
  pole 57
  RF 450 antenna 100
  UPS 57
  mounting brackets 97
Novus Micro Secure 52
  illustrated cable version 53
  illustrated surveillance version 53
NTP server 107

OMA-DM 69, 72
OTASP 70
output connectors 54

part numbers 87
parts list
  CDMA modem 10
  Ethernet 9
  GPRS modem 8
  WiFi modem 9
performance
  issues 6
  maintaining 8
  optimizing 6
pole
  galvanized steel 16
  installation 5
  mount 15
  site 15
pole mounting 57
  steel or concrete 57
  wooden 58
power light
  GPRS 29
  WiFi 29
power measurement 90
power supply 43
PPP status 70, 72
primary DNS server 107
provisioning tab 69

R450 DC 1, 65
  kit 8
  mounting 4
  performance issues 6
  potential problems 74
  product description 1
  securing 33
  stand 5
  synchronizing 32
  transmitter 102
R450 MIU
  performance issues 6
radio power 76
receiver
  recommended 7
  sensitivity 7
RF 450, antenna connection 101
RF antenna
  installation kit 97
RF antenna, installation 85
Index

S

seal washers 17
seating pole 16
secondary DNS server 107
serial
cable 65, 67
connection 67
server
  NTP 107
  primary DNS 107
  secondary DNS 107
signal strenght 80
SIM card 9, 26, 33
site
  preparation 55
  requirements 56
  surveys 7-8
site, recommendations 85
SLP 82
specifications 11
  electrical 11
  environmental conditions 11
  footprint 11
  mechanical 11
  safety approval 11
spectrum analyzer 6
Sprint modem 69
stable ties 13
stand, R450 DC 5
storage 12
storm activity 8
structure 85
strut
  channels 16, 21
  clamp 8-10, 16, 18
syncing 81
T
testing connections 29
tool kit 13
tools 13
tools and materials 98
tower 85
transceiver 95
trench 15, 99
troubleshooting 73
  equipment required 73
  PC Notebook Configuration 74
  storm damage 75
  voltage checks 77
tune knob 82
U
unlicensed equipment 6
unpacking 12
upacking 97
UPS 43
  checklist 46
  connecting 58
  electrical specifications 45
  LED description 62
Index

mechanical specifications 43
mounting 57
output 45
powering on 61
regulatory specifications 44
returns 52
troubleshooting 62
unpacking and inspection checklist 52

USB 67
building for collector configuration 110
flash drive 27, 30
ports 27

V

Verizon modem 70
voltmeter 61
VSWR 82, 90, 95

W

wall mounting 57
WAN connection 107
wattmeter 95
weatherizing
  antenna connection 24
  cable connections 23, 102
  kit 13
WiFi modem 9
wiring connectors 59