CE5320

NEPTUNE
TECHNOLOGY GROUP

R900® Gateway v4 Installation and Maintenance Guide

Ti SALES

36 Hudson Rd
Sudbury MA 01776

800-225-4616
www.tisales.com

NEPTUNE
TECHNOLOGY GROUP

ARB® UTILITY
MANAGEMENT
SYSTEMS™

R900® Gateway v4 Installation and Maintenance Guide

Copyright

This manual is an unpublished work and contains the trade secrets and confidential information of Neptune Technology Group, which are not to be divulged to third parties and may not be reproduced or transmitted in whole or part, in any form or by any means, electronic or mechanical for any purpose, without the express written permission of Neptune Technology Group Inc. All rights to design or inventions disclosed herein, including the right to manufacture, are reserved to Neptune Technology Group Inc.

The information contained in this document is subject to change without notice. Neptune reserves the right to change the product specifications at any time without incurring any obligations.

Trademarks used in this manual

R900 and R900 Gateway are registered trademarks of Neptune Technology Group Inc. N_SIGHT PLUS is a trademark of the Neptune Technology Group Inc. Other brands or product names are trademarks or registered trademarks of their respective holders.

FCC Conformity

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can emit radio frequency energy, and if not installed and used in accordance with the instruction, 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 where the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

> **Warning: Changes or modifications to this device not expressly approved by Neptune Technology Group Inc. could void the user's authority to operate the equipment.**

Industry Canada

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operation.

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

This page intentionally left blank.

Contents

Figures

Tables

Chapter 1: Overview

The R900® Gateway v4 (Gateway) is a fixed network data collector that collects meter reading data from Neptune's R900® meter interface unit (MIU). Data from the MIU is stored in the Gateway until it synchronizes with the N_SIGHT™ PLUS host software by means of web services. The data is uploaded to the N_SIGHT PLUS host software where it is used for analysis and transfer to the customer information system (CIS) for billing purposes.

About This Guide

The *R900 Gateway v4 Installation and Maintenance Guide* describes how to install, maintain, and troubleshoot the Gateway. This guide also provides information for configuring the cellular modem for the Gateway, installing the solar power unit, and ordering information for necessary cables and accessories.

Conventions Used in this Manual

This manual uses the following icons and typographical conventions to identify special information.

	Identifies actions that can cause injury to the user or permanently damage the product.
	Identifies important information that is critical to ensuring that data stored with the Gateway is not lost.
	Identifies information that clarifies a point within the text.
SMALL CAPS	Refers to keys. Examples: ENTER, ALT, TAB.
All Bold Initial Caps	Refers to field names, menus, buttons, and menu options. Example: **Device** field or **File** menu.
+ (between keys)	Refers to pressing the keys at the same time. Example ALT+B.

General Product Overview

The Gateway can operate on either solar power or standard AC power. It is easy to install and does not require an operating license.

Figure 1 – Solar Unit

Figure 2 – AC-Powered Wall Unit

Before you begin to set up the Gateway, 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 with the installation process. In addition, this guide contains information on individual components, material specifications, site selection, and detailed installation instructions.

Determining How to Install the Gateway

⚠️ **Because of the risks involved to personnel and equipment, Neptune recommends using qualified professional for installation and service.**

Regardless of whether you are installing the Gateway in an indoor or outdoor environment, Neptune provides a kit for five types of setups as detailed in Table 1 on the facing page. A cellular modem or Ethernet connection is used for backhaul communications. The kits provide materials needed for both types of installations. The Gateway can be installed in the combinations listed in Table 1 on the facing page.

Table 1 – Types of Gateway Installations

	Solar-Powered	AC-Powdered
Wall		✓
Stand	✓	✓
Pole[1]	✓	✓

[1] Ranging from 2 inch to 16 inch in diameter.

Site Considerations

One of the first installation considerations is where to locate the Gateway. The first priority in choosing a site is selecting a line-of-sight location not obstructed by trees, hills, mountains, or anything else that would block the RF communications from the MIUs in that area. The Gateway can be installed on top of a building so that it is set higher than the MIUs it is reading. If a rooftop installation is not feasible, the Gateway can be installed on a pole ranging from 2 inches to 16 inches in diameter.

> **Do not mount the Gateway, antenna mast, or antenna to a pole or similar structures carrying open electric light, power wires, or trolley wires over 250 volts between conductors. (See NEC, Article 8.10). See Appendix A.**

The Gateway mounts easily to a wall. However, for an indoor wall-mounted unit, you need to choose a location that is easily accessible and in close proximity to where the antenna mast can be mounted outdoors.

> RF propagation should be conducted prior to site selection to ensure adequate RF communications.
>
> The antenna should have, at the minimum, 10-feet vertical separation from other antennas to minimize the interference between the systems. Locations that must share space with multiple transmitting systems may require additional equipment to protect the systems from interfering with each other. See Appendix C.

Mounting Configurations

Wall Mount

A wall-mounted Gateway can be attached directly on a wall or mounted to a strut channel that is affixed to a wall.
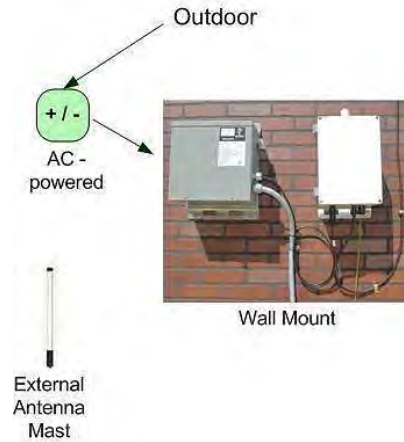
Figure 3 – Gateway Wall Mount Installation

> ⓘ The Gateway allows for a cellular modem or Ethernet connection for backhaul communication.

Gateway Stand

The Gateway mounted on a stand can be either solar-powered or AC-powered. Figure 4 shows a typical stand configuration.
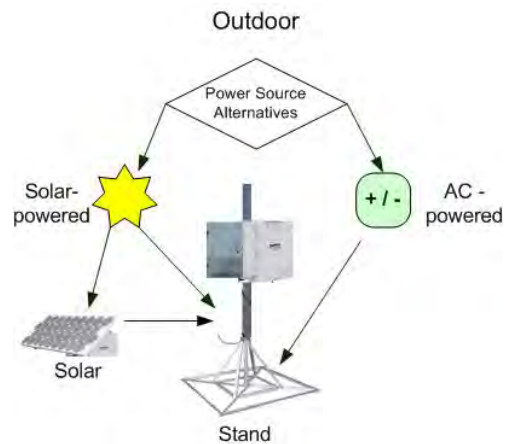
Figure 4 – Gateway Stand Installation

Pole Installation

The pole installation is used with an outdoor free-standing pole ranging from 2 inches to 16 inches in diameter, such as a utility pole. Refer to Figure 5 for typical pole configuration.
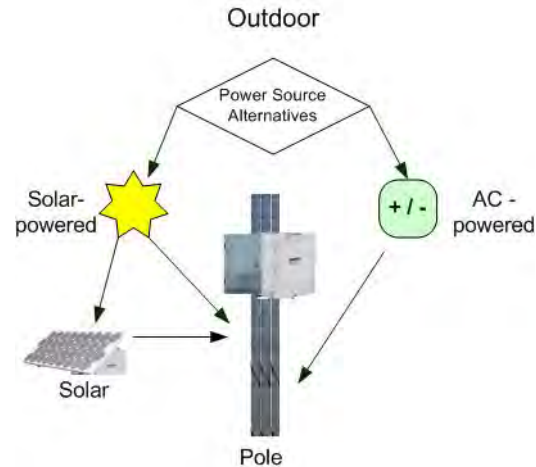
Figure 5 – Gateway Pole Installation

> The Gateway allows for a cellular modem or Ethernet connection for backhaul communication.

Gateway Kits

The following section describes the Gateway components for each of the Gateway kits: cellular modem and Ethernet. The Gateway is powered by 12 VDC. The 12 VDC can be provided by a solar power system or Uninterruptible Power Supply (UPS).

Solar Unit

The solar version of the Gateway uses a solar power source in conjunction with a cellular modem or Ethernet option. Solar panels are available in two different sizes depending on installation location. The 150 W solar panel can be used for Zones A, B, C, and D. The 220 W solar panel must be used for Zone E and Canada. If the utility is located near or along the boundary between Zones D and E, then the 220 W option is recommended. See Appendix A for more details. The kit is mounted on a 2-inch to 16-inch pole or a stand.

AC Unit

The AC version of the Gateway uses the UPS in conjunction with a celluar modem or Ethernet option. The kit is mounted on a wall, stand or 2-inch to 16-inch pole.

Cellular Modem

The following list includes the parts needed for the Gateway cellular modem installation.

Table 2 – Cellular Modem Parts List

Part No.	Description	Qty
13458-000	R900 Gateway v4 - Cellular Modem[1]	1
13194-001	R900 Gateway v4 Installation and Maintenance Guide	1
N/A	SIM card with cellular service account (customer provided)	1
13147-000	External Cellular Antenna Mounting Kit, optional[2]	1
13566-001	Cellular to Ethernet Conversion kit, optional	1

[1] Accessories are available. Contact your Neptune sales representative for details.

[2] Some installation sites have a weak cellular signal (-90 dBm or weaker). An optional external cellular antenna mounting kit (Neptune Part No. 13147-000) can increase the signal strength in these cases.

Ethernet

The following list includes the parts needed for the Ethernet connection.

Table 3 – Ethernet Parts List

Part No.	Description	Qty
13458-100	R900 Gateway v4 - Ethernet[1]	1
13194-001	R900 Gateway v4 Installation and Maintenance Guide	1
13247-000	Ethernet-to-Cellular Modem Conversion Kit, optional [2]	

[1] Accessories are available. Contact your Neptune sales representative for details.

[2] The Cellular Modem Conversion Kit is an optional kit that is only required when converting an Ethernet Gateway to a Cellular Gateway in the field.

Provisioning the Cellular Service to the Gateway

To activate the cellular service to the Gateway, complete the following steps.

1. Select your preferred wireless service provider.

> When selecting a carrier, choose a wireless service provider that provides service in the area of the installation site and is approved by your utility.
>
> Certain cellular services, such as Code Division Multiple Access (CDMA), do not require a SIM card to operate. However, some cellular services do require a SIM card, such as GSM (UMTS, EDGE, and GPRS). Verify with the chosen cellular service provider.

2. Identify the modem identification numbers from the Gateway International Mobile Equipment Identifier (IMEI) and Mobile Equipment Identifier (MEID).

3. After selecting the carrier, contact them to obtain a SIM card (if applicable) which needs to be activated with an unlimited data plan.

4. When you have the SIM card activated, make sure the unit is turned off and insert it into the cellular modem.

5. After you have completed all the above steps, configure the cellular modem as described in "Configuring the Cellular Modem" on page 108 of Appendix D.

This page intentionally left blank.

Chapter 2: Activating Gateway in the Host Software

This chapter provides information on how to activate the Gateway.

Step One

Log on to the N_SIGHT PLUS server application through your web browser.

Step Two

Determine whether to use an existing Gateway server or add a new one to the N_SIGHT PLUS host software.

If you want to use an existing Gateway server, proceed to "Step Three" on page 11.

To add a new Gateway server to the N_SIGHT PLUS host software, complete the following steps.

1. Click **Settings**. See Figure 6.
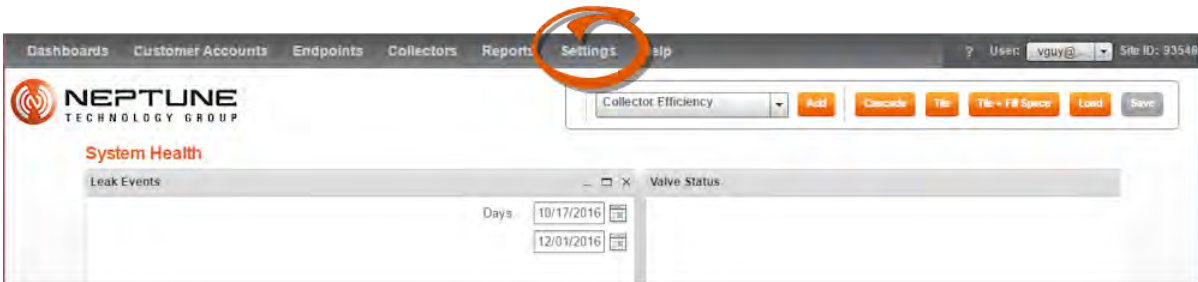
Figure 6 – N_SIGHT Main Menu

2. Click **Table Maintenance** from the drop-down list. See Figure 7.
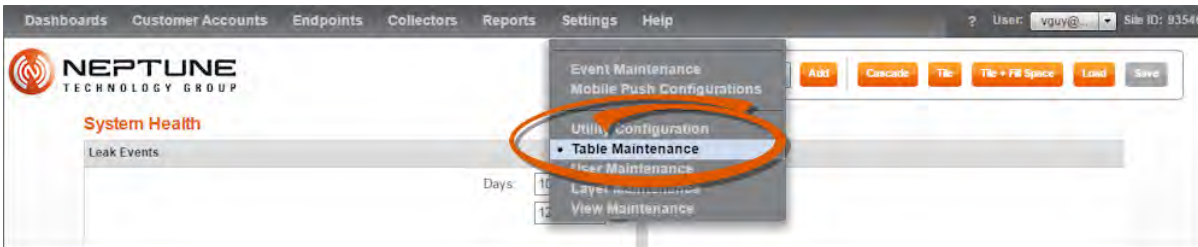
Figure 7 – Settings Menu

3. Select **Gateway Servers** from the Table Maintenance drop-down menu. See Figure 8.
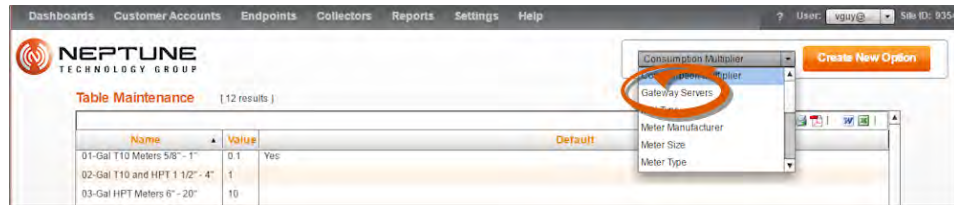
Figure 8 – Table Maintenance Window

The Table Maintenance window appears. See Figure 9.
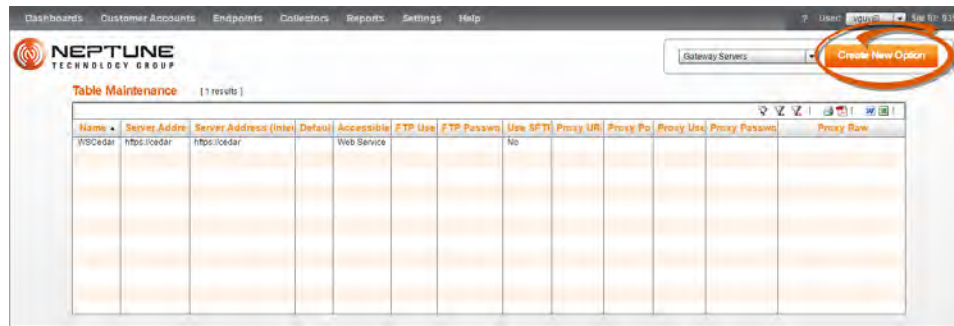
Figure 9 – Gateway Detail Window

4. Click the **Create New Option** button. See Figure 10.

The following dialog appears.

Figure 10 – Table Details

> Although the server needed is already created, complete Step 5 which follows.

5. Complete the required fields of the **Table Details** tab. See Figure 10 – page 10.

Field	Enter
Server Name	Type the server name.
Server Address	Type the Web address. Do not add http:// or https://; the software does that automatically.
Server Address (Internal)	Type the internal Web address, if different from above.
Accessible	Select the Web service.

6. Click **Save & Close**.

Step Three

Create a new Gateway record in N_SIGHT PLUS.

To create a new record, complete the following steps.

1. Click **Collectors** from the N_SIGHT PLUS main menu. See Figure 11.
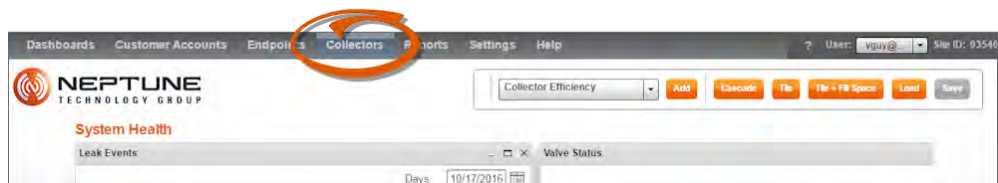
Figure 11 – Collectors Tab

2. Click **Create Collector** from the drop-down menu. See Figure 12.
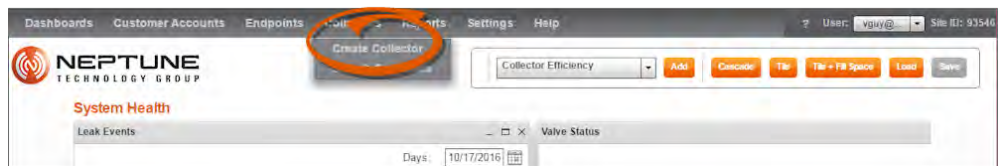
Figure 12 – Create Collector

The following dialog appears.
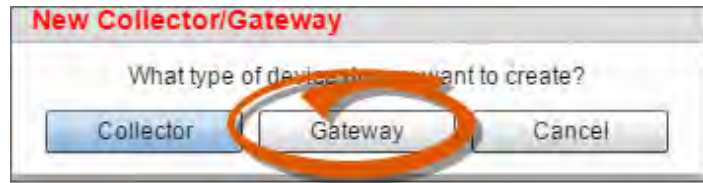
Figure 13 – New Collector/Gateway Dialog

3. Click **Gateway**. See Figure 14.

   The following dialog appears.
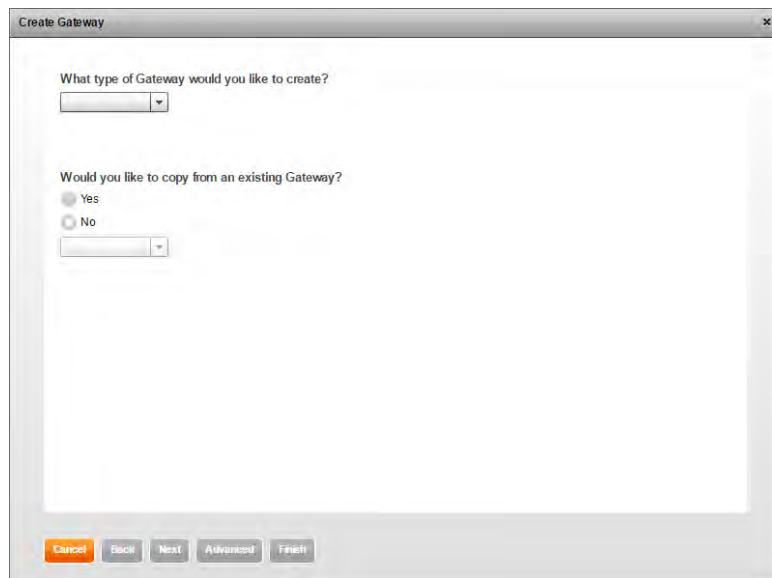
Figure 14 – Collector Type

4. Select **V4** from the drop-down menu. See Figure 15.
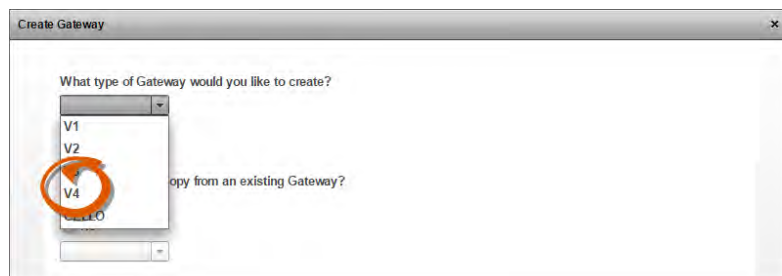
Figure 15 – Select Type

5. Select **Yes** or **No** to copy an existing Gateway. See Figure 16.

Yes	Allows you to select the Gateway to copy configuration settings.
No	Allows you to build a new configuration.
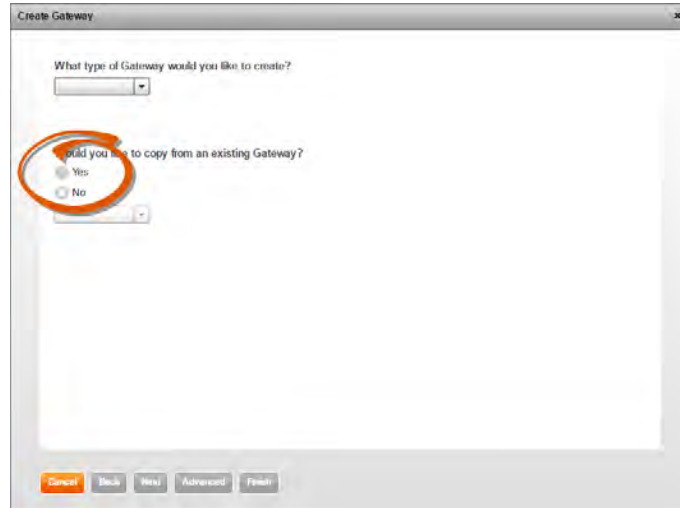
Figure 16 – Copy an Existing Gateway

Basic Information

1. Click **Next** and the following dialog appears.
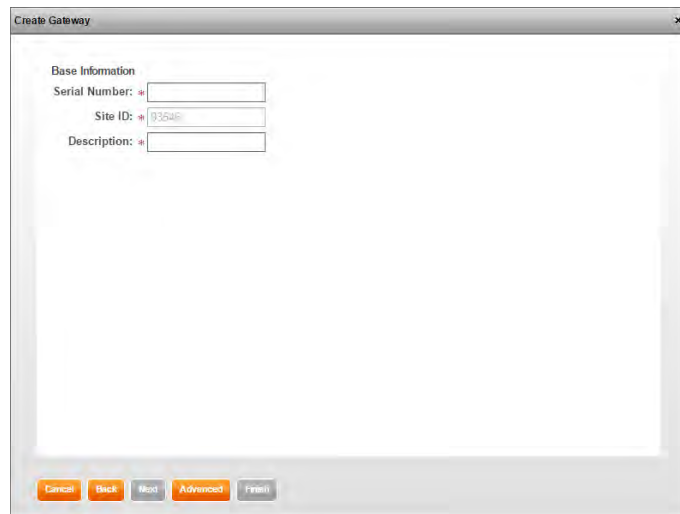
Figure 17 – Basic Information

2. Complete the required fields on the Basic Information dialog. See Figure 17 – page 13.

Field	Enter
Serial Number	Type the serial number from the Gateway (GPV4xxxxx).
Site ID	Completed by the N_SIGHT PLUS host software.
Description	Type reference name for location (5thStTank,WTP1).

Location

1. Click **Next** and the following dialog appears.

Figure 18 – Gateway Location

2. Complete the required fields on the Location dialog box. See Figure 18.

- **Address**
- **City**
- **State**
- **Zip**
- **Lat** (decimal degrees)
- **Long** (decimal degrees)

Static IP

1. Click **Next** and the Static IP dialog appears. See Figure 19.
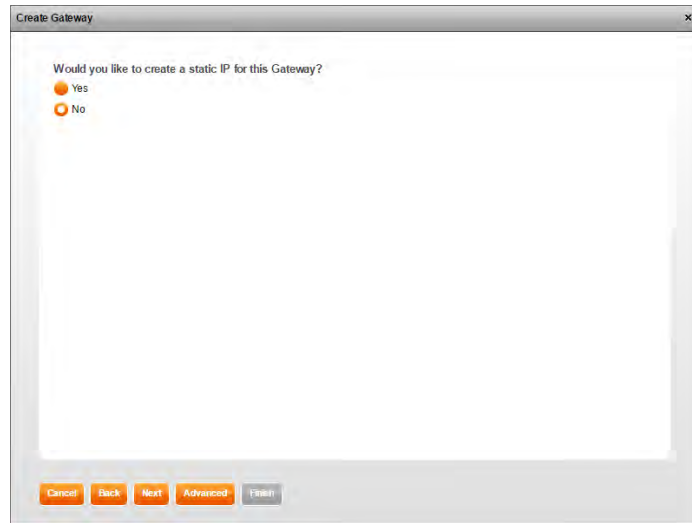
Figure 19 – Static IP Window

2. Select **Yes** or **No**.

   - If **No** is selected, go to "Web Service" on the next page.

   - If **Yes** is selected, click **Next** and the following dialog appears.
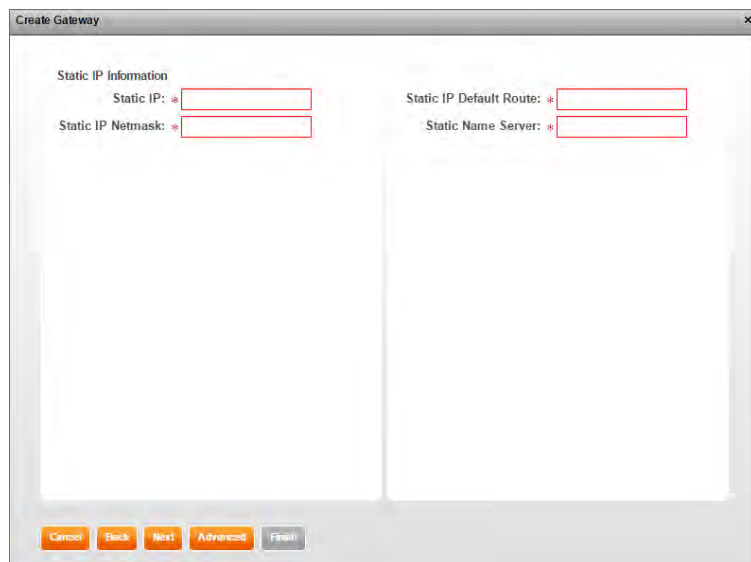
Figure 20 – Static IP Details

3. Complete the required fields on the Static IP Details dialog. See Figure 20 – page 15.

- **Static IP**
- **Static IP Network**
- **Static IP Default Route**
- **Static Name Server**

Web Service

1. Click **Next** and the following dialog box appears.
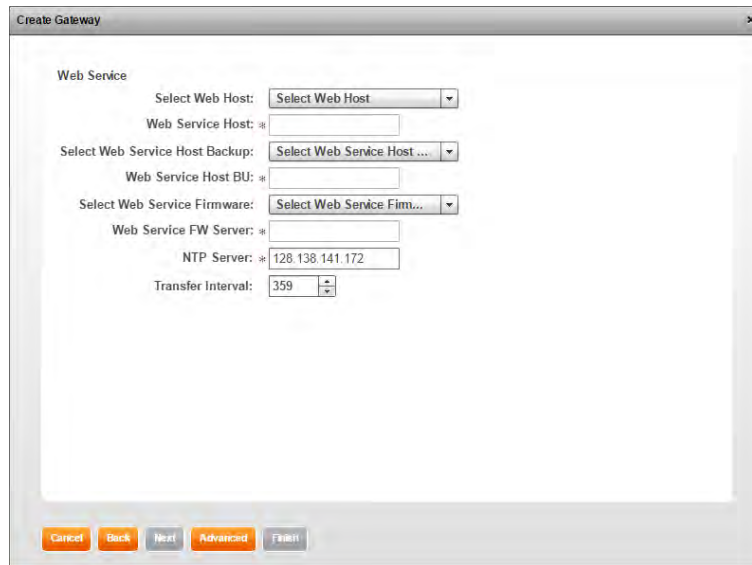
Figure 21 – Web Service

2. Select an option from the drop-down list for each of the following fields.

Field	Option
Select Web Host	Select Web server name.
Select Web Service Host Backup	Select Web server name.
Select Web Service Firmware	Select same Web server.
Network Time Protocol (NTP) Server	Provide NTP server Web address. It can be a public NTP (ex: time.nist.gov) or a Neptune NTP.
Transfer Interval	Set to minutes between uploads (default: 359) six hours.

Read Reporting

1. Click **Next** and the following dialog appears.

Figure 22 – Read Reporting

2. Leave all values set to zero.

Command Polling

1. Click **Next** and the following dialog appears.

Figure 23 – Command Polling

2. Leave all values set to zero.

Process Configuration

1. Click **Next** and the following dialog appears.
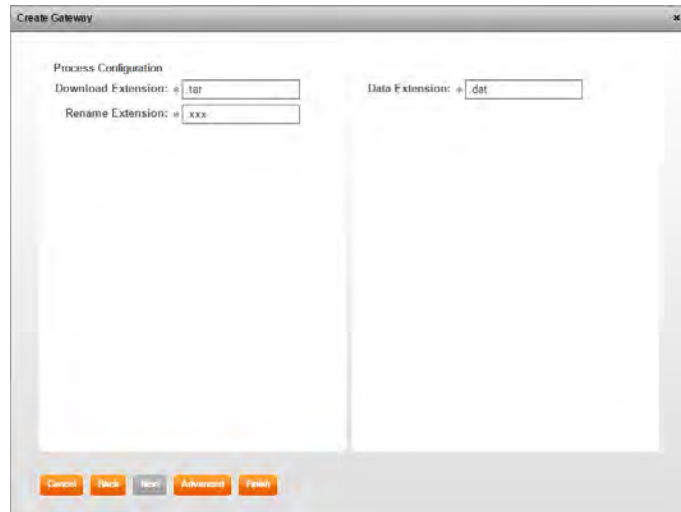
Figure 24 – Process Configuration

2. Verify that the fields have the following default values.

- **Download Extension** - .tar
- **Rename Extension** - .xxx
- **Data Extension** - .dat

Advanced Options

1. Click **Next** and the following dialog appears.
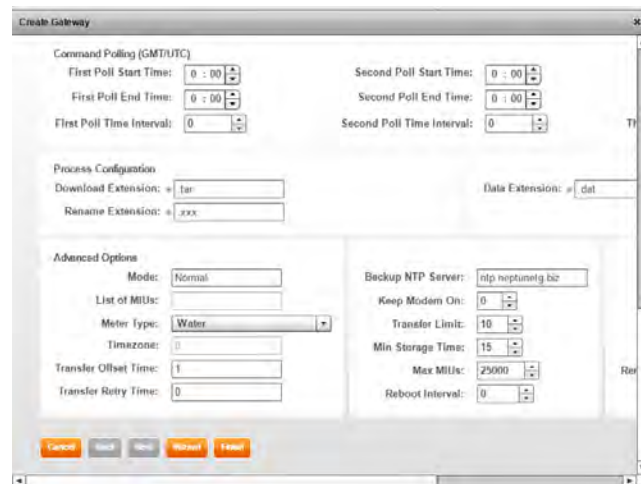
Figure 25 – Advanced Options

2. Scroll through the dialog until you see the **Advanced Options**.

3. Select the meter type from a drop-down list next to the **Meter Type** field.

4. Select **1** for the value for the **Keep Modem On** field.

5. Select **25000** as the value for the **Max MIUs** field.

6. Click **Finish** and the Gateway is created.

The Collectors Search window appears. See Figure 26.

> If the **Finish** button is not active, some of the fields could be invalid.

Figure 26 – Collectors Search Window

Chapter 2: Activating Gateway in the Host Software

Step Four

Transfer the configuration file to a USB drive.

1. Select the Gateway that was created.

2. Click **Build USB** and the following dialog appears.

Figure 27 – Save USB Build

3. Click **OK**.

   The R900_Configcfg file is transferred to a USB flash drive..

Step Five

Activate the Gateway in the field.

1. Install the Gateway and power source (UPS or Solar). See "Installation of the Gateway" on page 29 and "Solar Power Information" on page 77 in Appendix A.

2. Open the Gateway.

> (i) If cellular modem activation is required, see "Cellular and Ethernet Considerations" on page 107.

3. Insert the USB flash drive into the USB port on the Gateway until the light turns green.

4. Remove the USB flash drive.

   The Gateway reboots and is configured.

5. Press the **Test Report** button on the top right to send data to the server.

20   R900 Gateway Installation and Maintenance Guide

Chapter 3: General Installation Information

Use the information in this chapter to ensure that you are properly prepared for installing Gateway units according to the guidelines provided in this guide.

Preparation

This section describes the necessary procedures to prepare for the installation of new Gateway units, and must be completed before hardware installation occurs. Verify that all of the items in the following checklist are installed and working as designed. This provides a quick and easy implementation when the hardware is ready to be installed. This checklist includes the following.

✓	N_SIGHT PLUS host server.
✓	Firewall ports and IP addresses opened.
✓	User name and password for N_SIGHT PLUS (admin or supervisor level log on credential).
✓	Gateway configuration file folders uploaded to an USB flash drive.
✓	Timeout.
✓	Provisioned modems or SIM cards (obtained from cellular provider, if required) including modem setup instructions.

Gateway Specifications

This section describes the specifications for the Gateway including the following.

- Storage

- Unpacking instructions

- Tools and materials

- Safety and preliminary checks

Electrical Specifications

DC Power (solar or UPS)	12 VDC 0.46 A nominal (1 A peak)
Power Consumption	5.6 W nominal (12 W peak)

Environmental Conditions

Operating Temperature	-22° to 140° (-30° to 60°C)
Storage Temperature	-40° to 185° (-40° to 85°C)
Operating Humidity	0 to 95%
Environmental Rating	NEMA 4X Enclosure

Mechanical Specifications

Maximum Weight	19 lbs. (8.61 kg), with mounting bracket
Dimensions	9.0 W x 13.0 H x 7.5 in. D (22.8 x 33 x 19 cm)

Gateway Stands

Manufacturer	ROHN
Dimensions	5 x 5 ft. square (1.5 x 1.5 m)
Height	10 ft. (304.8 cm)
Pole Diameter	2.375 in (72.4 cm)
Weight (excluding ballast)	50 lbs. (22.6 kg)

UPS Specifications

Manufacturer	TSI Power
Part No.	OUTDOOR-DC-UPS-8009 w/option BH-5
AC Input	120V 60Hz (100 - 140 VAC range)
Output	12 VDC
Dimensions	10.0 W x 12.0 H x 6.0 in. D (25.4 x 30.5 x 15.2 cm)
Weight	30 lbs. (14kg)
Mounting	Pole or wall mountable
Safety	ELT listed (US & Canada)

Solar Power System Specifications

This section provides a description of the system specifications for solar power.

Solar Panel

Two solar panel options are available for the Gateway, depending on the zone of the installation site.

- "150 W Option" below

- "220 W Option" on the next page

To determine which option to use, see Table 13 on page 80.

150 W Option

Rate Power	150 W
Rated Voltage (Vmp)	18.1V
Rated Current (Imp)	8.3 A
Open Circuit Voltage (Voc)	22.2V
Short Circuit Voltage (Isc)	8.5 A
Dimensions	26.0 x 58.0 in. (66 x 147.3 cm)
Weight	25.4 lbs. (11.5 kg)
Mounting	Pole mount: 2.0 to 16.0 in. diameter (5.08 to 40.64 cm)

220 W Option

Rated Power	220 W
Rated Voltage (Vmp)	17.4 V
Rated Current (Impt)	12.6 A
Open Circuit Voltage (Voc)	22.0 V
Short Circuit Current (Isc)	13.2 A
Dimensions	52.0 x 48.0 in. (132 x 121.9 cm)
Weight	42.8 lbs. (19.4 kg)
Mounting	Pole mount: 2.0 to 16.0 in. diameter (5.08 to 40.64 cm)

Battery Enclosure

Dimensions	20.8 H x 16.0 W x 9.4 in. D (52.8 x 40.6 x 23.8 cm)
Weight	23 lbs. (10.4 kg)
Mounting	Pole mount: 2.0 to 16.0 in. diameter (5.08 to 40.64 cm)

Battery

Manufacturer	Sun Xtender
Part No.	PVX-1040T
Battery Type	Sealed Lead Acid, AGM, maintenance free
Voltage	12 V
Nominal Capacity	104 Ah (C/24 rate)
Dimensions	12.0 L x 6.6 W x 8.93 H (30.5 x 16.8 x 22.7 cm)
Weight	66 lbs. (30 kg)

RF Antenna Specifications

Manufacturer	PCTEL
Part No.	MFB9155NF
Center Frequency (factory tuned)	916 MHz
Frequency Range	902-928 MHz
Gain	5 dB
Normal Impedance	50 ohms
Bandwidth @ 1.51 Voltage Standing Wave Ratio (VSWR)	20 MHz
Vertical Beam Width @ 1/2 Power	22°
Maximum Power	150 watts
Height	48.0 in.
Weight	1.75 lbs.
Radome Material	1.0 in. Outer Diameter (OD pultruded white fiberglass
Radiator Material	Coated steel wire
ESD Protection	DC grounded
Wind Survival	100 mph
Bending Moment at Rated Wind	14.2 ft.-lbs.
Lateral Thrust at Rated Wind	8.0 lbs.
Equivalent Flat Plate Area	.22 sq ft.
Termination	N Female
Mounting Base Diameter	1.3125 (5/16) in.
Mounting Method	Mast or wall mounted
Mounting Hardware	MMK4 heavy duty mast mount (sold separately). Optional wall mounting kit (Neptune Part No. 13145-000)

Storage

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

After completing the inspection, store the cartons in a clean, dry environment. The temperature of the unit should remain between -40° and 185°F (-40° and 85°C). Keep in mind that the Gateway solar unit has an external battery. Storage for more than one year affects product life.

Unpacking

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

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

Tools and Materials

Table 4 shows the recommended tools and materials you need to successfully install the Gateway or to replace the internal battery.

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

Table 4 – Recommended Tools and Materials

Item	Description/Recommendation	Use
Took Kit	Contains standard tools including: • Assorted screwdrivers (medium, flat head, Phillips) • Cordless electric drill / assorted bits • Crescent wrench • Standard socket wrench set • Compass • Protractor or Johnson Magnetic Angle Locator (Mode: 700)	Various installation procedures performed by the installer

Table 4 – Recommended Tools and Materials - Continued

Item	Description/Recommendation	Use
	• Hammer • Channel locks • T27 Torx Pin-Head Tool (Wiha Part No. 36283)	
Ultraviolet (UV) - stable cable ties	8 in. and 12 in. (20 cm and 30 cm)	Securing coax cable
Coax ground kits	See Figure 28 – page 28	
Coax hoisting grips	See Figure 29 – page 28	
Cable clips	Various sizes	Securing coax cable
Concrete Blocks	8 x 8 x 12 in. (20 x 20 x 30 cm)	Ballast for the Gateway stand
Weatherizing Kit	Times Microwave Part No. WK-S-2, or PolyPhasor Part No. WK-1, or Scotch Part No. WK-101	Weatherizing coax cable connections
Additional Materials	3M Super 88 black electrical tape	Weatherizing coax cable connections
Corrosion inhibitor	NOCO Company's NCP-2 or Sanchem Inc.'s No-OxID Grease "A"	Apply to battery terminals for corrosion protection
American Wire Gage (AWG)	Copper wire with a minimum temperature rating of 75° C	#4 or #6

The following images are examples of the coax ground kit and coax hoisting grips.
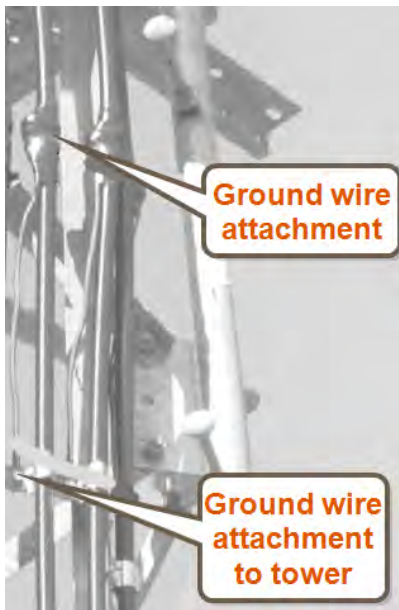
Figure 28 – Coax Ground Kit
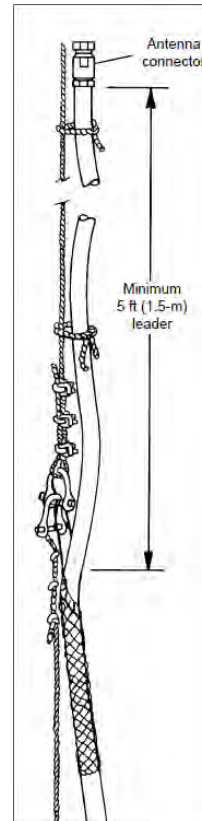
Figure 29 – Coax Hoisting Grips

Safety and Preliminary Checks

Always follow your company's safety practices and installation guidelines when installing your Gateway unit. Never perform an installation during a lightning storm or under excessively wet conditions. Use only approved climbing equipment.

Chapter 4: Installation of the Gateway

This chapter contains sections detailing the installation instructions for the Gateway installation options.

- "Mounting RF Antenna to a Pole or Stand" below

- "Mounting the Battery Box" on page 32

- "Attaching the Solar Panel" on page 34

- "Mounting the Gateway - Solar Configuration" on page 32

- "Installing the Gateway Large Pole Mount System" on page 44

- "Installing a Large Pole Mount System" on page 44

- "Installation Troubleshooting" on page 70

Mounting RF Antenna to a Pole or Stand

If mounting a 2-inch round, SCH40, galvanized steel pole, seat the pole according to the recommendations from the solar-powered system's installation guide. In general, the pole used to support the solar panel must be designed for the local soil conditions, and meet the following minimum requirements.

- The solar panel area based at tilted angle.

- The typical sustained wind speed according to the recommended local building code.

- The pole must be seated against a firm, crushed-stone base.

- The pole must be on firm, compacted soil a minimum of 6 inches below the frost line.

- The pole must be encased in reinforced concrete per ASTM standards.

- The pole must be level and plumb.

- The pole diameter and wall thickness must be seized to withstand solar panel forces without damage.

Mounting the RF Antenna

To mount the RF antenna to a pole or a stand, complete the steps which follow. For more information go to "RF Antenna and Coax Installation" on page 101.

1. Assemble the stand in accordance with the manufacturer's instructions.

2. Attach the antenna mounting brackets to the pole. See Figure 30.

Figure 30 – Mounting Brackets

3. Attach the coax cable to the RF antenna. See Figure 31.

Figure 31 – Attaching Coax Cable

Verify that the coax cable type is correct for the run length. See "Coaxial Cable Lengths for the Gateway" on page 103 in Appendix C.

Do not hoist the antenna while it is attached to the coax cable. Doing so may damage the antenna connector. Attach the coax cable after the antenna is hoisted and mounted.

Figure 32 – Weatherizing RF Antenna

4. Weatherize the RF antenna connection using the weatherizing kit specified in Table 4 on page 26. See Figure 32.

Figure 33 – Using Mounting Brackets
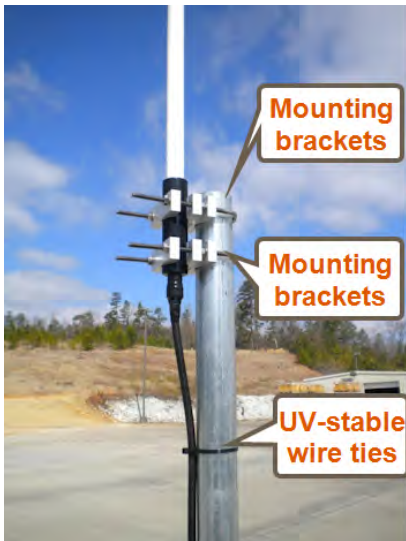
5. Mount the RF antenna pole using antenna mounting brackets. See Figure 33

6. Secure the coaxial cable every 2 feet along the pole using UV-stable wire ties. See Figure 33.

Secure larger 1/2-inch and 7/8-inch diameter coax cable according to the manufacturer's recommendations.

Mounting the Gateway - Solar Configuration

This section provides instructions for mounting the Gateway with a solar configuration.

Mounting the Battery Box

> (i) Before installing a solar-powered unit, choose a non-shaded location that faces true south. Determine true south by using a magnetic compass corrected for magnetic declination. Refer to "Facing True South" on page 77 of Appendix A.

The following instructions are for the installation of the battery box needed for the solar panel of a Gateway solar-powered system. If you are installing an AC-powered system, skip this step.

To mount the battery box, complete the following steps.

1. Install the brackets onto the pole using the U-bolts provided. Be sure the U-bolts are spaced 12.75 inches (32.39 cm) apart and face the brackets true south. See Figure 34.

Figure 34 – Installing Pole Brackets
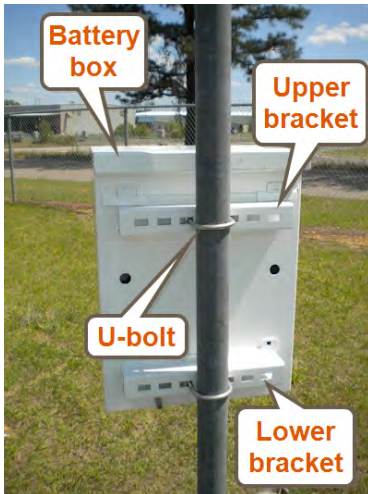
Figure 35 – Battery Box Installed

2. Hang the battery box without batteries on the upper mounting bracket. See Figure 35.

3. Attach the lower bracket to the battery box using the 5/16-inch carriage bolts.

4. Tighten bolts using a 1/2-inch wrench to 10-12 ft.lbs. torque.

5. Check alignment of all assembled parts and tighten all bolted connections.

For more detailed instructions, see *SunWize* ® *Installation, Operation, and Maintenance Manual*. (Part Number: PM296038)
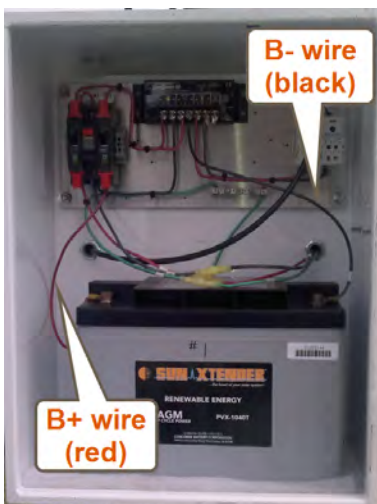
Figure 36 – Battery and Wiring

6. Install the battery in the battery box leaving ventilation areas free of blockage.

7. Connect the B+ wire to the positive battery terminal. Connect the B- wire to the negative battery terminal. See Figure 36.

8. Remove the two knockouts in the back of the battery box by tapping them with a flathead screwdriver and a hammer. See Figure 35.

Apply corrosion inhibitor, for example NOCO Company's NCP-2 (Non Corrosion Product) or Sanchem Inc.'s No-OX ID Grease "A", to the battery terminals.

Attaching the Solar Panel

Figure 37 – Gateway Solar Panel

The solar panel is mounted to the Gateway stand or to a pole. See Figure 37. This panel allows the Gateway to operate using energy generated by the sun.

The solar panel comes with mounting brackets already attached, and is pre-terminated with 15 feet (#10 AWG) wire in flexible non-metallic conduit.

Figure 38 – Solar Panel Attached

To mount the solar panel, complete the following steps.

1. Install the solar panel on the pole immediately above the battery box so that the mounting height clears any shadowing or partial obstruction to the cellular antenna.

2. Position the solar panel so that it faces true south. See "Facing True South" on page 77.

3. Attach the solar panel to the pole using the U-bolts or bands provided. See Figure 38.

See "Solar Power Information" on page 77 of Appendix A for more information.
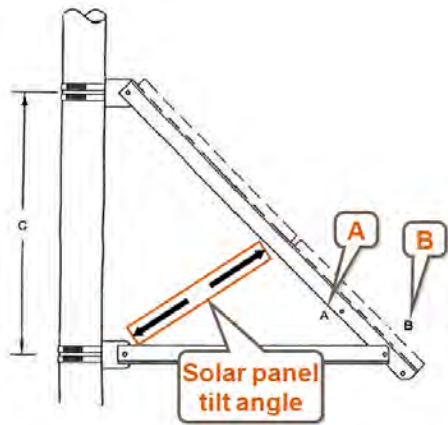
Figure 39 – Solar Panel Tilt Angle

4. Use a protractor or angle locator to set the angle of the solar panel tilt angle based on latitude. For latitude range between 25° and 60°, set solar panel tilt angle for latitude plus 15°.

- Use solar panel hole "A" for 25° -40° tilt.
- Use solar panel hole "B" for 41° -60° tilt.

> You can find the latitude of your location by using a map, mapping software, or a Global Positioning System (GPS) device. It is recommended that the solar panel tilt be limited to 15° minimum angle and 60° for maximum tilt angle. See "Specific Tilt Angle" on page 78 of Appendix A.

5. Tighten all the nuts and bolts.

> Consider the following:
>
> - In areas with potential for strong winds, add a bolt through the bracket and pole to secure the panel from rotation over time.
>
> - The pole/wall mounting bracket is included with the Gateway. Contact your Neptune sales representative to order the stainless steel clamps for mounting the Gateway to a pole.

To mount the Gateway to a pole or stand, complete the following steps.

Figure 40 – Mounting Bracket

1. Position the Gateway so that the top of the box is approximately level with the battery box. See Figure 40.

Figure 41 – Positioning the Gateway

2. Attach the Gateway to the pole using two stainless steel clamps. See Figure 41.

Wiring the Solar Panel

Connect the solar panel to the battery box by completing the following steps.
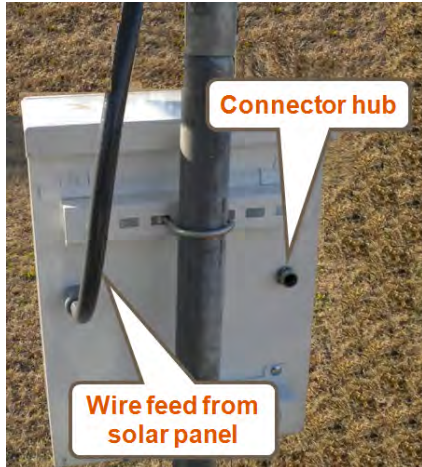
Figure 42 – Back of Battery Box

1. Feed the flexible conduit wiring from the solar panel to the back of the battery box. See Figure 42.

2. Connect the green ground (GND) solar panel to the green GND lead in the battery box.

3. Connect the red Photovoltaic (PV) (+) solar panel positive lead to the red PV (+) wire in the battery box.

4. Connect the black PV (-) solar panel negative lead to the black PV (-) wire in the battery box.

Wiring the Battery Box

Connect the Gateway to the battery box by completing the following steps.

> The following instructions are for wiring the battery box for the solar panel of a Gateway solar-powered system. If you are installing an AC-powered system, skip this procedure.
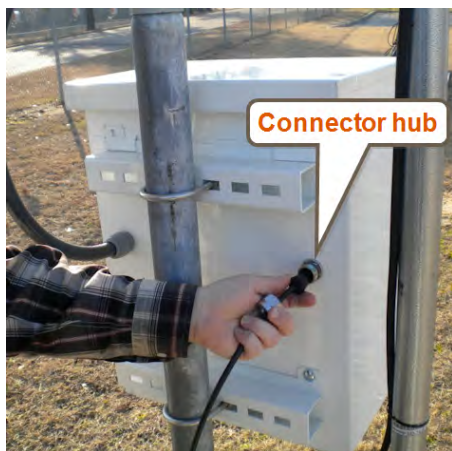
Figure 43 – Feeding Conductor Wire

1. Attach the connector hub to the back of the battery box. See Figure 43.
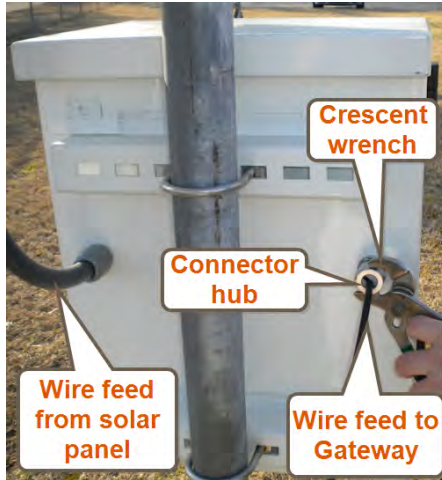
Figure 44 – Connector Hub

2. Insert the DC power cable through the connector hub.

3. Tighten the connector hub using a crescent wrench to secure the cable. See Figure 44.

> ⓘ Insert enough cable so that it can be terminated to the load terminals inside the battery box. See Figure 45.

Figure 45 – Battery Box Wires

4. Strip 1/2 inch of the insulation from both the red and black wires.

5. Attach the **red** (+) wire to the **load** (+) terminal inside the battery box.

6. Attach the **black** (-) wire to the **load** (-) terminal inside the battery box. See Figure 45.

Wiring the Gateway

Connect the wiring in the Gateway as described in this section.

Connecting the Ground Wire

Attach the ground wire by completing the following steps.

Figure 46 – Ground Wire

1. Locate the lightning protection system ground wire for the site.

2. Connect the external ground lug of the Gateway to the lightning protection system ground wire for that site. See Figure 46. Use #4 or #6 AWG copper wire with a minimum temperature rating of 74°C.

3. Tighten with a flathead screwdriver. Torque to 35 in-lb. (4.0 Nm).

Attaching the RF Antenna Cable

Complete the following instructions to attach the RF antenna cable.

Figure 47 – RF Antenna Cable

1. Locate the RF antenna cable that extends from the RF antenna.

2. Connect the RF antenna cable to the RF antenna connector located on the bottom of the Gateway, as shown in Figure 47.

3. Tighten the coaxial connector to 14 in-lbs. (1.58 Nm).

4. Weatherize the RF antenna connection using the weatherization kit. Refer to "Recommended Tools and Materials" on page 26.

Attaching the Power Cable

Figure 48 – Power Cable

Attach the power plug to the Gateway by pushing and rotating the circular power connector clockwise to engage it.

Do not weatherize the power connection. The power connector is IP68-rated and does not require weatherization wrap.

The protective cover (CONEC P/N: 17-10002) should always cover the Ethernet port when the port is not in use. See Figure 48.

Securing the Gateway

Secure the Gateway cover with the tamper-resistant T27 Torx Pin-Head tool.

Applying the Ballast to the Stand

Install a roof pad between the stand and rooftop to protect the roof. See "Ballast Requirements" on page 99 of Appendix B.

Apply ballast according to applicable local code requirements. The installation must meet all applicable local, state, and federal requirements.

The stand and antenna mast must be grounded according to applicable NEC, CEC, and local codes. Refer to NEC Article 810 and CEC Section 54.

After the Gateway is wired, the next stage is to apply the ballast material (for example, concrete blocks). To apply the ballast to the stand, complete the following steps.
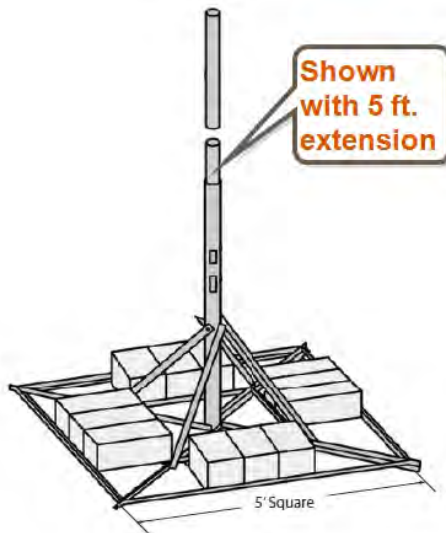
Figure 49 – Concrete Block Ballast

1. Refer to "Ballast Requirements" on page 99 in Appendix B to determine the adequate amount of ballast for your installation.

2. Evenly distribute the ballast material as illustrated in Figure 49.

3. Secure the stand and ballast material in accordance with local code requirements.

Activating the Gateway System

After you have all the kit items in place, attached, and mounted, you can activate the Gateway. To activate the Gateway, complete the following steps.
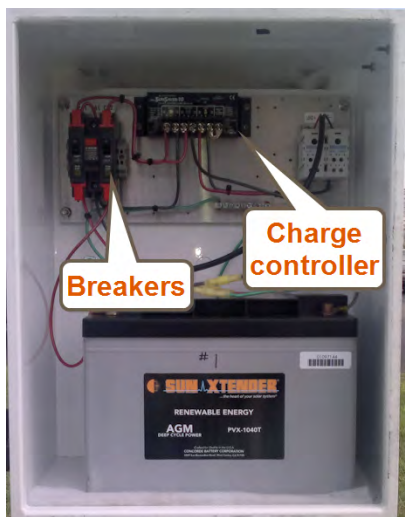
Figure 50 – Activating the Battery

1. Open the door of the battery box.

2. Turn the two breakers to the **ON** position.

3. Verify that the **CHARGING LED** on the charge controller is lit. See "Solar Power Information" on page 77 of Appendix A.

4. Close the battery box with the locking key.

   This should activate both the battery box and the Gateway system.

Figure 51 – Gateway Cover Screws

5. Open the Gateway.

6. Watch for LED activity. See "Installation Troubleshooting" on page 70 for definitions and status indications of LED lights.

   There is approximately a three-minute delay before the Gateway becomes fully functional.

Gateway screws should be loosened and tightened in a specific pattern:

- Loosen the left screws first, then the right.
- Tighten the right screws first, then the left.

Configuring the Cellular Modem

See "Configuring the Cellular Modem" on page 108 of Appendix D.

Before you begin, you need an active cellular account with the carrier of your choice.

Configuring the Gateway

The Gateway can be configured by either using a USB flash drive or the N_SIGHT PLUS host software, as delineated in Table 5.

Table 5 – Determining the Configuration Options

If you have ...	Use this configuration option ...
No internet access from the installation site prior to installing the Gateway.	Configure the Gateway with a USB flash drive. See the following section.
Internet access is readily available at the installation site prior to installing the Gateway.	Configure the Gateway by means of web services.

Configuring the Gateway with the USB Flash Drive

To use a USB flash drive for configuring the Gateway, complete the following steps.

1. Configure a USB flash drive using the N_SIGHT PLUS host software.

2. Verify that the Gateway is powered up.

3. Insert the configured USB flash drive into the Gateway's USB port.

4. Observe LEDs D500 and D501, which should begin to alternate flashing red.

5. When both D500 and D501 begin flashing green, it is safe to remove the USB flash drive from the Gateway.

6. After removing the USB Flash drive, the Gateway reboots. Allow the Gateway approximately three minutes to complete the boot-up sequence.

7. LED D501 (BF MIU Activity) should begin flashing green to indicate that the Gateway has finished booting up and is receiving MIU readings. However, in areas where the MIU density is high, this green light may remain on constantly to indicate a high volume of MIU RF traffic. Refer to Figure 93 – page 72.

Securing the Gateway

Secure the Gateway cover with the tamper-resistant T27 Torx Pin-Head tool.

Installing a Large Pole Mount System

This section provides the steps (see Table 6) to mount the Gateway system to a large pole.

The instructions to mount the Gateway system to a large pole are very similar to the instructions for installing a stand system.

- Please refer to "Mounting the Gateway to a Large Pole" on page 46.

- Please note that information bullets, such as these, are included in each section for special considerations added for the large pole installation.

To assemble and install the pole mount system, complete the instructions contained in the following sections of this manual.

Table 6 – Installing the Gateway Large Pole Mount System

Complete	Steps for…
1	"Mounting the RF antenna to a Large Pole" on the facing page
2	"Mounting the Gateway to a Large Pole" on page 46
3	"Mounting the Battery Box to a Large Pole" on page 47
4	"Mounting the Solar Panel to a Large Pole" on page 49

Mounting the RF antenna to a Large Pole

Mount the RF antenna to a 5-inch to 16-inch (12.7 to 40.65 cm) diameter pole by completing the following steps.

1. Mount the RF antenna bracket to the large pole using the two stainless steel Snaplock clamps. See Figure 52.
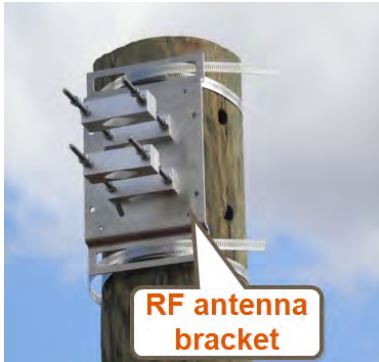
Figure 52 – Large Pole Bracket

2. Mount the RF antenna to the bracket. See Figure 53.

Figure 53 – RF Antenna Bracket

> **Do not hoist the antenna while it is attached to the coax cable. Doing so may damage the antenna connector. Always hoist the coax cable and antenna separately. Attach the coax cable after the antenna is hoisted and mounted.**

Figure 54 – Coax Cable Attached

3. Attach the coax cable to the base of the RF antenna. See Figure 54.

> Verify that the coax cable type is correct for the run length. See "Coaxial Cable Lengths for the Gateway" on page 103.

Figure 55 – Weatherized Connection

4. Weatherize the RF antenna connection using the weatherization kit. Refer to "Recommended Tools and Materials" on page 26.

5. Secure the coax cable approximately every 3 feet.

Mounting the Gateway to a Large Pole

Mount the Gateway to a 5-inch to 16-inch diameter pole by completing the following steps. See "Solar Power Information" on page 77.

Figure 56 – Gateway Pole Hardware

1. Mount the Gateway to pole using two stainless steel clamps. See Figure 56.

The pole/wall mounting bracket is included with the Gateway. Contact your Neptune sales representative to order the stainless steel clamps for mounting the Gateway to a pole.

Figure 57 – Slot on Mounting Bracket

2. Insert the clamps through the slots on the mounting bracket. See Figure 57.

Mounting the Battery Box to a Large Pole

Mount the battery box to a 5-inch to 16-inch (12.7 to 40.64 cm) diameter pole by completing the following steps.

Figure 58 – Battery Box Clamps

1. Open the battery box, and make sure the breakers are in the OFF position. See Figure 36 – page 33.

2. Mount the battery box to a large pole. However, use the stainless steel clamps as shown in Figure 58.

Figure 59 – Pole Hardware

3. Install the brackets onto the pole using stainless steel clamps. Be sure that the brackets are spaced 12.75 inches (32.39 cm) apart. See Figure 59.

4. Lift the battery box then lower it so that the flange on the top rear of the box slides over the flange of the top bracket and locks in place.

   The square holes in the bottom bracket now line up with the holes in the bottom rear of the enclosure.

Figure 60 – Mounted Battery Box

5. Secure the box to the bottom bracket using the 5/16-inch carriage bolts.

6. Center the battery in the battery box leaving ventilation areas free of blockage.

7. Close the door of the battery box with the locking key.

Prior to installing a solar unit, choose a non-shaded location that faces true south. Determine true south by using a magnetic compass corrected for magnetic declination. See "Facing True South" on page 77 of Appendix A.

Mounting the Solar Panel to a Large Pole

Mount the solar panel to a 5-inch to 16-inch (12.7 cm to 40.64 cm) diameter pole by completing the following steps. See "Solar Power Information" on page 77.

Figure 61 – Mounted Solar Panel

1. Attach the solar panel to the large pole using stainless steel clamps.

2. Install the solar panel so that it faces true south.

3. Set the solar panel tilt angle based on latitude. See Figure 61.
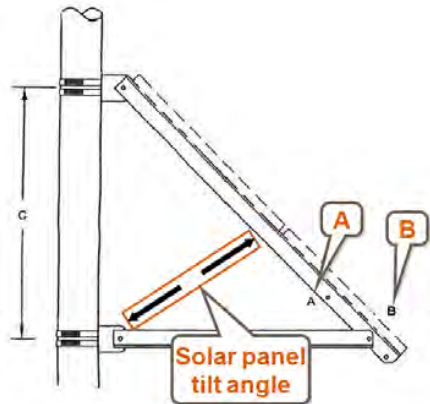
Figure 62 – Adjust Tilt Angle

4. Adjust the solar panel mounting bracket to obtain the proper tilt angle. See Figure 62. Refer to "Specific Tilt Angle" on page 78 in Appendix A.

   - Use solar panel hole "A" for 25° -40° tilt.
   - Use solar panel hole "B" for 41° -60° tilt.

Attaching Cables for the Gateway

The corresponding sections detail how to attach the following components.

- "Attach Ground Wire" on the next page
- "Attaching the RF Antenna Cable" on the next page
- "Attaching the Power Cable" on page 51

Attaching Ground Wire

Figure 63 – Attach Ground Wire

Attach the ground wire by completing the following steps.

1. Locate the lightning protection system ground connection for the site.

2. Connect the external grounding lug of the Gateway to the lightning protection system for that site. See Figure 63. Use #4 or #6 AWG.

3. Tighten with a flathead screw driver. Torque to 35 in-lbs (40 Nm).

Attaching the RF Antenna Cable

Figure 64 – RF Antenna Cable

Complete the following instructions to attach the RF antenna cable.

1. Locate the RF antenna cable that extends from the RF antenna.

2. Connect the RF antenna cable to the RF antenna connector located on the bottom of the Gateway. See Figure 64.

3. Tighten the coaxial connector to 14 in-lb (1.5 Nm).

> **Special consideration should be given when the Gateway is installed inside a building.**
>
> **The screen (shield) of the coaxial cable must be connected to 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 RF Antenna Connection

Complete the following instructions to weatherproof the RF antenna.

Figure 65 – Weatherized RF Port

1. Weatherize the RF antenna port connection using the weatherizing kit, as described in "Recommended Tools and Materials" on page 26.

2. Start the tape at the top of the RF antenna connection.

3. Wrap the tape around the connection several times and slowly work your way downward to weatherize the RF antenna connection. Be sure to overlap the tape at least 1/4 inch (0.635 cm).

4. When complete, the weatherized port should resemble Figure 65.

Connecting Power to the Gateway

This section covers connecting power to the Gateway.

Attaching the Power Cable

Figure 66 – Power Cable

Attach the power plug to the Gateway by pushing and rotating the circular power connector clockwise to engage it. See Figure 66.

> Do not weatherize the power connection. The power connector is IP68-rated and does not require weatherization wrap.

> The protective cover (CONEC P/N: 17-10002) included with the unit should always cover the Ethernet port when the port is not in use.

Configuring the Cellular Modem

See "Configuring the Cellular Modem" on page 108 of Appendix D.

Configuring the Gateway

The Gateway can be configured by either using a USB flash drive or the N_SIGHT PLUS host software, as delineated in Table 7.

Table 7 — Determining the Configuration Options

If you have ...	Use this configuration option ...
No internet access from the installation site prior to installing the Gateway.	Configure the Gateway with a USB flash drive. See the following section.
Internet access is readily available at the installation site prior to installing the Gateway.	Configure the Gateway by means of web services.

Configuring the Gateway with the USB Flash Drive

To use a USB flash drive for configuring the Gateway, complete the following steps.

1. Configure a USB flash drive using the N_SIGHT PLUS host software.

   Refer to "Building a USB Drive for Collector Configuration" in the Collectors topic of the N_SIGHT PLUS Help.

2. Verify the Gateway is powered up.

3. Insert the configured USB flash drive into the Gateway's USB port.

4. Observe LEDs D500 and D501, which begin to alternate flashing red.

5. When both D500 and D501 begin flashing green, it is safe to remove the USB flash drive from the Gateway.

6. After removing the USB flash drive, the Gateway reboots. Allow the Gateway approximately three minutes to complete the boot sequence.

7. LED D501 (BF MIU Activity) begins flashing green to indicate that the Gateway has finished booting and is receiving MIU readings. However, in areas where the MIU density is high, the green light can remain on constantly to indicate a high volume of MIU RF traffic.

Installing the UPS to a Large Pole

This section provides instructions on how to install the UPS to a large pole.

Attach the UPS to a large pole using the two stainless steel clamps. See Figure 67 and Figure 68.

Figure 67 – UPS Attached to a Large Pole

Figure 68 – UPS Attached with Clamps

The UPS is rated for indoor and outdoor use.

Connecting Power to the UPS

This section contains the instructions for connecting the UPS to the Gateway. The UPS requires 120 VAC on the input and provides 12 VDC output to the Gateway.

Connect the UPS according to the manufacturer's instructions. Install the UPS only in a well-ventilated area that is free from explosive or corrosive gases, vapor, or excessive dust, dirt, and moisture. Ensure a free flow of air around the UPS.

Wiring the AC-Power for the UPS and Gateway must be done by a licensed electrician. Install in accordance with the National Electrical Code, Canadian Electrical Code, and local electrical codes.

The integrity of the protective earthing should be ensured when installed.

The AC input to the UPS must have a readily accessible disconnect device installed.
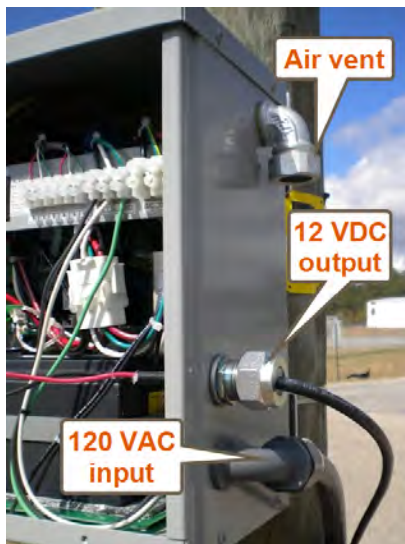
Figure 69 – Inside of the UPS

1. Remove the two cover screws from the UPS cover, and then remove the cover. See Figure 69.

2. Wire the 120 VAC input through the lower 1/2 inch (12 mm) diameter knockout hole.

3. Wire the 12 VDC output through the upper 1/2 inch (12 mm) diameter knockout hole. See Figure 69.

4. Attach the circular power connector (12 VDC) to the Gateway by pushing and rotating the connector clockwise to engage it.

5. Turn on the power switch inside the UPS to activate the system. See Figure 77 – page 58. Also see "Checking UPS Status LEDs" on page 70.

6. Install the cover on the UPS and secure it with the two cover screws.

Installing a Wall Mount System

The following sections contain the instructions needed to install a wall-mounted system.

Table 8 – Installing a Wall Mount System

Complete	Instructions	Cellular	Ethernet
1	"Mounting the Gateway to a Wall" below	✓	✓
2	"Mounting the RF Antenna and Antenna Mast" on page 59	✓	✓
4	"Mounting the Antenna Mast to the Building" on page 60	✓	
	"Connecting the Ethernet Cable" on page 63		✓
5	"Troubleshooting" on page 69	✓	✓

Mounting the Gateway to a Wall

Figure 70 – Wall-Mounted Gateway

Mount the Gateway to a wall, as illustrated in Figure 70, using one of the following ways.

- If mounting to wood, use #14 corrosion-resistant wood screws.

- If mounting to masonry, use 1 3/4 inch long, 3/16 inch diameter, corrosion-resistant masonry screws.

- If mounting to sheet metal, use #14 corrosion-resistant sheet metal screws.

Installing the UPS

To install the UPS, complete the following steps.

Figure 71 – UPS Mounted on a Wall

1. To mount the UPS to a wall near the Gateway, use corrosion-resistant hardware through the four holes provided in the mounting bracket. See Figure 71.

The Gateway and UPS can be mounted directly to a wall or strut channel that is attached to a wall.

The mounting brackets for the Gateway and UPS have the same horizontal and vertical hole spacing. This allows you to mount both of them on the same two pieces of the strut channel. The two pieces of the strut channel can be mounted horizontally (Gateway and UPS in a "side by side" arrangement) or the strut channel can be mounted vertically (Gateway and UPS in a "stacked" arrangement).

Be sure to mount the UPS in close proximity (within 3 feet) of the Gateway.
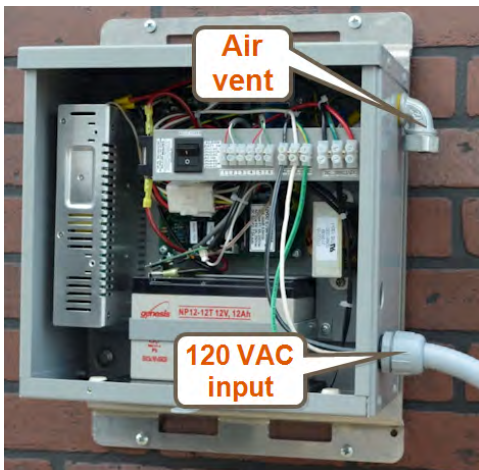
Figure 72 – UPS with VAC Input Wired

2. Remove the two screws from the cover on the UPS, and remove the cover.

3. Wire the 120 VAC input through the lower knockout hole. See Figure 72.

> ⚠️ **The AC input (to the UPS) must have a readily accessible disconnect device installed.**
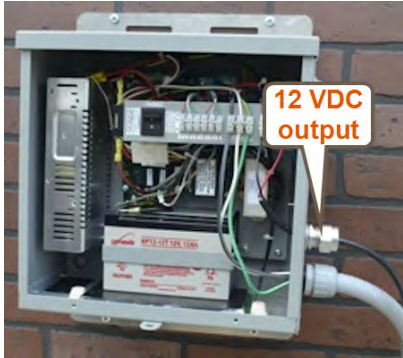
Figure 73 – 12 VDC Output Wired

4. Wire the 12 VDC output through the upper knockout hole.

5. Install the cover on the UPS and secure with the two cover screws.

Connecting the Ground Wire

Figure 74 – Ground Wire

Attach the ground wire by completing the following steps.

1. Locate the lightning protection system ground connection for the site.

2. Connect the external grounding lug of the Gateway to the lightning protection system ground for that site (see Figure 74). Use #4 or #6 AWG with a minimum temperature rating of 75° C.

3. Tighten with a flathead screwdriver. Torque to 35 in-lb (4.0 Nm).

Connecting the Cables to the Gateway

The RF antenna is attached to an outside structure and is connected to the Gateway as follows.
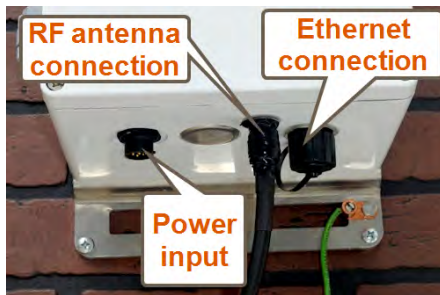
Figure 75 – Adding Gateway Cables

1. Attach the RF antenna cable to the bottom of the unit. See Figure 75.

2. Weatherize the RF antenna connection using the weatherization kit, as described in "Recommended Tools and Materials" on page 26.

> ℹ Do not weatherize the power connector. The power connector is IP68-rated and does not require weatherization wrap.

Figure 76 – Power Connector

3. Attach the circular power connector to the Gateway by pushing and rotating the connector clockwise to engage it. See Figure 76.
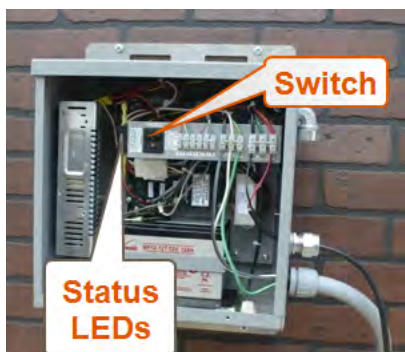
Figure 77 – UPS Power Switch

4. Turn on the power switch inside the UPS to activate the system. See Figure 77. Also see "Checking UPS Status LEDs" on page 70 of the Installation Troubleshooting section.

5. Install the cover on the UPS and secure it with two screws.

⚠️ **When the Gateway's Ethernet port is not in use, cover with the included protective guard (CONEC P/N:17-10002).**

Figure 78 – Wall Installation

6. Illustrates the completed Gateway and UPS wall installation.

Mounting the RF Antenna and Antenna Mast

⚠️ **The RF 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).**

Antenna contact with high voltage wires may result in death. Watch for overhead electric power lines when erecting the antenna and mast.

Do not mount the antenna, antenna mast, or Gateway on utility poles, electric service masts, or other structures carrying open electric light or power wires, or trolley wires of over 250V between conductors. Coaxial cable must maintain clearance of at least 2 feet (.61 M) from power or light wires of less than 250V, or at least 10 feet (3.048 M) from power wires of more than 250V, in accordance with NEC Article 810, CEC Section 64.

ℹ️ When mounting the RF antenna and antenna mast, it is important to maximize the line-of-site relationship between the RF antenna and R900 MIUs for optimum RF communications.

Mounting the Antenna Mast to the Building

With a wall mount installation, it is necessary to mount the RF antenna on the exterior of the building. Complete the following steps to mount the antenna mast to the building.

Figure 79 – Securing Pole Bracket

1. Install the pole to the building using antenna-pole brackets. See Figure 79.

2. Before you start, 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 corrosion-resistant wood screws rated at a minimum of 20 pounds loading.

   - If mounting to sheet metal or masonry, use appropriate sheet metal, corrosion-resistant screws or masonry anchors rated at a minimum of 20 pounds loading.

> The model of pole bracket shown can be different than what Neptune supplies. Please contact Neptune Customer Support if you have any questions.

Figure 80 – Lining up Second Pole Bracket

4. Place antenna mast pole within the bracket.

5. Make sure the pole is vertical. Use a level if necessary.

6. Line up a second bracket a minimum of 2 feet from the bracket you just installed.

7. Secure the second bracket similarly to the first one (follow steps two and three).

8. Line up the pole in the two brackets. See Figure 80.

9. Secure the pole with the bolts provided.

Mounting RF Antenna to Antenna Mast

To mount the RF antenna to the antenna mast, complete the following steps.
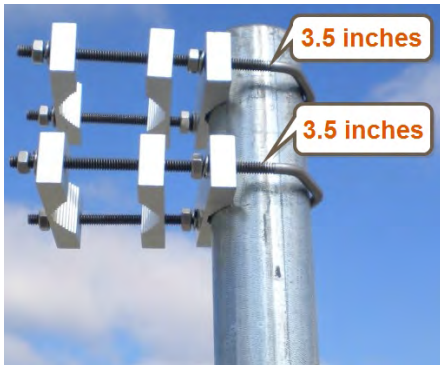
Figure 81 – Mounting Brackets

1. Attach antenna mounting brackets to mast. See Figure 81.

Figure 82 – Coax Cable

2. Attach coax cable to RF antenna. See Figure 82.

Figure 83 – Weatherizing RF Antenna

3. Weatherize RF antenna connection using the weatherizing kit, as described in "Recommended Tools and Materials" on page 26. See Figure 83.

4. Follow instructions in the weatherizing kit and coax ground kits for proper installation.

> ⚠ **Do not hoist antenna while attached to coax cable. Doing so may damage the antenna connector. Attach the coax after the antenna is hoisted and mounted.**

Figure 84 – RF Antenna to Mast

5. Mount the RF antenna to the antenna mast using antenna mounting brackets. See Figure 84.

Figure 85 – Securing the Coax Cable

6. Secure the coaxial cable every 2 feet along the mast using UV-stable wire ties. See Figure 85.

 Secure larger 1/2-inch and 7/8-inch diameter coax cable according to manufacturer's recommendations.

Connecting the Ethernet Cable

> ⓘ This step is only for kits using the Ethernet backhaul. If you are using a cellular modem, then skip this section.

Prior to connecting the Ethernet port, you must run an Ethernet cable to the location of the Gateway. Use a shielded category 5e or better Ethernet cable that is rated for outdoor use, and is sunlight resistant. For example, a Belden cable (P/N 7919A). The Ethernet connector on the Gateway is IP67 rated.

To connect the Ethernet modem, complete the following steps.

1. Locate the Ethernet port at the bottom of the Gateway. See Figure 86.
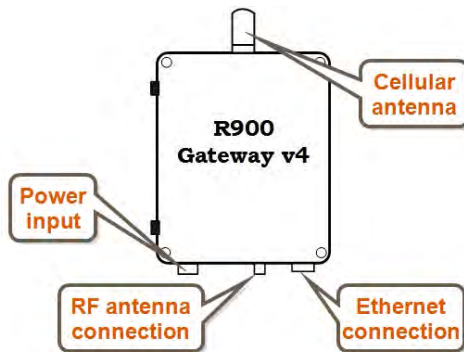
Figure 86 – Port Connection

2. Locate the Ethernet plug that's included with the Gateway. See Figure 87.
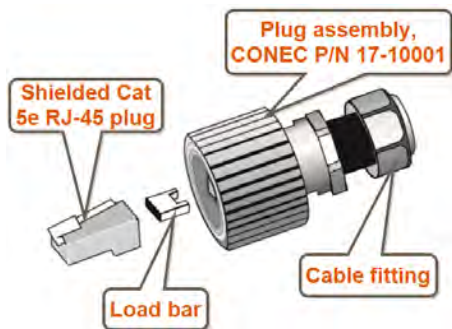
Figure 87 – Feed-Through Assembly
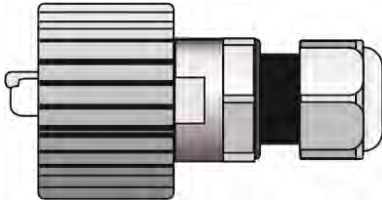
Figure 88 – RJ45 Ethernet Plug

3. Assemble the Ethernet plug according to the instructions included. See Figure 88.

Figure 89 – Ethernet Plug Terminated

4. Terminate the Ethernet jack to the Ethernet cable. See Figure 89. Refer to "Ethernet Termination" on page 114 of Appendix D.

Figure 90 – Ethernet Plug Inserted

5. Insert the Ethernet plug into the Ethernet receptacle on the Gateway.

6. Screw the entire Ethernet plug assembly into the RJ45 Ethernet housing which is already mounted at the bottom of the Gateway.

7. Tighten the cable fitting until the gasket is tight around the RJ45 cable. See Figure 90.

> The Ethernet connector is weatherproof (IP67 rated) and does not require weatherization wrap.

Configuring the Gateway

See "Mounting the Gateway - Solar Configuration" on page 32.

Chapter 5: Gateway Monitoring

This section contains basic techniques that allow you to diagnose and resolve unusual activity that you may notice when monitoring your Gateway system.

Monitoring the Gateway

N_SIGHT PLUS host software allows the user to monitor each Gateway. See Figure 91.
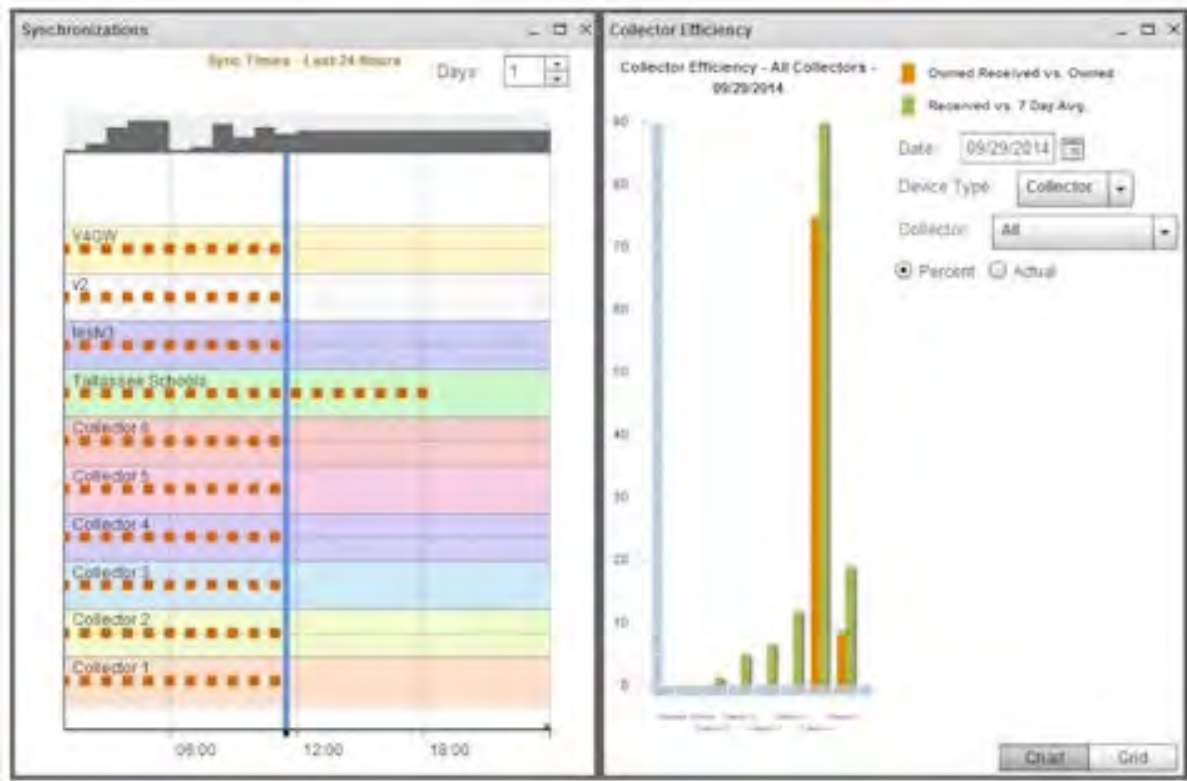
Figure 91 – Examples of N_SIGHT PLUS Gateway Monitoring

Files Missing for Days

> (i) If files are missing for a number of days, this means that there is a problem with cellular communication or that the Gateway has stopped operating.

If files are missing for a number of days, complete the following steps before calling Neptune Customer Support.

1. Try to reboot the Gateway that has missing files by disconnecting the black power connector from the bottom of the Gateway unit.

2. Wait until all LEDs are off, and then reconnect the power connector. See "Activating the Gateway System" on page 41.

3. Wait the appropriate amount of time, as defined by the transfer interval in the configuration file, which is the standard amount of time needed for the unit to configure and send packets. The packets should appear on the N_SIGHT PLUS host server.

4. After the appropriate amount of time, if there are still no files, call your cellular provider to be sure that the service is active.

5. If the previous steps have been completed without success, call Customer Support at (800) 647-4832, and then select **Option 2**. See "Contacting Customer Support" on page 75.

Using a USB Drive to Retrieve Gateway .TAR Files

If you are still unable to establish communications with a Gateway, you can use a USB flash drive to retrieve the .TAR files directly from it as follows.

> (i) The USB flash drive that you use for this procedure must be blank.

1. Go to the Gateway site.

2. Loosen the screws on the Gateway cover.

3. Open the Gateway.

4. Insert the USB flash drive in the Gateway USB port.

   The LED lights underneath the USB port begin to flash red alternately, in a railroad or wigwag pattern, indicating that the files are loading to the USB flash drive from the Gateway.

> The amount of data the Gateway has stored determines the amount of time it takes to load the files to the USB flash drive. This could take up to 10 minutes, if needed.

   When the data has completely loaded to the USB flash drive, the LEDs at the USB port begin to flash green simultaneously.

5. Remove the USB flash drive.

   The Gateway reboots.

6. Close the Gateway cover and secure the screws.

7. Take the USB flash drive back to your laptop or PC.

8. Insert the USB flash drive into your laptop or PC, and copy the .TAR files, or process them in the N_SIGHT PLUS host software. See topic "Importing a File" from the N_SIGHT PLUS Help file.

9. Safely remove (eject) the USB flash drive from the computer.

Processing Files

A web service is used to place files on the server in the "upload/data" directory so they can be processed. The file name follows this naming convention.

[CollectorNumber]_[CollectorName]_[NTP5digitDateCode]_[RecordedMMDD] with a file extension of .TAR or .DAT.

You can verify remotely that the collector was able to sync with an NTP site by completing the following steps.

1. Enter the five-digit date code from the file name into a cell in Excel.

2. Format the cell as a date to verify when the collector is synced to the NTP site.

   Files with a bad five-digit date process but do not post.

Up-to-Date Files

If you see files that are up-to-date and have been processed but the file size is 0KB, this means that the Gateway is communicating well with the N_SIGHT PLUS host software but it is not receiving readings. This usually indicates there is a problem with the receiver.

To resolve this issue, reset the Gateway, as recommended in the "Files Missing for Days" on page 66.

- If the next packet after the configured transfer interval time period is larger than 0KB, it is fixed.

- If the file is still 0KB, call Customer Support and explain the issue you are experiencing. See "Contacting Customer Support" on page 75.

Chapter 6: Troubleshooting

This section provides possible symptoms, areas of focus, and actions you can take to resolve problems that could arise with your Gateway unit.

Performance Troubleshooting

Refer to the following table to troubleshoot performance or failure issues.

Table 9 – Performance Troubleshooting

Problem/Failure	Recommended Action
N_SIGHT PLUS host software	• Check to ensure that the database service is running. • Check with your cellular provider to ensure that the cellular service has not been terminated. • Cellular connectivity - Refer to "Checking Power and Receiver" on page 71 and "Checking Cellular Modem Connectivity" on page 73 for further diagnosis.
All of the packets appear to be there but some packets are empty (0 bytes)	Please refer to "Installation Troubleshooting" on the next page.

Poor MIU read performance	• Perform a VSWR check on the coax cable feeding the RF antenna. If it is bad, please do the following.
	  • Inspect the coax cable for damage.
	  • Inspect the weatherproofing on the coax cable connections.
	  • Check for moisture ingress inside the coax cable for the RF antenna.
	  • Verify that RF antenna is good.
	• Verify that the internal RF and cellular antenna coax connections aren't swapped.

Installation Troubleshooting

Checking UPS Status LEDs

Complete the following steps to check the UPS status.

1. Remove the two screws that secure the UPS cover.

2. Remove the cover.

3. Verify that the internal power switch is on.

4. Verify the status LEDs inside the UPS. See Table 10.

Table 10 – UPS Status LEDs

Description	LED Indicators
DC output is OK	Green LED turns on
Battery is being charged (AC input ok)	Amber LED blinks slowly
Battery is being discharged (AC input failure)	Amber LED blinks rapidly
DC output is faulty	Red LED turns on

5. Verify that the UPS is producing the correct voltage at the output terminals by measuring across DC+ and DC-. The voltage should measure 13.6 to 14.4 VDC.

> (i) Verify that the AC input is present and the UPS's internal switch is on (for example, battery should be charging).

6. If the AC input voltage is not present, then the voltage across DC+ and DC- should measure 10.5 to 12.8 VDC.

7. If the DC voltage is not present across DC+ and DC-, then:

   - Measure the AC input voltage across L1 and N1. This voltage should measure 120 VAC (± 20 V).
   - Verify that the UPS's internal switch is on.
   - Verify the UPS status LEDs. See Table 10.

8. Install the UPS cover again and secure it with the two screws.

Checking Power and Receiver

It is a good practice to check the main power and make sure it is within specification. If there are no power indications on the Gateway, perform the following procedure.

Verify Main Power

> ⓘ The Gateway uses the same DC power cable (Part No. 13065-000) for both the solar power and UPS option.

Complete the following steps to check the power for the unit and the receiver.

Figure 92 – Gateway Power Plug

1. Disconnect the power plug to the Gateway. See Figure 92.

2. Using a voltmeter, verify that there is 12 VDC present between pins C+ and D- on the power plug.

3. If voltage is not present on the power plug or is less than 11 VDC, there is something wrong with the wiring or the power source (solar power system or UPS). See "Solar Power Information" on page 77.

Verify the RF Receiver

When the system is on, there are two LED lights labeled RXMODE (red) and LOCKED (green) on the RF receiver board that should be illuminated and remain on. See Figure 93 – page 72. If the two LED lights do not illuminate, check that there is power to the unit.
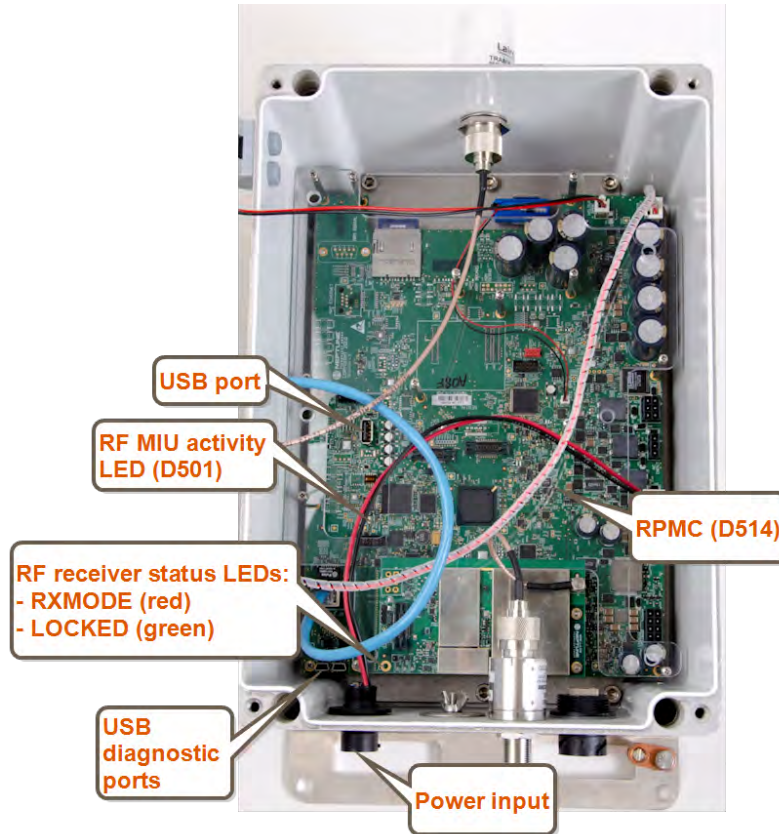
Figure 93 – System LEDs

Verifying the Digital Board

During initial startup, wait approximately three minutes for the Gateway to complete the booting. LED D514 displays green when power is applied. Under normal operation LED D514 blinks green in a repeating pattern of eight seconds steadily-lit green, then one-half second off, indicating normal operations. If it is red, this indicates an error and/or power issues.

In addition, the green LED D501 should begin flashing to indicate that the unit is receiving MIU readings. However, in areas where the MIU density is high, this LED can remain green constantly to indicate a high volume of MIU RF traffic.

Checking Cellular Modem Connectivity

There are LED lights located on the digital and RF board that should be lit as the unit is powered on. See Figure 93 – page 72. LED lights on the Ethernet connector (EF Ethernet J1003) should be flashing or steadily lit indicating that the Ethernet connection is good.

Complete the following steps to check for modem connectivity.

Figure 94 – Modem Front View

1. If any of the lights are not illuminated, check the Ethernet connection to the board.

   The LED lights on the cellular modem should be illuminated. See Figure 94, Figure 95, and Table 11 on the next page. At power up, all LEDs display red, then amber, and then green. When the boot sequence is complete, the RSSI indicator is steadily green and the service (SVC) indicator is flashing green.

> RSSI flashing green and SCV amber - indicates reduced RSSI and/or 2G cell coverage, and is sufficient for normal operation.

Figure 95 – Modem Back View

2. If the lights are off, this indicates that there is a power problem with the modem or the power source. See "Verifying Cellular Modem Power" on the next page.

3. Verify that the cellular modem has a SIM card installed (if applicable) and has been configured. See "Configuring the Cellular Modem" on page 108 in Appendix D.

> Certain cellular services, such as CDMA, do not require a SIM card to operate. However, some cellular services do require a SIM card, such as Global System for Mobile Communication (GSM), Enhanced Data for GSM Evolution (EDGE) and General Packet Radio Service (GPRS). Verify with the cellular service provider.

Table 11 – Vanguard 3000 LED Functions

LED Function	Off	Green	Flash Green	Red	Flash Red	Amber	Flash Amber
RSSI		Strong		Weak/None		Medium	
SVC		3G	3G/NC		NC	2G	2G/NC
NET	No Connectivity		RX Data		Tx Data		RX/TX
GPS	Disabled	Fix	Search	No Fix			
Aux	Disabled	Good		Failed			

5. After you have verified that all of the steps have been completed and you are still having issues with the unit operating properly, call Neptune Customer Support at (800) 647-4832 for assistance with further diagnosis. See "Contacting Customer Support" on the facing page.

Verifying Cellular Modem Power

Remove the power plug from the cellular modem by pressing the latch to disengage it, and then remove the plug.

Measure between pins shown in Figure 96. There should be 12 VDC between the pins shown.
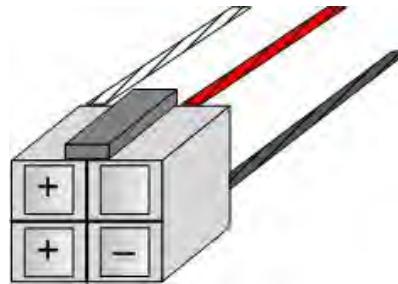
Figure 96 – Cellular Modem Power Plug

Report Now Function

The Gateway can be forced to report back by momentarily pressing the SW1009 switch. See Figure 97.
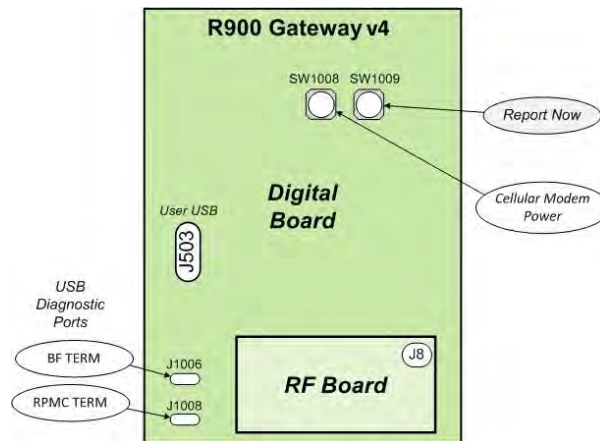
Figure 97 – Report Now Button

Still Not Operating Properly

After you have verified that all of the steps have been completed and you are still having issues with the Gateway unit operating properly, call Neptune Customer Support at (800) 647-4832 for assistance in further diagnosis. See "Contacting Customer Support" which follows.

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, email, or fax.

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 Fax

To contact Neptune Customer Support by fax, send a description of your problem to (334) 283-7497. Please include on the fax cover sheet the best time for a customer support specialist to contact you.

By Email

To contact Neptune Customer Support by email, send your message to hhsupp@neptunetg.com.

Appendix A Solar Power Information

Appendix A provides information on the installation of the solar panels.

Installation Considerations for Solar Panels

Solar panels should be installed in a location where they receive maximum sunlight throughout the year. When choosing a site, avoid trees, buildings, or obstructions which could cast shadows on solar panels especially during the winter season when the arc of the sun is lowest over the horizon. See "Facing True South" on this page.

Magnetic Declination

Correction for Magnetic Declination and Solar Panel Tilt

Facing True South

For optimum performance, your photovoltaic (PV) array (solar panel) should face true south in the Northern Hemisphere or true north in the Southern Hemisphere. However, when determining direction using a magnetic compass, indicated bearings vary from true bearings because of the difference between the location of the true magnetic north poles. This angular difference varies with location on the globe and is called the declination. Values of declination for the contiguous United States and portions of Mexico, Canada, and the Caribbean are shown on the map in Figure 98 – page 79. In order to correct for magnetic declination when sighting your solar panel, complete the following steps.

1. Locate your site on the map shown in Figure 98 – page 79.

2. Interpolate the value for magnetic declination in degrees based on the lines of constant declination (isogonic lines) shown in Figure 98 – page 79. For example, the declination of Washington, D.C. is approximately -11°, for Chicago, IL, -1°, and for Los Angeles, CA, +14°.

3. Determine magnetic south at your site using a magnetic compass.

> If the local declination found in step two is negative, true south is that number of degrees added to magnetic south. For example, at Washington D.C., true south is the same as 180° + 11° = 191° indicated.
>
> If the local declination found in step two is positive, true south is that number of degrees subtracted from magnetic south. For example, at Los Angeles, true south is the same as 180° - 14° = 166° indicated.

5. Orient your solar panel in direction of true south (or north if applicable) as determined above.

6. A declination chart for North America is provided in Figure 98 – on the facing page for assistance in determining the appropriate correction for other sites. Other suggested resources include World Aeronautical Charts (WAC), local airports, or government agencies, and the Internet site www.ngdc.noaa.gov/cgi-bin/, which calculates magnetic variation from an input of altitude, latitude, and longitude.

Specific Tilt Angle

For optimum performance, set your solar panel to a specific tilt angle. To determine the desired tilt angle of the solar panel, complete the following steps.

1. Obtain a copy of an atlas.

2. Locate your site on the map.

3. Determine what latitude line closest intersects your region.

4. Take this value and add the factor based on the list in Table 12.

This provides the optimum performance in the event of a worse case scenario, based on the winter months (Northern hemisphere). For example, if the solar panel location is at 32° latitude, take 32° + 15° = 47°. In this example, the solar panel tilt angle would be set for 47°.

Table 12 – Recommended Solar Panel Tilt Angle[1]

Site Latitude Range (Degrees)	Recommended Fixed Tilt Angle
60° - 90°	60°
25° - 60°	Latitude + 15°
15° - 25°	Latitude + 5°
0° - 15°	15°

[1] Based on winter performance.

> It is recommended that the solar panel tilt be limited to 15° for a minimum angle and 60° for a maximum tilt angle.

Magnetic Declination for the United States

The map of the United States in Figure 98 illustrates the magnetic declination of the United States. Magnetic declination refers to the angle between the Magnetic North (MN, compass north) and True North (TN) at any given latitude/longitude. The black contour line shows the imaginary line along which the declination is zero, where MN and TN converge. The magnetic declination increases as one moves east or west from this line. The red line shows the negative (west) declination contours, and the blue line shows the positive (east) declination contours. The degrees of declination required to orient the compass with the map is added east of this line and subtracted west of the line. Magnetic declination gradually changes with time and location. The dotted gray lines show the expected annual change in the magnetic declination in arc minutes. Figure 98 is produced from the World Magnetic Model (WMM).

Mercator Projection   http://www.ngdc.noaa.gov/geomag-web
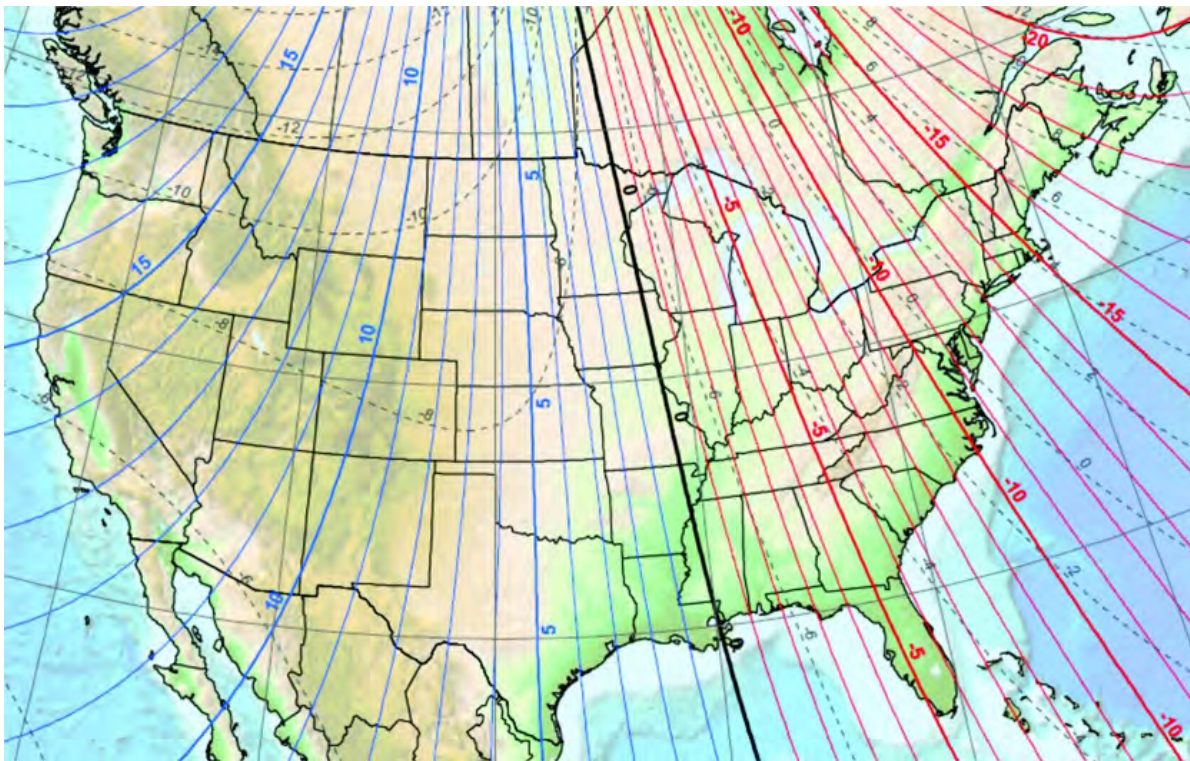
Contours of Declination of the Earth's magnetic field, expressed in degrees.

Contour Interval: 1 Degree (Positive declinations in blue, negative in red)

Produced by National Oceanic and Atmospheric Administration's (NOAA) National Geophysical Data Center (NGDC), Boulder, Colorado

Figure 98 – Magnetic Declination U.S.

Selecting the Correct Solar Power System

Complete the following steps to select the correct solar power system for the Gateway.

1. Determine the installation location.

2. Using Figure 99, determine in which zone the site location is situated.

Figure 99 – Solar Power Zones

3. Select the appropriate solar power system from the following table.

Table 13 – Solar Power System Selection

Zone	Solar Panel Wattage	Solar Power Dimensions	Solar Power System Selection Neptune Part No.
A, B, C, and D	150 W	26 inch x 58 inch	13068-200 (small pole/stand) 13068-400 (large pole)
E and Canada[1]	220 W	52 inch x 48 inch	13068-300 (small pole/stand) 13068-500 (large pole)

[1] If the utility is located near or along the boundary between Zones D and E, then the 220 W option is recommended

- The small pole/stand version is for a 2-inch to 4-inch diameter schedule 40 galvanized steel pole or stand.

- The large pole version is for a 5-inch to 16-inch diameter pole.

> When a site location is near a zone transition line, choose the larger size solar power system. For example, if the site location falls on transition line D and E, choose the zone E solar power system recommendation.

4. For accessories, contact your Neptune sales representative for the most current information.

Solar Power System Operation Summary

When the installation of the system is complete, you can expect the following typical performance.

- When sunlight is available, the system begins to charge. The amount of charging current available depends on the time of year and the position of the sun in the sky. There is low charging power in the morning, which gradually increases and reaches full potential during the middle of the day, then gradually decreases until the end of daylight. Usually, you can see both an increase in charging current and in battery voltage throughout the day.

- The charge controller, located inside the battery enclosure, regulates the charge.

- In the evening, the Gateway runs strictly from battery. Throughout the evening the battery discharges but remains at a safe operating level.

- The system battery is designed to carry the Gateway through five continuous days of no sunlight availability. This allows the Gateway to maintain operation without interruption through extended days without availability of sunlight.

- When the no-sun availability period exceeds five days, the system disconnects the Gateway unit from the battery to prevent the battery from being discharged to the extreme. This happens when the battery voltage drops to 11.5 V, which is approximately 85% depth of discharge (DOD).

- Upon return of sunlight availability, the system recharges the battery and automatically reconnects the Gateway when the battery voltage reaches 12.6 V. This does not happen immediately, because it must first allow the battery to reach a 50% state of charge (SOC) to ensure that the system does not cycle on and off repeatedly in a short time frame. Therefore, battery recharge can take one or more days, depending on the time of year and size of the system.

- The system voltage fluctuates throughout the year depending on outside air temperature. In cold weather, the system voltage can rise to 16 VDC (12 V battery); and in summer, it usually is 13.5 VDC (12 V battery). The range varies with specific controller type and battery configuration; however, this stated fluctuation can usually be expected. The load output tracks the battery voltage.

Troubleshooting the Solar Power System

The following table shows some of the problems you could experience with the solar power system.

Table 14 – Solar Power System Troubleshooting

Problem	Probable Cause	Recommended Action
No Charging Power	Overload solar/load	Verify that the load is not exceeding the system capability.
	High temperature disconnect	Allow the controller to cool down, and then verify continued operation.
	Reverse polarity	Configure the wiring terminations again to restore operation.
	Battery select fault	Verify that the jumper settings are correct for the system configuration.
	Solar panel is shaded	Confirm that the solar panel angle and direction are correct. Make sure there is no shade.

Table 14 – Solar Power System Troubleshooting (continued)

Problem	Probable Cause	Recommended Action
Load Disconnected	Load low voltage disconnect (LVD) trip on the load controller	Confirm that the battery voltage is above the LVD cutoff voltage of 11.5 V. If not, allow the battery to fully charge. LVD reconnects at 12.6 V.
	Load overload or short circuit	Check the wire terminations for proper configuration.
	LVD trip repeatedly	Verify that the load is not exceeding the system capability. Confirm that the battery depth of discharge (DOD) cycles have not exceeded the normal end of life.
Breaker Trip or Fuse Blown	Improper wiring	Confirm that wiring is correct and terminals are not corroded. Use an ohm meter to confirm the wire and terminal continuity.
	Short circuit	Confirm that the load end of the circuit breaker does not have a short circuit.
	Breaker damaged	Use an ohm meter to verify the breaker continuity out of circuit. Replace the breaker if necessary.

Troubleshooting the Solar Controller

You can measure load voltages at the designated terminal blocks.

- If the battery voltage is present at the load blocks, you can assume that the load fuse and the LVD are fully functional.

> (i) LVD occurs at 11.5 V. LVD reconnects at 12.6 V.

- If the battery voltage is above 12.8 VDC with the solar panel in the sunlight, and the load is attached and active, the controller is actively charging. During the daytime, the green charging LED should be illuminated.

- No further troubleshooting of the controller is required.

Solar Charge Controller

In general two solar charge controllers (by Morningstar) are used in the solar power systems:

- SunSaver-10L

- ProStar-15

The SunSaver-10L charge controller has two topology generations: Gen 2 and Gen 3.

Both the SunSaver Gen 2 and SunSaver Gen 3 solar controllers ship with a jumper installed. This sets the controller for charging:

- The sealed valve, a regulated lead acid (VRLA)

- The absorbent glass mat (AGM) batteries, used by the solar power system

See Figure 100 below and Figure 101 – page 85.

SunSaver Gen 2

The Figure 100 depicts the SunSaver Gen 2 solar controller.

Figure 100 – Gen 2 Solar Controller

Green LED

The green LED indicator illuminates whenever sunlight is available for battery charging and turns off at night. Because the SunSaver uses a PWM constant voltage charging process, there is usually some amount of energy going into the battery at any given time. Although the charging current falls to very low levels when the battery reaches full charge, the green LED remains illuminated during the daytime, indicating that the controller is working, and energy is available from the solar panel for charging.

Red LED

The SunSaver Gen 2 includes an LVD feature indicated by a red LED. Whenever the battery charge state falls below the LVD set-point (11.5V), the load is disconnected, and the red LED illuminates. This indicates that the controller has disconnected the load to protect the battery from further discharge and possible damage. After some period of recharging the battery, so that it recovers almost 40 to 50 percent of its rated capacity (12.6V), the load automatically reconnects and the red LED is unlit.

SunSaver Gen 3

The SunSaver Gen 3 solar controller has different LED status lights than the SunSaver Gen 2. See Figure 101.

Figure 101 – Gen 3 Solar Controller

Charging Status LED

The charging status LED indicates controller state and any existing solar input error conditions. The charging status LED is on when charging during the day and off at night. The charging status LED flashes red whenever an error condition exists. Table 15 on the next page lists the charging status LED definitions.

Table 15 – Charging Status LED Definitions

Color	Indication	Operating State
None	Off (with heartbeat[1])	Night
Green	On solid (with heartbeat[2])	Charging
Red	Flashing	Error
Red	On solid (with heartbeat[2])	Critical error

[1] Status LED heartbeat indication flickers ON briefly every 5 seconds.

[2] Status LED heartbeat indication flickers OFF briefly every 5 seconds.

Battery Status LEDs

Three battery status LEDs indicate the level of charge on the battery, based only on battery voltage set points, providing an approximation of the actual SOC of the battery. Table 16 identifies the battery status LED definitions.

Table 16 – Battery Status LED Definitions

SOC LED	Indication	Battery Status	Load Status
Green	Fast flashing (2 flash/sec)	Full battery: equalize charge	Load on
	Med. flashing (1 flash/sec)	Full battery: absorption charge	Load on
	Slow flashing (1 flash/2 sec)	Full battery: float charge	Load on
	On solid	Battery nearly full	Load on
Yellow	On solid	Battery half full	Load on
Red	Flashing (1 flash/sec)	Battery low	LVD warning (load on)
	On solid	Battery empty	LVD (load off)
None	No LEDs on	Battery missing	Load off

An error condition exists if multiple battery SOC LEDs are flashing. See Table 18 on the facing page for more information.

LED Error Indications

The following tables describe how to interpret the LED error indications.

Table 17 – Charging Status LED Error Indications

Error Condition	LED Status
Solar overload	Flashing red
High voltage disconnect	Flashing red
High temperature disconnect	Flashing red
Damaged local temperature sensor	Solid red[1]
Damaged heat-sink temperature sensor	Solid red[1]
Damaged input MOSFETs	Solid red[1]
Firmware error	Solid red[1]

1 A heartbeat indication flickers the Status LED off briefly every five seconds. A solid red Status LED indicates that a critical fault has been detected. Critical faults typically indicate that the controller is damaged and requires service.

Table 18 – Battery Status LED Error Indications

Error Condition	LED Status
High voltage disconnect	R-G sequencing[1]
High temperature disconnect	R-Y sequencing[2]
External wiring error	R&G-Y sequencing[3]
Load overcurrent	R&G-Y sequencing
Load short circuit	R&G-Y sequencing
Self-test error	R-Y-G sequencing[4]

[1] R-G sequencing means that the red LED is on, then the green LED is on, then red LED is on, and so forth.

[2] R-Y sequencing means that the red LED is on, then the yellow LED is on, then red LED is on and so forth.

[3] R&G-Y sequencing means that both the red LED and green LED are on, then just the yellow LED is on, then red and green LED are on, and so forth.

[4] R-G-Y sequencing means that the red LED is on, then the green LED is on, then the yellow LED is on, then the red LED is on, then the green LED is on, and so forth.

ProStar Controllers

There are four different ProStar controller models that may be installed in the solar power systems.

- PS-15 (15A rating)

- PS-15M (15A rating, with digital meter option included)

- PS-30 (30A rating)

- PS-30M (30A rating, with digital meter option included)

Figure 102 – ProStar Controllers

The ProStar controllers have three LEDs which indicate charging status, battery status, and various faults.

Charging Status

For charging status indications, see Table 19.

Table 19 – Charging Status LED Indicator

LED Color	Charging Status
Green	• **ON**: battery charging during sunlight (always on during sunlight). • **OFF**: normal during night (off during sunlight indicates solar reverse polarity or overcurrent).

Battery Status

For battery status indications, see Table 20.

Table 20 – Battery Status LED Indicators

LED Color	Battery Status
Green	• **ON:** indicates battery is near full charge. • **BLINKING**: indicates PWM charging (regulation).
Yellow	**ON:** indicates battery at middle capacity.
Red	• **BLINKING:** indicates a low charge state and a LVD warning. • **SOLID:** indicates that the load has been disconnected (LVD).

Fault Indications

For fault indications, see Table 21.

Table 21 – Fault Indications

LED Color	Fault Indications (G = green, Y = Yellow, R = Red
G/Y/R blinking together	Battery select fault
R - Y sequencing	High temperature disconnect
R - G sequencing	High voltage disconnect
R/G - Y sequencing	Load short circuit or overload

Digital Meter

The ProStar PS-15M and PS-30M controllers include an optional digital meter. This section describes the information that can be displayed with the meter, and the added capabilities that are enabled by the push button switch (for example, manual disconnect).

The precision three-digit digital meter continuously displays battery voltage, solar current, and the load current. The meter automatically scrolls through these three displays. The three red LEDs indicate which parameter is being displayed.

The digital meter operates from -30°C to +85°C. The values displayed are calibrated electronically in production and are accurate to within a few percent.

- If the Battery Sense is not connected, the voltage displayed is in error by the voltage drops in the battery wires.
- If the battery is located more than 5 meters from the controller, the Battery Sense connection is recommended.

Manual Disconnect

The ProStar PS-15M and PS-30M controllers have a push button next to the digital display which can disconnect the load or both load and solar. A second push of the button returns the controller to normal operation.

- **LOAD OFF** - A brief push of the button (less than two seconds) disconnects the load. The solar remains on and charging.

- **LOAD and SOLAR OFF** - If the button is held for two seconds, the solar is disconnected.

When the button is pushed, the red LED inside the cap lights up. In addition, the load or both load and solar displays **OFF** in the digital meter to indicate the disconnected state.

Display Disconnects and Protections

The following protection functions and disconnect conditions are displayed in the digital meter when they occur.

- **Lud** - Low voltage disconnect (load only)

- **Hud** - High voltage disconnect (both solar and load)

- **Hot** - High temperature disconnect (both solar and load)

- **OCP** - Overcurrent and short circuit protection (load, solar, overcurrent)

- **0.0** - Short circuit protection (solar only)

Self-Diagnostics (Self-Test)

If the push button is held for four seconds, the ProStar goes into automatic self-diagnostics. The button must be released to start the self-test. See Table 22

> (i) The push button can be used to toggle through the displays faster. The entire self-test takes 30 to 45 seconds. The load is turned on for 0.1 seconds and can flash during the test. A short or overload condition could cause a controller restart.

Table 22 – Self-Test Display Examples

Display	Battery Status
8.8.8	Self-test started, checking the digital meter segments
12u	System voltage (12/24/48)
15A	ProStar current rating
r1.5	Software version installed
E04	Fault detected (see Table: 12 on page 1 for fault error list)
---	Display if no fault is found
25c	Temperature measured at the controller remote
rP	Temperature probe is detected (if connected)
25c	Temperature at the remote probe (if connected)
SEn	Battery sense detected (if connected)
S-2	Battery selected position (1, 2, or 3) Example: Position '2" is the desired position for AGM batteries
J-1	Telecom noise jumper cut (change to on-off regulation)
END	End of self-test
END---END	Display; continues if no error was detected
END END	Display; continues if an error has been detected

Table 23 – Fault Error List

Display	Error Condition
E01	Rotary switch battery selection failure
E03	Voltage reference test failed (circuit, malfunctions)
E04	Solar array current fault (circuit, (FET[1])
E07	Load FETs off test (load connection, FETs shorted)
E08	Load current fault (circuit, FETs)
E09	Load FETs on test (load circuit, FETs open)
E10	Internal temp sensor out of range high
E11	Internal temp sensor out of range low
E12	Remote temp probe out of range
E13	Battery sense fault (battery V drop over 5V, no Sense negative connection)

[1] Field-Effect Transistor

Terminate the Self Test

To terminate the self test, push the button. The self-test can be repeated to confirm the result.

Select Battery Type

The ProStar controllers contain a battery type rotary switch that allows the selection of one of three charging algothrithms. Set the Battery Type switch to **position 2** (Sealed: AGM). The switch positions are defined as the following battery types shown in Table 24.

Table 24 – Battery Type Switch Positions

Switch Position	Battery Type
1	**Gel**: Some gel and other battery types recommend lower regulation voltages and no equalization. This setting regulates to 14.0V (for a 12V battery).
2	**Sealed**: AGM, "maintenance free" and some types of gel batteries. Regulates to 14.15V (12V battery) with 14.35V boost charging.
3	**Flooded**: Vented cells that require water to be added. Regulates to 14.4V with 14.9V and 15.1V equalizations (12V battery).

Additional Troubleshooting Information

For additional troubleshooting information, refer to the *ProStar Solar Controller Operations Manual*. This should be included with the solar power system. The manual is also available online from Morningstar.

Troubleshooting the Solar Panel's Battery

You can measure both the batteries voltage open circuit (Voc) and voltage under charge (Vuc). The Vuc is a simple method to measure voltage without disabling the load or disabling the system from charging. Use Voc when the battery end-of-life is in question and a more accurate means of measurement is required.

Batteries should be tested for end-of-life whenever a particular system begins to fall in a SOC below 80% repeatedly, or the system begins to exhibit LVD on a recurring basis. Battery life varies depending on load use, depth of discharge, and temperature extremes, but can vary between three to ten years.

To measure for battery end-of-life, complete the following steps.

1. Disconnect the battery from the system.

2. Charge the battery with an appropriate three-stage battery charger.

3. After completion, allow the battery to settle for three hours with no charge or load attached.

Table 25 provides Voc and Vuc for SOC at 25°C.

Table 25 – Voltages for SOC at 25°C

SOC (%)	Voc	Vuc
100	12.8	14.2
80	12.6	12.91
60	12.3	12.60
40	12.0	12.25
20	11.8	11.81
0	<11.6	<11.81

- If an individual battery does not hold a voltage of a least 12.6 VDC open circuit after a full charge and a three-hour wait period under no load, you could have a damaged cell and require a battery replacement.

- If battery voltage climbs very rapidly under charge, then falls rapidly after removing the charge, you could have a damaged cell and require a battery replacement.

> The same battery, Sun Xtender Part No. PVX-1040T, is used in the 150 W and 220 W solar power options.

Table 26 provides the 120-hour load voltages during the discharge cycle from full charge to 100% discharge to 10.5V at 25°C (77°F).

Table 26 – Battery Load Voltage by DOD

DOD (%)	Battery Voltage (volts)
10	12.69
20	12.58
30	12.45
40	12.32
50	12.18
60	12.05
70	11.88
80	11.65
90	11.40
100	10.50

> These voltages are averages. They vary slightly from battery to battery even if they are of the same rating. However, they are a good indicator of state of charge for AGM batteries. This data is for newer batteries with relatively few cycles. An older battery measures a lower voltage for a given DOD.

Solar Panel Troubleshooting

This section provides information that can assist with troubleshooting problems with a solar panel.

Decreased Solar Panel Output

The solar panel is designed for long life and requires very little maintenance. Under most weather conditions, normal rainfall is sufficient to keep its glass surface clean and free of debris. Inspect for this annually. When solar panels are dirty, it can decrease the power output by 10-15%.

If dirt build up becomes excessive, clean the solar panel's glass surface only with a soft cloth using Windex or a mild dish washing soap (such as Dawn) and water.

> **Do not use harsh or abrasive chemicals to clean solar panels, because they could damage the seal between the frame and the laminate. Panels should never be pressure washed, because pressure washing forces moisture through the front glazing seal causing corrosion.**

When choosing a site, avoid trees, buildings or obstructions which could cast shadows on the solar panel. Especially during the winter season, when the arc of the sun is lowest over the horizon. See "Facing True South" on page 77. Partial shading (3-13%) can cause a 25-54% reduction in output power from the solar panel.

Install solar panels in a location where they receive maximum sunlight throughout the year. In the northern hemisphere, the solar panel should face true south, and in the southern hemisphere, the solar panel should face true north. Panels facing 30° away from true South (or North, if Southern Hemisphere) lose approximately 10-15% of their power output. If the solar panel faces 60° away from true South (or North), the power loss is 20-30%.

Solar panels should be tilted for optimum winter performance. Incorrect tilt (off by 15°) can cause approximately a 7% reduction in solar power production. In general, if the system power production is adequate in the winter, it is satisfactory during the rest of the year. The tilt angle of the solar panel is measured between the solar panel tilt angle for your site. See "Solar Power Zones" on page 80.

Verifying Solar Panel Output

If the solar panel is unobstructed, unshaded, at the correct tilt angle, and in full light between 10 a.m. and 3 p.m., you can verify the solar panel's performance per the nameplate ratings for Voc and short circuit current (ISC) as follows.

To verify the solar panel output, complete the following steps.

1. Set the **PV(+)** breaker to **OPEN (OFF)** position.

2. Using a volt meter, measure the Voc voltage between the **PV(+)** and **PV(-)** terminal blocks. It should measure within 5% of the nameplate rating in LOW to HIGH sunlight.

3. Set the **PV(+)** breaker to **CLOSED (ON)** position.

4. Using an ammeter rated for a maximum system ISC value, measure the charging current through the **PV(+)** terminal.

   In LOW sunlight, it should measure approximately 30% or less of the rating shown on the nameplate: 60% or less of nameplate rating in MED sunlight; and 60% or greater in HIGH sunlight. The degree of sunlight is based on cloud cover and height on the horizon for that time of day in winter.

   Table 27 provides the degree of sunlight at various times on a clear, sunny day in the winter.

Table 27 – Sunlight by Time of Day in Winter

Degree of Sunlight	Time	Sun Capacity
LOW	7:00 a.m. - 9:00 a.m.	10 - 30%
MED	9:00 a.m. - 11:00 a.m.	30 - 60%
HIGH	11:00 a.m. - 1:00 p.m.	60 - 100%
MED	1:00 p.m. - 3:00 p.m.	30 - 60%
LOW	3:00 p.m. - 5:00 p.m.	10 - 30%

Table 28 provides the degrees of sunlight at various times on a clear, sunny day in the summer.

Table 28 – Sunlight by Time of Day in Summer

Degree of Sunlight	Time	Sun Capacity
LOW	7:00 a.m. - 9:00 a.m.	10 - 30%
MED	9:00 a.m. - 11:00 a.m.	30 - 60%
HIGH	11:00 a.m. - 2:00 p.m.	60 - 100%
MED	2:00 p.m. - 5:00 p.m.	30 - 60%
LOW	5:00 p.m. - 8:00 p.m.	10 - 30%

This page intentionally left blank.

Appendix B Ballast

This appendix discusses the requirements for a proper ballast for the Gateway stand (a non-penetrating roof mount).

Ballast Requirements

Prior to installation, verify that the supporting structure (for example, rooftop) has been investigated and found capable of withstanding all loads imposed by the proposed Gateway system installation. If it has been determined that a particular supporting structure cannot withstand the load imposed by the proposed Gateway system using the JRM stand (5 ft. x 5 ft.), then a larger footprint stand (such as ROHN BRM4 or BRM6) may be considered. The larger footprint stand requires less ballast for the same given EPA (Effective Projected Area). See Table 29.

Table 29 – ROHN Stand Footprint Dimensions

ROHN Stand Model No.	Footprint Dimension	Protective Pad (3/8" thick)
JRM	5 ft. x 5 ft.	JRMPAD
BRM4	6.5 ft. x 6.5 ft.	BRM4PAD
BRM6	10 ft. x 10 ft.	BRM6PAD

The installation must meet all applicable local, state, and federal requirements. All antenna installations (including stand and mast) must be grounded to meet applicable electrical codes.

ROHN recommends a minimum 75 mph Effective Wind Velocity be used for determining ballast requirements. Higher velocities may be required by local codes or for sites located on hills, escarpments or ridges (refer to ANSI/TIA-222-G). You should not rely on the information presented without competent professional examination and verification of its accuracy and suitability for a specific site or application.

Ballast material can be applied in the form of concrete blocks, 4 in. x 8 in. x 16 in. (10 cm x 20 cm x 40 cm) or 8 in. x 8 in. x 16 in. (20 cm x 20 cm x 40 cm) which weigh 20 lbs to 30 lbs each. Verify weight with local supplier. Evenly distribute the ballast material.

> ⚠️ **Install a roof pad beneath the stand to protect the roof surface. For a 5 ft. x 5 ft. (1.5 m x 1.5 m) ROHN stand, use ROHN Part No. R-JRMPAD or JRMPAD.**

ROHN Industries Stand

The ROHN-JRM stand ships disassembled on one skid and weighs approximately 50 lbs when assembled. It is 10 ft. (3 m) high and has a base that is 5 ft. x 5 ft. (1.5 m x 1.5 m). The stand is galvanized for corrosion protection. For ballast requirements for the ROHN Industries Stand (Part No. JRM23855), refer to the JRM Non-Penetrating Roof Mount section at ROHN'S website: http://w.w.w.rohnnet.com/rohn-jrm-mount.
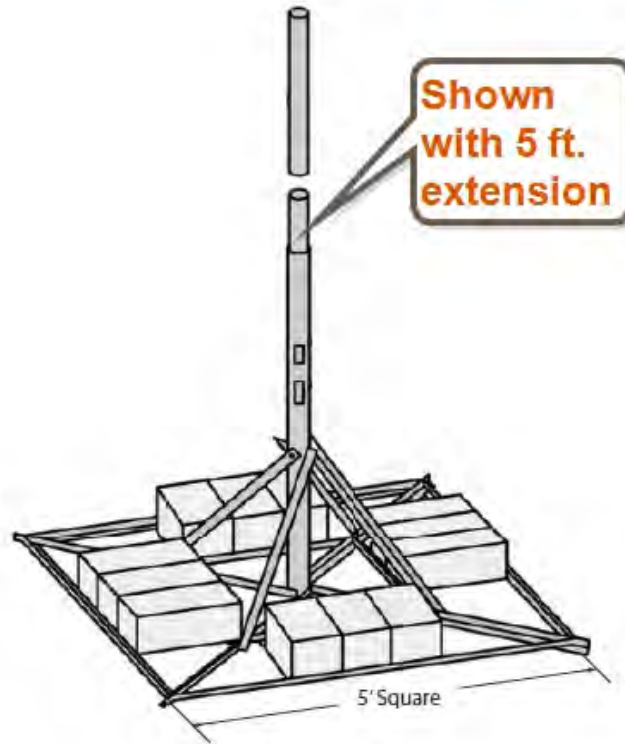
Figure 103 – ROHN JRM23855 Stand

Appendix C RF Antenna and Coax Installation

This appendix provides information about how to install the RF antenna and coax cable.

> ⚠️ **Neptune recommends that you consult with a qualified installer on the design and installation of the antenna system. If the installer is already familiar with the site and the existing equipment, this can make the installation go more smoothly.**

RF Antenna Overview

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

Mounting the Antennas

Consider the following when mounting the antennas.

Table 30 – Mounting Antenna Considerations

Action	Consider….
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 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 5 feet away from the tower to minimize coverage area problems.
Avoid making the antenna the tallest point in the surrounding area.	This may be unavoidable, but it increases the risk of the antenna being damaged by lighting.

Site Recommendations

These sites require extra care when determining a location to install the antenna.

The following are recommendations for sites with multiple transmitters, receivers, and antennas.

- Avoid mounting the antenna so that it is at the same height as another on the site, regardless of the frequencies.

- Mount the antennas one above the other (if possible) for sites that have multiple antennas. Separate each antenna by at least 10 feet. This minimizes the interference between the systems.

- Exception to the previous rule is for cellular antennas. As long as the antenna is either above, below, or in the middle of the ring of cell antennas, the two systems can coexist without inference.

- Antenna sites that must share space with multiple transmitting systems could require additional equipment to protect the systems from interfering with each other. These sites could also require additional engineering to make them perform well.

- If there are radio systems at the site that are already operating on the frequency band, it can 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 can require additional equipment, and might dictate how an installation is to be performed. Follow the site's requirements as long as the installation meets Neptune's minimum requirements.

Antenna Requirements

Consider the following.

- The antenna, if mounted on the side of a tower or other supporting structure, must be mounted so that it is at least 5 feet away from the structure. The components to offset the antenna are specific to the installation and are not provided by Neptune.

- The antenna must be carefully hoisted 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.

- The antenna connector must not be damaged during installation. 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.

Feed Line Overview

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 works properly. It is best to install the connectors 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 seemingly proper operation.

Coaxial Cable Lengths for the Gateway

Table 31 provides part numbers of acceptable coax cables.

Table 31 – Acceptable Coax Cables

Length	Part Number
40 ft. or <	Times Microwave Part Number: LMR-400-UF or LMR-400
100 ft. or <	Andrew Part Number: LD54-50A
> 100 ft.	Andrew Part Number: AVA5-50 or AVA5-50FX

You can order coax cable assemblies already terminated as accessories from Neptune or purchased from companies such as Tessco Technologies, Talley Communications, and Hutton Communications. Each end must be terminated with an N-male type connector. However, the larger 7/8-inch diameter coaxial cable, such as Andrew AVA5-50, uses a 7-16 DIN female connector on each end. Jumpers provide downsizing for the last 6 feet of the installation, allowing a more flexible and manageable connection. The jumpers are preassembled with the appropriate connectors at each end: a 7-16 DIN male on one end and an N-male on the other. See Table 32 on the next page.

Table 32 – Coaxial Order Matrix

Coax Lengths	Description	Loss/100 ft. @ 900 MHz	Max Length	Min Bend Radius	Neptune Part No.	Manufacturer Part No.
≤ 60 ft. - Pre-terminated Coax Cable Assemblies	LMR-400-UF 10 ft. assembly	4.7 dB	40 ft.	1 in.	13090-001	Tessco LMR400UFNMNM-10
	LMR-400-UF 20 ft. assembly	4.7 dB	40 ft.	1 in.	13090-002	Tessco LMR400UFNMNM-20
	LMR-400-UF 30 ft. assembly	4.7 dB	40 ft.	1 in.	13090-003	Tessco LMR400UFNMNM-30
	LMR-400-UF 40 ft, assembly	4.7 dB	40 ft.	1 in.	13090-004	Tessco LMR400UFNMNM-40
	LDF4-50A 50 ft. assembly	2.09 dB	100 ft.	5 in.	13090-006	Tessco 377096 or Hutton HSF-L4A-PNMNM-50
≤ 100 ft.	Cable, Coax, Heliax 1/2-in. Diameter[1]	2.09 dB	100 ft.	5 in.	10046-119	Andrew LDF4-50A
≤ 100 ft.	Connector, Coax N-male (two connectors required per installation)				8138-200	Andrew L4TNM-PS
≤ 200 ft.	Cable, Coax, Heliax 7/8-in. Diameter[1]	1.08 dB	200 ft.	10 in.	10046-118	Andrew AVA5-50 or AVA5-50FX
	Connector Coax, 7-16 DIN Female (two connectors required per installation)				8138-190	Andrew AL5DF-PS or Andrew 78EZDF
	Cable, Coax 6 ft. Jumper N-Male to 7-16 DIN male (two jumpers required per installation)				10046-117	Andrew F4A-PNMDM-6-USA

Feed Line Requirements

Consider the following.

- The antenna and feed line system installation must be certified by the installer after it is completed. The installer confirms that the installation is performing according to specifications.

- The cable must be secured at intervals per manufacturer specifications on vertical and horizontal runs. Horizontal runs may require a bridge to prevent damage.

- The feed line and connectors maximum loss must be less than 3dB.

- The feed line must be bonded at the top of the tower and at the base of the tower. Use Andrew bonding kits and procedures for all bonds.

- The feed line should be bonded at regular intervals down the tower for towers over 150 feet tall. The general recommendation is that the feed line should be bonded by a minimum of 200 feet. Site requirements and standard practices should dictate the configuration.

- A surge protector can be installed on the tower near the antenna to help protect the feed line, but it is optional.

- The cable should not exceed the bend radius. This helps prevent damage, which is not always visible on the exterior of the cable.

- The AVA5-cable (or larger) needs jumpers between the larger cable, and the collector and antenna connectors.

- The installation could use more than one type of coax cable. The 1/2-inch cable is flexible and may be used for the last section of a coax run to the collector, if the additional flexibility is required. See "Coaxial Cable Lengths for the Gateway" on page 103.

- The installation instructions for the Heliax Coaxial Cable are provided by Andrew. See Bulletin 17800B Revision C. Neptune can supply a PDF copy by request through Customer Support.

Table 33 – Installation Materials Needed

Items	Description/Recommendation
Securing Coax Cable	• Cable clips/coax hangers - for 1/2 inch or 7/8 inch • UV-Stable cable ties 8 inch - 12 inch (20.32 cm-30.48 cm)
Weatherzing Kit	Pick one of the following: • PolyPhasor P/N: WK-1 • Times Microwave P/N: WK-S-2 • Andrews P/N: 245171 • Scotch P/N: WK-101
Additional Weatherizing Materials	• Scotch® Heavy Duty Vinyl 22 • Scotch® Super 88 Electrical Tape • Scotch® Super 33+ Electrical Tape
Coax Ground Kits	Manufacturer specified for specific cable
Coax Hoisting Grips	Manufacturer specified for specific cable

System Certification

The antenna supplied is specified as having a VSWR of 1.5:1 for operating frequency. When measuring VSWR, you need to take into account losses in the feed line. The 1.5:1 VSWR translates into a Return Loss of 14.0dB. It is recommended that the feed line be certified as a separate step. This is best performed by completing the following steps.

1. Put a known amount of power into one end of the cable.

2. Correct the cable losses.

3. Verify the correct amount of power is coming out the other end with the proper test equipment, such as Frequency Domain Reflectometry (FDR) or Time Domain Reflectometry (TDR) cable and antenna testers.

Appendix D Cellular and Ethernet Considerations

This appendix provides information on the cellular modem used with the Gateway and the Ethernet.

Cellular Modem Overview

CalAmp's Vanguard 3000™ modem is designed for operation on both GSM and CDMA networks. It offers more choices and redundancy in carrier networks.

Table 34 – CDMA Bands & Speeds Supported by Vanguard 3000

CDMA Technology	Bands	Downlink	Uplink
EVDO Rev A (IS-856-A)	• 800 MHz Cellular • 1900 MHz PCS • 2100	3.1 Mbps	1.8 Mbps
1xEVDO Rev 0 (IS-856)	• 800 MHz Cellular • 1900 MHz PCS • 2100	2.4 Mbps	153.6 Kbps
1xRTT (IS-2000)	• 800 MHz Cellular • 1900 MHz PCS	153.6 Kbps	153.6 Kbps

Table 35 – GSM Bands and Speeds Supported by Vanguard 3000

GSM Technology	Bands	Downlink	Uplink
UMTS/HSPA	Five band: • 850 MHz • 900 MHz • 1900 MHz • 2100 MHz • AWS	7.2 Mbps	2.0 Mbps
EDGE/GPRS	Quad-band: • 850 MHz • 900 MHz • 1800 MHz • 1900 MHz	236 Kbps	23 Kbps

Table 36 – Certifying Carriers by Nation

United States	Canada	Mexico
• AT&T • Verizon	• Rogers • Bell • Telus	TBD

Configuring the Cellular Modem

You can configure CalAmp's Vanguard 3000 modem to operate in either a GSM or CDMA network. To manually configure the cellular modem for the Gateway, you need a Vanguard 3000 modem from CalAmp, and then complete the steps to configure it. Refer to the quick start guide for the Vanguard 3000 on CalAmp's website:

http://www.calamp.com/help/devicehelp/desktop/homepage.htm.

Equipment Required

To configure the cellular modem, you need the following equipment.

- Laptop or PC with Ethernet network port

- Vanguard 3000 Quick Start Guide

- Ethernet cable

- Cellular service provider, SIM card, if applicable, APN, and password (from the cellular service provider)

> Certain cellular services, such as CDMA, don't require a SIM card to operate. However, some cellular services do require a SIM card, such as GSM (EDGE and GPRS). Verify with cellular service provider.

Configuring the Modem

> The customer maintains the username, password, and APN information provided by the celluar service provider.

To configure the cellular modem, complete the following steps.

1. Insert the SIM card, if applicable in the cellular modem's SIM card slot. For CalAmp Vanguard 3000, be sure to insert the SIM card gold side facing upward.

2. Verify that the Gateway is powered on if you are configuring the cellular modem in the field.

> (i) It takes about three minutes for the Gateway to boot.

3. Verify the status LEDs (see Figure 104 and Figure 105) on the cellular modem are:

    - RSSI - active
    - SVC - active or flashing

Figure 104 – Cellular Modem Front - Status LEDs

Figure 105 – Cellular Modem Back - Status LEDs

4. Run the online configuration application for the modem by following the steps outlined in the *Quick Start Guide* for the Vanguard 3000.

    The Unit Status window appears. See Figure 106 – page 110.

Figure 106 – Unit Status Window

5. Verify the service is operational by opening an Internet browser page on the laptop.

   If you are able to successfully connect to a Web page, then the service is operational.

   > ⓘ If the service is not operational, contact the service provider.

   If you are unable to connect to a web page, refer to the *Vanguard 3000 User Manual* at:

   http://www.calamp.com/help/devicehelp/desktop/homepage.htm

Provisioning the Vanguard 3000 for GSM

> (i) After initial log on, change the password to enhance modem's security. Contact Neptune Customer Support for how to change the password on the Vanguard 3000 modem.

To provision the Vanguard 3000 for GSM service, complete the following steps.

1. Log on using **admin** as user name, and **password** as the password.

2. Confirm the settings, and then click **OTASP**.

   The provisioning process could take up to 90 seconds.

3. Click **Reset**, and then click **Reboot**, after the modem is provisioned.

4. Click **Yes** to confirm reboot, when prompted**.**

Provisioning is completed after rebooting, when the confirmation message displays and the PPP status is UP.

Modem Setup Troubleshooting

If you finish provisioning the modem and the main screen still displays empty fields, select the **Cell Connection** tab, then **Carrier,** and make sure that you have a primary carrier selected. Carrier APN must be populated with a number that you obtain from the carrier.

Cellular Modem Conversion Kit

The cellular modem conversion kit (Neptune Part No. 13247-000) is an optional kit that's required to convert an Ethernet version Gateway to a cellular version Gateway in the field.

Installing the Cellular Modem Conversion Kit

To convert an Ethernet version Gateway to a cellular version, complete the following steps.

1. Disconnect power to the Gateway.

2. Loosen the four security screws on the Gateway cover using the T27 Torx Pin-Head tool.

3. Open the Gateway cover.

4. Remove the Ethernet surge protector form the inside of the Gateway cover.

5. Install the cellular modem so that the SIM card slot faces left, when the Gateway cover is open, by attaching it to the inside of the Gateway cover using the four screws that are #4-40 in. x 3/16 in. long.

6. Connect the coax cable from the stubby cellular modem antenna to the cellular modem's **ANT** port.

7. Connect the Ethernet cable from the **J1003 BF Ethernet** port on the Gateway to the **LAN 1** Ethernet port on the cellular modem.

8. Connect the power cable (Neptune Part No. 13220-000) from the **J5** port on the Gateway to the **PWR** port on the cellular modem.

9. Configure the cellular modem as described in "Configuring the Cellular Modem" on page 108.

10. Close the Gateway cover.

11. Tighten the four screws in the Gateway cover to secure it.

External Cellular Antenna Option

Some installation sites can have a very weak signal (-90 dBm or weaker). An optional external cellular antenna kit (Neptune Part No. 13147-000) can increase the signal strength in these cases. Refer to "Gateway Kits" on page 5.

Installing the External Cellular Antenna

To install the external cellular antenna, complete the following steps.

1. Open the Gateway cover.

2. Disconnect the internal coax cable from the stubby cellular antenna.

3. Loosen and remove the lock-down nut and lock washer on the stubby cellular antenna, and then remove the antenna.

4. Install the coax surge arrestor in the same hole.

5. Verify that the O-ring for the surge arrestor is in place and is located on the inside of the Gateway enclosure.

6. Attach the internal coax cable to the surge arrestor.

7. Install the external cellular antenna, mounting the antenna higher than the Gateway to obtain better service reception.

> An optional wall mounting kit (Neptune Part No. 13145-000) is available for the external cellular antenna. The kit includes a 5-foot mast and wall mount brackets.

8. Connect the 6-foot coax cable (included) from the Gateway to the external cellular antenna.

> Longer coax cable assemblies (terminated) can be ordered, if needed, or refer to the coax cable matrix (Table 32 on page 104). The coax cables are available in lengths from 10 feet to 40 feet. The LMR-400-UF and LMR-400 by Times Microwave are acceptable coax cable types for use up to 40 feet. Use Andrew Part No LDF4-50A for coax cable lengths greater than 40 feet.

9. Weatherize the coax connections using the weatherization kit. See Table 4 on page 26.

Ethernet Termination

This section provides information on the termination of the Ethernet cable.

Straight-Through Ethernet Cable

For most installations of the Gateway, the straight-through Ethernet cable is used. Use a shielded category 5e or better Ethernet cable that is rated for outdoor use and is sunlight resistant, for example, Belden cable Part No. 7919A. Terminate the Ethernet cable according to Figure 107 using the T-568B wiring standard for both ends. One end should already be terminated to the switch or hub.
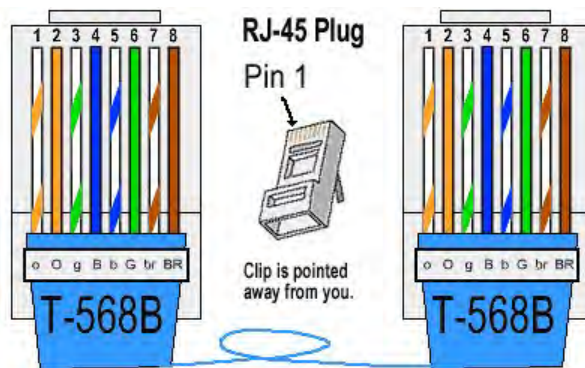
Figure 107 – Straight-Through Ethernet Cable

Crossover Ethernet Cable

In some cases, a crossover Ethernet cable is required. For example:

- You require a cable to connect two Ethernet devices together without a hub.

- You connect two hubs together.
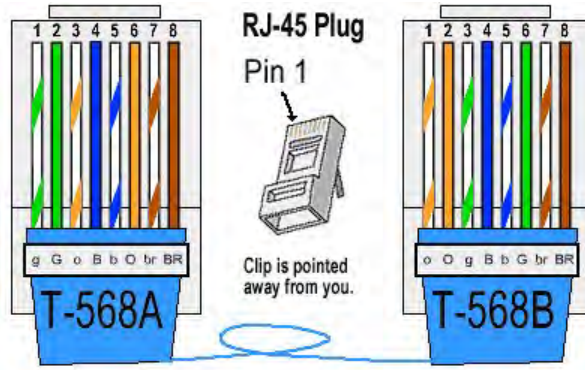
Figure 108 – Crossover Ethernet Cable

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 requires a crossover Ethernet cable to be compatible with the Gateway.

Table 37 – Cable Color Code

Symbol	Wire Color
o	White with orange stripe
O	Solid orange
g	White with green stripe
B	Solid blue
b	White with blue stripe
G	Solid green
br	White with brown stripe
BR	Solid brown

This page intentionally left blank.

R900 Gateway Installation and Maintenance Guide

Glossary

A

AC

Abbreviation for alternating current, typically used in grid applications.

Agonic lines

Imaginary line on the surface of the earth connecting all points at which the declination of magnetic field of the earth is zero.

AH

Abbreviation for Amp-hour. Refers to battery capacity.

Ammeter

Instrument used to measure current.

Amp

Common unit of measurement for electrical current.

AMR

Automatic Meter Reading. The automated process of reading meters.

APN

Access Point Name.

Array

PV modules and all the associated wiring and mounting hardware.

AWG

American Wire Gage.

B

Ballast

Heavy material used to secure the stability of the equipment stand. For the R900 Gateway v4 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 allow mutiple users to be connected over the same channel.

CIS

Customer Information System.

Converter

Instrument used to convert power from AC:DC or DC:DC in a regulated manner.

D

DC

Abbreviation for direct current, typically used in battery applications.

DOD

Abbreviation for Depth of discharge. Refers to a battery's state of discharge.

E

Earth

Common term referring to the reference point for electrical equipment where it comes into contact with the soil, also referred to as Earth Ground.

EDGE

Enhanced Data for GSM Evolution.

F

FDR

Frequency Domain Reflectometry.

FET

Field-effect transistor.

G

Gateway

Device that collects meter reading data from Neptune's absolute encoder register interfacing with Neptune's R900 MIU and transmits the data for collection. This unit receives the data and stores data to be downloaded through the N_SIGHT PLUS host software.

GPRS

General Packet Radio Service. It is a packet-based wireless communication service that promises data rates from 56 up to 114 Kbps and continuous connection to the Internet.

Ground

Common term referring to the electrical zero volt reference point.

GSM

Global System for Mobile Communication. It is an international standard for digital cellular communications.

H

Hud

High voltage disconnect (both solar and load).

Hz

Abbreviation for hertz, unit of measurement for AC frequency. 60Hz equals 60 cycles per second.

I

IMEI

International Mobile Equipment Indentifier.

Inverter

Instrument used to convert power from DC:AC in a regulated manner.

Isogonic lines

Lines on the Earth's surface along with the declination have the same constant value.

J

Joule

Common unit of measurment for electrical energy. Joules equals watts per second.

L

LED

Light-Emitting Diode.

Lud

Low voltage disconnect (load only).

LVD

Abbreviation for Low Voltage Disconnect. A device in charge controllers that disconnects the load from the battery to protect from over discharge.

M

Magnetic Declination

The angle between the Magnetic North (MN, compass north) and True North (TN) at any given latitude/longitude.

MEID

Mobile Equipment Identifier.

MHz

Abbreviation for megahertz, where 1 MHz represents one million cycles per second.

MIU

Meter Interface Unit.

MMK4

Heavy duty fiberglass base station mount.

MOSFET

Metal-oxide semiconductor field-effect transistor is a specialized FET (field-effect transistor), and like all transistors, is used for switching or amplifying signals.

N

N_SIGHT PLUS Host Software

N_SIGHT PLUS is a software tool for gathering data packets containing information on remote MIU readings. This software provides the ability to obtain frequent meter readings to perform detailed usage analysis, such as flow profiling. N_SIGHT PLUS can increase the frequency of data collection and improve customer service.

NCP-2

Non Corrosion Product.

NGDC

National Geophysical Data Center.

No-OX ID

Electrical contact lubricant (electrical contact grease). It is an electrically conductive grease that keeps metals free from rust and corrosion.

NOAA

National Oceanic and Atmospheric Administration.

NTP

Network Time Protocol.

O

OCP

Overcurrent and short circuit protection (load, solar, overcurrent).

OD

Outer Diameter.

Ohm

Common unit of measurement for electrical resistance.

P

PF

Abbreviation for Power Factor. Used to describe the quality of AC current in percentage.

PV

Abbreviation for Photovoltaic. Refers to the solar module that generates power from sunlight.

PVM

Pulse Width Modulation. Is the most effective means to achieve constant voltage battery charging by switching the solar system controller's power devices.

R

RSSI

Strength of the radio signal when it is received.

S

SIM

System Information Manager.

Sine Wave

Refers to the wave-form of AC power, measured in hertz (Hz).

SOC

State of Charge.

SOV

Abbreviation for Silicon Oxide Varistor. Used to protect electrical equipment from surges.

SVC

Service.

T

TDR

Time Domain Reflectometry.

U

UV

Ultraviolet light.

V

VA

Common unit of measurement for AC power. VA equals Volts x Amps x Power Factor.

Voc

Voltage open circuit.

Voltmeter

Instrument used to measure voltage.

Volts

Common unit of measurement for electrical potential.

Vpc

Abbreviation for Volts Per Cell, used to describe the individual battery cell voltage. A 12V battery has 6, 2V cells.

VSWR

Voltage Standing Wave Ratio.

Vuc

Voltage under charge.

W

Watt

Common unit of measurement for DC power. Watts equals Volts x Amps.

Wattmeter

Instrument used to measure power.

Index

A

AC

    power 2

    unit 6

AC-powered system 32

accessories 1

activate 7, 9

analysis 1

angle locator 35

antenna

    cable 39

    cellular 112

    mast 3

B

backhaul 2, 5

ballast, requirements 40, 99

battery box 24, 32, 92

    enclosure 24

    mounting to large pole 47

    terminal 33

    wiring 37

bend radius 105

brackets 48

breakers 47

build USB 20

C

calibrated 90

carriage bolts 48

cellular

    considerations 107

    modem 2, 5-6

        configure 42, 52, 108

        connectivity 73

        conversion kit 111

        power 74

    service 7

charge controller 41

CIS 1

coax cable 1, 31, 103, 112

collectors tab 11

command polling 17

components 5

configure 7

connecting

    cables 58

    Ethernet cable 63

connector hub 37

controller 88

corrosion inhibitor 33

crossover, ethernet 114

D

digital board 72

DOD 83

E

EDGE 7

W

WAC 78

wall mount 4

weatherize 31, 39, 51, 61, 113

Web Host 16

web services 1

wind velocity 99

wireless service provider 7

Z

Zones 5

Ti SALES

36 Hudson Rd
Sudbury MA 01776

800-225-4616
www.tisales.com

NEPTUNE
TECHNOLOGY GROUP