



R900<sup>®</sup> Belt Clip Transceiver  
Users' Guide



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## FCC Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

**NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

### **RF Exposure Information**

This equipment complies with the FCC RF radiation requirements for uncontrolled environments. To maintain compliance with these requirements, the antenna and any radiating elements should be installed to ensure that a minimum separation distance of 20 cm is maintained from the general population.

### **Professional Installation**

In accordance with section 15.203 of the FCC rules and regulations, the MIU must be professionally installed by trained meter installers.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### **Industry Canada (IC) Statements**

Section 8.4 of RSS-GEN

This device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Cet appareil est conforme aux normes RSS exonérées de licence d'Industrie Canada. L'opération est soumise aux deux conditions suivantes: 1) cet appareil ne doit pas provoquer d'interférence, et 2) cet appareil doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement indésirable de l'appareil.

Section 8.3 of RSS-GEN

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada.

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

This radio transmitter IC: 4171B-L900M has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

- Maximum permissible gain of +1 dBi and required impedance of 75 ohm.
- Approved Antenna types:
  - R900<sup>®</sup> Pit Antenna, part number 12527-XXX.
  - High Gain R900<sup>®</sup> Pit Antenna, part number 13586-XXX.
  - R900<sup>®</sup> Wall Antenna, part number 13717-000.
  - Wire monopole, part number 12641-XXX.

En vertu de la réglementation d'Industrie Canada, cet émetteur radio ne peut fonctionner qu'avec une antenne d'un type et un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Pour réduire les interférences radio potentielles avec d'autres utilisateurs, le type d'antenne et son gain devraient être choisis de manière à ce que la puissance rayonnée isotropiquement équivalente (e.i.r.p.) ne soit pas supérieure à celle nécessaire à une communication.

Cet émetteur radio IC: 4171B-L900M a été approuvé par Industrie Canada pour fonctionner avec les types d'antennes énumérés ci-dessous avec le gain maximal admissible et l'impédance d'antenne requise pour chaque type d'antenne indiqué. Les types d'antenne non inclus dans cette liste, ayant un gain supérieur au gain maximal indiqué pour ce type, sont strictement interdits pour être utilisés avec ce périphérique.

- Gain maximal admissible de +1 dBi et impédance requise de 75 ohms.
- Type(s) d'antenne approuvé
  - Antenne de puits R900<sup>®</sup>, numéro de pièce 12527-XXX
  - Antenne de puits à gain élevé R900<sup>®</sup>, référence 13586-XXX
  - Antenne murale R900<sup>®</sup>, numéro d'article 13717-00
  - Fil monopôle, numéro d'article 12641-XXX

*R900® Belt Clip Transceiver Users' Guide*  
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# Chapter 1: Setting Up the R900<sup>®</sup> Belt Clip Transceiver

This chapter introduces you to the R900<sup>®</sup> Belt Clip Transceiver (R900 BCT) and provides basic instructions for unpacking and inspecting the unit.



This guide contains instructions only for the use of the BCT with N\_SIGHT<sup>®</sup> and N\_SIGHT<sup>®</sup> PLUS. For instructions on how to use the BCT with Neptune<sup>®</sup> 360<sup>™</sup>, see the *Neptune<sup>®</sup> 360<sup>™</sup> Mobile Users' Guide*. Also, see the *Neptune<sup>®</sup> 360<sup>™</sup> Handheld Users' Guide* for information about setting up the BCT in the Neptune<sup>®</sup> 360<sup>™</sup> system.

## R900<sup>®</sup> Belt Clip Transceiver Overview

The R900 BCT is a software-defined receiver capable of simultaneously receiving R900, Advantage, and Pocket ProReader RF transmissions. The R900 BCT collects readings and transfers them to the handheld through a Bluetooth<sup>®</sup> connection. The R900 BCT also receives and stores R900 readings to import into the billing system without the use of a handheld. The R900 BCT is software-defined so you can apply firmware updates to keep your R900 BCT current with new products introduced to the market.



You can pair the R900 BCT with either an Android<sup>™</sup>\* or an Apple<sup>®</sup> iOS smart mobile device to use for field presentment purposes or as an additional tool for field service personnel using Neptune's NGO<sup>™</sup> app. Download Neptune's NGO<sup>™</sup> app on either the Apple Store or Google Play<sup>™</sup>.

\*Android is a trademark of Google LLC.

## Nomad<sup>®</sup> Handheld and R900<sup>®</sup> BCT

The Trimble<sup>®</sup> Nomad<sup>®</sup> handheld connects to Neptune's R900 BCT via Bluetooth to receive the meter readings.

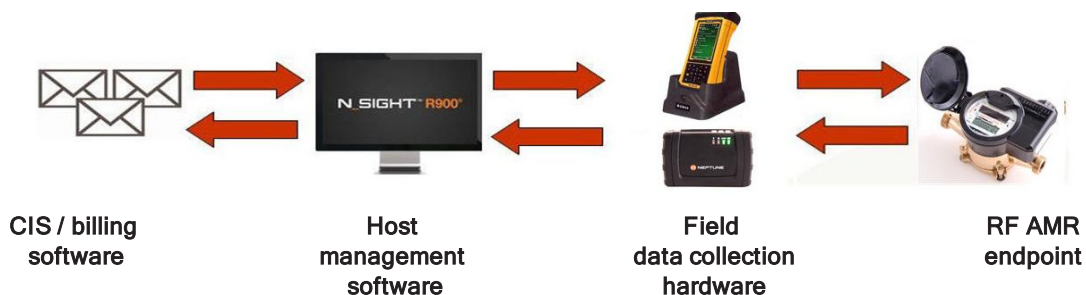


Figure 1 – R900<sup>®</sup> BCT Meter Reading Cycle

## Unpacking and Inspecting Equipment

Check that you have received all the items you need for the type of system configuration and inspect the items for shipping damage. If you detect any damage, return the damaged equipment to Neptune. See the *Neptune® Handheld System Users' Manual* for instructions for returning damaged equipment.



Save the packing box used to ship the handheld for repacking the unit in its original box. The handling involved in land and air transport often subjects the handheld to impact beyond normal use. The packing box absorbs shocks and protects the handheld during shipping.

## R900® BCT Components

"R900® BCT Components" below shows the basic components of the R900 BCT.

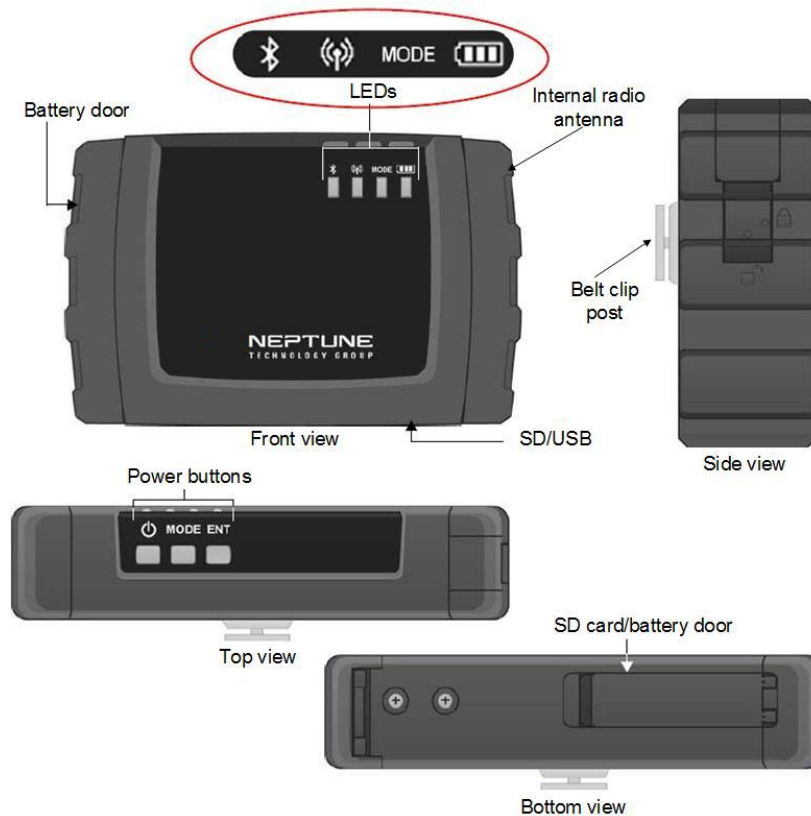


Figure 2 – R900® BCT Components

## Chapter 2: Using the R900® BCT

This chapter explains how to incorporate the R900® BCT into the N\_SIGHT® R900® host software and how you use the BCT.

### Understanding the R900® BCT Modes

The following tables describe the R900 BCT modes of operation. You change modes on the R900 BCT with a combination of the Mode and Enter buttons. This combination prevents accidental mode changes during operation.

To cycle through available modes, press **Mode**. The Mode indicator flashes the color for the mode to enter. To enter and display the Mode, press **Enter** within two seconds after pressing Mode. If you do not press Enter in time, the R900 BCT stays in the previous mode.

Table 1 – R900®BCT Power



Function	Description
Power ON	Press  for two seconds. The backlight turns orange when the power is on.  The unit takes approximately one minute to fully boot. The Mode and RF lights are white during most of bootup. The unit is fully booted when the Mode and Enter light turn off and the Mode LED displays the previous mode of operation.
Power OFF	Press  for two seconds. The mode and RF lights blink.
Setting Date / Time	The R900 BCT synchronizes the time with the Trimble® Nomad® when the two are paired. The time on the R900 BCT defaults to the time from the last Nomad synchronization.

Table 2 – R900®LEDs










Function	LED Color	Description
<b>Reading Modes</b>		
Normal	Green	Normal mode connects through Bluetooth to a host device. Selection between Route (filtered) and RF Test (unfiltered) occurs in the host software.  1. Press <b>MODE</b>  until the Mode LED flashes green.








Table 2 – R900® LEDs (continued)

Function	LED Color	Description
		2. Press <b>ENT</b>  and the Mode LED turns green.
Un-attended	Yellow	<p>Unfiltered Operations Mode can operate using the battery or when connected to vehicle power.</p> <p>To enter this mode with battery power:</p> <ol style="list-style-type: none"> <li>1. Press <b>MODE</b>  until the Mode LED is yellow.</li> <li>2. Press <b>ENT</b> .</li> </ol> <p>To enter from when connected to vehicle power, press <b>MODE</b>  until the Mode LED is yellow.</p>
Installed Mode	Magenta	<ol style="list-style-type: none"> <li>1. Press <b>ENT</b>  and release.</li> <li>2. Press <b>ENT</b>  again and hold for five seconds, then release. The <b>Mode</b> LED is <b>Magenta</b>.</li> <li>3. Connect the USB. The USB charger must be capable of supplying 1A of current.</li> </ol>
USB mass storage	White	<p>The SD card appears as an external drive to the PC. To enter this mode:</p> <ol style="list-style-type: none"> <li>1. Connect the <b>USB</b> to the R900 BCT and to the PC. You must connect the USB before the unit can enter the USB mass storage mode.</li> <li>2. Press <b>MODE</b>  until the Mode LED flashes white.</li> <li>3. Press <b>ENT</b> . The SD card now shows as an external drive attached to the PC.</li> </ol>

## Accessing the R900® BCT Status Screen

First, set the R900 BCT to Normal Mode to access the R900 BCT Status screen. The following table explains how to access the status screen on the handheld.

Table 3 – R900® BCT Software Functions

Function	Description
While in Route	Neptune Key, System, UTILS, AMR Status =  ,  ,  , 
	<ol style="list-style-type: none"> <li>1. Select the <b>Advanced Options</b>.</li> <li>2. Select the <b>check box</b>.</li> <li>3. Select <b>Belt Clip Status</b>.</li> </ol>
From the Synchronize screen	<ol style="list-style-type: none"> <li>1. Press <b>Tab</b> twice.</li> <li>2. Select .</li> <li>3. Select  UTILS.</li> <li>4. Select  <b>Belt Clip Status</b>.</li> </ol>

### Understanding the R900® BCT LED Operating Modes

The following table defines the different colors for the flashing Mode LED.

Table 4 – R900® BCT LED Operating Modes


State	LED Colors
Unit powered OFF	No color; LEDs off.
<b>Power</b> 	
On-Battery 100% – 31%	Green.
On-Battery 30% – 16%	Yellow.
On-Battery 15% – 6%	Red.
On-Battery 5% – Critical	Flashes red.
Battery – Charging	Flashes yellow.
<b>Mode</b>	
Normal mode	Green.
Unattended mode	Yellow.

Table 4 – R900® BCT LED Operating Modes (continued)

State	LED Colors
Installed mode	Magenta.
Mass storage mode	White.
<b>RF Mode</b> 	
No reading being received	Off.
Receive R900 / ERT packet	Flashes green when receiving.
Receive Advantage packet	Flashes cyan when receiving.
No reading received in two + minutes	Solid red.
<b>Bluetooth</b> 	
Not Connected	Off.
Pairing	Flashes blue.
Connected	Blue.
<b>Error Codes</b>	
Temperature error	Bluetooth and Power LED flash red five times.
Hardware error	Bluetooth and Power LED are solid red.
Battery error	Power LED flashes red and yellow.
Cannot power on - battery too low	Power LED flashes red three times.
SD card error	Mode LED is solid red.

## Understanding the External Battery Charger Status

The following table defines the external battery LED indicators.

Table 5 – Battery LED Indicators

LED	Indicates
Red, yellow, green or OFF	Startup initialization when applying power.
OFF	No battery inserted.
Yellow	Battery charging.
Solid green	Battery charged successfully.
Red	Error.

## Battery Disposal and Recycling

Call2Recycle® at 1-800-822-8837 handles battery disposal and recycling. Customers are encouraged to contact Call2Recycle to find their nearest drop-off location for proper disposal and recycling.

## Pairing the Trimble® Nomad® to the R900® BCT through Bluetooth

Complete these steps only if you are pairing the Nomad to the R900 BCT for the first time.

1. Power **ON** the R900 BCT and set to Normal Node, if not already set. See "Understanding the R900® BCT Modes" on page 3.

2. On the Nomad, click .

3. Click  – UTILS.

4. Click  – **Belt Clip Status**.

The AMR Connection screen appears. The R900 BCT is visible in the **Broadcasting Device** drop-down selection list.

5. Choose the device from the drop-down selection list and click **Bluetooth**.


The R900 BCT Status screen now displays the device details:

- If you have previously paired a device, go to the **R900 BCT Status** screen *not* the AMR Connection screen.
- To **Change Devices**, click this option on the bottom of the R900 BCT Status screen. You then see the AMR Connection screen and can choose the device from the drop-down selection list.

## Using the R900® BCT to Read a Route

To begin reading a route using the R900 BCT, first load a route into the Nomad. See “Loading and Unloading Data for Handhelds” in the *N\_SIGHT® R900® Online Help*.



Click  to load a route when you are working in the N\_SIGHT® R900® host software. Press F1 to see the instructions for loading a route to a handheld.

After the route is loaded and the pairing is complete, log in to receive readings. For optimum RF performance, point the R900 BCT's radio antenna toward the direction of the meter.



Neptune recommends meter readers place the belt clip for their R900 BCT with the antenna end pointed forward. Human bodies and other structures can interfere with radio transmission between MIUs and the R900 BCT. Wearing the R900 BCT with the antenna side pointed forward minimizes that interference.

## R900® BCT Status Screen in N\_SIGHT®

While the Nomad and the R900 BCT are paired, you can access a screen that shows the status of the R900 BCT. You see a message like the following:

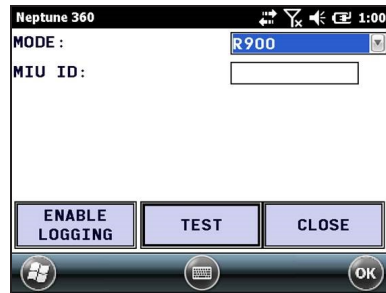


Figure 3 – R900® BCT Status Screen



The following information appears on this screen.

Table 6 – R900® BCT Status Screen Information

Field	Description
Connection	Displays the type of connection used to pair the R900 BCT, such as Bluetooth.
Device	Displays the name of the R900 BCT.
Temperature	Displays the temperature of the R900 BCT, such as normal.
SD MEM Free	Displays the amount of available memory for the SD card.
Date	Displays the date and time as MM/DD/YYYY HH:MM.
Firmware	Displays the version of the firmware on the R900 BCT.
Battery	Displays the available battery percentages.
RF Mode	Allows you to change the reading mode for the R900 BCT by clicking the drop-down selection list: <ul style="list-style-type: none"> <li>• Efficiency – reduced RF performance, has best battery life.</li> <li>• Moderate – default RF performance.</li> <li>• Performance – best RF performance, decreases battery life.</li> </ul>

### R900® BCT Status Screen in Neptune® 360™ Mobile

Follow these steps to access the belt clip status information on your mobile device.

1. Open Neptune® 360™ Mobile on your device, and then power on a compatible R900 Belt Clip Transceiver (BCT) to display the Neptune 360 Mobile main screen.

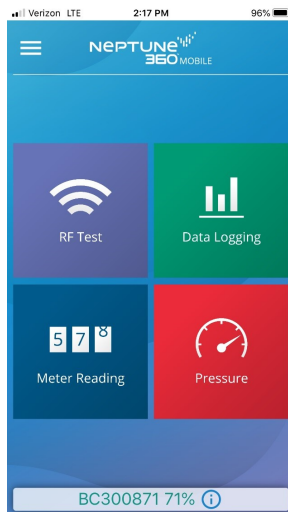


Figure 4 – Neptune® 360™ Mobile Main Screen

2. Tap the menu icon in the top left corner of the screen to display the Neptune 360 Mobile menu.

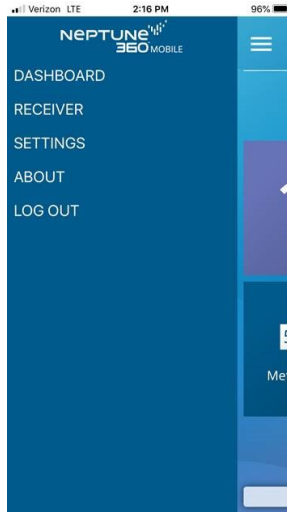


Figure 5 – Neptune® 360™ Mobile Menu

3. Tap **RECEIVER** to display all compatible R900 Belt Clip Transceivers within connectivity range.



Figure 6 – Available BCTs

4. Tap the ID for the transceiver you want to pair with.

## Displaying Transceiver Information

After you pair with a transceiver, you can display transceiver details on your mobile device.

1. On the Neptune 360 Mobile main menu, tap the transceiver ID at the bottom of the screen.

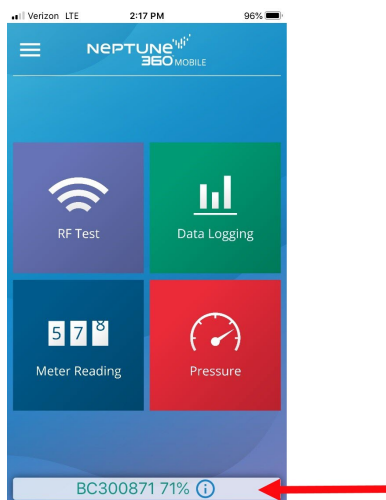


Figure 7 – Transceiver ID

Neptune 360 Mobile displays the following screen showing the transceiver details.

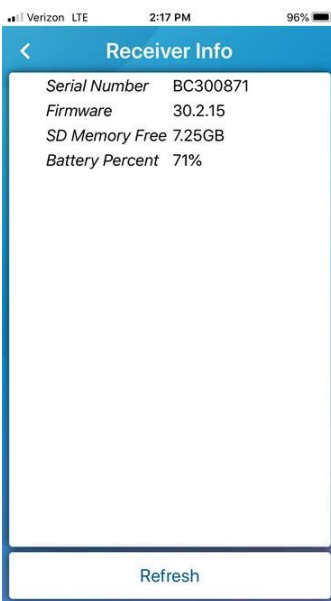


Figure 8 – Paired Transceiver Details

## RF Performance Modes

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You can change the Mode on the R900 BCT Status screen. The unit has three options for the RF performance during a reading:

- Efficiency – reduces RF performance, has best battery life.
- Moderate – default RF performance.
- Performance – best RF performance, decreases battery life.

RF performance refers specifically to the throughput of the receiver that can impact the processing speed of readings in high density areas. The modes do not impact the range.

### Selecting the R900® BCT Reading Mode




To choose the reading mode, complete the following steps.

1. On the Nomad, click .
2. Click  – UTILS.
3. Click  – Belt Clip Status.  
The R900 BCT Status screen appears.
4. Tap the drop-down selection list for **RF Mode** to choose the reading mode. See "Setting Up the R900® Belt Clip Transceiver" on page 1.

### Using the R900® BCT RF Test Mode

RF Test Mode allows the R900 BCT to go into a continuous receive mode and listen for any and all R900 transmissions.

*From the Login Screen:*

1. On the Nomad, click .
2. Click  – UTILS.
3. Click  – RF Test.

The RF Test Mode screen appears.

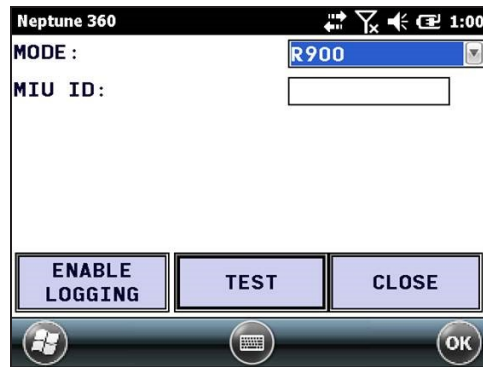






Figure 9 – RF Test Mode Screen

*From the Route Screen:*

1. In the route, click .
2. Click  – System.
3. Click  – Utilities.
4. Click  – RF Test.

The RF Test Mode screen appears.

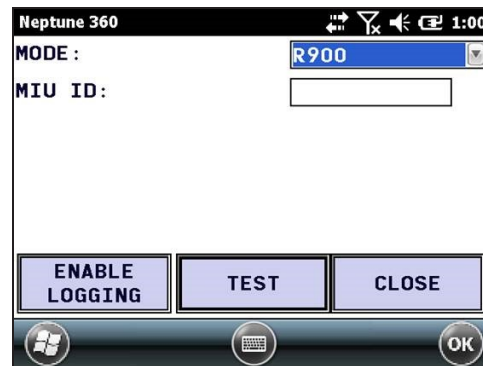


Figure 10 – R900® BCT RF Mode Screen from Route

### R900® BCT SD Card Functionality

Any data that the R000 BCT reads and captures it stores on its internal SD card.

The SD card also handles the firmware updates explained in the "R900® Belt Clip Transceiver Overview" on page 1.

## Using the R900® BCT for Field Presentment and Field Service

---

In addition to meter reading, you can pair the R900 BCT with an Android™\* or an Apple® device and the associated NGO app utility. The R900 BCT can then perform data logging to acquire data on water usage for a particular meter. In addition, the utility's field personnel can use the NGO app's RF test functionality to test the MIU's transmission. For additional information, consult the NGO product literature.

## Updating the R900® BCT Firmware

---



You cannot update multiple R900 BCTs at once; you must update them individually.

When there is an update to the R900 BCT firmware, it is available from Neptune through the web updates in the R900 BCT software. You can also obtain it from Neptune Customer Support through email or direct directly from an FTP site.

\*Android is a trademark of Google LLC.

With either choice for receiving the firmware update, the system updates the firmware in the N\_SIGHT R900 database and sends it to the R900 BCT through the USB transfer cable, or saves it to the SD card and installs on the R900 BCT.



To update the R900 BCT firmware with the USB cable, connect the R900 BCT to the PC and be in Mass Storage Mode. To update through the SD card, use an SD card reader to transfer the Firmware Update File to the SD card.

To update the R900 BCT firmware, complete the following steps.

1. Connect the R900 BCT to the PC and place it in **Mass Storage Mode**.
2. In the N\_SIGHT R900 host software, select **Utilities**.
3. Select the **Beltclip Firmware** tab. See "Tab within N\_SIGHT® R900® Utilities " below.

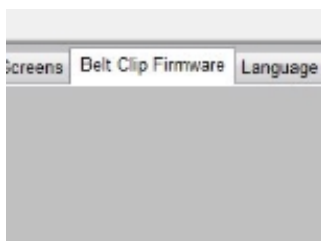


Figure 11 – Tab within N\_SIGHT® R900® Utilities

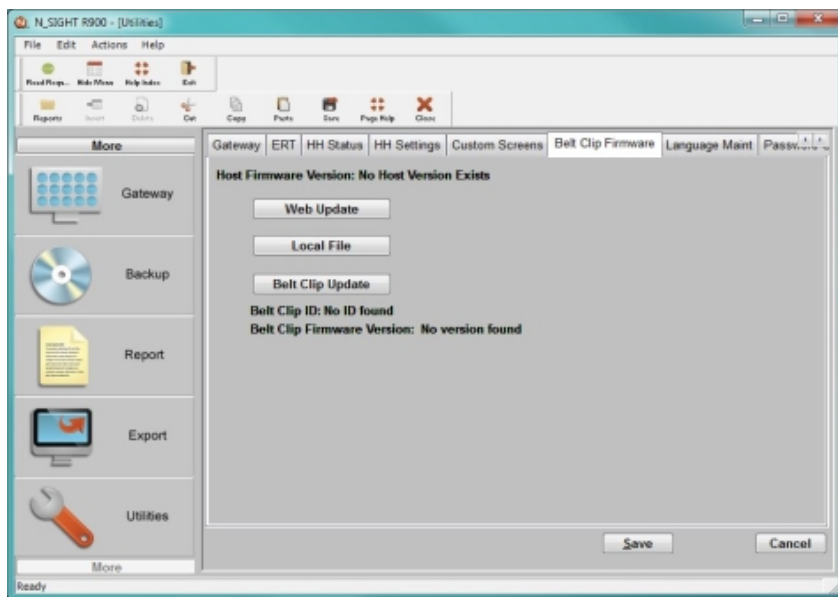


Figure 12 – R900® BCT Firmware Tab with Update Options



The Web Update and Local File buttons perform the same task of updating the database with the new firmware version depending on where the new firmware file is located.

## How the Firmware Update Works

---

The following explains how the firmware update works.

- Web Update – looks to the Neptune servers for an updated version of the R900 BCT firmware and downloads it to the database.
- Local File – allows you to import updated firmware from a thumb drive, network drive, or FTP site into the database.
- Belt Clip Update – locates the updated firmware file after the updated firmware is downloaded and sends it to the R900 BCT through the USB transfer cable.



# Appendix A: N\_SIGHT<sup>®</sup> Meter Reading and Override

## Neptune<sup>®</sup> Meter Dials

Meter odometers appear similar to these examples. All meters contain six-indexing wheels, and the shaded dials are fixed zeros printed on the meter dial face. The E-CODER<sup>®</sup> register displays a nine-dial output and transmits eight.

### Number of Dials

In N\_SIGHT<sup>®</sup>, the host software adjusts the reading to the value of the Dials field in the import file whether the Adjust Dials option is enabled. The unadjusted reading is also exported to a different field.

N\_SIGHT captures eight-digit readings (reflecting the higher resolution of the E-CODER). Readings from ARB<sup>®</sup> V and ProRead<sup>™</sup> encoders are padded with trailing zeros to fill the eight digits.



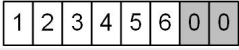
#### Example:

A two-board ARB V register reading of 1234 becomes 12340000 in the N\_SIGHT host software. There are settings in N\_SIGHT that allow the number of dials displayed to be eight or less.

### Typical Meter Dials

The cubic foot measurement dial is used in the following examples.

Table 7 – Meter Reading Display

Readings as They Appear For	Small Meters 5/8" - 1" 1 Cu. Ft. Dial	Intermediate Meters 1 1/2" - 4" 10 Cu. Ft. Dial	Large Meters 6" and up 100 Cu. Ft. Dial
Typical meter dials			
Actual cumulative meter reading	123,456 cu. ft.	1,234,560 cu. ft.	12,345,600 cu. ft.
Four-digit meter reading	1234	1234	1234
Six-digit meter reading (the sixth digit in a six-digit meter reading is rounded down to five or zero)	123455	123455	123455

## Meter Readings

---

As shown in Table 7 on the previous page, typical four-digit remote meter readings include only the four left-most indexing digits on the meter odometer. They appear in the handheld as an uninterrupted string of numbers

**Example:** 1234, 9876, 0617

If the reading includes a digit error, the error is displayed.

**Example:** 123-

Typical six-digit meter readings include all of the indexing digits on the meter odometer and also appear as an uninterrupted string of numbers.

**Example:** 123455, 987650, 051705

If the reading includes a digit error, the error is displayed.

**Example:** 987-0, 051H05



In all remote meter readings:

- Non-encoded digits, including fixed zeros, are not included in the meter reading.
- The sixth digit in a six-digit ARB reading is displayed as a five or zero.

The CIS utility billing system vendor must compensate for the number of billing units based on utility-specific requirements. This procedure is normally handled by the billing software by using a multiplier or type code for each meter type to calculate the billing amount. In a mixed meter environment, the CIS utility billing system vendor should track meter size, type, manufacturer, and multiplier for each account.

**Example:**

Assume all customers are billed by 100-cubic-foot increments. All meters are four-digit remotes. Using the same figures as in Table 7 on the previous page, refer to Table 8 on the facing page for the required multipliers.

Table 8 – Meter Reading Display - Four Digit Remotes

Elements Needed to Determine Billed Reading	Small Meters 5/8 inch - 1 inch 1 Cu. Ft. Dial	Intermediate Meters 1½ inch - 4 inch 10 Cu. Ft. Dial	Large Meters 6 inch and up 100 Cu. Ft. Dial																					
Typical meter dials	<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4*</td><td>5</td><td>6</td></tr></table>	1	2	3	4*	5	6	<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5*</td><td>6</td><td></td></tr></table>	1	2	3	4	5*	6		<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6*</td><td>0</td><td>0</td></tr></table>	1	2	3	4	5	6*	0	0
1	2	3	4*	5	6																			
1	2	3	4	5*	6																			
1	2	3	4	5	6*	0	0																	
Four-digit meter reading	1234	1234	1234																					
Actual cumulative meter reading	123,456 cu. ft.	1,234,560 cu. ft.	12,345,600 cu. ft.																					
Required billing units	1234	12345	123456																					
Billing system multiplier and billed meter reading	1234 x 1 = 1234	1234 x 10 = 12340	1234 x 100 = 123400																					

\*Required billing units = 100 cu. ft. increments

## ProRead™ (ARB® VI) Registers

The Neptune ProRead™ register contains a programmable odometer. The odometers in the previous examples are hard-wired to present either a four-digit or six-digit meter reading. The odometer in the ProRead registers is also available with those options, but the meter can be programmed to return up to the maximum number of digits that are hard-wired in the odometers. Programming always begins at the leftmost odometer digit.

Example: 

1	2	3	4	5	6
---	---	---	---	---	---

A four-digit hard-wired version can be programmed to read either:

- Four digits = 1234
- Three digits = 123

The four-digit hard-wired version cannot be programmed to return five digits or six digits. If this accidentally occurs, the read would appear as an error.

Example: 1234-0 

1	2	3	4	5	6	0	0
---	---	---	---	---	---	---	---

Likewise, a six-digit hard-wired version can be programmed to read:

1. Six digits = 123455
2. Five digits = 12345
3. Four digits = 1234
4. Three digits = 123

Applying and programming these types of registers correctly for the appropriate meter size can greatly enhance billing accuracy. Instead of the previous meter reading examples in which multipliers of 10 are used to create zero billing digits at the end of the actual read digits, these meters can provide greater resolution. This results in an increase in billing accuracy.

With the given scenario on the previous page (100-cubic foot increments), we recommend using four-digit, hard-wired meters for all small meters, since only four digits are required to obtain the appropriate billing unit accuracy. We also recommend using six-digit, hard-wired meters on all intermediate and large meters. The intermediate meters can be programmed to return five digits, and the large meters can be programmed to return all six digits.

### E-CODER® (ARB® VII) Electronic Digital Register

The E-CODER® is an electronic digital encoder register that has a proprietary integrated circuit that provides absolute registration with no internal battery requirement. The E-CODER functions in two modes: E-CoderBASIC and E-CoderPLUS. The E-CoderBASIC mode functionality is the same as ProRead featuring a programmable ID number (up to 10-digits), three user characters, and three-digit to six-digit meter reading.

When connected to Neptune's R900® v2 radio MIU, the E-CODER operates in E-CoderPLUS mode providing a high-resolution, eight-digit meter reading and value-added features including leak, tamper, and backflow detection.

**Example: Nine-digit LCD displays the meter reading in billing units of gallons or cubic feet.**

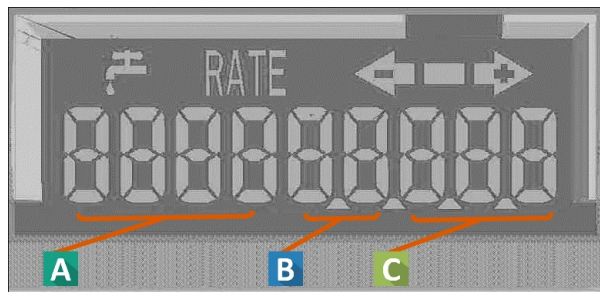


Figure 13 – Nine-Digit LCD Display

<b>A</b>	First four digits	Typical billing digits.
<b>B</b>	Fifth and Sixth reading digits	Reading units.
<b>C</b>	Last three digits	Testing units used for meter testing.

The following sections describe the two modes of the E-CODER.

## E-CoderBASIC Mode

E-CoderBASIC Mode applies when an E-CODER is connected to a TouchPad.

The E-CODER functionality is the same as a standard ProRead™ encoder; that is, the odometer can be programmed with a field programmer to yield meter readings, from three to six digits.

A specific ID number and user characters can also be programmed into the unit just like the standard ProRead encoder.

### Example 1

E-CODER Odometer-Cubic Foot dial for residential meters, 5/8 inch through 1 inch:

1	2	3	4	5	6	.	7	8	9
---	---	---	---	---	---	---	---	---	---

- Digit position six = one cubic foot position.
- This reading = 123,456 cubic feet (123,456.789 cubic feet).



If programed as a six-digit meter reading, the interrogator and hand-held device displays:

1	2	3	4	5	6
---	---	---	---	---	---

After the handheld device is unloaded, the N\_SIGHT host software database (dependent on the number of dials, justification, and zero-fill setting in the N\_SIGHT software setup). In the following example, the number of dials is 6 displayed as:

1	2	3	4	5	6
---	---	---	---	---	---

### Example 2

E-CODER (ARB VII) Odometer-Gallon dial for residential meters, 5/8 inch through 1 inch.

1	2	3	4	5	6	7	.	8	9
---	---	---	---	---	---	---	---	---	---

- Digit position six = 10-gallon position.
- Digit position seven = one-gallon position.
- This reading = 1,234,567 gallons (1,234,567.89 gallons).



If programmed as a six-digit meter reading, the handheld displays:

1	2	3	4	5	6
---	---	---	---	---	---

The N\_SIGHT software database (see the previous note) displays.

1	2	3	4	5	6
---	---	---	---	---	---

## E-CODER® PLUS Mode

The E-CoderPLUS Mode applies when an E-CODER is connected to an R900 v2.

### Example 1

E-CODER Odometer-Cubic Foot dial for residential meters, 5/8 inch through 1 inch:

1	2	3	4	5	6	.	7	8	9
---	---	---	---	---	---	---	---	---	---

- Digit position six = one-cubic foot position.
- This reading = 123,456 cubic feet (123,456.789 cubic feet)

The handheld device receiving the RF transmission displays:

1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---

The read displayed appears like this example in either RF Test Mode or in Route Mode:

1	2	3	4	5	6
---	---	---	---	---	---

The display is dependent upon the number of dials, justification, and zero-fill setting in the N\_SIGHT software setup. In the previous example, the number of dials is six.

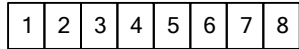
### Example 2

E-CODER Odometer-Gallon dial for residential meters, 5/8 inch through 1 inch.

1	2	3	4	5	6	7	.	8	9
---	---	---	---	---	---	---	---	---	---

- Digit position six = 10-gallon position.
- Digit position seven = one-gallon position.
- This reading = 1,234,567 gallons (1,234,567.89 gallons).

The handheld device receiving the RF transmission displays:



The read appears like this example in either RF Test Mode or in Route Mode.

The N\_SIGHT software database displays:



The display is dependent upon the number of dials, justification, and zero-fill setting in the N\_SIGHT software setup. In the previous example, the number of dials is six.

Table 9 – Meter Reading Display for Cubic Feet and Gallons

Readings as They Appear For	Small Meters 5/8 inch - 1 inch	Intermediate Meters 1 1/2 inch - 4 inch	Large Meters 6 inch and up
E-CODER (ARB VII) Dial			
Cubic Feet	123456.789	1234567.89	12345678.9
Gallon	1234567.89	12345678.9	123456789



The sixth digit in a six-digit meter reading is rounded down to five or zero.

Table 10 – Meter Reading Display for Cubic Meters

Readings as They Appear For	Small Meters 5/8 inch - 1 inch	Intermediate Meters 1 1/2 inch - 4 inch	Large Meters 6 inch and up
E-CODER (ARB VII) Dial			
Cubic Feet	12345.6789	123456.789	1234567.89

## Manual Meter Readings

Manually entered meter readings are not restricted to the same digit rules as the remote meter readings. For consistency, Neptune prefers that meter readers enter manual readings in the same format that automatic reads appear for a given meter. This is especially important

in a mixed manual or automatic metering system. However, manual reads entered are based on instructions the utility gives the meter reader.

Example: 

1	2	3	4	5	6	0	0
---	---	---	---	---	---	---	---

Using the meter shown here, a typical manual read appears as:

- 123
- 1234
- 12345
- 123456
- 12345600

The preferred manual reading for billing in 100-cubic-foot increments is 123456. Any unused digit positions in the meter reading defaults to spaces.

The meter reader is generally instructed to enter a specific quantity of digits to match the billing requirements. For example, if the CIS utility billing system vendor calculates bills based on 100-cubic-foot increments, the meter reader should enter all meter digits from left to right, down to the 100-cubic-foot position on the meter dial. For example:

- **1 cu ft meter** - Enter the four left-most digits, including leading zeros.
- **10 cu ft meter** - Enter the five left-most digits, including leading zeros.
- **100 cu ft meter** - Enter the six left-most digits, including leading zeros.



In some cases, the utility can instruct the meter reader to enter the reading without leading zeros. This can work because the CIS utility billing system vendor can construct the correct consumption and produce a bill from these types of readings.

## Right Justify and Zero Fill Meter Readings

---

The N\_SIGHT host software can right justify or zero fill the readings that are unloaded from the handheld. The settings of this parameter are determined by the utilities and their billing requirements.

### Examples:

- A typical four-digit reading: 1527
- Zero-filled enabled: 1527000000
- Right-justify enabled: 0000001527

If a meter reading contains an error, the system does not right-justify or zero-fill adjustments. Treat these readings as rejects or re-reads or estimated by the CIS utility billing system vendor.



## Adjust the R900® / R900v2 / R900v3 Readings for EZ Route

This section is only for EZ Route users.

After you install and configure the N\_SIGHT software, the first time you start N\_SIGHT you are directed to enter the initial setup values for your system so that it is ready for use. Refer to Table 6 in the N\_SIGHT Software Suite Getting Started Guide for a description of all the values.



Neptune strongly recommends that you do not change the locations for the directories created by the installation program.

Adjust R900 Readings is the option for an automatic adjustment of R900 readings. To enable this adjustment, check this box on the N\_SIGHT Initial Setup Values Dialog.



This option reads only the first set of digits depending on the number of dials set in the Import file.

When this option is selected, the Adjust Dials option appears. This option allows you to set the number of dials. This option is only available if you check the box for Adjust R900 Readings

### Examples:

If the number of dials is set to four, then the system reads and returns the reading for the first four digits. If the number of dials is set to a number higher than six, then the system drops the trailing zeros.

The number of dials in the Import file should be set to adjust to the actual number of digits of the register. If the number of dials is less than the actual reading digits, the readings have a shortened number of digits and are not accurate.

## Enabling the R900® Adjustment

To enable the Adjust R900 Readings option, complete the following steps.

1. When you start N\_SIGHT for the first time, the Enter Initial Setup Values dialog appears as pictured in "N\_SIGHT® Meter Reading and Override" on page 17. Select **Adjust R900 Readings** to enable the setup option.

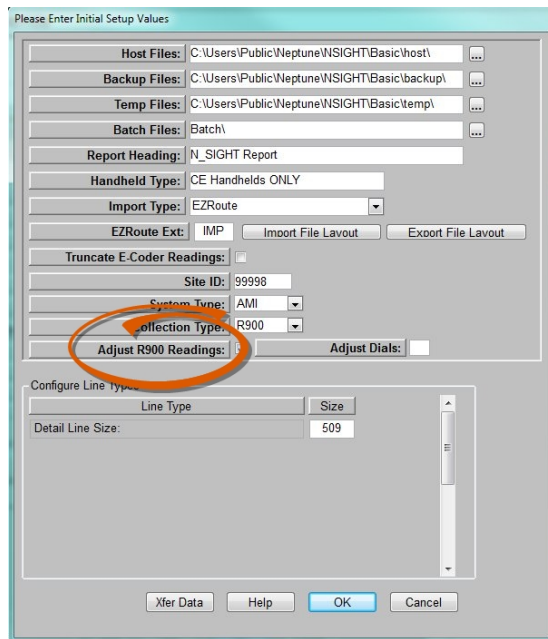


Figure 14 – Initial Setup Values Dialog



The Adjust R900 Readings option only appears when EZRoute is selected for Import Type. The option reads only the first set of digits depending on the number of dials set in the import file.

The Adjust Dials check box appears on the Initial Setup Value dialog.

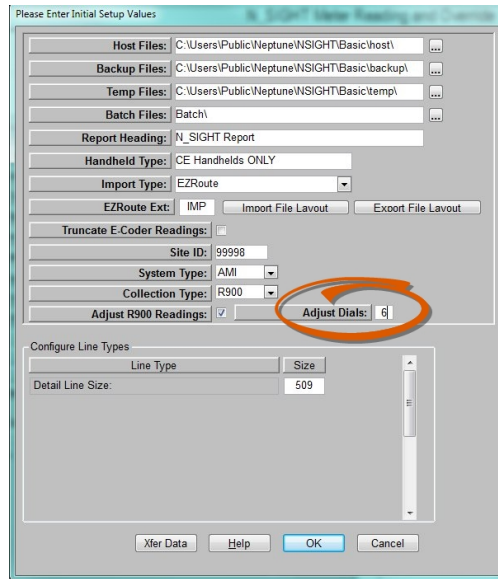


Figure 15 – Adjust Dials Check Box



The Adjust Dials value is used as the default for all R900 records, if the number of dials is not set for accounts in the import file.

2. Select **Adjust Dials**, if applicable. This field displays only when you select Adjust R900 Readings.



The Number of Dials in the Import file should be set to adjust to the actual number of digits of the reading. If the Number of Dials is less than the actual reading digits, the readings have a shortened number of digits and are not accurate.

## Override Readings

This section describes overriding the meter readings.

### High / Low Limit Tests

As meter readings are entered, a high / low meter reading limit test is performed on all accounts that contain data in the High Reading Limit and Low Reading Limit fields.

The characteristics of four fields affect high / low testing: the Meter Reading field, High Reading Limit, Low Reading Limit, and Number of Dials fields.

## Meter Reading Field

---

Before continuing, review the definition of a meter reading field.

### *Meter Readings Review*

The four-digit meters transmit the four most significant digits on the odometer to the handheld. If the meter odometer has a reading of:

1	2	3	4	5	6
---	---	---	---	---	---

 the handheld receives 1234.

The six-digit meters transmit all six indexing digits on the odometer to the handheld. For example, if the meter odometer has a reading of:

1	2	3	4	5	6
---	---	---	---	---	---

 the handheld receives 123455. The last digit of a six-digit meter displays a five or a zero.

In addition, remember that the utility can program ProRead registers to transmit between three and six digits in a meter reading program.



The meter transmits leading zeros in ARB readings, which the handheld receives. If the Read Direction is L or R, the number of digits in the Hi/Lo fields must match the number of digits in the reading. If the Read Direction is C, then leading zeros in the accompanying High Limit and Low Limit fields can be omitted, but the Number of Dials field must contain the correct quantity of digits that are expected to be received by the handheld.

### *Manual Meter Review*

For manually-entered meter readings, the **Meter Reading** field can contain from one to 10 digits entered by the meter reader.

If the meter odometer reads 001234, the meter reader (depending on the value in the **Number of Dials** field and the utility instructions) can enter any of these valid reads:

- 001234 – 1
- 00123 – 12
- 0012 – 123
- 001 – 234

## High and Low Limit Fields

The data placed in the **High Limit** and **Low Limit** reading fields can be either left-justified or right-justified. However, all unused leading or trailing characters in the field must be spaces.

### Example

Using the same example from the Manual Meter Review section, if the low reading limit is equal to the previous reading, the value in the Low Limit field can be any of the following:

- **Number of Dials** = six...**Low Limit** = 001234 or 1234
- **Number of Dials** = five...**Low Limit** = 00123 or 123
- **Number of Dials** = four...**Low Limit** = 0012 or 12

The data in the **High Limit** field would need to be equivalent quantities:

- **Number of Dials** = six...**High Limit** = 001350 or 1350
- **Number of Dials** = five...**High Limit** = 00135 or 135
- **Number of Dials** = four...**High Limit** = 0013 or 13

Table 11 – Disabling the High / Low

High Limit Field	Low Limit Field	Test Results
Contains nines.	Contains zeros.	All readings pass the high / low test.
Contains all spaces.	Contains all spaces.	Handheld does not attempt the test for that account.
Contents equals <b>Low Limit</b> field.	Contents equals <b>High Limit</b> field.	All readings pass the high / low test.



If the Number of Dials field contains incorrect data, the handheld attempts, but does not complete, the high / low test for that account. The meter reader receives a warning.

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## Appendix B: N\_SIGHT<sup>®</sup> Record Types, Codes, and Configurations

The appendix includes the following information.

- N\_SIGHT<sup>®</sup> Record Types (see Table 12 below)
- Types of N\_SIGHT Read Codes (see Table 13 below)
- Meter Type, Read Type Configurations (see the following):
  - Table 14 on page 33
  - Table 15 on page 33
  - Table 16 on page 33

### N\_SIGHT<sup>®</sup> Record Types

The following table defines the N-SIGHT record types.

Table 12 – N\_SIGHT<sup>®</sup> Record Types

Record Type	Description
COMHD	Company Header.
RTEHD	Route Header: belongs to the company header it follows.
PRMDT	Premises Detail: Belongs to the route header it follows.
PRMNT	Premises Notes: Belongs to the premises detail it follows.
MTRDT	Meter Detail: Belongs to the premises detail it follows.
ORDST	Order Status: Belongs to the meter it follows (Export file only).
RDGDT	Reading Detail: Belongs to the meter it follows.
ERTDT	ERT Detail: Belongs to the reading it follows.

### Read Codes Types

Appendix B above is intended for the N\_SIGHT file format only.

Table 13 – Read Code Types

Read Code	Description
AH	Admin Hi Fail.
AL	Admin Low Fail.

Table 13 – Read Code Types (continued)

Read Code	Description
AR	Admin Read.
AU	Admin Inactive.
AZ	Admin Zero Use.
EF	External Failure; adds more for validation of radio and probe reads.
ER	External Read (Probe Read).
KA	Keyed Alpha.
KH	Keyed High.
KI	Keyed Inactive.
KL	Keyed Low.
KN	Keyed Negative Usage.
KR	Keyed Read.
KV	Keyed Verified.
KZ	Keyed Zero Consumption.
RA	Radio Alpha Characters (:::;).
RH	Radio High Reading.
RI	Radio Inactive.
RL	Radio Low Reading.
RN	Radio Negative Consumption.
RR	Radio Read.
RT	Radio Tamper.
RV	Radio Verified.
RZ	Radio Zero Consumption.



## Meter Type, Read Type Configurations

The following tables are examples of Meter Type, Read Type configurations.

Table 14 – Single Read Type Examples

Read Type	Meter Type	Indicates
WATR	0001	Advantage.
WATR	0002	R900.
WATR	0003	ERT.
WATR	0004	Keyed.

Table 15 – Multiple Read Type Examples

Read Type	Meter Type	Indicates
WATR	0001	Advantage.
WATR	0002	R900.
WATR	0003	ERT.
WATR	0004	Keyed.
KWHR	0009	Keyed.
DEMA	0010	Keyed.

Table 16 – Compound Meters

Read Type	Meter Type	Indicates
WATH	0011	Keyed.
WATL	0011	Keyed.



Meter Types cannot be shared with multiple Read Types, unless it involves the high and low sides of a compound meter.

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## Appendix C: N\_SIGHT<sup>®</sup> PLUS Required Forms

This appendix provides information about the Sample Fixed Network Questionnaire and Propagation Analysis Request Form necessary for N\_SIGHT<sup>®</sup> PLUS.

### Fixed Network Questionnaire

You must complete the Fixed Network Questionnaire before implementing an AMI system.

**Fixed Network Questionnaire**

Please respond to each question with as much detail as necessary in order to provide a complete picture of the project.

Territory Manager: \_\_\_\_\_ Date: \_\_\_\_\_  
Distributor Contact (name, title, phone number): \_\_\_\_\_  
Current Neptune System Customer?  Yes  No Existing Neptune software version? \_\_\_\_\_  
Who will do system N\_SIGHT<sup>™</sup> training? \_\_\_\_\_

Utility Information

1. Utility Name: \_\_\_\_\_  
2. Utility Address: \_\_\_\_\_  
3. Utility Key Contacts (name, title, phone number): \_\_\_\_\_  
4. Utility Fixed Network Project Manager (name, title, phone number): \_\_\_\_\_

IT (Network, Server, Backhaul)

5. Utility IT Contacts for Project Duration (name, title, phone number): \_\_\_\_\_  
6. Who is providing server? \_\_\_\_\_ Meets Specs?   
7. Backhaul Type (Cellular, Ethernet, Point2Point Radio): \_\_\_\_\_

Billing/MS System

8. Billing Provider (name, company name, phone number): \_\_\_\_\_  
9. Is an interface necessary to Billing?  Yes  No Is Transfer File already in Place? Yes  No   
10. Transfer File Writer (name, title, phone number): \_\_\_\_\_

MIU

11. MIU Installer (name, company name, phone number): \_\_\_\_\_  
12. What is meter/MIU installation schedule? \_\_\_\_\_  
13. Meter units of measure? \_\_\_\_\_  
14. Box lids style? \_\_\_\_\_ Who is providing? \_\_\_\_\_  
15. Total Services: \_\_\_\_\_  
16. Number of Start/Pilot Services: \_\_\_\_\_  
17. Duration of Pilot/Project: \_\_\_\_\_  
18. Square miles to be covered: \_\_\_\_\_

Gateway/Collector

19. How many collectors? \_\_\_\_\_  
20. Collector installer (name, company name, phone number): \_\_\_\_\_  
21. Electrical Contractor (name, company name, phone number): \_\_\_\_\_  
22. Antenna installer (name, company name, phone number): \_\_\_\_\_  
23. Any solar sites? \_\_\_\_\_  
24. Any permits required? \_\_\_\_\_  
25. Traffic control required? \_\_\_\_\_  
26. Any height/wind restrictions? \_\_\_\_\_  
27. Airport/AM towers in area? \_\_\_\_\_

Additional Comments:

\_\_\_\_\_


**NEPTUNE**  
v20150902

Figure 16 – Sample Fixed Network Questionnaire

## Propagation Analysis

The Propagation Analysis Request Form, electronic list of services, suggested antenna location details, and environmental factors are required to evaluate the utility account area to determine the extent of R450™ or R900® system coverage.

Following is a Sample Propagation Analysis Request Form Neptune uses to conduct the propagation study.



### Fixed Network Propagation Analysis Request Form

Requestor: \_\_\_\_\_ Request Date: mm/dd/yy \_\_\_\_\_

Distributor: \_\_\_\_\_ NTG Account Manager: \_\_\_\_\_

Date Required: mm/dd/yy \_\_\_\_\_ RFP Due/Presentation Date: mm/dd/yy \_\_\_\_\_

Purpose:  RFP  Presentation/Estimate/Decision  Other: \_\_\_\_\_

TURNKEY Collector Installation Quote Request (additional time required after study)

Utility/Account Name: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_

Services (addresses/coordinates) Attached  
[preferred files: ESRI Shape file (SHP), EXCEL spreadsheet]

#Services (for study): \_\_\_\_\_ Project Location (city/state): \_\_\_\_\_

**Check all to include:**

System Type:  R450  Enhanced R900  R900v3  Other: \_\_\_\_\_

Reading Interval:  Daily (default)  Hourly  Other: \_\_\_\_\_

Service Coverage Expectation:  99% / 90% (default)  Other: \_\_\_\_\_

**MII/Endpoint Type:**

PIT with External Pit Lid Antenna (recommended)  WALL External/Outside (recommended)

INSIDE WALL (not recommended)  INSIDE E-CODER/R900/  
(not recommended and requires RM approval)

GAS/R900G  
(R900G system only requires RM approval)  OTHER: \_\_\_\_\_

Asset (collector/antenna) Locations Attached  
[preferred files: ESRI Shape file (SHP), EXCEL spreadsheet] - Include Coordinates, Address, City, State, Structure Type, Structure Height, Ground Elevation, Antenna Height, etc.

Known RF Systems (SCADA, WiFi, etc.) on Structures (details included with asset information)

Height/Wind Restrictions for Structures  Details: \_\_\_\_\_

Permitting Required  Details: \_\_\_\_\_

Airport in Area (5miles/8km)  Details: \_\_\_\_\_

AM Stations in Area (2miles/3km)  Details: \_\_\_\_\_

**Additional Comments:**

ALL PROPAGATION REQUESTS SHOULD BE ROUTED THROUGH A NEPTUNE ACCOUNT MANAGER (TERRITORY, DISTRICT, OR AREA)

v20150601
[propagationrequest@neptunete.com](mailto:propagationrequest@neptunete.com)
06/19/2015

Figure 17 – Propagation Analysis Request Form

## Appendix D: Fixed Network System - IT Requirements

Fixed network systems are information technology (IT) dependent. As a result, it is critical to have your IT department involved at the earliest stages of the project.

### N\_SIGHT<sup>®</sup> / N\_SIGHT<sup>®</sup> PLUS - Server

You can provide or purchase a dedicated server for the host software per specifications. Hosting through a cloud server is also an available option.

The host software requires a dedicated standalone server. Server specifications are based on the size of your customer base and are listed in Table 1.6 on page 1 and Table 1.9 on page 1.

It is also important to review the *N\_SIGHT<sup>®</sup> Software Suite Getting Starting Guide* for additional information.

### Utility IT - Role and Responsibility

The following list includes the role and responsibility of the IT department at your utility.

- Install and setup a dedicated server for N\_SIGHT / N\_SIGHT PLUS software, including internal / external static IP addresses / DNS, NTP service.
- Set up the server with the local admin account required for support, upgrades, maintenance, etc.
- Configure the server network connections to email server, firewall, third-party applications, client workstations, etc.
- Open the R900 Gateway to server communication ports in the firewall. You can do this through an Ethernet connection (to a switch, router, media converter, or point-to-point radio communications) or via cellular communications (GPRS / CDMA) through the Internet. You can use the Static IP addresses.
- Remote access (RDP or VPN) to SERVER for system support access.



**A critical component of a successful system is ongoing support from Neptune's Customer Support Group.**

- Solicit support for the CIS utility billing system vendor interface which often requires support from your IT and billing departments to verify or create billing transfer files. (Neptune v4 import file recommended.)
- Purchase cellular data plans using approved supported providers.
- Set up and support billing and mobile meter reading workstations for the N\_SIGHT host software installation.
- Be sure to have an FTP server, which is required for R900 Gateway v1-v3 systems. Secure FTP is not supported.

- Provide usual services for the server, same as existing servers within utility network:
  - UPS.
  - Anti-virus.
  - Server data backup (off-site).
  - NTP.

## Server, Firewall, and Network

---

The following typical ports are required to open the firewall, servers, and routers.

**Table 17 – Firewall, Server, and Router Ports**

Port	Purpose
TCP 2638	Systems to access the server Sybase database.
TCP 25	SMTP - Email server to server (unless changed).
TCP 8080	HTTP N_SIGHT and PLUS client / server connections.
TCP 20/21	FTP support to server (upgrades, maintenance) and FTP location communication to R900 Gateway v1-v3 and server.
UDP 123	NTP - R900 Gateway to access server or Public NTP.
TCP 443	Web Services - R900 Gateway v4 communication with server.
TCP 3389	RDP - Support access to server.

## Key Points

---

- The server must connect to the utility SMTP mail server in order to process system-generated emails and alarms. Default SMTP port TCP 25 is required
- The server must have a static IP address (internal/public-external) and DNS for R450 DCs, R450 MCs, and R900 Gateways. Public-External IP/DNS is required for cellular; can also be needed for other third-party application connectivity.
- The R900 Gateways require NTP service. The server should be configured with NTP in Windows OS or other Utility NTP server; otherwise R900 Gateways need connection to public NTP servers. Using this NTP source requires UDP 123 to be open.
- The Support Group requires FTP ports 20 and 21 to transfer files to and from the server.

## N\_SIGHT® PLUS Server

This section provides information on the N\_SIGHT PLUS server.

### Server Specifications

The server requires the following specifications. The N\_SIGHT PLUS software requires a dedicated standalone server. Server specifications are shown in Table 19 and are based on the size of the utility's customer base.

Neptune recommends using the services provided for other servers in network including:

- UPS
- Server data backup (off-site)
- Anti-virus
- The server must connect to the utility SMTP mail server in order to process system generated emails and alarms. Default SMTP port TCP 25 is required.
- The server must have a static IP address for R450 DCs and R450 MCs to connect to the database.
- The server typically is located behind the utility firewall. A static public / external IP address is also needed when cellular backhaul is used. TCP 2440 must be opened on the firewall.
- The R450 DCs and R450 MCs require NTP service. The server should be configured with NTP in Windows OS or other utility NTP server; otherwise R450 DCs and R450 MCs need connection to public NTP servers. Using this NTP source requires UDP 123 to be open.
- The FTP ports 20 and 21 are required for the Neptune Technical Support Group to transfer files to / from the server. The following typical ports are required to be open on the firewall, servers, and routers.

Table 18 – FTP Ports Definitions

Port	Purpose
TCP 2638	Systems to access server Sybase database
TCP 25	SMTP – Email server to server (unless changed)
TCP 8080	HTTP – Client and N_SIGHT push access to server
TCP 3389	RDP – Support access to server and Ethernet for R450 DCs and R450 MCs
TCP 20/21	FTP – Support access to server (for example: upgrades and maintenance)
UDP 123	NTP – R450 DCs and R450 MCs to access server or public NTP

## R450™ DC or R450™ MC Backhauls

There are two different types of backhaul options available for the R450 DC and R450 MC: Ethernet and cellular. The network setup is slightly different for each type, depending on the method used.

### Network (Ethernet) R450™ DCs or R450™ MCs

The R450 DCs and R450 MCs are installed inside the utility network and there are very few firewall considerations.

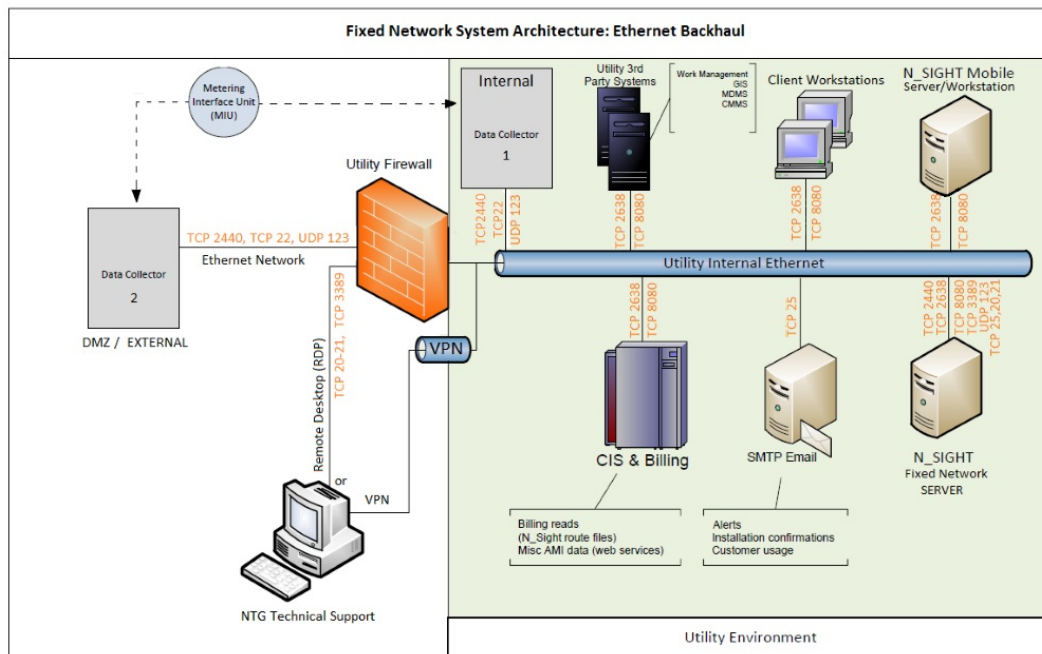


Figure 18 – Fixed Network System Architecture – Ethernet Bakhhaul

The R450 DCs and R450 MCs require either dynamic or static IP addresses. Static IP addresses are more reliable and secure for firewall maintenance as ports can be opened for specific addresses rather than a range of addresses assigned by the IT network administrator. Regardless, a list of IP addresses or ranges must be made available prior to R450 DCs or R450 MCs configuration and activation.

An external IP address is required for the database. R450 DCs and R450 MCs can connect to the external address through a DMZ. The external address can use NAT (network address translation) to point to the internal address.



The following ports are required to be open on the firewall, servers, and routers.

Table 19 – Required Ethernet Ports

Port	Purpose
UDP 123	NTP - R450 DC and R450 MC to access server or public NTP.
TCP 22	SSH - used for troubleshooting R450 DCs and R450 MCs by Technical Support.
TCP 2440	MobiLink - R450 DC and R450 MC communication with server.
TCP 2440	Collector database version 2.6-
TCP 2500	Collector database version 5.0+.

*Cellular (GPRS or CDMA) R450™ DCs or R450™ MCs*

The R450 DCs and R450 MCs are installed outside the utility network and connect through the Internet to the database.

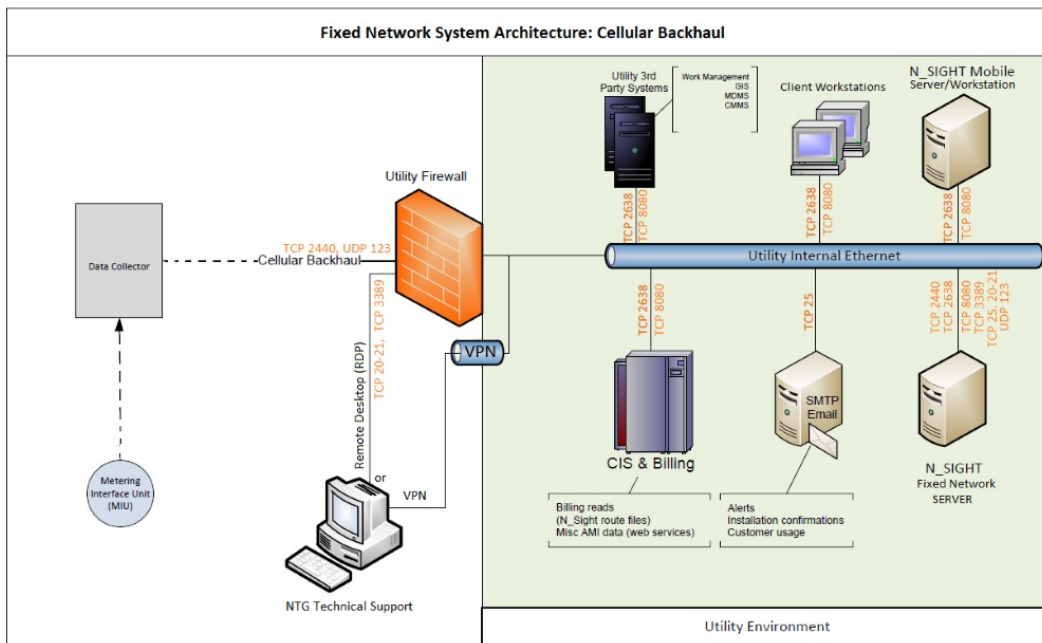


Figure 19 – Fixed Network System Architecture - Cellular Backhaul

The modems in the R450 DCs and R450 MCs support GSM (GPRS) or CDMA networks.

The R450 DCs and R450 MCs require either dynamic or static IP addresses provided by the carrier. Static IP addresses are more reliable and secure for firewall maintenance as ports can be opened for specific addresses rather than a range of addresses assigned by the cellular network provider. Regardless, a list of static IP addresses must be made available prior to R450 DCs or R450 MCs configuration and activation.

A static public / external IP address is required for the server. R450 DCs and R450 MCs can connect to the public / external IP address through DMZ and firewall. The external address uses NAT (network address translation) to point to the internal address.

The following ports are required to be open on the firewall, servers, and routers.

Table 20 – Required Cellular Ports

Port	Purpose
UDP 123	NTP - R450 DC and R450 MC to access the server
TCP 2440	MobiLink - R450 DC and R450 MC communication with the server
TCP 2440	Collector database versions 2.6-
TCP 2500	Collector database versions 5.0+

Cellular data plans required for cellular modem provisioning are usually referred to as M2M plans. For new systems, it is recommended to start with a large (2-GB to 4-GB / collector, unlimited) data plan until usage can be assessed after several months. MIU, R450 DC, or R450 MC installations can create added usage at project start. It is possible to provide an estimate; however, the cellular account holder is responsible for any overage costs. Some carrier plans include pooling multiple cellular devices into one large bucket of data, so make sure the bucket equals number of collectors multiplied by 4-GB.

The carrier could require a SIM card and/or the IMEI, ESN, or MEID from cellular modem to add to account and provision. The IMEI, ESN, or MEID are provided to the project / utility stakeholders after R450 DCs and R450 MCs are shipped from the manufacturer, so the account setup and provisioning can be completed by carrier.

If static IP addresses are desired for implementation, they must be requested during setup and provisioning. GPRS with SIM cards have different APN for static IP versus dynamic IP. The carrier also provides a static IP address for each modem or SIM.

### R900® Gateway Backhauls

R900 Gateway ports are the same for Ethernet or cellular. However, ports must be opened in external firewalls for cellular to connect with server. Internal firewalls can also be challenging for Ethernet when multiple networks are connected. It is important to verify all firewall ports are set between R900 Gateway and server.

#### *R900® Gateway v4 Using Web Services*

In addition to above server ports, the R900 Gateway v4 requires the following ports to be opened for the firewall, servers, and routers for connectivity. These ports are subject to change and additional ports could be needed in the future. The following ports are required to be open on the firewall, servers, and routers.

Table 21 – R900® Gateway Ports

Port	Purpose
UDP 123	NTP - R450 DC and R450 MC to access the server or public NTP
TCP 443	Web services - R900 Gateway communication with server

*Cellular Data Plans*

Cellular provider plans are required for cellular modem provisioning, which usually refers to M2M plans. For new systems, Neptune recommends starting with a large (2-GB to 4-GB/R900 Gateway, or unlimited) data plan, until usage is assessed after several months. MIU and R900 Gateway installations can create added usage at project start.

It is possible to provide an estimate; however, the cellular account holder is responsible for any overage costs. Some carrier plans include pooling multiple cellular devices into one large bucket of data, so make sure bucket equals the number of R900 Gateway multiplied by 4-GB.

The carrier could require a SIM card or the IMEI, ESN, or MEID from the cellular modem to add to the account and provision. The IMEI, ESN, or MEID are provided to Project / Utility Stakeholders after R900 Gateways are shipped from the manufacturer so the carrier can complete the account setup and provisioning. If R900 Gateway static IP addresses are desired for implementation, request them from the carrier during setup and provisioning. GPRS carriers with SIM cards often have different APNs for static and dynamic IPs. The carrier can provide a list with static IP address details for each modem and SIM.

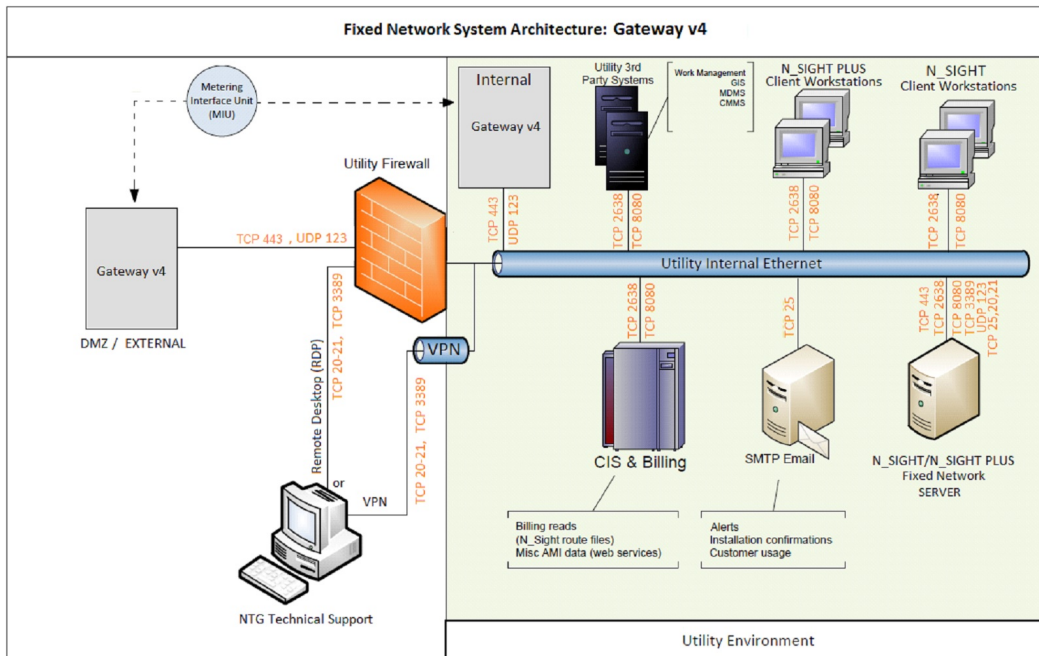


Figure 20 – R900® Gateway v4 (Cellular / Ethernet)

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### A

---

#### AMI

Advanced Metering Infrastructure. A system that captures, stores, and provides to the utility, at frequent intervals, detailed consumption and other information, such as, usage, leak, and flow status, to support advanced applications.

#### AMR

Automated or Automatic Meter Reading.

#### ARB®

Automatic Reading and Billing.

### B

---

#### BCT

Belt Clip Transceiver.

### C

---

#### CCM

Central Configuration Manager.

#### CIS

Customer Information System.

### M

---

#### MIU

Meter Interface Unit.

## N

---

### NGO

Mobile app that leverages the detailed, accurate metering data from the E-CODER® absolute encoder register to provide on-the-spot analysis and presentment capabilities.

## R

---

### RDP

Remote Desktop Protocol.

## T

---

### Trimble® Nomad®

Handheld device you use for keyed entry, probed, and walk-by RF data collection. The handheld pairs with Neptune's R900® Belt Clip Transceiver for RF-activated data logging and off cycle reading.

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### VPN

Virtual Private Network.

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