Excellence in Compliance Testing

Certification Test Report

Frequency Hopping Spread Spectrum Transmitter

FCC ID: P2SNTGPRFV3
IC: 4171B-NTGRFV3

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 07-0360 - 15C

Manufacturer: Neptune Technology Group, Inc.
Model: R900v3

Manual

NEPTUNE TECHNOLOGY GROUP

ARB UTILITY MANAGEMENT SYSTEMS WATER | ELECTRIC | GAS

R900 Wall and Pit Installation and Maintenance Guide

R900 WALL AND PIT INSTALLATION AND MAINTENANCE GUIDE

ARB UTILITY MANAGEMENT SYSTEMS WATER | ELECTRIC | GAS

R900 Wall and Pit Installation and Maintenance Guide

Trademarks used in this manual

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

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.

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

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

Professional Installation

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

Industry Canada

The term "IC:" before the radio certification number only signifies that Industry Canada technical specifications were met.

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

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

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

R900 v3 Wall MIU Antenna (Neptune Technology Group, Inc. model number 12277-001)

R900 Pit MIU Lid Mount Antenna (Neptune Technology Group, Inc. model number 12527-000)

R900 Wall and Pit MIU
Installation and Maintenance Guide

Literature No. IM R900 09.07

Part No. 12560-001

Neptune Technology Group Inc.

1600 Alabama Highway 229

Tallassee, AL 36078

Tel: (334) 283-6555

Fax: (334) 263-7299

Contents

Figures

Figure	Title	Page

Tables

Notes:

1 Product Description

This section provides a general description of the R900 Meter Interface Unit (subsequently referred to as R900 MIU or MIU).

The R900 MIU by Neptune is a compact electronic device that collects meter reading data from an encoder register. It then transmits the data for collection by the meter reader. A walk-by handheld or mobile unit receives the data and stores it to be downloaded into the utility billing system for processing.

The R900 MIU is easily installed and operates within an RF bandwidth which does not require an operating license. Because the R900 MIU can be mounted as far as 500 feet from the encoder register, optimum broadcast signal strength is obtainable, ensuring a high percentage of accurate, one pass readings.

Figure 1 Wall MIU

Figure 2 Pit MIU

The R900 MIU meets FCC regulations part 15.247, allowing higher output power and greater range. The R900 MIU uses frequency-hopping spread spectrum technology to avoid RF interference and enhance security. The MIU reads the ProRead (ARB® VI) registers on an hourly basis and E-Coder (ARB VII) registers at 15 minute intervals and transmits the meter reading data and the unique 10-digit MIU ID every 14 seconds. This allows the meter to be read by a walk-by handheld or mobile data collection unit.

The R900 MIU is designed to offer advantages to utility organizations of all sizes:

- Increases meter reading accuracy.
- Eliminates “hard to read” meters.
- Protects utility liability by increasing meter reader safety.
- Requires no programming.

However, a ProRead (ARB VI) register must be programmed in a three-wire mode.

Product Description

R900 MIU Programming

The MIU is NOT field programmable. At the factory, each of the following items are programmed into the MIU:

- Serial numbers – Each MIU is given two unique serial numbers/identification numbers (two IDs for compound units). Even numbers are given to the single registers and odd numbers are given to a two-networked registers unit. Custom serial numbers are not available.
- Time between encoder register reads – The MIU reads the ProRead (ARB VI) register once an hour and E-Coder (ARB VII) registers at 15-minute intervals.
- Time between MIU transmissions – The time between MIU transmissions is set for approximately 14 seconds for single registers, and alternates register transmissions every eleven (11) seconds for two networked registers. Custom time is not available.

RF Protocol Error Detection

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

RF Frequency Control Algorithm

The MIU's frequency-hopping, spread-spectrum has a sequence of at least 50 different channels for transmitting data. Associated with the 50 channels are 50 frequencies that can be pre-selected in a pseudo random manner. These 50 frequencies are coded into the software.

The R900 MIU avoids 914 MHz to prevent collision with the Advantage® probe.

RF Transmission Period and Randomness

The random period generation uses the same random seed created for the channel definition to generate the transmission randomness. The randomness algorithm is defined so that no two consecutive transmissions from two MIUs will interfere with one another.

Low Battery RF Emissions

The MIU stops RF transmissions when the battery discharges below the normal operating voltage.

2 Specifications

This section provides you with the specifications for the R900 MIU.

Electrical Specifications

Power	Lithium battery

Transmitter Specifications

Transmit Period	• Every 14 seconds - Single register configuration • Every 11 seconds - Alternate ID #s and meter readings for two networked register configurations
Encoder reading	ProRead (ARB VI) registers once an hour E-Coder (ARB VII) registers every 15-minutes[1]
Transmitter Channels	50
Channel Frequency	910-920 MHz
Output Power	Meets FCC Part 15.247
FCC Verification	Part 15.247

[1]This feature may result in a minor discrepancy between the actual reading on the register and the reading on the hand-held or mobile unit. The discrepancy results from a time lapse up to an hour between the time the MIU reads the encoder and the time the MIU is read. This discrepancy will be corrected within the next hour when the MIU takes a new reading

Encoder Register Interface

Supported Encoder Maximum Cable Length

Neptune ARB® V[2]	300 feet (91 meters)
Neptune ProRead (ARB® VI) and E-Coder (ARB® VII)	500 feet (152 meters)
Invensys ECR II®and ECR III®[3]	200 feet (61 meters)
Networked Neptune ProRead (ARB VI) / E-Coder (ARB VII)	250 feet (76 meters)

[2]The length, which meets manufacturers' published specification for wire length between encoder and remote receptacle, is based on solid 3 conductor wire, 22 AWG.

[3]Only specific formats of ECRIII programming are compatible. Contact Neptune for details.

Specifications - R900 Pit MIU

Environmental Conditions

Operating Temperature	-22° to 149°F (-30° to 65°C)
Storage Temperature	-40° to 158°F (-40° to 70°C)
Operating Humidity	0 to 95% Condensing

Functional Specifications

Register Reading	6-8 digits
MIU ID	10 digits

Dimensions and Weight

Dimensions	Refer to Figure 3
Weight	1.0 lbs. (454 grams)

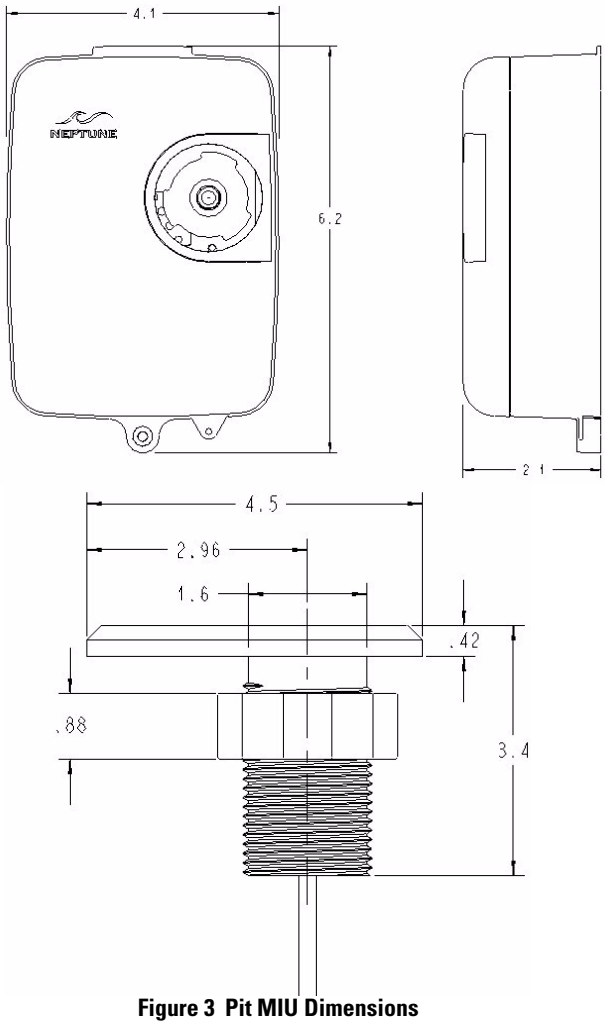

Figure 3 Pit MIU Dimensions

Specifications - R900 Wall MIU

Environmental Conditions

Operating Temperature	-22° to 149°F (-30° to 65°C)
Storage Temperature	-40° to 158°F (-40° to 70°C)
Operating Humidity	0 to 95% Condensing

Functional Specifications

Register Reading	6-8 digits
MIU ID	10 digits

Dimensions and Weight

Dimensions	Refer to Figure 4
Weight	1.0 lbs. (454 grams)

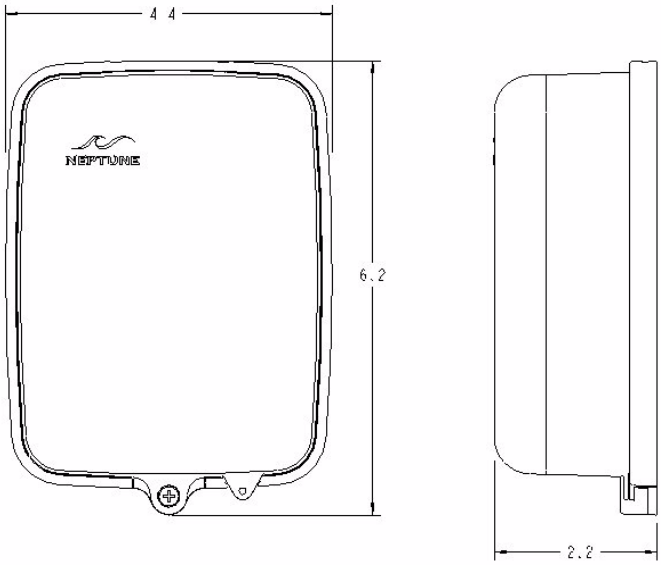

Figure 4 Wall MIU Dimensions

3 General Installation Guidelines

This section describes tools, materials, and general installation information for the R900 MIU.

Tools and Materials

Tables 1 and 2 show the recommended tools and materials you may need to successfully install the R900 MIU or to replace the MIU's internal battery.

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

Table 1 Recommended Tools

Item	Description/ Recommendation	Use
Tool Kit	Contains standard tools including: • Assorted screwdrivers • Needle-nose pliers • Wire stripper • Diagonal cutters • Electrician's knife • Hammer • Crimping Tool Part #: 5500-158	Various installation procedures performed by the utility
Magnet	6 lb. force Part #: 12287-001	Activating the MIU

Table 2 Recommended Materials

Item	Description/Recommendation	Use
Cable	Solid 3 conductor, #22 AWG (black/green/red) Part#: 6431-352	Connecting MIU to encoder register
Moisture protection compound	Novaguard sealant Part #: 96018-072	Covering exposed wires and terminal screws on register and MIU

Table 2 Recommended Materials

Item	Description/Recommendation	Use
Scotchloks	Part #: 8138-125	Splicing replacement battery wire and connecting Wall MIU or replacement Pit MIU to encoder register
Site Work Order	Documentation provided by your utility	Receiving and recording information about the work site

Safety and Preliminary Checks

Observe the following safety and preliminary checks before and during each installation:

- Verify that you are at the location specified on the Site Work Order.
- Verify that the site is safe for you and your equipment.
- Notify the customer of your presence and tell the customer that you will need access to the water meter.
- If the Site Work Order does not have an MIU ID number on it, write in the ID number(s) of the MIU you are about to install. If the Site Work Order already has an MIU ID number on it, verify that it matches the ID numbers on the MIU you are about to install.

Verifying/Preparing the Encoder Register

This R900 MIU is designed for use with the following encoder registers:

- ARB III, IV, and V
- ProRead (ARB VI)
- ProRead AutoDetect
- E-Coder (ARB VII)
- Invensys ECRII, ECR III *

*when programmed in ECR II 6-wheel format

Before installing an MIU, the encoder register must be correctly wired and/or programmed to work with the MIU. ProRead (ARB VI) encoder registers do not require programming.

When a ProRead (ARB VI) encoder register is used, the non-AutoDetect ProRead (ARB VI) register must be programmed for three-wire mode.

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

Installation of at Register (Non Pre-Wired or Potted Only)

1 Before wiring the pit encoder register, make sure the cable is long enough. Then, when the installation is complete, the pit lid can be removed easily without straining the cable.

2 Use only 22 AWG cable to make the connection from the encoder register to the MIU.

3 Remove the terminal screw cover from the encoder register.

4 Strip off 3/4" of jacket from the cable, leaving only the three insulated wires.

5 Taking precautions not to nick or cut the insulation on the three wires, strip off 1/2" of insulation from each of the three wires.

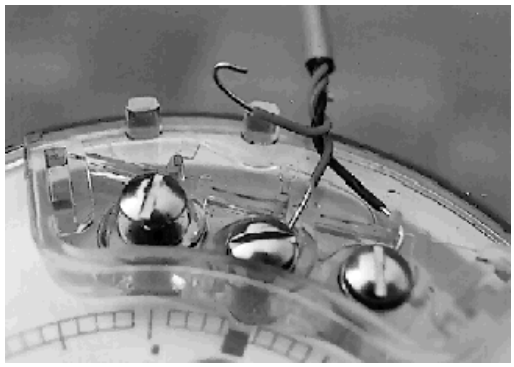

Figure 5 Wiring a Neptune Encoder Register

Table 3 MIU Color Code for Wires

Encoder Register	MIU Wire Color/ Encoder Terminal Marking		
Neptune ARB® III, IV, and V	Black / B	Green / G	Red / R
Neptune ProRead (ARB VI) E-Coder (ARB VII)	Black / B	Green / G	Red / R
ECRII® and ECRIII®	Black / R	Green / B	Red / G

6 If required, connect the 3 conductor wire to the encoder register's terminals per the manufacturer's instructions. See Figure 5 and Table 3.

7 Thread the cable around the strain relief posts of the encoder (Figure 6).

Figure 6 Cable Threaded Around Strain Relief Posts

8 Apply sealant liberally and ensure that it encapsulates the terminal screws and exposed wires. (See Figure 7).

Neptune requires Novaguard G661 sealant or Dow Corning compound 4.

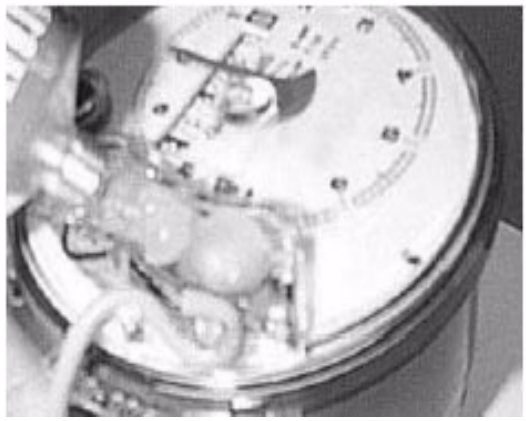

Figure 7 Application of the Sealant

Any leak point can cause a reading failure in a submerged meter setting.

9 Snap the cover onto the encoder register (Figure 8).

Figure 8 Covering the Terminal Screws

10 Run the cable to the MIU, fastening it securely as necessary.

Do not exceed maximum cable lengths as defined in Table 4.

11 If encoder register is pre-wired and potted, use Scotchloks for connecting register to MIU as illustrated in Figure 35 on page 26.

12 Proceed to the section specified for either Pit or Wall installation.

4 Pit Installation

This section describes storage and unpacking instructions, preliminary tests, tools, materials, site selection, and pit installation of the R900 MIU.

Prior to Installation

Storage

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

Once the inspection is complete, store the cartons in a clean, dry environment. Keep in mind that the R900 MIU has an internal battery. Storage for more than one year may affect product life. Be sure to use a first-in first-out inventory control system. See “Environmental Conditions” on page 4.

Unpacking

As with all precision electronic instruments, the R900 MIU should be handled carefully; however, no additional special handling is required.

After unpacking the MIU, inspect it for damage. If the MIU appears to be damaged or proves to be defective upon installation, notify your Neptune Sales Representative. If one or more items requires reshipment, use the original cardboard box and packing material.

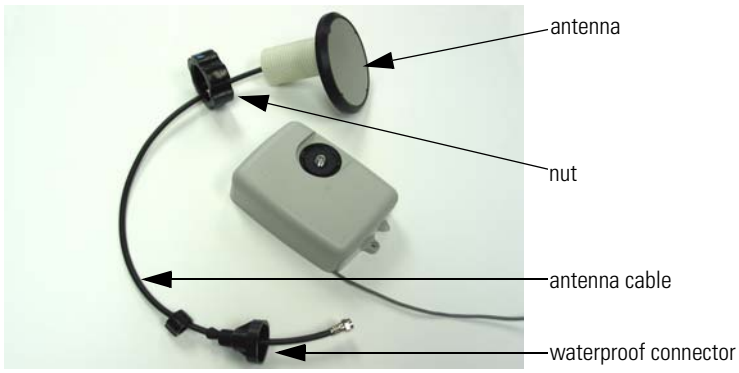

Figure 9 R900 Pit MIU Kit

Tools and Materials

Tables 1 and 2 on page 6 shows the recommended tools and materials you need to successfully install the R900 MIU or replace the MIU's internal battery.

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

Site Selection

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

Installation and operation in moderate temperatures increase reliability and product life. See "Environmental Conditions" on page 4.

Follow these guidelines when selecting a location to install the R900 MIU:

- For best results, Neptune recommends selecting a location where there is no chance that another object can be set over the antenna.
- Avoid installing the MIU behind metal fences or walls.
- Make sure the pit location gives adequate room for installing both the MIU and the pit antenna.

For maximum performance the flange of the pit antenna needs to be located above the pit lid.

- For maximum performance, Neptune recommends that pit antennas be installed above the lid as illustrated in Figure 10.
- **When installing in a high-traffic area, Neptune recommends that the dome of the antenna be recessed in the pit lid as shown in Figure 11.**
- Recessing the installation reduces the range of the installation.

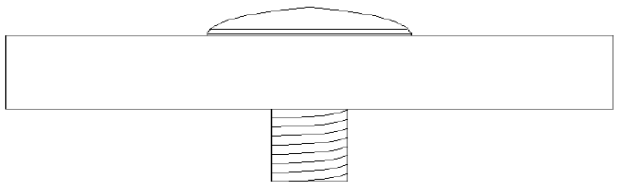

Figure 10 Antenna Placement for Low Traffic Areas

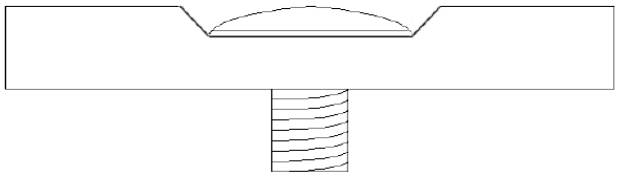

Figure 11 Antenna Placement for High Traffic Areas

- For best results, Neptune recommends that the MIU be installed in a location that provides a direct line of site to the path of the meter reader.
- Although the MIU has a cable already attached—either 6 feet or 25 feet long—some installations can require additional cable. In these cases, the maximum cable length between the encoder register and MIU depends on the register's manufacturer and model. Refer to Table 4 for maximum cable lengths.

Table 4 Cable Length and Manufacturer

Encoder Register	Maximum Cable Length
Neptune ARB III, IV and V*	300 feet (91 meters)
Neptune ProRead (ARB VI) /E-Coder (ARB VII)	500 feet (152 meters)
Invensys ECRII and ECR III	200 feet (61 meters)
Networked Neptune ProRead (ARB VI) / E-Coder (ARB VII)	250 feet (76 meters)

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

Single Pit MIU Installation

The following section describes how to install a single R900 MIU in a pit location. If you are installing the R900 Pit MIU to read two registers, skip this section.

The steps included in this section describe the installation for one single pit MIU. See "Dual Register Applications" on page 20, to install compound units.

Beginning the Installation

Figure 12 Inserting Antenna into the Pit Lid

1 Select a location for the MIU that meets the recommendations in “Site Selection” on page 12.

2 Insert the antenna cable and housing through the 1 3/4” hole in the meter pit lid. (Figure 12.)

Figure 13 Locking Nut on Antenna

3 Thread the locking nut onto the antenna (unthreaded end towards lid) and hand-tighten.

Figure 14 Black Thread Guard from Male F-Connector

4 Remove black plastic thread protector cap from the male “F” connector on the MIU.

Figure 15 Seating Washer

5 Place the flat black rubber washer around the male “F” connector on the MIU as shown in Figure 15.

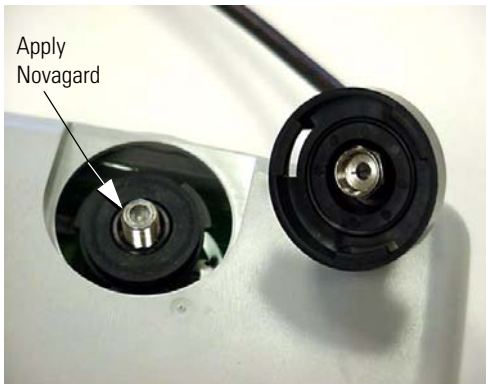

Figure 16 Connector Cables

6 Apply a coating of Novaguard around the base of the “F” connector and on the flat rubber washer.

Antenna connection should have Novagard applied inside the connector.

7 Thread the male “F” connector from the antenna cable onto the female “F” connector on the MIU as shown in Figure 16. The “F” connector should be hand-tightened. The torque should not exceed 20 in./lb.

Threading the F Connector

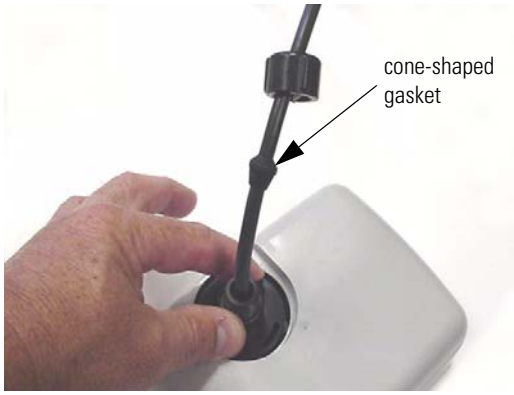

Figure 17 Tightening Connector and Latchplate

1 Making sure that the flat washer is properly seated, connect the black plastic cable connector housing to the 3-lobed plastic latch plate.

2 Tighten the connector by making a 1/4 turn to the right as shown in Figure 18.

3 Slide the black cone-shaped gasket down the cable until it seats against the connector housing.

Figure 18 Black Cone-Shaped Gasket and Connector

4 Slide black plastic female threaded connector down the coax cable.

5 Seat on top of cone-shaped rubber gasket and thread onto 3-lobed plastic latch plate as shown in Figure 18.

6 Finger tighten the connector to depress cone-shaped rubber gasket. This seals the coax cable from moisture intrusion.

Tying the Cable and Activiating the MIU

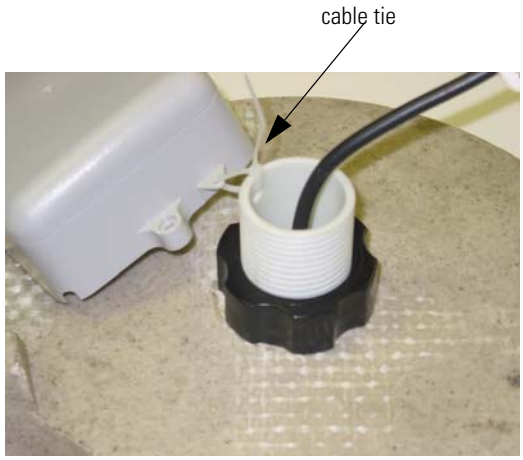

Figure 19 Attaching MIU to Antenna Shaft

1 Place the MIU in place in the pit location, using the following suggestions:

- In shallow pit application, you can place the MIU beside the meter.

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

- In deep pit applications, use a cable tie to suspend the MIU from the antenna shaft, as show in Figure 19.

Make sure the MIU is placed in such a way that it does not lodge itself when the pit lit is removed.

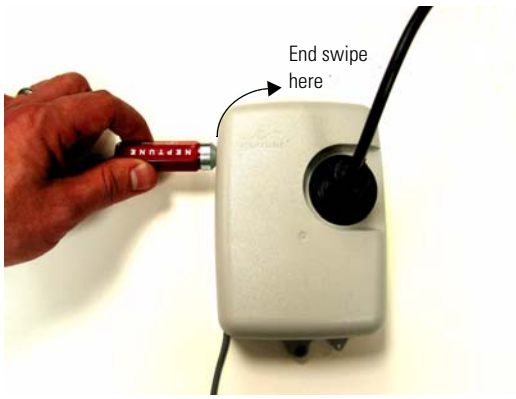

Figure 20 Activating the MIU

2 Position the magnet against the left side of the MIU directly in line with the Neptune logo, as shown, and swipe it bringing it from the side and around the corner to the top to activate the MIU. (See Figure 20.)

3 Remove the “twisty tie” (wire tie) from the coiled ProRead (ARB VI) encoder cable.

Installing the Scotchloks

Figure 21 Scotchlok Connector

1 Complete steps 1 through 9 outlined in “Single Pit MIU Installation” on page 13 to install the MIU through the lid.

2 Use 3M Scotchlok Type UR connector to connect the MIU wires to the encoder wires.

3 Hold the Scotchlok connector between index finger and thumb with the red cap facing down. (See Figure 21.)

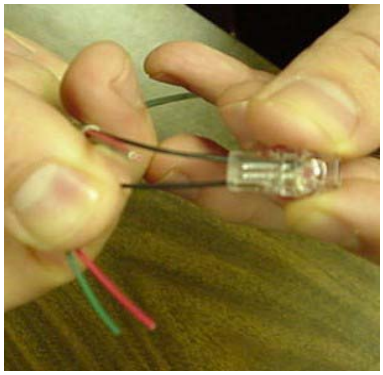

Figure 22 Seating Connector Wires

4 Take a non-stripped black wire from the pigtail and a non-stripped black wire from receptacle/MIU and insert wires into the Scotchlok connector until fully seated in connector. (See Figure 22.)

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

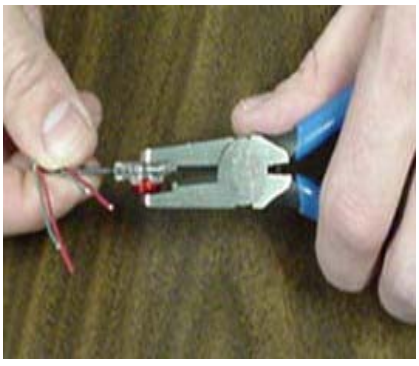

Figure 23 UR Crimping Tool

5 Place the connector red cap side down between the jaws of the UR crimping tool as shown in Figure 23. Refer to Table 5 on page 18 for a list of the manufacturers and part numbers.

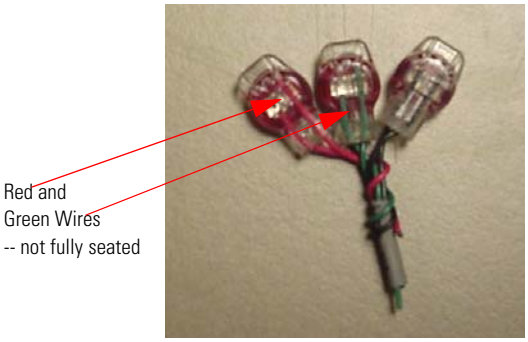

Figure 24 Improper Connections

6 Check to ensure that the wires are still fully seated in the connector before crimping the connector. Figure 24 illustrates improper connections due to wires not fully seated.

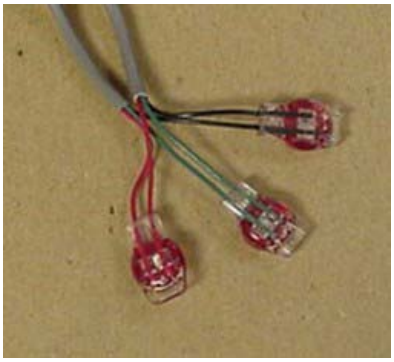

Figure 25 Three Color Wires Connected

7 Squeeze the connector firmly with the proper crimping tool until you hear a pop and gel oozes out the end of the connector.

8 Repeat steps 2 through 6 for each color wire. (See Table 5.)

9 Once all three color wires have been connected, read the encoder register to ensure proper connections and the receptacle/MIU is functioning properly. (See Figure 25.)

Table 5 Color Code for Wires

Approved Encoder Register	MIU Wire Color/ Encoder Terminal		
Neptune ARB® V	Black / B	Green / G	Red / R
Neptune ProRead (ARB® VI)	Black / B	Green / G	Red / R
Neptune E-Coder (ARB® VII)	Black / B	Green / G	Red / R
Sensus (Invensys) ECR II	Black / R	Green / B	Red / G
Sensus (Invensys) ECR III	Black / R	Green / B	Red / G

Connecting the Splice Tube

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

Figure 26 Splice Tube

1 Take all 3 connected Scotchlok's and push into the splice tube until fully encapsulated by the silicone grease. (See Figure Figure 26.)

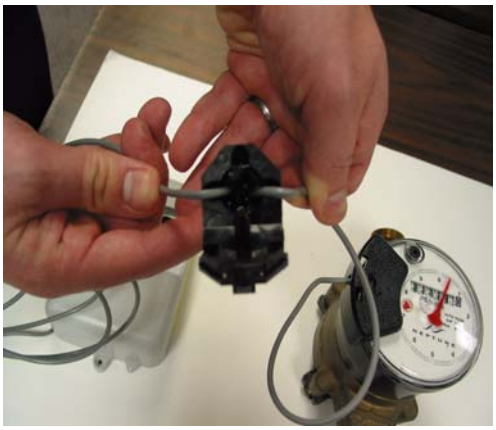

Figure 27 Gray Wires in Slots

2 Separate each gray wire and place in the slots on each side as shown in Figure 27.

Figure 28 Cover in Place

.

3 Snap cover closed to finish the installation as shown in Figure 28.

Dual Register Applications

The R900 can be connected to two networked ProRead (ARB VI) or E-Coder (ARB VII) encoder registers. The following section describes the configuration for a pit location. If you are installing one single R900 Pit MIU within a pit, complete the instructions contained in “Single Pit MIU Installation” on page 13.

To connect two registers, complete the following steps.

1 Ensure the registers are programmed in network mode.

- **The field programmer must have software SESW 56.05 or higher.**
- **ProRead (ARB VI) or E-Coder (ARB VII) registers cannot be programmed while connected together in a network. Each register must be programmed separately prior to making the network connections.**

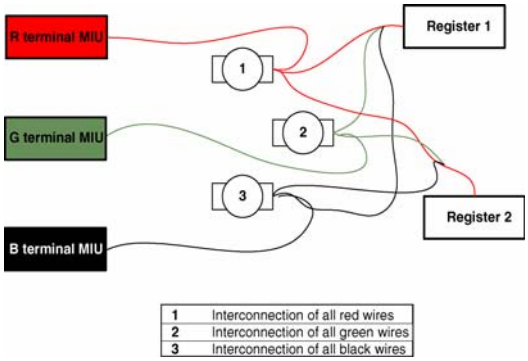

Figure 29 Compound Registers Wired to One MIU

2 Connect the registers by daisy-chaining the registers and MIU together using the 3-wire connector cable. See Figure 29.

- For a compound register, the turbine side is considered the (Hi) side, and the disc side is considered the (Low) side. When connecting an R900 to two separate meters, select one meter to be the (Hi) side and the other to be the (Low) side.
- Every R900 MIU has two ID numbers: one is listed as (Hi) side, and the other is listed as (Low) side on the bar-coded pull tabs. Be sure the appropriate tag is assigned to the correct register. See Table 5.

Type	Programmed Network ID	Network Register Assigned	MIU Assigned ID
Master	99	(Hi) side	Even 10-digit ID#
Slave	01	(Low) side	Odd 10-digit ID#

Testing the Installation

To test the installation, complete the following steps.

1 Power up the handheld unit (HH with HHIU) and put in RF test mode.

To avoid RF signal saturation of the HH, do one of the following:

- **Position yourself at least two to three feet from the MIU.**
- **Remove the antenna from the HH.**

2 When the MIU is installed correctly, its ID number(s) and meter reading(s) appear on the display of the HH. Verify the correct meter reading(s) by comparing it to the meter's dial. If the readings are the same, proceed to the next section.

3 If a meter reading does not appear on the HH's display, or the meter reading in the HH's display is not the same as the reading on the meter's dial, do one of the following:

- Reactivate the MIU using the magnet.
- Verify all electrical connections.
- Verify registers are programmed correctly.
- Test the installation again.

4 If a ProRead (ARB VI) Encoder Register is used:

- Ensure the unit is programmed in **3-wire mod**e.
- Verify all electrical connections.
- Reactivate the MIU. (See Step 1.)

5 If an ECRIII register is used, make sure the register is programmed in a
compatible format.

Activating the MIU with a magnet is recommended, but not a mandatory step. The R900 automatically checks every eight (8) hours for the presence of a register. If one is detected, the MIU wakes up and starts transmitting.

If a problem still exists, contact your Neptune Sales Representative.

5 Wall Installation

This section describes storage and unpacking instructions, preliminary tests, tools, materials, site selection, and wall installation of the R900 MIU.

Prior to Installation

Storage

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

Once the inspection is complete, store the cartons in a clean, dry environment. Keep in mind that the R900 MIU has an internal battery. Storage for more than one year may affect product life. Be sure to use a first-in first-out inventory control system. See “Environmental Conditions” on page 4.

Unpacking

As with all precision electronic instruments, the R900 MIU should be handled carefully; however, no additional special handling is required.

After unpacking the MIU, inspect it for damage. If the MIU appears to be damaged or proves to be defective upon installation, notify your Neptune Sales Representative. If one or more items requires reshipment, use the original cardboard box and packing material.

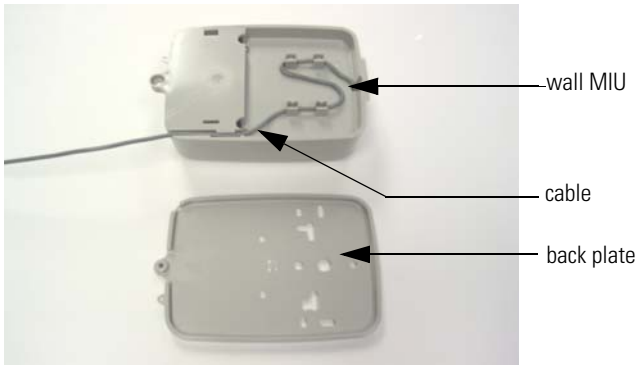

Figure 30 R900 Wall MIU Kit

Tools and Materials

Tables 1 and 2 on page 6 show the recommended tools and materials you may need to successfully install the R900 MIU or to replace the MIU's internal battery.

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

Site Selection

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

Installation and operation in moderate temperatures increase reliability and product life. See "Environmental Conditions" on page 4.

Follow these guidelines when selecting a location to install the R900 MIU:

- For best results, Neptune recommends mounting the MIU on the outside of the building and in a location that provides a direct line-of-sight to the path of the meter reading device.
- For best results, Neptune recommends the MIU be installed approximately five feet above the ground.
- The MIU must be installed in a vertical and upright position.
- The preferred mounting surface for the MIU is a flat wall, but it can also be mounted to a pipe.
- The selected location should be clear of all obstructions.
- Avoid installing the MIU behind metal fences or walls.
- The maximum cable length between the encoder register and MIU depends on the register's manufacturer and model. Refer to Table 6 on page -24 for maximum cable lengths.

Table 6 Cable Lengths and Manufacturers

Encoder Register	Maximum Cable Length
Neptune ARB III, IV, and V	300 feet (91 meters)
Neptune ProRead (ARB VI) / E-Coder (ARB VII)	500 feet (152 meters)
Invensys ECRII and ECRIII	200 feet (61 meters)
Networked Neptune ProRead (ARB VI) / E-Coder (ARB VII)	250 feet (76 metres)

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

- ARB, ProRead (ARB VI), and E-Coder (ARB VII) are trademarks of Neptune Technology Group Inc.
- ECRII is trademark of Invensys.
- ECRIII must be programmed with the proper format.

Installing the R900 Wall MIU

Removing the Main Housing

Figure 31 Wall MIU Main Housing

Complete the following steps to install the wall MIU.

1 Remove the main housing from the mounting adapter.

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

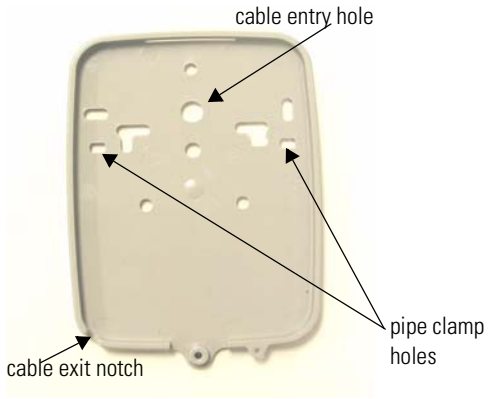

Figure 32 Mounting Adapter

2 Study Figure 32 and the location requirements, then decide how to install the MIU and mount adapter with set screw positioned at bottom.

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

- The cable enters through the bottom or rear cable entry of the mounting adaptor.
- When the MIU replaces a receptacle, use the appropriate holes to allow reuse of the receptacle's original mounting holes. (See mounting hole configuration in Figure 32.)
- When mounting the MIU to a pipe, use the bolt hole for pipe mounting to bolt the mounting adapter to a pipe clamp.

Applying the Scotchloks

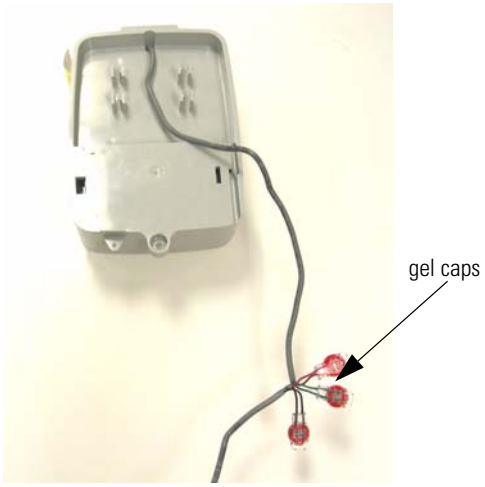

Figure 33 Gel Cap Connections

1 Using Scotchlok Gel Caps, connect the register wires to the pigtail from the MIU. (See Figure 35.)

2 Pair the wires according to the color chart in Table 7.

Table 7 MIU Color Code for Wires

Encoder Register	MIU Wire Color/ Encoder Terminal Marking		
Neptune ARB III, IV and V	Black / B	Green / G	Red / R
Neptune ProRead (ARB V) and E-Coder (ARB VII)	Black / B	Green / G	Red / R
Sensus (Invensys) ECRII® and ECRIII®	Black / R	Green / B	Red / G

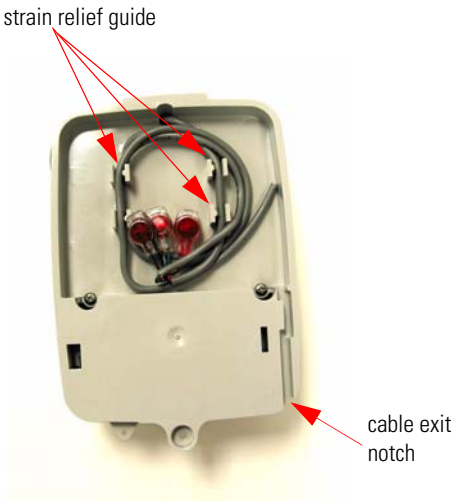

Figure 34 Cable in Back of Mounting Adapter

3 Slide the paired wires into the grooves provided until they seat into the back of the gel cap. Refer to Figure 35.

4 Using an appropriate crimping tool, firmly squeeze the gel cap to ensure a good connection.

5 Repeat this process until all connections are complete.

6 For rear cable entry, store excess wire and Scotchloks in the hollow cavity in the back of the MIU using the strain relief guides as shown in Figure 34.

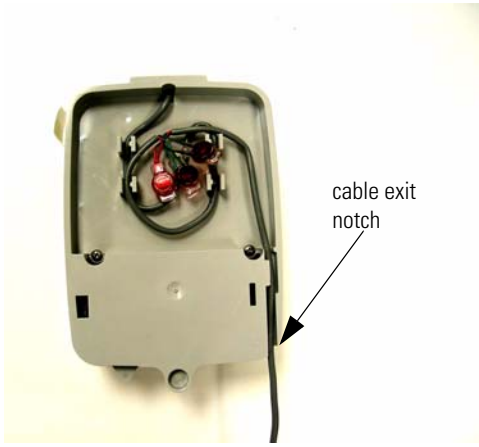

Figure 35 Cable Exit Notch

7 Next, continue to guide the remaining wire through the cable exit notch at the bottom right side of the MIU as shown in Figure 34.

Activating and Completing the Installation

Figure 36 Securing Mounting Adapter

1 Slide the tongue on the top of the MIU into the groove on the top of the mounting adapter.

2 Secure the MIU to the mounting adapter using the set screw. See Figure 36.

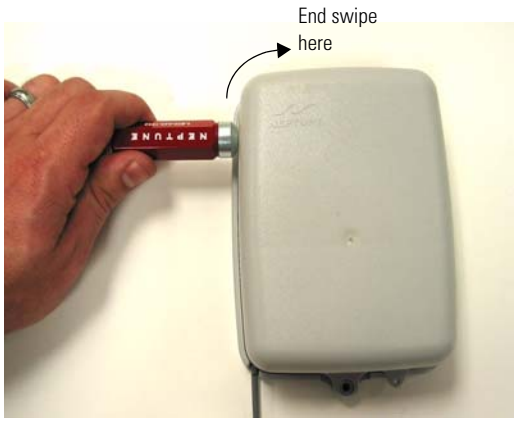

Figure 37 Activating the MIU

3 Position the magnet against the left side of the MIU directly in line with the Neptune logo, as shown, and swipe it bringing it from the side and around the corner to the top to activate the MIU.

Testing the Installation

To test the installation, complete the following steps.

1 Power up the handheld unit (HH) test device and start the testing programs provided.

To avoid RF signal saturation of the HH, do one of the following:

- **Position yourself at least two to three feet from the MIU.**
- **Remove the antenna from the HH.**

2 When the MIU is installed correctly, its ID number(s) and a meter reading(s) appear on the display of the HH. Verify the correct meter reading(s) by comparing it to the meter's dial. If the readings are the same, proceed to the next section.

3 If a meter reading does not appear on the HH's display, or the meter reading in the HH's display is not the same as the reading on the meter's dial:

- Reactivate the MIU using the magnet.
- Verify all electrical connections.
- Test the installation again.

4 If a ProRead (ARB VI) Encoder Register is used:

- Ensure the unit is programmed in **3-wire mode**.
- Verify all electrical connections.
- Reactivate the MIU. (See Step 1.)

5 If ECRIII, make sure register is programmed in a compatible format.

Activating the MIU with a magnet is not a mandatory step. The R900 automatically checks every eight (8) hours for the presence of a register. If one is detected, the MIU wakes up and starts transmitting.

If a problem still exists, contact your Neptune Sales

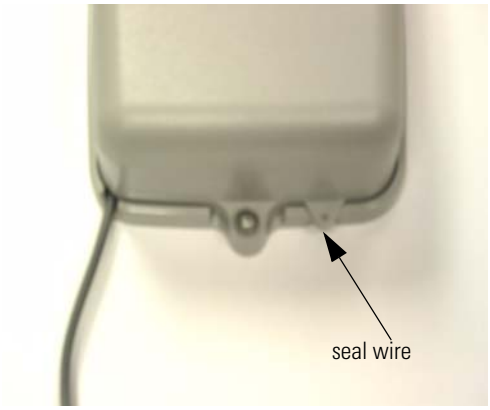

Figure 38 Install Seal Wire

6 To complete the installation, install a seal wire or seal clip through the seal holes at the
bottom of the main housing. See Figure 38.

7 Verify that the requirements of the site work order have been met and that you have recorded all information.

8 Clean up the installation site before leaving.

6 Maintenance and Troubleshooting

This section takes you through maintenance and troubleshooting procedures for the R900 MIU. The first topic will guide you through the steps necessary to replace the battery that is in the main housing.

In addition, this section will guide you through some troubleshooting procedures for both a six-wheel and a four-wheel encoder.

Six-Wheel Encoder Normal Operation

If the odometer reads 123456, the display should show 1 2 3 4 5 5.

Note that the last digit displayed is a five if the last digit on the odometer is five through nine. The last digit displayed is a zero if the last digit on the odometer is zero through four.

Four-Wheel Encoder Normal Operation

If the odometer reads 123456, the display should show 1 2 3 4 0 0.

Abnormal Operation

Below are examples of abnormal operation for four-wheel encoders. Abnormal operation for six-wheel encoders is similar except that digits occupy all six positions.

- If an (H) or a (-) occurs on any of the four positions, the display on the HH will display it.
  Examples: 1 2 - 4 0 0 or 1 2 H 4 0 0
- If the wire between the R900 wall MIU and the encoder is cut or reads as open, the display on the HH shows dashes.
  Example: - - - - -
- If using ECRIII, verify data format is correct.
- If using a non-AutoDetect ProRead (ARB VI) register, verify that it has been programmed correctly. All non-AutoDetect ProRead (ARB VI) registers must be programmed for 3W mode.
- Use the magnet on the R900 MIU to force the R900 to read the encoder.
- On the handheld, check the **System Setup** menu and verify the adapter type is set to **R900**.

Hourly Reads

ProRead (ARB VI) registers are read every hour and E-Coder (ARB VII) is read every 15 minutes.

continued on next page

Replacing the MIU Battery (Wall and Pit)

Follow these steps to change-out the pit R900 MIU's internal battery:

Removing the Battery

1 Slowly remove the pit lid.

Because the MIU is connected to both the antenna in the pit lid and the meter in the pit base, take care not to strain the cable when removing the lid.

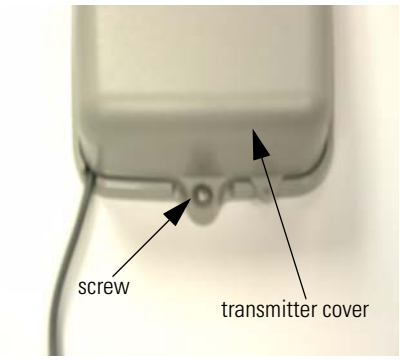

Figure 39 Removing the MIU Transmitter Cover

2 Remove the transmitter cover by removing the two Phillips head crews located inside the back cavity of the main housing. (See Figure 39.)

3 Lift the transmitter cover from the MIU.

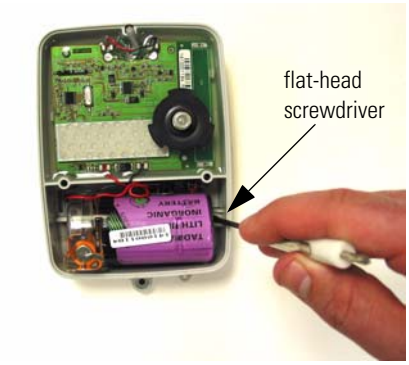

Figure 40 The Battery Compartment

4 Remove the battery casing from the main housing by inserting a flat-head screwdriver and dislodging the battery from the battery compartment. (See Figure 40.)

When removing the battery, it may be helpful to press on the connected end while prying the other end.

Cutting and Splicing the Battery Wires

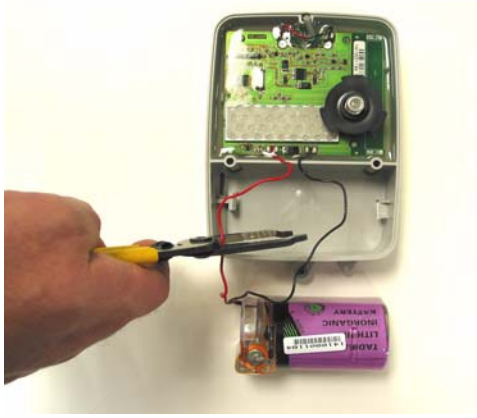

Figure 41 Cutting the Battery Connection

1 As close to the battery casing as possible, cut the battery connection wires one at a time. See Figure 41.

2 Insert battery wire left in MIU ensuring insulation has not been compromised.

Cutting the battery connection wires one at a time prevents shorting.
Ensure the R900 MIU's black wire is connected to the black wire on the new battery (-) and the red wire is connected to the red wire on the new battery (+).

Figure 42 Splicing the New Battery

3 Use Scotchlok to splice the wires from the new battery casing to the wires that were connected to the old battery casing. See Figure 42.

Figure 43 Location of Toroid

4 Be sure to carefully position wires and Scotchloks into compartment in space available next to battery as shown in Figure 43, making sure the wires are not pinched when the battery is snapped into the MIU housing.

Figure 44 Returning Spliced Battery to Main Housing

5 Snap the battery casing into the receiving clips on the main housing. See Figure 44.

6 Reactivate the MIU as shown in Figure 20 on page 16. For help with this procedure, refer to “Tying the Cable and Activiating the MIU” on page 16.

Replacing the Transmitter Cover

1 Secure the transmitter cover using the two Phillips head screws, until the cover is snug and fully seated.

Be careful not to pinch the battery wires between the cover and the housing.

2 Replace the pit lid.

3 Test the installation using the procedure in “Testing the Installation” on page 21.

Replacement Parts

Table 8 lists the available replacement parts for the R900 MIU.

Table 8 Available Replacement Parts

Part Name	Part Number
Solid 3 conductor wire, 22 awg (1000 ft.)	6431-352
Dow Corning #4 compound (5.3oz tube)	96018-064
GE Novaguard (4cc Packet)	96018-072
Scotchloks (UG)	8138-125
Battery Assembly	12213-100
Mounting Adapter	12539-001
Fastener Screw	8328-302
Magnet	12287-001
Antenna	12527-000
Flat Washer	8340-054

Notes:

Glossary

antenna (pit)	The MIU antenna used for pit installations.
conical-shaped gasket	The cone-shaped rubber gasket on antenna cable used to seal cable at top of connector housing.
connector housing	The black plastic 1/4-turn connector used to waterproof antenna cable connection to pit MIU.
connector nut	The black plastic nut used to depress conical-shaped gasket and seal antenna cable at the top of connector housing.
flat washer	The washer used to seal cable connector housing to pit MIU.
main housing	The main body of the MIU that attaches to the mounting adapter.
main housing fastener screw	The set screw (Hi-Lo fastener) that holds the main housing to the mounting adapter.
maximum cable length	The length set by the manufacturer for the wire between the encoder and the remote receptacle. The specifications for this length are based on a solid 3 conductor wire.
MIU	Meter Interface Unit.
mounting adapter	The back plate of the MIU that is attached to the wall.
register read time	The default time is once an hour for ProRead and 15 minute interval for E-Coder (ARB VII). Custom time is not available.
seal wire	Wire inserted into the seal holes, adjacent to the main housing fastener screw. This seal must be broken to remove the main housing from the mounting adapter.
serial number	A unique identification number given to each MIU at the factory. The default value is the last programmed plus one. Custom serial numbers are not available.
strain relief posts	Posts located on the encoder register and the back of the main MIU housing.

terminal screw cover	The plastic cover on the encoder register that protects the terminal screws and exposed wires.
terminal screws	The screws on the encoder register face that are used to connect and anchor the three (3) conductor wire to the register.
transmission time	The time between MIU transmissions. The default is approximately fourteen (14) seconds. Custom time is not available.

Index

L

M

O

P

R

S

T

Index

U

W

Notes:

Neptune Technology Group Inc.
1600 Alabama Highway 229
Tallassee, AL 36078
USA
Tel: (800) 645-1892
Fax: (334) 283-7299

Neptune Technology Group (Canada) Ltd.
7275 West Credit Avenue
Mississauga, Ontario
L5N 5M9
Canada
Tel: (905) 858-4211
Fax: (905) 858-0428

Neptune Technology Group Inc.
Ejército Nacional No. 418
Piso 12, Desp. 1201-1202
Col. Chapultepec Morales
Delegación Miguel Hidalgo
11570 México, Distrito Federal
Tel: (525) 55203 5294 / (525) 55203 5708
Fax: (525) 55203 6503

NEPTUNE TECHNOLOGY GROUP

Take Control.

neptunetg.com

IM R900 09.07 Part No. 12560-001