

L900™ MIU Pit and Wall Installation and Maintenance Guide



NEPTUNE
TECHNOLOGY GROUP

ARB[®] | UTILITY
MANAGEMENT
SYSTEMS[™]

**L900[™] MIU Pit and Wall
Installation and Maintenance Guide**

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FCC Notice

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

Note: This equipment has been tested and found to comply with the limits for a Class 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 instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does not 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 20cm is maintained from the general population.



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

Professional Installation

In accordance with section 15.203 of the FCC rules and regulations, the L900 MIU must be professionally installed by trained utility meter installers.

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: 1) this device may not cause interference, and 2) this device must accept any interference, including interference that may cause undesired operation of the device.

.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-L900M2 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 type(s).
 - R900 Pit Antenna, part number 12527-XXX
 - High Gain R900 Pit Antenna, part number 13586-XXX
 - R900 Wall Antenna, part number 13717-000

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-L900M2 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, numéro de pièce 12527-XXX
 - Antenne de puits à gain élevé R900, référence 13586-XXX
 - Antenne murale R900, numéro d'article 13717-000

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Neptune Technology Group Inc.
1600 Alabama Highway 229
Tallahassee, AL 36078
Tel: (800) 633-8754
Fax: (334) 283-7293

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Chapter 1: Product Description

This chapter provides a general description of the L900™ meter interface unit (subsequently referred to as L900 MIU).

The L900 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 unit (HHU), mobile unit, R900® Gateway collector, or LoRa® (Long Range) collector receives the data and stores it to be downloaded into the utility billing system for processing.

The L900 MIU is easily installed and operates within a radio frequency (RF) bandwidth which does not require an operating license. Because the L900 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 – L900 MIU - Wall



Figure 2 – L900 MIU - Pit

The L900 MIU meets FCC regulations Part 15.247, allowing higher output power and greater range. The L900 MIU uses frequency-hopping, spread-spectrum technology to avoid RF interference and enhanced security. The L900 MIU reads the encoder registers at 15-minute intervals and transmits a mobile message that includes the meter reading data and the unique nine-digit L900 MIU ID every 20 seconds. This allows the meter to be read by an HHU or mobile data collection unit. The L900 MIU also transmits a high power fixed network message every seven and one-half minutes on an interleaved basis to an R900 Gateway.

In addition to the mobile message that is transmitted every 20 seconds and the fixed network message that is transmitted every seven and one-half minutes, the L900 MIU is capable of supporting fixed network using a LoRa network.

The fixed network message that transmits for use on a LoRa network is sent every three hours.

The L900 MIU is designed to offer advantages to utility organizations of all sizes:

- Increases meter reading accuracy.
- Eliminates infrastructure concerns and the burden of managing collection devices.
- Eliminates “hard-to-read” meters.
- Protects utility liability by increasing meter reader safety.
- Requires no programming.

Product Description

This section gives an overview of the L900 MIU.

L900 MIU Programming

The L900 MIU does NOT require field programming.

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 L900 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 L900 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 L900 MIUs interfere with one another.

Low Battery RF Emissions

The L900 MIU stops RF transmissions when the battery discharges below the normal operating voltage.

Chapter 2: L900 Specifications

This chapter provides you with the specifications for the L900 MIU.

Electrical Specifications

The power is supplied by a Lithium battery.

Transmitter Specifications

This section provides information on transmitter specifications.

Transmit Period	• Every 20 seconds - R900® standard mobile message • Every seven and one-half minutes - R900 standard, high power, fixed network message • Every three hours - LoRa fixed network message
Encoder Reading	Encoder registers every 15 minutes
Transmitter Channels	50
Channel Frequency	902 - 928 MHz
Output Power	Meets FCC Part 15.247
FCC Verification	Part 15.109

Encoder Register Interface

This section provides information on the maximum cable lengths required for different registers. See the table on the following page.

Table 1 – Supported Encoder Maximum Cable Length

Neptune ARB® V ¹	300 feet (91 meters)
Neptune ProRead™ and E-CODER®	500 feet (152 meters)
Sensus Protocol registers	200 feet (61 meters)

¹ Meets manufacturer's published specifications for wire length between encoder and remote receptacle. The length is based on solid three conductor wire, 22 AWG.

Specifications - L900 MIU Pit

Environmental Conditions

This section provides the environmental specifications for the L900 MIU.

Table 2 – L900 MIU Pit 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 100% Condensing

Functional Conditions

This section provides the functional specification of the L900 MIU.

Table 3 – L900 MIU Pit Functional Specification

Register Reading	Eight digits
L900 MIU ID	Nine digits

Dimensions and Weight

This section provides the dimensions and weight of the L900 MIU.

Table 4 – L900 MIU Pit Functional Specification

Dimensions	Refer to Figure 3 and Figure 4
Weight	1.0 lbs. (454 grams)



Figure 3 – L900 MIU - Pit Dimensions - Front

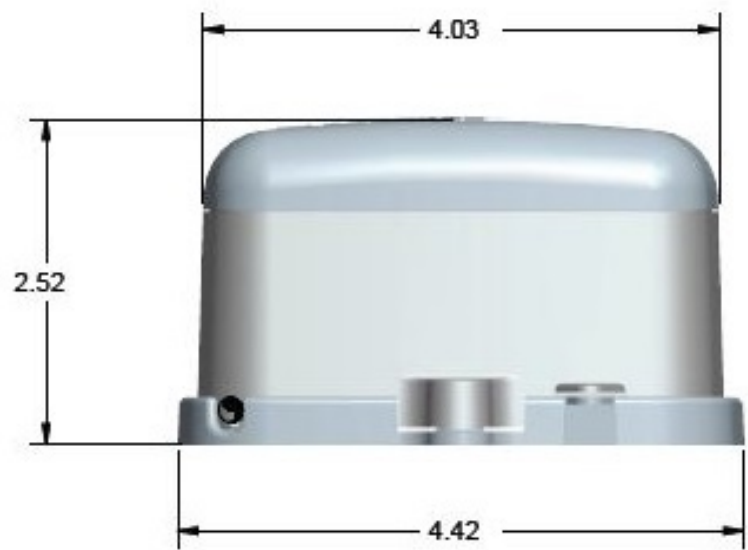


Figure 4 – L900 MIU Pit Dimensions - Side

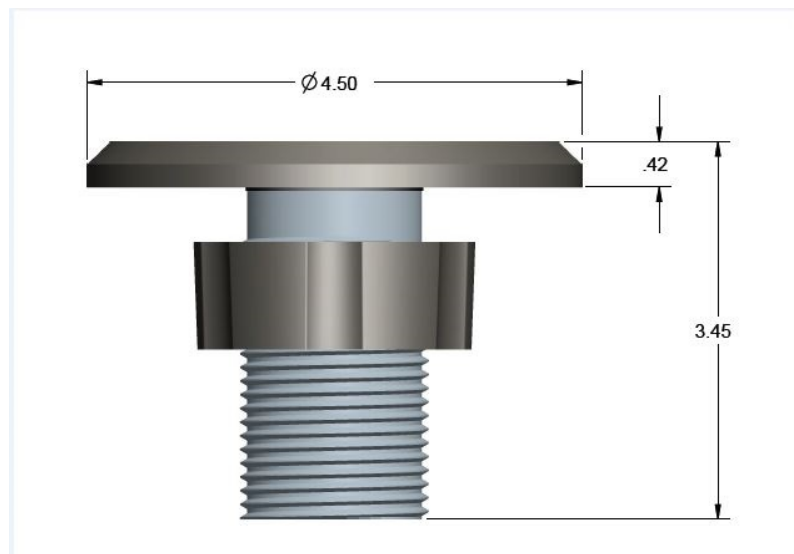


Figure 5 – L900 MIU Pit Antenna

Specifications - L900 MIU Wall

Environmental Conditions

Table 5 – L900 MIU Wall 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 100% Condensing

Functional Specifications

Table 6 – L900 MIU Wall Functional Specifications

Register Reading	Eight digits
L900 MIU ID	Nine digits

Dimensions and Weight

Table 7 – L900 MIU Wall Dimensions and Weight

Dimensions	Refer to Figure 6 and Figure 7
Weight	1.0 lbs. (454 grams)



Figure 6 – L900 MIU Wall Dimensions - Front

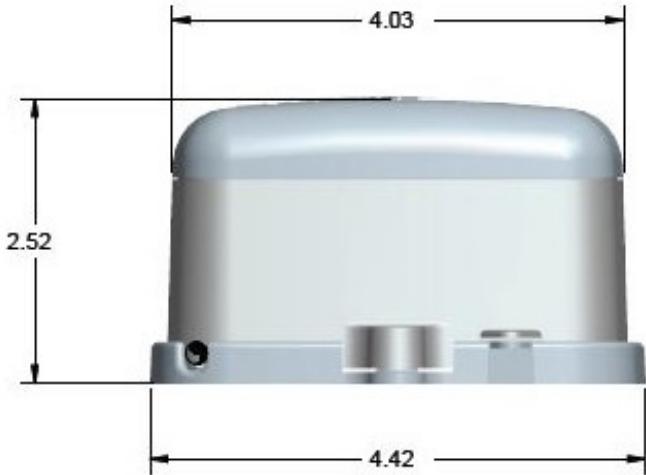


Figure 7 – L900 MIU Wall Dimensions - Side

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Chapter 3: General Installation Guidelines

This chapter describes tools, materials, and general installation guidelines for the L900 MIU.

Tools and Materials

Table 8 below and Table 9 on the next page show the recommended tools and materials you need to successfully install the L900 MIU.



It is possible that some items do not apply to your specific installation, or the list does not contain all required tools or materials.

Table 8 – Recommended Tools

Item	Description/Recommendations	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)	Performs various installation procedures.
Magnet	6 lb. force (Part # 12287-001)	Magnet swipe the L900 MIU.

Table 9 – Recommended Materials

Item	Description/Recommendation	Use
Cable	Solid 3 Conductor #22 AWG (black/green/red) Part # 6431-352	Connect L900 MIU to encoder register.
Moisture Protection Compound	Novaguard sealant Part# 96018-072	Cover exposed wires and terminal screws on register and L900 MIU.
Scotchloks	Part# 8138-125	Connect wall L900 MIU or replacement pit L900 MIU to encoder register.
Site Work Order	Documentation provided by your utility	Receive and record 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 them you need access to the water meter.
- Write in the ID number(s) of the L900 MIU you are about to install, if the site work order does not have an L900 MIU ID number.
- Verify that the ID number(s) matches the ID number(s) on the L900 MIU you are about to install, if the site work order already has a L900 MIU ID number.

Verifying/Preparing the Encoder Register

The L900 MIU is designed for use with the following encoder registers:

- ARB V
- ProRead

- ProRead AutoDetect
- E-CODER
- MACH 10
- Competitive registers using Sensus which include: Sensus ECRIII, ICE, iPerl, OMNI, and electronic registers; also Hersey/Mueller Translator, Badger ADE, and HR ELCD

Before installing an L900 MIU, the encoder register must be correctly wired and/or programmed to work with the L900 MIU. E-CODER registers do not require programming.



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

If connecting the L900 MIU to a new ProRead encoder register, or if a three-conductor cable is already connected to a ProRead encoder register, ensure that the ProRead register is programmed for three-wire mode using the ProRead programmer and its RF/L900 MIU 6, 8, or 10 ID TDI format. This can be accomplished through the ProRead receptacle before it is removed.

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

Before wiring the pit encoder register, consider the following.

1. Make sure the cable is long enough. 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 L900 MIU.
3. Remove the terminal screw from the encoder register.
4. Strip $\frac{3}{4}$ -inch insulation from the cable jacket, leaving only the three insulated wires.
5. Take precautions not to nick or cut the insulation on the three wires, strip off $\frac{1}{2}$ -inch of insulation from each of the three wires.

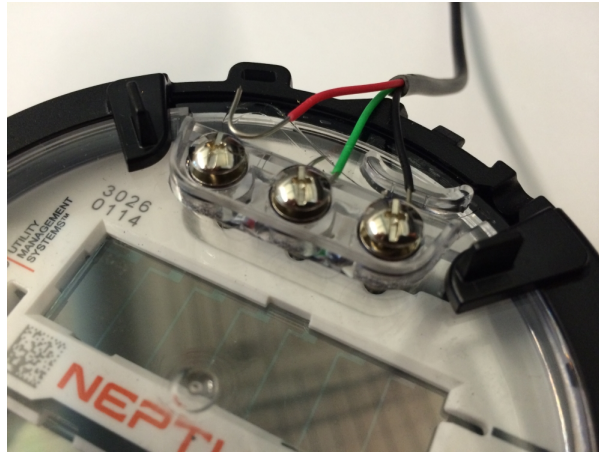


Figure 8 – Wiring a Neptune Encoder Register

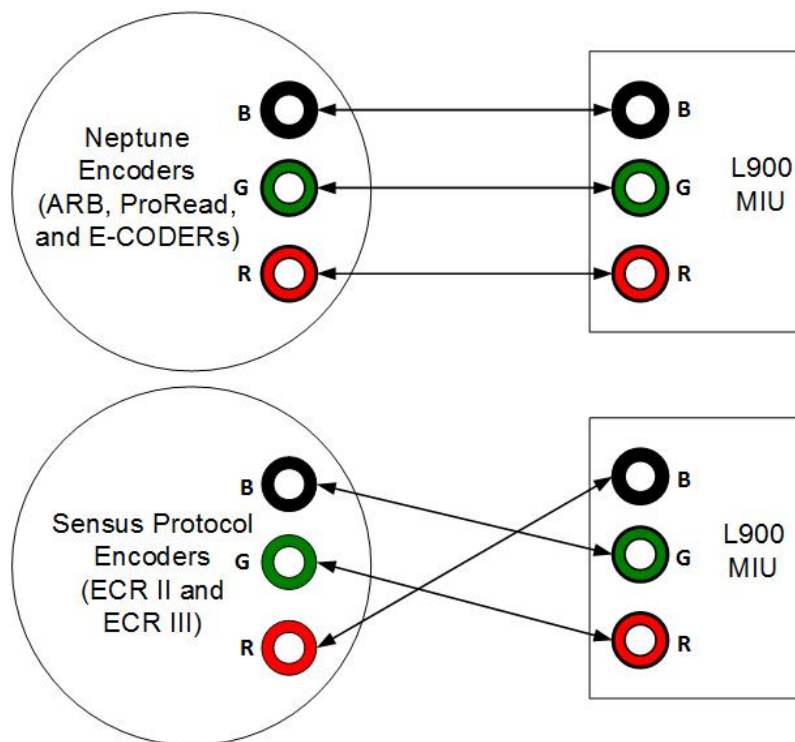


Figure 9 – L900 MIU Color Code for Wires

6. If required, connect the three conductor wires to the encoder register's terminal per the manufacturer's instructions. See Figure 8 and Figure 9.

7. Thread the cable around the strain relief posts of the encoder.
See Figure 10.



Figure 10 – Cable Threaded Around Strain Relief Posts

8. Apply sealant liberally and ensure that it encapsulates the terminal screws and exposed wires. See Figure 11.



Neptune requires Novaguard G661 sealant or Dow Corning compound 4.



Figure 11 – 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. See Figure 12 below.



Figure 12 – Covering the Terminal Screws

10. Run the cable to the L900 MIU and fasten it securely.



Do not exceed maximum cable lengths as defined in Table 1 on page 4. If the encoder register is prewired and potted, use Scotchloks for connecting the register to the L900 MIU.

Chapter 4: Wall Installation

This chapter describes storage and unpacking instructions, preliminary tests, tools, materials, site selection, and wall installation of the L900 MIU.

Prior to Installation

Any existing network registers must be reprogrammed.



The L900 MIU is not capable of being networked.

Storage

After receipt, inspect shipping containers and contents for damage prior to storage.

After the inspection is complete, store the cartons in a clean, dry environment. Keep in mind that the L900 MIU has an internal battery. Storage for more than one year can 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 L900 MIU should be handled carefully; however, no additional special handling is required.

After unpacking the L900 MIU, inspect for damage. If the L900 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.

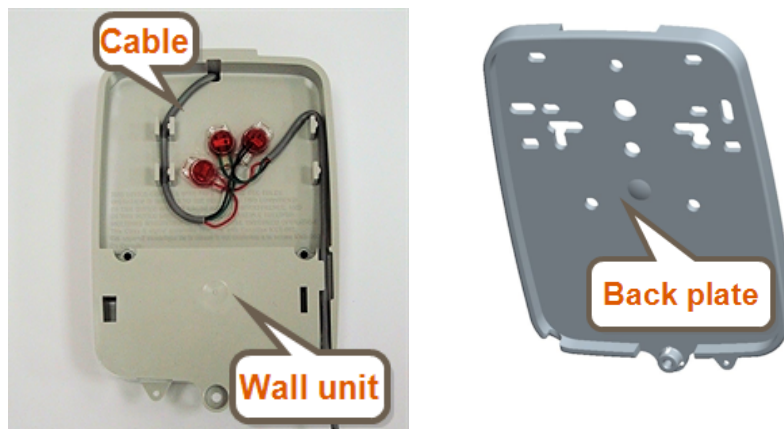


Figure 13 – L900 MIU Wall Kit

Tools and Materials

Table 8 on page 9 and Table 9 on page 10 show the recommended tools and materials you need to successfully install the L900 MIU.



It is possible that some items do not apply to your specific installation or the list does not contain all required tools or materials.

Site Selection



Always follow your company's safety practices and installation guidelines when installing an L900 MIU. Never perform an installation during a lightening storm or under excessively wet conditions.

Installation and operation in moderate temperatures increase reliability and product life. See "Functional Specifications" on page 6.

Follow these guidelines when selecting a location to install the L900 MIU.

- For best results, Neptune recommends mounting the L900 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 L900 MIU be installed approximately five feet above the ground.
- The L900 MIU must be installed in a vertical and upright position.
- The preferred mounting surface for the L900 MIU is a flat wall, but it can also be mounted to a pipe.
- The selected location should be clear of all obstructions.
- For best results, avoid installing the L900 MIU behind metal fences or walls.

Refer to Table 10 on page 17 for maximum cable lengths.

Table 10 – Maximum Cable Lengths

Encoder Register	Maximum Cable Lengths
Neptune ARB V*	300 feet (91 meters)
Neptune ProRead/ E-CODER	500 feet (152 meters)
Sensus Protocol registers	200 feet (61 meters)

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

Installing the L900 MIU

Remove the Main Housing

Complete the following steps to install the wall L900 MIU.

1. Remove the main housing from the mounting adapter. See Figure 14.



Figure 14 – L900 MIU Wall Main Housing



The Hi-Lo fastener for securing the main L900 MIU housing to the adapter plate is shipped separately.

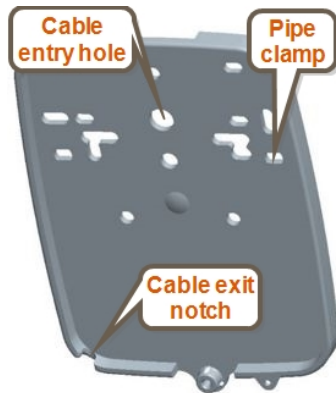


Figure 15 – Mounting Adapter

2. Study Figure 15 and the location requirements, and then decide how to install the L900 MIU.

- The cable enters through the cable entry hole in the back of the mounting adapter.
- When the L900 MIU replaces a receptacle, use the appropriate holes to allow reuse of the receptacle's original mounting holes. See Figure 15.
- When mounting the L900 MIU to a pipe, use the pipe clamp holes to secure the mounting adapter to a pipe.



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

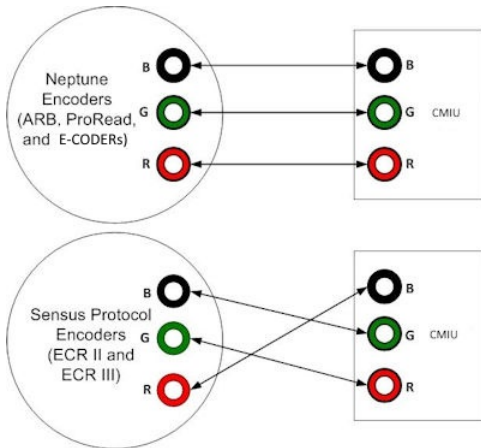
Applying the Scotchloks



Figure 16 – Gel Cap Connections

To apply the Scotchloks, complete the following steps.

1. Using Scotchloks gel caps, connect the register to the pigtail from the L900 MIU. See Figure 16.



2. Pair the wires according to the color diagram. See Figure 17.

Figure 17 – Color Code for Wires



Figure 18 – Adapter Cable

3. Slide the paired wires into the grooves provided until they seat into the back of the gel cap.
4. Squeeze the gel cap firmly using the appropriate crimping tool to ensure a good connection.
5. Repeat this process until all connections are complete.
6. Store excess wire and Scotchloks in the hollow cavity in the back of the L900 MIU using the strain relief guides as shown in Figure 18.



Figure 19 – Cable Exit Notch

7. Continue to guide the remaining wire through the cable exit notch at the bottom right side of the L900 MIU as shown in Figure 19.

Magnet Swiping and Completing the Installation



Figure 20 – Securing Adapter



Figure 21 – Magnet Swipe the L900 MIU

1. Slide the tongue on the top of the L900 MIU into the groove on the top of the mounting adapter.
2. Secure the L900 MIU to the mounting adapter using the set screw. See Figure 20.

3. Position the magnet against the left side of the L900 MIU directly in line with the Neptune logo.
4. Move the magnet up and over the top left corner of the L900 MIU. See Figure 21.

Testing the Installation

To test the installation, complete the following steps.



To avoid RF signal saturation of the HHU, position yourself at least two to three feet from the L900 MIU.

1. Power up the HHU test device and start the testing programs provided.

2. When the L900 MIU is installed correctly, its ID number(s) and meter reading(s) appear on the display of the HHU. Verify the correct meter reading(s) by comparing it to the meter's dial. If the reading(s) is the same, proceed to the next section.
3. If a meter reading does not appear on the HHU display, or the meter reading in the HHU display is not the same as the reading on the meter's dial:
 - Magnet swipe the L900 MIU using the magnet.
 - Verify all electrical connections.
 - Test the installation again.
4. If a ProRead encoder register is used:
 - Ensure the unit is programmed in three-wire mode.
 - Verify all electrical connections.
 - Magnet swipe the L900 MIU. (See Step 1.)



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

Completing the Installation

To complete the installation, follow these steps.



Figure 22 – Install Seal Wire

1. To complete the installation, install a seal wire or seal clip through the seal holes at the bottom of the main housing. See Figure 22.
2. Verify that the requirements of the site work order have been met and that you have recorded all information.
3. Clean up the installation site before leaving.