

# **SECTION 1**

## **INTRODUCTION**

### **ABOUT THIS MANUAL**

This instruction manual explains the installation, operation, and maintenance of the Schlumberger CellNet-Ready Pit MIU (ProRead Only) (MIU1). Schlumberger urges you to read the entire manual before attempting installation, tests, operations, or maintenance.

Section 1 Introduction -This section describes the organization of this manual, provides a product description, operations overview, and product specifications.

Section 2 Installation -This section describes storage and unpacking instructions, preliminary tests, tools and materials, site selection, and installation.

Section 3 Operating Instructions -This section describes controls and indicators, application of power, power ON/OFF procedures, operating procedures, and any special procedures.

Section 4 Theory Of Operation -This section explains how the product works.

Section 5 Testing And Maintenance -This section explains how to test, troubleshoot, and maintain the product.

Section 6 Replacement Parts, Schematics, And Drawings -This section provides part numbers for replacement parts, and any applicable schematic and block diagrams.

Section G Glossary

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FCC REGULATORY NOTICE

## PRODUCT DESCRIPTION

The CellNet Ready Pit MIU (ProRead Only version) provides an interface between the Schlumberger ProRead encoder register and the CellNet fixed network RF system. The MIU reads the meter on a hourly basis and transmits this reading every 15 minutes to the CellNet network. The MIU operates in a one-way mode using the unlicensed 902 to 928 MHz bandwidth to the CellNet MicroCell Controller (MCC).

The pit version of the product has two primary components. The first is the MIU Housing containing the electronics and battery. The MIU Housing is designed to be installed in high humidity or flooded areas such as those located inside a meter pit or vault. The electronics in the housing are attached by a coaxial cable to an antenna assembly. The antenna assembly is designed to mount in the meter pit lid through a 1-3/4" hole that is drilled in the lid. The upper part of the antenna is about 4" in diameter and slightly domed. The antenna assembly is designed to withstand extremes in weather and traffic that it will be exposed to.

The MIU meets FCC regulations part 15.247, allowing higher output power and greater range. The unit also meets CellNet's "Over The Air RF Specification" which outlines the applicable performance standards required to work within the CellNet network. The MIU uses direct sequence spread-spectrum technology to avoid RF interference and enhance security.

A few key features of the MIU are:

- Increases meter reader safety.
- Requires no field programming.
- Improves reading efficiency

Compatible with Schlumberger ProRead equipped meters



**Figure 1.1 Pit MIU**

## **OPERATIONS OVERVIEW**

The CellNet-Ready Pit MIU (ProRead Only) collects meter readings from the encoder register on an hourly basis and transmits the information every fifteen minutes. This redundant transmission of the same data four times an hour increases the reliability of the data to be received by the fixed network MCC.

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## **SPECIFICATIONS**

### **Electrical Specifications**

#### **Transmitter Specifications**

#### **Environmental Conditions**

#### **Encoder Register Interface**

##### **Table 1.2 Electrical Specifications**

Battery 3.6V D size Lithium

Transmit Period Every 15 min

Register Read Period Once an hour

##### **Table 1.3 Transmitter Specifications**

Spread Spectrum Direct Sequence

Carrier Frequency 902-928 MHz

FCC Verification Part 15.247

##### **Table 1.4 Environmental Conditions**

Operating Temperature -22° to 149°F (-30° to 65°C)

Storage Temperature -40° to 185°F (-40° to 85°C)

Operating Humidity 0 to 95% Condensing

##### **Table 1.5 Encoder Register Interface**

###### **Encoder Register Maximum Cable Length**

Schlumberger PRO-READ\* 500 feet (152 meters)

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

## **Dimensions and Weight**

##### **Table 1.6 Dimensions and Weight**

Dimensions Refer to following figures

Weight approximately 2.2 LB (1044 grams)

## SECTION 2

# INSTALLATION

This section describes unpacking and storage instructions, preliminary tests, tools and materials, site selection, and installation.

## UNPACKING

As with all precision electronic instruments, the CellNet-Ready Pit MIU (ProRead Only) should be handled with care; however, special handling is unnecessary. Inspect shipping containers for damage upon receipt and inspect contents of any damaged cartons prior to storage. After unpacking the MIU, inspect it for damage. If the MIU appears to be damaged, or proves to be defective upon installation, notify your Schlumberger Sales Representative. If the MIU requires reshipment, use the original cardboard box and packing material.

## STORAGE

Store the cartons in a clean, dry environment. The temperature should remain between -40° and 185°F (-40° and 85°C). Keep in mind that the CellNet-Ready Pit MIU (ProRead Only) has an internal battery. Storage for more than one year, of the CellNet-Ready Pit MIU (ProRead Only), may affect product battery life. Be sure to use a first-in first-out inventory control system.

## PRELIMINARY TESTS

The CellNet-Ready Pit MIU (ProRead Only) does not require any testing or programming prior to installation.

## TOOLS AND MATERIALS

Tables 2.1 and 2.2 show the recommended tools and materials you may need to successfully install the CellNet-Ready Pit MIU (ProRead Only) or to replace the MIU's internal battery. Note that some items may not apply to your specific installation or the list may not contain all the required tools and/or materials.

### Table 2.1 Recommended Tools

#### Item Description/Recommended Use

Tool kit contains standard tools including:

- Assorted screwdrivers
- Needle-nose pliers

- Wire strippers
- Scotchlok crimping tool or Channel Locks
- Diagonal Cutters
- Electrician's knife
- Hammer
- Various installation procedures
- Magnet with 6 lbs. force for activating the MIU

## Table 2.2 Recommended Materials

### Item Description/Recommendation Use

- Cable - Solid 3 conductor, #22 AWG (black/green/red) / Connecting MIU to encoder register
- Moisture protection compound Dow Corning #4 or GE Novaguard G624 ® / Covering exposed wires and Terminal Screws on register and MIU
- Scotchlocks ® / Splicing three-conductor cables and replacement battery wires
- Site Work Order Documentation provided by your utility / Receiving and recording information about the work site

## INSTALLATION

### 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 might need access to the water meter.
- If the Site Work Order does not have an MIU ID (LAN ID) number on it, write in the ID number of the MIU you are about to install. If the Site Work Order already has a MIU ID number on it, verify that it matches the LAN ID number on the MIU you are about to install.

**Note:** 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.
- Use only approved climbing equipment.

### Site Selection

The CellNet-Ready Pit MIU (ProRead Only) should be installed and operated in an environment where the temperature stays between -22° and 149°F (-30° and 65°C). Installation and operation in moderate temperatures increases reliability and product life.

Follow these guidelines when selecting a location to install the CellNet-Ready Pit MIU (ProRead Only):

- For best results, Schlumberger recommends mounting the MIU in a location that provides a direct line-of-sight to the MCC.
- The selected location should be clear of all obstructions.
- Avoid installing the MIU behind metal fences or walls.
- RF line-of-sight must be verified to a nearby MCC for improved signal strength.

### **Table 2.3 Maximum Cable Lengths**

#### **Encoder Register Maximum Cable Length**

Schlumberger PRO-READ ® \* 500 feet (152 meters)

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

## **Verifying/Preparing the Encoder Register**

The CellNet-Ready Pit MIU (ProRead Only) is designed for use with Schlumberger ProRead Encoder Rev. C, D and E.

Before installing an MIU, the encoder register must be correctly wired and/or programmed to work with the MIU.

**Note:** The Pro-Read ® encoder must be programmed for three-wire mode using a Pro-Read ® Programmer and it's ten-digit TDI format. Do this through the Pro-Read ® receptacle before removing the receptacle. For more information about Pro-Read ® programmers, contact your Schlumberger sales representative.

A three-conductor wire is required to connect the MIU to the encoder. Refer to Steps 1 - 9 in this procedure for that information.

If a three-conductor cable already connects a Pro-Read ® encoder register to a Pit-mounted receptacle, verify the Pro-Read ® is programmed for three-wire mode.

If a three-conductor cable already connects a Pro-Read ® encoder register to a Pit-mounted receptacle, the cable may have to be extended to a location that is appropriate for mounting the MIU. Refer to the section "Splicing a Three-Conductor Cable."

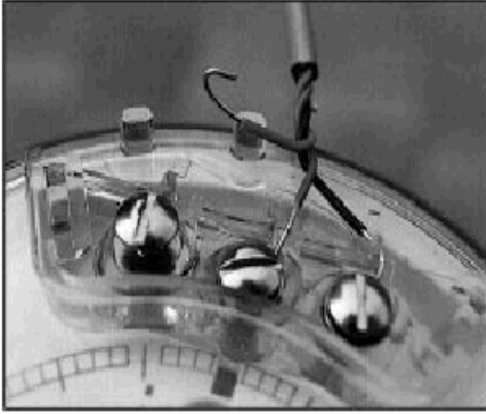
### **Connecting the MIU to the ProRead ® encoder:**

1. Remove the terminal screw cover from the encoder register.
2. Strip off 3/4" from the jacket of the three-conductor cable.
3. Strip off 1/2" of insulation from each of the three wires.
4. Connect one wire to each terminal screw as described in Table 2.4 and shown in Figure 2.4.

**Table 2.4 Encoder Register Interface**

**Encoder Register Wire Color / Encoder Terminal**

Schlumberger Pro-Read ® Black / B Green / G Red / R



**Figure 2.4 Wiring a Schlumberger Encoder Register**

5. Thread the cable around the strain relief posts (Figure 2.5).



**Figure 2.5 Cable Threaded Around Strain Relief Posts**

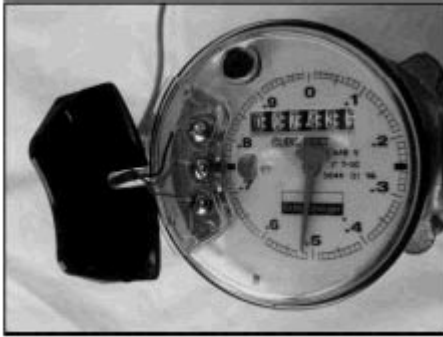
6. Use a generous amount of moisture protection compound (Dow Corning #4 ® or GE Novaguard G624 ® ) to completely cover the terminal screws and exposed wire (Figure 2.6).



**Figure 2.6 Installing Moisture Protection Compound**



7. Align the cable with the notch in the terminal screw cover and snap the cover onto the encoder register (Figure 2.7).



**Figure 2.7 Covering the Terminal Screws**

8. Run the cable from the MIU installation point to the encoder register, fastening it securely as necessary.

## **Installing the MIU**

Please read and comply with all of the information in “Verifying/Preparing the Encoder Register” before continuing with this section, “Installing the MIU.” Always be sure to comply with OSHA Safety Standards for confined space entry.

### **CellNet-Ready Pit MIU (ProRead Only) Installation**

1. Unscrew the small tube with attached cable from the antenna assembly.
2. Remove the plastic nut from the antenna assembly.
3. Insert the antenna assembly in the 1 ¾” hole in the meter pit lid.
4. Secure the antenna assembly to the pit lid by tightening the plastic nut from the underside of the lid.
5. Make sure the o-ring is in place in the groove on the top of the small tube with attached cable.
6. Thread the small tube with attached cable into the antenna assembly until tube bottoms out in the antenna assembly.

## **Testing the Installation**

Refer to Section 5, “Testing And Maintenance.”

## **Completing the Installation**

After verifying that the MIU is working correctly, follow these steps to complete the installation:

1. Install the Hi-Lo fastener that holds the Main Housing to the Mounting Adapter.
2. Use a generous amount of moisture protection compound (Dow Corning #4 or GE Novaguard G624) to completely cover the Terminal Screws and exposed wires.
3. Slide the Terminal Cover onto the Main Housing. Make sure the Terminal Cover is seated properly and the cable is fitted into the notch at the top of the Terminal Cover.
4. Install the Seal Pin into the Terminal Screw Cover.
5. Install a seal wire or seal clip through the Seal Holes at the bottom of the Main Housing. (optional)
6. Verify that the requirements of the Site Work Order have been met and that you have recorded all required information.
7. Clean up the installation site before leaving.



**Figure 2.13 Unstripped Wires in a Scotchlok**

### **Splicing A Three-Conductor Cable**

Splicing three-conductor cables together should be avoided whenever possible. However, if an existing Pro-Read® Pit receptacle is not in an appropriate location for replacement by an MIU, it may be necessary to splice the cable and extend it to an appropriate location.

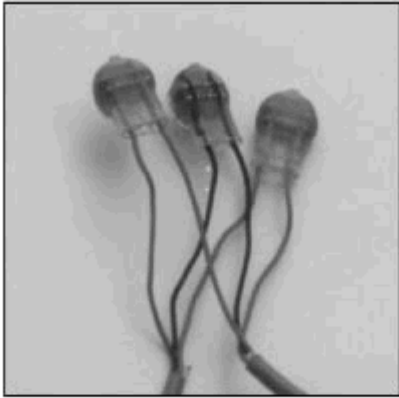
Follow these steps to splice a three-conductor cable:

1. Remove the receptacle from the Pit.
2. Remove the wires from the receptacle.
3. Cut away the exposed copper from each wire.
4. On the three-conductor cable to be spliced, strip off at least 1" of the outer jacket. Do not strip the insulation from the individual wires.
5. Match up one pair of colored wires (Black to Black, Green to Green, and Red to Red) and insert the matching-colored pair into a Scotchlok (Figure 2.13).

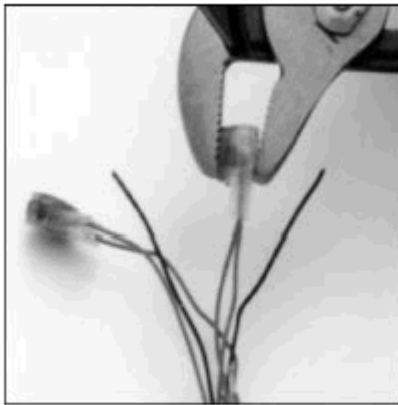
**Note: The Pro-Read® encoder must be programmed for three-wire mode using a Pro-Read® programmer and its ten-digit TDI format. Do this through the Pro-Read® receptacle before removing the receptacle.**

6. Using a Scotchlok crimping tool or a pair of Channel locks, squeeze the “button” on the Scotchlok until it is completely flat (Figure 2.14).

7. Inspect the Scotchlok to verify that both wires are fully inserted. If they are not, redo the splice (Figure 2.15).

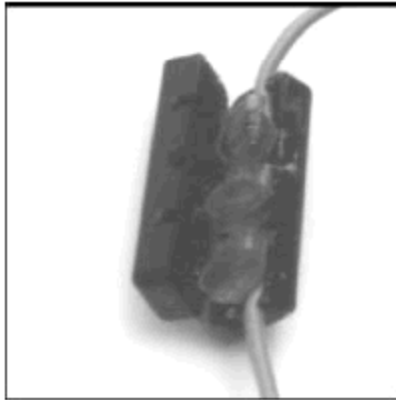


**Figure 2.15 Completed Scotchlok Splices**



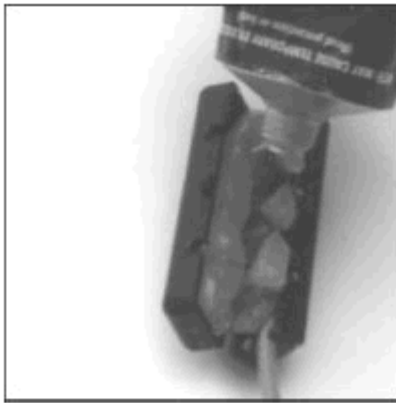
**Figure 2.14 Depressing the Scotchlok Button**

8. Repeat Steps 5 through 7 for each pair of wires.
9. Tuck the Scotchloks into a splice enclosure and route the cables through the cutouts at the ends of the splice enclosure (Figure 2.16).



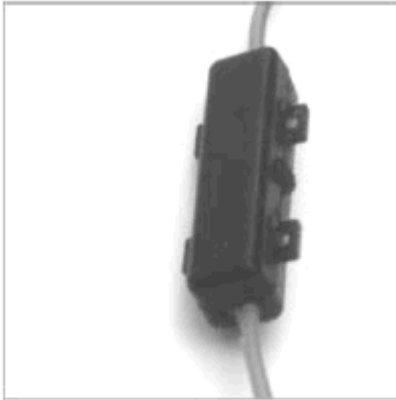
**Figure 2.16 Spliced Cables in a Splice Enclosure**

10. Coat the inside of the splice enclosure with Dow Corning #4<sup>®</sup> or GE Novaguard G624<sup>®</sup> moisture protection compound (Figure 2.17).



**Figure 2.17 Filling the Splice Enclosure**

11. Close the splice enclosure, pressing it firmly until the teeth lock together (Figure 2.18).



**Figure 2.18 A Completed Splice**

## **REPLACING THE BATTERY**

Follow these steps to change-out a Pit MIU's internal Battery:

1. Unscrew the Hi-Lo fastener holding the Main Housing to the Mounting Adapter.
2. Remove the seal wire or seal clip from the Seal Holes at the bottom of the Main Housing.
3. Punch the Seal Pin out of the Terminal Screw Cover.
4. Remove the Terminal Screw Cover.
5. Remove the wires from the Terminal Screws. (optional)
6. Using a flat-head screwdriver, gently pry open the clip on the bottom of the Main Housing.  
When the clip clears the tab on the Mounting Adapter, pull the Main Housing away from the Mounting Adapter.
7. Remove the Main Housing by lifting and unhinging it from the Mounting Adapter.
8. Remove the Battery from the Main Housing by pressing in on the right end of the Battery until it releases and comes free from the Main Housing.
9. As close to the Battery as possible, cut the battery connection wires one at a time.

**Note:** Cutting the battery connection wires one at a time prevents shorting.

10. Use Scotchlocks to splice the wires from the new Battery to the wires that connected to the old Battery.

**Note:** Insure the Pit MIU's black wire is connected to ground (-) and the red wire is connected to the positive (+) wires of the new battery.

11. Snap the Battery into the Receiving Clips on the Main Housing.
12. Install the Main Housing on the Mounting Adapter.
14. Install the appropriate color wires to each Terminal Screw (Black to B, Green to G, Red to R).
15. Follow the steps in “Testing the Installation.”

## **SECTION 3**

### **OPERATING INSTRUCTIONS**

At the time of installation, the installer uses the CellNet installation tool to verify that the CellNet-Ready Pit MIU (ProRead Only) is operating properly. Following the installation, the CellNet-Ready Pit MIU (ProRead Only) operates automatically and continuously without any type of human intervention.

## **SECTION 4**

### **THEORY OF OPERATION**

#### **CellNet<sup>®</sup> MIU Programming**

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

**LAN Address** - Each MIU is given a unique, numeric LAN address.

**Time between encoder register reads** -The time between encoder register reads is one hour.

**Time between MIU transmissions** - The time between MIU transmissions is 15 minutes on average.

#### **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 Transmission Period and Randomness**

The random period generation uses the same CellNet ALOHA model to generate the transmit randomness. The randomness algorithm is defined so that no two consecutive transmissions from two MIU's will interfere with one another.

#### **Low Battery RF Emissions**

The MIU stops RF transmissions when the battery discharges below the normal operating voltage of 3.1 volts.

## **TROUBLESHOOTING**

### **Six-Wheel Encoder Normal Operation**

If the odometer reads 123456, the display should be 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 be 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 CellNet-Ready Pit MIU (ProRead Only) will transmit the data as follows:

Examples: 1 2 E 4 0 0 or 1 2 b 4 0 0

If the wire between the CellNet-Ready Pit MIU (ProRead Only) and the encoder is cut or reads as open, or if the encoder is not programmed in a three-wire TDI format, the MIU will transmit the following data:

Example: AAAAAA

## **SECTION 5**

### **TESTING AND MAINTENANCE**

After the CellNet-Ready Pit MIU (ProRead Only) has been installed and wired, follow these steps to verify that the MIU is working properly:

1. Activate the MIU by holding the magnet for two seconds against the arrow on the Main housing. The arrow is just to the right of the Terminal Screws.
2. Use a CellNet installation tool to verify the transmission from the Pit MIU.
3. Verify all electrical connections.
4. Test the installation again.
5. If a Pro-Read<sup>®</sup> Encoder Register is used, ensure the unit is programmed in the 3-wire, ten digit TDI format.
6. Verify all electrical connections.
7. Reactivate the MIU. (See Step 1)
8. If a problem still exists, install a different MIU.



## FCC REGULATORY NOTICE

Service Return Address:  
Schlumberger RMS, Inc.  
1600 Alabama HWY 229 S.  
Tallasse, AL 36078

This CellNet-Ready Pit MIU (ProRead Only) 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.

(c) The provisions of paragraphs (a) and (b) of this section do not apply to digital devices exempted from the technical standards under the provisions of §15.103.

(d) For systems incorporating several digital devices, the statement shown in paragraph (a) or (b) of this section needs to be contained only in the instruction manual for the main control unit.

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