

FCC Part 15 Subpart C Transmitter Certification

Direct Sequence Spread Spectrum Transmitter

Test Report

FCC ID: R7PUWE-PIT

FCC Rule Part: 15.247

ACS Report Number: 05-0412 - 15C

Manufacturer: Cellnet Technology, Inc.
Model: Cellnet Water Endpoint – Pit

Installation Guide



Cellnet Water Endpoint

6010/6020 Pit

Installation Guide

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Sensus

Neptune

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Microtex

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Cellnet Water Endpoint

6010/6020 Pit

Installation Guide

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Cellnet

30000 Mill Creek Avenue

Suite 100

Alpharetta, GA 30022

Tel: (678) 258-1500

Fax: (678) 258-1550

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CHAPTER 1 INTRODUCTION

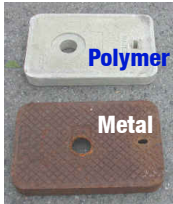
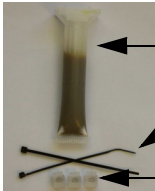
This manual explains how to correctly install Cellnet Water Endpoints (CWE) for pit applications. It covers endpoint installation, encoder register connection, pulse register programming, and troubleshooting.

TOOLS AND EQUIPMENT

This section outlines the necessary tools and equipment for installing a Cellnet Water Endpoint for pit applications. A "potted" register requires more equipment than a "screw terminal" register.

Equipment

The following table contains all required equipment:

Image	Description
	Cellnet Water Endpoint Model 6010 - Pit with Leads, Single Port
	OR
	Cellnet Water Endpoint Model 6020-Pit, with connector, with submersible connector
	Pit Lids
	NOTE: A pit lid with a recessed antenna hole to flush-mount the antenna is recommended, particularly for the street or sidewalk, shown here a polymer lid with a recessed hole.
	Badger Field Splice Kit 62084-001
	Splice Enclosure Tie wraps 3M Scotchloks, Model UY2 or Equivalent
image	scotchlok
image	Gel sealant remover

Image



Description

Additional cable
Specification 22-AWG...

Tools

The following table contains all required tools:

<u>Image</u>	<u>Description</u>
Magnet →  The image shows a blue rectangular device with a red dot on the top and a label that reads "TOMM DETECTOR", "Detector 26-1050 Rev. 1.1", and "Installation 03-1050 Rev. 0.1".	RF Buster P/N 26-1050
	Screwdrivers (flat and Phillips)
	Wire Cutter and Stripper
	Scotchlok® E-9Y Crimping Tool or Equivalent www.3M.com
	DAP HandHeld Computer www.dap.com
	Microtex Fastreader Probe P/N FR1L-DAP-18 www.microtex.com

Image**Description**

Optical Probe Adapter (Optional)



ProRead Field Programmer (only required for Neptune encoders)
www.neptunetg.com



SAFETY AND ENVIRONMENT

Preliminary Checks

The installer should already be able to operate the DAP handheld computer. Additionally, you should already have route information and the required number of endpoints.

- Verify that you are at the correct site, specified on the handheld computer or work order.
- Verify that the site is safe for you and your equipment.
- Notify the customer of your presence. Tell the customer that you must have access to the water meter. If necessary, have the customer sign the work order.
- When installing meters, follow any guidelines issued by your company in addition to those given in this guide.
- Never perform an installation during a lightning storm or under excessively wet conditions.

Site Requirements

The site must comply with the following criteria:

- There is no chance that another object will be set over the antenna.
- There is enough room in the pit for the endpoint. Because the meter position is fixed, the antenna is usually installed off-center.
- The pit is not flooded; it is debris free.
- The endpoint has an attached cable, but in some instances it may require additional cable. The maximum cable length between the encoder register and the endpoint depends on the register's manufacturer and model.

[Table 1.1](#), lists maximum cable lengths, meeting the manufacturer's published specification for wire length between encoder and remote receptacle.

Table 1.1

Encoder Register	Maximum Cable Length
Badger ADE	200 feet (61 meters)
Badger RTR	200 feet (61 meters)
Neptune ProRead (ARB VI)	200 feet (61 meters)
Sensus ECR-II	200 feet (61 meters)
Sensus ECR-III	200 feet (61 meters)

FCC & INDUSTRY CANADA INFORMATION TO THE USER

FCC Class B

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.



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

RF Exposure

In accordance with FCC requirements of human exposure to radio frequency fields, the radiating element shall be installed such that a minimum separation distance of 20 centimeters will be maintained.

Industry Canada

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, 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.

FCC ID: R7PUWE-PIT

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.

IC: 5294A-UWEPIT

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

CHAPTER 2 INSTALLING THE CELLNET WATER ENDPOINT

If the meter register inside the pit is pre-potted with a 'Cellnet 6020 ready' submersible cable, and reusable, *female* 4-pin connector on its open end, proceed to "Installing Cellnet Water Endpoint 6020 Pit on a "Cellnet 6020 ready" Register" on page 2-16.



Figure 2.1 6020 Endpoint with a water submersible, reusable, female 4-pin connector

All other registers use:

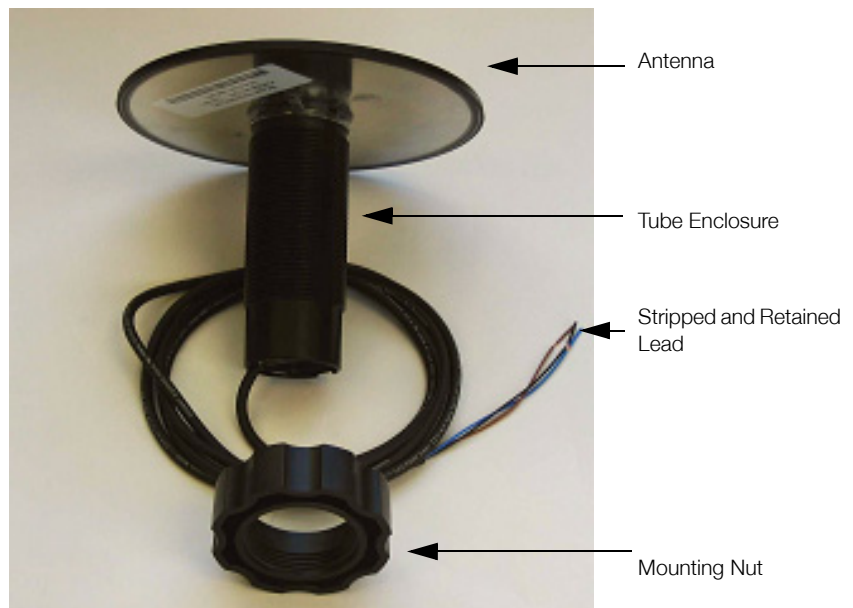


Figure 2.2 6010 Pit Endpoint exploded view

Callouts indicate the assembly parts.

Installing the 6010 Endpoint

- 1 Unscrew the nut from the 6010 endpoint. Reserve it for later.
- 2 Route the endpoint (attached cable first) through the antenna hole in the pit lid from the top.
Certain installations may require you to remove the existing touchpad from the antenna hole before you can insert the antenna. Verify that there is enough room in the pit for the endpoint, and that the cable is long enough.



Figure 2.3 Antenna hole in pit lid

- 3 Thread the nut to the top of the antenna, tightening it against the bottom of the pit lid.



Figure 2.4 Threading the antenna nut

- 4 Put the pit lid with the 6010 endpoint aside for later.

IDENTIFYING THE REGISTER FOR INSTALLATION

Register connecting instructions listed by register type:

- If the register has screw terminals, proceed to "Connecting a Neptune or Sensus Encoder Register with Screw Terminals" on page 2-4

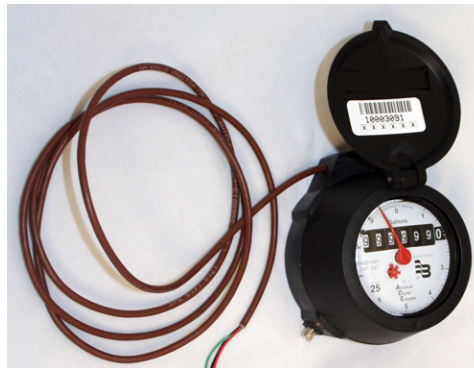


update photo

- If the register is a badger RTR with the words "Recordall Transmitter Register" recorded on the face, proceed to "Connecting a Badger RTR Register with Potted Leads" on page 2-11



- If the register is not a Badger RTR and has potted leads, proceed to "Connecting a Badger, Neptune or Sensus Encoder Register with Potted Leads" on page 2-6



- "Pro-Read Encoder Register" on page 2-17

photo

Connecting a Neptune or Sensus Encoder Register with Screw Terminals

Remove terminal cover. Use a manufacturer-approved gel sealant remover on the terminals to remove gel from existing encoder installations before connecting the 6010 cable to the screws. Use clean, disposable towels or rags to wipe the gel away from the terminals and screws. After the gel is removed, disconnect any wires connected to the terminals. Clean the terminals and screws again. Be careful not to lose any screws when disconnecting the wires or cleaning the screw terminals.

If the cable to be connected to the screw terminals has been pre-stripped, proceed to step 3 below.

- 1 Using the #10 AWG position (second largest hole) on the 64-1919 wire stripper, remove 1.5 inches of external insulation from the cable coming from the 6010.



Figure 2.5 64-1919 Wire stripper



Do not damage the internal wire insulation when removing the external insulation.

- 2 Using the #22 AWG wire-stripping hole of 64-1922 tool, strip .5 inch of insulation from each of the three internal wires.



Figure 2.6 64-1922 Wire stripper

- 3 Connect the three-conductor wire from the 6010 endpoint to the encoder register's terminals, matching colors carefully, using the following table.

Table 1

Encoder Register	6010 Wire Color/Encoder Terminal
Neptune ProRead (ARB VI) pic with proper config of wires	Blk/G Green/R Red/B
Sensus ECR-II, ECR-III (ICE) pic with proper config of wires	Blk/B Green/G Red/R

- 4 Thread the cable around the strain relief posts of the encoder register.



Figure 2.7 Threading the cable around the strain relief posts



Position the end of the cable jacket so that the compound will cover it and it will not be visible when the cover is installed, as shown.

- 5 Apply moisture protection compound to terminal screws and exposed wires (Dow Corning Compound #4 or Novagard® G661™)

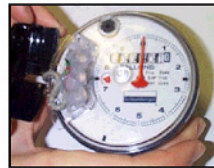


Figure 2.8 Applying moisture compound



Be sure that the waterproofing compound completely seals the wires. Apply compound under the cable and individual wires. Cover the top of the cable, wires, and screws. Use enough compound so it flows from openings when the cover is attached.

- 6 Snap the cover onto the encoder register.
- 7 Wipe away excess compound.
- 8 Clean the area and remove all disposable materials.
- 9 Proceed to *Chapter 3, Testing the Endpoint*.

Connecting a Badger, Neptune or Sensus Encoder Register with Potted Leads

Use the following installation procedure for sites equipped with potted encoders.



Do not open a potted encoder for any reason. This will void the manufacturer's warranty.

- 1 Using the cutting blade portion of the Wire Cutter and Stripper tool, cut the wire connecting the encoder register to the touchpad (or other device). The wire attached to the encoder register should contain at least three wires. If not, replace the encoder register with a 3-wire version.



Figure 2.9 Wire cutter & stripper

- 2 Using the #10 AWG position (second largest hole) on the 64-1919 wire stripper, remove 1 inch of the external insulation from the cable coming from the encoder register. Do not strip the insulation from the internal wires.



Figure 2.10 64-1919 Wire Stripper

- 3 Peel back foil, if present; cut excess foil and uninsulated wire.
- 4 Repeat this procedure for the cable coming from the 6010 endpoint, if necessary.

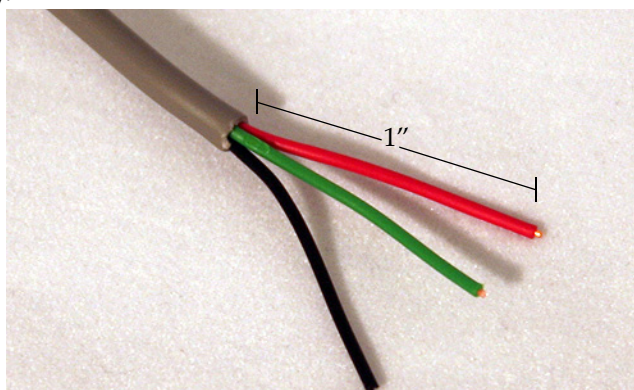


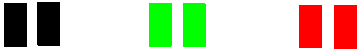
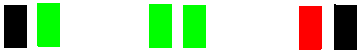
Figure 2.11 3-Wire cable



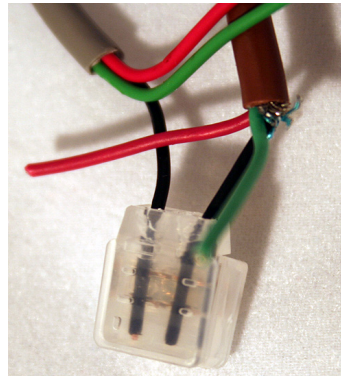
Do not damage the internal wire insulation when removing the external insulation.

- 5 Splice the wires from the UWE to the encoder wires. Match colors carefully according to the table below:

Table 2

Encoder Register	6010 Wire Color/Encoder Terminal
Badger ADE <i>pic with proper config of wires</i>	Blk/Blk Green/Green Red/Red 
Neptune ProRead (ARB VI) <i>pic with proper config of wires</i>	Blk/Grn Green/Green Red/Blk 
Sensus ECR-II, ECR-III (ICE) <i>pic with proper config of wires</i>	Blk/Blk Green/Green Red/Red 

- 6 Push the wires to be connected as far as possible into the Scotchlok connector.

**Figure 2.12 Wires pushed into Scotchlok connector**

- 7 Place the Scotchlok connector (with wires) into the jaws of the crimping tool.

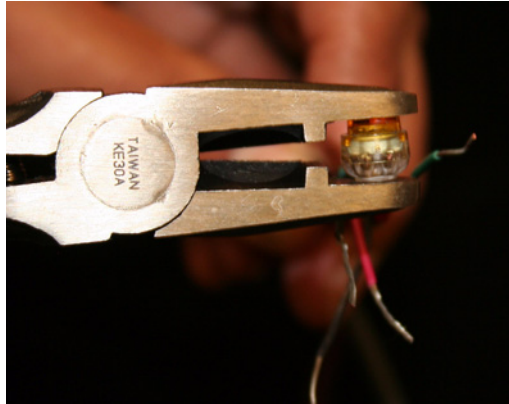


Figure 2.13 ScotchLok connector in crimping tool jaws



Always use 3M Parallel Jaw Crimping Tool 3M Model E-9Y or equivalent.

- 8 Crimp the Scotchlok connector by squeezing the handles until it discharges gel. Continue to apply pressure for three seconds..

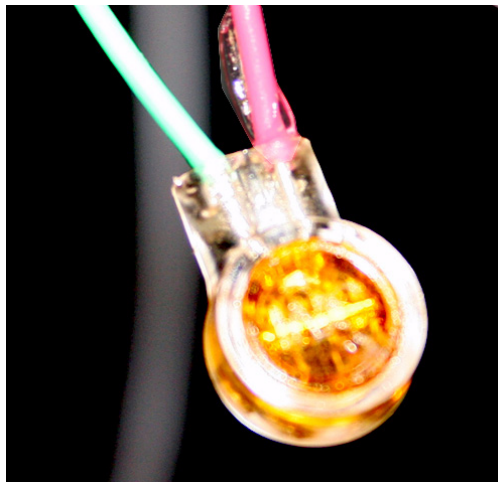


Figure 2.14 Crimped Scotchloks discharge gel

- 9 Place two plastic cable ties on wires and tighten securely for strain relief. Remove excess cable tie with wire cutters..

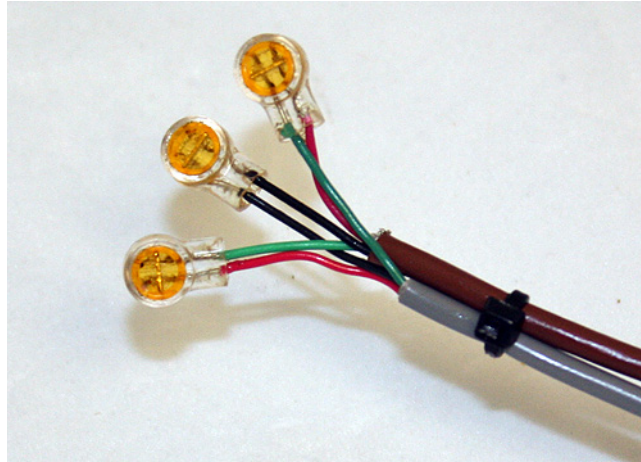


Figure 2.15 Placing plastic ties on cables

- 10 Insert the entire splice assembly into the silicone-filled splice enclosure. Close the cover with leads exiting alternate sides

match up wires with above

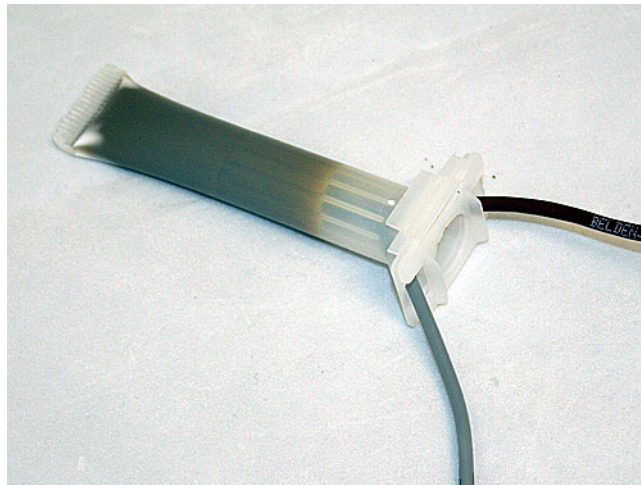


Figure 2.16 Inserting splice assembly into silicone-filled splice enclosure



Cellnet strongly recommends a splice enclosure, particularly for Badger RTR installations. Failure to use a splice enclosure may invalidate the manufacturer's warranty.



The 3M Gel splice connector is NOT reusable. Replace the splice if necessary.

- 11 Proceed to [Chapter 3](#), *Testing the Endpoint*.

Connecting a Badger RTR Register with Potted Leads

Badger manufactures "potted" RTR registers for water meter applications. These registers have a three-conductor cable already attached to the register. The factory seals them with a "potting compound".



Do not open a potted encoder for any reason. This will void the manufacturer's warranty.

Use the following installation procedure for sites equipped with potted RTR registers.

- 1 Using the cutting blade portion of the Wire Cutter and Stripper tool, cut the wire connecting the encoder register to the touchpad (or other device). The wire attached to the encoder register should contain at least three wires. If not, replace the encoder register with a 3-wire version.



Figure 2.17 Wire cutter & stripper

- 2 Using the #10 AWG position (second largest hole) on the 64-1919 wire stripper, remove 1 inch of the external insulation from the cable coming from the encoder register. Do not strip the insulation from the internal wires.



Figure 2.18 64-1919 Wirestripper

- 3 Peel back foil, if present. Cut excess foil and uninsulated wire.

correct wire color config

- 4 Repeat this procedure for the cable coming from the 6010 endpoint, if necessary.

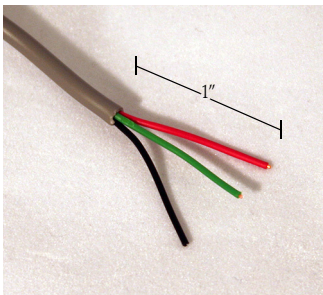


Figure 2.19 3-Wire cable



Do not damage the internal wire insulation when removing the external insulation.

- 5 Splice wires from UWE to Badger RTR. Match colors carefully according to the table below.

Table 3

Encoder Register	6010 Wire Color/Encoder Terminal
Badger RTR 3-Wire	Blk/Blk Green/Red Red/Green
Badger RTR 2-Wire	Blk/Blk Green/Red

- 6 Push the wires to be connected as far as possible into the Scotchlok connector.

photo

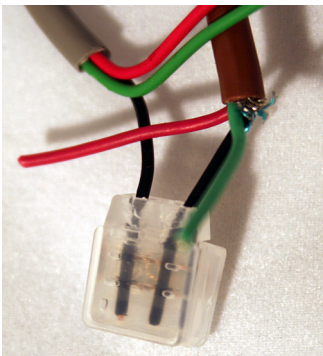


Figure 2.20 Wires inserted into Scotchlok connector

- 7 Place the Scotchlok connector (with wires) into the jaws of the crimping tool.

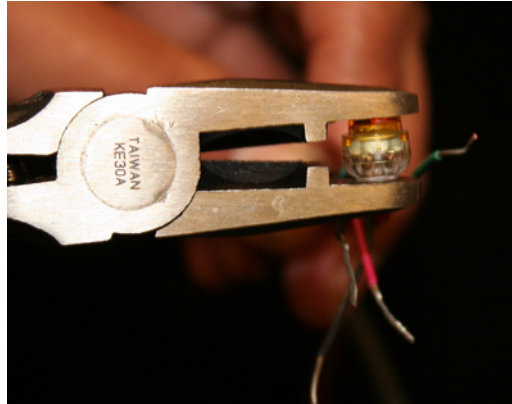


Figure 2.21 ScotchLok connector in crimping tool jaws



Always use 3M Parallel Jaw Crimping Tool 3M Model E-9Y or equivalent.

- 8 Crimp the Scotchlok connector by squeezing the handles until it discharges gel. Continue to apply pressure for three seconds..

match wire colors

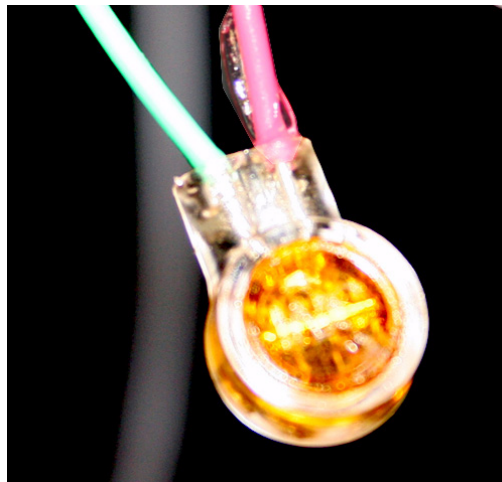


Figure 2.22 Crimped Scotchloks discharge gel

- 9 Place two plastic cable ties on wires and tighten securely for strain relief. Remove excess cable tie with wire cutters..

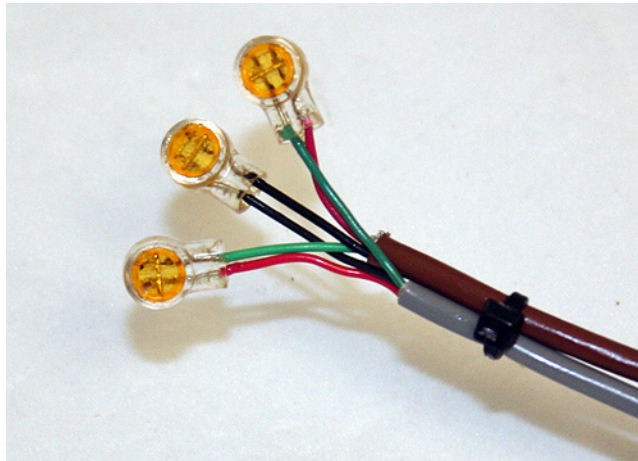


Figure 2.23 Placing plastic ties on cables

- 10 Insert the entire splice assembly into the silicone-filled splice enclosure. Close the cover with leads exiting alternate sides

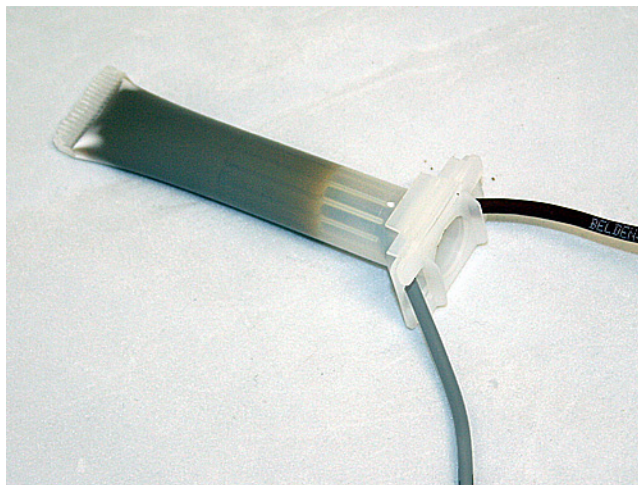


Figure 2.24 Inserting splice assembly into silicone-filled splice enclosure



Cellnet strongly recommends a splice enclosure, particularly for Badger RTR installations. Failure to use a splice enclosure may invalidate the manufacturer's warranty.

Programming 6010 endpoint for operation with a Badger RTR Register

You must program the 6010 endpoint with the DAP HandHeld computer before it can operate with a Badger RTR register. Connect the MicroTex Fastreader Probe to the DAP HandHeld as shown below



Figure 2.25 MicrTex Fastreader connected to DAP HandHeld

- 1 Place the optic probe adaptor over the top of the 6010 endpoint tube, using the keyed slot. Align the magnet tab on the optic adapter with the horseshoe shaped magnet symbol on the housing.
- 2 Attach the Microtex Fastreader Probe optic head to the optic probe adapter.
- 3 Ensure that the Microtex Fastreader Probe is properly connected to the HandHeld LEMO connector.
- 4 Follow the HandHeld computer prompts to program the endpoint.
- 5 Once the programming is complete, proceed to *Chapter 3, Testing the Endpoint*.

INSTALLING CELLNET WATER ENDPOINT 6020 PIT ON A "CELLNET 6020 READY" REGISTER

- 1 Unscrew the mounting nut from the 6020 endpoint. Reserve it for later.
- 2 Route the endpoint (attached cable first) through the antenna hole in the pit lid from top.
Certain installations may require you to remove the existing touchpad from the antenna hole before you can insert the antenna.
- 3 Pull the cable through the hole.
- 4 Insert the antenna into the antenna hole, flush with the top surface of the pit lid.



Figure 2.26 Antenna hole in pit lid

- 5 Verify that there is enough room in the pit for the endpoint, and that the cable is long enough. Thread the nut to the top of the antenna, tightening it against the bottom of the pit lid.



Figure 2.27 Threading the mounting nut

- 6 Put the pit lid with the 6020 endpoint aside for later.
- 7 Bring the mating connector parts (female attached to the register, male attached to the endpoint) of the water submersible connector together. Align the keyed connector and tighten the screw until it is snug.



Figure 2.28 Tightening connector screw

- 8 Proceed to [Chapter 3, Testing the Endpoint](#).

PRO-READ ENCODER REGISTER

Before removing the ProRead receptable, ensure that the ProRead register is programmed for three-wire mode.

- If a two-wire conductor cable is connected to a "potted" ProRead encoder register, replace the register with a three-wire register.

Reprogramming a ProRead encoder from 2-wire to 3-wire

It may sometimes be necessary to reprogram a ProRead register encoder from 2-wire to 3-wire mode. Accomplish this with a Neptune ProRead field programmer.

A basic overview of the steps is as follows:

- 1 Connect to the remote receptacle with the field programmer.
- 2 Interrogate the encoder register to determine its operating mode (2 or 3-wire).
- 3 Reconfigure the encoder register to make it operate in 3-wire model.
- 4 Verify that the reconfiguration was successful by looking at the Field Programmer screen. The OM field should be 3W (see below).

Table 2.1

**Before Reprogramming
(2-wire mode)**

**After Reprogramming
(3-wire mode)**



If the register has screw terminals, proceed to "Connecting a Neptune or Sensus Encoder Register with Screw Terminals" on page 2-4.

If the register has potted leads, proceed to "Connecting a Badger, Neptune or Sensus Encoder Register with Potted Leads" on page 2-6.

CHAPTER 3 TESTING THE ENDPOINT

After you have completed the installation process, test the installation by passing a magnet near the endpoint's sensor. The CWE tests the connection to the register and transmits a pattern to indicate if the installation is good or bad. The RF Buster detects the transmission pattern, beeps and lights the LED.

- 1 Using the RF Buster, activate the CWE by holding the magnet for less than 1 second against the horseshoe-shaped magnet symbol on the tube housing.



Figure 3.1 Horseshoe Shaped Magnet Symbol



Caution: If you hold the RF Buster magnet near the endpoint horseshoe magnet sensor for more than 2 seconds, the endpoint attempts to connect to the DAP Handheld Computer. It will not transmit the installation test pattern. If you do not hear beeps, hold the RF Buster away from the CWE for 15 seconds to allow it to reset to normal operating mode.

- 2 Press and hold the button on the RF Buster. Position the RF Buster less than 6 inches away from the top of the CWE. The RF Buster makes audible beeps and the LED flashes to confirm transmission of an RF packet from the endpoint.



Do not use a cell phone or any other RF device while conducting this test.

- 3 If the RF Buster detects 6-10 packets within 1 minute, the installation is good and the endpoint has been activated properly. If the RF Buster detects 3 or fewer packets, it indicates a bad connection between the endpoint and the register, a bad register, or a bad endpoint. Refer to the troubleshooting section of this guide to fix the problem.

- 4 When you are satisfied that the CWE and the register are functioning correctly, clean up any installation debris.
- 5 Replace lid onto pit.
- 6 Double-check that all necessary information is recorded in the handheld. Proceed to the next location in the route.

CHAPTER 4 ENDPOINT REPLACEMENT

Lift the pit lid and put it aside safely.

If you are replacing a:

- *6020*
Unscrew and disconnect the submersible connector. Remove the nut that secures the 6020 the lid. Pull the endpoint out of the antenna hole along with the attached wires completely.
- *6010 connected directly to the encoder register terminals*
Remove the terminal cover, loosen screws on terminals, and remove wires. Loosen the nut that secures the 6010 endpoint to the lid. Pull the endpoint out of the antenna hole along with the attached wires completely.
- *6010 connected with gel splice connectors*
Cut off the old splice. Loosen the nut that secures the 6010 endpoint to the lid. Pull the endpoint out of the antenna hole along with the attached wires completely.

Proceed to "*Identifying the Register for Installation*" on page 2-2.

CHAPTER 5 TROUBLESHOOTING

What if the register is not compatible with the CWE?

Verify that the register is one of the following:

- Badger ADE
- Badger RTR
- Neptune ProRead (ARB VI)
- Sensus ECR-II
- Sensus ECR-III

If the register is not one of the models listed above, replace with a supported register type and/or the appropriate meter.

What if the RF Buster does not beep when testing the installation?

Does the RF Buster beep and light the LED when the switch is initially pressed? if not, the battery in the RF Buster is dead. Replace the RF Buster battery, or use another RF Buster.

Be careful not to hold the RF Buster magnet near the magnet symbol on the CWE for more than 1 second.

After activating the magnetic switch on the CWE, hold the RF Buster switch on continuously. Point the LED end of the RF Buster toward the top of the CWE. Hold the RF Buster between 6" and 12" from the top of the CWE. Wait 10 seconds. If the RF Buster does not beep, replace the CWE.

What if the RF Buster does not beep more than 6 times when testing the installation?

Re-check the manufacturer and model of the register that you are installing. Make sure you have used the correct color code for that register.

Check the wire between the CWE and the register for cuts, nicks, or broken wires. Repair or replace the cable if necessary.

If you are using a Pro-read encoder, make sure it is programmed for 3-wire mode.

If you are using a Badger RTR, double-check the programming of the CWE.

If the CWE still does not transmit more than 6 times, replace it.

How can I tell the difference between a Sensus ECR-I and ECR-II encoder register?

The easiest way to determine the difference between ECRI and ECRII is physical appearance. ECRI is a “high top” design with odometer wheels behind a flange. If you still cannot determine which encoder register it is, please contact your local Sensus Meter Representative.

GLOSSARY

6010/6020	Cellnet manufactured water endpoint (CWE) - available for pit installations
MIU	Meter Interface Unit
CWE	Cellnet Water Endpoint
Register	Device used for registering water usage. This can be an Encoder or a Pulse-counting device
ADE	Absolute Digital Encoder
RTR	Recordall Transmitter Register
Concentrator	Collects all information provided by the Cellnet endpoints.
Pit	Cement/metal box containing water meter
PowerLAN	Unique network address of endpoints
RF	Radio Frequency
Screw terminal	Terminal with stripped and retained leads
Potted terminal	Terminal with integrated, water submersible, reusable connector
RF Buster	Device used to verify RF transmission from endpoint

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