

Instruction Sheet

Banner MultiHop Wireless Radio Network

Part number 0094130



1 Overview	3
Radio Component Diagram	4
Tools Required	4
2 Configuring In-Situ Instruments Using Win-Situ Software	5
Connecting an In-Situ Instrument to the Computer	5
Connecting an Instrument to the Software	5
Selecting the Correct COM Port	5

Changing the End of Session (EOS) Timeout	6
Setting Instrument Addresses	7
Changing the Device Address	7
Recording the Instrument Address	8
Setting Up a Data Log	8
Disconnecting an Instrument From the Software	9
Section Checklist	9
3 Configuring Master, Slave, and Repeater Radios	9
Accessing the DIP Switches	9
DIP Switch Settings	10
Setting Radio Addresses	11
Binding Radios into the Network	13
Section Checklist	15
4 Installing the TROLL Link Telemetry System	16
5 Installing the Wireless Radio Network	16
Installing Slave and Repeater Radio Enclosures and Solar Panels	16
Installing the Master Radio Enclosure and Solar Panel	19
Installing the External Battery Kit	21
Installing Batteries	22
Connecting the TROLL LINK to the External Battery Kit Enclosure	23
Connecting the Master Radio Enclosure to the TROLL Link Telemetry System	23
Section Checklist	24
6 Testing Functionality, Deploying Instruments, and Connecting to the Data Center	24
Performing a Functionality Test (Site Survey)	24
Connecting and Deploying Instruments	25
Accessing the Data Center	26
7 Desiccant	27
8 Changing Win-Situ Software Device Address and Communication Settings	27
9 Configuring the TROLL Link Telemetry System Using Over-Air Commands	28
10 Installing a Replacement Radio	29
11 Network Configuration Reference Sheet	32

Overview

This system supports a radio network integrated into a TROLL Link Telemetry System. The radio network connect can support up to eight In-Situ instruments.



Radio networks consist of one master radio, up to eight slave radios, and up to six repeater radios. Each radio is housed inside of its own enclosure. Radios are configured to be one of the three modes.

- One radio is set to master mode and controls the overall wireless network.
- Radios set to slave mode are the end points of the wireless network. Slave radios connect to probes.
- Radios may be set to repeater mode to extend the range of the wireless network. Repeater radios cannot be connected to probes.

The master radio connects to the TROLL Link Telemetry System. Data from the radio network is sent to the In-Situ Data Center, where it can be viewed and downloaded in real time. Power is provided to all components of the system by sealed lead-acid batteries and solar panels.

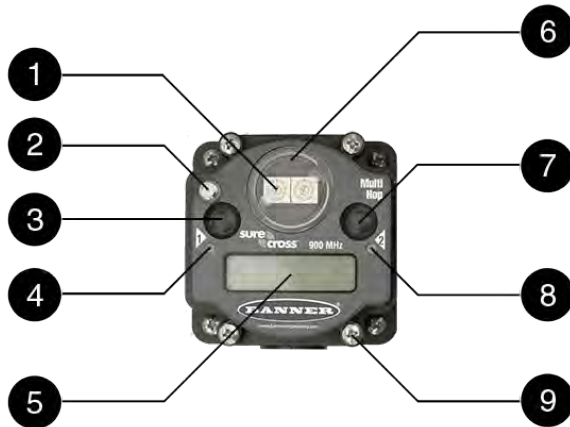
You must do the following to set up and operate your radio network:

1. Set the device address and change communication settings for all In-Situ instruments using Win-Situ[®] Software.
2. Configure DIP switch settings for each radio in the network.
3. Address each radio in the network.
4. Bind all radios into the network.
5. Install the TROLL Link Telemetry System.
6. Install all radio enclosures and accessories.
7. Test the wireless system for functionality.

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8. Install all In-Situ instruments.
 9. Connect to the Data Center to view and download data.

Steps 1 to 4 must be completed at home or in the office. Steps 5 to 8 must be completed in the field. Read this entire instruction sheet prior to beginning work.

Radio Component Diagram



1	Rotary address dials
2	Antenna/antenna cable connector
3	Button 1
4	LED 1
5	LCD Display
6	Rotary address dial cover
7	Button 2
8	LED 2
9	Cover mount screw

Tools Required

- A small flathead screwdriver
- A Phillips screwdriver
- A wrench
- Wire cutters
- Wire stripper
- A pencil or pen
- Win-Situ[®] 5 Software

- A laptop or cell phone with wireless internet access (optional, but recommended)
- Locks for enclosures (optional)

Configuring In-Situ Instruments Using Win-Situ Software

Perform the following steps for each In-Situ instrument you will be connecting to the system. Connect the first instrument, perform the steps, and then disconnect the instrument. Repeat for all other instruments.

Connecting an In-Situ Instrument to the Computer




1	Laptop or PC
2	TROLL [®] Com Communication Device*
3	RuggedCable [®] System**
4	In-Situ instrument

* TROLL Com device may be a USB-connect, serial-connect, or direct-connect** model

** RuggedCable is omitted when using a direct-connect TROLL Com

Connecting an Instrument to the Software

When you open Win-Situ 5 Software, you are asked if you want to connect to your device. Click **Yes**.

Parameters and measurements are displayed in light gray on the home screen if a connection is established. Click the **Play** button  to view live readings.

The software displays an error message if a connection cannot be established. See page 5.

Selecting the Correct COM Port

If you are using a USB TROLL Com, select the correct COM port by following the steps below. If you are using a serial TROLL Com, the Win-Situ Software should default to the correct COM port, which is usually COM 1.

Steps for Windows[®] 7 systems.

1. Minimize the Win-Situ Software.
2. Click the Windows Start button, and open the **Control Panel**.
3. Click **Hardware and Sound**, and open the **Device Manager**.

-
4. Click the arrow next to **Ports (COM and LPT)**, and locate the USB Serial Port listing. The number listed next to this entry is your COM port address.

Steps for Windows® XP systems.

1. Minimize the Win-Situ Software.
2. Click the Windows Start button, and open the **Control Panel**.
3. Double-click the **System** icon. Click the **Hardware** tab, and open the **Device Manager**.
4. Click the plus sign next to **Ports (COM and LPT)**, and locate the USB Serial Port listing. The number listed next to this entry is your COM port address.


Once you have determined the correct COM port address in your operating system, reopen Win-Situ 5 Software. The following steps apply for all Windows operating systems.

5. Close any open windows in Win-Situ Software.
6. Click **Preferences**.
7. Click **Comm Settings**, and then click the **Port Number** menu.
8. Scroll down to find the correct COM port address. Click the **check mark** to accept the changes.
9. Click the yellow **Connect** button in the lower right corner to establish a connection to the instrument.

Changing the End of Session (EOS) Timeout

The End of Session (EOS) Timeout device communication setting is changed to allow larger data packets to be transmitted successfully.

With the instrument connected to the software:

1. Click the **Device Setup** tab. 
2. Click the **Modbus Setup...** button.
3. Select the **End of Session Timeout (ms)** box and change the number to the desired value.
4. Click the **check mark** button to save changes.



Change the EOS value to 60000 ms for each instrument you will be deploying in the wireless radio network.

Setting Instrument Addresses

Instrument and radio addresses must be set to communicate within the wireless system. In a typical setup, an instrument's address is the same as the address of the radio connected to it.

Instrument addresses must be set sequentially from 1 to 8 to communicate. Slave radio addresses should also be set 1 to 8.

In addition, instrument addresses must match the addresses set during the site survey process. This information is provided with your shipment.

The instrument listed 1 must be addressed 1, instrument 2 must be addressed 2, and so on.

Figure 2.1 for an example network.

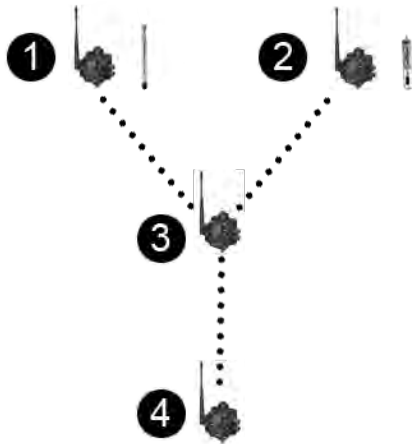


Figure 2.1 Typical radio network

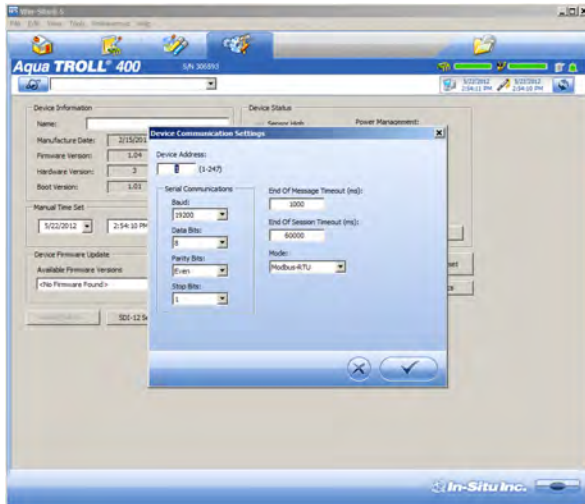
Number	Radio - Device Address	Instrument - Device Address
1	Slave radio - Device address 1	Level TROLL [®] 700 - Device address 1
2	Slave radio - Device address 2	Aqua TROLL [®] 400 - Device address 2
3	Repeater radio	No instrument
4	Master radio	No instrument

Changing the Device Address

When networking multiple Level TROLL, Aqua TROLL, Rugged TROLL, or RDO PRO Instruments, each device requires a unique device address.

Complete the following steps with the instrument connected to the software.

1. Click the **Device Setup** tab.
2. Click the **Modbus Setup...** button.
3. Select the **Device Address** box and change the number to the desired value.



4. Click the **check mark** to save changes. Click **Yes** when asked to proceed.
5. Click **No** when prompted to save the changes as the new default settings.



You must change Win-Situ Software communication settings to match the device address next time you connect the instrument. See page 27.

Recording the Instrument Address

Record the address of each instrument when you program it. You can use the **Network Configuration Reference Sheet** located at the end of this document to record the address.


Setting Up a Data Log

Data from all instruments connected to the network are transmitted to and logged in the Data Center.

A separate, internal data log can be set up for any instrument with data logging capabilities. This log can be downloaded from the instrument using a TROLL Com device. It will not be available on the Data Center.

Refer to the instrument Operator's Manual for information on setting up an internal data log.

Disconnecting an Instrument From the Software

Click the plug icon  in the lower-right corner of the screen to disconnect the instrument from the software.

Disconnect the instrument from the TROLL Com Communication Device. Attach a desiccant pack if you are using a vented cable.

Section Checklist

Before moving on to the next section, ensure the following has been completed:

- Each instrument has been addressed correctly, according to the document from the site summary.
- The End of Session time has been changed to 60000ms for each instrument.
- (Optional) Data logs have been created for each logging-capable instrument.

Configuring Master, Slave, and Repeater Radios

Prior to installation, radios must be configured and bound into the network. Radios are configured using an internal DIP switch that is accessed by removing the radio cover.

You must designate one radio as the master radio.

All other radios will be either slave or repeater radios.

Accessing the DIP Switches

Perform the following steps for all radios.

1. Open the enclosure.
2. Remove the antenna or antenna cable, if connected. The antenna or cable is connected to the radio above the arrow button labeled 1.
3. Remove the four screws that mount the cover to the bottom housing (not the four screws that mount the radio to the enclosure).



Figure 2.2 Cover mount screws

4. Remove the cover from the housing.



Wires permanently connect the housing to the cover. Be careful not to damage the wires or connections by pulling on the cover.

5. Remove the black cover plate from the bottom of the device cover. The cover plate may not exist on all models.

The DIP switches are located behind the rotary dials. Use a small tool to change the switches, such as a miniature screwdriver or the point of a mechanical pencil.



Figure 2.3 Radio DIP switch location

DIP Switch Settings

Ensure the power is disconnected before making any changes to the DIP switch positions. DIP switch changes will not be recognized while power is on.

Change settings for the master radio.

Turn switch 4, 6, and 8 to the ON position. All other switches should be in the OFF position.

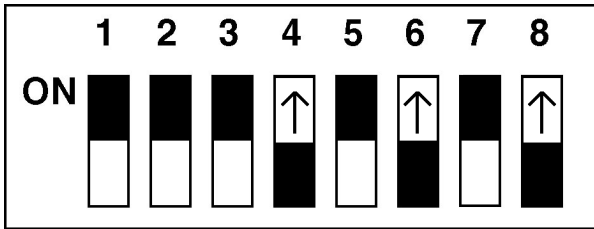


Figure 2.4 Master radio DIP switch setting

Change settings for slave radios.

Turn switch 4, 6, and 7 to the ON position. All other switches should be in the OFF position.

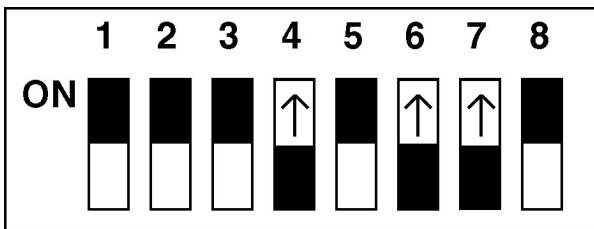


Figure 2.5 Slave radio DIP switch setting

Change settings for repeater radios.

Turn switch 3, 4, and 6 to the ON position. All other switches should be in the OFF position.

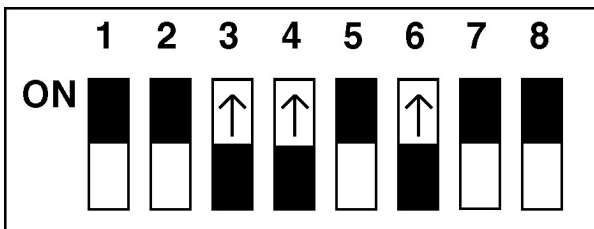


Figure 2.6 Repeater radio DIP switch setting

After making the necessary changes to the DIP switches, place the black cover plate back into position and gently push into place (if applicable). Reattach the cover to the housing.

Setting Radio Addresses

Radios must have a unique address within a network to communicate properly. In a typical setup, the radio device address is the same as the device address of the instrument connected to it.

Instruments connect only to slave radios. Since instruments must be addressed 1 to 8, **slave radios will also have addresses 1 to 8.**

The master radio does not connect to instruments. **The master radio address will be 9.**

Repeater radios do not connect to instruments. **Repeater addresses will be A to F.**

See "Typical radio network" on page 12. for an example network.

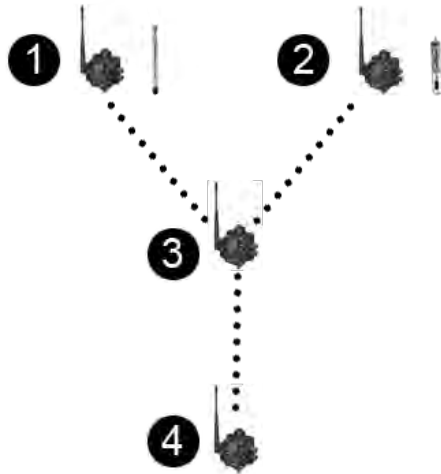


Figure 2.7 Typical radio network

Number	Radio - Device Address	Instrument - Device Address
1	Slave radio - Device address 1	Level TROLL 700 - Device address 1
2	Slave radio - Device address 2	Aqua TROLL 400 - Device address 2
3	Repeater radio - Device address A (to F)	No instrument
4	Master radio - Device address 9	No instrument

Use the rotary dials on the front cover to set radio addresses. Turn to front cover counterclockwise to remove it. The small arrow on the dial indicates the address, not the slot.

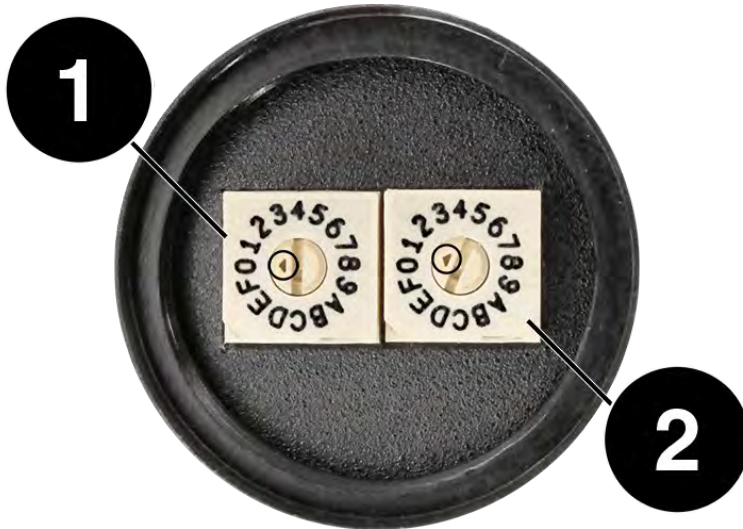


Figure 2.8 Radio addressing dials (arrows point to address)

Number	Description
1	Network address
2	Device address

The left dial arrow represents the network address. **All radios within the network must have the same network address.** The right dial arrow represents the device address. The device address must be different for each radio.

1. Use a miniature screwdriver to set the network address (left dial arrow) on all radios to the same value.
2. Use a miniature screwdriver to set the device address (right dial arrow) on each radio to the appropriate value:
Slave radios are addressed 1 to 8.
The Master radio is addressed 9.
Repeater radios are addressed A to F.
3. Replace the covers on the rotary dials. Do not over-tighten the cover.

Remember that all radios within a network will have the same network address (left dial number) but different device addresses (right dial number).

Record the network address and device address of each radio. You can use the Network Configuration Reference Sheet located at the back of this document to record the device address.

Binding Radios into the Network

Once radios have been configured to the appropriate mode and the address has been set, they must be bound into the network to communicate with each other.

Be sure that all radio covers and antennas (or antenna cables) have been replaced, and that radios are properly reinstalled in the enclosures before proceeding.

Power must be applied to begin the binding process. Power is supplied by lead-acid batteries. Batteries are ordered and shipped separately. Install a battery into each slave and repeater enclosure.

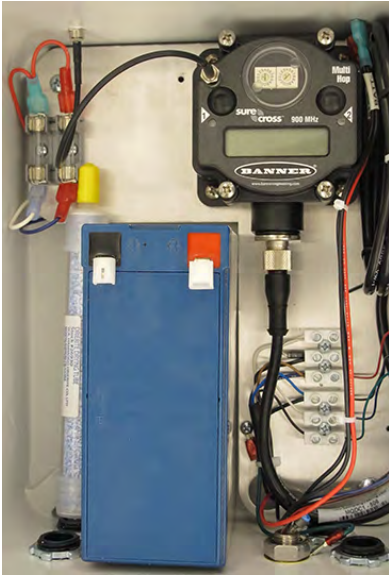


Figure 2.9 Enclosure with a battery installed

Master radios are powered by the external battery kit used for the telemetry system. Use one of these batteries or the battery for the TROLL Link Telemetry enclosure to temporarily power the master radio for binding. Install the battery into the master radio enclosure.

Apply power to all of the radios.

1. Remove the plastic terminal guards from the batteries.
2. Plug the negative lead (the black wire labeled BATT -) into each negative terminal.
3. Plug the positive lead (the red wire labeled BATT +) into each positive terminal.
4. Each radio displays POWER on the LCD screen and the right LED illuminates. The LCD screen begins auto-scrolling through the RUN menu.

Enter the radios into binding mode.

1. Press the **right button** three times on the master radio. The LCD screen displays MASTER BINDING and the LED lights will alternate flashing.
2. Press the **right button** three times on each slave and repeater. The LCD screen displays BINDING and either SLAVE or REPEAT, depending on the radio mode. The LCD screen displays BOUND once the radio is bound into the network, and returns to displaying the RUN menu.
3. Repeat step 2 for all other radios.
4. When all slave and repeater radios have been bound to the network, press the **right button** two times on the master radio to exit binding mode. The LCD display returns to the RUN menu.

Verify communications between the radios.

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1. Ensure each radio is at least 2 meters (6 feet) apart and that power is applied.
 2. After a few minutes, check the LEDs for each radio. You may need to press the left button to enable the LCD display and LED lights. The left LED of each radio should flash green, indicating synchronization.
 3. If the LED flashes red or is solid red, the radio is still trying to synchronize. Check the addressing dials to ensure the radio is set to the correct network (left dial).
 4. If the network dial is correct, try moving the radios further apart. If communications continue to fail, contact technical support.

Document the radio address settings.

Once the radios are bound, communicating, and displaying the RUN menu, write down the device address (DADR) the radio displays. *This address is different from the network address and device address set with the dials earlier.*

The device address is the 5-digit number displayed after (DADR) is displayed in the RUN menu. The master radio displays only (DADR). Slave and repeater radios display (DADR) and the parent address, (PADR). The parent address for slave radios may change during operation, so write down only the DADR for each radio.

Record the DADR of each radio. You can use the **Network Configuration Reference Sheet** located at the end of this document to record each DADR.

The DADR is factory set and will never change.

Remove power from all of the radios.

1. Remove the positive lead, and then the negative lead from all slave and repeater batteries. You may wish to remove the batteries from the enclosure for transportation to the installation site.
2. Remove the positive lead, and then the negative lead from the master radio. Remove the battery from the master radio enclosure.
3. Close all enclosures and latch them shut.

Section Checklist

Before moving on to the next section, ensure the following has been completed:

- DIP switch settings have been set for one master radio, and the master radio has been properly addressed using the rotary dials.
- DIP switch settings have been set for all slave radios, and all slave radios have been properly addressed using the rotary dials.
- (Not applicable in all instances) DIP switch settings have been set for all repeater radios, and all repeater radios have been properly addressed using the radio dials.

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- All radios have been successfully bound into a wireless network, and radios are in communication.



Perform all remaining steps of this document in the field.

Installing the TROLL Link Telemetry System

To mount the enclosure, you may obtain a mounting tripod or install your own pole. Install the pole before proceeding.

1. Hold the enclosure to the pole at the desired elevation (be sure to leave room at the top of the pole for the solar panel).
2. Place a hose clamp or U-bolt into the two cutouts of the top bracket of the enclosure and around the pole.
3. For hose clamps tighten the clamp until the enclosure does not move. Attach the second hose clamp to the bottom of the enclosure.
For U-bolts Place the smaller bracket over the open ends of the bolt. Use split-lock washers and nuts to tighten the assembly to the pole. Repeat for any remaining open brackets.
4. Remove the two yellow caps from the vent tube inside the enclosure.

Installing the Wireless Radio Network

Installing Slave and Repeater Radio Enclosures and Solar Panels

Enclosures are shipped with hose clamps or U-bolts that allow them to be mounted to variable-width poles or mounting tripods. Enclosures can also be mounted to flat surfaces (such as walls or posts) with user-supplied hardware. Always use appropriately-sized bolts and washers when mounting an enclosure to flat surfaces.

1 W solar panels must be installed with each slave radio and repeater radio enclosure.

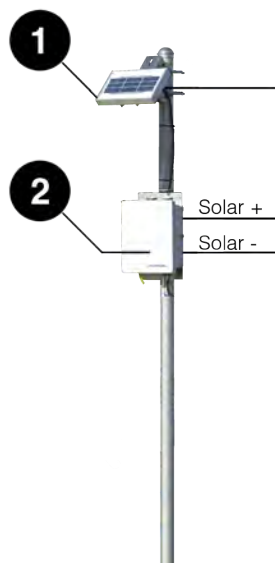


Figure 2.10 Slave/repeater enclosure setup

Number	Description
1	1 W solar panel
2	Slave/repeater enclosure

Perform the following steps for one radio, then move on to the next radio and repeat the steps.

Mount an enclosure.

1. Open the enclosure and remove the yellow end caps from the desiccant and vent tube. Close the enclosure and secure the latch.
2. Hold the enclosure to the pole at the desired elevation (be sure to leave room at the top of the pole for the solar panel).
3. Place a hose clamp or U-bolt into the two cutouts of the top bracket of the enclosure and around the pole.
4. For hose clamps tighten the clamp until the enclosure does not move. Attach the second hose clamp to the bottom of the enclosure.
For U-bolts place the smaller bracket over the open ends of the bolt. Use split-lock washers and nuts to tighten the assembly to the pole. Repeat for any remaining open brackets.
5. Point the enclosure antenna toward the master radio location or toward the nearest repeater. If line-of-sight between the radios does not exist, you may need to install a yagi or high gain omni-directional antenna using an antenna conversion kit.

Description	Part Number
Yagi Antenna	0097200
High Gain Omni-Directional Antenna	0097080

Description**Part Number**

Antenna Conversion Kit

0094140

Mount a solar panel.

1. Hold the solar panel near the top of the pole. Point the panel towards the equator. The panel angle may need to be adjusted for optimum sunlight reception.
2. Thread the U-bolt through the solar panel bracket. Place the smaller bracket over the open ends of the bolt. Use the split-lock washers and nuts to tighten the assembly to the pole. Repeat for any remaining open brackets.

Connect the battery.

1. Install one battery into each enclosure (if batteries are not already present). Install batteries with the terminals oriented toward the top of the enclosure.
2. Connect the black lead (BATT-) to the black terminal first. Ensure that the terminal does not sit between the lead clip and the plastic sheath, but that the lead clip encompasses the battery terminal.



Figure 2.11 Incorrect and correct battery connection

3. Connect the red lead (BATT+) to the red terminal. Ensure that the terminal does not sit between the lead clip and the plastic sheath, but that the lead clip encompasses the battery terminal.

Connect a solar panel.

1. Cover the solar panel that will connect to the enclosure so it will not receive any sunlight.
2. Remove one of the dome connector caps near the bulkhead connector on the outside of the enclosure. Remove the port plug. Save the plug for later use (you can store the plug inside the enclosure).

Trim the solar panel wire before inserting it into an enclosure.



Do not cut through the entire solar panel wire. The blade creates a current loop when in contact with both leads and shorts the solar panel.

Instead, trim off the insulation, then cut one wire at a time.

3. Strip the cable ends to 1.3 cm (0.5 inches).

4. Insert the solar panel cable into the dome connector cap, and then through the enclosure.

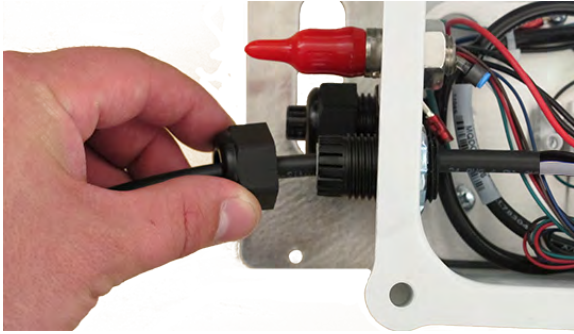


Figure 2.12 Inserting the cable

5. Connect the black lead (negative) from the solar panel to open screw terminal 2. Note the wiring diagram on the inside lid of the enclosure for help. Tighten the screw terminal.
6. Connect the white lead (positive) from the solar panel to open screw terminal 1. Refer to the wiring diagram on the inside lid of the enclosure for help. Tighten the screw terminal.

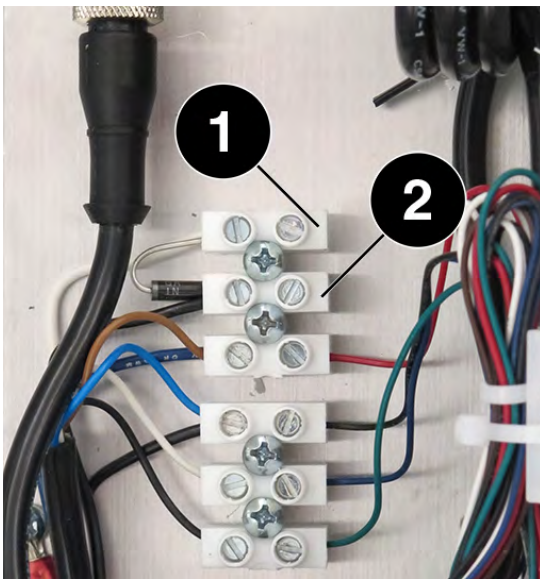


Figure 2.13 Solar panel connection point

7. Tighten the dome connector cap so the port with the cable will be watertight.

Document the radio location:

Record the location of each radio. You can use the **Network Configuration Reference Sheet** located at the end of this document to write a brief description of each location.

Installing the Master Radio Enclosure and Solar Panel

The master radio enclosure can be installed on the same pole as the TROLL Link Telemetry System.

A 10 or 20 W solar panel must be installed with the master radio and TROLL Link System. It can be installed on the same pole.

The external battery kit can also be installed on the same pole.

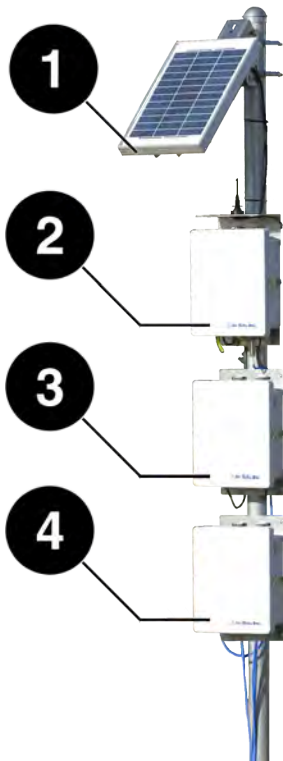


Figure 2.14 Master radio pole setup

Number	Description
1	10 or 20 W solar panel
2	TROLL Link Telemetry enclosure
3	Master radio enclosure
4	External battery kit

Mount the master radio enclosure.

1. Open the enclosure and remove the yellow end caps from the desiccant and vent tube. Close the enclosure and secure the latch.
2. Hold the enclosure to the pole at the desired elevation (be sure to leave room at the top of the pole for the solar panel).
3. Place a hose clamp or U-bolt into the two cutouts of the top bracket of the enclosure and around the pole.
4. For hose clamps tighten the clamp until the enclosure does not move. Attach the second hose clamp to the bottom of the enclosure.
For U-bolts place the smaller bracket over the open ends of the bolt. Use split-lock washers and nuts to tighten the assembly to the pole. Repeat for any remaining open brackets.

Mount the 10 or 20 W solar panel.

1. Hold the solar panel near the top of the pole. Point the panel towards the equator. Adjust the panel angle for optimum sunlight reception.
2. Thread the U-bolt through the solar panel bracket. Place the smaller bracket over the open ends of the bolt. Use the split-lock washers and nuts to tighten the assembly to the pole. Repeat for any remaining open brackets.

Install the external battery kit before connecting it to the solar panel.

Installing the External Battery Kit

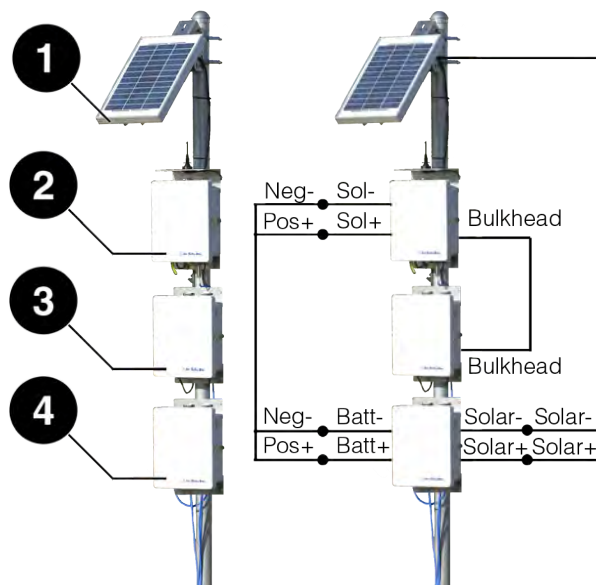


Figure 2.15 Master radio pole installation and wiring

Number	Description
1	10 or 20 W solar panel
2	TROLL Link Telemetry enclosure
3	Master radio enclosure
4	External battery kit

Install the External Battery Kit enclosure.

1. Hold the enclosure to the pole at the desired elevation. The external battery kit should be installed below the TROLL Link Telemetry enclosure, as shown in Figure 2.15 .
2. Place a hose clamp or U-bolt into the two cutouts of the top bracket of the enclosure and around the pole.
3. For hose clamps tighten the clamp until the enclosure does not move. Attach the second hose clamp to the bottom of the enclosure.

For U-bolts place the smaller bracket over the open ends of the bolt. Use split-lock washers and nuts to tighten the assembly to the pole.

Connect the solar panel to the External Battery Kit enclosure:

1. Cover the solar panel that will connect to the enclosure so it will not receive any sunlight.
2. Remove a dome connector cap on the outside of the enclosure. Remove the port plug. Save the plug for later use.

Trim the solar panel wire before inserting it into an enclosure.



Do not cut through the entire solar panel wire. The blade creates a current loop when in contact with both leads and shorts the solar panel.

Instead, trim off the insulation, then cut one wire at a time.

3. Strip the cable ends to 1.3 cm (0.5 inches).
4. Insert the solar panel cable into the dome connector cap, and then through the enclosure.
5. Connect the black lead (negative) from the solar panel to the screw terminal labeled "SOLAR-". Tighten the screw terminal.
6. Connect the white lead (positive) from the solar panel to the screw terminal labeled "SOLAR+". Tighten the screw terminal.
7. Tighten the dome connector cap to ensure that the port with the cable is watertight.

Installing Batteries

Install one battery into the TROLL Link enclosure, and install two batteries into the External Battery Kit enclosure.

Batteries should already be installed and connected for slave and repeater radios.

1. Install the batteries with the terminals oriented toward the top of the enclosure.
2. Plug the black (negative) leads into the black terminals of the batteries first. Ensure that the terminal does not sit between the lead clip and the plastic sheath, but that the lead clip encompasses the battery terminal.

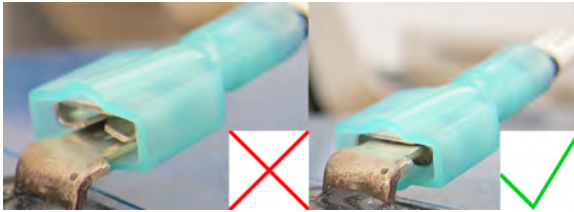


Figure 2.16 Incorrect and correct battery connection

3. Plug the red (positive) leads into the red battery terminals. Ensure that the terminal does not sit between the lead clip and the plastic sheath, but that the lead clip encompasses the battery terminal.

Connecting the TROLL LINK to the External Battery Kit Enclosure

1. Remove two dome connector caps, one from the outside of the battery kit enclosure, and one from the TROLL Link Telemetry System. Remove the port plugs. Save the plugs for later use.
2. Insert the separate power cable shipped with the external battery kit into one dome connector cap, and then through the battery kit enclosure.
3. Connect the black lead (negative) of the cable to the "BATT-" screw terminal of the battery box.
4. Connect the white lead (positive) of the cable to the "BATT+" screw terminal of the battery box.
5. Insert the other side of the cable through the remaining dome connector cap. There should be two dome connector caps on the cable, oriented in opposite directions.
6. Insert the cable through the dome connector to the inside of the enclosure.
7. Connect the black lead (negative) of the external battery kit cable to the "SOLAR-" screw terminal of the enclosure.
8. Connect the white lead (positive) of the external battery kit cable to the "SOLAR+" screw terminal of the enclosure.
9. Tighten all dome connector caps so the ports with cable are watertight.

Connecting the Master Radio Enclosure to the TROLL Link Telemetry System

Use RuggedCable to connect the master radio to the TROLL Link Telemetry System.

Remove the red dust caps from the TROLL Link and master radio bulkhead connectors.

Connect one end of the cable to the radio enclosure bulkhead. Connect the other end of the cable to the TROLL Link enclosure. Ensure both connections are tight.

Section Checklist

Before moving on to the next section, ensure the following has been completed:

- The TROLL Link Telemetry System has been properly installed, including the TROLL Link enclosure, solar panel, and External Battery Kit.
- All slave and repeater radio enclosures and solar panels have been properly installed.
- All radio antennas point towards the master radio, or towards the nearest repeater radio with clear line-of-sight.
- The master radio enclosure has been properly installed near the TROLL Link enclosure.
- All radios are properly powered with batteries and solar panel connections.
- The master radio is connected to the TROLL Link Telemetry System.

Testing Functionality, Deploying Instruments, and Connecting to the Data Center

Performing a Functionality Test (Site Survey)

Perform a functionality test once the TROLL Link System, radios, and power supplies are installed.

The functionality test determines communication strength between radios. The test is performed between two radios at a time. Each radio in the network must be tested.

Use the master radio to test all other radios in the network. If you note problems with a particular radio during the test, you can then travel to that radio to perform troubleshooting.

1. On the master radio, press the **left button** until the display reads *SITE.
2. Press the **right button** to enter the Site Survey menu. The master radio will display CHLDRN.
3. Press the **right button** to display a synchronized slave/repeater DADR (device address).
4. Press the **left button** to scroll between all synchronized radios. Refer to the **Network Configuration Reference Sheet** at the end of this document (if you filled out the guide during configuration) to ensure all radios are listed.
5. Select the DADR for the radio you want to test (use the Network Configuration Reference Guide if possible).
6. With the correct DADR displayed, press the **right button**.

-
- The site survey begins. LED 2 (on the right side of the radio) flashes for every received RF packet. To indicate the master radio is in site survey mode, LED 1 (on the left side) will be solid green. The radio analyzes the quality of the signal by counting the number of packets received and measuring the signal strength (green, yellow, and red).
 - Examine the reception readings (GRN, YLW, RED, MIS). MIS displays the percent of missed packets while GRN, YLW, and RED display the percent of received packets at those signal strengths.



GRN = excellent signal strength
YLW = good signal strength
RED = marginal signal strength
MIS = missed packets

The colored signal strength indicators and missed packets indicate if you need to alter your system for better functionality. This can include proper antenna alignment or selection, and number of repeaters within the network.

Green and yellow signal strength is desirable. Red signal strength is generally inadequate.

The network can function at approximately 40% missed packets without serious degradation, but situations with more missed packets or a frequently marginal signal strength should be reviewed.

The maximum range of the standard antenna is 1930 meters (1.2 miles). Distances greater than 360 meters (1,200 feet) between radios, especially without clear line-of-sight, are subject to poorer signal. Poor signal performance or missed packets could indicate the need for a yagi antenna (PN0097200) or high-gain omni-directional antenna (0097080), or a repeater radio.

- During a site survey, press the **right button** to pause or resume auto-scrolling the results. While paused, press the **left button** to advance through the four signal strength categories. Press the **right button** to exit the results display.
- Press the **right button** two times on either radio to exit the site survey. The devices resume normal operation.
- Repeat the previous steps for all other radios within the network.
- Once all radios are communicating effectively, install instruments and access the data.

Connecting and Deploying Instruments

Ensure data-logging capable instruments have been programmed with a data log before completing the following steps if data redundancy is required.

Ensure all instruments have been properly, uniquely addressed in Win-Situ Software.

Perform the following steps for each instrument. Ensure the instrument is being installed in its proper location.

1. Connect the instrument to the RuggedCable using the twist-lock connector. The twist-lock connector will click when the connection is tight.
2. Remove the red dust cap from the bulkhead connector of the enclosure.
3. Connect the up-hole end of the cable to the bulkhead connector of the enclosure.
4. Install the instrument into the deployment location. Refer to the instrument Operator's Manual for any questions regarding proper connection or deployment.
5. Ensure the cable does not apply excessive weight on the radio enclosure.

Record the installation location of each instrument.

Accessing the Data Center

Note that it may take up to an hour for data to be transmitted to the Data Center, depending on the data service package you have.

1. Open a Web browser.
2. Enter the URL:
http://www.isi-data.com
3. Enter your User ID and Password. Click **Login**.
4. The Site Index appears. The Site Index displays the site name, most recent message received date, number of devices at the site, and the alarm status.
5. Click a site name to view more data from that site.
6. Select a Device to view more data from that device.

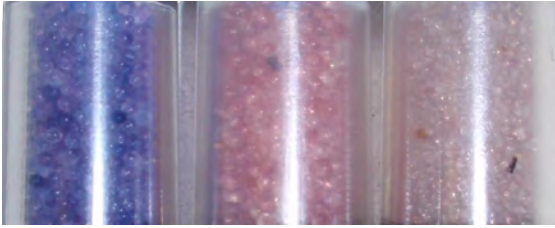
If the next transmission interval has not occurred, you should confirm that communication from all devices in the network has been successful.

1. Ensure all components of the TROLL Link Telemetry System have power applied.
2. From the Site Index, click the site name.
3. Click the first device listed.
4. Select **Manage Device** under the **Site Management** heading in the left navigation bar.
5. Select **View Config Messages** under the **Device Config** heading in the left navigation bar.

If data does not refresh at the expected rate or the site does not display the network, contact technical support.

Desiccant

Desiccant protects electronics from condensation, which can cause irreparable damage and loss of data. Indicating desiccant changes from blue to pink as it becomes saturated with moisture.



*Desiccant stages (from left)
New, nearly expired (replace now), expired*

It is **extremely important** to use a properly-sized desiccant for your deployment, and to **change desiccant often**. Desiccant should be changed before the entire volume has turned pink, and you should use enough desiccant to effectively keep cables, instruments and electrical boards dry until your next scheduled maintenance. Desiccant life span is dependent on site conditions.

Changing Win-Situ Software Device Address and Communication Settings

If you change an instrument's device address or other communication settings, you must change Win-Situ Software communication settings to reconnect and communicate with the instrument.

1. Connect an instrument to a laptop or PC.
2. Open Win-Situ Software. When it asks "*Connect to device now?*" click **No**.
3. In the top menu bar, click **Preferences**.
4. Click **Comm Settings**.
5. Enter instrument's device address into the **Device Address** box.*
6. Ensure the correct COM port is selected in the **Port Number** box. See page 5.
7. Ensure other communication settings (e. g., Baud, Data Bits, Parity Bits, Stop Bits, Mode) match the device settings.*
8. Click the **check mark**.
9. Click the **Connect** button in the lower right corner.

* If you do not know the device address or communication settings for an instrument, disconnect the instrument from the networking device. Connect the instrument directly to the PC. Click the **Search For Devices** or **Reset All Devices** button in the Comm Settings window. Clicking the **Reset All Devices** button restores device defaults.



If the instrument is connected to a networking device when **Reset All Devices** is clicked, all other instruments connected to the network are restored to default settings.

Any device deployed in a network must have the appropriate device communication settings reapplied.

Configuring the TROLL Link Telemetry System Using Over-Air Commands

TROLL Link Telemetry System 101 and 201 models are pre-configured to the correct instrument types, requested parameters, and transmission interval prior to shipping.

Altering this configuration is possible, but not recommended. Increasing the number of parameters or the transmission interval may result in data overage charges if the increased data transmission exceeds the purchased data plan. Consult In-Situ Inc. prior to altering the original configuration to avoid data overage charges.

The TROLL Link Telemetry System is configured using over-air commands from the Data Center.

Access the Data Center.

1. Open a Web browser.
2. Enter the URL: *http://www.isi-data.com*
3. Enter your User ID and Password.
4. Click **Login**. The Site Index screen appears.

Change transmitted parameters for each instrument.

1. Click **Manage Site**. The Configuration Screen appears.
2. Click the plus sign next to your site name (the name may be Default). The site menu expands and instruments in your site are displayed below the **Assign Devices** entry. Instrument names may be a series of numbers.
3. Click the first instrument listed.
4. Click **Over-Air Commands** under the **Device Config** heading in the left sidebar.
5. Click the **Add** or **Remove** check box next to the parameter name to change the transmitted parameters. All parameters are transmitted under default settings.
6. Click the **Send Config** button. You may need to scroll to view the button.
7. Click the site name in the left navigation window.
8. Click **Manage Site** under the **Site Management** menu in the left navigation window.
9. Repeat steps 2 through 8 for the remaining instruments in your site.

Change the transmission interval for the site.

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1. Log in to the Data Center if you have not already done so.
 2. Follow steps 1 through 4 of the previous instruction set to access the **Over-Air Commands**.
 3. To change the transmission interval, click the arrow button next to **Update transmission interval**, and select **Yes**.
 4. Click the arrow button next to **Base message interval** and select the desired interval rate.



Available message intervals are displayed based on your data service plan.

5. Click the arrow next to **Sample Rate/Hyper mode**, and select **None**.
6. Click the arrow next to **Message Holding**, and select **No Holding**.
7. Click the **Send Config** button at the bottom of the parameter list to finalize the configuration. All other instruments are updated to transmit using these settings.

Installing a Replacement Radio

A replacement radio (part number 0094050) includes a Banner MultiHop radio module, 5-pin Euro single-ended cable, mounting screws, Banner documentation, and CD.

Replacing a Slave or Repeater Radio

1. Open the enclosure of the radio you are going to replace.
2. Disconnect the white (positive) lead of the solar panel wire from the enclosure screw terminals. Refer to the wiring diagram on the inside of the enclosure door for wire location.
3. Disconnect the red (positive) lead from the battery.
4. Disconnect the black (negative) lead from the battery.
5. Disconnect the antenna cable from the radio module.
6. Remove the brown, blue, white, and black wires of the radio cable from the enclosure screw terminals. Refer to the wiring diagram on the inside of the enclosure door for wire locations.
7. Remove the four radio module mounting screws, and then completely remove the radio and cable from the enclosure.
8. Set the replacement radio DIP switch settings and rotary dials to match the settings of the radio you are replacing prior to installing the radio. See ***Accessing the DIP Switches***, ***DIP Switch Settings***, and ***Setting Radio Addresses*** for instructions on changing these settings.

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9. Install the Euro cable connector to the radio module. There is a slot on the connector that ensures proper connection.
 10. Install the radio module into the enclosure using the mounting screws.
 11. Trim the gray wire of the radio cable to the black sheath. This wire is not connected to the enclosure.
 12. Connect the blue, brown, white, and black wires of the radio cable to the enclosure screw terminals. Refer to the wiring diagram on the inside of the enclosure door for wire locations.

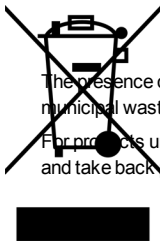


Ensure the larger blue (+12 V) and black (GND) wires have not been disconnected from their respective screw terminals.

13. You may need to bundle the extra radio cable, and bind it to the bracket on the side of the enclosure.
14. Connect the antenna cable to the radio.
15. Connect the black (negative) lead to the battery.
16. Connect the red (positive) lead to the battery. The radio should display POWER on the LCD screen and the right LED should illuminate. The LCD screen will then auto-scroll through the RUN menu.
17. Connect the white (positive) lead of the of the solar panel wire to the enclosure screw terminal. Refer to the wiring diagram on the inside of the enclosure door for wire location.
18. Record the DADR of the new radio. You can use the Network Configuration Reference Sheet located at the back of this document to record the new DADR.
19. Press the **right button** on the radio three times. The LCD screen displays BINDING and either SLAVE or REPEAT, depending on the radio mode. Close the radio enclosure.
20. Travel to the master radio. Open the master radio enclosure. Press the **right button** on the radio three times. The LCD screen displays MASTER BINDING and the LED lights alternate flashing. The replacement radio automatically binds into the existing network.
21. Press the **right button** two times on the master radio to exit binding mode. The LCD display begins displaying the RUN menu.
22. Perform a functionality test (site survey) to ensure the new radio is properly communicating with the network. See page 24. You need the DADR you recorded from the new radio.
23. Once the test is complete and communications have been confirmed, close the enclosure.

Replacing a Master Radio

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1. Open the External Battery Kit enclosure.
 2. Remove the red (positive) leads from both batteries. Remove the black (negative) leads from both batteries.
 3. Open the TROLL Link Telemetry enclosure.
 4. Remove the red (positive) lead from the battery. Remove the black (negative) lead from the battery.
 5. Cover the solar panel. Disconnect the white (positive) lead of the wire connecting the External Battery Kit to the TROLL Link Telemetry enclosure.
 6. Complete steps 5 to 14 from the previous section.
 7. Reconnect the white (positive) lead of the wire connecting the External Battery Kit to the TROLL Link Telemetry enclosure. Refer to the wiring diagram on the inside of the enclosure door for wire location.
 8. Connect the black (negative) lead to the battery in the TROLL Link Telemetry enclosure. Connect the red (positive) lead to the battery.
 9. Connect the black (negative) leads to the batteries of the External Battery Kit. Connect the red (positive) leads to the batteries.
 10. Record the DADR of the new radio. Use the Network Configuration Reference Sheet located at the back of this document to record the new DADR.
 11. Press the **right button** on the radio three times. The LCD screen will display MASTER BINDING and the LED lights will alternate flashing.
 12. Travel to the first slave radio. Press the **right button** on the radio three times. The LCD screen displays BINDING and either SLAVE or REPEAT, depending on the radio mode. The LCD screen displays BOUND once the radio is bound into the network, and returns to displaying the RUN menu. Repeat this step for all other radios.
 13. When all slave and repeater radios have been bound to the network, press the **right button** two times on the master radio to exit binding mode. The LCD display returns to displaying the RUN menu.
 14. Perform a functionality test (site survey) to ensure the new radio is properly communicating with the network. See page 24.
 15. Once the test is complete and communications have been confirmed, ensure all enclosures have been shut and latched before leaving the site.



The presence of the Waste Electrical and Electronic Equipment (WEEE) marking on the product indicates that the device is not to be disposed via the municipal waste collection system of any member state of the European Union.

For products under the requirement of WEEE directive, please contact your distributor or local In-Situ Inc. office for the proper decontamination information and take back program, which will facilitate the proper collection, treatment, recovery, recycling, and safe disposal of the device

Network Configuration Reference Sheet

Use this sheet to help document your network configuration and assist in troubleshooting. Make a copy of this sheet to place in your master radio enclosure or other documentation.

Radio	Instrument model and address	Network*	Radio device address	DADR	Radio/Instrument Location
	Set in Win-Situ Software	Left dial value	Right dial value	On radio RUN display	Brief description of the installation location
Master**					
Slave 1					
Slave 2					
Slave 3					
Slave 4					
Slave 5					
Slave 6					
Slave 7					
Slave 8					
Repeater A					
Repeater B					
Repeater C					
Repeater D					
Repeater E					
Repeater F					

*Network must be the same for all radios.

** Master radio device address should be 9.

Master radio DIP switch: 4, 6, 8 ON | 1, 2, 3, 5, 7 OFF

Slave radio DIP switch: 4, 6, 7 ON | 1, 2, 3, 5, 8 OFF

Repeater radio DIP switch: 3, 4, 6 ON | 1, 2, 5, 7, 8 OFF