

# Technical Note

## Using Banner Multihop Radios with Tube/Cube Telemetry

### Overview

Locations with multiple wells present a unique challenge. The costs associated with multiple wells can be significant when factoring in instrumentation, cable, data collection, and maintenance required. Multi-well sites may also face imposing regulations that must be creatively met.

Radio networks used in conjunction with telemetry can significantly reduce the long-term cost of managing multi-well sites. Radios can be installed at individual wells, which eliminates the need for expensive, lengthy cable runs or having to install telemetry units at every well. These radios broadcast data to a central radio connected to a single telemetry unit, which can upload the data in real-time. This wireless monitoring, which includes alarming capabilities, improves data collection, reduces visits to the site, lessens the chance of vandalism and stolen property, and considerably cuts the cost of equipment required to monitor such sites.

In-Situ's Banner Multihop Radios can be used in conjunction with Tube and Cube Telemetry systems to create these over-the-air networks of monitoring instruments. Radio networks consist of one master radio that connects to a Tube or Cube telemetry unit, up to eight slave radios that connect to instruments, and up to six repeater radios that can expand the network's area or improve signal strength. The telemetry units can send real-time data to In-Situ's HydroVu Data Services platform for access to data anywhere that has an internet connection, or they can upload data to existing FTP servers.

### Tools Required

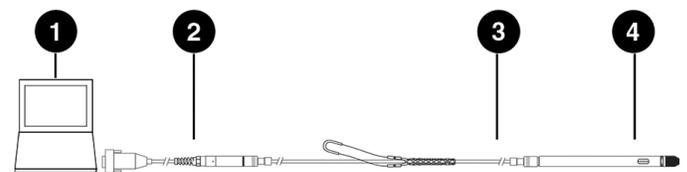
- A small flathead screwdriver
- A Phillips screwdriver
- A wrench

- 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

---

## 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 8.1 and Windows 10 systems.

1. Right-click the **Start** button.
2. Click **Device Manager**.
3. 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 8 systems.

1. Right-click the **Start** screen.
2. Select **All Apps**.
3. Click **Control Panel**.
4. Open the **Device Manager**.
5. 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 7 systems.

1. Click the **Start** button, and open the **Control Panel**.
2. Click **Hardware and Sound**, and open the **Device Manager**.
3. 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. Click the **Start** button, and open the **Control Panel**.
2. Double-click the **System** icon. Click the **Hardware** tab, and open the **Device Manager**.
3. 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.

### The following steps apply for all Windows operating systems.

1. Once you have determined the correct COM port address in your operating system, reopen Win-Situ 5 Software.

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

## 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**. Synchronize the instrument clock to the PC clock. 

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

## 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 1.1 for an example network.

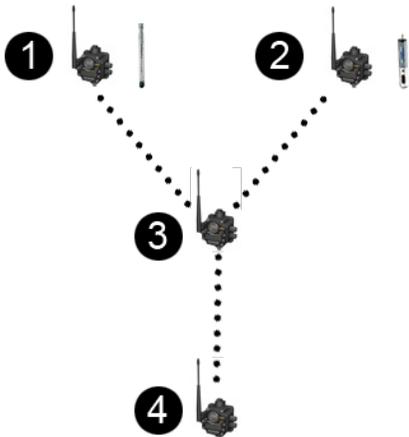


Figure 1.1 Typical radio network

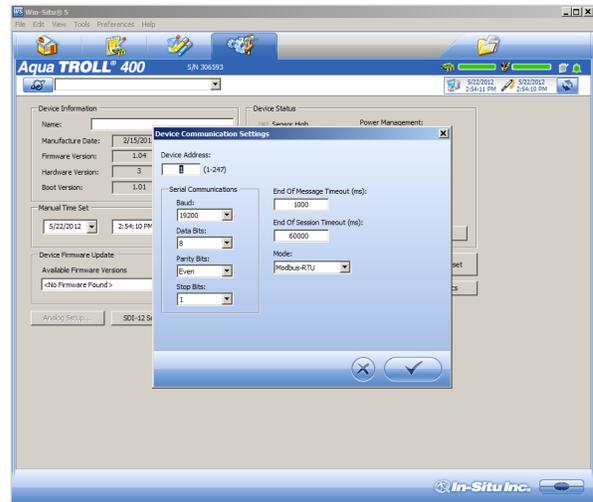
Number	Radio - Device Address	Instrument - Device Address
1	Slave radio - Device address 1	Level TROLL® 700 - Device address 1
2	Slave radio - Device address 2	Aqua TROLL® 400 - Device address 2
3	Repeater radio	No instrument
4	Master radio	No instrument

## Changing the Device Address

Networking multiple Level TROLL, Aqua TROLL, Rugged TROLL, or RDO PRO Instruments requires each device to have 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, making sure to not duplicate an address within the network.



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 1.

## 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 communication device. Attach a desiccant pack if you are using a vented cable.

## 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).

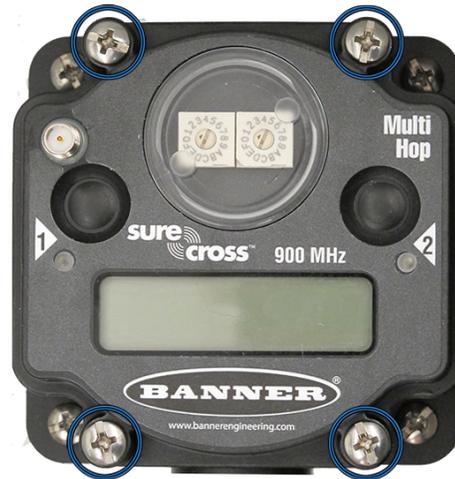


Figure 1.2 Cover mount screws

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 1.3 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 1, 6, and 8 to the ON position. All other switches should be in the OFF position.

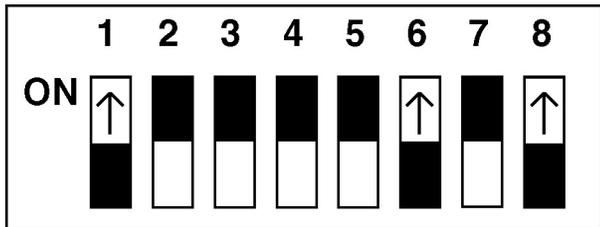


Figure 1.4 Master radio DIP switch setting

### Change settings for slave radios.

Turn switch 1, 6, and 7 to the ON position. All other switches should be in the OFF position.

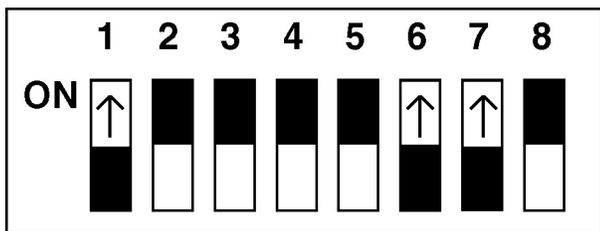


Figure 1.5 Slave radio DIP switch setting

### Change settings for repeater radios.

Turn switch 1, 3, and 6 to the ON position. All other switches should be in the OFF position.

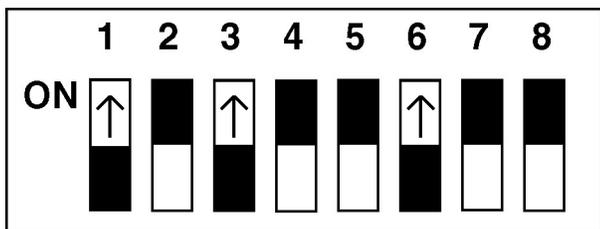


Figure 1.6 Repeater radio DIP switch setting

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 5. for an example network.

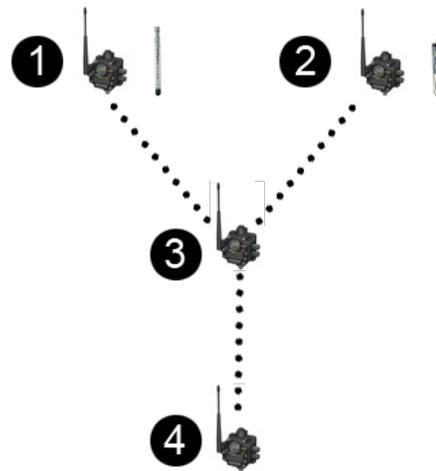


Figure 1.7 Typical radio network

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 1.8 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 1.9 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.

- 
- 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.**

- Press the **right button** three times on the master radio. The LCD screen displays MASTER BINDING and the LED lights will alternate flashing.
- 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.
- Repeat step 2 for all other radios.
- 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.**

- Ensure each radio is at least 2 meters (6 feet) apart and that power is applied.
- 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.
- 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).
- 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.**

- 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.
- Remove the positive lead, and then the negative lead from the master radio. Remove the battery from the master radio enclosure.
- Close all enclosures and latch them shut.

## ***Installation***

Refer to the Banner Multihop Wireless Radio Network manual for instructions on installing Banner radios.

Refer to the appropriate Tube or Cube manual for instructions on installing a Tube or Cube telemetry unit.

Manuals can be downloaded from ***www.in-situ.com***