



## Datalogger RF407-Series Spread Spectrum Radio Option

Revision: 9/16





# ***Limited Warranty***

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“Products manufactured by CSI are warranted by CSI to be free from defects in materials and workmanship under normal use and service for twelve months from the date of shipment unless otherwise specified in the corresponding product manual. (Product manuals are available for review online at [www.campbellsci.com](http://www.campbellsci.com).) Products not manufactured by CSI, but that are resold by CSI, are warranted only to the limits extended by the original manufacturer. Batteries, fine-wire thermocouples, desiccant, and other consumables have no warranty. CSI’s obligation under this warranty is limited to repairing or replacing (at CSI’s option) defective Products, which shall be the sole and exclusive remedy under this warranty. The Customer assumes all costs of removing, reinstalling, and shipping defective Products to CSI. CSI will return such Products by surface carrier prepaid within the continental United States of America. To all other locations, CSI will return such Products best way CIP (port of entry) per Incoterms ® 2010. This warranty shall not apply to any Products which have been subjected to modification, misuse, neglect, improper service, accidents of nature, or shipping damage. This warranty is in lieu of all other warranties, expressed or implied. The warranty for installation services performed by CSI such as programming to customer specifications, electrical connections to Products manufactured by CSI, and Product specific training, is part of CSI’s product warranty. **CSI EXPRESSLY DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** CSI hereby disclaims, to the fullest extent allowed by applicable law, any and all warranties and conditions with respect to the Products, whether express, implied or statutory, other than those expressly provided herein.”

# Assistance

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Products may not be returned without prior authorization. The following contact information is for US and international customers residing in countries served by Campbell Scientific, Inc. directly. Affiliate companies handle repairs for customers within their territories. Please visit [www.campbellsci.com](http://www.campbellsci.com) to determine which Campbell Scientific company serves your country.

To obtain a Returned Materials Authorization (RMA), contact CAMPBELL SCIENTIFIC, INC., phone (435) 227-9000. Please write the issued RMA number clearly on the outside of the shipping container. Campbell Scientific's shipping address is:

**CAMPBELL SCIENTIFIC, INC.**

RMA# \_\_\_\_\_  
815 West 1800 North  
Logan, Utah 84321-1784

For all returns, the customer must fill out a "Statement of Product Cleanliness and Decontamination" form and comply with the requirements specified in it. The form is available from our website at [www.campbellsci.com/repair](http://www.campbellsci.com/repair). A completed form must be either emailed to [repair@campbellsci.com](mailto:repair@campbellsci.com) or faxed to (435) 227-9106. Campbell Scientific is unable to process any returns until we receive this form. If the form is not received within three days of product receipt or is incomplete, the product will be returned to the customer at the customer's expense. Campbell Scientific reserves the right to refuse service on products that were exposed to contaminants that may cause health or safety concerns for our employees.

# Safety

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**DANGER — MANY HAZARDS ARE ASSOCIATED WITH INSTALLING, USING, MAINTAINING, AND WORKING ON OR AROUND TRIPODS, TOWERS, AND ANY ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC. FAILURE TO PROPERLY AND COMPLETELY ASSEMBLE, INSTALL, OPERATE, USE, AND MAINTAIN TRIPODS, TOWERS, AND ATTACHMENTS, AND FAILURE TO HEED WARNINGS, INCREASES THE RISK OF DEATH, ACCIDENT, SERIOUS INJURY, PROPERTY DAMAGE, AND PRODUCT FAILURE. TAKE ALL REASONABLE PRECAUTIONS TO AVOID THESE HAZARDS. CHECK WITH YOUR ORGANIZATION'S SAFETY COORDINATOR (OR POLICY) FOR PROCEDURES AND REQUIRED PROTECTIVE EQUIPMENT PRIOR TO PERFORMING ANY WORK.**

Use tripods, towers, and attachments to tripods and towers only for purposes for which they are designed. Do not exceed design limits. Be familiar and comply with all instructions provided in product manuals. Manuals are available at [www.campbellsci.com](http://www.campbellsci.com) or by telephoning (435) 227-9000 (USA). You are responsible for conformance with governing codes and regulations, including safety regulations, and the integrity and location of structures or land to which towers, tripods, and any attachments are attached. Installation sites should be evaluated and approved by a qualified engineer. If questions or concerns arise regarding installation, use, or maintenance of tripods, towers, attachments, or electrical connections, consult with a licensed and qualified engineer or electrician.

## General

- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations, such as those of the FAA in the USA.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a **hardhat** and **eye protection**, and take **other appropriate safety precautions** while working on or around tripods and towers.
- **Do not climb** tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

## Utility and Electrical

- **You can be killed** or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in **contact with overhead or underground utility lines**.
- Maintain a distance of at least one-and-one-half times structure height, 20 feet, or the distance required by applicable law, **whichever is greater**, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.

## Elevated Work and Weather

- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

## Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

WHILE EVERY ATTEMPT IS MADE TO EMBODY THE HIGHEST DEGREE OF SAFETY IN ALL CAMPBELL SCIENTIFIC PRODUCTS, THE CUSTOMER ASSUMES ALL RISK FROM ANY INJURY RESULTING FROM IMPROPER INSTALLATION, USE, OR MAINTENANCE OF TRIPODS, TOWERS, OR ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.



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# ***Datalogger RF407-Series Spread Spectrum Radio Option***

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## **1. Introduction**

This manual discusses the RF407-series frequency-hopping spread-spectrum (FHSS) radio option for the CR6-series and CR300-series dataloggers. This manual will refer to these dataloggers collectively as “CRX-RF407.”

Throughout the manual CRX-RF407 can be replaced with any datalogger and radio option, unless otherwise noted. The standalone radios (that is, not the dataloggers with the radio option) will be referred to collectively as “RF407.” Throughout the manual RF407 can be replaced with RF412 or RF422, unless otherwise noted.

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### **NOTE**

The radio options cannot be mixed. A CRX-RF407 can only be used with other CRX-RF407s and RF407s. A CRX-RF412 can only be used with other CRX-RF412s and RF412s. A CRX-RF422 can only be used with other CRX-RF422s and RF422s.

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These dataloggers are designed for license-free use in several countries:

- The RF407 option has a 902 to 928 MHz operating-frequency range appropriate for use in the United States and Canada (FCC / IC compliant).
- The RF412 option has a 915 to 928 MHz operating-frequency range appropriate for use in Australia and New Zealand (ACMA compliant).
- The RF422 option has an 863 to 873 MHz operating-frequency range appropriate for use in most of Europe and some of Asia (ETSI compliant).

A CRX-RF407 can be used with an RF407 at a base computer to establish communication between *LoggerNet* and the CRX-RF407. A CRX-RF407 can also be part of a new or existing RF407 network.

This document describes how to set up a simple base RF407 to remote CRX-RF407 network. It also describes how to extend that system to include more CRX-RF407s and how the CRX-RF407 can be used in combination with other communication methods.

A CRX-RF407 contains the same radio as a standalone RF407. Most of the radio settings are the same for the CRX-RF407 and the RF407. See the [\*RF407-Series Spread Spectrum Radios manual\*](#) for more information on specifications and radio communication using the CRX-RF407.

**NOTE**

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

## 2. Communication Setup

### 2.1 Basic Procedure: PC with RF407 to CRX-RF407

**NOTE**

This procedure assumes the RF407 and the CRX-RF407 are in their Factory Default settings.

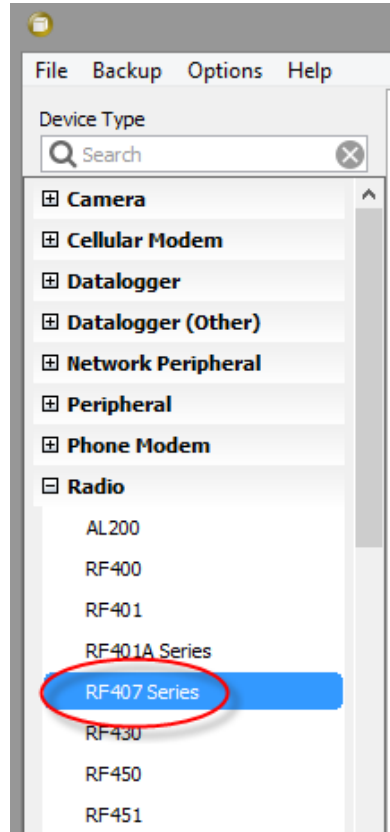
Click the *Device Configuration Utility* icon on the PC.

*Device Configuration Utility* (DevConfig) opens.



In *DevConfig*, select **Device Type | Radio | RF407 Series**.

*DevConfig* displays RF407 series information in the right pane.



On the right pane, click the **Install the USB device driver** link.

The *Device Driver Installation Wizard* opens.

RF407 Series
Send OS

## RF407, RF412, RF422

The RF407 Series are serial radios for point-to-point and point-to-point connected to a datalogger, computer, or another communication computer-to-datalogger and datalogger-to-datalogger communication Frequency Hopping Spread Spectrum (FHSS) radio modems. They implement Listen Before Talk (LBT) and Automatic Frequency



### Connect Instructions


Note: Install the USB device driver before connecting this product.

1. Connect the device USB port to your computer using the supplied cable.
2. Select the correct Communication Port in the left pane.  
Note: It may take a few seconds for the Communication Port to appear when connecting the device to your computer.
3. Click the Connect button.

Click **Next**.

The device drivers are installed and the *Wizard* advances to the next screen.

Device Driver Installation Wizard



## Welcome to the Device Driver Installation Wizard!

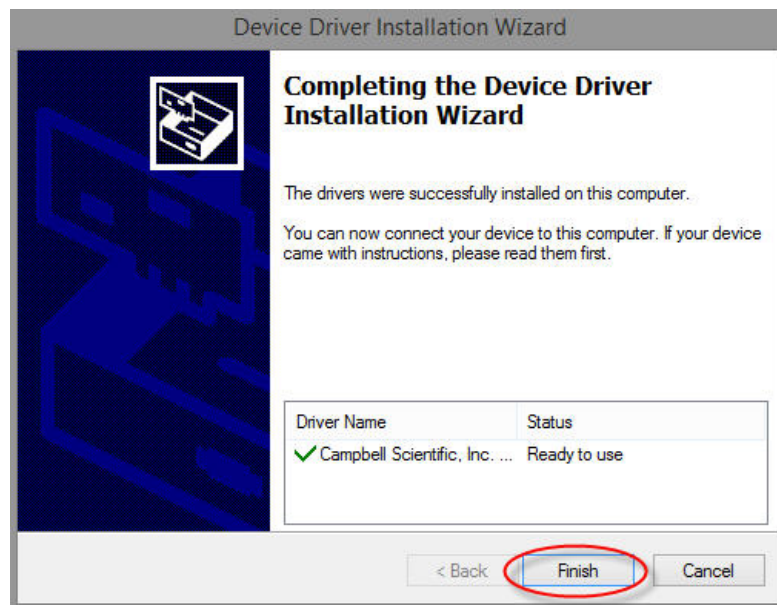
This wizard helps you install the software drivers that some computer devices need in order to work.

To continue, click Next.

< Back
Next >
Cancel

Click **Finish**.

The *Device Driver Installation Wizard* closes.



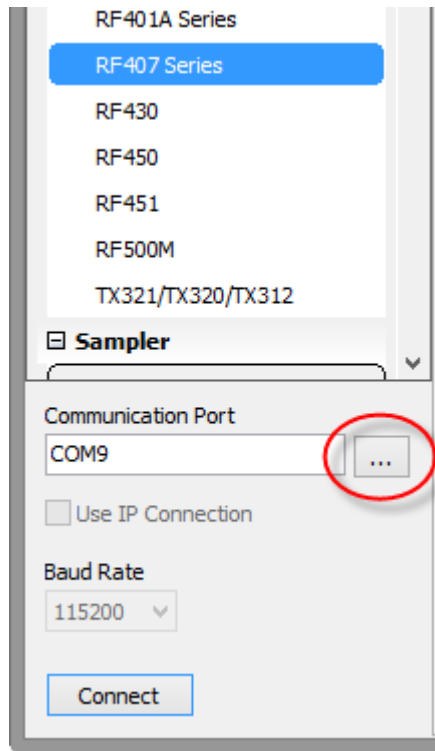
Connect the **USB** port on your RF407 to a USB port on your computer.

The **TX/PWR** and **RX** LEDs flash once, after which the **TX/PWR** LED begins blinking at the **Power Mode** interval (0.5 sec, by default).



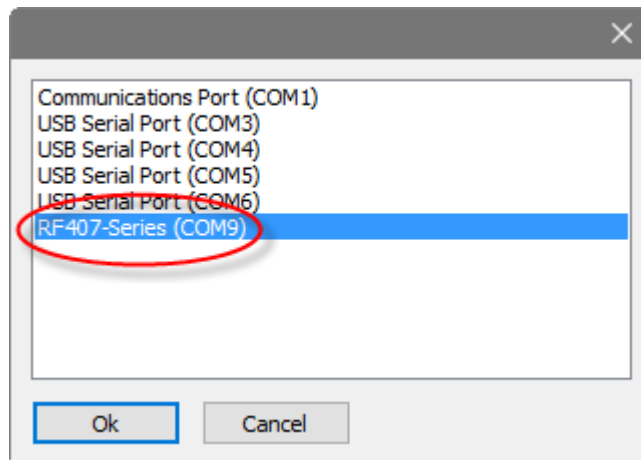
In the lower left of the *DevConfig* screen, click the **Communication Port** list button.

A list of available communication ports appears.



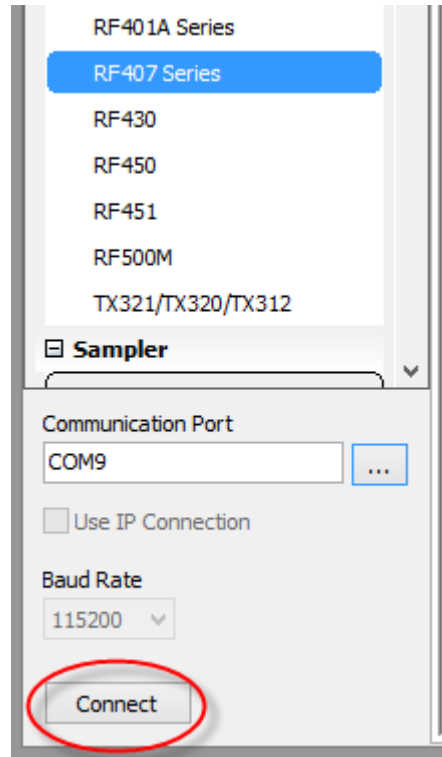
In the list of available communication ports, click **RF407-Series (COMnn)**, where **nn** is the COM port number assigned by your PC. Click **OK**.

The COM port number assigned to the RF407 populates the **Communication Port** box.

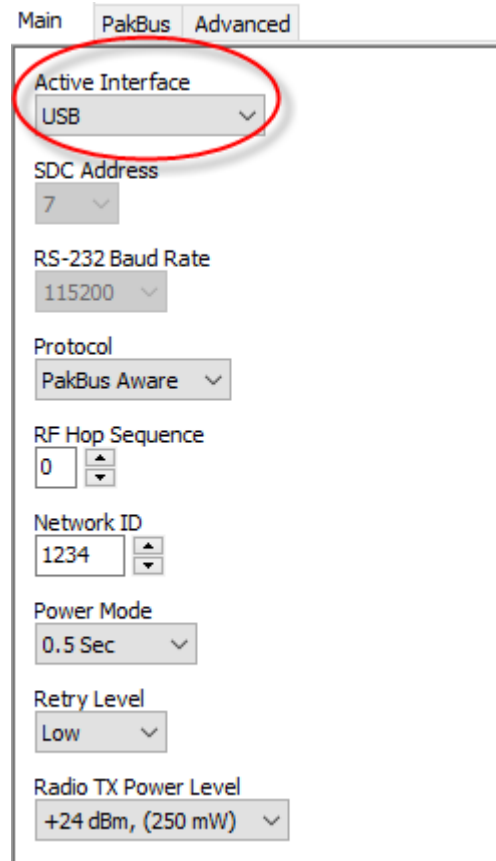


In the lower left of the *DevConfig* screen, click **Connect**. If the **Avoid Conflicts with the Local Server** window appears, click **OK**.

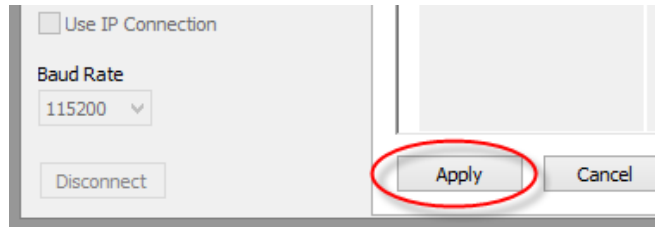
*DevConfig* displays the **Deployment** tab in the right pane.



In the **Deployment** tab, set the **Active Interface** to **USB** or **RS-232** depending on how your computer will be connected to the RF407.



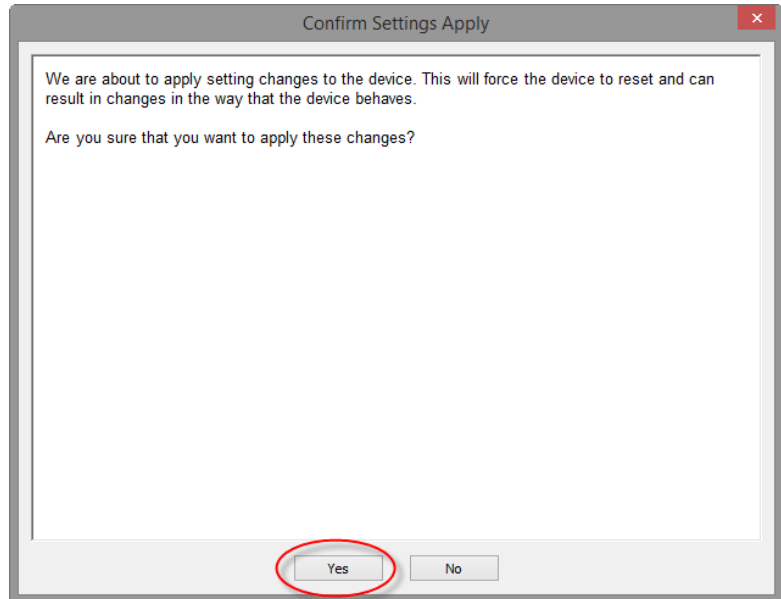
Click **Apply**.



The **Confirm Settings Apply** dialog box appears.

Click **Yes**.

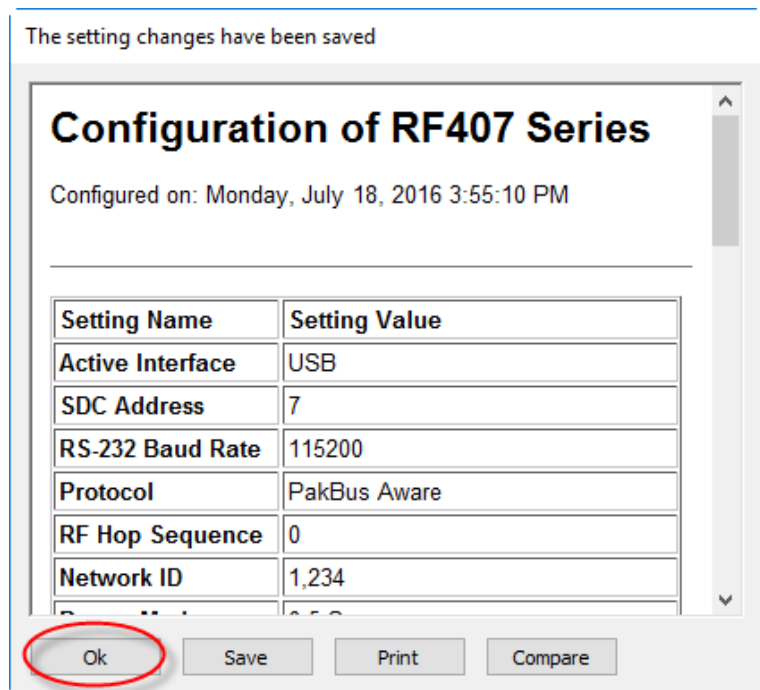
The **TX/PWR** and **RX** LEDs flash once, after which the **TX/PWR** LED returns to blinking at the **Power Mode** interval (0.5 sec, by default).



The **settings changes have been saved** dialog box appears.

Click **OK**.

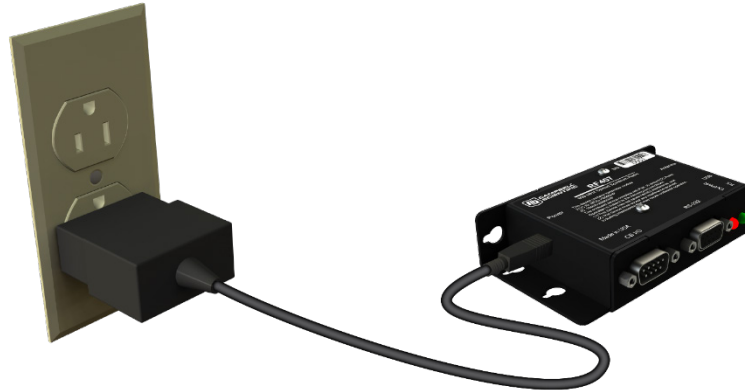
*DevConfig* disconnects from the RF407 and returns to the main RF407 screen.



Attach an antenna to the RF407.



Provide power to the RF407. (The RF407 can be powered through the **USB** port or through the DC **Power** jack.)

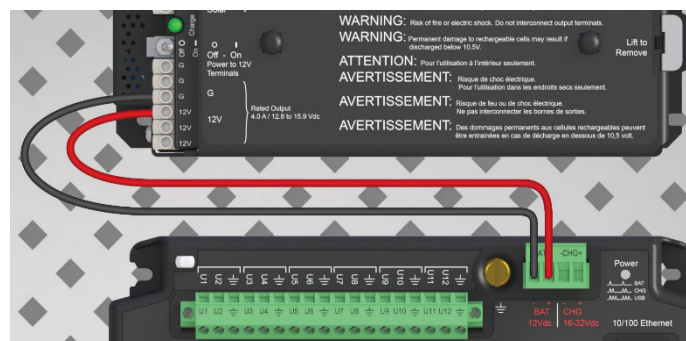


Attach an antenna to the CRX-RF407.



Provide power to the CRX-RF407:

- connect 12 Vdc at the green –**BAT+** terminals,
- or connect 16 to 32 Vdc at the –**CHG+** terminals.



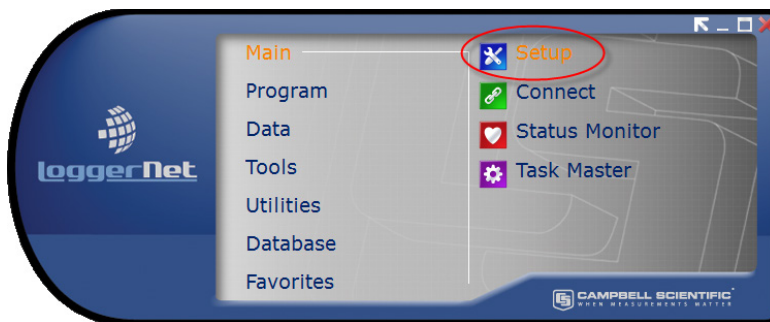
Open *LoggerNet*.





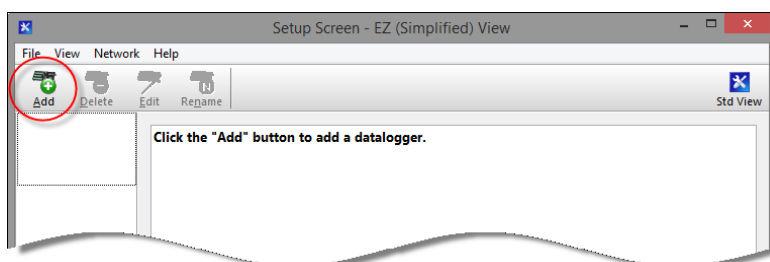
From the *LoggerNet* toolbar, select **Setup** from the **Main** category.

If the *Setup* screen does not say **EZ (Simplified) View** at the top, click **EZ View** in the top-right corner, to switch to the EZ View.

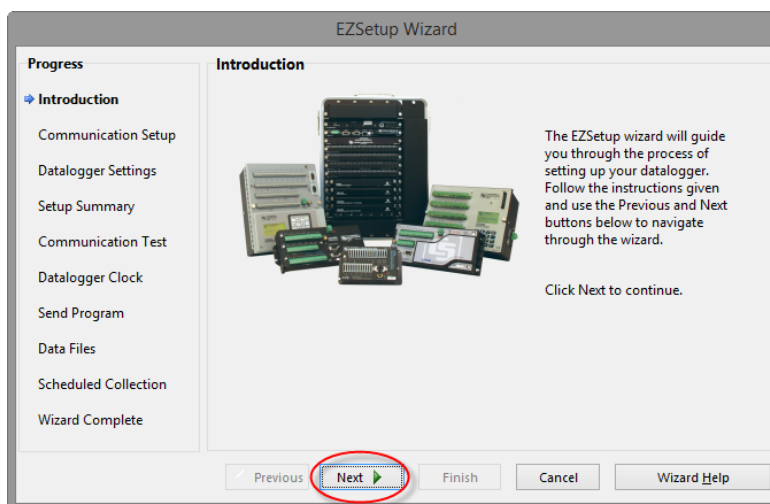


Click **Add**.

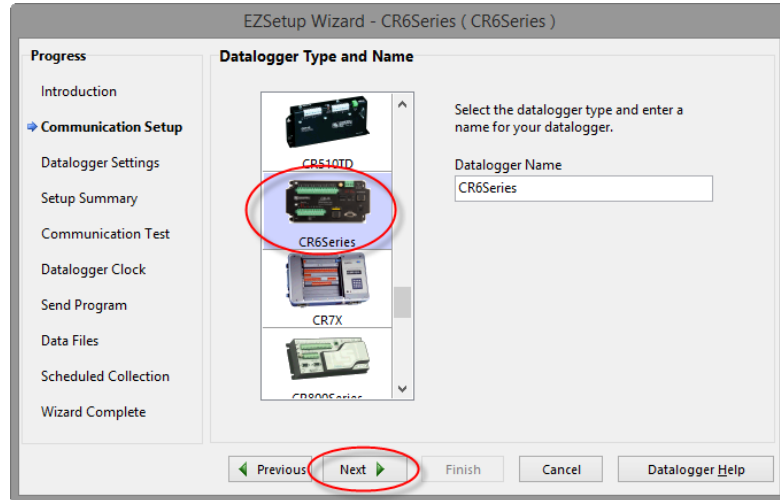
The *EZSetup Wizard* opens.



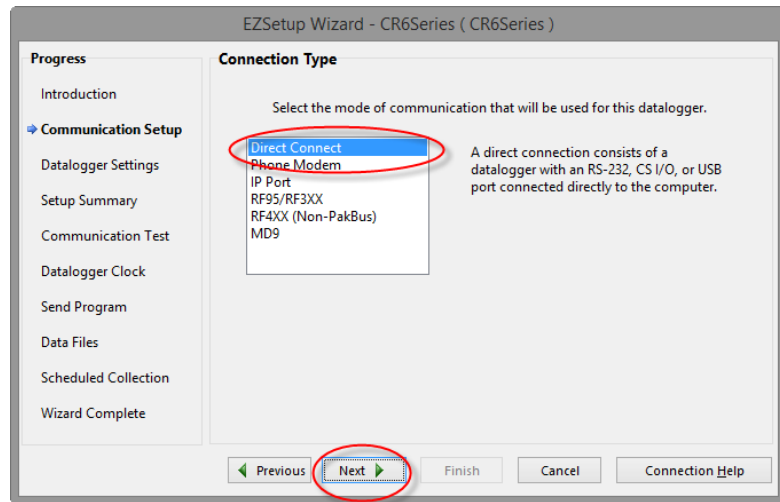
Click **Next**.



Select **CR6Series** or **CR300Series** depending on your datalogger. Click **Next**.

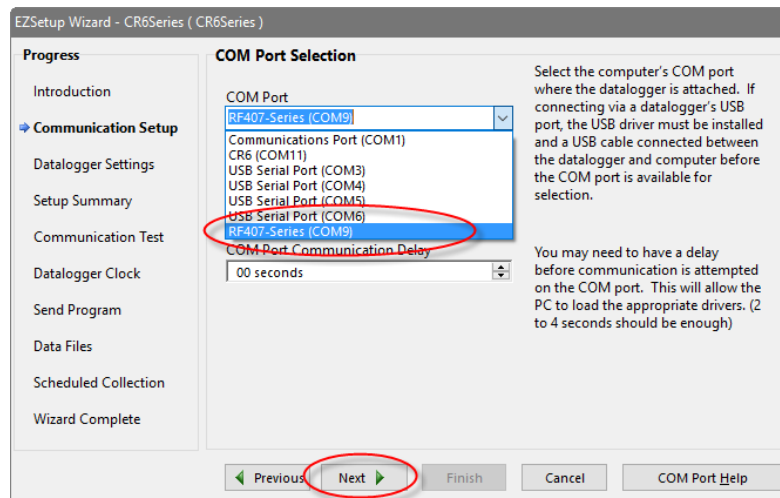


Select **Direct Connect**. Click **Next**.



In the list of available communication ports, click **RF407-Series (COMnn)**, where **nn** is the COM port number assigned by your PC. Click **Next**.

(Note that you choose **RF407-Series (COMnn)** to select the USB port to which the RF407 is attached. *LoggerNet* sees the CRX-RF407 as directly connected to this port. The RF407-to-datalogger link does not need to be indicated in *LoggerNet*.)



Enter the **PakBus Address** of your datalogger. The default address is 1. Keep all other defaults. Click **Next**.

The screenshot shows the 'Datalogger Settings' window of the EZSetup Wizard. The 'Progress' pane on the left lists steps: Introduction, Communication Setup, **Datalogger Settings** (highlighted), Setup Summary, Communication Test, Datalogger Clock, Send Program, Data Files, Scheduled Collection, and Wizard Complete. The main area contains settings for Baud Rate (115200), PakBus Address (1), Extra Response Time (00 seconds), and Max Time On-Line (00 h 00 m 00 s). The 'Next' button at the bottom is circled in red.

Leave the datalogger security settings at their default values. Click **Next**.

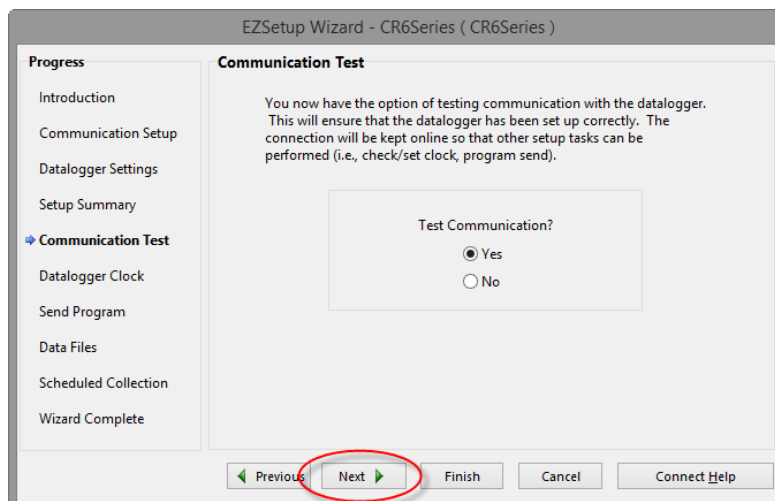
The screenshot shows the 'Datalogger Settings - Security' window. The 'Progress' pane is the same as the previous screen. The main area has fields for Security Code (0) and PakBus Encryption Key. The 'Next' button at the bottom is circled in red.

The **Communication Setup Summary** screen shows a summary of the settings that you entered. Click **Next**.

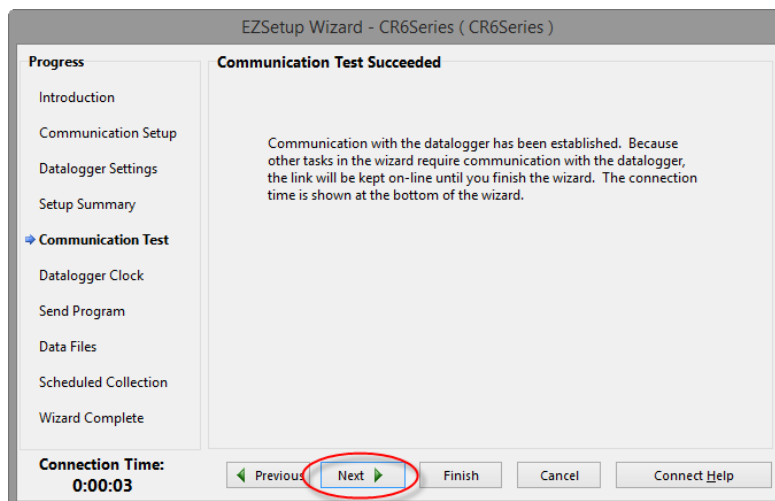
The screenshot shows the 'Communication Setup Summary' window. The 'Progress' pane highlights 'Setup Summary'. The main area displays a summary of the datalogger setup, including Datalogger Information (Name: CR6Series, Type: CR6Series), Direct Connect Connection (COM Port: RF407-Series (COM9)), and Datalogger Settings (Baud Rate: 115200, PakBus Address: 1, Security Code: 0, Extra Response Time: 0s, Max Time Online: 0h 0m 0s). The 'Next' button at the bottom is circled in red.

Make sure that **Yes** is selected.  
Click **Next**.

*LoggerNet* attempts to communicate with the CRX-RF407 and, if successful, the *EZSetup Wizard* advances to the **Communication Test Succeeded** screen. (If communication is unsuccessful, click **Previous** and verify all of the settings are correct.)

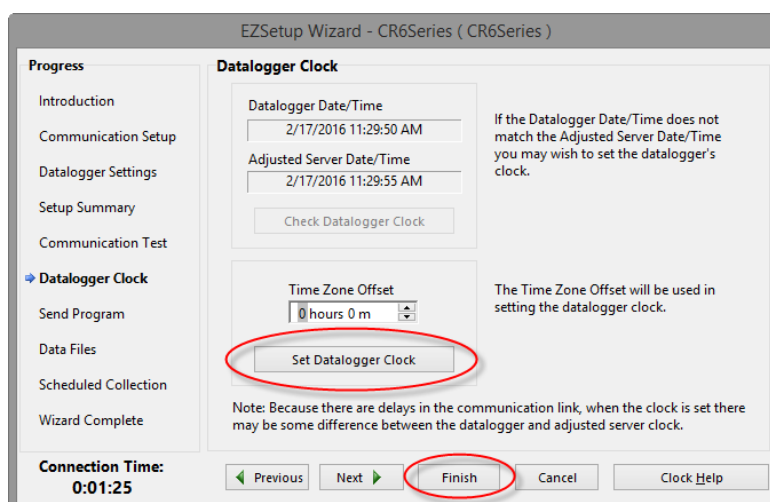


Click **Next**.

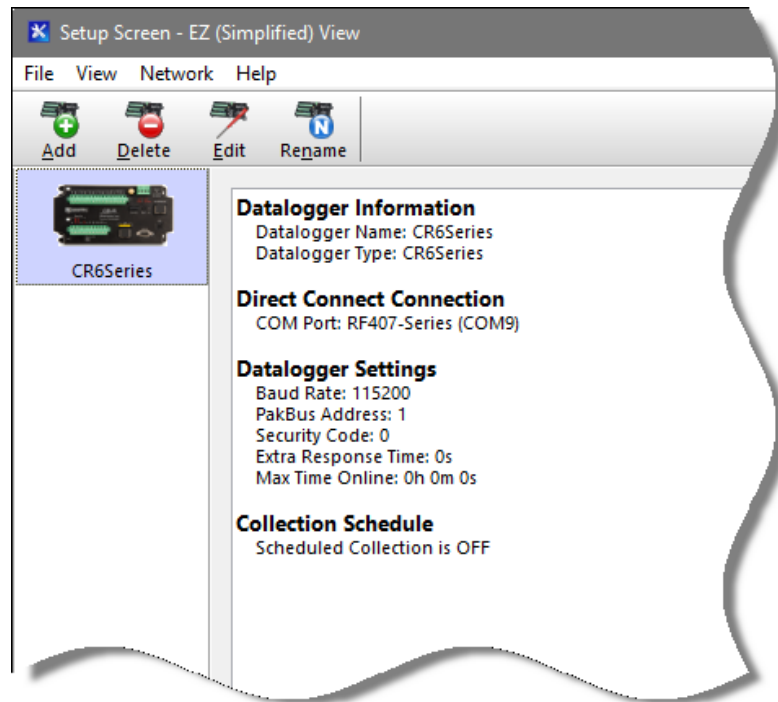


Click **Set Datalogger Clock**, and then click **Finish**.

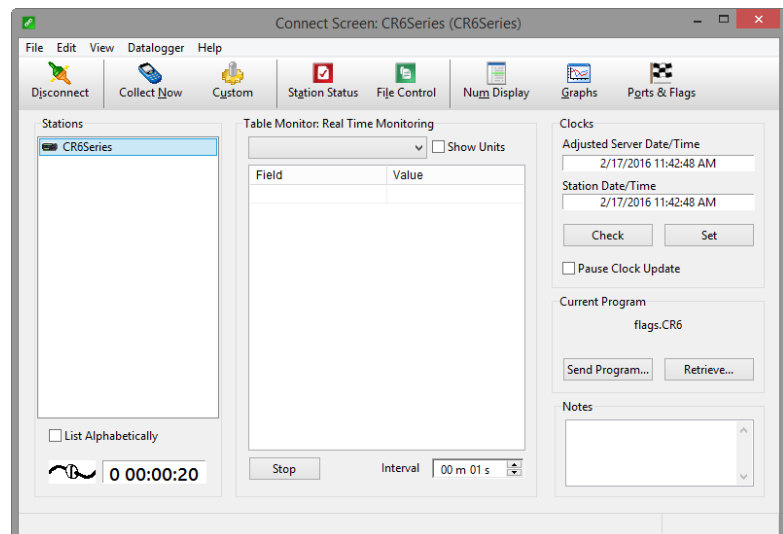
The datalogger clock is set to the PC clock, the *EZSetup Wizard* closes.



The CRX-RF407 is added to the *Setup* screen. (Note that it will be named **CR6Series** or **CR300Series**. The radio option will not be indicated.)

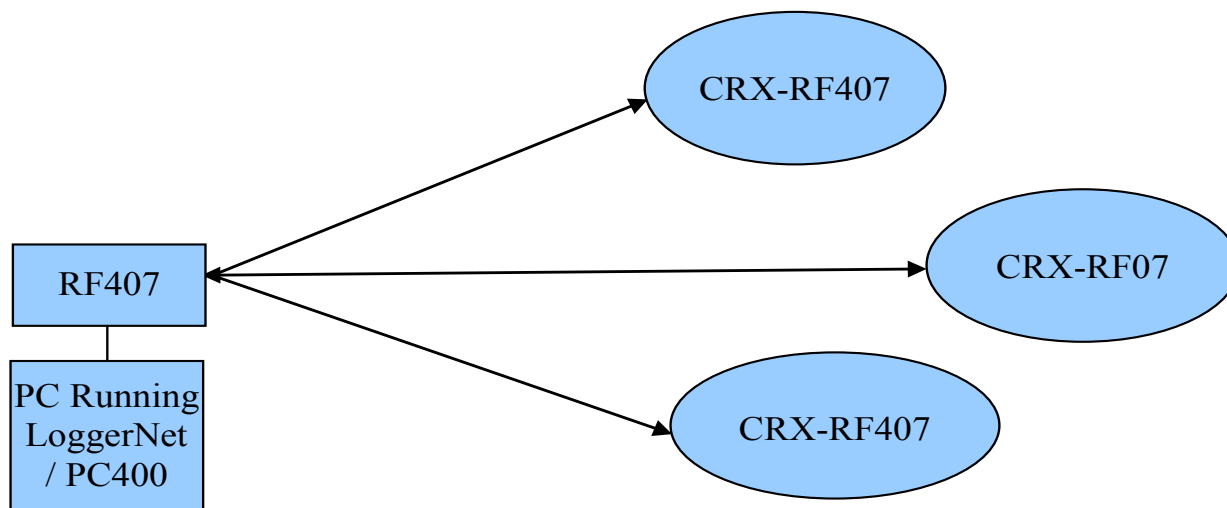


Use *LoggerNet Connect* to connect to the datalogger, send programs, and view and collect data.



## 2.2 PC with RF407 to Multiple CRX-RF407s

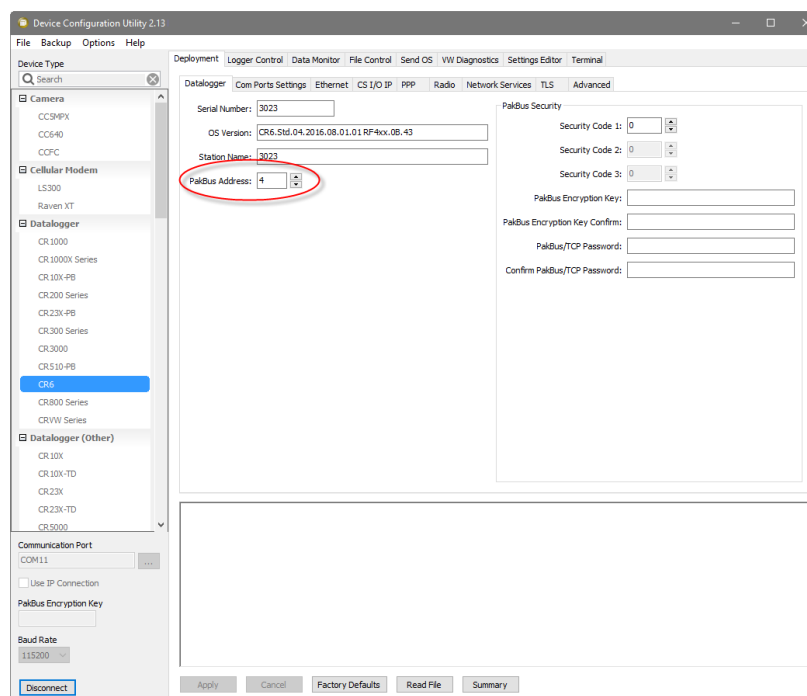
The Basic Procedure can be extended to include multiple CRX-RF407s in the system.



With multiple CRX-RF407s, *DevConfig* must be used to give each CRX-RF407 a unique **PakBus Address**. This changes the hardware setting in the CRX-RF407.

### NOTE

Most Campbell Scientific devices come from the factory with a default PakBus address of 1. For this reason, it is best not to assign PakBus address 1 to any device in the network. Then, if a new device with default settings is added to the system, it will not create a conflict.



These unique PakBus® addresses must be entered on the **Datalogger Settings** tab of the *LoggerNet EZSetup Wizard*. This change is to make the software settings (*LoggerNet*) match the change we made in the hardware settings using *DevConfig*.

**EZSetup Wizard - CR6Series\_3 ( CR6Series )**

**Progress**

- Introduction
- Communication Setup
- Datalogger Settings**
- Setup Summary
- Communication Test
- Datalogger Clock
- Send Program
- Data Files
- Scheduled Collection
- Wizard Complete

**Datalogger Settings**

Baud Rate: 115200

PakBus Address: 7

Extra Response Time: 00 seconds

Max Time On-Line: 00 h 00 m 00 s

Select the baud rate that will be used in communicating with the datalogger. Note: The max baud rate for SC32A interfaces is 19,200 bps. The max for SC929 is 38,400 bps.

A unique PakBus address is used to identify the datalogger in the PakBus network. Enter the PakBus address that was set on the datalogger. Valid range is 1-4094. Suggested range is 1-3999.

If the datalogger requires extra time to respond, enter the extra response time.

Because some links are costly, it may be desired to have the connection closed automatically. Enter the maximum time for a connection to stay online. 0 means stay online until the user disconnects.

Previous Next Finish Cancel Settings Help

Once you have used the *EZSetup Wizard* to add all of the dataloggers in your network, they will all appear on the *Setup* screen.

**Setup Screen - EZ (Simplified) View**

File View Network Help

Add Delete Edit Rename Std View

**Datalogger Information**

Datalogger Name: CR6Series\_PBA\_7  
Datalogger Type: CR6Series

**Direct Connect Connection**

COM Port: RF407-Series (COM9)

**Datalogger Settings**

Baud Rate: 115200  
PakBus Address: 7  
Security Code: 0  
Extra Response Time: 0s  
Max Time Online: 0h 0m 0s

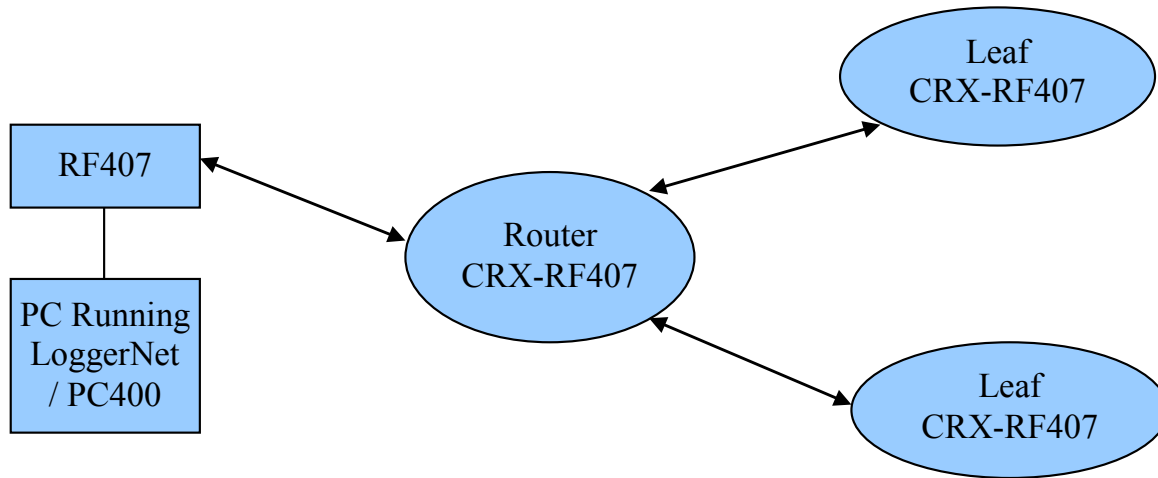
**Collection Schedule**

Scheduled Collection is OFF

Connected: localhost

## 2.3 CRX-RF407 as a Router

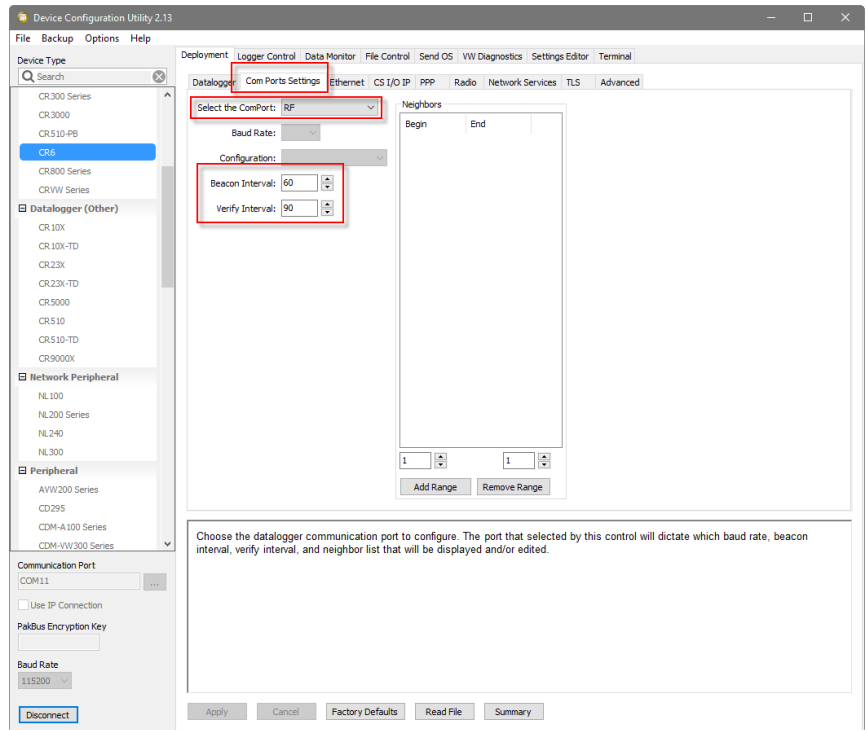
The previous procedure can be extended to use one CRX-RF407 as a router in the network to go around an obstacle such as a hill or to reach longer distances.



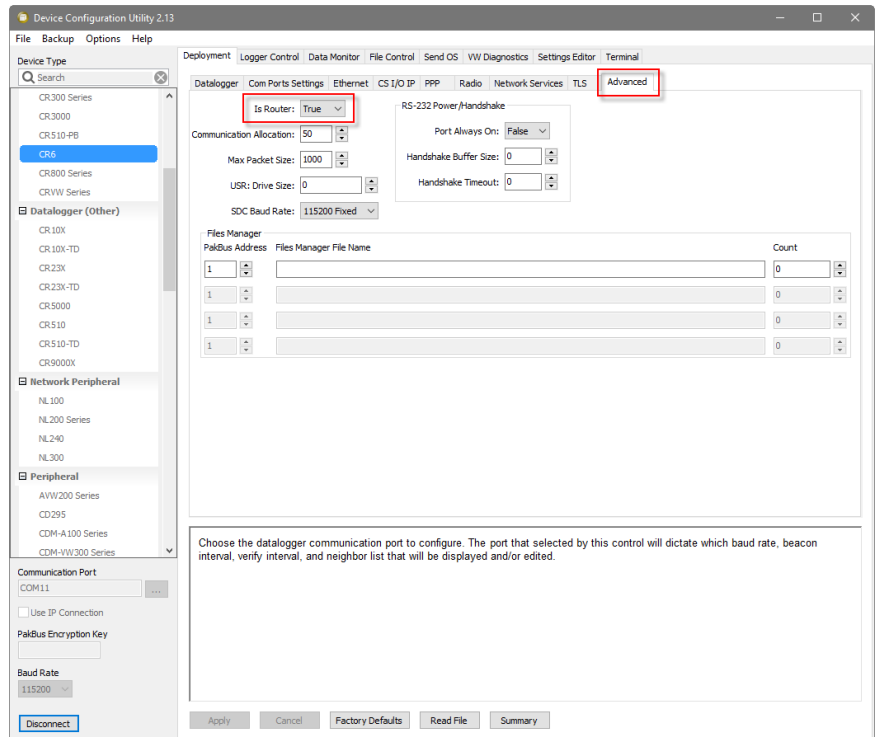
This requires only a few changes to the previous procedure.

First, use *DevConfig* to connect to the CRX-RF407 that will be used as a router. On the **Com Ports Settings** tab, set **Select the ComPort** to **RF**. Set the **Beacon Interval** to **60** seconds (or the amount of time you are willing to wait for the leaf dataloggers in the network to be discovered) and the **Verify Interval** to something slightly greater than the expected communication interval between the router and the leaf dataloggers in the network. For example, the following screenshot shows the **Verify Interval** set to **90** seconds.



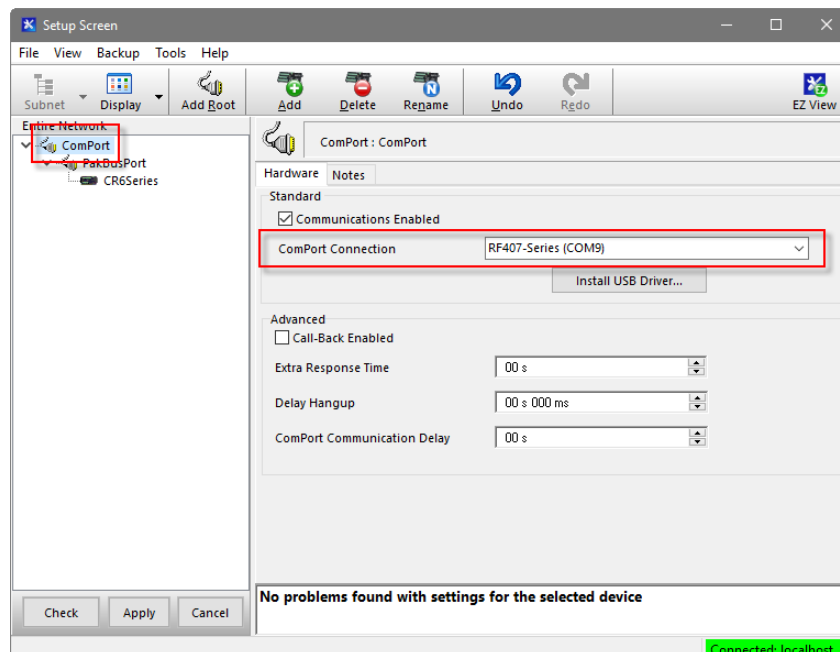


Next, use the **Advanced** tab in *DevConfig* to set **Is Router** to **True** in the CRX-RF407 that will act as a router.

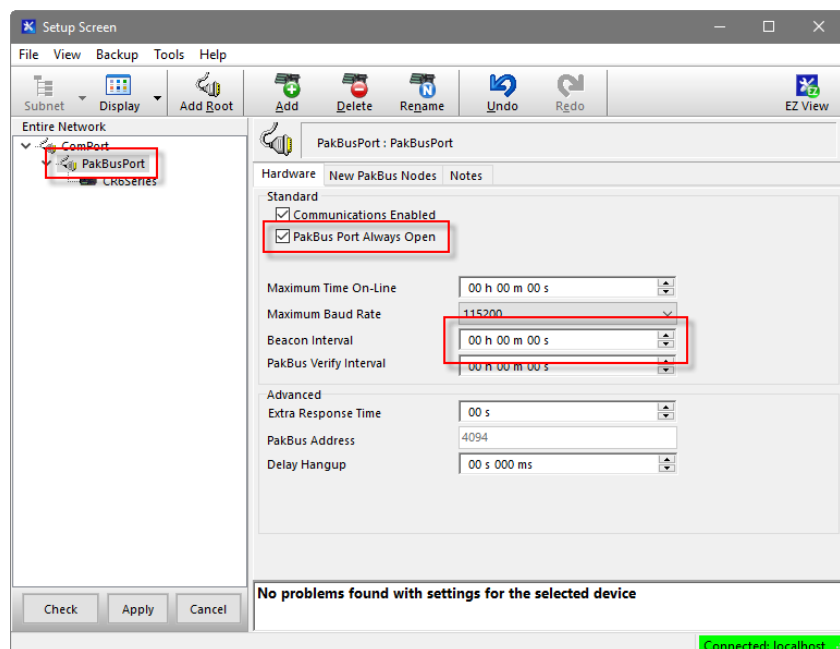


As in the previous example, *DevConfig* should be used to give each CRX-RF407 in the network a unique **PakBus Address**.

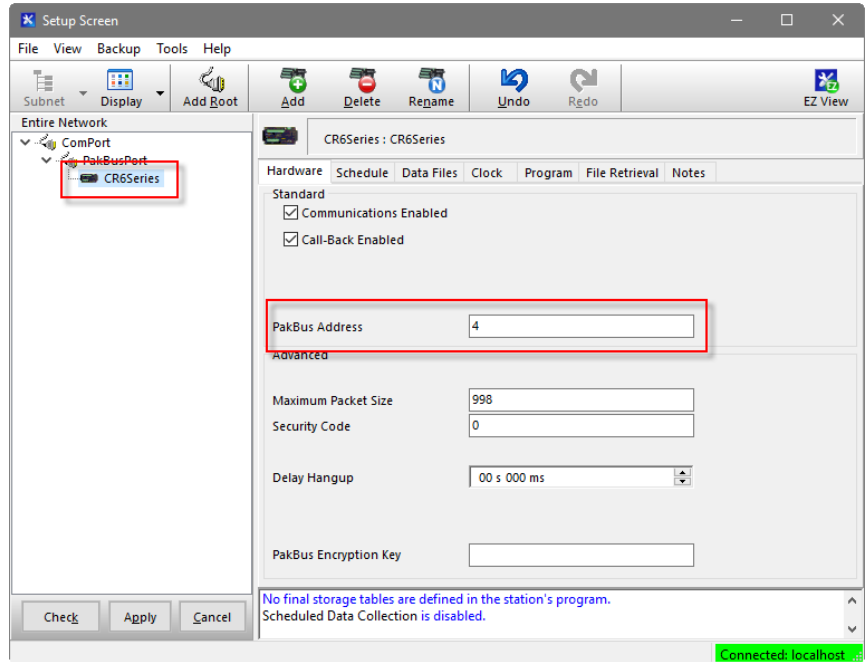
To set up the network in *LoggerNet*, select **Setup** from the **Main** category. If the *Setup* screen says **EZ (Simplified) View** at the top, click **Std View** in the top-right corner to switch to the **Standard View**. Select **Add Root | ComPort | PakBusPort (PakBus Loggers) | CR6Series** or **CR300Series** (the type of datalogger that will be used as a router). Close the **Add** selection window. Select the **ComPort** in the network map. Use the **ComPort Connection** drop-down list to select the COM port assigned to the RF407-Series.



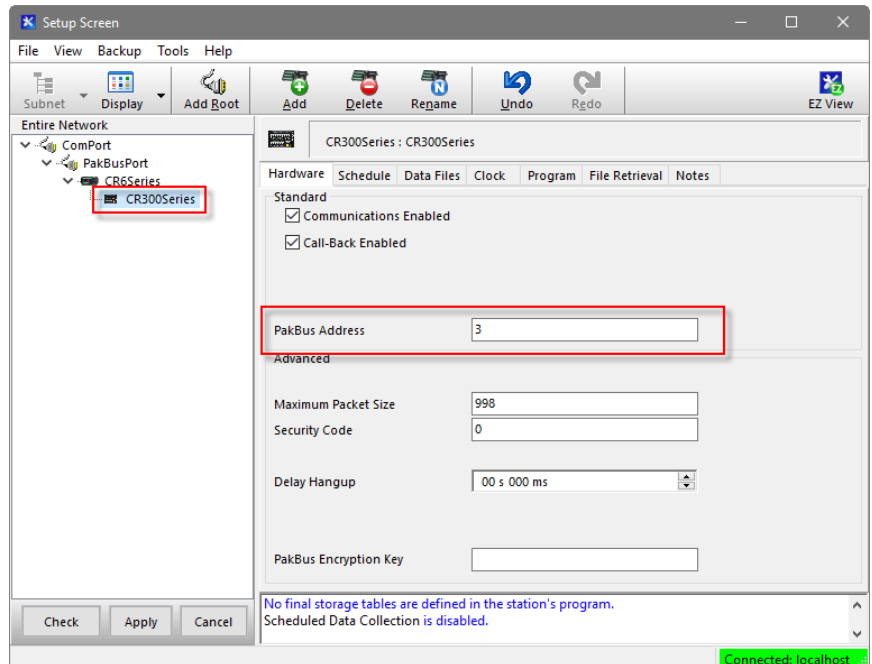
Select the **PakBusPort** in the network map. Select the **PakBus Port Always Open** checkbox. If it is possible that *LoggerNet* could communicate with any other dataloggers in the network without going through the router CRX-RF407 and you wish to prevent this, set the **Beacon Interval** to **00 h 00 m 00s**.



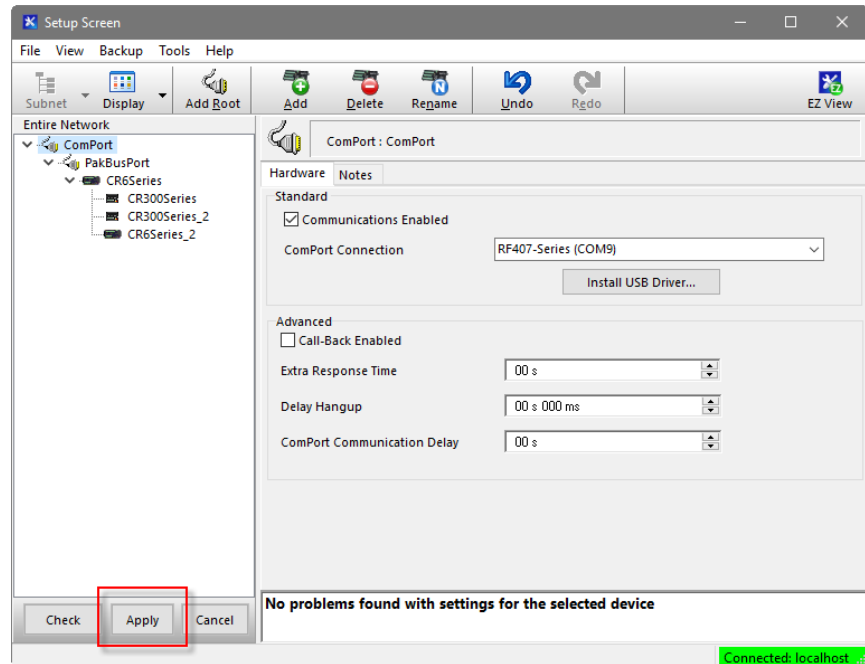
Select the router datalogger in the network map. Set the **PakBus Address** to the address that was assigned in *DevConfig*.



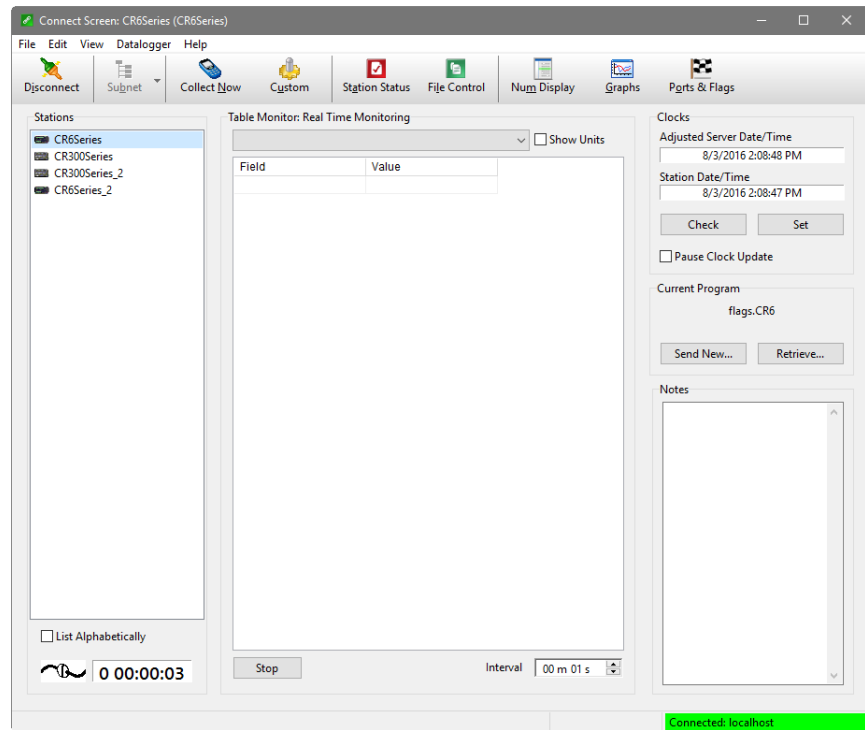
For each of the leaf CRX-RF407s in the network, right-click on the router CRX-RF407 and select the appropriate datalogger type. Select the newly added datalogger in the network map and set the **PakBus Address** to that assigned using *DevConfig*.



After all of the leaf dataloggers have been added to the network map, click **Apply**.

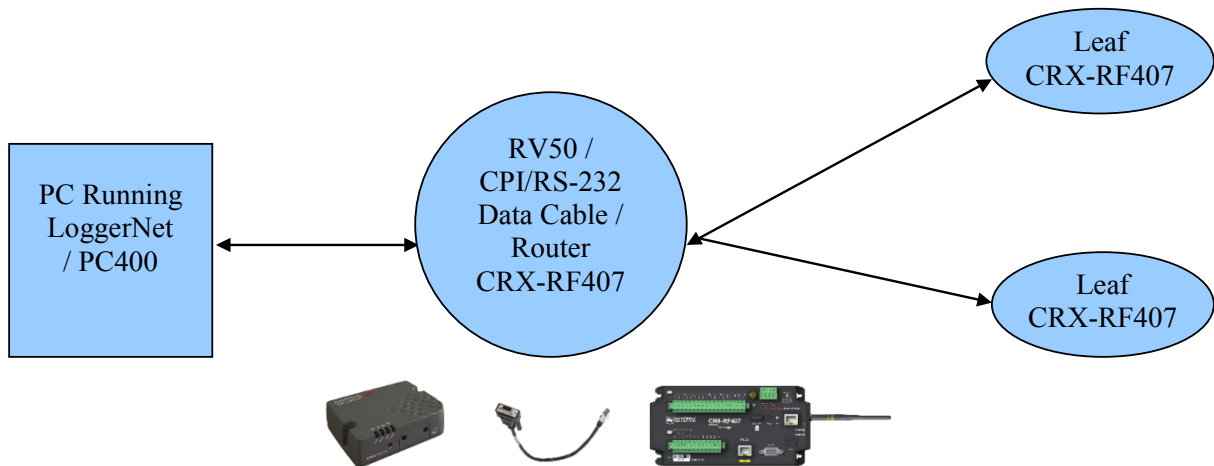


All of the dataloggers will be added to the *Connect* screen, where you can connect to each datalogger, send programs, and view and collect data.



## 2.4 Communication Combinations

The CRX-RF407 can be used in a system with multiple communication methods. For example, in the figure below, the router CRX-RF407 communicates with *LoggerNet* through an RV50 cellular modem connected to the CRX-RF407 using a CPI/RS-232 Data Cable. (An Ethernet connection could also be used between the RV50 and the CRX-RF407. See the RV50 manual for more information.) The router CRX-RF407 communicates with the leaf CRX-RF407s through RF.

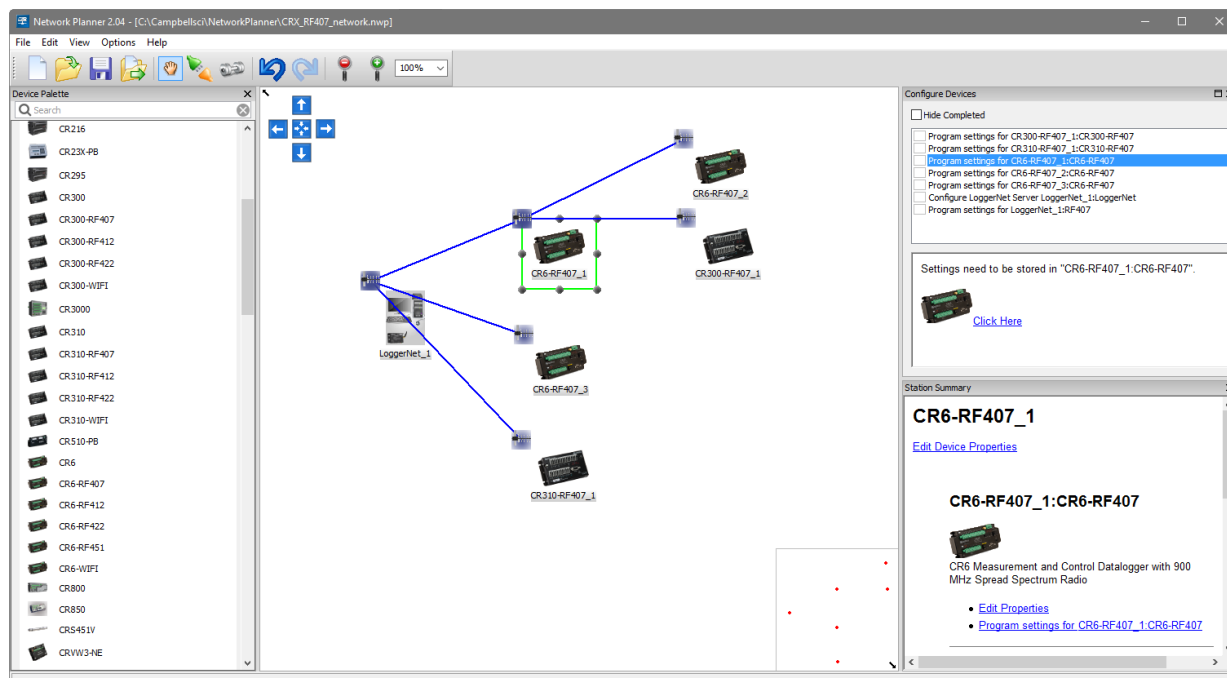


The RF portion of this network requires no changes to the hardware settings described in the previous procedure (Section 2.3, *CRX-RF407 as a Router* (p. 16)). See the manual for the communication product being used in combination with the CRX-RF407 (in this example, the RV50) for information on setting up *LoggerNet* to communicate with the router CRX-RF407.

## 2.5 Network Planner



For more complicated networks, *LoggerNet Network Planner* is recommended for the network setup. Select devices from the **Device Palette** and place them on the drawing canvas. Use the link tool to draw lines indicating the communication links between devices. Use the activity tool to indicate activities that will take place between devices.

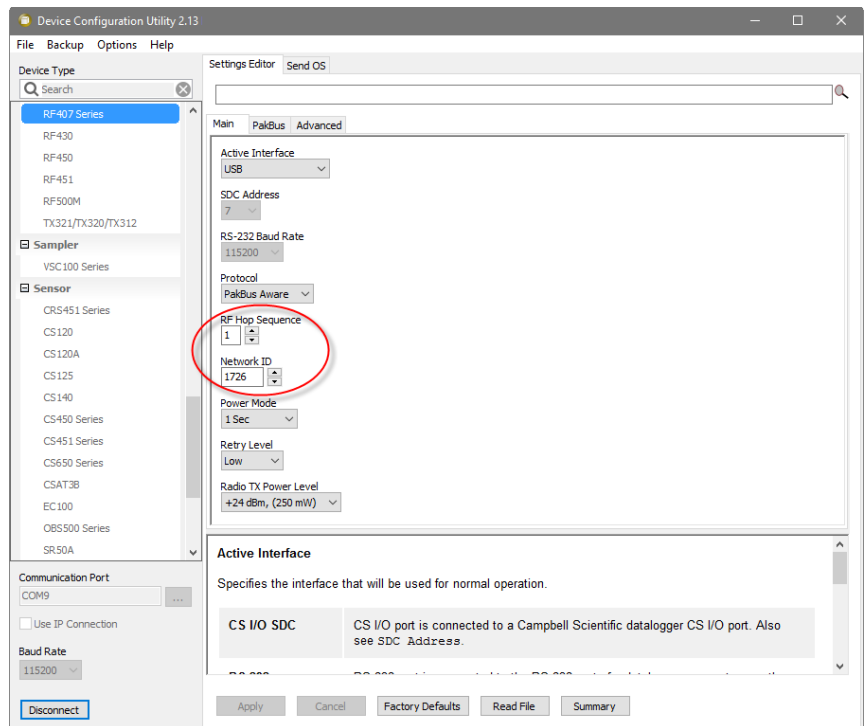


*Network Planner* calculates the optimum settings for each device in the network and allows you to send these settings to the device. If any change is made to a device in the network, that change is propagated to every affected device setting. *Network Planner* can then use the information entered to configure *LoggerNet Setup*.

Refer to the *Network Planner* help for more information.

### 3. Troubleshooting

If there are intermittent communication problems with the above setups, there may be another network in the area causing interference. To help remove the interference, use *DevConfig* to change the **Network ID** and **RF Hop Sequence** in all RF407s and CRX-RF407s to a different value. Each of these settings must have the same value in all RF407s and CRX-RF407s. For example, the **Network ID** in all devices could be set to **1726**, and the **RF Hop Sequence** in all devices could be set to **1**. This is just an example. The **Network ID** can be any number between 0 and 32767. The **RF Hop Sequence** can be any number between 0 and 7 in an RF407 or RF412 network; it can be any number between 0 and 9 in an RF422 network.









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