INSTRUCTION MANUAL

RavenXTV CDMA
Sierra Wireless Cellular Modem

Revision: 3/17

Limited Warranty

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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*. A completed form must be either emailed to *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

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 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.

Table of Contents

PDF viewers: These page numbers refer to the printed version of this document. Use the PDF reader bookmarks tab for links to specific sections.

Figures

CRBasic Example

RavenXTV CDMA Sierra Wireless Cellular Modem

1. General Description

This manual provides information for interfacing the Sierra Wireless RavenXTV cellular modem to Campbell Scientific dataloggers. Sierra Wireless manuals referenced in this manual may be found on the Sierra Wireless website. They include:

AceManagerGuide.pdf
Raven_XT_UserGuide.pdf
Raven_XT_QuickStart.pdf

The RavenXTV digital cellular modem is manufactured by Sierra Wireless for use on the Verizon Wireless Code Division Multiple Access (CDMA)/1xRTT/EVDO Rev A network. The modem is accessed through the Internet using TCP/IP communications protocol using a Static or Dynamic IP address.

- A Static IP address is permanently assigned to a particular account and will always be used whenever the Raven connects to the Internet.

- A Dynamic IP address is assigned on a "need to have" basis. A dynamic IP address is used with a service such as IP Manager (Section 5.1, *Configuring the Raven for Dynamic IP (p. 13)*) to translate a (domain name) to a dynamic IP address, so that the Raven can be contacted by name as if it had a static IP.

A Verizon account can be setup for a Static or Dynamic IP address; a Static IP is preferred. Generally, there is a one-time-per-customer charge to activate a Static IP account. Once activated, additional Static IP accounts may be added at no additional charge.

The *Device Configuration Utility* (*DevConfig*) is used to configure the RavenXTV modem to function as a serial server or in Point-to-Point Protocol (PPP). *DevConfig* is included with *LoggerNet*, *PC400*, and *RTDAQ*. It may be downloaded at no charge from our website, *www.campbellsci.com/downloads*.

This manual describes how to use *LoggerNet* to connect to your datalogger with a RavenXTV. You can also use other software packages, such as *PC400*, *RTDAQ*, or *LoggerLink* Mobile Apps for iOS and Android.

2. Establish Cellular Service

2.1 RavenXTV Cellular Coverage/Service Requirements

What you need:

Verizon Wireless CDMA/1xRTT/EVDO coverage at the datalogger site. For a coverage map, refer to: *www.verizonwireless.com* plans / coverage maps.

CDMA/1xRTT/EVDO Static IP or Dynamic IP account established at Verizon Wireless. Verizon's Broadband Access Plan is recommended. You will need to request 'unrestricted IP'.

To setup an account, you will need the ESN number of the modem. The ESN number is listed on a label on the modem and also on the box. To setup an account with Verizon Wireless, call:

800-526-3178 for Business Sales
800-256-4646 for Personal Sales

What you receive from Verizon:

10-digit Mobile Directory Number (MDN)
IP address (for a Static IP account only)

3. Specifications

3.1 RavenXTV Specifications

Sierra Wireless RavenXT, model 2227-V

Technology:	CDMA 1xRTT, EVDO Rev. A, CDMA IS-95
Bands:	800 MHz Cellular, 1900 MHz PCS
Transmit Frequency:	1850 to 1910 MHz and 824 to 849 MHz
Transmit Power:	1.0 W for 1900 MHz; 0.8 W for 850 MHz
Receiver Frequency:	1930 to 1990 MHz and 869 to 894 MHz
CDMA Throughput:	Up to 80 kbps
RS-232 Data Rates:	1200 bps to 115.2 kbps
Serial Interface:	RS-232, DB9-F
Serial Protocols:	AT Commands, PPP, SLIP, UDP/IP, TCP/IP
RF Antenna Connector:	50 Ohm SMA (female)
Input Current Range:	50 to 250 mA
Typical Current Drain (at 12 Vdc):	50 mA dormant (idle for 10 to 20 seconds), 120 mA transmit/receive
Input Voltage Range:	6 to 28 Vdc
Operating Temperature Range:	–30 to 70 °C
Operating Humidity Range:	5% to 95% RH non-condensing
Status LEDs:	Power, Network, Signal, Activity

Dimensions
Width:	7.6 cm (3 in)
Depth:	2.5 cm (1 in)
Length:	10 cm (4 in)

Weight: <0.5 kg (<1 lb)

4. Configuration

4.1 Base Station Requirements for RavenXTV

PC running Campbell Scientific's *LoggerNet* or *PC400* software, with access to the Internet.

4.2 Datalogger Site Equipment

- Raven modem with power cable (included with modem).

- Datalogger—21X, CR510, CR10(X), CR23X, CR7, CR1000, CR5000, CR3000, CR800 Series, CR6, CR200(X) Series.

- Modem Interface

    If connecting to CS I/O port:

    SC105 or SC932A Interface—connects the modem to the 21X, CR510, CR10(X), CR7, or other dataloggers' CS I/O port.

    The SC105 must be configured for use with the modem using the *Device Configuration Utility*. Settings should be:

    CS I/O Mode: SDC Address 7
    RS-232 Mode: Modem
    Baud Rate: 115.2K or 9600 baud depending on datalogger model
    8 data bits, 1 stop bit, no parity

    If connecting to RS-232 port:

    PN 18663 Null Modem Cable—connects the modem to the CR23X, CR3000, CR800, CR2XX, CR1000, or CR5000 RS-232 port.

    PN 31055 CPI/RS-232 Cable—connects the modem to the CR6 CPI port.

- PN 14394 Raven Mounting Kit—includes mounting hardware for securing the modem to below-referenced environmental enclosure and a 9-pin male to 9-pin female cable.

- Antenna—the following antennas are available from Campbell Scientific. Contact a Campbell Scientific applications technician for help in determining the best antenna for your application.

    o The **20679** is a dual-band, omnidirectional antenna for our CDMA and GPRS digital-cellular modems. It covers both the 800-MHz band

and the 1.9-GHz band. For the 800-MHz band, the 20679 provides a 0-dBd gain. For the 1.9-GHz band, the 20679 provides a 3-dBd gain. This antenna is recommended for locations where cellular coverage is strong.

The 20679 includes a mount/u-bolt assembly that allows the antenna to be mounted to a mast, crossarm, or user-supplied pole (outer diameter of up to 3.8 cm (1.5 in)).

o   The **18285** 1 dBd omnidirectional antenna. This antenna is dual band, covering both the 800 MHz and 1.9 GHz bands, and is strongly recommended where cellular coverage is strong. The 18285 includes a mount/u-bolt assembly for attaching the antenna to a mast, post, or crossarm up to 3.8 cm (1.5 in) in diameter.

o   The **31128** Yagi Antenna is a wideband, high-gain, directional antenna that must be "aimed" at the service provider's antenna. It is uniquely suited for cellular applications because of its ability to provide gain across all of the cellular frequency bands. The antenna has a Type N female connector and includes the mounting hardware.

o   The **21831** Half-Wave Dipole Whip Antenna is a lower gain antenna used in transmitting short distances. It is an 800 MHz cellular antenna that terminates in a SMA Male connector for attachment to the modem. This antenna is intended for use inside the enclosure. Please note that the backplate of the enclosure is a grounded plane. If it is interposed between the antenna and the cell tower, it may attenuate the strength of the transmission signal. Simply turning the enclosure 90 to 180 degrees on its mounting mast may solve weak transmission issues.

PN 20679 Omni Directional Antenna
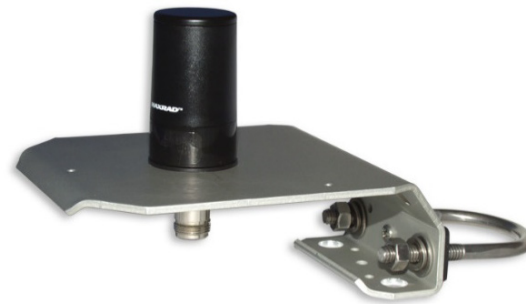
PN 18285 1 dBd Omni Directional Antenna

PN 31128 Wideband, Directional Yagi Antenna

PN 21831 Half-Wave Dipole Whip Antenna

FIGURE 4-1. Antennas for use with the Raven modems

- Power Supply (see power considerations).

- Environmental Enclosure—ENC10/12, ENC12/14, or ENC16/18.

4.3 Wiring and Connections

4.3.1 Modem Connections Using PN 18663 Null Modem Cable

PN 18663 Null Modem Cable is used to connect the modem to the CR23X, CR3000, CR800, CR2XX, CR1000 or CR5000 RS-232 port (not compatible with the 21X, CR510, CR10X, or CR7 dataloggers).

<u>Wiring:</u>

Red   12V (or
         switched 12V)

Black   G

White   Not Used
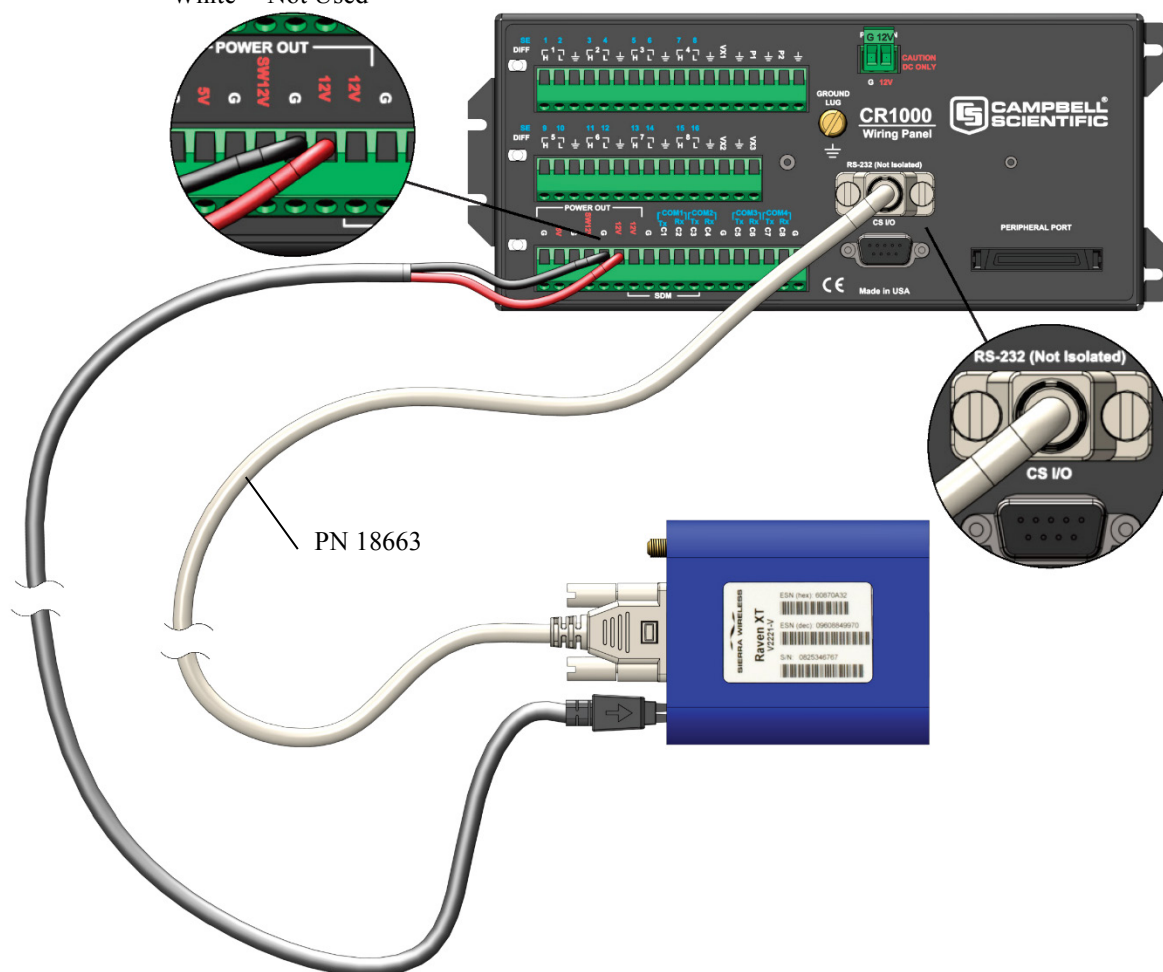
FIGURE 4-2. Connections using PN 18663 Null Modem Cable

4.3.2 Modem Connections Using the SC105

The SC105 interface is used to connect the modem to a datalogger's CS I/O port, and is recommended for dataloggers with the PakBus operating system.

Wiring:

Red   12V (or switched 12V)

Black   G

White   Not Used

10873 serial cable
provided with the SC105

SC105 Settings:

CS I/O Mode: SDC Address 7
RS-232 Mode: Modem
Baud Rate: 115.2K or 9600 baud depending on datalogger model
8 data bits, 1 stop bit, no parity

FIGURE 4-3. Connections using the SC105

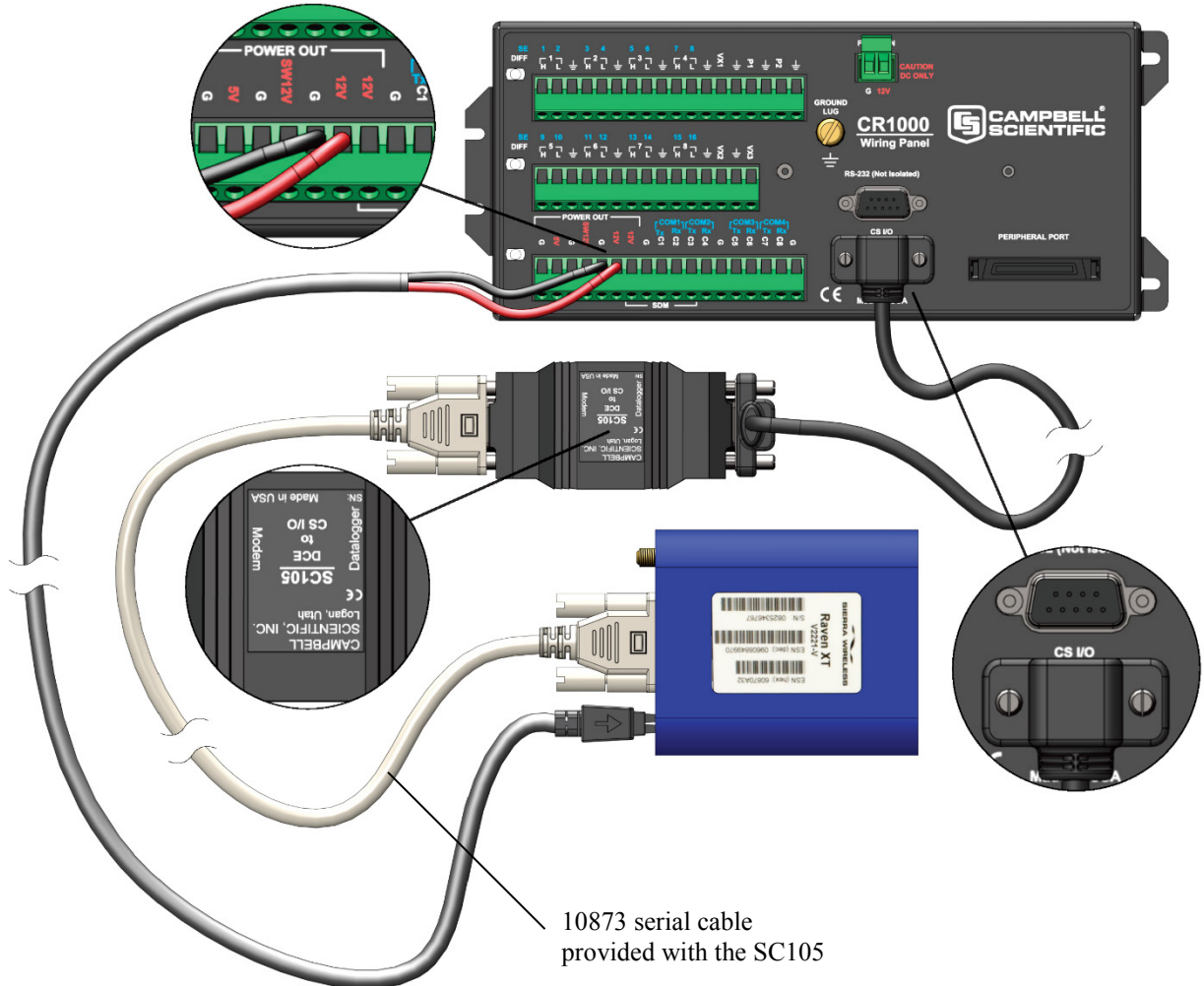### 4.3.3   Modem Connections Using the SC932A

The SC932A interface is used to connect the modem to the CS I/O port, and is recommended for dataloggers with the mixed-array operating system (e.g., the CR10X).

Wiring:

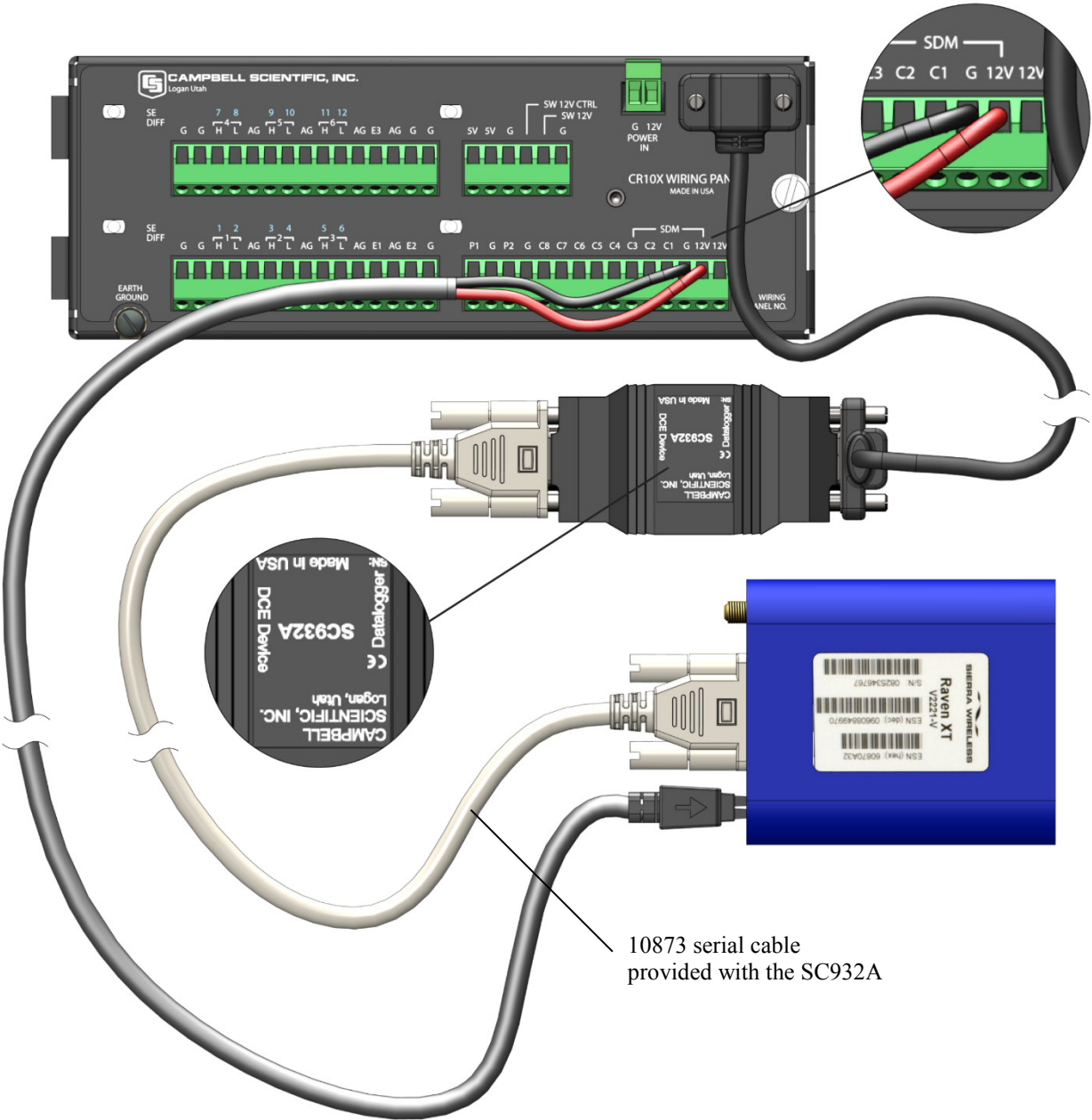|	
Red	12V (or switched 12V)
Black	G
White	Not Used

FIGURE 4-4. Connections using the SC932A

10873 serial cable
provided with the SC932A

4.4   Power Considerations

A power cable included with the modem connects to the datalogger's 12 V or switched 12 V terminal. Connection to the switched 12 V terminal allows the datalogger to switch power to the modem during scheduled transmission intervals if desired. Connect the red lead wire to 12 V for constant power and to SW12 for program-controlled power, and the black lead to G (ground). The white wire lead has no function and can be ignored.

When using the switched 12 V terminal, the modem can typically be powered with a BP12 battery, CH100 charger/regulator, and SP10 solar panel.

When using SW12V to power the RavenXTV, it is a good idea to have a default.CRX (default.CR1 for a CR1000, default.CR3 for a CR3000, and so forth) stored on the datalogger CPU: drive. This can be used to preserve critical datalogger settings, such as SW12V, if the datalogger somehow ends up in a no program state (for example, if a program with an invalid instruction is sent to the datalogger). The default.CRX cannot be more than a few lines of code.

At power up, the datalogger loads default.CRX, if no other program takes priority (see *Executable File Run Priorities* in the datalogger manual). It should configure the appropriate settings to allow you to establish communication with your datalogger and load a valid program.

The following program example can be used as a default.cr1 program to turn SW12V on.

```
BeginProg
  Scan (1,Sec,3,0)
    SW12(1)
  NextScan
EndProg
```

4.5   Automatic Provisioning (Activation)

NOTE   It is recommended that the modem be provisioned and tested in the office (assuming there is cellular coverage) rather than in the field.

One of the special features of your RavenXTV is the ability to activate itself automatically. When you first power on the RavenXTV, it will check to see if it has been activated with account data. If it finds that it has not yet been activated, the RavenXTV will attempt to retrieve the account data from the Verizon network using Over-the-Air Service Provisioning (OTASP). If the modem has previously been provisioned on another account, see Appendix E, *Reprovisioning a Modem (p. E-1)*.

CAUTION   You need to have an account with Verizon before you attempt automatic activation. If you have not ordered an account from Verizon for your RavenXTV, it will not succeed at activating.

1.   Attach the antenna to your RavenXTV.

2. Plug the RavenXTV into power.

3. While the LED lights cycle from the outside to the inside, the RavenXTV is attempting to download its account information. The download process may take one to two minutes to complete.

| CAUTION | Do not move your RavenXTV while it is being programmed. |

4. When the Network light is on solid, your RavenXTV has successfully completed OTASP and is registered on the Verizon network.

4.6 Indicator Lights

When your RavenXTV is connected to power and an antenna, there is a specific pattern to the lights to indicate its operation mode.

- **Network**—On solid indicates a successful connection to the cellular network with an IP address given and a channel acquired. Flashing indicates that the modem is attempting to authenticate on the network.

- **Signal**—Light shows the strength of the signal and may be nearly solid (strong signal) or flashing (weaker signal). A slow flash indicates a very weak signal.

- **Activity**—Lights will flash as data is transferred to and from the PinPoint modem on the remote network.

- **Power**—Indicates the power adapter is connected and there is power getting to the RavenXTV.

- The **Reset button** (on the left side of the RavenXTV) has two functions. If it is quickly depressed and released, the modem will simply power cycle the internal hardware. If, however, the reset is depressed and held for several seconds (count to 10 slowly and wait for the power light to go off after the light pattern stops), the ALEOS configuration settings will return to the factory defaults.

4.6.1 Light Patterns

The LEDs on the front of the modem will respond in different patterns to indicate modem states.

- **Normal**—Each LED, mentioned above, lit as applicable.

- **Start up**—The LEDs will cycle from left to right.

- **PassThru Mode**—Network and Signal LEDs will blink in tandem. The Activity LED will blink when transmitting or receiving data.

- **Configuration Reset**—The LEDs will cycle left to right and then right to left 4 times.

- **Authentication Failure**—The Network, Signal, and Activity LEDs blink every 2 seconds. Contact the cellular provider and have the account information verified, and verify the modem is located in an area covered by cellular service.

- **Data Retry**—The Network, Signal, and Activity LEDs blink every 3 seconds.

5.   Using *DevConfig* to Program the Modem

After the Raven has been provisioned, certain settings have to be changed for the modem to be compatible with Campbell Scientific dataloggers. The recommended way to change the settings is to use *DevConfig*.

Connect the Raven to a COM port on the PC with a direct RS-232 cable. Also connect the antenna and 12V power.

Run *DevConfig* to get the following screen:
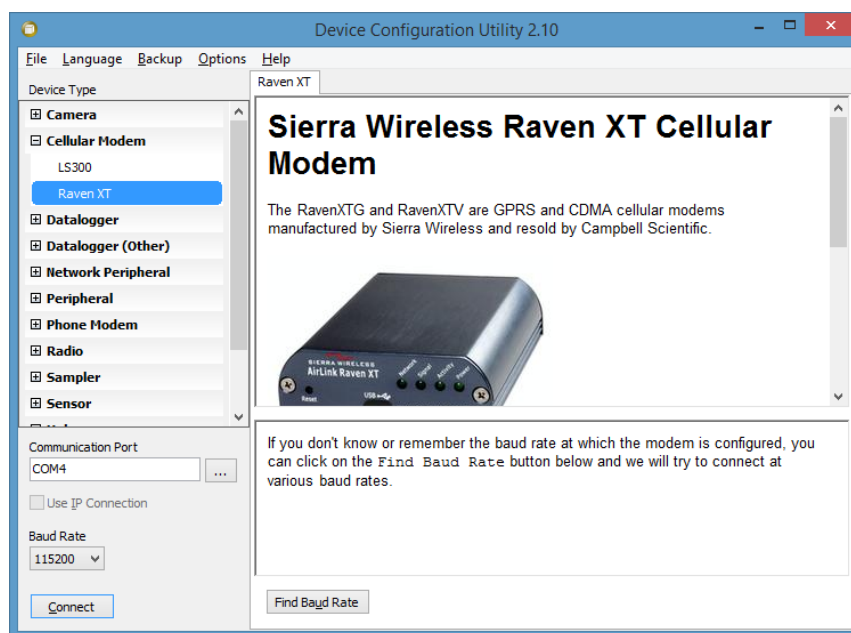
Select the **Communication Port** on your PC that will be used to connect with the Raven modem. Select the correct **Baud Rate**. If you do not know the current baud rate setting of the Raven modem, you can click **Find Baud Rate** and *DevConfig* will try the valid baud rates until it gets a response from the modem.

Click **Connect** to connect with the Raven modem and to see the current settings.

The **Modem Status** tab will display the modems **Network State**, **Signal Strength**, current **Modem IP Address,** and other values related to the modem.
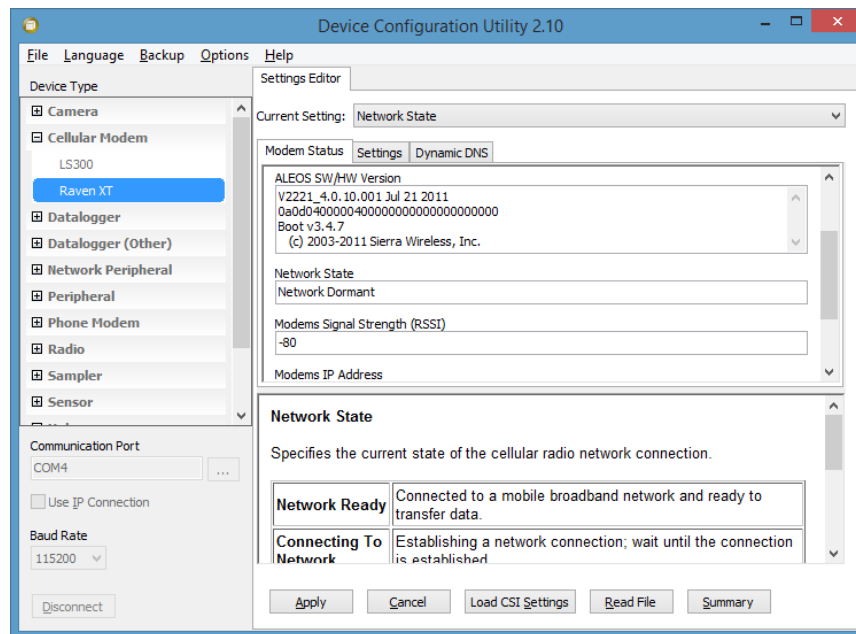
The **Settings** tab displays user-configurable settings to configure the modem for use with a Campbell Scientific Datalogger.
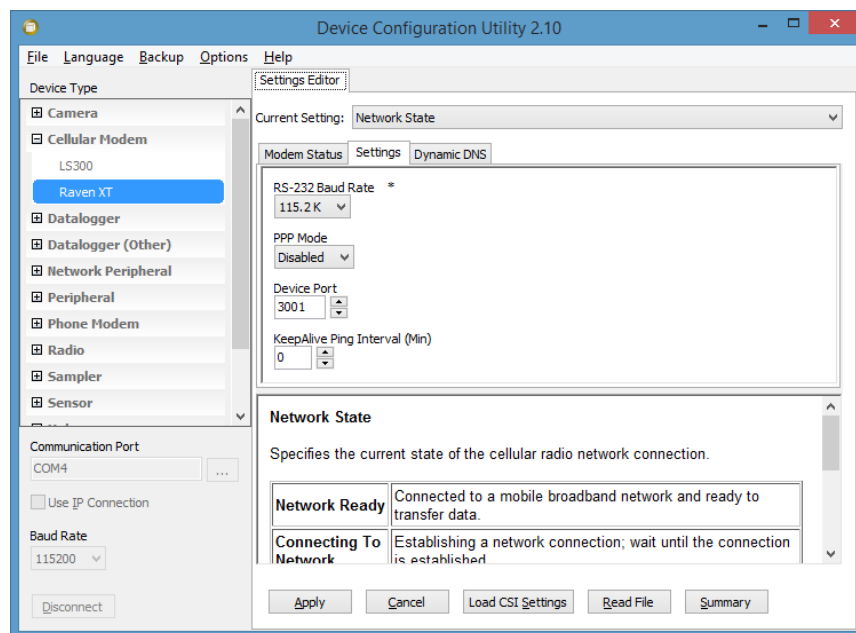
If you are configuring the modem for the first time, click on **Load CSI Settings** to load a default set of settings in *DevConfig*.

The default settings will configure the modem for **Serial Server** mode and **115200** baud. This is recommended for most applications. For older dataloggers (CR200(X), CR10(X), CR510, CR500, 21X, and CR7) which have 9600 baud as the highest supported baud rate, change the **Baud Rate** to **9600**.

As a serial server, the modem has an IP address and port number (3001) for the Raven RS-232 port. *LoggerNet* sends data via TCP/IP over the Internet to the datalogger. The modem removes the data from the TCP packet and sends the data out the RS-232 port to the datalogger. Returning data is put into a TCP packet by the modem and sent back to *LoggerNet*.

Enable **PPP** mode for newer dataloggers (CR1000, CR800 Series, CR3000, and CR6) that support PPP mode, if you wish to gain access to the datalogger IP stack. See Appendix B, *Configuring the Raven Modem for PPP (p. B-1)*, for more information.

When configured as PPP, the Raven functions as a router, routing TCP/IP communications to the IP stack of the datalogger. PPP enables the datalogger to send/receive messages via email, HTTP, FTP to and from the datalogger, and it allows concurrent communications between networked dataloggers and *LoggerNet*.

5.1   Configuring the Raven for Dynamic IP

Most networks assign dynamic IP addresses when a modem or other device is connected. The address can change each time the modem or device reconnects to the network.

IP Manager is a free service provided by Sierra Wireless for the Raven to translate a dynamic IP address into a fully qualified domain name so it can be contacted directly on the Internet. IP Manager translates a dynamic IP address to a fully-qualified domain name so you can contact your Raven by name as if it had a static IP.

If the Raven is configured for dynamic IP, when the Raven first connects to the Internet, it sends an IP change notification to IP Manager. IP Manager will acknowledge the change and update the dynamic DNS record. The changed IP address will then be the address for the Raven's configured name. Once the Raven's IP has been updated in IP Manager, it can be contacted via name.

DevConfig is used to configure the Dynamic IP settings in your Raven so that it will use IP Manager as described below.

Connect with the modem using *DevConfig*. Select the **Dynamic DNS** tab to configure your modem to use IP Manager.

To configure your Sierra Wireless modem to be addressed by name, the modem needs to have three elements configured.
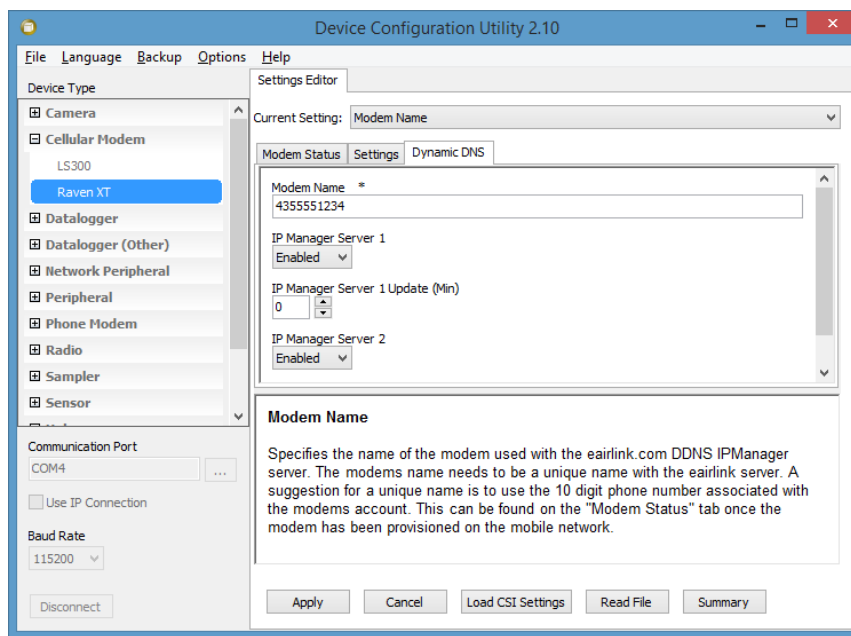
1. **Modem Name**: A unique name for the modem (the 10-digit MDN number is recommended).

2. Enable **IP Manager IP Server 1** and **IP Manager Server 2**.

3. **IP Manager Server 1 Update** and **IP Manager Server 2 Update** intervals: How often you want the address sent to IP Manager. If this is set to zero, the modem will only send an update if the IP changes (that is, if the modem is reset or is assigned a different IP). The value can be set from 0 to 255 minutes.

Restrictions for modem name:

- Must begin with a letter or number
- Can include a hyphen (-)
- Cannot contain spaces
- Must be no longer than 20 characters total

Click **Apply** to save the changes.

Click **Disconnect** to terminate communications with the modem.

Power cycle or reset the modem for the modem to use the new settings.

6. *LoggerNet/PC400* Software Setup

The *Loggernet* **Network Map** is configured from the *LoggerNet Setup* screen.

NOTE   *Setup* has two options, **EZ (simplified)** and **Standar**d. Click on the **View** menu at the top of the *Setup* screen, and select **Standard** view.

From the *LoggerNet* toolbar, click **Main | Setup**, and configure the Network Map as described below.

1. Select **Add Root | IPPort**.

2. Add a datalogger to the **IPPor**t (PakBus dataloggers; e.g., the CR1000, require a **PakBusPort**).

3. On the **IPPort** page in the **Internet IP Address** field, enter the IP address or domain name and the port number. The IP address (or domain name) and port number are entered on the same line, separated by a colon. Preceding zeroes are not entered (e.g., 070.218.074.247 is entered as 70.218.74.247). The Raven template file configures the port number to 3001 for Serial Server mode. For modems configured as PPP, the port number is 6785.

    Add **4 Seconds** of **Extra Response Time**.

    Example settings for a static IP address:
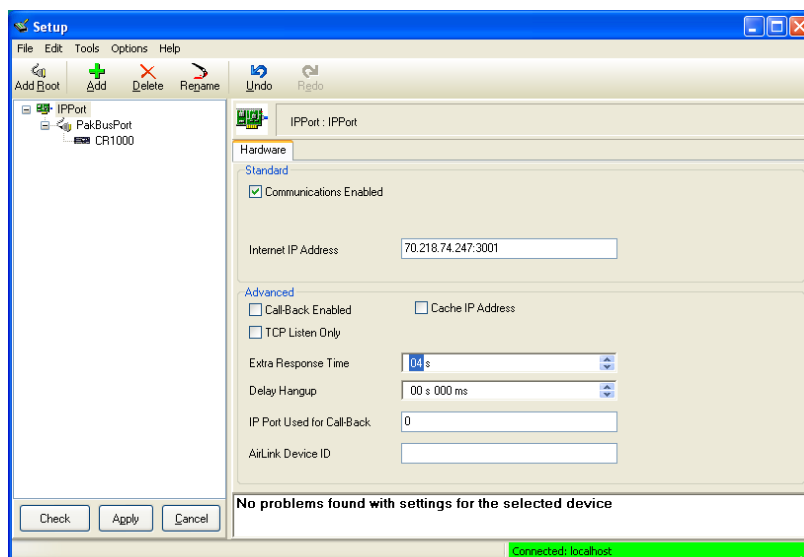
Example settings for a dynamic IP address:
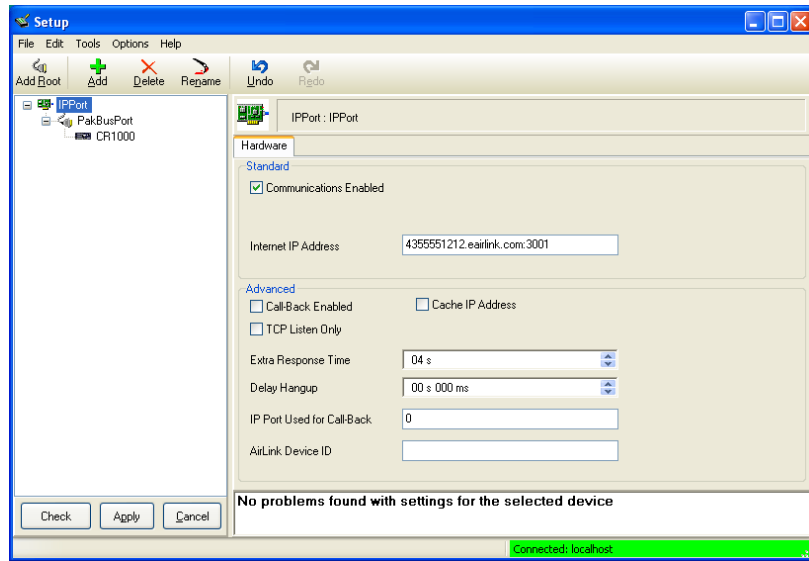
For a dynamic IP using Sierra Wireless's IP Manager, enter the **Internet IP Address** as: xxxx.yyyy:3001, where xxxx is the modem name, yyyy is the domain name, and 3001 is the port number. For modems configured as PPP, the port number is 6785.

4. For PakBus dataloggers, leave the default settings on the **PakBusPort** page. **PakBus Port Always Open** should not be checked.
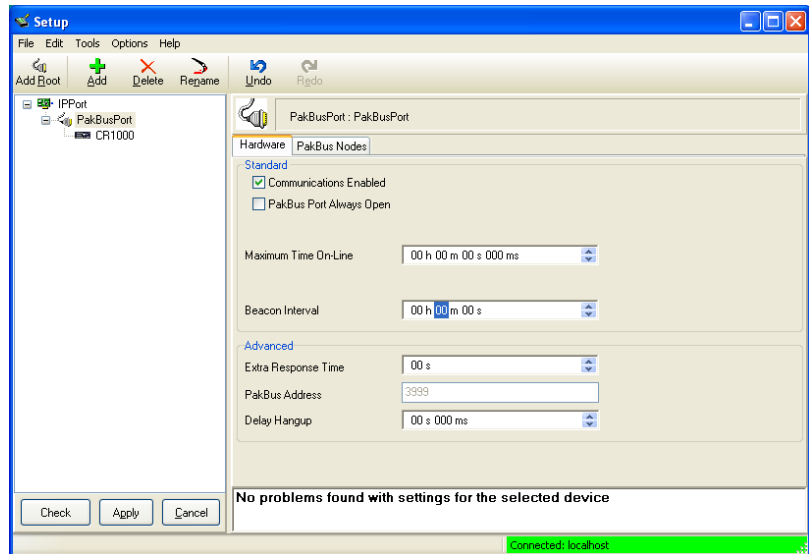
5. For PakBus dataloggers, set the **PakBus Address** on the datalogger page to match that of the datalogger (default address in the datalogger is 1).
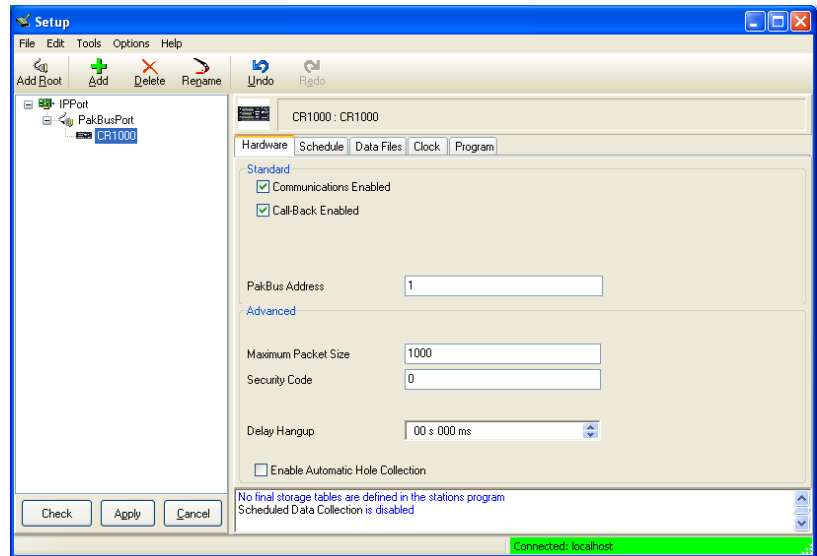
6. Click **Apply** to save the changes.

6.1   Test the Cellular Connection

After the **Network Map** has been configured, test the cellular connection using the *Connect* screen as shown below. Click on the appropriate station, then click **Connect** to initiate a call to the datalogger. If the call is successful, the connectors at the bottom of the screen will come together, and time information from the datalogger will be displayed in the **Station Date/Time** field. If the connection fails, a **Communications Failure** message is displayed. Troubleshooting procedures can be found in Section 7, *Troubleshooting (p. 18)*, and Appendix D, *Troubleshooting Flowchart (p. D-1)*.
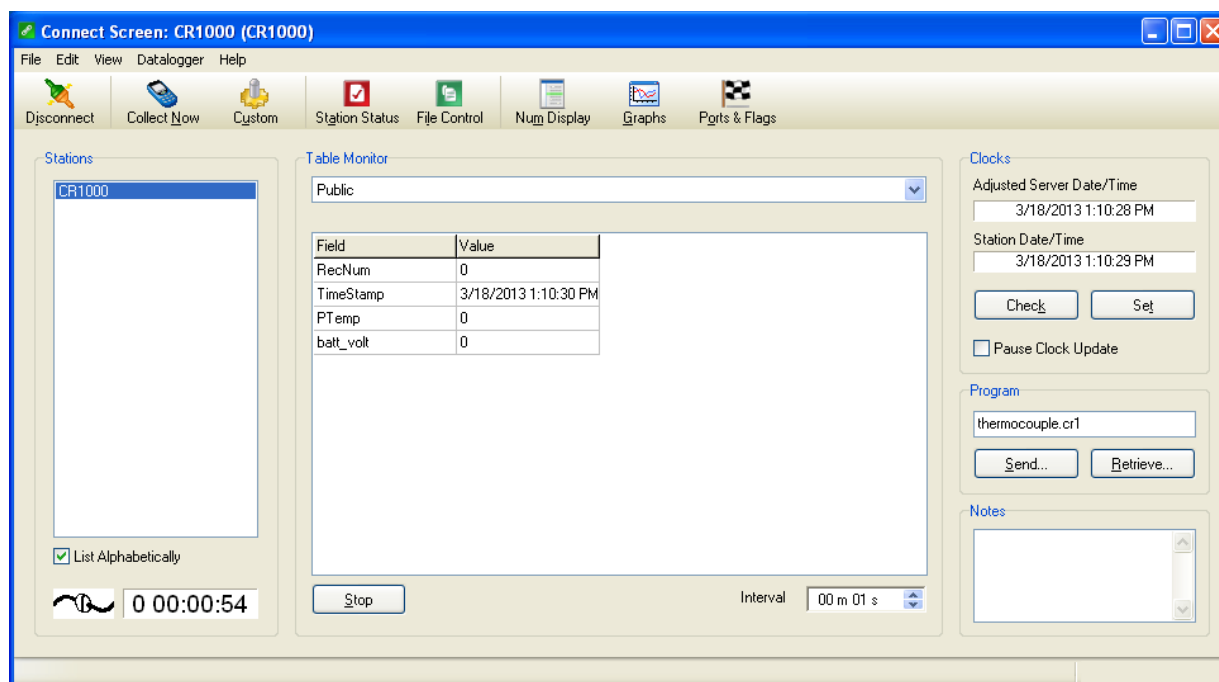
7. Troubleshooting

NOTE   Please refer to Appendix D, *Troubleshooting Flowchart (p. D-1)*, for additional troubleshooting procedures.

If *LoggerNet/PC400* software is unable to establish a connection with the modem:

1. **Check your account information (you may have to call your provider for this or look at your agreement).**

   a. Verify there is coverage at your location.

   b. Check the Network light. Solid green indicates a successful connection to the cellular network with an IP Address given and a channel acquired.

   c. Make sure the modem has sufficient power.

   d. Check the signal strength using *DevConfig* (make sure your antenna is properly connected and oriented). Signal strength should be in the –51 to –90 range (–51 is a strong signal, –90 is a weak signal).

   e. If you have a Static IP account, verify the Static IP Address. Preceding zeros in the IP address are not entered in *LoggerNet/PC400*.

   f. If you have a Dynamic IP account, you will need to have a DDNS (dynamic domain name server) name that *LoggerNet* can reference to make the connection. See Section 5.1, *Configuring the Raven for Dynamic IP (p. 13)*.

2. **Connect with the modem through the serial port using *DevConfig*.**

From the **Modem Status** tab, make sure the **Network State** is **Network Ready** or **Network Dormant**, and note the **Modems IP Address**. This is the current IP address for the modem (a dynamic IP address will change each time the modem is reset). Try connecting to this IP address using *LoggerNet*. If *LoggerNet* connects with the IP address, but not with the modem name.domain name, there may be a problem with the Dynamic IP setup in the modem. See Section 5.1, *Configuring the Raven for Dynamic IP (p. 13)*.
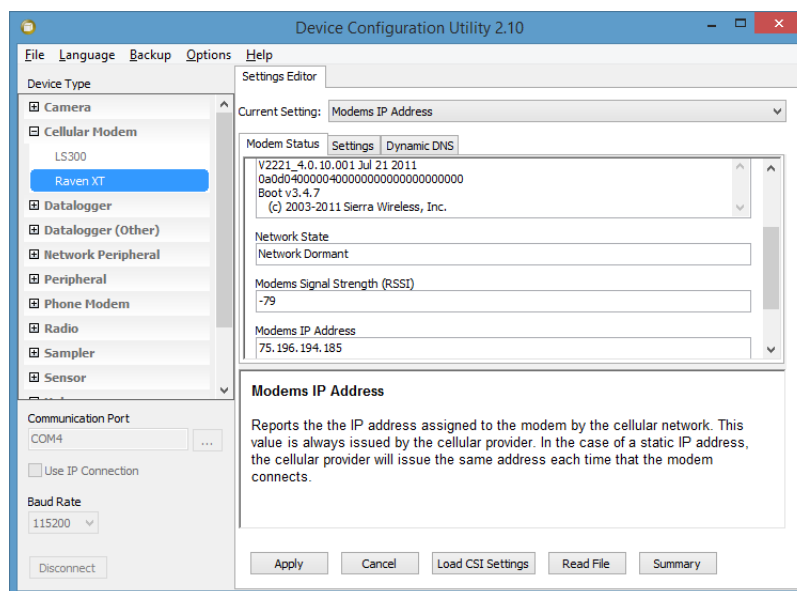
If the modem answers but you do not get a connection to the datalogger:

1. **Check your connection to the datalogger.**

   a. An SC932A or SC105 interface is required to connect the modem to a datalogger CS I/O port (Section 4, *Configuration (p. 3)*). The default settings for SC105 (OS > 4) can be used with the RavenXTV when the modem is configured for 115200 baud (baud rate is set by the template file).

      Baud rate of the SC105 must match the baud rate in the modem (which has to be supported by the datalogger). SC105 settings for use with the RavenXT are listed below, which are configured using *DevConfig*.

      SC105 settings for the RavenXT:

      CS I/O Mode: SDC Address 7
      RS-232 Mode: Modem
      Baud Rate: 115.2K or 9600 baud depending on datalogger model
      8 data bits, 1 stop bit, no parity

      Make sure the modem is connected to the **DCE Device** connector on the SC932A or the **Modem** connector on the SC105.

    b.   A null modem cable is required to connect the modem to a datalogger RS-232 port. No other interface is required.

2.   **Check your *LoggerNet* setup.**

    a.   Make sure the port number at the end of the IP address matches the port number of the Raven (e.g., 3001, see FIGURE 7-1).
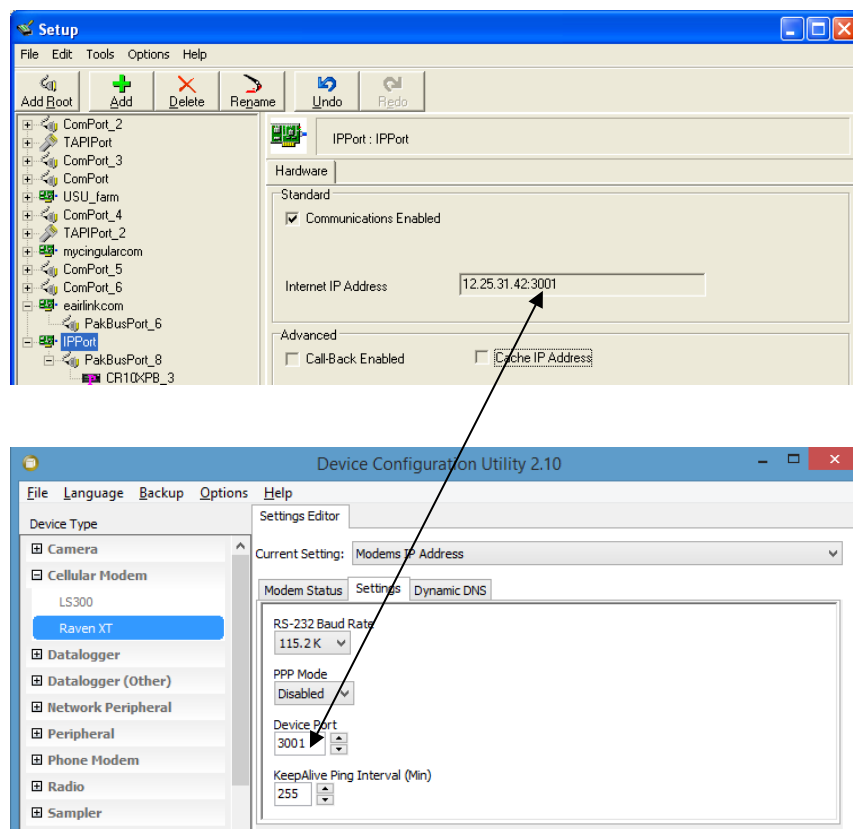
FIGURE 7-1. Device Port configuration

    b.   Try adding a few seconds to the **Extra Response Time** on the **IP Port** in *LoggerNe*t (you should not need more than 5 seconds).

    c.   If you are trying to communicate to a PakBus datalogger:

        i.   Verify the PakBus address in the *Setup* screen matches that of the datalogger.

        ii.   If you have multiple PakBus networks/ports setup in *LoggerNet*, uncheck the **PakBus Port Always Open** option on all PakBus ports.

3. Use AceManager to check modem communications with datalogger.

The modem **Serial IP Packets Sent** and **Serial IP Packets Received** windows can indicate whether or not the modem is communicating with the datalogger.

Establish a connection with the modem through the cellular network using AceManager via the web browser, *Internet Explorer*. (For compatibility, Internet Explore must be used. Other web browsers do not function properly.) In *Internet Explorer*, enter the IP address or domain name followed by port number 9191. For example, http://75.121.63.14:9191. When prompted, the default user name and password are **user** and **12345**. Go to the **Serial** under the **Status** tab and note **the Serial IP Packets Sent** and **Serial IP Packets Received** values (FIGURE 7-2). Try connecting with the datalogger using *LoggerNet/PC400*. If a connection cannot be established, close *LoggerNet* and reconnect with AceManager and compare the current values with the previous values.

If the values are the same, the modem is not attempting to make a connection with the datalogger. Check that the settings are correct in *DevConfig*. (See Section 5, *Using DevConfig to Program the Modem (p. 11)*).

If the **Serial IP Packets Sent** increased but the **Serial IP Packets Received** has not, the modem attempted to connect to the datalogger, but the response from the datalogger did not make it back to the modem. Check the interface between the modem and the datalogger (Section 4.2, *Datalogger Site Equipment (p. 3)*).

If both values incremented, the modem and the datalogger are communicating. Try adding some extra response time in *LoggerNet*.

NOTE
Any setting changes require the modem to be reset before the change takes effect. Click **Reboot** in the upper right corner of AceManager to reset the modem and implement the change.
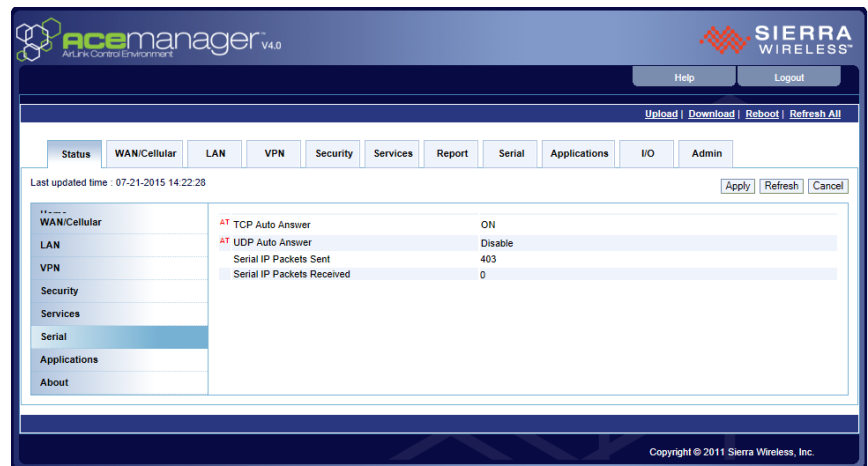
FIGURE 7-2. AceManager status page showing communications with modem

Appendix A. AceManager Setup without Template File

AceManager is used to program settings in the RavenXT modems to make the modems compatible with Campbell Scientific dataloggers. Sierra Wireless CDMA and GPRS template files to send the modems are available on the Campbell Scientific website (*www.campbellsci.com/downloads*).

When the template files are not available, AceManager can be used to change the settings described below.

Establish a connection with the modem through the cellular network using AceManager via the web browser Internet Explorer (for compatibility) and enter the IP address or domain name of the modem followed by the port number 9191. Example http://75.121.63.14:9191. When prompted, the default **User Name** and **Password** are **user** and **12345**.
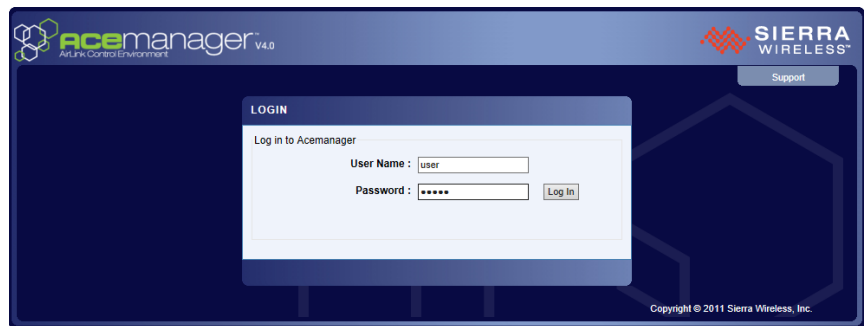
Make a note of the **Device Port**. The default is 12345, and we use 3001 in our template. Any valid port can be used. This is the port number used in *LoggerNet* to get to the datalogger.
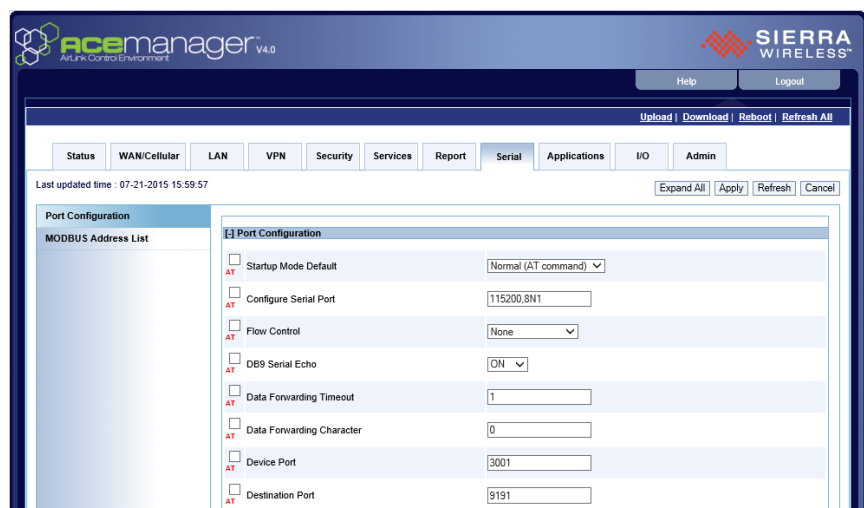
- Configure Serial Port — The baud rate needs to be configured to match a valid datalogger baud rate. For a CR10X: 9600,8N1 and for a CR1000: 115200,8N1.

- Flow Control — This should be set to None.

- AT Verbose Mode — Set this to Verbose for CR800, CR1000, CR3000, CR6; Numeric for CR10(X), CR510, CR23X.

- DTR Mode — Set to Ignore DTR

- TCP Auto Answer — Set to On

- TCP Idle Timeout — Set to a reasonable value such as 2 min.

Appendix B. Configuring the Raven Modem for PPP

Settings in the Raven and datalogger (CR800, CR1000, and CR3000), can be changed to configure the RS-232 serial ports for Point-to-Point protocol (PPP). When configured as PPP, the Raven functions as a router, routing TCP/IP communications to the IP stack of the datalogger. PPP enables the datalogger to send/receive messages via email, HTTP, FTP to and from the datalogger, and allows concurrent communications between networked dataloggers and *LoggerNet*.

The default datalogger port number for PakBus/TCP communications is 6785. The datalogger will also respond to port 80 for HTTP, 23 for Telnet, and 21 for FTP. These ports can be disabled in the datalogger's configuration.

NOTE   The **Device Port** configured in the RavenXTV (shown in *DevConfig* screen below) should not use any of the port numbers configured in the datalogger settings. It is recommended to leave the **Device Port** set to **3001**.

Connect to the modem with *DevConfig* and go to the **Settings** tab. Enable **PPP** and click **Apply**. Reboot the modem for the new settings to take effect.
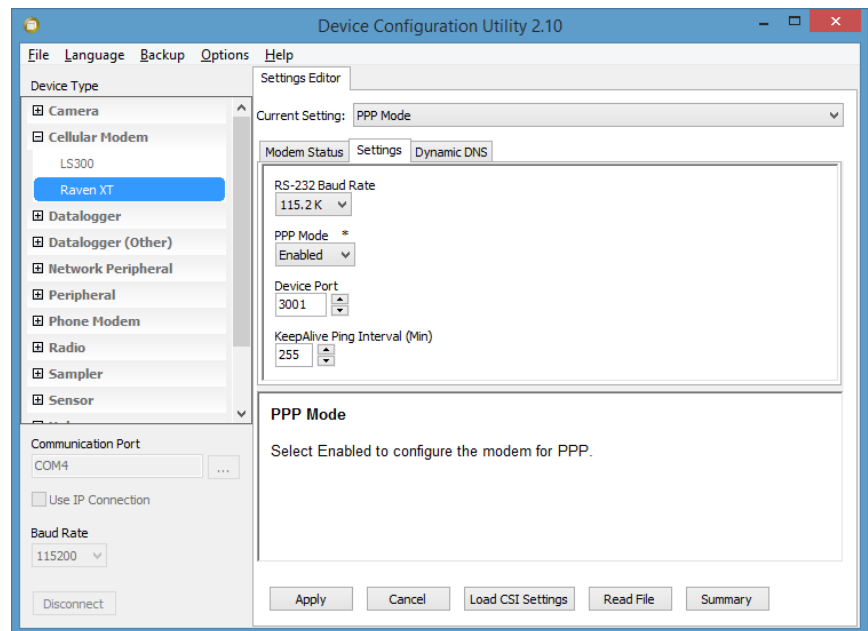
Datalogger Settings:

Using *DevConfig*, configure the following setting on the **PPP** tab:

- Config Port Used = RS-232
- IP Address = 0.0.0.0
- Modem Dial String = PPP

- Modem Dial Response = CONNECT
- User Name and Password are blank

NOTE   These settings are case sensitive and need to be upper case.
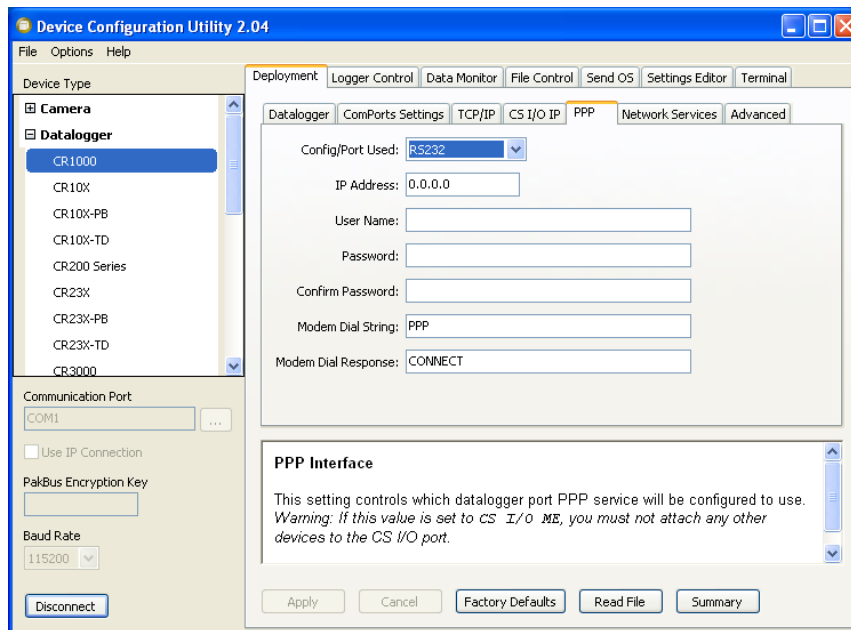
Using *DevConfig*, select the **Network Services** tab. The **PakBus/TCP Service Port** default is 6785. This is the port number that will follow the IP address for *LoggerNet* to communicate with the datalogger.
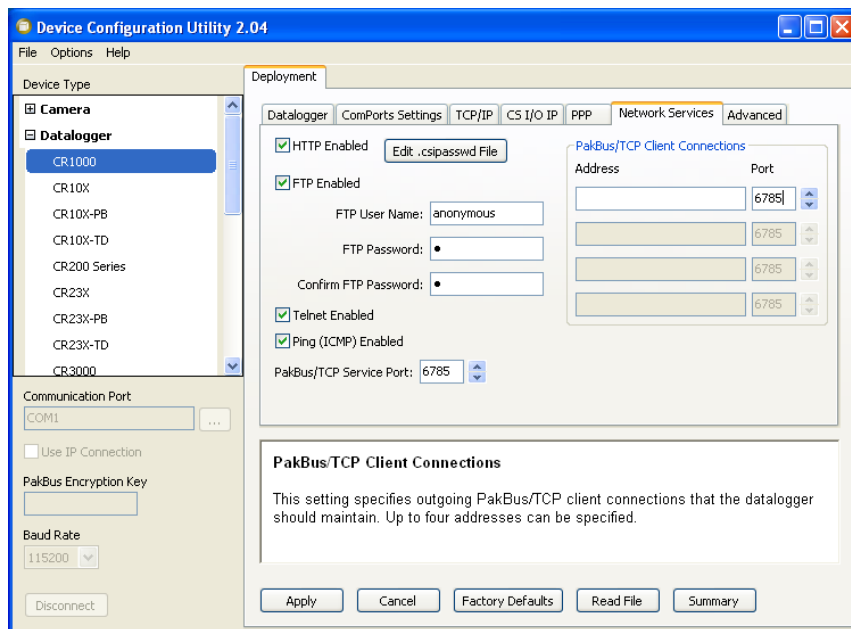
Using *DevConfig*, fix the RS-232 Baud Rate to **115200 Fixed** from the **ComPorts Settings** tab.
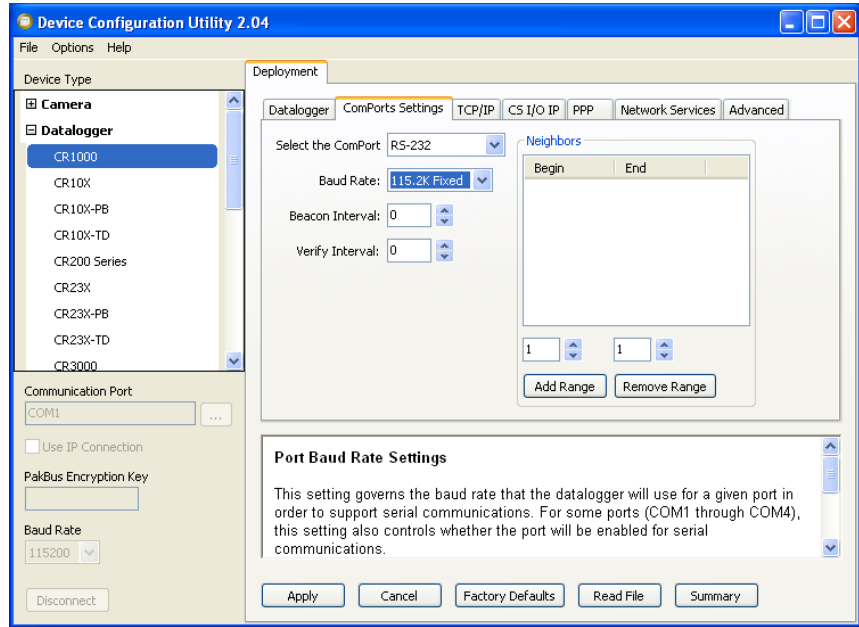
LoggerNet **Settings:**

Enter the IP address of the Raven, and the **PakBus/TCP Service Port** number of the datalogger (for example, 6785 as explained above).
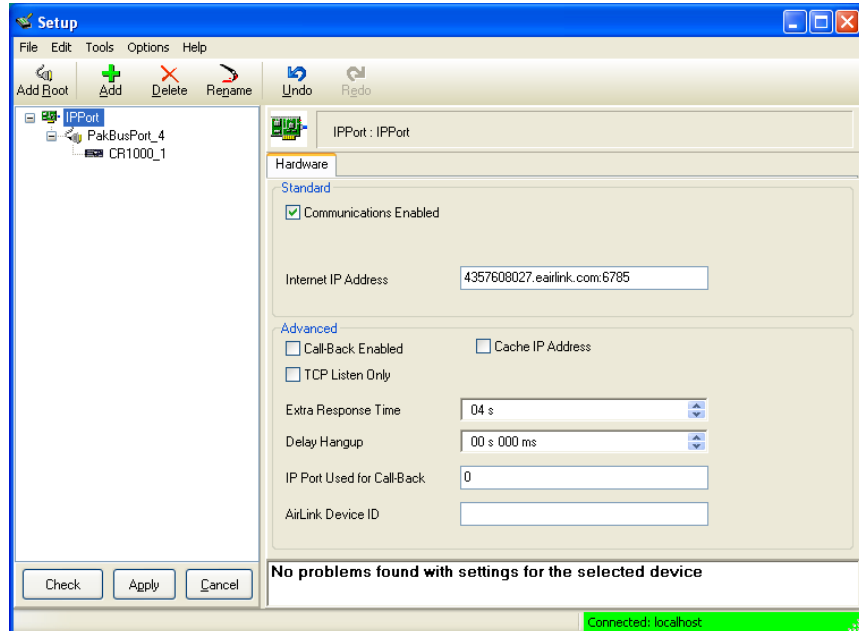
Appendix C. EmailSend Using the Gmail Outgoing SMTP Server

The datalogger has a mail client in it similar to a mail client on a computer. For the datalogger to send an email, it needs an SMTP server to send through like any other mail client. The Gmail SMTP server can be used for sending outgoing email from the datalogger. Both the modem and the datalogger must be configured for PPP as described in Appendix B, *Configuring the Raven Modem for PPP (p. B-1)*.

C.1 Setting up a Gmail Account

First you need to create a Gmail account if you do not already have one. To create one go to *www.gmail.com* from your PC. Gmail accounts are free of charge.

The credentials to access the mail server will be the username and password used when creating the Gmail account.

In the following example program you will see:

- ServerAddr set to smtp.gmail.com:587
- UserName set to (the gmail account user name)
- Password (the one you established at gmail)

Early in 2013, Gmail changed the way they receive email. The changes require a port number of 587 to be added to the IP address or server name you are sending to (i.e., 174.194.68.108:587, smtp.gmail.com:587). This will allow for the datalogger to establish a TLS connection with the correct SMTP (Simple Mail Transfer Protocol) port on Gmail's SMTP servers.

Also, a new security feature has been added to Gmail that will prompt if the device/PC sending the email is authorized to do so. You will see a message in the Result variable (of the EmailSend Instruction) that states something to the effect of opening your email account in your web browser. If you see this message, open your web browser and point it to *http://email.google.com*. Enter the username and password that your datalogger is using to send email with. You should then see a red bar at the top of the browser screen. Follow the listed instructions to allow the datalogger to send email.

C.2 Sending to Multiple Addresses

Sending to multiple email address can be done by using a comma to separate the email addresses (4355551212@hotmail.com, 4355551234@vtext.com).

C.3 Sending a Text Message to a Phone

To send a text message to a phone, the email needs to be converted to a text message via an email to text message gateway. Most cellular providers have an email to text message service for their phone subscribers. To send a text message to Verizon Wireless phone subscribers, send an email to the (10 digit phone number of the person's phone)@vtext.com (4355551234@vtext.com).

Most text messages are limited to 160 characters, so any email messages greater than 160 characters will be truncated.

Email-to-Text Message Gateways

T-Mobile: *phonenumber@tmomail.net*
Virgin Mobile: *phonenumber@vmobl.com*
AT&T: *phonenumber@txt.att.net*
Sprint: *phonenumber@messaging.sprintpcs.com*
Verizon: *phonenumber@vtext.com*

EmailSend Program Example

The following example sends an email message when an alarm condition is True. Both the CR1000 and Raven modem must be configured as PPP as described in Appendix B, *Configuring the Raven Modem for PPP (p. B-1)*. Transport Layer Security (TLS) must be enabled in the datalogger to use the Gmail mail server.

CRBasic Example C-1. Using EmailSend to Send a Text Message

```
'Main program variables
Public Batt, RefTemp, Temp
Public Socket AS Long
'declare Email parameter strings (as constants), Message String & Result Variable
Const ServerAddr="smtp.gmail.com:587"
Const UserName="gmail account name"
Const Password="datalogger"
Const ToAddr="datalogger@hotmail.com, 4355551234@vtext.com"
Const FromAddr="gmailaccount@gmail.com"
Const Subject="Email Message Test"
Const Attach=""
Const CRLF = CHR(13)+CHR(10)
Public Result as String * 100
Public AlarmTrigger As Boolean
Public Message As String * 250
Public EmailSuccess As Boolean
DataTable (TenSecData,True,-1)
DataInterval (0,10,Sec,10)
Sample (1,Batt,FP2)
Sample (1,Temp,FP2)
EndTable
BeginProg
Scan (1,Sec,3,0)
Battery (Batt)
PanelTemp (RefTemp,250)
TCDiff (Temp,1,mV2_5C,1,TypeT,RefTemp,True ,0,250,1.0,0)
CallTable TenSecData
NextScan
SlowSequence
Scan(1,sec,1,0)
If AlarmTrigger = False Then
If Temp > 27 Then AlarmTrigger = True
If AlarmTrigger Then
Message = "Warning!" + CRLF + CRLF
Message = Message + "An alarm condition has been identified. "
Message = Message + "The temperature is " + Temp + " degrees C." + CRLF + CRLF
Message = Message + "Datalogger time is " + Status.Timestamp
EmailSuccess=EmailSend (ServerAddr,ToAddr,FromAddr,Subject,Message,Attach,UserName,Password,Result)
EndIf
EndIf
If Temp < 27 Then AlarmTrigger=False
NextScan
EndProg
```

Appendix D. Troubleshooting Flowchart

Can't connect...

Is Network LED on solid?	—— Yes ——▶ Go to page D-2.

No ▼

Not provisioned/registered on network.

▼

Verizon or AT&T?	—— AT&T ——▶ Go to page D-4.

Verizon ▼

Check coverage map. Are you in an area that should be covered?	—— No ——▶ No solution available.

Yes ▼   Or ▼

May be out of Verizon's 'native' network. Self-provisioning may not work in this case (though this is increasingly rare). Try setting up the modem in an area with strong cellular coverage and then installing it.

May be something with Verizon account; contact Verizon.

Can't connect, Network light is solid...

| Check signal strength (should be between -51 (strong) and -91 (weak). | Weak → | Weak signals are more affected by RF noise. This may prevent making a strong enough connection to send/receive data. |

Strong ↓

| Static or Dynamic IP? | Static → | Verify IP entered correctly. Preceding zeros are not entered in LoggerNet or PC400. |

Dynamic ↓

Check dynamic DNS entered correctly.

Yes ↓

| Connect with AceManager: Status: NetworkState=NetworkReady? Note IP and try this IP in LoggerNet: If this works, the Dynamic setup is incorrect. | Incorrect → | Go to Dynamic setup in manual. |

Correct ↓

| May have been assigned IP behind Verizon's firewall — do you have a mobile terminated IP? | No or don't know → | Check with Verizon **billing** department — need an IP that is NOT in the general IP pool. Without this, can only have datalogger **send** data. |

↓ Yes — continued on next page

Can't connect, Network light is solid... (cont.)
Have mobile terminated IP

Is DPort (AceManager; Misc Group) set to 3001?
Or 6785?
Is LoggerNet trying to connect to same?

PPP or Serial Server

PPP

Serial Server

Was correct template loaded into AceManager?

Could be wrong baud rate.

Yes

Did you click "Write" and then "Reset"?

Yes

Verify Dport (AceManager; Misc group) is set to 3001.

Should be correct if the correct template was loaded, written and the modem reset.

Verify baud rate is correct for datalogger.

If LoggerNet is set to connect to the DPort of the modem, it will connect only to the modem, rather than through the modem to the logger.

In AceManager (Status group); Check Host Serial Bytes Sent/Received — try to connect to logger — check Host sent/received again.

If sent increases, but received does not, almost always a physical connection between the logger and modem, not the modem.

Can't connect, AT&T...
(cont. from page D-1)

```
┌─────────────────────────┐              No          ┌──────────────────────────────┐
│  Was SIM card installed? │ ──────────────────────▶ │  Contact AT&T if don't have.  │
└─────────────────────────┘                          └──────────────────────────────┘
             │
            Yes
             │
             ▼
┌─────────────────────────┐
│ Was correct template     │
│ loaded in AceManager,    │
│ written to the modem and │
│ the modem reset?         │
└─────────────────────────┘
             │
            Yes
             │
             ▼
┌─────────────────────────┐          ┌──────────────────────────────────────────┐
│ Was APN entered and      │ ◀─────── │ I2Gold is best for static IP outside       │
│ correct?                 │          │ firewall (but extra $/mo)                   │
└─────────────────────────┘          │ Note: I2Gold does not allow mobile to       │
             │                        │ mobile communication, so if the application │
            Yes                       │ requires loggers to communicate with each   │
             │                        │ other via the cell modems, this APN will    │
             ▼                        │ not work.                                   │
┌─────────────────────────┐          └──────────────────────────────────────────┘
│   Go to page D-2.        │
└─────────────────────────┘
```

One computer can connect, other(s) cannot...

PPP or Serial Server?

PPP →

If multiple PCs are trying to connect simultaneously, do they have unique PakBus addresses?

Serial Server ↓

In this mode, it's first come, first serve, so one connection can exclude others.

↓

In LoggerNet, is PakBus port set to "Always Open"?

Yes →

Uncheck

No ↓

In LoggerNet, is IP port "Callback enable" checked?

Yes →

Uncheck

No ↓

Connect with AceManager; under Status; what does HostMode say?

"TCP" →

Something is currently connected and preventing other connections.

"AT" ↓

If none of these fix the issue, the customer should check their firewall.

"AT" = ready for incoming communications

Appendix E. Reprovisioning a Modem

If the modem has previously been activated on another account, you will need to do the following to provision the modem on a new account:

1. Connect an antenna and power to the modem.

2. Connect the PC RS-232 port to the modem RS-232 port.

3. Using a terminal program (for example, *DevConfig* with **Device Type** set to **Unknown**), issue the following command substituting XXXXXXXXXX with your modem's new phone number and press **Enter**.

   AT*provision=000000,XXXXXXXXXX

The modem will enter OTASP provisioning and, after about 2 minutes, will respond with a Success message if the provisioning was successful. The modem will then reboot.

Appendix F. Regulatory Information

F.1 Federal Communications Commission Safety and Hazards

This apparatus is suitable for use in Class I, Division 2, Groups A, B, C, and D.

WARNING	**Explosive hazard—Substitution of components may impair suitability for Class 1, Division 2.**

WARNING	**Explosive hazard—Do not disconnect while circuit is live unless area is known to be non-hazardous.**

WARNING	**Do no use USB connector in hazardous areas.**

F.2 Notice (FCC United States)

Electronic devices, including computers and wireless modems, generate RF energy incidental to their intended function and are therefore subject to FCC rules and regulations.

This equipment has been tested to, and found to be within the acceptable limits for a Class A digital device, pursuant to part 15 of the FCC Rules.

This equipment generates radio frequency energy and is designed for use in accordance with the manufacturer's user manual. However, there is no guarantee that interference will not occur in any particular installation.

If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna

- Increase the separation between the equipment and the receiver

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected

- Consult the dealer or an experienced radio/television technician for help

- This device complies with Part 15 of the Federal Communications

Commission (FCC) Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operation.

WARNING	**Changes or modifications to this device not expressly approved by Sierra Wireless could void the user's authority to operate this equipment.**

F.3 Industry Canada

This Class A digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

F.4 RF Exposure

NOTE	At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.

In accordance with FCC/IC requirements of human exposure to radio frequency fields, the radiating element shall be installed such that a minimum separation distance of 20cm should be maintained from the antenna and the user's body.

WARNING	**This product is only to be installed by qualified personnel!**

To comply with FCC/IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain must not exceed 4.55 dBi in the Cellular band and 2.85 dBi in the PCS band.

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