Product Manual

Communications Device

RV50

Sierra Wireless AirLink®
4G LTE Cellular Modem

RELIABLE
SINCE 1974
MONITORING

CAMPBELL®
SCIENTIFIC

Guarantee

This equipment is guaranteed against defects in materials and workmanship. We will repair or replace products which prove to be defective during the guarantee period as detailed on your invoice, provided they are returned to us prepaid. The guarantee will not apply to:

- Equipment which has been modified or altered in any way without the written permission of Campbell Scientific

- Batteries

- Any product which has been subjected to misuse, neglect, acts of God or damage in transit.

Campbell Scientific will return guaranteed equipment by surface carrier prepaid. Campbell Scientific will not reimburse the claimant for costs incurred in removing and/or reinstalling equipment. This guarantee and the Company's obligation thereunder is in lieu of all other guarantees, expressed or implied, including those of suitability and fitness for a particular purpose. Campbell Scientific is not liable for consequential damage.

Please inform us before returning equipment and obtain a Repair Reference Number whether the repair is under guarantee or not. Please state the faults as clearly as possible, and if the product is out of the guarantee period it should be accompanied by a purchase order. Quotations for repairs can be given on request. It is the policy of Campbell Scientific to protect the health of its employees and provide a safe working environment, in support of this policy a "Declaration of Hazardous Material and Decontamination" form will be issued for completion.

When returning equipment, the Repair Reference Number must be clearly marked on the outside of the package. Complete the "Declaration of Hazardous Material and Decontamination" form and ensure a completed copy is returned with your goods. Please note your Repair may not be processed if you do not include a copy of this form and Campbell Scientific Ltd reserves the right to return goods at the customers' expense.

Note that goods sent air freight are subject to Customs clearance fees which Campbell Scientific will charge to customers. In many cases, these charges are greater than the cost of the repair.

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WHEN MEASUREMENTS MATTER

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PLEASE READ FIRST

About this manual

Please note that this manual was originally produced by Campbell Scientific Inc. primarily for the North American market. Some spellings, weights and measures may reflect this origin.

Some useful conversion factors:

Area:	1 in^2 (square inch) = 645 mm^2		**Mass:**	1 oz. (ounce) = 28.35 g
				1 lb (pound weight) = 0.454 kg
Length:	1 in. (inch) = 25.4 mm			
	1 ft (foot) = 304.8 mm		**Pressure:**	1 psi (lb/in^2) = 68.95 mb
	1 yard = 0.914 m			
	1 mile = 1.609 km		**Volume:**	1 UK pint = 568.3 ml
				1 UK gallon = 4.546 litres
				1 US gallon = 3.785 litres

In addition, while most of the information in the manual is correct for all countries, certain information is specific to the North American market and so may not be applicable to European users.

Differences include the U.S standard external power supply details where some information (for example the AC transformer input voltage) will not be applicable for British/European use. *Please note, however, that when a power supply adapter is ordered it will be suitable for use in your country.*

Reference to some radio transmitters, digital cell phones and aerials may also not be applicable according to your locality.

Some brackets, shields and enclosure options, including wiring, are not sold as standard items in the European market; in some cases alternatives are offered. Details of the alternatives will be covered in separate manuals.

Part numbers prefixed with a "#" symbol are special order parts for use with non-EU variants or for special installations. Please quote the full part number with the # when ordering.

Recycling information

At the end of this product's life it should not be put in commercial or domestic refuse but sent for recycling. Any batteries contained within the product or used during the products life should be removed from the product and also be sent to an appropriate recycling facility.

Campbell Scientific Ltd can advise on the recycling of the equipment and in some cases arrange collection and the correct disposal of it, although charges may apply for some items or territories.

For further advice or support, please contact Campbell Scientific Ltd, or your local agent.

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IMPORTANT INFORMATION FOR USERS OF THE RV50 MODEM PURCHASED IN EUROPE

Modems supplied by Campbell Scientific in Europe will be the international version of the RV50. This uses the MC7304 radio modules that covers the 3G/4G wavebands more commonly used outside of North America. The modem also supports the common WCDMA bands and Quad band 2G services. The modem automatically reconfigures itself for the waveband and services of the local networks linked to the SIM fitted.

References in this manual to the setup of the modem for the AT&T and Verizon networks should be used as examples only. Setup for other operators is a similar process using the APN details provider by them.

Reference is also made in this manual to being able to connect and reconfigure the modem over the air using the AceManager web interface. Worldwide this feature will only work on some networks and usually requires the use of a fixed IP service from the airtime provider. For initial setup the AceManager interface will work with direct Ethernet connections from a pc.

Mounting the RV50

The mounting kit (#32252) shown in this manual is available to special order. The manufacturers DIN rail mount can also be supplied to special order. The RV50 can also be mounted on any flat surface providing there is adequate space and suitable matching mounting holes. For fixed installations the MB3 Mounting bracket (009847) can be used to mount the modem in an enclosure, this uses a Velcro strap.

Antenna

The antennae described in this manual can be provided to special order, but they are designed for North American frequencies and will not work effectively on all world frequencies.

In Europe, for use in areas of good reception a single, standard low gain, wideband antenna can be used; Campbell Scientific offers suitable pole mount or enclosure mount antennae:

Part 009528   2G/3G/4G ANTENNA (Wall/Pole Mount) C/W 5M CABLE & SMA CONNECTOR

Part 009960   2G/3G/4G ANTENNA (ENCLOSURE MOUNT) 750-2700 MHz C/W 400 mm CAB (SMA conn)

Where reception is marginal, higher gain antenna can be used as can an additional diversity antenna.   The antenna would then need to be matched to the waveband used by the preferred cell phone network. Please contact Campbell Scientific for more information on other antenna options.

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.eu or by telephoning +44(0) 1509 828 888 (UK). 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, or 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.

Table of Contents

1. Introduction

This manual provides information for interfacing the RV50 Sierra Wireless AirLink® 4G LTE Cellular Modem to Campbell Scientific dataloggers.

The RV50 digital cellular modem is manufactured by Sierra Wireless® and supports network operator switching based on the SIM for use on GSM (Global System for Mobile Communications) and CDMA (Code Division Multiple Access) networks. The modem is accessed through the Internet using TCP/IP communications protocol.

Use of the RV50 requires a Verizon® CDMA/1xRTT/EVDO/LTE or AT&T® GSM/GPRS/EDGE/HSPA+/LTE business account or an equivalent account from Campbell Scientific or another service provider. For more information, see Establish cellular service (p. 3)

For additional information on the RV50 module, see the Support section of the Sierra Wireless website.

Before using the RV50, please study:

- Safety (p. iii)
- Initial inspection (p. 2)
- Pre-installation (p. 3)
- QuickStart (p. 7)

The RV50 module may be configured in one of two ways, depending on the communications type and needs of the user. ACEmanager, a web based configuration tool is hosted by the RV50. It can be accessed using a web browser over the cellular WAN or locally over Ethernet. A number of templates will be provided for download to make most configurations very simple once connected to ACEmanager.

For many applications, that just need a connection for data collection and datalogger maintenance or monitoring, setup as a serial server is sufficient. In this mode, the module receives IP communications over the cellular network and converts those to serial (RS-232) communications to pass on to the datalogger. From the datalogger perspective, this is no different than a serial cable connecting it to a computer. QuickStart (p. 7) describes setting up the RV50 in serial server mode.

Alternatively, if IP communications are needed on the datalogger, the module may be set up in Point-to-Point Protocol (PPP) mode. In this mode, the module simply passes IP communications directly to the datalogger. This enables features such as FTP, HTTP, and emailing. For information on configuring the RV50 in PPP mode, see ACEManager and template files (p. 20) and

Enabling PPP mode (p. 23). See the EmailRelay() paper and Blog article with example programs for more information on emailing.

2. Precautions

READ AND UNDERSTAND the Safety (p. iii) section at the front of this manual.

> **CAUTION:**
> This device uses considerably more power than the datalogger, see Specifications (p. 12). It may require a larger power supply, switching power with the datalogger, or a combination of these to ensure the battery is not drained. See Controlling power to the RV50 (p. 32) for program examples of using switched 12V to control power to the RV50.

We strongly recommend changing the default RV50 ACEmanager password to prevent unauthorized access and the potential of malware infection. The password can be changed from the ACEmanager **Admin** tab.

3. Initial inspection

The RV50 ships with the following items:

- (1) grey power cable (from original manufacturer)
- (4) screws and washers (from original manufacturer)
- (1) 2 ft Ethernet cable
- (1) Quick Deploy Guide

Upon receipt of the RV50, inspect the package and contents for damage. File any damage claims with the shipping company.

Immediately check package contents against the shipping documentation. Contact Campbell Scientific about any discrepancies.

4. Pre-installation

4.1 Establish cellular service

For better security, we recommend using Konect PakBus® Router with a private dynamic IP address. This method allows only incoming PakBus communication. No other incoming communication is supported. However, all forms of outbound communication from the data logger are supported, including but not limited to PakBus, email, and ftp.

A public static IP address can also be used. This provides more incoming communication functionality, but is less secure and more vulnerable to unsolicited traffic.

> **NOTE:**
> A public static IP account must be used when the module is set up in serial server mode. Private dynamic IP accounts do not support the serial server mode.

4.1.1 Campbell Scientific cellular data service

Campbell Scientific can provide subscriptions to cellular service through Verizon, AT&T, T-Mobile, Vodafone, Telstra, and over 600 other providers worldwide. When this cellular service is purchased with the module, the module will come pre-provisioned with the required SIM card and APN. If you have already purchased the RV50, call Campbell Scientific to set up service.

4.1.2 Other service providers

While using Campbell Scientific is the simplest way to obtain cellular data service for your module, you can go directly to a provider. For more information on obtaining service directly from Verizon and AT&T, see Verizon Wireless and AT&T (p. 36).

4.2 Install the SIM card

> **NOTE:**
> If you purchased cellular service from Campbell Scientific with the module, it will come with the SIM card already installed. Proceed to Konect PakBus Router setup (p. 4)

The SIM in the RV50 is a smartcard that securely stores the key identifying a mobile subscriber. You should only need to install the SIM once in the life of the module.

To install the micro-SIM card:

1. Remove the SIM card cover.
2. Note the location of the notched corner for correct alignment. The gold contact points of the SIM face down when inserting the SIM card as shown in FIGURE 4-1 (p. 4). **Gently** slide the card into the slot until it stops and locks into place. To eject the SIM card, press it in slightly and release.
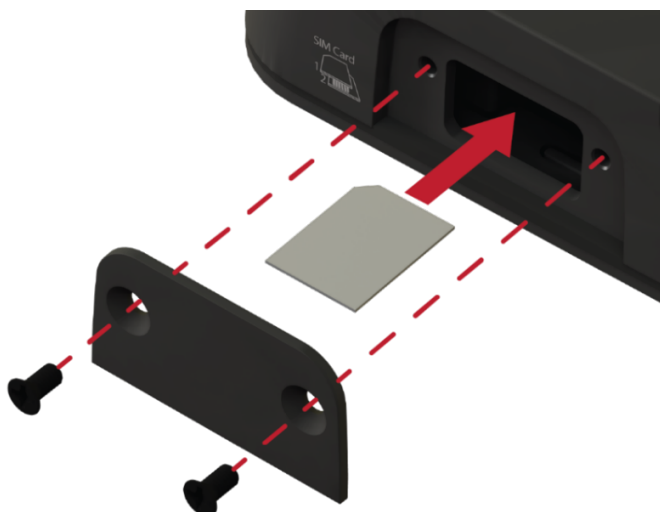3. Replace the SIM card cover.

FIGURE 4-1. SIM card installation

4.3 Konect PakBus Router setup

For better security, we recommend using Konect PakBus® Router with a private dynamic IP address. This method allows only incoming PakBus communication. No other incoming communication is supported. However, all forms of outbound communication from the data logger are supported, including but not limited to PakBus, email, and ftp. Complete the steps in the following two sections.

4.3.1 Get started

Open a web browser and go to www.konectgds.com.

First-time users need to create a **free account**. After you submit your information, you will receive two emails up to five minutes apart. One email will contain a Passport ID and the other your Password. If emails are not received, check your email junk folder.

You will need the Konect PakBus Router redemption code that came on a card with the Campbell Scientific cellular module.
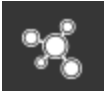
4.3.2 Set up Konect PakBus Router

Sign in to www.konectgds.com using your Passport ID and Password found in the two received emails. Once logged in, you will be at the Welcome page.
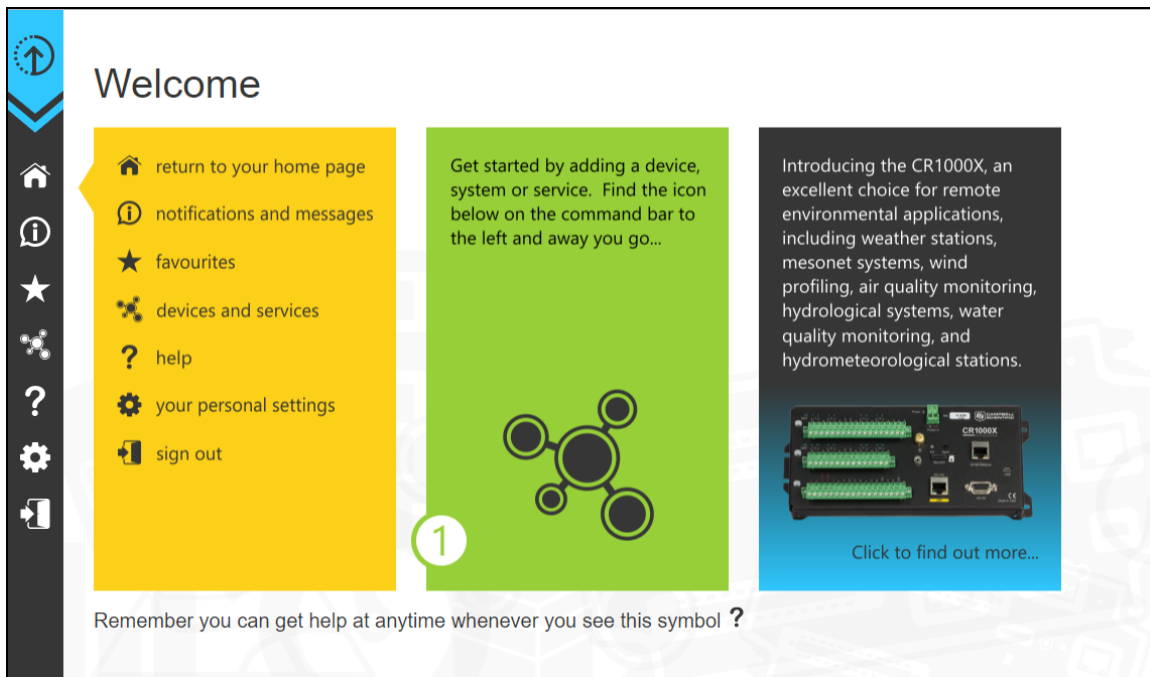
Click **devices and services** on the command bar to the left and select **Redeem PakBus Router Code**. Enter your complimentary Router Code found on the included card with your cellular-enabled device and click **Submit**.
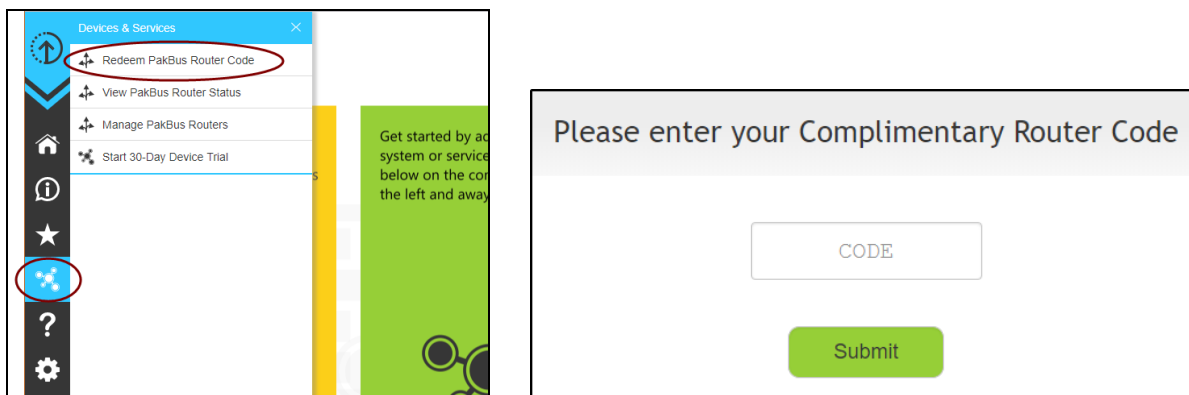
The next screen shows the assigned **DNS** address and **Port** for the router. An optional **TCP Password** may be entered for additional security, and you must select a unique **PakBus Address** for your data logger.

> **TIP:**
> **Make note of this information** for use in later steps.

Click **Submit**.

5. QuickStart

This section describes configuring the RV50 in serial server mode.

> **NOTE:**
> A public static IP account must be used when the module is set up in serial server mode. Private dynamic IP accounts do not support the serial server mode.

5.1 Configure RV50

1. Download the collection of RV50 configuration templates from www.campbellsci.eu/downloads and run the executable downloaded.
2. Connect the **Cellular** antenna.

3. Connect the **Diversity** antenna, if used. Recommended but not required. Note: If a **Diversity** antenna is not used, use ACEmanager to disable **WAN/Celluar | Network Credentials | RX Diversity**.
4. Connect the power cable leads to a power supply.

Wire Color	Function	Connect To
Black	Ground	G
White	Enable (On/Off)	12V or SW12V or control port
Red	Power (7 to 36 V)	12V

5. Connect the power cable to the RV50 **DC Power** input. When the RV50 is properly set up and powered, the status LEDs will turn on. The RV50 will begin the activation/provisioning process and attempt to connect to the mobile network. This process typically takes 5 to 10 minutes. A successful connection is indicated by a solid green or solid amber **Network** LED. If the RV50 does not automatically connect to the network, you may need to proceed to Step 6 to confirm or enter your **WAN/Cellular | SIM Slot 1 Configuration | Network Credentials | User Entered APN** information.
6. Connect your Windows® computer to the RV50 using the supplied Ethernet cable.
7. Launch a web browser, and enter http://192.168.13.31:9191 into the address bar. The ACEmanager login screen should appear in your browser.
8. Log in using **User Name** = user and **Password** = 12345. (We strongly recommend changing the default password to prevent unauthorized access and the potential of malware infection. The password can be changed from the Admin tab.)
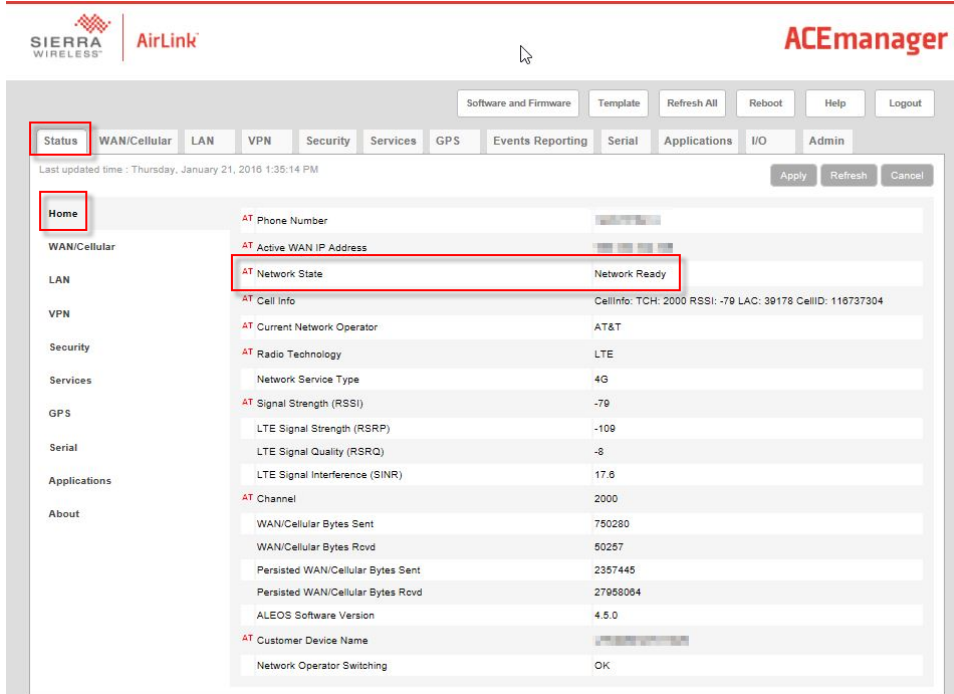
9. Once logged in, check the Status | Home | Network State field. It should read Network Ready, indicating the RV50 is connected to the cellular network. You can easily test the RV50 connection to the Internet by selecting the Admin | Advanced tab and using the PING tool to ping an Internet server, such as www.campbellsci.com.

10. Click the Template button in the ACEmanager toolbar. A template application window will appear. Browse to and upload one of the configuration templates downloaded from Campbell Scientific.

Template Files	
Template File Name	Description
RV50_115200.xml	Default configuration with RS-232 at 115200 baud and Ethernet communication enabled.[1]
RV50_9600.xml	Default configuration with RS-232 at 9600 baud and Ethernet communication enabled.[2]
[1]CR1000, CR1000X series, CR800 series, CR6 series, CR300 series, CR3000, CR5000	
[2]CR200(X)	

11. Reboot the RV50 after successfully applying the configuration template. You can do this by clicking the Reboot button on the ACEmanager toolbar, by momentarily pressing the Reset button (2 sec), or by temporarily removing power from the RV50.

5.2 Set up hardware

The simplest hardware setup for modern dataloggers is to connect a null module cable between the RS-232 ports of the datalogger and the RV50. See Wiring and connections (p. 17)
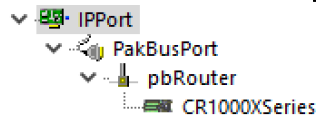
5.3 Set up LoggerNet

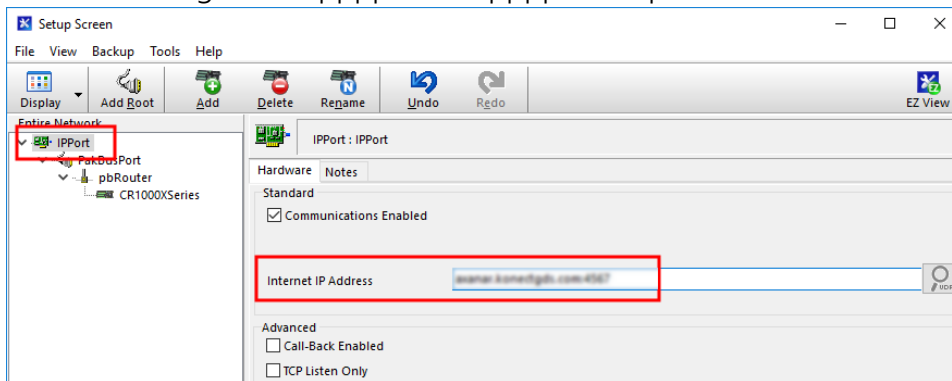The LoggerNet Network Map is configured from the **LoggerNet Setup** screen.

> NOTE:
> Setup has two options, EZ (simplified) and Standard. 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 in the following steps:
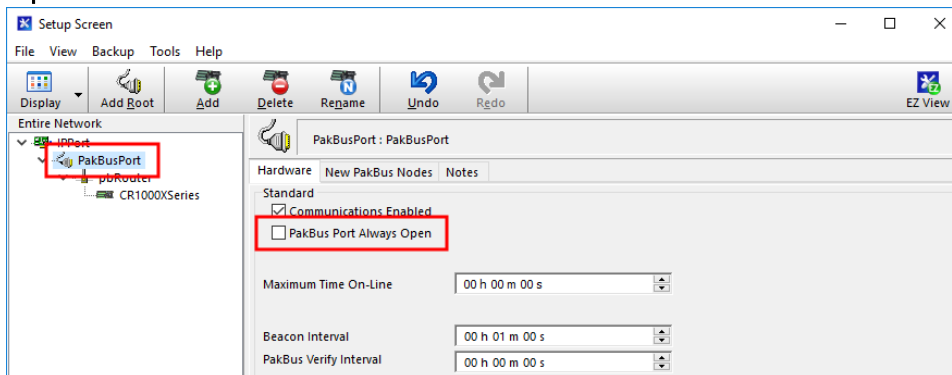
1. Select **Add Root** > **IPPort**.
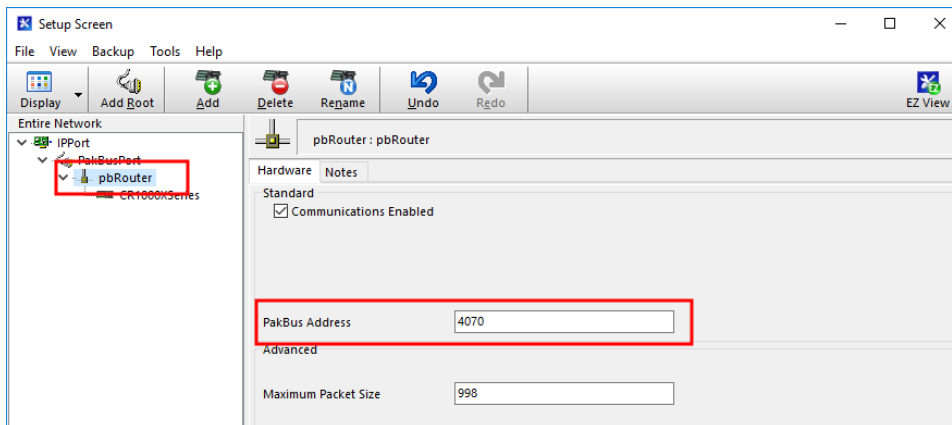2. Select **PakBusPort** and **pbRouter** for PakBus data loggers such as the CR1000X.

3. Add a data logger to the **IPPort** or **pbRouter**.
4. Select the **IPPort** in the Network Map. Enter the Konect PakBus Router DNS address and port number as noted in the Konect PakBus Router setup. The DNS address and port number are input in the **Internet IP Address** field separated by a colon. For example, axanar.konectgds.com:pppp where pppp is the port number.
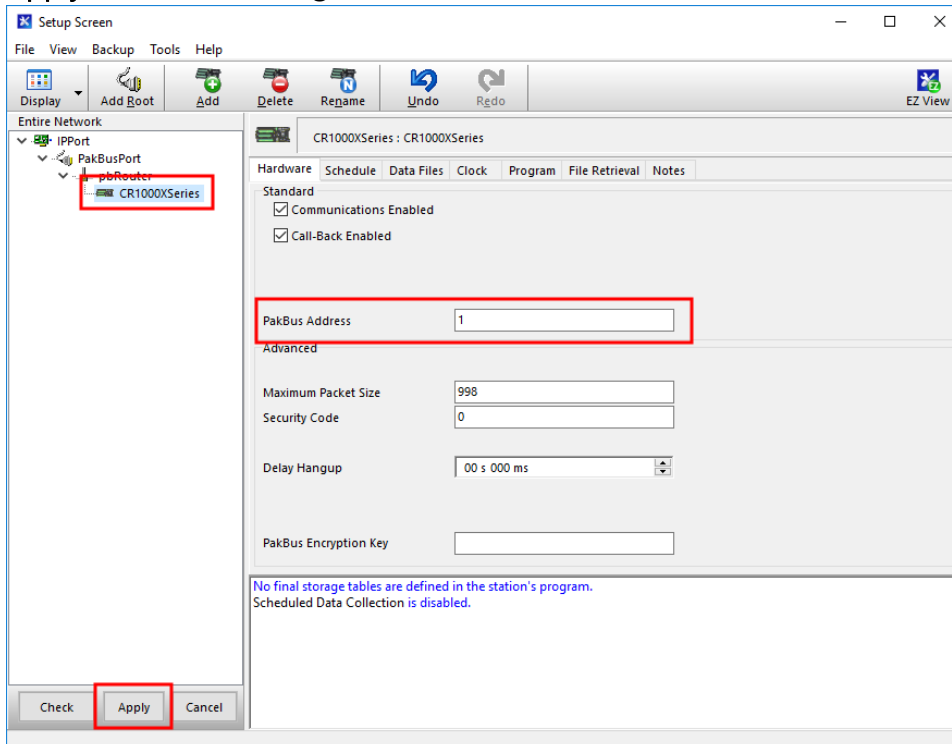

5. For PakBus data loggers, leave the default settings for the **PakBusPort. PakBus Port Always Open**; it should not be checked. If used, enter the **TCP Password**.

6. For PakBus data loggers, select the pbRouter in the Network Map and set the **PakBus Address** to **4070**.

7. For PakBus data loggers, select the data logger in the Network Map and set the **PakBus Address** to match that of the data logger (default address in the data logger is 1). Click **Apply** to save the changes.


5.4 Test the connection

After the Network Map has been configured, test the cellular connection by using the **Connect** screen as shown in the following image. Click on the appropriate station and click **Connect** to initiate a call to the data logger.

> **TIP:**
> The connection time is subject to many external factors and could be up to fifteen minutes. Be patient.

If the call is successful, the connectors at the bottom of the screen will come together and clock information from the data logger will be displayed in the **Station Date/Time** field. If the connection fails, a **Communications Failure** message will be displayed.
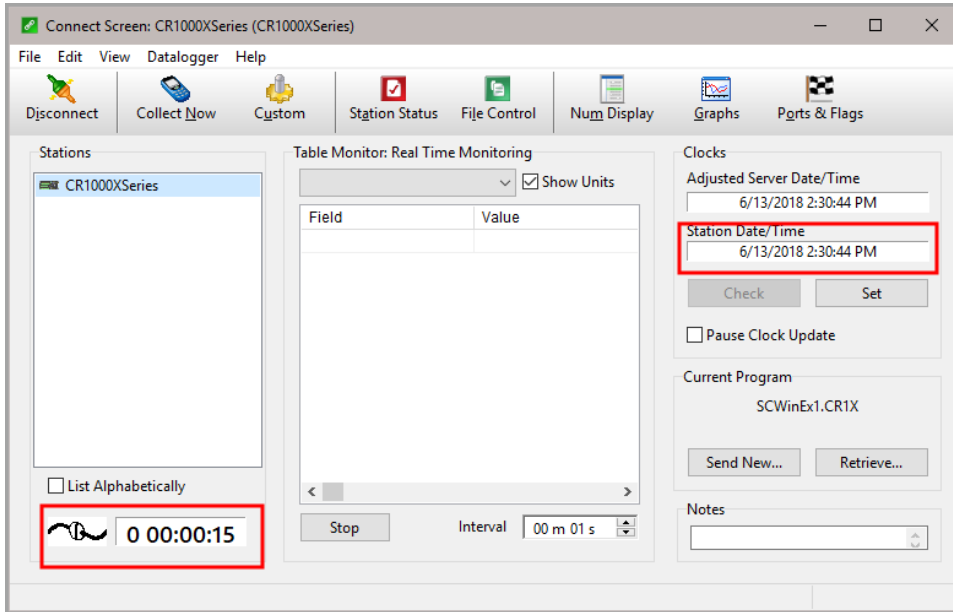
6. Specifications

Sierra Wireless® AirLink® RV50 cellular module (MC7354 radio module)

Cellular WAN

- Network Technology: 4G with automatic fallback to 3G and 2G
- Cellular WAN: North American Model
  - Carrier Approvals: Verizon®, AT&T®, Sprint®, T-Mobile® USA, Rogers™, Bell®, Telus®
  - LTE: 1900(B2), AWS(B4), 850(B5), 700(B13), 700(B17), 1900(B25)
  - WCDMA: 2100(B1), 1900(B2), AWS(B4), 850(B5), 900(B8)
  - EV-DO/CDMA: 800(BC0), 1900(BC1), 1700(BC10)
  - GSM/GPRS/EDGE: Quad-band
  - Industry Approvals: FCC, IC, PTCRB

- ○ Radio Type: Software-defined (with automatic network operator switching)
  - ○ Interfaces: Dual SIM interfaces
- Cellular WAN: International Model
  - ○ LTE: 2100(B1), 1800(B3), 2600(B7), 900(B8), 800(B20)
  - ○ WCDMA: 2100(B1), 1900(B2), 850(B5), 900(B8)
  - ○ GSM/GPRS/EDGE: Quad-band
  - ○ Industry Approvals: CE, RCM, GCF, R&TTE
  - ○ Radio Type: Software-defined (with automatic network operator switching)
  - ○ Interfaces: Dual SIM Interfaces (2FF)

Host Interfaces

- 10/100/1000 Ethernet RJ45
- RS-232 serial port, DB9 female
- USB version 2.0 with micro-B connector

RF Connectors

- 3 SMA antenna connectors (primary, diversity & GPS)
- Active antenna support

Power

- Operating Voltage: 7 to 36 Vdc
- Typical Enable/Ignition Sense Line Low: 1 mA @ 12V
- Typical Idle: 65 to 95 mA @ 12V, depending on configuration
- Typical Active: 250 to 300 mA @ 12V, depending on configuration

Size

- Dimensions: 119 x 34 x 94 mm (4.69 x 1.34 x 3.7 in)
- Weight: 320 g (11.3 oz)

Environmental

- Operating Temperature Range: –30 to 70 °C (–22 to 158 °F)
- Storage Temperature: –40 to 85 °C (–40 to 185 °F)
- Humidity: 90% @ 60 °C
- Military Specification: MIL-STD-810G conformance to shock, vibration, thermal shock, and humidity
- IP64 rated ingress protection

Industry Certifications

- Safety: IECEE Certification Bodies Scheme (CB Scheme), UL60950
- Vehicle Usage: E-Mark (UN ECE Regulation 10.04), ISO7637-2, SAE J1455 (Shock & Vibration)
- Hazardous Environments: Class 1 Div 2
- Environmental: RoHS, REACH, WEEE

7. Installation

7.1 Base station requirements

A computer running Campbell Scientific LoggerNet software with access to the Internet is needed.

7.2 Data logger site equipment

- RV50 module with power cable (included with module)
- Data logger — CR1000X series, CR300 series, CR6 series, CR1000, CR3000, CR800 series, and CR200(X) series
- Module Interface, see Module communications connections (p. 18)
- Environmental Enclosure — ENC10/12, ENC12/14, or ENC16/18

If connecting to CS I/O port:

SC105 Interface — connects the module to any data logger with a **CS I/O** port. It must be configured using Device Configuration Utility. Settings should be:

- CS I/O Mode: Modem Enable
- CS I/O ME Baud Rate: 9600
- RS-232 Mode: Modem (default)
- Baud Rate:
  - 115.2K for CR1000X series, CR300 series, CR6 series, CR1000, CR3000, CR800 series, and CR200(X) series data loggers
  - 9600 for CR10X, CR10X-PB, CR510, CR510-PB, CR23X, and CR23XPB data loggers
- 8 data bits, 1 stop bit, no parity

If connecting to RS-232 port:

Null Modem Cable (9 pin, male-to-male) — connects the module to the CR1000X series,

CR300 series, CR1000, CR3000, CR800 series, and CR200(X) series **RS-232** port.

CPI/RS-232 RJ45 to DB9 Cable — connects the module to the CR6 series or CR1000X series **CPI/RS-232** port.

If connecting to Ethernet port:

Ethernet cable - connects the module to CR6 or NLxxx.

- Antenna — the following antennas are available from Campbell Scientific. Contact Campbell Scientific for help in determining the best antenna for your application.
  - 2 dBd 4G/3G Omnidirectional Antenna: An omnidirectional antenna with mounting bracket that is ideally suited for use with 4G and 3G cellular gateways. The mounting bracket attaches to a mast or crossarm, and it serves as the antenna ground plane. The antenna has an N type (female) threaded permanent stud for easy mounting to the included bracket or through an enclosure wall. A coaxial cable, sold separately, is required to connect this antenna to the inline surge suppression or module antenna jack. The antenna 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.

  - 8 dBd Yagi Wideband Antenna: A higher gain antenna that should be "aimed" at the service provider antenna. It covers both the 800-MHz band and the 1.9-GHz band. The antenna comes with bracket/U-bolt assembly for attaching the antenna to a mast or post. A coaxial cable, sold separately, is required to connect this antenna to the inline surge suppression or module antenna jack. This antenna is recommended for areas that require a higher gain antenna.

- 4G/3G Cellular Whip Antenna with SMA Connector: A wideband termination antenna with SMA connector and articulating base. It has a high-efficiency response on nearly all 4G, 3G, and 2G frequency bands and is, therefore, primarily used with cellular gateways and routers. This antenna attaches directly to the RV50 and 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.

7.2.1 RV50 mounting kit
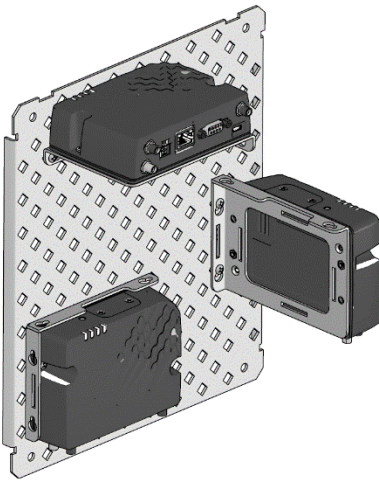
7.2.1.1 Mounting the RV50 flat on the backplate

Use the two included flat-head Phillips screws to mount the bracket to the backplate first. Then use two of the included pan-head Phillips screws to mount the RV50 to the bracket.

FLAT MOUNT
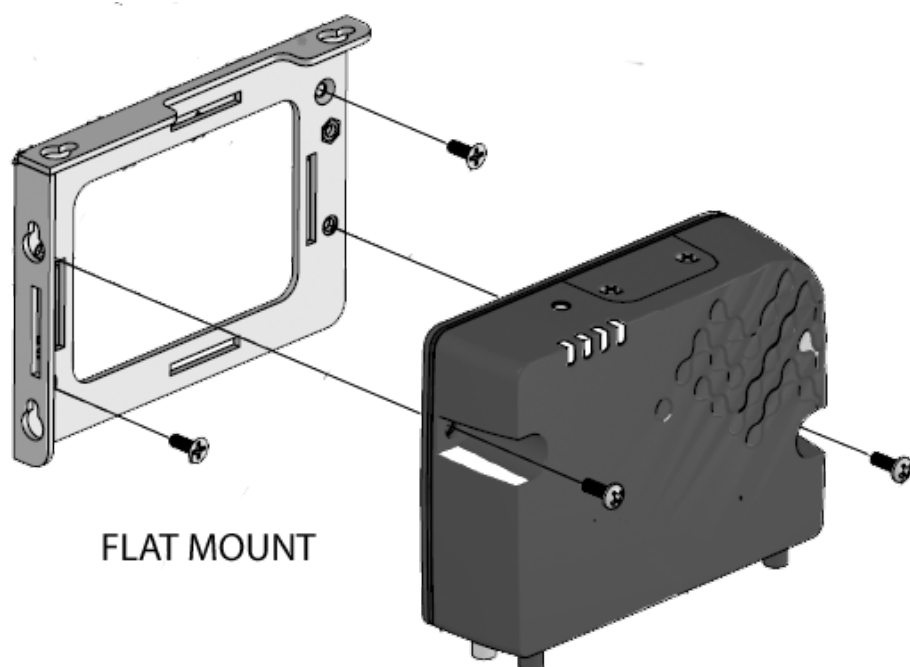
7.2.2 Mounting the RV50 on edge to the backplate

Use two of the included pan-head Phillips screws to mount the RV50 to the bracket. Then use two of the included pan-head Phillips screws to mount the bracket to the backplate.

EDGE MOUNT
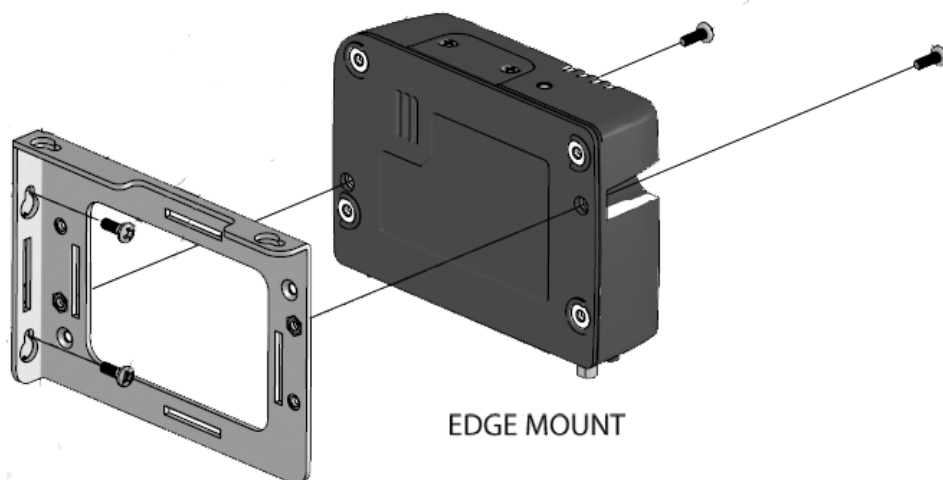
7.3 Wiring and connections

This section explains how to connect the module for different communications methods. It also describes how to power the module and connect an antenna.
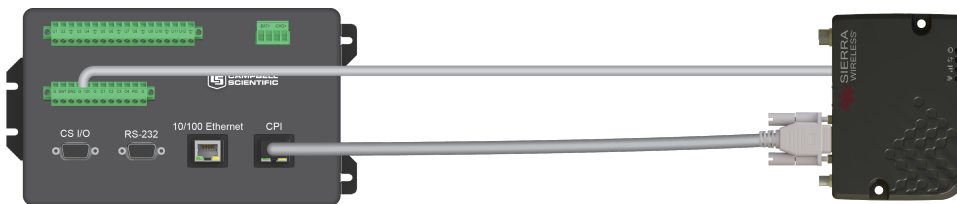
7.3.1 Module communications connections

RS-232 connection using a null module cable
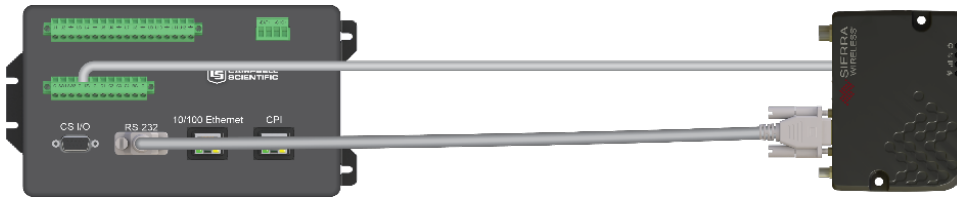
Null module Cable, is used to connect the module to the CR3000, CR800 series, CR2XX, CR300 series, CR1000, CR1000X series or CR5000 **RS-232** port.

CR6 RS-232 connection using a CPI/RS-232 cable

RS-232/CPI RJ45 to DB9 Male DTE, is used to connect the module to the CR6.

Ethernet connection
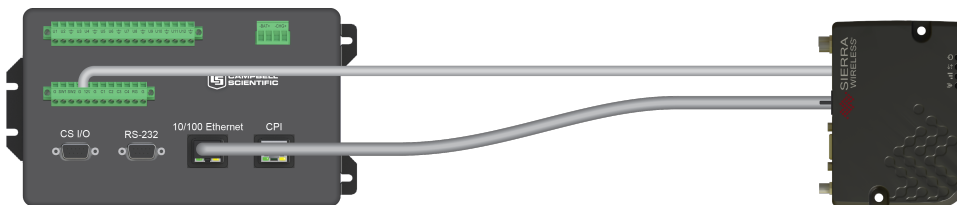
An Ethernet cable is used to connect the module to the **Ethernet** port of the datalogger, NL1XX, or NL2XX.

CS I/O connection using an SC105
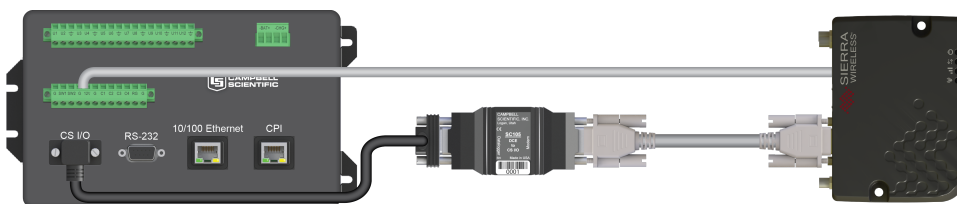
The SC105 interface is used to connect the module to a datalogger **CS I/O** port. The SC105 can be connected directly to the module **RS-232** port. Alternatively, it can be connected to the module

using the serial cable supplied with the SC105. The SC105 is attached to the datalogger **CS I/O port** using the SC12 cable supplied with the SC105.

7.3.2 Module power connections

When connecting through the **CS I/O port**, power for the module is provided by the data logger. When connecting through the **RS-232** port, power must be supplied through the **Power In** connector.

Controlling power to the RV50 (p. 32) provides an example CRBasic program using the `IPNetPower()` instruction to control power to the RV50. This functionality is available in the CR300 series (all operating systems), the CR6 series with operating system 09.00 or greater, and the CR1000X with operating system 03.00 or greater. To control power in these data loggers with older operating systems or any CR1000, CR800 series, or CR3000, you will need to use a **SW12V** port on the data logger and communicate over RS-232. When using a **SW12V** port, we recommend using a `PPPClose()` instruction to shut down the network prior to powering down the RV50.

The **USB** port provides power for module configuration, but is not sufficient for normal operation.

7.3.3 Antenna connections

Connect the antenna to the **Cellular** SMA antenna connector.

FIGURE 7-1. Antennna connections

Use of the **Diversity** antenna can improve performance, but is not required.

Antenna diversity, also called space diversity, is a scheme that uses two or more antennas to improve the quality and reliability of a wireless link. Often, especially in urban and indoor environments, there is no clear line of sight between transmitter and receiver. Instead, the signal is reflected along multiple paths before finally being received. Each bounce can introduce phase

shifts, time delays, attenuations, and distortions that can destructively interfere with one another at the aperture of the receiving antenna.

7.4 ACEManager and template files

QuickStart describes how to set up the RV50 in serial server mode using ACEmanager. ACE-manager along with template files can be used to set up the RV50 in serial server mode or PPP.

ACEmanager is accessed via a web browser. For initial setup or troubleshooting with a direct (cabled) connection, connect a standard Ethernet (RJ45) cable between the Ethernet port on the computer and that on the module. Type **http://192.168.13.31:9191** into a web browser.

Once the module is provisioned on the network, it may be accessed over the air by typing **http://** followed by the IP address of the module, followed by the port **:9191**.

The first screen is a login (shown below). The default password is 12345. We strongly recommend changing the default password to prevent unauthorized access and the potential of malware infection. The password can be changed from the **Admin** tab.

After entering the password and pressing enter (or clicking **Log In**), the following status screen is displayed:
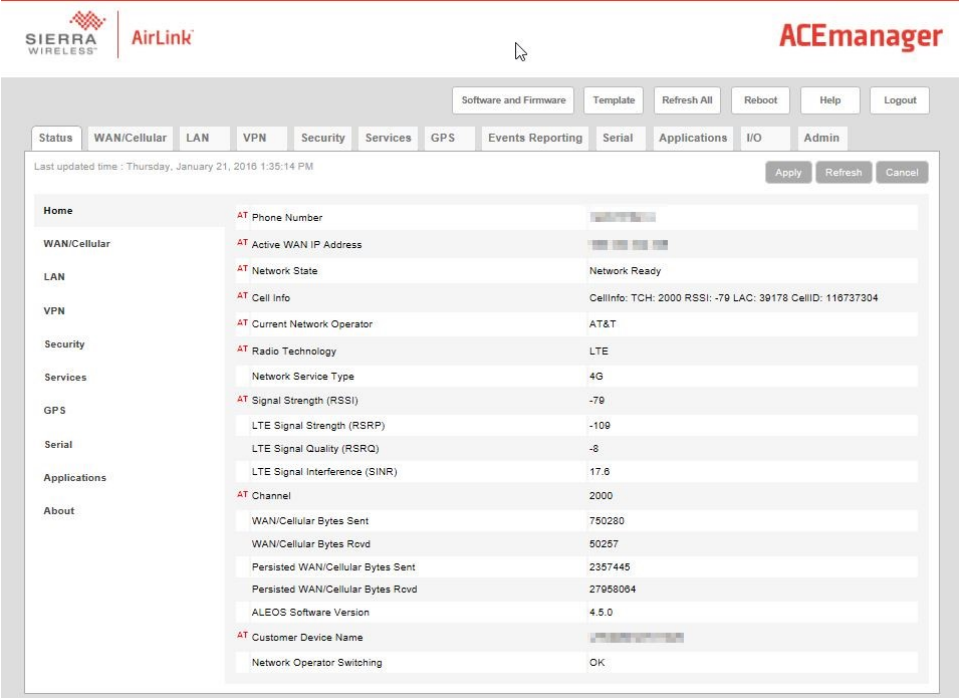
RV50 template files from the Campbell Scientific website (www.campbellsci.eu/downloads) are used to configure the RV50 module using ACEmanager.

Table 7-1: AceManager Template Files	
Template Files for the RV50	**Description**
RV50_115200.xml	Serial server mode or PPP mode, for newer dataloggers[1]
RV50_9600.xml	Serial server mode, for older dataloggers[2] that support 9600 baud
[1]CR1000, CR1000X series, CR800 series, CR3000, CR6 series, CR300 series, CR5000 [2]CR200(X)	

Click the **Template** menu in the top right of the screen. When prompted for a template file name, select **RV50_115200.xml** or **RV50_9600.xml**. The following screen shows the settings under the **Serial** tab after the 115200 baud template file has been loaded.

Click on **WAN/Cellular** for the following screen:

Enter the APN as shown in the screen above. The example is for an **APN = I2GOLD**.

After the template file has been loaded, and the APN entered, click **Apply** to save the changes in the module.

Click **Reboot** to restart the module. Alternately, reset the module by pressing **Reset** on the front of the module or by removing power from the module.

Click **Logout** to terminate communications with the module.

> **WARNING:**
> Unless you Apply the commands, the changes made will not be saved in the module. For most commands, you must reboot the module for the newly written values to take effect.
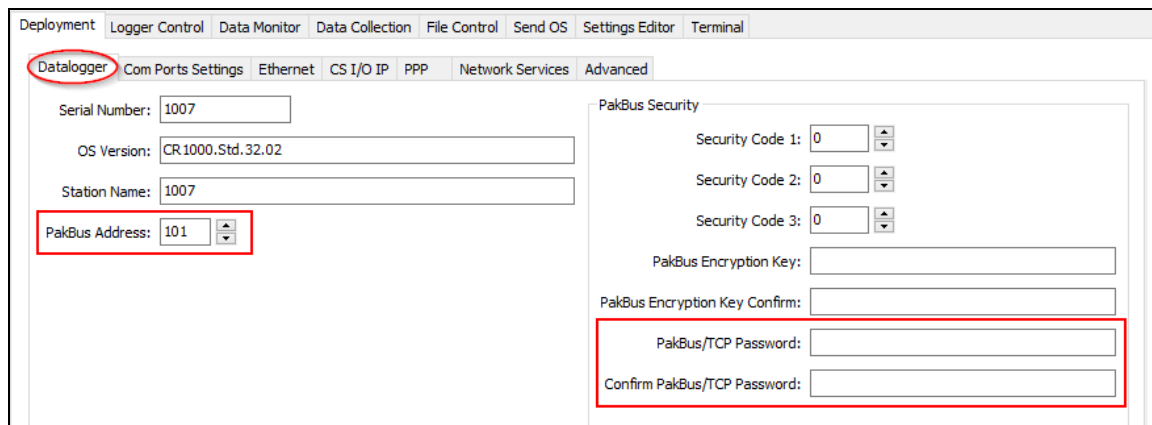
The module is now set up in serial server mode. Alternatively, to enable PPP mode, see Enabling PPP mode (p. 23).

7.5 Enabling PPP mode

The first step in enabling PPP mode is using the template file to configure the RV50 as described in ACEManager and template files (p. 20)

Launch the Device Configuration Utility . All tabs are within the **Deployment** category.

On the **Datalogger** tab, change the data logger **PakBus Address** and optional **PakBus/TCP Password** to match the values entered in the Set up Konect PakBus Router (p. 6) step.

On the **Com Ports Settings** tab, **Select the COMPort** where the module is connected; this is generally RS-232 or CS I/O. When connecting to the CS I/O port, the default address is SDC8. When connecting via RS-232, change the **Baud Rate** to **115200 Fixed**.

On the **PPP** tab select the **Config/Port Used** where the modem is connected. This is the same as was selected on the **Com Ports Settings** tab. Set **Modem Dial String** to AT\APPP.

On the **Network Services** tab, in the **PakBus/TCP Clients** box, type the DNS address and Port number noted during the Set up Konect PakBus Router (p. 6) step.
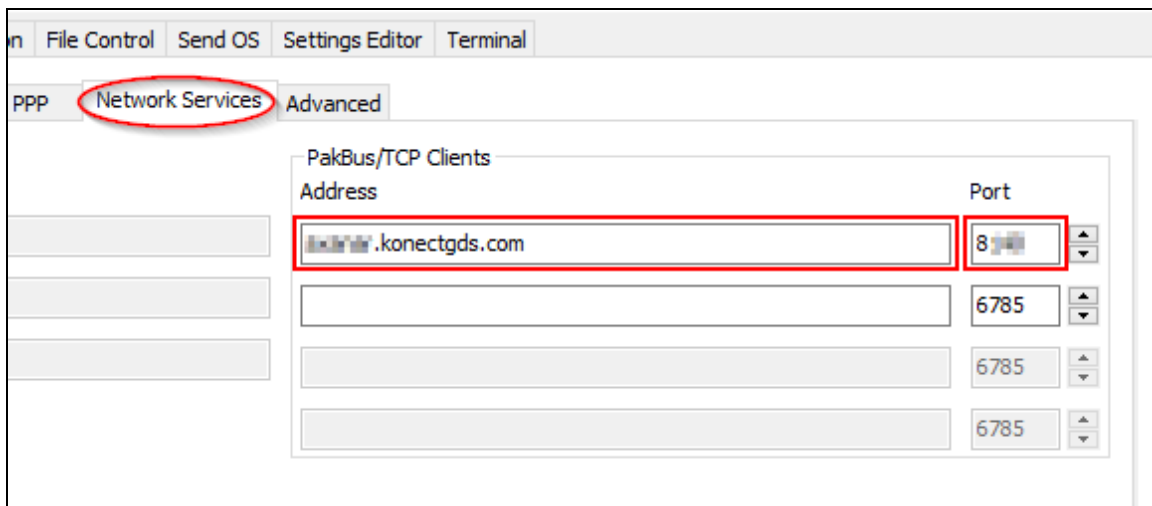
Apply to save your changes.

7.6 Set up LoggerNet

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

> **NOTE:**
> Setup has two options, EZ (simplified) and Standard. 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 in the following steps:

1. Select **Add Root** > **IPPort**.
2. Select **PakBusPort** and **pbRouter** for PakBus data loggers such as the CR1000X.

3. Add a data logger to the **IPPort** or **pbRouter**.
4. Select the **IPPort** in the Network Map. Enter the Konect PakBus Router DNS address and port number as noted in the Konect PakBus Router setup. The DNS address and port number are input in the **Internet IP Address** field separated by a colon. For example,

axanar.konectgds.com:pppp where pppp is the port number.

5. For PakBus data loggers, leave the default settings for the **PakBusPort. PakBus Port Always Open**; it should not be checked. If used, enter the **TCP Password**.

6. For PakBus data loggers, select the pbRouter in the Network Map and set the **PakBus Address** to **4070**.

7. For PakBus data loggers, select the data logger in the Network Map and set the **PakBus Address** to match that of the data logger (default address in the data logger is 1). Click

Apply to save the changes.

7.7 Test the connection

After the Network Map has been configured, test the cellular connection by using the **Connect** screen as shown in the following image. Click on the appropriate station and click **Connect** to initiate a call to the data logger.

> **TIP:**
> The connection time is subject to many external factors and could be up to fifteen minutes. Be patient.

If the call is successful, the connectors at the bottom of the screen will come together and clock information from the data logger will be displayed in the **Station Date/Time** field. If the connection fails, a **Communications Failure** message will be displayed.
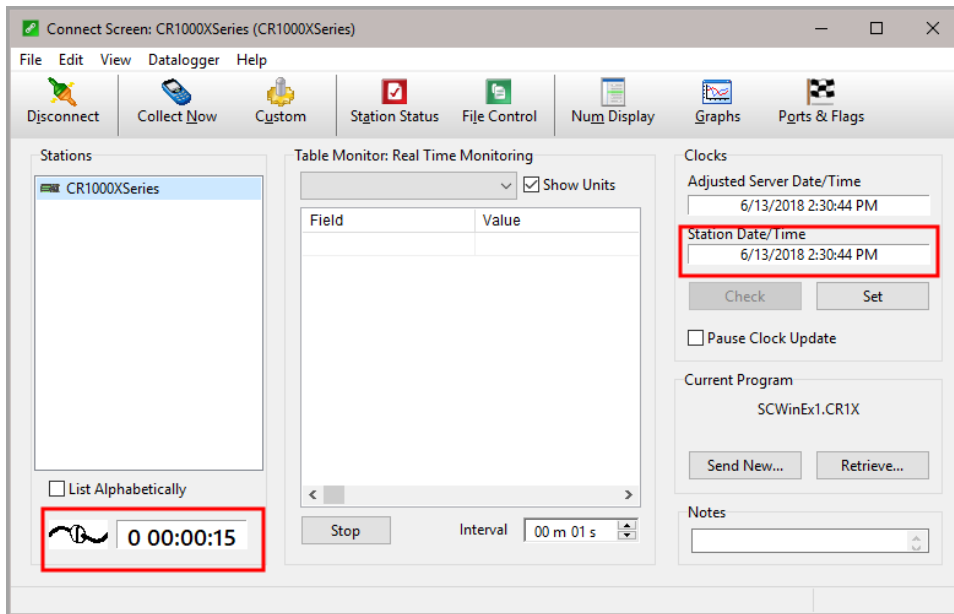
8. Operation

8.1 Ports

RS-232

The **RS-232** port is the main port used with Campbell Scientific dataloggers. Its function is described throughout this manual.

USB

The **USB** port is not used in Campbell Scientific applications.

Ethernet

The **Ethernet** port may be used in place of PPP Mode to get to the IP stack of the datalogger. However, this method comes with higher current drain for both the module and the datalogger. See Using the RV50 Ethernet port (p. 34) for more information.

8.2 LED indicator lights

When your RV50 is connected to power and an antenna, there is a specific pattern to the lights to indicate its operation mode as described in the following table:

Table 8-1: LED indicator lights			
LED	**Color / Pattern**	**Description**	**LED Power Saving Mode**
Power	Off	No power or input voltage ≥ 36 Vdc or ≤ 7 Vdc	
	Solid Green	Power is present.	
	Green with Amber Flash	Power is present and the gateway has a GPS fix.	
	Solid Red	Standby mode	
	Flashing Green	When you press the reset button, flashing green indicates when to release the reset button to reboot the gateway.	
	Flashing Red	When you press the reset button, flashing red indicates when to release the reset button to reset the gateway to the factory default settings.	
Signal	Solid Green	Good signal (equivalent to 4–5 bars)	Off
	Solid Amber	Fair signal (equivalent to 2–3 bars)	Off
	Flashing Amber	Poor signal (equivalent to 1 bar) If possible, Sierra Wireless® recommends moving the gateway to a location with a better signal.	
	Flashing Red	Inadequate (equivalent to 0 bars) Sierra Wireless recommends moving the gateway to a location with a better signal.	
NOTE: The quality of the signal strength is measured using the appropriate parameters for the radio technology in use.			

Table 8-1: LED indicator lights			
LED	**Color / Pattern**	**Description**	**LED Power Saving Mode**
Network	Solid Green	Connected to an LTE network	Off
	Solid Amber	Connected to a 3G or 2G network	Off
	Flashing Green	Connecting to the network	
	Flashing Red	No network available	
	Flashing Red / Amber	Network Operator Switching is enabled, but the gateway is unable to locate the required firmware. For more information, refer to the ALEOS Software Configuration User Guide (Admin chapter) from the Sierra Wireless website.	
Activity	Flashing Green	Traffic is being transmitted or received over the WAN interface.	
	Flashing Red	Traffic is being transmitted or received over the serial port. This behavior only appears if the RV50 is configured to display it. For more information, refer to the ALEOS Software Configuration Guide (Serial chapter) from the Sierra Wireless website.	
	Flashing Amber	Traffic is being transmitted or received over both the WAN interface and the serial port. This behavior only appears if the RV50 is configured to display it. Refer to the ALEOS Software Configuration Guide (Serial chapter) from the Sierra Wireless website.	
ALL	Green LED chase	Radio module reconfiguration/firmware update or Network Operator Switching is in progress.	
	Amber LED chase	ALEOS software update is in progress.	

8.3 Rebooting the RV50

To reboot the RV50:

- On the RV50, press the **Reset** button for 1–5 seconds. (Release the button when the **Power** LED flashes green.)
- In ACEmanager, click the **Reboot** button on the toolbar.

8.4 Reset the RV50 to factory default settings

To reset the RV50 to the factory default settings:

- On the RV50, press the **Reset** button for more than 5 seconds. (Release the button when the **Power** LED flashes red.) Once the LEDs resume their normal operating behavior, the reset is complete.
- In ACEmanager, go to **Admin | Advanced** and click the **Reset to Factory Default** button.

9. Attributions

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Appendix A. Controlling power to the RV50

The RV50 uses considerably more power than the datalogger. Therefore, it may be necessary to use the datalogger to control power to the RV50. The following program examples show how to control power to the RV50 using the switched 12V (**SW12V**) terminal on the datalogger.

This example shows how to control power to the RV50 by using the CRBasic `TimeIsBetween ()` instruction to turn on **SW12** for 15 minutes every 60 minutes between 9:00 a.m. and 5:00 p.m.

> **NOTE:**
> The `TimeIsBetween ()` requires operating system version 28.00 or greater in the CR1000, CR3000, or CR800. It is supported in all CR1000X, CR6, and CR300 operating systems.

CRBasic Example 1: Turn RV50 ON and OFF under data logger control

```
'CR300 Series

'Declare Variables and Units
Public BattV
Public PTemp_C
Public ModuleState As Boolean

Units BattV=Volts
Units PTemp_C=Deg C

'Define Data Tables
DataTable(Daily,True,-1)
  DataInterval(0,1440,Min,10)
  Minimum(1,BattV,FP2,False,False)
EndTable

'Main Program
BeginProg
  'Main Scan
  Scan(5,Sec,1,0)
    'Default Data Logger Battery Voltage measurement 'BattV'
    Battery(BattV)
    'Default Wiring Panel Temperature measurement 'PTemp_C'
    PanelTemp(PTemp_C,60)
    'Between the hours of 9:00 and 17:00, turn the RV50
    'on for 15 minutes at the start of every hour
```

```
    If TimeIsBetween(9,17,24,Hr) AND TimeIsBetween(0,15,60,Min) Then
      ModuleState=True
    Else
      ModuleState=False
    EndIf
    'Always turn OFF RV50 if battery drops below 11.5 volts
    If BattV<11.5 Then ModuleState=False
    'Set RV50 power to the state of 'ModuleState' variable
    SW12(ModuleState)
    'Call Data Tables and Store Data
    CallTable Daily
  NextScan
```

Appendix B. Using the RV50 Ethernet port

The RV50 **Ethernet** port can be used to communicate with IP-enabled devices such as dataloggers and IP cameras. However, the use of Ethernet communication increases the total system current demand (the module and the device you are connecting to) by several milliamps as compared to the use of serial communication.

The following example can be used to communicate with a CR1000 / NL121 via the RV50 **Ethernet** port. Port forwarding in the RV50 must be enabled and specific ports need to be forwarded to the CR1000 (in this case ports 80 and 6785). Additional ports can be configured as needed. The host IP address 192.168.13.50 specified in the figure below is the IP address of the CR1000.

For this example, a static **IP Address**, **Subnet Mask**, **IP Gateway**, and **DNS Server** is configured in the CR1000 as shown in the figure below. The example CR1000 IP address of 192.168.13.50 is the same address used in the RV50 port forwarding configured previously.
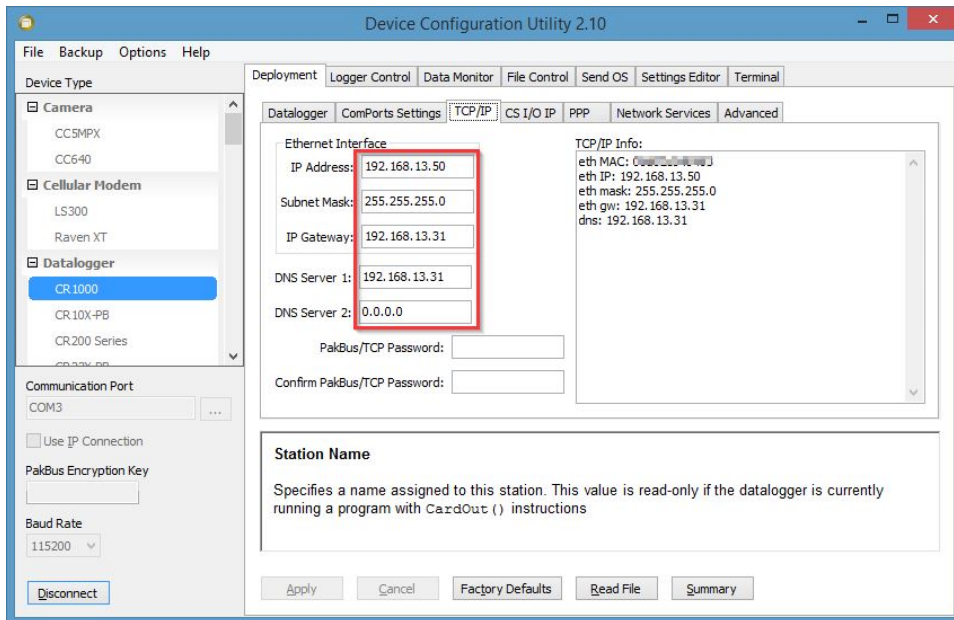
Once the RV50 and the CR1000 have been configured and the RV50 has been rebooted, you can communicate with the CR1000 via LoggerNet using the public IP address of the RV50 and port 6785. You can also open a web browser and enter the public IP address of the RV50 to see the default web page of the CR1000.

Appendix C. Verizon Wireless and AT&T

> **NOTE:**
> Campbell Scientific can provide Verizon Wireless or AT&T service. This is the simplest way to set up your module on the Verizon Wireless or AT&T network. See Campbell Scientific cellular data service (p. 3).

C.1 Verizon Wireless

What you need:

- Verizon Wireless 4G LTE CAT-1 coverage at the data logger site. For a coverage map, refer to: www.verizonwireless.com/landingpages/better-matters/#maps
- Verizon Wireless 4G LTE private dynamic IP account in conjunction with Campbell Scientific Konect PakBus Router Service. (A Verizon Wireless 4G LTE static unrestricted IP account can also be used. However, Verizon generally requires new users to have 50 lines of service to obtain the static unrestricted IP account. Also, there is generally a $500 one-time-per-customer charge to activate static IP on the account.)

To set up an account, you will need the IMEI number of the module. The IMEI number is listed on a label on the module. To set up an account with Verizon Wireless, call:

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

Verizon Wireless will provide a SIM card for each module. The micro-SIM (3FF) card must be installed inside of the module as described in Install the SIM card (p. 3). In addition to the SIM card, you should receive:

- 10-digit MSISDN number (telephone number associated with the SIM, used for billing)
- An APN (Access Point Name) for 4G LTE CAT-1 service. A common APN used for this application is: VZWINTERNET. The user must program the APN name into the module as described in Configure RV50 (p. 7).
- For static IP accounts only, an IP Address will be included.

C.2 AT&T

What you need:

- AT&T 4G LTE CAT-1 coverage at the data logger site. For a coverage map refer to: www.at-t.com/maps/wireless-coverage.html.
- AT&T 4G LTE private dynamic IP account in conjunction with Campbell Scientific's Konect Router Service. (An AT&T 4G LTE static unrestricted IP account can also be used. However, AT&T charges $3/month/device for the static IP account.)

To set up an AT&T account, contact your AT&T Business Account Representative or Blu-Telecommunications.

Blu-Telecommunications is part of the Alliance Channel with AT&T and can assist any customer nationwide. Blu-Telecommunications will contact AT&T and work with an AT&T account manager to set up an account.

Contact information for Blu-Telecommunication:

Website: www.blu-tel.com
Phone number: (877) 422-2616, or Email box: i2gold@blu-tel.com
What to ask for: M2M Setup
Who to ask for: Carlos Morales or Andy Tran

An APN must be added onto the account to make the module accessible through the Internet. For networks with fewer than 30 modules, the standard 'I2Gold APN' can be used; networks with more than 30 modules will require a 'Custom APN'. A Custom APN has a setup fee starting at $500 and takes a minimum of 7 to 14 business days to complete. The user must program the APN name into the module as described in Configure RV50 (p. 7).

AT&T will provide a Subscriber Identity Module (SIM) card for each module. The micro-SIM (3FF) card must be installed inside of the module as described in Install the SIM card (p. 3). In addition to the SIM card, you should receive:

- 10-digit MSISDN number (telephone number associated with the SIM, used for billing)
- An APN (Access Point Name) for 4G LTE CAT-1 service. A common APN used for this application is: BROADBAND. The user must program the APN name into the module as described in Configure RV50 (p. 7).
- For static IP accounts only, an IP Address will be included.

Appendix D. Regulatory information

This information provided by Sierra Wireless®.

D.1 Important information for North American users

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 own expense.

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

D.2 RF exposure

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 20 cm should be maintained from the antenna and the user's body.

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 the specifications listed below for the device used.

Device	Frequency Band	FCC ID/IC Number N7NMC7355 2417C-MC7355
AirLink RV50	Cellular Band	6.5 dBi
	PCS Band	3.0 dBi
	Band 4	6.0 dBi
	Band 13	9.0 dBi
	Band 17	9.0 dBi
	Band 25	3.0 dBi

D.3 EU

Sierra Wireless hereby declares the AirLink RV50 devices is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

The RV50 displays the CE mark.

CE

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

This product is only to be installed by qualified personnel.

D.4 Declaration of conformity

The Declaration of Conformity made under Directive 1999/5/EC is available for viewing at: http://-source.sierrawireless.com/resources/airlink/-certification_and_type_approval/rv50_ce_declar-ation_of_conformity/

D.5 RoHS compliance

DECLARATION OF EUROPEAN UNION RoHS COMPLIANT PRODUCT

Sierra Wireless S.A. for itself and its subsidiaries (collectively, "Sierra Wireless") certifies that to the best of its knowledge the products identified below to be "RoHS Compliant":

Item	Product Description
1	RV50

RoHS compliant defines that the product conforms to the requirements of the European Union's restriction on use of hazardous substances in electrical and electronics equipments directive, 2011/65/EC (RoHS directive") which limits the content of certain hazardous substances.
The RoHS directive is with respect to any homogenous components used in the product as shipped by Sierra Wireless, in its entirety.

ROHS - Exemptions according to annex III

☐ No exemption
☒ Exemption 6(b): Lead as an allying element in aluminum containing up to 0.4 % lead by weight
☒ Exemption 6(c): Copper alloy containing up to 4 % lead by weight
☐ Exemption 7(a): Lead in high melting temperature type solder (ie lead-based alloys containing 85% by weight or more lead)
☐ Exemption 7(c)-I: Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, eg piezoelectronic devices, or in a glass or ceramic matrix compound
☐ Exemption 7(c)-II: Lead in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher
☐ Exemption 15: Lead in solders to complete a viable electrical connection between semiconductor die and carrier with integrated circuit flip chip packages.
☐ Other exemption than above.

Sierra Wireless has reach its conclusion that the products listed above are RoHS compliant based on its knowledge and belief via internal design controls, analytical test data and information provided by its component suppliers. However, Sierra Wireless makes no representation or warranty as to the accuracy of such third party information.

Sierra Wireless, S.A.

Name: Rafet Lakhdar
Title: Operations Director EMEA
Date: August 31th, 2015

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