

# 4GMini/4GPlus <u>Cellular Modem</u>

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## 1. Introduction

This manual provides information for interfacing the 4GMini/4GPlus Cellular Modems to Campbell Scientific dataloggers. Please note that this manual will focus on the use of Bell, Telus, and Rogers networks.

The 4GMini/4GPlus Cellular Modems are high-speed interfaces optimized for use on the 4G (LTE) network. The modem is accessed through the Internet using TCP/IP communication protocols using a Public IP address (Dynamic or Static).

These cellular modems offer two-way communication between a datalogger (and other devices such as the CCFC camera) and any computer with Internet access.

## 2. Initial Inspection

- Upon receipt of your cellular modem, inspect the packaging 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.
- The 4GMini and 4GPlus cellular modems are shipped with an informational USB.

## 3. Cautionary Statements

- Although these cellular modems are designed to be rugged and reliable devices for field use, care should be taken when handling or moving them to avoid damage.
- There are no user-serviceable parts and any attempt to disassemble the device will void the warranty.
- To avoid possible damage, an antenna should be connected to the modem prior to applying power.

## 4. Specifications

## General

- Operating Temperature:  $-40^{\circ}C (40^{\circ}F)$  to  $85^{\circ}C (185^{\circ}F)$
- Humidity: 5% to 95% non-condensing

## **Serial Interface**

• RS-232, RS-485, RS-422

## Serial Baud Rate

• 300bps to 921kbps

### Ethernet

• 10/100 BaseT, Auto – MDI/X, IEEE 802.3

## I/O

- 2x Programmable Analog/Digital Inputs
- Up to 2x Digital Outputs 60mA current sink on open drain

#### SIM Card

• Dual: 1.8 / 3.0V (2FF)

#### **PPP** Characteristics

• Dial on Demand/Idle Time

## **Network Protocols**

- TCP
- UDP
- TCP/IP
- TFTP
- ARP
- ICMP
- DHCP
   HTTP
- HTTP
- HTTPS\*
- SSH\*
- SNMP
- FTP
- DNS
- Serial over IP
- QoS

## Management

- Telnet
- WebUI
- SNMP
- FTP & Wireless Upgrade
- RADIUS authentication

#### Diagnostics

- Temperature
- RSSI
- Remote Diagnostics

#### **Input Voltage**

• 7 - 30 Vdc

## **Power over Ethernet (POE)**

• Passive PoE on Ethernet Port (LAN)

#### GPS

- Tracking Sensitivity: -158 dBm (50% valid fixes)
- Tracking L1, CA code
- 12 Channels
- Max. update rate 1Hz

• Error calculated location less than 11.6 meters 67% of the time; less than 24.2 meters 95% of the time

## **GPS Antenna Requirements**

- Frequency Range: 1575.42MHz (GPS L1 Band)
- Bandwidth: ± 2MHz
- Total NF <2.5dB
- Impedance 500hm
- Amplification (Gain applied to RF connector): 19-23bD
- Supply Voltage 1.5V to 3.05V
- Current Consumption: Typical 20mA (100mAmax)
  - Cellular Power Antenna Rejction + Isolation:
    - o 824 915MHz>10dB
    - o 1710-1785MHz>19dB
    - o 1850-1980MHz>23dB

## 4.1 4GMini

## Dimensions

•

- Length: 45mm (1.75")
- Height: 85mm (3.25")
- Width: 25mm (1.0")

#### Weight

• Approximately 150g

## **Supported Bands**

- LTE FDD (Bands 1-5, 7, 8, 13, 17, 18, 19, 20)
- UMTS | DC-HSPA+ (Bands 1, 2, 4, 5, 8)
- GSM | GPRS | EDGE (Bands 2, 3, 5, 8)
- 3GPP Protocol Stack Release 9

## **Data Features**

- LTE: DL 100 Mbps, UL 50 Mbps
- HSPA+:DL 42 Mbps, UL 5.7 Mbps
- HSPA+:DL 21 Mbps, UL 5.7 Mbps
- WCDMA: DL/UL 384 kbps
- EDGE Class 33: DL/UL 236.8 kbps
- GPRS Class 33: DL/UL 85.6 kbps

## **TX** Power

- WCDMA/HSDPA/HSUPA Power Class
- Power Class 3 (24 dBm) for WCDMA/HSDPA/HSUPA mode GSM/GPRS Power Class
- Power Class 4 (33 dBm) for GSM/E-GSM bands
- Power Class 1 (30 dBm) for DCS/PCS bands
- EDGE Power Class
- Power Class E2 (27 dBm) for GSM/E-GSM bands
- Power Class E2 (26 dBm) for DCS/PCS bands

## USB

- USB 2.0
- USB Console Port
- USB to Serial Data Routing

- USB to Ethernet Data Routing (NDIS)
- USB OTG (Host)

#### Connectors

- Antenna(e): CELL, DIV, GPD: SMA Female
- Data: Data:DB-9 Female (RS-232); Ethernet:RJ45

### Current Draw (at 12Vdc)

- Average with Serial Data: 115mA
- Average with Ethernet Data: 130mA
- Tx Max: 210mA

## 4.2 4GPlus

## Dimensions

- Length: 56mm (2.21")
- Height: 97mm (3.85")
- Width: 37mm (1.46")

## Weight

• Approximately 245g

## **TX Power**

- WCDMA/HSDPA/HSUPA Power Class
- Power Class 3 (24 dBm) for WCDMA/HSDPA/HSUPA mode GSM/GPRS Power Class
- Power Class 4 (33 dBm) for GSM/E-GSM bands
- Power Class 1 (30 dBm) for DCS/PCS bands
- EDGE Power Class
- Power Class E2 (27 dBm) for GSM/E-GSM bands
- Power Class E2 (26 dBm) for DCS/PCS bands

#### USB

- USB 2.0
- USB Console Port
- USB to Serial Data Routing
- USB to Ethernet Data Routing (NDIS)

## North Americian Supported Bands

- UMTS | DC-HSPA+ (Bands 1, 2, 4, 5, 8)
- GSM | GPRS | EDGE (Bands 2, 3, 5, 8)
- 3GPP Protocol Stack Release 9

### North American Supported Data Features

- LTE: DL 100 Mbps, UL 50 Mbps
- HSPA+:DL 42 Mbps, UL 5.7 Mbps
- HSPA+:DL 21 Mbps, UL 5.7 Mbps
- WCDMA: DL/UL 384 kbps
- EDGE Class 33: DL/UL 236.8 kbps
- GPRS Class 33: DL/UL 85.6 kbps

## **China Supported Bands**

- LTE FDD: Bands 1, 3, 8, all bands with diversity
- LTE TDD: Bands 39, 40, 41(38), all bands with diversity

- DC-HSPA+/HSPA+/HSPA/UMTS: Bands 1, 5, 8, 9, all bands with diversity
- TD-SCDMA: Bands 34, 39, all bands with diversity
- GSM/GPRS/EDGE: 1800 MHz/900MHz

#### **China Supported Data Features**

- LTE: FDD: UL 50Mbit/s, DL 150Mbit/s@20M BW cat4
- LTE: TDD: UL 10Mbit/s, DL 112Mbit/s@20M BW cat4
- TD-SCDMA PA: UL 384kbit/s; DL 384 kbit/s
- TD-HSPA+: UL 2.2Mbit/s; DL 4.2Mbit/s
- DC-HSPA+: UL 5.76Mbit/s; DL 42 Mbit/s
- HSPA+: UL 5.76Mbit/s; DL 21.6 Mbit/s
- WCDMA PS: UL 384kbit/s; DL 384 kbit/s
- WCDMA CS: UL 64kbit/s; DL 64 kbit/s
- EDGE: UL 236.8 kbit/s; DL 236.8 kbit/s
- GPRS: UL 85.6 kbit/s; DL 85.6 kbit/s

#### **Current Draw (at 12Vdc)**

| Model                    | AVG (mA) | w/WiFi (AP) |
|--------------------------|----------|-------------|
| BulletPlus               | 120      | 170         |
| BulletPlus + Serial Data | 142      | 180         |
| BulletPlus + Ethernet    | 155      | 195         |
| BulletPlus Peak          | 230      | 305         |

## 5. Installation

Note

It is recommended to discuss the account types available and their requirements with the intended service provider before purchasing the 4GMini or 4GPlus Cellular Modem.

A public IP (Dynamic or Static) subscription on the HSPA network is required. Service providers tend to have different names or descriptions for these service add-ons. Following are key terms for each service provider:

#### Bell

- Public Dynamic IP Access
- Public Static IP Access

#### Telus

- Public Dynamic IP Connect
- Public Static IP Connect

#### Rogers

- Public Dynamic IP
- Public Static IP

#### Data plan type

• "Flex Data for Tablet" – (all 3 service providers)

What will be received from each service provider:

- SIM card (standard size)
- 10-digit cellular telephone number
- Access Point Name (APN)
- User name
- Network password for use with user name (optional, based on configuration)

## 5.1 Datalogger Equipment Requirements

To carry out network provisioning, a PC running Campbell Scientific's LoggerNet or PC400 software with Internet access is required.

Additionally:

- A 4GMini or 4GPlus cellular modem
- Power cable
- Antenna(e): The antenna(e) chosen for use must be connected to the Antenna connector of the cellular modem. If using a diversity antenna, it must be connected to the Rx diversity connector.
- L18663 Null Modem Cable is required if the modem is to be connected to the RS-232 port of a datalogger.
- L31056 used to connect the CR6 CPI port to the L18663 Null Modem Cable.
- L28900 Ethernet Cable connects the modem's Ethernet port to a PC, CR6 or other Ethernet device. The L28900 is commonly used to configure the modem. The 4GMini or 4GPlus Ethernet ports are autosensing; therefore, a cross-over cable may also be used (optional).
- C2809 USB Cable connects the modem's USB port to a PC to configure the modem (optional).
- SC932A Interface is required if the modem is being connected to the CS I/O port of a datalogger.

**Note** If there is a black SC12 cable that is not Rev1 or newer (indicated on the cable), it is a CS I/O cable and will not work for RS-232. Connect the black SC12 cable between the datalogger and the SC932A. Use a 9 pin serial cable or a blue ribbon cable between the modem and the SC032A.

## 6. Configuration

## 6.1 Getting Started

1. SIM Card: insert the card, using the correct orientation, into the slot located on the front of the modem. The card is properly installed when it clicks into place. If only one SIM card is being used in the 4GPlus, ensure the card is inserted into card slot 1.



Sim slot for SIM1: The contacts should face down, and the notch to the right

2. Antenna: connect the antenna to the *Main* jack on the modem. Do this before applying power.



3. Connect the power connector to the modem and the power source (is using bare leads on power source end Red connects to +12V and Black connects to Power Ground; white and blue are not used).



4. Connect the USB (C2809), Ethernet (L28900) or equivalent cable between the modem and the PC to start the configuration process.

## 6.2 Connecting for Configuration

- In order to configure the modem, you must be connected via USB or Ethernet using a web browser (e.g. Internet Explorer).
- Be sure to allow the modem to warm up for at least two mintues before trying to connect.

## 6.2.1 Connect using USB or Ethernet

```
Note Requires the use of related USB driver and cable.
```

- Connecting using an ethernet cable: Enter the following IP address into the navigation bar of the web browser: http://192.168.168.1
- Connecting using an USB cable: Enter the following IP address into the navigation bar of the web browser: http://192.168.1.111
- Enter User ID (admin) and password (admin). After initial connection, a change of password is prompted and required.

## 7. Network Provisioning

s

Certain network provision configurations are specific to the service provider. If not specified, the configurations are the same for Bell, Telus, and Rogers.

To provision the modem on the service provider network, the following information needs to be entered into the *Config* tab under *Carrier*. Please note that the guidelines below may not apply in all cases. If provisioning issues are encountered, please contact the service provider for the APN, User Name, and password requirements for the specific SIM card.

| ystem Network Carrier V           | Vireless Firewall | VPN Ro | uter Serial | I/0 | GPS | Apps | Diag | Adm <u>in</u> |
|-----------------------------------|-------------------|--------|-------------|-----|-----|------|------|---------------|
| tatus Settings SMS SMSCo          | nfig DataUsage    |        |             | _   |     |      |      |               |
| Carrier Configuration             | 5                 |        |             |     |     |      |      |               |
| - i                               |                   |        |             |     |     |      |      |               |
| General                           |                   |        |             |     |     |      |      |               |
| Carrier status 0                  | Enable 🔻          |        |             |     |     |      |      |               |
| IP-Passthrough                    | Disable 🔻         |        |             |     |     |      |      |               |
| MTU Size(500~1500/Blank) ❶        |                   |        |             |     |     |      |      |               |
| SIM Selection                     | Dual SIM Cards V  | ]      |             |     |     |      |      |               |
| Dual Cards Management             |                   |        |             |     |     |      |      |               |
| Primary Slot 0                    | SIM Card-1 •      |        |             |     |     |      |      |               |
| SIM Card-1 (Bottom slot) Settings |                   |        |             |     |     |      |      |               |
| SIM Number(ICCID) 0               | 893026102030108   | 332398 |             |     |     |      |      |               |
| Data Roaming                      | Disable 🔻         |        |             |     |     |      |      |               |
| Carrier Operator                  | Auto 🔻            |        |             |     |     |      |      |               |
| Technologies Mode                 | AUTO •            |        |             |     |     |      |      |               |
| APN                               | wrstat.bell.ca    |        |             |     |     |      |      |               |
| Advanced+                         |                   |        |             |     |     |      |      |               |
| Network+                          |                   |        |             |     |     |      |      |               |
| SIM Card-2 (Top slot) Settings    |                   |        |             |     |     |      |      |               |
| SIM Number(ICCID) 💿               | N/A               |        |             |     |     |      |      |               |
| Data Roaming                      | Disable 🔻         |        |             |     |     |      |      |               |
| Carrier Operator                  | Auto 🔻            |        |             |     |     |      |      |               |
| Technologies Mode                 | AUTO •            | 1      |             |     |     |      |      |               |
| APN                               | wrstat.bell.ca    | _      |             |     |     |      |      |               |
| Advanced+                         |                   |        |             |     |     |      |      |               |
| Network+                          |                   |        |             |     |     |      |      |               |

FIGURE 7-1. Carrier Settings

# **Note** Both Public and Static APNs may differ across Canada, please contact the service provider for the appropriate APN.

## 7.1 Bell

If Static IP is being used, follow these steps:

- APN: For example, wrmstatic.bell.ca.ioe
- *Submit* (save)

If **Dynamic IP** is being used, follow these steps:

- APN: For example, mcorp.bell.ca.ioe
- *Submit* (save)

## 7.2 Telus

If **Static IP** is being used, follow these steps:

- APN: For example, static.telus.com
- *Submit* (save)

If **Dynamic IP** is being used, follow these steps:

- APN: For example, connect.telus.com
- Submit (save)

## 7.3 Rogers

If **Static IP** is being used, follow these steps:

- APN: For example, ltestatic.ip.apn
- Submit (save)

If **Dynamic IP** is being used, follow these steps:

- APN: For example, vpn.com or internet.com
- Submit (save)

| System    | Network          | Carrier  | Wireless     | Firewall | VPN   | Router | Serial        | I/0                 | GPS      | Apps            | Diag       | Admin     |  |
|-----------|------------------|----------|--------------|----------|-------|--------|---------------|---------------------|----------|-----------------|------------|-----------|--|
| ummary    | Settings         | Services | Keepaliv     | e Mainte | nance | Reboot |               |                     |          |                 |            |           |  |
| System I  | nformation       |          |              |          |       |        |               |                     |          |                 |            |           |  |
| System I  | Information      |          |              |          |       |        |               |                     |          |                 |            |           |  |
| Hos       | t Name           |          | UserDevice   |          |       | C      | escription    |                     |          | my              | Bulletplus | -GPS      |  |
| Proc      | Product Name     |          |              | OPS      |       | S      |               | 2016-05-16 10:33:47 |          |                 |            |           |  |
| Har       | Hardware Version |          |              |          |       | s      | System Uptime |                     |          | 48 min          |            |           |  |
| Soft      | Software Version |          |              |          |       | В      | uild Date     |                     |          | 201             | 6-05-09    |           |  |
| Soft      | Software Build   |          |              | 1014     |       |        | uild Time     |                     | 10:49:51 |                 |            |           |  |
| Tem       | perature (°C)    |          | 46.9         |          |       | s      | upply Volta   | age (V)             |          | 12.             | 23         |           |  |
| Carrier I | Information      |          |              |          |       |        |               |                     |          |                 |            |           |  |
| Mod       | dule Status      |          | Enabled      |          |       | 1      | MEI           |                     |          | 867             | 2230200    | 82723 0   |  |
| Cur       | rent APN         |          | wrstat.bell. | ca       |       | IMSI   |               |                     |          | 302610012606734 |            |           |  |
| Con       | nection Status   |          | Connected    |          |       | s      | IM Card       |                     |          | REA             | DY         |           |  |
| Net       | work             |          | N/A          |          |       | s      | IM Number     | (ICCID)             |          | 893             | 0261020    | 301083239 |  |
| Hon       | ne/Roaming       |          | Home         |          |       | P      | hone Num      | ber                 |          | 158             | 7432793    | 9         |  |
| Cur       | rent Technolog   | IY       | WCDMA        |          |       | c      | ell ID        |                     |          | 793             | 20699      |           |  |
| Serv      | vice Mode        |          | WCDMA        |          |       | -      | hannel Nu     | mbor                |          | 105             | 7          | _         |  |
| IP A      | ddress           |          | 184.151.22   | 20.2     |       | R      | SSI (dBm)     |                     |          | -55             | dBmIl      | Ĭ         |  |
|           |                  |          | 70.28.245.   | 227      |       | R      | SCP (dBm)     |                     |          | -63             |            |           |  |
| DNS       | 5                |          | 184.151.1    | 18.254   |       | E      | CNO (dB)      |                     |          | -8              |            |           |  |

#### FIGURE 7-2. System - Summary

When provisioning details are saved to the modem, it should provision on the network. The following should be visible from the *System Summary* page.

- Connection Status: Connected
- Network = Name of the service provider
- SIM card: Ready

Check the RSSI value for signal strength. Signal strength should be greater than 105dBm; the preferred signal strength is greater than -95.

## 7.4 Dynamic DNS (DDNS)

## Note

If the modem is configured with a Static IP, skip this step. If the modem is configured with a Dynamic IP, complete this step.

In order to complete this step, sign-up online for a Dynamic Domain Name System (DDNS) service. Free services are available, but a paid service may be recommended, depending on the application or network size (i.e. ChangeIP.com or dyn.com).

To setup the DDNS, follow these steps:

1. Navigate to the DDNS link under the Network tab.

- 2. Enable DDNS by selecting it from the drop down menu.
- 3. Select a DDNS service from the drop down menu.

4. Enter related domain, user name, and password for the service that has been signed up for.

5. Submit to commit changes to the modem.

## 7.5 Serial Port Configuration

In order for the modem to communicate with a Campbell Scientific datalogger, the modem's serial port must be properly configured. The 4GMini/4GPlus has one 9-pin serial port. The COMport can be used for either a TCP server or PPP configuration.

A PPP configuration is possible for CR300, CR6, CR800 series, CR1000, or CR3000 dataloggers. This allows access to the connected datalogger's IP functionality (e.g. FTP client, Email client, HTTP server, and FTP server).

A TCP configuration is also possible for use with these dataloggers, if IP functionality is not required.

For any datalogger without an IP stack (e.g. CR200X series or legacy dataloggers), a TCP server configuration is the only option.

The following settings are applicable to the TCP server configuration. Parameters which are not specified, should be left at the default settings. Under *Serial*, navigate to the *RS-232* tab.

- Data Baud Rate = 115200 for use with a CR300, CR6, CR800 series, CR1000, or CR3000 datalogger. Or, 9600 for use with a CR200X series or legacy datalogger.
- Character Timeout = 50
- No-Connection Data Intake = Disable
- Local listening port = 6785 (default datalogger PakBus/TCP Service port)
- Submit (save)

| System Network Carrier                  | Firewall VPN | Serial             | USB   | I/0 | GPS | Applications | Admin |  |
|---|--------------|--------------------|-------|-----|-----|--------------|-------|--|
| Summary RS232                           |              |                    |       |     |     |              |       |  |
| RS232 Configuration                     |              |                    |       |     |     |              |       |  |
| RS232 Configuration                     |              |                    |       |     |     |              |       |  |
| RS232 Port status                       | Enable •     |                    |       |     |     |              |       |  |
| Data Baud Rate                          | 115200 🔻     |                    |       |     |     |              |       |  |
| Data Format                             | 8N1 T        |                    |       |     |     |              |       |  |
| Flow Control                            | none         | ۲                  |       |     |     |              |       |  |
| Data Mode                               | Seamless     | Transp             | arent |     |     |              |       |  |
| Character Timeout                       | 50           |                    |       |     |     |              |       |  |
| Maximum Packet Size                     | 256          |                    |       |     |     |              |       |  |
| No-Connection Data                      | Disable      | • Disable O Enable |       |     |     |              |       |  |
| MODBUS TCP Status                       | Disable      | Enable             |       |     |     |              |       |  |
| IP Protocol Config                      | TCP Server   |                    | •     |     |     |              |       |  |
| TCP Configuration                       |              |                    |       |     |     |              |       |  |
| Server Mode                             | Monitor      | Polling            |       |     |     |              |       |  |
| Polling Timeout (seconds)               | 10           |                    |       |     |     |              |       |  |
| Local Listening port                    | 6785         |                    |       |     |     |              |       |  |
| Incoming Connection<br>Timeout(seconds) | 300          |                    |       |     |     |              |       |  |

FIGURE 7-3. Serial – RS-232

## 7.6 Firewall

The firewall controls incoming and outgoing traffic through the modem, based on user-created rules. The firewall must be configured in order to communicate with the datalogger. Additionally, the firewall helps prevent unauthorized access of data useage. The following setup can be used with all service providers.

## 7.6.1 Firewall Rules (TCP Server)

Note

This section does not apply to PPP or Ethernet connections or devices.

The following steps for setting up the firewall assume a RS-232 or CS I/O connection to the modem's RS-232 port, when using the modem's TCP serial server mode.

1. Navigate to the *General* tab under the *Firewall* section.

2. Ensure *Carrier Remote Management* is Enabled. The allows remote configuration of the modem, if required.

3. Set Carrier request to Block.

4. Click Submit to save changes.

With the firewall enabled, it is possible to define specific traffic that will be allowed by configuring the destination port:

1. Navigate to the *Rules* tab.

- 2. Enter a name for the rule (Loggernet in the image below).
- 3. Verify that the action is set to *Accept*.
- 4. Select *Carrier* from the source list.
- 5. Select *Carrier* from the destination list.
- 6. For both Source IP and Destination IP, select the radio button Subnet/Prefix.

7. Configure the Destination Port to match that of the datalogger (i.e. 6785). This must be the same as the PakBus port and the local listening port configured in the *Serial RS-232* section.

8. Click Add Rule to add the rule of the modem's firewall.

9. In Source IP to and Destination IP to enter the following IP address: 255.255.255.255

9. Click Submit to save.

| Bule Name          | Loggemet  |         |          |     |  |  |  |
|--------------------|-----------|---------|----------|-----|--|--|--|
| ACTION             | Accept •  |         |          |     |  |  |  |
| Source 0           | Carrier • |         |          |     |  |  |  |
| Source IPs 0       | IP range  | Subnet  | / prefix |     |  |  |  |
|                    | 0.0.0.0   | 1-0-0-0 | 1        | 0   |  |  |  |
| Destination 0      | None V    |         |          | Lon |  |  |  |
| Destination IPs 😐  | IP range  | Subnet  | / prefix |     |  |  |  |
|                    | 0.0.0.0   |         | 1        | 0   |  |  |  |
| Destination Port 0 | 6785      |         |          | 5.0 |  |  |  |
| Protocol           | TCP *     |         |          |     |  |  |  |
| Add Rule           |           |         |          |     |  |  |  |
|                    |           |         |          |     |  |  |  |

FIGURE 7-4. Firewall Rules

| tem Network Ca               | rrier Firewall | VPN Serial L      | ISB 1/0 GPS       | Applications A   | Imin              | 2 AUN        |
|------------------------------|----------------|-------------------|-------------------|------------------|-------------------|--------------|
| imary General Po             | ort Forwarding | AC-IP List Rule   | Firewall Defau    | It               |                   |              |
| ewall Rules                  |                |                   |                   |                  |                   |              |
| Firewall Rules Configuration | n              |                   |                   |                  |                   |              |
|                              |                |                   |                   |                  |                   |              |
| Rule Name                    | rule1          |                   |                   |                  |                   |              |
| ACTION                       | Accept •       |                   |                   |                  |                   |              |
| Source C                     | None •         | about I and       |                   |                  |                   |              |
| Source IPs                   | e in range es  | subnet / prenx    |                   |                  |                   |              |
| Destination 0                | 0.0.0.0        | 10                | 0.0.0.0           | 1                |                   |              |
| Destination •                | None •         | dentes d'anna fra |                   |                  |                   |              |
| Destination ins              | lo o o o       | To To             | 0000              |                  |                   |              |
| Destination Past 0           | 0.0.0.0        | 10                | 0.0.0.0           |                  |                   |              |
| Protocol                     | TCD .          |                   |                   |                  |                   |              |
| Add Dule                     | ICP •          |                   |                   |                  |                   |              |
| Nuu Ruie                     |                |                   |                   |                  |                   |              |
| Firewall Rules Summary       |                |                   |                   |                  |                   |              |
| Name Action Src              | Src IP From    | Src IP To /Prefix | Dest Dest IP From | Dest IP To /Pr   | efix Dest Port Pr | rotocol      |
| Logat Accept Y Can           | rier • 0.0.0.0 | 255 255 255 21 0  | Carrier * 0.0.0.0 | 255 255 255 25 0 | 6785              | TCP . Remove |
| ( interest in our            |                |                   |                   | 255,255,255,255  | 10.00             |              |

FIGURE 7-5. Firewall Rules IP Address range

## 7.6.1.1 Port Forwarding (PPP and Ethernet Devices)

If the modem's serial PPP mode is being used or an Ethernet device (i.e. CCFC) is being connected to, port forwarding rules specifying how to direct incoming traffic to the device must be created. When there are multiple devices or only specific ports need to be passed, port forwarding is used to forward incoming traffic from the Wide Area Network (WAN) to specific IP addresses and ports on the Local Area Network (LAN). The 4GMini/4GPlus looks at each incoming Ethernet packet on the WAN and by using the destination port number, determines where it will send the data on the private LAN.

The fields required to configure port forwarding are found on the *Port Forwarding* tab under the *Firewall* tab of the 4GMini/4GPlus user interface. In order to implement a port forwarding rule, enter the required values, click *Add Port Forwarding*, then the *Submit* button. Port forwarding can be used in combination with other firewall features, but carrier requests must be blocked for port forwarding to be in effect. If using PPP mode both Port Forwarding and Rules are required.

| 111                               | -                 |                     |                    |            |           |                |       | -    | 0         |
|-----------------------------------|-------------------|---------------------|--------------------|------------|-----------|----------------|-------|------|-----------|
|                                   |                   |                     |                    |            | 101       | 01010          | 11    | 3    | 1         |
| stem Network Carrier              | Firewall          | VPN Serial          | USB                | 1/0        | GPS       | Applications   | Admin | -9.5 |           |
| mmary General Port Fo             | rwarding M        | AC-IP List R        | ules Fi            | irewall    | Defau     | It             |       |      |           |
| irewall Port Forwarding           |                   |                     |                    |            |           | 1023           |       |      |           |
| newan rolt rolwarding             |                   |                     |                    |            |           |                |       |      |           |
| Notice                            |                   |                     |                    |            |           |                |       |      |           |
| Port Forwarding Rules are tak     | en into consider  | ation after the Ge  | neral fire         | wall setti | ngs are i | applied, If    |       |      |           |
| the WAN and/or cellular traffi    | c is blocked, add | ditional rules must | t be creat         | ted:       |           |                |       |      |           |
| 1. Add rules in the Rules cont    | iguration to ope  | n ports or allow IF | <sup>address</sup> | es.        |           |                |       |      |           |
| 2. Create a IP/Mac List to allo   | w desired conne   | ctions.             |                    |            |           |                |       |      |           |
| Firewall DMZ Configuration        |                   |                     |                    |            |           |                |       |      |           |
| DMZ Source: Carrier               |                   |                     |                    |            |           |                |       |      |           |
| DMZ Mode                          | Disal             | ole 🔻               |                    |            |           |                |       |      |           |
| DMZ Server IP                     | 192.1             | 68.100.100          |                    |            |           |                |       |      |           |
| Exception Ports                   | 0                 |                     |                    |            |           |                |       |      |           |
| Combined with source NAT          | No                | •                   |                    |            |           |                |       |      |           |
| Firewall Port Forwarding Configur | ation             |                     |                    |            |           |                |       |      |           |
| Name                              | forwa             | rd1                 | 1                  |            |           |                |       |      |           |
| Source                            | Carri             | er 🔻                |                    |            |           |                |       |      |           |
| Internal Server IP                | 192.1             | 68.2.1              |                    |            |           |                |       |      |           |
| Internal Ports                    | 3000              |                     |                    |            |           |                |       |      |           |
| Protocol                          | TCP               | •                   |                    |            |           |                |       |      |           |
| External Ports                    | 2000              |                     |                    |            |           |                |       |      |           |
| Combined with source NAT          | No                |                     |                    |            |           |                |       |      |           |
| Add Port Forwarding               |                   |                     |                    |            |           |                |       |      |           |
| Firewall Port Forwarding Summary  | ,                 |                     |                    |            |           |                |       |      |           |
| Name Source Internal              | IP                | Internal Ports      |                    |            | Protocol  | External Ports |       | SNAT |           |
| Loggerne Carrier • 192.16         | 8.0.99            | 6785                |                    | -1         | TCP .     | 6785           |       | No • | Remove Ru |

#### FIGURE 7-6. Firewall Port Forwarding Configuration

**Name:** Enter a convenient reference or description for the rule. Each rule must have a unique name, which can be up to 10 characters.

**Internal Server IP:** Enter the IP address of the intended internal server (i.e. on the LAN side of 4GMini/4GPlus). This is the IP address given to the device connected to the Ethernet port or the device connected to the serial port using PPP. The IP address must be based on the default IP gateway and IP subnet mask of the modem. This information can be located by navigating to:

- Network > LAN for Ethernet devices
- Serial > RS-232 for PPP devices

**Internal Port:** Target port number of internal server on the private LAN IP entered above.

**Protocol:** Select the type of transport protocol used. Although there are several options, TCP should be the most common protocol in port forwarding applications.

External Port: Port number of incoming requests (from public WAN side).

#### 7.6.1.2 4GMini/4GPlus RS-232 PPP Configuration

It is necessary to configure the RS-232 port to use PPP, so that the datalogger can communicate with a network using a PPP connection. Other PPP settings

can be adjusted as needed, but any changes must be reflected appropriately in the modem and datalogger configuration.

- Under *Serial*, navigate to the *RS-232* tab
- Data Baud Rate = 115200
- Character Timeout = 50
- Protocol Config = select PPP
- Expected String = delete 'CLIENT' and leave the field blank
- Response String = 'CONNECT' (entry must be uppercase)
- PPP Local IP = 192.168.0.1 (this is the default local IP of the modem)
- PPP Host IP = 192.168.0.99 (this is the IP address that will be assigned to the datalogger
- Submit (save)

The following parameters must be the same in both the modem and the datalogger:

| •       | Baud 1           | rate       |          |                       |         |     |     |     |              |       |  |  |  |
|---------|------------------|------------|----------|-----------------------|---------|-----|-----|-----|--------------|-------|--|--|--|
| •       | Data f           | ormat      |          |                       |         |     |     |     |              |       |  |  |  |
|         |                  |            |          |                       |         |     |     |     |              |       |  |  |  |
| System  | Network          | Carrier    | Firewall | VPN                   | Serial  | USB | I/0 | GPS | Applications | Admin |  |  |  |
| Summary | / RS232          |            |          |                       |         |     |     |     |              |       |  |  |  |
| RS232 ( | <br>Configuratio | on         |          |                       |         |     |     |     |              |       |  |  |  |
| 10252   | Johnguruu        |            |          |                       |         |     |     |     |              |       |  |  |  |
| RS232 ( | Configuration    |            |          |                       |         |     |     |     |              |       |  |  |  |
| RS23    | 32 Port status   |            | Ena      | ble 🔻                 |         |     |     |     |              |       |  |  |  |
| Data    | Baud Rate        |            | 1152     | 200 •                 |         |     |     |     |              |       |  |  |  |
| Data    | Format           |            | 8N1      | 8N1 •                 |         |     |     |     |              |       |  |  |  |
| Flow    | Control          |            | none     | none T                |         |     |     |     |              |       |  |  |  |
| Data    | Mode             |            | 0 s      | Seamless  Transparent |         |     |     |     |              |       |  |  |  |
| Char    | acter Timeou     | t          | 50       | 50                    |         |     |     |     |              |       |  |  |  |
| Maxi    | mum Packet       | Size       | 256      | 256                   |         |     |     |     |              |       |  |  |  |
| No-C    | Connection Da    | ita        | • D      | Isable Enable         |         |     |     |     |              |       |  |  |  |
| MOD     | BUS TCP Stat     | tus        | • D      | Disable     Enable    |         |     |     |     |              |       |  |  |  |
| IP Pr   | otocol Config    |            | PPF      | )                     |         | •   |     |     |              |       |  |  |  |
| PPP Cor | figuration       |            |          |                       |         |     |     |     |              |       |  |  |  |
| PPP     | Mode             |            | 0 A      | ctive 🖲               | Passive |     |     |     |              |       |  |  |  |
| CCP     | negotiation      |            | E        | nable 🔍               | Disable |     |     |     |              |       |  |  |  |
| Expe    | cted String      |            |          |                       |         |     |     |     |              |       |  |  |  |
| Resp    | onse String      |            | CON      | CONNECT               |         |     |     |     |              |       |  |  |  |
| PPP     | LCP Echo Fail    | ure Number | 0        |                       |         |     |     |     |              |       |  |  |  |
| PPP     | LCP Echo Inte    | erval      | 0        |                       |         |     |     |     |              |       |  |  |  |
| PPP     | Local IP         |            | 192.     | 168.0.1               |         |     |     |     |              |       |  |  |  |
| PPP     | Host IP          |            | 192.     | 168.0.99              |         |     |     |     |              |       |  |  |  |
| PPP     | Idle Timeout(    | s)         | 30       |                       |         |     |     |     |              |       |  |  |  |

FIGURE 7-7. Serial RS-232

#### 7.6.1.3 4GMini/4GPlus Firewall and Port Forwarding Configuration for PPP

The proper configuration of the firewall and related port forwarding rules are necessary to control different types of access and ensure that IP traffic is properly routed through the modem to the datalogger. The configuration of the firewall helps avoid unauthorized access to data usage.

• Ensure firewall carrier requests are set to *Block* in order to proceed with the remaining configuration.

Click Submit.

| System   | Network        | Carrier     | Firewall | VPN       | Serial   | USB  | I/0    | GPS     | Applications | Admin |
|----------|----------------|-------------|----------|-----------|----------|------|--------|---------|--------------|-------|
| Summary  | / General      | Port For    | warding  | MAC-IF    | P List F | ules | Firewa | ll Defa | ult          |       |
| Firewall | General        |             |          |           |          |      |        |         |              |       |
| Firewal  | l General Con  | figuration  |          |           |          |      |        |         |              |       |
| Carri    | er Remote Ma   | anagement   | •        | Enable 🔍  | Disable  |      |        |         |              |       |
| Carri    | er Request 0   |             | ۲        | Block 🔍 🌶 | Allow    |      |        |         |              |       |
| LAN      | to Carrier Aco | ess Control | 0 0      | Block 🖲 🕯 | Allow    |      |        |         |              |       |
| Anti-    | Spoof 🕕        |             |          | Enable 🖲  | Disable  |      |        |         |              |       |
| Pack     | et Normalizat  | ion 🕕       |          | Enable 🖲  | Disable  |      |        |         |              |       |
|          |                |             |          |           |          |      |        |         |              |       |
|          |                |             |          |           |          |      |        |         |              |       |
|          |                |             |          |           |          |      |        |         |              |       |
|          |                |             |          |           |          |      |        |         |              |       |

FIGURE 7-8. Firewall - General

Under the *Firewall* tab, select *Port Forwarding*. Rules are required to map the ports, which are necessary to ensure HTTP, FTP, and LoggerNet communications to the datalogger are at the assigned IP address.

1. To setup access to the datalogger's HTTP server (for access to the datalogger's webpage), the following rule configuration needs to be added and applied:

- Enter a Rule Name for HTTP
- Internal Server IP = 192.168.0.99 (IP address assigned to the datalogger)
- Internal Port = 80
- Protocol = TCP
- External Port = 8000
- Click Add Port Forwarding
- Click Submit

**Note** The external port number 8000 is an example. Use any (unrestricted) port number other than 80, 433, or 23, as they are required for modem access and configuration. Be sure to include the external HTTP port number in any communications attempting to reach the datalogger webpage (e.g. 173.182.77.117:8000).

2. To setup access to the datalogger's FTP server (for remote file access), the following rule configuration needs to be added and applied:

- Enter a Rule Name for FTP
- Internal Server IP = 192.168.0.99 (IP address assigned to the datalogger)
- Internal Port = 21
- Protocol = TCP
- External Port = 2100
- Click Add Port Forwarding
- Click Submit

#### Note

The external port number 2100 is an example. Use any (unrestricted) port number other than 80, 433, or 23, as they are required for modem access and configuration. Be sure to include the external FTP port number in any communications attempting to reach the datalogger webpage (e.g. ftp://173.182.77.117:2100).

3. To setup access to the datalogger via LoggerNet and the PakBus/TCP Service Port, the following rule configuration needs to be added and applied:

- Enter a Rule Name
- Internal Server IP = 192.168.0.99 (IP address assigned to the datalogger)
- Internal Port = 6785
- Protocol = TCP
- External Port = 6785
- Click Add Port Forwarding
- Click Submit

**Note** Be sure to include the external port number in any communications attempting to reach the datalogger webpage (e.g. ftp://173.182.77.117:6785).

|   |               | -              | -            |           |               |           |          | 101       | 101010                   | 2.1.  |      | 01       |
|---|---------------|----------------|--------------|-----------|---------------|-----------|----------|-----------|--------------------------|-------|------|----------|
| tem Ne  | twork (       | Carrier I      | Firewall     | VPN       | Serial        | USB       | 1/0      | GPS       | Applications             | Admin |      |          |
| imary G   | eneral F      | Port Forw      | arding       | MAC-IF    | List Ru       | iles F    | irewal   | ll Defau  | ilt                      |       | 1    |          |
| ewall Port                                      | Forwardi      | ng             |              |           |               |           |          |           |                          |       |      |          |
| and as  |               |                |              |           |               |           |          |           |                          |       |      |          |
| Dtice   |               |                |              |           |               |           |          |           |                          |       |      |          |
| Port Forw                                       | arding Rules  | s are taken i  | into conside | eration a | fter the Cen  | eral fire | wall set | tings are | applied, if              |       |      |          |
| the WAN a                                       | and/or cellu  | dar traffic is | blocked, a   | dditional | rules must    | be creat  | ed:      |           |                          |       |      |          |
| 1. Add rul                                      | ies in the Ru | ules configur  | ration to op | en ports  | or allow IP   | address   | es.      |           |                          |       |      |          |
| 2. Create                                       | a IP/Mac Lis  | st to allow de | lesired conn | ections.  |               |           |          |           |                          |       |      |          |
|   |               |                |              |           |               |           |          |           |                          |       |      |          |
| rewall DMZ                                      | Configuratio  | on             |              |           |               |           |          |           |                          |       |      |          |
| DMZ Sout  | rce: Carrier  |                |              |           |               |           |          |           |                          |       |      |          |
| DMZ Mod   | e             |                | Dis          | able *    |               |           |          |           |                          |       |      |          |
| DMZ Serve                                       | er IP         |                | 192          | 168.100   | 100           |           |          |           |                          |       |      |          |
| Exception                                       | Ports O       |                | 0            |           |               |           |          |           |                          |       |      |          |
| Combined  | i with sourc  | e NAT 🔍        | No           | ۲         |               |           |          |           |                          |       |      |          |
| rewall Port                                     | Forwarding    | Configuratio   | m            |           |               |           |          |           |                          |       |      |          |
| Name  |               |                | forv         | ard1      |               |           |          |           |                          |       |      |          |
| Source  |               |                | Car          | rier •    |               |           |          |           |                          |       |      |          |
| Internal Se                                     | erver IP      |                | 192          | 168.2.1   |               |           |          |           |                          |       |      |          |
| Internal Pi                                     | orts 💿        |                | 300          | 0         |               |           |          |           |                          |       |      |          |
| Protocol  |               |                | TC           | P •       |               |           |          |           |                          |       |      |          |
| External P                                      | forts O       |                | 200          | 0         |               |           |          |           |                          |       |      |          |
| Combined  | d with source | e NAT O        | No           |           |               |           |          |           |                          |       |      |          |
| Friday and the second                           | Forwarding    |                |              |           |               |           |          |           |                          |       |      |          |
| Add Port 8                                      | Townseller.   | Summary        |              |           |               |           |          |           |                          |       |      |          |
| Add Port i                                      | Forwarding    |                |              |           |               |           |          |           |                          |       |      |          |
| Add Port I<br>rewall Port                       | Source        | Internal IP    |              | la la     | ternal Ports  |           |          | Protocol  | External Ports           |       | SNAT |          |
| Add Port I<br>rewall Port                       | Source        | Internal IP    | 99           | 1         | ternal Ports  |           | _        | Protocol  | External Ports           |       | SNAT | Remove 2 |
| Add Port I<br>rewall Port I<br>Name<br>Loogerne | Source        | Internal IP    | 99           | 6         | iternal Ports |           |          | TCP •     | External Ports 6785 8000 |       | NO V | Remove 3 |

FIGURE 7-9. Firewall – Port Forwarding

## 7.6.1.4 Datalogger PPP Configuration

Using the Device Configuration Utility, connect to the datalogger to configure the PPP and ComPort settings.

Under the *ComPorts Settings* tab:

- Select the *RS-232 ComPort*
- Baud Rate = 115.2K Fixed (baud rate must be fixed and match the baud rate set in the modem under *Serial*)

| Elie       Backup       Options       Help         Device Type       Deployment       Lagger Control       Data Monitor       File Control       Settings Editor       Terminal         CR1000       CR10X-PB       CR200 Series       CR200 Series       Select the ComPort KS-222       Neighbors         CR3000       CR3000       E       Beacon Interval:       Image: ComPort KS-222       Neighbors         Beacon Interval:       Image: ComPort KS-222       Image: KS-222       Neighbors       Begin       End         CR3000       CR300       E       Image: KS-222       Image: KS-222       Neighbors       Begin       End         CR3000       CR300       Image: KS-222       Image: KS-222       Image: KS-222       Neighbors       Begin       End         CR3000       Image: KS-222   | Device Configuration Utility 2.0                         | 99 Beta   |
|--|--|---|
| Device Type       Deployment       Logger Control       Data Monitor       File Control       Settings Editor       Terminal   | <u>F</u> ile <u>B</u> ackup <u>O</u> ptions <u>H</u> elp |   |
| CK1000       ComPorts Settings       TCP/IP       CS I/O IP       PPP       Network Services       Advanced         CR10X-PB       CR23X-PB       Baud Rate:       1152K Fixed       Image: Setect the ComPort       Begin       End         CR3000       CR510-PB       Image: Setect the ComPort       Image: Setect | Device Type  | Deployment Logger Control Data Monitor File Control Settings Editor Terminal  |
| CR10X-PB       CR200 Series         CR23X-PB       Baud Rate: 115.2K Fixed         CR3000       Beacon Interval:         CR510-PB       Verify Interval:         CR6       Verify Interval:         CR600 Series       CR10X         CR10X Series       The selected port has been configured for PPP         Services and cannot be used for PakBus       Image: Cr10X         CR10X       CR10X         CR10X-TD       CR23X         CR23X-TD       Image: Communication Port         173.182.77.117:6785       Image: Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.  | CR1000   | Datalogger         ComPorts Settings         TCP/IP         CS I/O IP         PPP         Network Services         Advanced   |
| CR200 Series       Baud Rate: 15.2K Fixed         CR3000       Bescon Interval:         CR3000       CR300-PB         CR6       Verify Interval:         CR600 Series       The selected port has been configured for PPP         CR00X Series       The selected port has been configured for PPABBus         CR10X       CR10X         CR23X.TD       CR23X         CR23X.TD       Image: Cr23X reprint the selected port has been configured for PPABBus         Image: Cr23X reprint the selected port has been configured for PPABBus       Image: Cr23X reprint the selected port has been configured for PPABBus         Cr23X.CR23X.TD       Image: Cr23X reprint the selected port has been configured for PPABBus       Image: Cr23X reprint the selected port has been configured for PPABBus         Image: Permove Range       Image: Cr23X reprint the selected port has been configured for PPABBus       Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, worthy intervals, and neighbor lists will be displayed and/or edited.  | CR10X-PB   | Select the ComPort RS-232   |
| CR3000       Reacon Interval:       Reacon In   | CR200 Series<br>CR23X-PB                                 | Baud Rate: 115.2K Fixed V Begin End   |
| CR510-PB       Verify Interval:         CR6       The selected port has been configured for PPP         CR800 Series       The selected port has been configured for PPP         CR0X       CR10X-TD         CR10X-TD       CR23X-TD         CR23X-TD       CR23X-TD         Use IP Connection       Add Range         PakBus/TCP Password       Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, wrify intervals, and neighbor lists will be displayed and/or edited.   | CR3000   | Beacon Interval: 0  |
| CR6       The selected port has been configured for PPP         CR800 Series       Exercises and cannot be used for PakBus         Datalogger (Other)       CR10X         CR10X       CR10X-TD         CR23X-TD       Image: Creating the selected point is the selected point is selected by this control will dictate which baud beacon intervals, wrify intervals, and neighbor lists will be displayed and/or edited.  | CR510-PB   | Verify Interval: 0  |
| CR800 Series       Image: CRW Series         CRWV Series       Image: Creating Services and cannot be used for PakBus         CR10X       CR10X-TD         CR23X       CR23X-TD         CR23X-TD       Image: Creating Services         Vuse IP Connection       Add Range         PakBus/TCP Password       Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, wrify intervals, and neighbor lists will be displayed and/or edited.   | CR6  | The selected nort has been configured for PPP   |
| CRWW Series         Datalogger (Other)         CR10X         CR10X         CR23X         CR23X-TD         CR23X-TD         Use IP Connection         PakBus/TCP Password         Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.  | CR800 Series   | services and cannot be used for PakBus  |
| Datalogger (Other)         CR10X         CR10X         CR23X         CR23X.TD         CR23X.TD         Use IP Connection         PakBus/TCP Password         Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.  | CRVW Series  |   |
| CRIOX         CRIOX-TD         CR23X         CR23X-TD         Image: CR23X-TD <td< th=""><th>Datalogger (Other)</th><th></th></td<>  | Datalogger (Other)                                       |   |
| CR10X-TD       Image: CR23X         CR23X       Image: CR23X-TD         Communication Port       Image: CR23X-T17:6785         IT73.182.77.117:6785       Image: CR23X-T2         V Use IP Connection       PakBus/TCP Password         Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.   | CR10X  |   |
| CR23X         CR23X-TD         Communication Port         173.182.77.117.6785         Use IP Connection         PakBus/TCP Password    Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.  | CR10X-TD   |   |
| CR23X-TD       Image: CR23X-TD         Communication Port       Image: Cr20X-TD         173.182.77.117.6785       Image: Cr20X-TD         V Use IP Connection       PakBus/TCP Password         Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.   | CR23X  |   |
| Communication Port       Add Range         173.182.77.117:6785          Use IP Connection       Behavior Configure and the selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.  | CR23X-TD   |   |
| 173.182.77.117.6785          Use IP Connection       PakBus/TCP Password         Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.  | Communication Port                                       |   |
| Use IP Connection PakBus/TCP Password Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.   | 173.182.77.117:6785                                      |   |
| PakBus/TCP Password Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud beacon intervals, verify intervals, and neighbor lists will be displayed and/or edited.   | Use IP Connection  |   |
| beacon intervais, verity intervais, and neighbor lists will be displayed and/or edited.  | PakBus/TCP Password                                      | Choose the datalogger communication port to configure. The port that is selected by this control will dictate which baud rate |
|  |  | beacon intervais, verny intervais, and neignbor lists will be displayed and/or edited.  |
| PakBus Encryption Key  | PakBus Encryption Key                                    |   |
|  |  |   |
| Baud Rate  | Baud Rate  |   |
| 115200 -   | 115200 -   |   |
|  |  |   |
| Disconnect Apply Cancel Factory Defaults Read File Summary   | Disconnect   | Apply Cancel Factory Defaults Read File Summary   |

## FIGURE 7-10. Device Configuration Utility - CR1000 - ComPort Settings

Under the PPP Settings tab:

- Config/Port Used = RS-232
- Modem Dial String = PPP (entry must be in all upper case)
- Click Apply

| Device Configuration Utility 2.09 E  | leta  |
|--|---|
| Device Type  | Deployment Logger Control Data Monitor File Control Settings Editor Terminal  |
| CR1000         CR10X-PB           CR10X-PB         CR200 Series           CR23X-PB         CR3000           CR510-PB         CR6           CR800 Series         CR10X-VSeries           Datalogger (Other)         CR10X-TD           CR10X-TD         CR23X           CR23X-TD         Communication Port | Datalogger       ComPorts Settings       TCP/IP       CS I/O IP       PPP       Network Services       Advanced         Config/Port Used:       IS232       •       •       •       •         IP       Address:       0.0.0       •       •       •         User Name:       •       •       •       •         Password:       •       •       •       •         Confirm Password:       •       •       •       •         Modem Dial String:       PPP       •       •       •         Modern Dial Response:       CONNECT       •       •       • |
| Use IP Connection<br>PakBus/TCP Password<br>PakBus Encryption Key<br>Baud Rate<br>115200 ~   | PPP Interface This setting controls which datalogger port PPP service will be configured to use. Warning: If this value is set to CS I/O ME you must not attach any other devices to the CS I/O port.   |

FIGURE 7-11. Device Configuration Utility – CR1000 - PPP

## 7.6.2 Security

Note

If either password is lost, the modem will need to be manually reset to its default settings and reconfigured in order to regain access.

To keep the system secure, it is recommended to change the administrator and upgrade passwords from the factory defaults.

Changing the administrator password will protect against modifications to the modem's configuration. Changing the upgrade password will protect against unauthorized upgrades.

- Under Admin, navigate to the Users tab
- Change passwords as needed. Be sure to maintain a secure record, so a reference is available.
- Submit

| System | n Network       | Car      | rier    | Firewa     | II VPN      | Serial     | USB     | I/0      | GPS      | Applications | Admin |
|--------|-----------------|----------|---------|------------|-------------|------------|---------|----------|----------|--------------|-------|
| Users  | Authenticati    | ion      | NMS     | SNMP       | Discover    | y Pow      | erSaviı | ng Lo    | gout     |              |       |
| Acces  | s Control       |          |         |            |             |            |         |          |          |              |       |
| Pass   | word Change ( I | t will t | take ef | ffect imme | diately aft | er press " | Change  | Passwo   | rd" butt | on )         |       |
| U      | ser Name : adn  | nin      |         |            |             |            |         |          |          |              |       |
| N      | ew Password :   |          |         |            |             |            | (5-     | 64 char  | acters,n | o space)     |       |
| C      | onfirm Password | :        |         |            |             |            | Ch      | iange Pa | assword  |              |       |

FIGURE 7-12. Admin Users

## 7.6.3 Configuration Backup

•

It is possible to to backup the configuration of a modem after completion.

- Under *System*, navigate to the *Maintenance* tab
  - Select a name for the configuration under Backup Configuration
- Click *Backup Configuration* to save the file onto a PC

| System   | Network        | Carrier    | Firewall   | VPN        | Serial       | USB    | <b>I/O</b> | GPS      | Applications | Admin  |            |
|----------|----------------|------------|------------|------------|--------------|--------|------------|----------|--------------|--------|------------|
| Summary  | / Settings     | Services   | 6 Keepaliv | /e Ma      | intenan      | ce Rel | boot       |          |              |        |            |
| System   | Maintenanc     | e          |            |            |              |        |            |          |              |        |            |
|          |                |            |            |            |              |        |            |          |              |        |            |
| Version  | 1 Information  |            |            |            |              |        |            |          |              |        |            |
| Pro      | duct Name      |            | Hardware   | Туре       |              | Build  | Versio     | n        | Build        | Date   | Build Time |
| Bull     | et-LTE         |            | Rev A      |            |              | v1.2.0 | ) build 1  | 1048     | 2016         | -05-30 | 08:18:17   |
|          |                |            |            |            |              |        |            |          |              |        |            |
| Firmwa   | re Upgrade     |            |            |            |              |        |            |          |              |        |            |
| Erase    | e Current Con  | figuration | Kee        | p ALL Co   | onfiguration | •      |            |          |              |        |            |
| Firm     | ware Image     |            | Cho        | oose File  | No file ch   | osen   |            |          |              |        |            |
| Upgr     | ade            |            | Upgi       | rade Firm  | ware         |        |            |          |              |        |            |
| Reset to | o Default      |            |            |            |              |        |            |          |              |        |            |
| Rese     | t to Default   |            | Rese       | et to Defa | iult         | Keep   | Carrier !  | Settings |              |        |            |
| Backup   | Configuration  | ı          |            |            |              |        |            |          |              |        |            |
| Nam      | e this configu | ration     | Micro      | ohardBull  | etLTE.confi  | g      |            |          |              |        |            |
| Back     | up             |            | Back       | up Confi   | guration     |        |            |          |              |        |            |
| Restore  | Configuration  | ı          |            |            |              |        |            |          |              |        |            |
| Rest     | ore Configura  | tion file  | Cho        | oose File  | No file ch   | osen   |            |          |              |        |            |
| Chec     | k Configuratio | on file    | Chee       | ck Restor  | e File       |        |            |          |              |        |            |
|          |                |            |            |            |              |        |            |          |              |        |            |

FIGURE 7-13. System - Maintenance

## 7.6.4 Loading Configuration or Firmware

It is possible to upload a configuration file to a modem either to restore settings or as a template to help configure multiple modems.

- Under *System*, navigate to the *Maintenance* tab
- Under *Restore Configuration*, click *Choose File* and select the proper file from the PC being used
- Click *Check Restore File* to check the fie and upload it to the modem

## 7.6.5 Firmware Updates

HTTP Upgrade is used to upgrade the 4GMini/4GPlus system firmware.

- Select *Choose File* to locate the upgrade file provided by Microhard Systems
- To ensure that all settings remain in the modem after the update, ensure that *Keep ALL Configuration* is selected prior to uploading the firmware
- Click *Check Restore File* to confirm the validity of the configuration file and upload it to the modem

## 7.7 LoggerNet Setup

The LoggerNet Device Map is configured from the Setup button on the LoggerNet Toolbar. Click *Main / Setup* and configure the device map as described below.

**Note** The following process is the same for Bell, Telus, and Rogers' users.

1. Select Add Root, followed by IP Port

2. Add a datalogger to the IP Port PakBus datalogger (e.g. the CR1000 requires a PakBusPort as well)

3. On the IP Port setup:

- i. Add the Domain Name or IP address of the modem to the Internet IP Address field, followed by the port number (6785, which is the datalogger's default port number). It is also used to configure the RS-232 and Firewall settings of the 4GMini/4GPlus cellular modems.
- ii. Extra response time should be 10 12 seconds
- iii. Click Apply

| 🔀 Setup Screen                      | -   | -                              |                         |
|-------------------------------------|---|--------------------------------|-------------------------|
| <u>File View Backup Tools H</u> elp |   |                                |                         |
| Subnet Display - Add <u>Root</u>    | Add <u>D</u> elete Re <u>n</u> ame  | e Undo Redo                    | EZ View                 |
| Entire Network                      | IPPort_1 : IPPort<br>Hardware Notes<br>Standard<br>Communications Enabled<br>Internet IP Address<br>Advanced<br>Call-Back Enabled<br>TCP Listen Only<br>Extra Response Time<br>Delay Hangup<br>IP Port Used for Call-Back<br>AirLink Modem Name | modemtesting.4dq.com:6785      |                         |
| Check Apply Cancel                  | No problems found with se   | ttings for the selected device |                         |
|                                     | ,   |                                | Connected: localhost .: |

## FIGURE 7-14. Setup Screen – IPPort\_1

iv. For PakBus dataloggers, add 10 seconds of Extra Response Time. *PakBus Port Always Open* should **not** be selected.

| 🔀 Setup Screen                      |  | 0                             |                      |
|-------------------------------------|--|-------------------------------|----------------------|
| <u>File View Backup Tools H</u> elp |  |                               |                      |
| Subnet Display Add Root             | Add Delete Renam   | e <u>U</u> ndo R <u>e</u> do  | EZ View              |
| Entire Network                      | PakBusPort_1 : PakBu   | sPort                         |                      |
| CR1000                              | Hardware New PakBus Nodes<br>Standard<br>Communications Enabled<br>PakBus Port Always Open | Notes                         |                      |
|                                     | Maximum Time On-Line   | 00 h 00 m 00 s                | A<br>V               |
|                                     | Beacon Interval  | 00 h 01 m 00 s                |                      |
|                                     | PakBus Verify Interval   | 00 h 00 m 00 s                |                      |
|                                     | Advanced   | -                             |                      |
|                                     | Extra Response Time  | 10 s                          | ×                    |
|                                     | PakBus Address   | 4094                          |                      |
|                                     | Delay Hangup   | 00 s 000 ms                   |                      |
|                                     | TCP Password   |                               |                      |
| Check Apply Cancel                  | No problems found with s   | ettings for the selected devi | ce                   |
|                                     |  |                               | Connected: localnost |

FIGURE 7-15. Setup Screen – PakBusPort\_1

v. For PakBus dataloggers, set the PakBus address to match that of the datalogger (default address in the datalogger is 1). Click *Apply* to save changes.

| X Setup Screen                      |                             | Connect                                |                      |
|-------------------------------------|-----------------------------|--|----------------------|
| <u>File View Backup Tools H</u> elp |                             |  |                      |
| Subnet Display Add Root             | Add Delete Re               | Dame Undo Redo                         | EZ View              |
| Entire Network                      | CP1000 · CP1000             |  |                      |
| A day IPPort_1                      | CRIGOD. CRIGOD              |  |                      |
| CR1000                              | Hardware Schedule Data      | a Files Clock Program File Retrieval N | otes                 |
|                                     | Standard                    | bled                                   |                      |
|                                     | Call-Back Enabled           |  |                      |
|                                     | Call-back Enabled           |  |                      |
|                                     |                             |  |                      |
|                                     |                             |  | _                    |
|                                     | PakBus Address              | 1                                      |                      |
|                                     | Advanced                    |  |                      |
|                                     | Mauinum Daalust Cias        | 008                                    |                      |
|                                     | Maximum Packet Size         |  | _                    |
|                                     | Security Code               | 0                                      |                      |
|                                     | Delay Hangun                | 00 s 000 ms                            | <u> </u>             |
|                                     | City Hungup                 |  |                      |
|                                     |                             |  |                      |
|                                     | PakBus Encryption Key       |  |                      |
|                                     |                             |  |                      |
| Check Apply Cancel                  | Scheduled Data Collection i | s disabled.                            | *                    |
|                                     |                             |  | ·                    |
|                                     |                             |  | Connected: localhost |

FIGURE 7-16. Setup Screen – CR1000

## 7.8 4GMini/4GPlus Compatibility

The 4GMini/4GPlus Cellular Modem are compatible with the following Campbell Scientific dataloggers.

| TABLE 7-1. Compatability with contemporary and retired           Campbell Scientific Dataloggers |                            |  |  |  |  |
|--|----------------------------|--|--|--|--|
| Contemporary Dataloggers   | <b>Retired Dataloggers</b> |  |  |  |  |
| CR6 Series   | CR10X                      |  |  |  |  |
| CR1000/X   |                            |  |  |  |  |
| CR3000   |                            |  |  |  |  |
| CR800 series   |                            |  |  |  |  |
| CR300 Series   |                            |  |  |  |  |
| CR200X   |                            |  |  |  |  |

## 7.9 Wiring

Power for the modem can be sourced directly from the datalogger. Connection to the switched 12V terminal allows the user to control power to the modem through the datalogger program. In this way, power can be conserved by limiting the time that the modem is on. For example, the user could choose to power on the modem only for scheduled data collections or only during certain hours of the day. When using the switched 12V terminal, be sure to allow time for the modem to warm up and provision to the network. The required warm up time can vary, but the recommended minimum is 3 minutes.

|        | TABLE 7-2.Wiring |              |       |  |  |  |  |  |
|--------|------------------|--------------|-------|--|--|--|--|--|
| Colour | Function         | Datalogger   | Modem |  |  |  |  |  |
| Red    | Power source     | 12V or SW12V | Vin+  |  |  |  |  |  |
| Black  | Ground           | G            | Vin-  |  |  |  |  |  |

## 7.9.1 Modem Connection using the L18663 Null Modem Cable

To connect to a CR300, CR6, CR1000, CR3000, CR800, or CR200X series RS-232 port, a Null Modem Cable is required (Campbell Scientific L18663). Connect one end of the Null Modem Cable to the 4GMini/4GPlus cellular modem and the other to the RS-232 port on the datalogger.

## 7.9.2 Modem Connection using the SC932A

If connecting to any datalogger's CS I/O port, an SC932A interface from Campbell Scientific is required. Connect the supplied black SC12 cable to the datalogger side of the SC932A interface, followed by the CS I/O port of the

datalogger. Connect the DCE Device side of the SC932A interface to the 4GMini/4GPlus cellular modem's RS-232 port using the supplied straight through serial cable L10873.



## **FIGURE 7-17. SC932A**

## 7.9.3 Modem Connection using Ethernet

In some cases it may be desirable to connect using the Ethernet interface available on the 4GMini/4GPlus cellular modem. To do this, a CR1000 or CR3000 with either a NL120 Ethernet Interface, NL116 Ethernet/Compact Flash Module, or any datalogger using a NL2XX series device is required. A crossover Ethernet cable is needed to connect the two devices.

Please review the literature for the specific interface for more details.

## 7.10 Testing the Cellular Connection

After the Device Map has been configured, it is recommended to test the cellular connection using the *Connect* screen. Click on the appropriate station, then click the *Connect* button to initiate a call to the datalogger. Be sure all connections are complete and power is supplied to both the modem and 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 the *Station Date/Time* field. If the connection fails, a *Communications Failure* message is displayed.

| Connect Subnet Collect   | Now Custom         | St <u>a</u> tion Status File Contr | rol Nu <u>m</u> Display <u>G</u> raphs P <u>o</u> rts  |
|--|--------------------|------------------------------------|--|
| Stations   | Table Monitor: Pas | sive Monitoring (Program Stopp     | ped) Clocks<br>ts Adjusted Server Date/Time  |
|  | Field              | Value                              | Station Date/Time  |
|  |                    |                                    | Chec <u>k</u> S <u>e</u> t   |
|  |                    |                                    | Pause Clock Update   |
|  |                    |                                    | Program<br>CO2 Sensor Test CR1   |
|  |                    |                                    | Send <u>R</u> etrieve  |
|  |                    |                                    | Notes  |
|  |                    |                                    | *  |
| List Alphabetically  |                    |                                    |  |
| -<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>-<br>- | Stop               | Interval 00 m 01 s                 | The second secon |

FIGURE 7-18. Connect Screen – CR1000

## 8. Operation

## 8.1 Programming the Modem

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

## 8.2 LED Indicators

**Receive Signal Strength Indicator (RSSI) (3xGreen):** As the received signal strength increases, starting with the furthest left, the number of active RSSI LEDs increases.

Tx(Red)/Rx(Green) LEDs: The Tx/Rx LEDs indicate carrier (cellular) traffic.

**GPS:** Indicates that the optional standalone GPS module has synchronized and is ready for use.

**CPU LED:** The status LED indicates that power has been applied to the module. Flashing indicates bootup or firmware update status.

| Signal<br>(dBm) | RSSI1    | RSSI2    | RSSI3    |
|-----------------|----------|----------|----------|
| (-85, 0]        | ON       | ON       | ON       |
| (-90, -85]      | ON       | ON       | FLASH    |
| (-95, -90]      | ON       | ON       | OFF      |
| (-100, -95]     | ON       | FLASH    | OFF      |
| (-105, -100]    | ON       | OFF      | OFF      |
| (-109, -105]    | FLASH    | OFF      | OFF      |
| Other           | SCANNING | SCANNING | SCANNING |

## 8.3 Hardware

**L14162** - 4GMini/4GPlus Mounting Kit includes mounting hardware for securing the modem to the environmental enclosure. The 4GMini/4GPlus should be mounted in a position that allows easy access for the cables, so they are not bent or constricted.

**Antenna** - the following antennae are available from Campbell Scientific. The antenna(e) must be connected to the Antenna connector of the 4GMini/4GPlus. Contact a Campbell Scientific Applications Technician for help in determining the best antenna for the intended application.

**C2446** – is a dual band, 3dB omni-directional antenna for the CDMA and GPRS digital cellular modems. This antenna is recommended for locations where cellular coverage is strong. The C2446 includes a mount/u-bolt assembly that allows the antenna to be mounted to a mast, crossman, or user-supplied pole (outer diameter of up to 1.5" (3.8cm)).

**C2445** – 9dBd Yagi Antenna is a higher gain antenna that should be "aimed" at the service provider's antenna. The C2445 is a 800MHz antenna, which has a bracket/u-bolt assembly for attaching the antenna to a mast or post. The antenna comes with 10' of cable. This antenna is recommended for fringe areas that require a higher gain antenna.

**C244** - 9dBd Yagi Antenna is a higher gain antenna that should be "aimed" at the service provider's antenna. The C2445 is a 800MHz antenna, which has a bracket/u-bolt assembly for attaching the antenna to a mast or post. The antenna comes with 30' of cable and surge protection. This antenna is recommended for fringe areas that require a higher gain antenna.

**L21831** – Half-wave Dipole Whip antenna is a lower gain antenna used in transmitting short distances. It is an 800MHz cellular antenna that terminates in a SMA Male connector for attachement 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  $180^{\circ}$  on its mounting mast may solve weak transmission issues.



FIGURE 8-1. Yagi Antenna



### FIGURE 8-2. Antenna

- Power supply (see Section 7.9 Wiring)
- Environmental Enclosure ENC10/12, ENC12/14, or ENC16/18

## 9. Troubleshooting

If LoggerNet/PC400W software is unable to establish a connection with the modem:

- 1. Check the account information (a phone call to the provider may be required).
- 2. Verify that there is coverage at the location.
- 3. Check the SGNL Indicator LEDs on the front of the modem. Ensure that the modem has successfully connected to the cellular network.
- 4. Make sure the modem and datalogger have sufficient power.
- Check the RSSI LEDs on the front of the modem or in the Web Interface. If the measured signal strength is less than -110dBm no LEDs will be illuminated. If the signal is greater than -105dBm, 1 LED will be on, - 100dBm equals 2 LEDs and any signal greater than - 95dBm will show all 3 RSSI LEDs to be ON.
- 6. If using a Dynamic IP account, a dynamic domain name server (DDNS) name that LoggerNet can reference to make the connection will be required.
- 7. In the Summary tab in the System group of the modem's configuration

webpage, make sure Connection Status is *Call in Progress* or *Connected* and note the WAN 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, then there may be a problem with the Dynamic IP setup in the modem.

| System  | Network       | Carrier  | Firewall   | VPN      | Serial   | USB     | I/0  | GPS       | Applications | Admin  |                 |
|---------|---------------|----------|------------|----------|----------|---------|------|-----------|--------------|--------|-----------------|
| Summary | / Settings    | Services | Keepaliv   | ve Ma    | intenand | e Rel   | ooot |           |              |        |                 |
| System  | Informatio    | n        |            |          |          |         |      |           |              |        |                 |
|         |               |          |            |          |          |         |      |           |              |        |                 |
| System  | Information   |          |            |          |          |         |      |           |              |        |                 |
| Hos     | t Name        |          | UserDevi   | ce       |          |         | D    | escriptio | n            | Bullet | -LTE            |
| Pro     | duct Name     |          | Bullet-LTI | =        |          |         | S    | ystem D   | ate          | 2016-  | 10-13 16:13:06  |
| Har     | dware Versior | n        | Rev A      |          |          |         | S    | ystem U   | ptime        | 1 min  |                 |
| Sof     | tware Version |          | 1.2.0      |          |          |         | Т    | emperati  | ire(°C)      | 37.7   |                 |
| Bui     | d Number      |          | r1048      |          |          |         | S    | upply Vo  | ltage (V)    | 12.45  |                 |
| Bui     | d Time        |          | 2016-05-   | 30 08:1  | 8:17     |         |      |           |              |        |                 |
| Carrier | Information   |          |            |          |          |         |      |           |              |        |                 |
| Mod     | lule Status   |          | Enabled    |          |          |         | II   | 1EI       |              | 35640  | 6061376835 🛈    |
| Cur     | rent APN      |          | wrmstatio  | .bell.ca | .ioe     |         | I    | ISI       |              | 30269  | 0500015621      |
| Con     | nection Statu | s        | Connecte   | d        |          |         | S    | IM Card   |              | READ   | (               |
| Net     | work          |          | Bell       |          |          |         | S    | IM Numb   | oer (ICCID)  | 89302  | 690201000561210 |
| Hor     | ne/Roaming    |          | Home       |          |          |         | P    | hone Nu   | mber         | Unkno  | wn              |
| Cur     | rent Technolo | gy       | UMTS       |          |          |         | С    | ell ID    |              | 79254  | 482             |
| Free    | quency Band(  | MHz)     | BAND_UN    | ITS_V    |          |         | L    | AC        |              | 11201  |                 |
| IP 4    | ddress        |          | 174.90.23  | 33.208   |          |         | R    | SSI (dBn  | n)           | -71 dB | mI              |
| DN      | 5             |          | 70.28.24   | 5.227    |          |         | R    | SCP (dB   | m)           | -75    |                 |
|         | -             |          | 184.151.   | 118.254  |          |         | E    | CNO (dB   | )            | -4     |                 |
| Moo     | lule Version  |          | FIH7160_   | V1.1_W   | W_01.144 | 6.01_AT | M    | odule Bu  | uild Time    | 2015-  | Mar-16 07:34:06 |

FIGURE 9-1. System - Summary

# Appendix A. Example of Port Forwarding using the Modem

In this example, the 4GMini/4GPlus and all related equipment have been configured to allow for the simultaneous connection of 2 dataloggers to the modem. The first datalogger, a CR200X, is connected directly to the RS-232 port of the modem via a null modem cable. The second datalogger, a CR1000, is networked to the modem via an NL201 and a pair of RF401A radios. In any such arrangement it is important to configure the firewall and port forwarding rules to ensure proper access, while maintaining a reasonable level of protection.

This example assumes that all necessary configuration steps were taken to provision the modem on the network in either a Static or Dynamic IP arrangement, as well as the NL201 being configured properly with an IP address of 192.168.168.2.

Following is a diagram of the physical connection of the applications:



FIGURE A-1. Physical connections of the application

## **CR200X** portion of the application:

In this example, the CR200X is left in its default state.

#### 1. Modem Serial Configuration

- i. Change the COM1 data baud rate to 9600 to match the CR200X default baud rate.
- ii. Confirm that the local listening port is 6785 (default port of the CR200X). *Submit* new settings.

| System Network Carrier                  | Firewall VPN Serial USB I/O GPS Applications Admin |
|---|--|
| Summary RS232                           |  |
| RS232 Configuration                     |  |
| RS232 Configuration                     |  |
| RS232 Port status                       | Enable •   |
| Data Baud Rate                          | 9600 🔻   |
| Data Format                             | 8N1 V  |
| Flow Control                            | none T   |
| Data Mode                               | Seamless I Transparent                             |
| Character Timeout                       | 50   |
| Maximum Packet Size                     | 256  |
| No-Connection Data                      | • Disable  |
| MODBUS TCP Status                       | • Disable 		Enable                                 |
| IP Protocol Config                      | TCP Server   |
| TCP Configuration                       |  |
| Server Mode                             | Monitor O Polling                                  |
| Polling Timeout (seconds)               | 10   |
| Local Listening port                    | 6785   |
| Incoming Connection<br>Timeout(seconds) | 300  |

FIGURE A-2. Serial RS-232

## 2. Activate Firewall

Set the Firewall Carrier request to *Block*. This is required for the operation of the firewall and port forwarding rules.



FIGURE A-3. Firewall - General

## 3. Firewall rule for the CR200X in the 4GMini/4GPlus

i. Configure a rule that will allow WAN IP traffic through the firewall on port 6785. This allows remote access to the CR200X, which has a default port of 6785.

| System   | Network       | Carrier                                  | Firewall  | VPN       | Serial     | USB       | I/0      | GPS       | Applications  |
|----------|---------------|--|-----------|-----------|------------|-----------|----------|-----------|---------------|
| Summary  | General       | Port For                                 | warding   | MAC-IP    | List R     | ules I    | irewa    | ll Defa   | ult           |
| Firewall | Rules         |  |           |           |            |           |          |           |               |
| Firewall | Rules Config  | uration                                  |           |           |            |           |          |           |               |
| Rule     | Name          | rule1                                    | 1         |           |            |           |          |           |               |
| ACTI     | ON            | Acc                                      | ept ▼     |           |            |           |          |           |               |
| Sour     | ce 🕕          | Nor                                      | ie 🔻      |           |            |           |          |           |               |
| Sour     | ce IPs 🕕      | I  | range (   | Subne     | t / prefix |           |          |           |               |
|          |               | 0.0.0                                    | 0.0       |           | То         |           | 0.0.0.0  |           |               |
| Desti    | ination 🕕     | Nor                                      | ie 🔻      |           |            |           |          |           |               |
| Desti    | ination IPs 📵 | ) () () () () () () () () () () () () () | range (   | Subnet    | t / prefix |           |          |           |               |
|          |               | 0.0.0                                    | 0.0       |           | То         |           | 0.0.0.0  |           |               |
| Desti    | inationPort   | 0  |           |           |            |           |          |           |               |
| Proto    | col           | TCF                                      | •         |           |            |           |          |           |               |
| Add I    | Rule          |  |           |           |            |           |          |           |               |
| Firewall | Rules Summ    | ary                                      |           |           |            |           |          |           |               |
| Nam      | e Action      | Src Sr                                   | c IP From | Src IP To | /Pr        | efix Dest | De       | st IP Fro | om Dest IP To |
| CR20     | ox Accept ▼   | Carrier ▼ 0.                             | 0.0.0     |           | 0          | Carr      | ier ▼ 0. | 0.0.0     |               |

FIGURE A-4. Firewall - Rules

ii. Add the new rule and Apply.

### 4. LoggerNet setup for CR200X Remote Communications

- i. Add an IP port enter the Static or Dynamic DNS details for the 4GMini/4GPlus, followed by port 6785.
- ii. Add a PakBus port and a CR200 series datalogger. In this example, the two elements of the LoggerNet setup stay in their default state.
- iii. Apply setup.

| Subnet - Display - Add B | ot Add Delete Repa  | me Undo Redo                     | EZ View |
|--------------------------|---|----------------------------------|---------|
| ntire Network            | IPPort_1 : IPPort<br>Hardware Notes<br>Standard<br>Communications Enabled<br>Internet IP Address<br>Advanced<br>Call-Back Enabled<br>TCP Listen Only<br>Extra Response Time<br>Delay Hangup<br>IP Port Used for Call-Back<br>AirLink Modem Name | 00 s<br>00 s<br>00 s 000 ms<br>0 |         |

FIGURE A-5. Setup screen

CR1000 portion of the application:

## 1. Port Forwarding for the NL201 in the Cellular Modem

- i. Give the port forward a name.
- ii. Set the internal server IP to 192.168.168.2. The use of this IP address is based on the 4GMini/4GPlus having a gateway of 192.168.168.1 and an IP subnet mark of 255.255.255.0. These variables can be changed in the modem setup under Network>LAN, if required.
- iii. Set the internal and external ports to 6785.
- iv. Add Port Forwarding Rule and Apply.

|  | HELWOIK   | Carrier  | Firewall  | VPN   | Serial       | Acres 100 | 1/0        | GPS     | Applications  | Admin |     |
|--|---|--|---|---|--------------|-----------|------------|---------|---------------|-------|-----|
| mmar   | y General   | Port For   | warding   | MAC-IF  | List R       | ules F    | irewall    | Defa    | ult           |       |     |
| irewal   | Port Forwa  | arding   |   |   |              |           |            |         |               |       |     |
| Notice   |   |  |   |   |              |           |            |         |               |       |     |
| Nouce  |   |  |   |   |              |           |            |         |               |       |     |
| Port   | Forwarding Ru   | ules are tak   | en into cons  | ideration   | n after the  | Genera    | I firewall | setting | gs are        |       |     |
| appl   | ied. If the WA  | AN and/or c  | ellular traffic   | is block  | ed, additi   | onal rule | es must b  | e crea  | ted:          |       |     |
| 1. A   | dd rules in the   | e Rules con  | figuration to   | open po   | orts or allo | w IP add  | dresses.   |         |               |       |     |
| 2. C   | reate a IP/Ma   | c List to all  | ow desired c  | onnectio  | ns.          |           |            |         |               |       |     |
| Firewal  | ll DMZ Configu  | ration   |   |   |              |           |            |         |               |       |     |
| DMZ  | Z Source: Car   | rier   |   |   |              |           |            |         |               |       |     |
| DMZ  | Mode  |  | Dis   | able •  |              |           |            |         |               |       |     |
| DMT  | Server IP   |  | 102   | 168 100   | 100          |           |            |         |               |       |     |
| DMZ  | . our un  |  | 192   | 100.100.  | 100          |           |            |         |               |       |     |
| Exce   | eption Port   |  | 132   | 100.100.  | 100          |           |            |         |               |       |     |
| Exce<br>Firewal  | eption Port   | ding Configu   | uration   | . 100. 100.                                       | 100          |           |            |         |               |       |     |
| Firewal<br>Nam   | eption Port<br>II Port Forward  | ding Configu   | iration   | vard1   | 100          |           |            |         |               |       |     |
| Firewal<br>Nam<br>Sour   | eption Port<br>Il Port Forward<br>ne<br>rce   | ding Configu   | Iration<br>Ca   | /ard1<br>rrier ▼                                  |              |           |            |         |               |       |     |
| Firewal<br>Nam<br>Sour   | eption Port<br>II Port Forward<br>ne<br>rce<br>mal Server IP  | ding Configu   | Iration<br>Cai<br>192                                   | vard1<br>rrier ▼<br>.168.2.1                      | 100          |           |            |         |               |       |     |
| Firewal<br>Nam<br>Sour<br>Inter  | eption Port<br>Il Port Forward<br>ne<br>rce<br>mal Server IP<br>mal Port  | ding Configu   | form<br>Car<br>192<br>300                               | vard1<br>mier ▼<br>.168.2.1                       |              |           |            |         |               |       |     |
| Firewal<br>Nam<br>Soun<br>Inter<br>Prote                                 | eption Port<br>Il Port Forward<br>ne<br>rce<br>mal Server IP<br>mal Port<br>ocol  | ding Configu   | Iration<br>Forw<br>Cai<br>192<br>300<br>TC<br>200       | vard1<br>rrier ▼<br>.168.2.1<br>0<br>P ▼          |              |           |            |         |               |       |     |
| Firewal<br>Nam<br>Soun<br>Inter<br>Prote<br>Exte                         | eption Port<br>Il Port Forward<br>ne<br>mai Server IP<br>mai Port<br>ocol<br>emai Port  | ding Configu   | Iration<br>Forw<br>Cai<br>192<br>300<br>TC<br>200<br>   | vard1<br>mier ▼<br>168.2.1<br>0<br>P ▼<br>0       |              |           |            |         |               |       |     |
| Firewal<br>Nam<br>Soun<br>Inter<br>Prote<br>Exter<br>Com                 | eption Port<br>Il Port Forward<br>ne<br>mal Server IP<br>mal Port<br>ocol<br>ermal Port<br>ubined with so   | ding Configu<br>urce NAT 💿                                     | Iration<br>form<br>Cai<br>192<br>300<br>TC<br>200<br>No | vard1<br>mier ▼<br>168.2.1<br>0<br>P ▼<br>0<br>▼  |              |           |            |         |               |       |     |
| Firewal<br>Nam<br>Soun<br>Inter<br>Prote<br>Exte<br>Com                  | eption Port<br>Il Port Forward<br>ne<br>mal Server IP<br>mal Port<br>ocol<br>ernal Port<br>abined with so<br>Port Forwarding                      | ding Configu<br>urce NAT 💿                                     | Iration<br>form<br>Cai<br>192<br>300<br>TC<br>200<br>No | vard1<br>rrier ▼<br>168.2.1<br>0<br>P ▼<br>0<br>V |              |           |            |         |               |       |     |
| Firewal<br>Nam<br>Soun<br>Inter<br>Prote<br>Exte<br>Com<br>Add           | I Port Forward<br>Port Forward<br>Port<br>Formal Server IP<br>Fort Port<br>Socol<br>Fort Port<br>Bined with so<br>Port Forwarding                 | ding Configu<br>urce NAT <b>O</b><br>g<br>ding Summa           | ration<br>form<br>Car<br>192<br>300<br>TC<br>200<br>No  | vard1<br>mier ▼<br>.168.2.1<br>0<br>P ▼<br>0<br>▼ |              |           |            |         |               |       |     |
| Firewal<br>Nam<br>Soun<br>Inter<br>Prot<br>Exte<br>Com<br>Add<br>Firewal | eption Port<br>Il Port Forward<br>me<br>rece<br>rmal Server IP<br>rmal Port<br>ocol<br>ermal Port<br>abbined with so<br>Port Forward<br>ne Source | ding Configu<br>urce NAT <b>O</b><br>ding Summa<br>Internal IP | Iration<br>Forw<br>Cai<br>192<br>300<br>TC<br>200<br>No | vard1<br>mier ▼<br>168.2.1<br>0<br>P ▼<br>0<br>▼  | ernal Port   |           | Pr         | rotocol | External Port | 5     | NAT |

## FIGURE A-6. Firewall – Port Forwarding

| eployment     |                |                     |                      |
|---------------|----------------|---------------------|----------------------|
| NL200 Series  | RS-232 CS      | I/O Network Service | es                   |
|               | Bridge N       | Node: disable $~~$  | Serial No: 1000      |
| Admin         | istrative Pass | word:               | OS Version: NL200.05 |
| Confirm Admin | istrative Pass | word:               |                      |
| Network       |                |                     |                      |
| Use DH        | CP: disable    | ✓ DNS Serve         | Status               |
| IP Addre      | ss: 192.168.   | 8.8.8.8             |                      |
| Network Ma    | sk: 255.255.2  | 255.0               |                      |
| Default Gatew | ay: 192.168.   | 0.0.0.0             |                      |
|               |                |                     |                      |

FIGURE A-7. Deployment – NL200 Series

## 2. NL201 Setup – Network Settings

- i. Disable 'Use DHCP'
- ii. Enter the IP address, network mask, and default gateway, as required. In this example, the NL201 is given the IP address 192.168.168.2, with a network mask of 255.255.255.0 and a default gateway of 192.168.168.1.

iii. Set the internal and external ports to 6785.

| Deployment   |              |           |                  |             |          |
|--------------|--------------|-----------|------------------|-------------|----------|
| NL200 Series | RS-232       | CS I/O    | Network Services |             |          |
|              | Brid         | lge Mode: | disable $\sim$   | Serial No:  | 1000     |
| Admi         | nistrative F | assword:  | ••••             | OS Version: | NL200.05 |
| Confirm Admi | nistrative F | assword:  | ••••             |             |          |
| Network      |              |           |                  |             |          |
| Use DI       | ICP: disal   | ole 🖂     | DNS Servers      | Status      | 5        |
| IP Addr      | ess: 192.    | 168.168.2 | 8.8.8.8          |             |          |
| Network M    | ask: 255.3   | 255.255.0 | 8.8.4.4          |             |          |
| Default Gate | vay: 192.    | 168.168.1 | 0.0.0.0          |             |          |

FIGURE A-8. Deployment – NL200 – External ports

## 3. NL201 Setup – RS-232 Settings

- i. Set the active interface to *RS-232*.
- ii. Set the protocol to Transparent.
- iii. *Apply* the configuration.

| Ile Backup Options H | elp  | 2                       |                         |              |              |
|----------------------|------|-------------------------|-------------------------|--------------|--------------|
| ice Type             |      | Deployment Settings Edi | tor Send OS Terminal    |              |              |
| NL 100               | _ ^  | NL200 Series RS-232     | CS I/O Network Services |              |              |
| NL200 Series         |      | Configuration:          | TCP Serial Server       | PakBus Neigh | bors Allowed |
| NL240                |      | comgaration             |                         | Begin        | End          |
| NL300                | - 11 | Service Port:           | 6784                    |              |              |
| Peripheral           | _    | Baud Rate:              | 38400 -                 |              |              |
| Phone Modem          |      | Beacon Interval:        | 60                      |              |              |
| Radio                |      | beacon interval.        |                         |              |              |
| AL200                |      | Verify Interval:        | 0                       |              |              |
| RF400                |      | ModBus Time Out:        | 1000                    |              |              |
| RF401                | =    | Carial Client Address   |                         |              |              |
| RF401A Series        |      | Senai Client Address:   |                         | 3.           |              |
| RF430                |      | Serial Client Port:     | 1                       |              |              |
| RF450                |      |                         |                         |              | I v          |
| RF500M               |      |                         |                         | Add          | Remove       |
| TX320/TX312          |      |                         |                         |              |              |
| Sensor               | -    |                         |                         |              |              |
| ommunication Port    |      |                         |                         |              |              |
| OM12                 | ]]   |                         |                         |              |              |
| Use IP Connection    |      |                         |                         |              |              |
|                      |      |                         |                         |              |              |
| ud Rate              |      |                         |                         |              |              |
| 15200 +              |      |                         |                         |              |              |
|                      |      | Analu                   |                         |              |              |

FIGURE A-9. Device Configuration Utility – NL200 series

## 4. RF401A Spread Spectrum Radio – base (at NL201)

- i. Set the configuration to *TCP serial*.
- ii. If the use of a port other than 6784 is required, change the service port.

| O Device Configuration Utility 2.08 | LANCE LANCE AND A COMPANY  |
|-------------------------------------|--|
| <u>File Backup Options Help</u>     |  |
| Device Type                         | Settings Editor Send OS  |
| CR 3000                             | Current Setting: Active Interface  |
| CR510-PB                            | Main Pakeus Advanced   |
| CR800 Series                        |  |
| 🗄 Datalogger (Other)                | RS-232   |
| Network Peripheral                  | SDC &ddress  |
| NL100                               |  |
| NL200 Series                        | RS-232 Baud Rate   |
| NL240                               | 38400 🔻  |
| NL300                               | Protocol   |
| Peripheral                          | Transparent  |
| Phone Modem                         | RF Hop Sequence  |
| 🗆 Radio                             |  |
| AL200                               | RF Network   |
| RF400                               |  |
| RF401                               | RF Radio Address   |
| RF401A Series                       |  |
| RF430                               | Power Mode   |
| RF450                               | Batrulaval   |
| RF500M                              |  |
| TX320/TX312                         | Radio TX Power Level   |
| E Sensor                            | +24.0 dBm, (250 mW) 🔻  |
| Unknown                             |  |
| Unknown                             | A - di - la - di   |
| Wireless Sensor                     |  |
| Communication Port                  | Specifies the interface that will be used for normal operation.  |
| Use IP Connection                   | CS I/O SDC CS I/O port is connected to a Campbell Scientific datalogger CS I/O port. Also see SDC Address.     |
| Baud Rate<br>9600 v                 | RS-232 RS-232 port is connected to the RS-232 port of a datalogger, computer, or other RS-232 device. Also see |
| Disconnect                          | Apply Cancel Factory Defaults Read File Summary  |

FIGURE A-10. Device Configuration Utility – RF401A Series

## 5. RF401A Spread Spectrum Radio – remote (at CR1000)

- i. Set the active interface to *RS-232*.
- ii. Set the protocol to Transparent.
- iii. *Apply* the configuration.

## 6. LoggerNet Setup for CR1000 Remote Communication

- i. Add an IP port enter the static IP or Dynamic DNS details for the 4GMini/4GPlus Cellular Modem, followed by 6784.
- ii. Add a PakBus port and a CR1000 series. In this example, the two elements of LoggerNet setup stay in their default state.

iii. Apply setup.

| 🔀 Setup Screen                              |   |                     |                      |
|---|---|---------------------|----------------------|
| <u>File View Backup Tools H</u> elp         |   |                     |                      |
| Subnet Display Add Root                     | Add Delete Rename   | Lindo Redo          | EZ View              |
| Entire Network                              | IPPort : IPPort         Hardware       Notes         Standard       Image: Communications Enabled         Internet IP Address       Advanced         Call-Back Enabled       TCP Listen Only         Extra Response Time       Delay Hangup         IP Port Used for Call-Back       AirLink Modem Name | 205.206.43.200:6784 |                      |
| Chec <u>k</u> A <u>p</u> ply <u>C</u> ancel |   |                     | Connected: localhost |

FIGURE A-11. Setup screen

## A.1.1 Point to Point Protocol (PPP) Communications (optional)

In PPP mode, the modem assigns the datalogger an IP address by means of a serial connection. This allows access to the datalogger's IP capabilities without requiring an Ethernet peripheral. The modem's COM1/Data port must be used for a PPP connection. In order for the PPP to function properly, both the modem and datalogger need to be configured. The physical connection for PPP communications requires the use of a null modem cable to connect the datalogger's RS-232 to the modem's RS-232 port.



