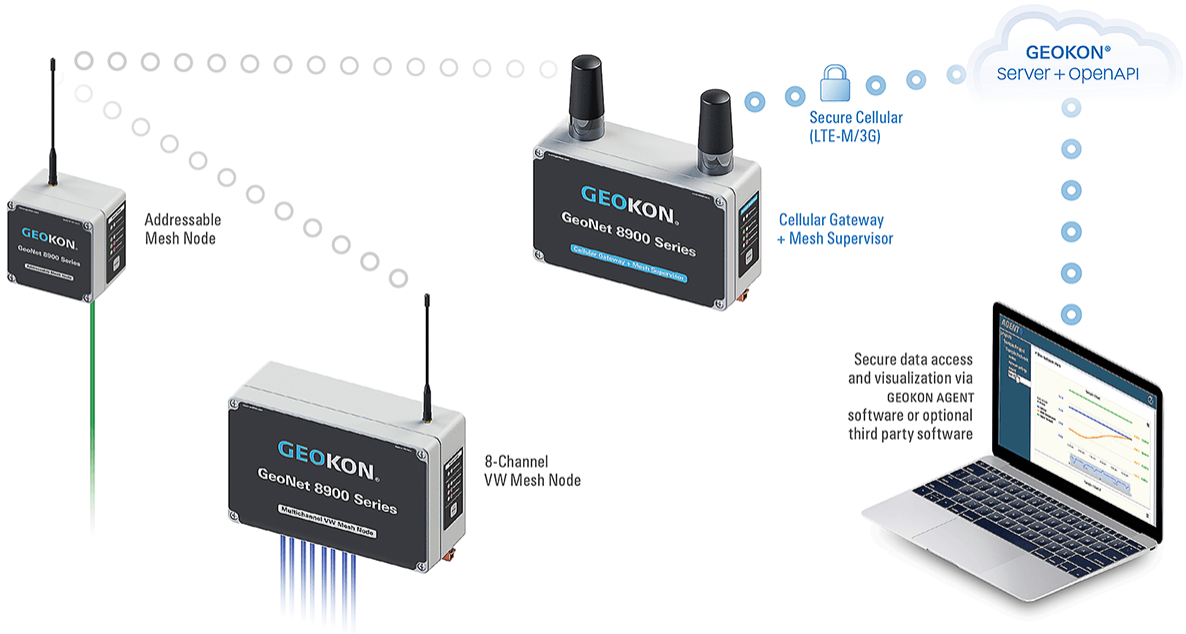
Model 8900 Series

GeoNet Wireless
Data Hosting System
Instruction Manual



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1. INTRODUCTION

GeoNet is a low-power wireless data hosting system, designed to efficiently collect data from many points. GeoNet is especially helpful in geographically-complex locations where a wired infrastructure would be expensive or even impossible. Available network components include a Cellular Gateway, Local Gateway, single- and/or multiple-channel Mesh Vibrating Wire (VW) Loggers, Mesh Addressable Loggers, a Mesh Tilt Logger, and Agent software.

Model 8900 Series loggers collect data from GEOKON's VW gauges and sensors.

The Mesh Tilt Logger contains an integrated GEOKON biaxial tiltmeter, and functions in the same manner as other loggers.

The Cellular Gateway contains a cellular module enabling it to send sensor data to the GEOKON cloud. The device stores battery and temperature data sent from the loggers, and data from the sensors, but it does not possess sensor-reading functionality on its own. Data can be retrieved using the GEOKON cloud, or manually using a cable.

The Local Gateway is the same as the Cellular Gateway except it lacks a cellular module. Data must be retrieved manually via a direct cable connection.

FEATURES:

- Automated cellular data connection to servers
- Automated calculation of engineering units via Web API integration with the GEOKON database
- Improved radio range

  Up to 60 km (15 km x 4 hops) range, line-of-sight (North America)

  Up to 22 km (5.5 km x 4 hops) range, line-of-sight (Europe)
- Up to 12 networks per area (using unique channels)
- USB connector for firmware updates, diagnostics, and more

GEOKON recommends that you configure your network with the devices at the same location, in close proximity to each other, before you deploy them to their respective on-site positions.

An installation tutorial on the GEOKON website, https://www.geokon.com/tutorial-videos, can help with this.

CAUTION! To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

1.1 MODEL IDENTIFICATION

The 8900 series model numbers are composed of codes that together indicate the following information about each unit:

GATEWAY IDENTIFICATION

8901 – NA – LTM – USB

Model/Region

8901-NA: North America
8901-BA: Brazil
8903-EU: Europe

Gateway Type

LTM: Cellular Gateway for LTE-M Networks
03G: Cellular Gateway for 3G Networks
SUP: Local Gateway

PC Connection

USB: USB Cable
232: RS-232 Cable

LOGGER IDENTIFICATION

8901 – NA – 01C – CBL

Model/Region

8901-NA: North America
8901-BA: Brazil
8903-EU: Europe

Logger Type

01C: Single-Channel Mesh VW Logger
ADR: Mesh Addressable Logger
04C: Four-Channel Mesh VW Logger
08C: Eight-Channel Mesh VW Logger
TLT: Mesh Tilt Logger

Sensor Connection

CBL: Cable Gland
10P: 10-Pin
NAP: Not Applicable

Note: 8900 series models made for North America, Brazil, and Europe are designed to operate in an identical manner.

1.2 MODEL LIST

The list of 8900 series models is as follows:

8901-NA-LTM-USB	USB LTE-M Cellular Gateway, North America
8901-NA-03G-USB	USB 3G Cellular Gateway, North America
8901-NA-SUP-USB	USB Local Gateway, North America
8901-NA-SUP-232	RS-232 Local Gateway, North America
8901-NA-01C-10P	Single-Channel Mesh VW Logger, 10-Pin Bulkhead, North America
8901-NA-01C-CBL	Single-Channel Mesh VW Logger, Cable Gland, North America
8901-NA-ADR-CBL	Mesh Addressable Logger, Cable Gland, North America
8901-NA-04C-CBL	Four-Channel Mesh VW Logger, Cable Gland, North America
8901-NA-08C-CBL	Eight-Channel Mesh VW Logger, Cable Gland, North America
8901-NA-TLT-NAP	Mesh Tilt Logger, No Cable Entry, North America
8901-BZ-SUP-USB	USB Local Gateway, Brazil
8901-BZ-SUP-232	RS-232 Local Gateway, Brazil
8901-BZ-01C-10P	Single-Channel Mesh VW Logger, 10-Pin Bulkhead, Brazil
8901-BZ-01C-CBL	Single-Channel Mesh VW Logger, Cable Gland, Brazil
8901-BZ-ADR-CBL	Mesh Addressable Logger, Cable Gland, Brazil
8901-BZ-04C-CBL	Four-Channel Mesh VW Logger, Cable Gland, Brazil
8901-BZ-08C-CBL	Eight-Channel Mesh VW Logger, Cable Gland, Brazil
8903-EU-LTM-USB	USB LTE-M Cellular Gateway, Europe
8903-EU-03G-USB	USB 3G Cellular Gateway, Europe
8903-EU-SUP-USB	USB Local Gateway, Europe
8903-EU-SUP-232	RS-232 Local Gateway, Europe
8903-EU-01C-10P	Single-Channel Mesh VW Logger, 10-Pin Bulkhead, Europe
8903-EU-01C-CBL	Single-Channel Mesh VW Logger, Cable Gland, Europe
8903-EU-ADR-CBL	Mesh Addressable Logger, Cable Gland, Europe
8903-EU-04C-CBL	Four-Channel Mesh VW Logger, Cable Gland, Europe
8903-EU-08C-CBL	Eight-Channel Mesh VW Logger, Cable Gland, Europe
8903-EU-TLT-NAP	Mesh Tilt Logger, No Cable Entry, Europe

TABLE 1: *GeoNet 8900 Series Model List*

1.3 MESH TILT LOGGER SERIAL NUMBERS

Mesh tilt loggers have two serial numbers: one for the device as a whole, and one for the internal tiltmeter. The device serial number label is below the model number label; the internal tiltmeter serial number is below the calibration date label. See the figure below.

FIGURE 1: *Mesh Tilt Logger Serial Number Placement*

2. NETWORK COMPONENTS

2.1 CELLULAR GATEWAY

Cellular Gateway models send their data to GEOKON's safe and secure Cloud via a cellular data connection, and are available with LTM or 3G connections.

The cellular connectivity is included in the data plan and no user configuration is necessary. Users can commission or decommission their own systems via GEOKON's online portal.

The gateway stores battery and temperature data sent from the loggers, and data from the sensors, but it does not possess sensor-reading functionality on its own.

FIGURE 2: *890X-XX-XXX-USB*

2.2 LOCAL GATEWAY

Local Gateway models lack an integrated cellular module, but they are otherwise functionally the same as Cellular Gateway models.

2.2.1 RS-232 (890X-XX-SUP-232)

This model features an RS-232 connector, for transferring data using an RS-232 cable to a PC running Agent software.

2.2.2 USB (890X-XX-SUP-USB)

This model features a USB connector, for transferring data using a USB cable to a PC running Agent software.

FIGURE 3: *RS-232 Local Gateway (left) and USB Local Gateway (right)*

2.3 SINGLE-CHANNEL LOGGERS

A single-channel logger will read one GEOKON vibrating wire gauge, either via 10-pin cable or via a cable with stripped conductor wires, depending on model.

Though designed to send data wirelessly to a gateway, this model also features a USB connector, for transferring data using a USB cable to a PC running Agent software.

2.3.1 10-PIN CONNECTOR (890X-XX-01C-10P)

For use with gauges with 10-pin cable connectors.

2.3.2 GLAND SEAL (890X-XX-01C-CBL)

For use with gauge cables that have stripped conductor wires. The gauge cable passes through an external cable gland and is wired into the terminal block.

FIGURE 4: *10-Pin Single-Channel Logger (left) and Gland-Seal Single-Channel Logger (right)*

2.4 MULTIPLE-CHANNEL LOGGERS

Multiple-channel loggers will read up to eight GEOKON vibrating wire gauges, depending on model, via cables with stripped conductor wires. The cables pass through external cable glands and are wired into the terminal blocks.

Multiple-channel loggers function in the same manner as other loggers.

Though designed to send data wirelessly to a gateway, these models also feature a USB connector for transferring data using a USB cable to a PC running Agent software, just as with single-channel loggers.

2.4.1 SINGLE-CHANNEL (8900-XX-ADR-CBL)

For use with sensor cables with stripped and tinned ends. The sensor cable passes through an external cable gland and is wired into the terminal block.

FIGURE 5: *Mesh Addressable Logger (8900-XX-ADR-CBL)*

2.4.2 FOUR-CHANNEL (890X-XX-04C-CBL)

FIGURE 6: *Four-Channel Logger (890X-XX-04C-CBL)*

Note: When inserting stripped conductor wires into the terminal blocks, be sure to connect them to the VW terminal blocks.

A four-channel logger can be configured as follows:

Model	Maximum Number of Gauges	Maximum Number of Load Cells
890X-XX-04C-CBL	Four	One 3-gauge **or** one 4-gauge load cell

TABLE 2: *Four-Channel Logger Gauge/Load Limits*

2.4.3 EIGHT-CHANNEL (890X-XX-08C-CBL)

FIGURE 7: *Eight-Channel Logger (890X-XX-08C-CBL)*

Note: When inserting stripped conductor wires into the terminal blocks, be sure to connect them to the VW terminal blocks.

An eight-channel logger can be configured as follows:

Model	Maximum Number of Gauges	Maximum Number of Load Cells
890X-XX-08C-CBL	Eight	One 3-gauge **and** one 4-gauge load cell Two 3-gauge **or** two 4-gauge load cells One 6-gauge load cell

TABLE 3: *Eight-Channel Logger Gauge/Load Limits*

2.4.4 ADDITIONAL INFORMATION

Addressable loggers are protected from environmental contaminants by a rugged IP66 die cast aluminum enclosure. An earth ground terminal is provided on the exterior of the enclosure to protect against lightning and other large, transient voltages.

2.5 MESH TILT LOGGER (890X-XX-TLT-NAP)

Tiltmeters are designed for permanent long-term monitoring of changes in tilt of structures such as dams, embankments, foundation walls, retaining walls, buildings, and the like.

GEOKON biaxial tiltmeter loggers contain an integrated tiltmeter sensor, and communicate with the gateway in the same manner as other loggers.

The two axes of the tiltmeter have a range of ±90°, based on a starting position of 0°. To achieve the best linearity, mount the tiltmeter so the back of the enclosure is as close as possible to vertical, and the bottom of the enclosure is as close as possible to horizontal.

Though designed to send data wirelessly to a gateway, this model also features a USB connector for transferring data using a USB cable to a PC running Agent software, the same as with the single-channel loggers.

FIGURE 8: *Mesh Tilt Logger (890X-XX-TLT-NAP)*

2.6 ACCESSORIES

Gateways and loggers are shipped with the following accessories:

- One omni-directional antenna (2.1 dBi). For other antenna options, please contact GEOKON technical support.
- Two D cell alkaline batteries
- Four desiccant packs

Gateways are shipped with the following additional accessories:

- Set of two screwdrivers, one Phillips head and one flat-head
- One RS-232 or USB cable (depending on the model purchased)
- USB to RS-232 adapter cable (RS-232 models only)

2.7 NETWORKS

Many networks use a star topology, where all loggers can send data directly to the gateway. Other networks use a mesh topology, in which loggers will relay data from any logger that might be blocked, or out of range from the gateway.

GeoNet networks are **self-healing**. This means that GeoNet will switch to a mesh topology so that loggers will automatically relay data from troubled loggers to the gateway, if needed.

GeoNet networks are **self-configuring**, meaning that the switch from a star topology to a mesh topology is automatic, and the loggers will determine for themselves which will relay data to the gateway.

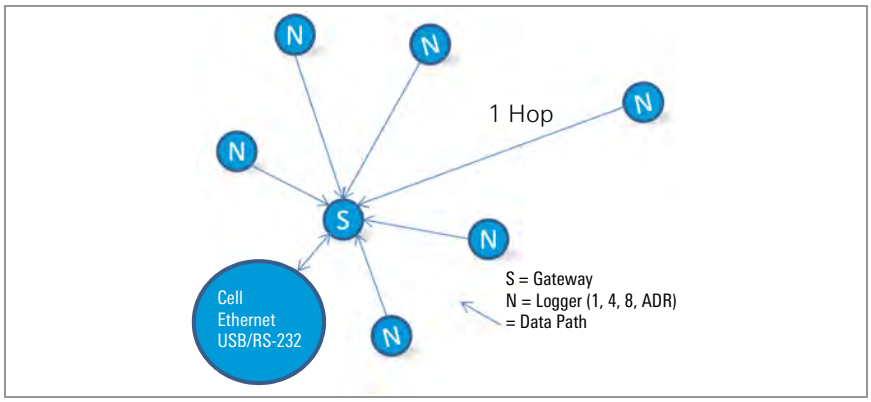

FIGURE 9: *Star Network Topology*

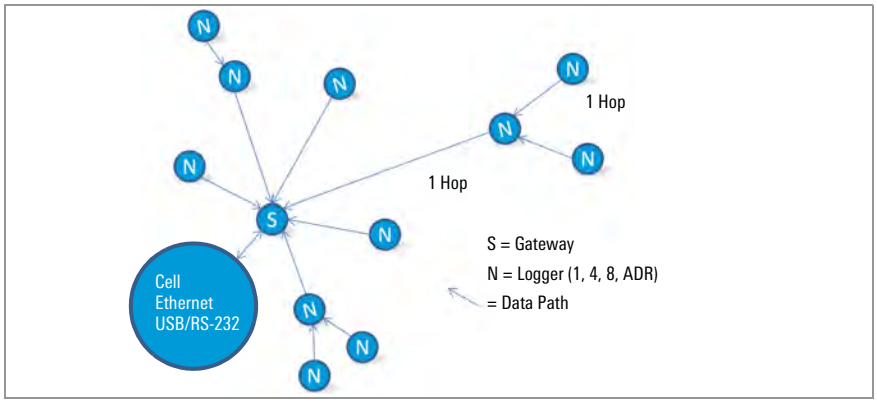

FIGURE 10: *Mesh Network Topology*

Each transmission from logger to gateway or logger to logger is considered one "hop". Examples of hops are shown in figures above and below. Up to four hops can be made between a logger and the gateway. With the ability to hop comes the ability for the gateway to communicate with loggers that have not established direct radio contact. GeoNet devices can operate around buildings or other barriers using hops.

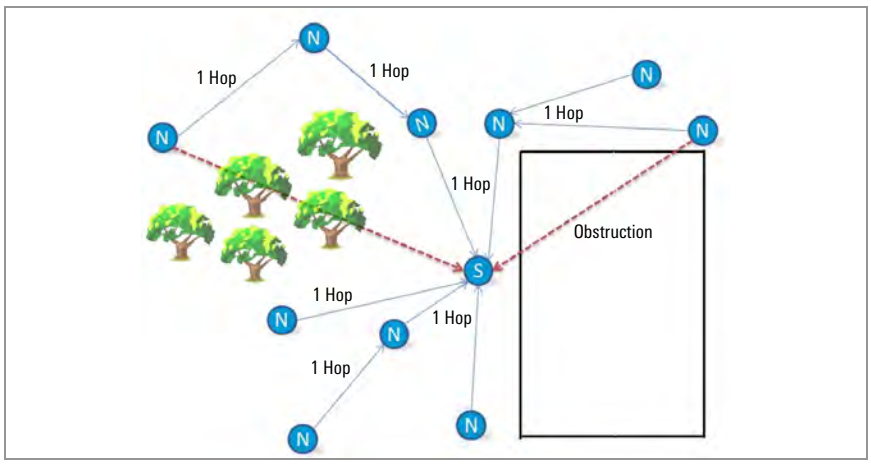

FIGURE 11: *Working Around Obstructions via Hops*

FRESNEL ZONE

The Fresnel zone is the geographic area between the sending antenna and the receiving antenna. Objects in the Fresnel zone can cause reflections of the transmitted signal. When these reflections arrive at the receiving antenna, they may be out of phase with the signal that took a straight-line path, and this can weaken the straight-line signal.

For optimum performance, GEOKON recommends creating as much vertical space as possible between the straight-line path and obstacles, including the ground.

The Fresnel zone must be at least 60% obstruction-free to ensure optimal wireless communication. The figure below illustrates the Fresnel zone.

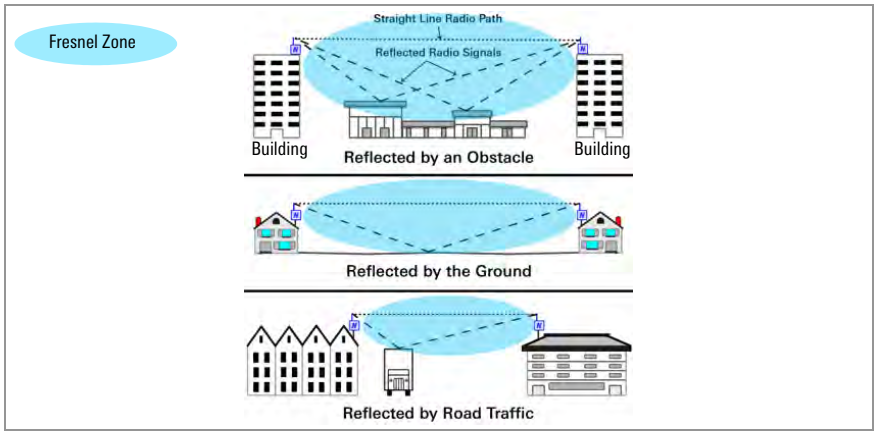

FIGURE 12: *Fresnel Zone*

IMPORTANT: If communication cannot be established when GeoNet is deployed to a site, it may be necessary to elevate the devices or their antennas, or to move them to a location where a radio link can be established. This may require extending the readout cable of the attached sensors, or adding an antenna cable extension.

3. NETWORK INSTALLATION

A network must include a gateway and at least one logger that is within radio range of the gateway.

GEOKON recommends that you configure your network with the devices at the same location, in close proximity to each other, before you deploy them to their respective on-site positions.

Skipping or omitting steps, or performing them out of order, could complicate the installation of your network.

An installation tutorial on the GEOKON website, https://www.geokon.com/tutorial-videos, can help with this.

Install the network using the following steps:

1. Configure the Network
   - Prepare the Gateway and Loggers
   - Configure the Gateway
   - Activate the network
2. Deploy the network
   - Mount the devices
   - Connect the Loggers to the sensors.
   - Link the Cellular Gateway to the Cloud (if used)

CONFIGURE THE NETWORK

3.1 PREPARE THE GATEWAY AND LOGGERS

3.1.1 INSTALL THE ANTENNAS ON ALL DEVICES

Remove the rubber caps from the antenna mounts. Position the antennas on the mounts and then rotate the antennas in a clockwise direction until tightened.

3.1.2 REMOVE THE COVERS FROM ALL DEVICES

Remove the cover by unscrewing the four captive screws on the front of the enclosure. Ensure that no dirt, water, or other contaminants are allowed to enter the enclosure.

Repeat this for each device.

3.1.3 CONFIGURE THE CHANNEL ON ALL DEVICES

GEOKON configures all devices to use Channel 1; if no other networks operate in the area, then no specific network configuration is needed and you can skip to Section 3.2.

If multiple networks are within radio range of each other, then each network (up to a limit of 12) must be configured to use a different channel. Devices of each network must be set to their respective channel.

SET THE GATEWAY AND LOGGER CHANNEL:

Move the channel select DIP switches (shown in the figure below) to any of the twelve valid positions listed in Table 4 below. The setting will take effect at power-up, or after the device is reset.

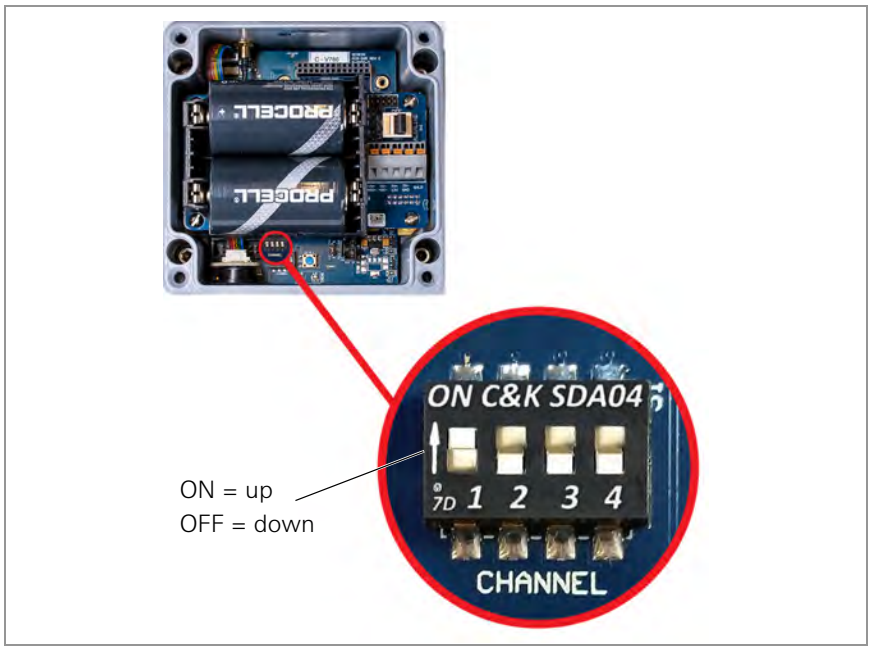

FIGURE 13: *Channel Select Switches*

Channel	1	2	3	4
1	OFF (down)	OFF	OFF	OFF
2	ON (up)	OFF	OFF	OFF
3	OFF	ON	OFF	OFF
4	ON	ON	OFF	OFF
5	OFF	OFF	ON	OFF
6	ON	OFF	ON	OFF
7	OFF	ON	ON	OFF
8	ON	ON	ON	OFF
9	OFF	OFF	OFF	ON
10	ON	OFF	OFF	ON
11	OFF	ON	OFF	ON
12	ON	ON	OFF	ON

TABLE 4: *Channel Selection*

3.2 CONFIGURE THE GATEWAY

3.2.1 POWER CONCERNS

In a new network, be sure to power the gateway **before** powering the loggers.

When the unit is powered, a green LED on the right side of the box will flash twice after a small delay, indicating the unit has power. The LEDs will not flash again until at least one logger has joined the Network.

Note: Deployment mode starts as soon as devices are powered on or reset. See Section 3.7 for information on Deployment mode.

Note: If replacing batteries in an existing network, ensure that the network is in Deployment Mode prior to removing the batteries. See Section 4.3 for more information on battery replacement.

3.2.2 POWER THE GATEWAY

- Cellular Gateway 890X-XX-LTM-USB, 890X-XX-03G-USB

  Move the battery switch to the EXT BATTERY or INT BATTERY position, according to the chart below. Connect to external DC power, then proceed to Section 3.2.3.

  For solar panel information, see Appendix F.

	Geographic Zone	
Power Source	**Sub Polar**	**Temperate**
Mains or solar with external battery	EXT BATTERY	INT BATTERY
Solar without external battery	N/A	

TABLE 5: *Cellular Gateway Battery Switch Options*

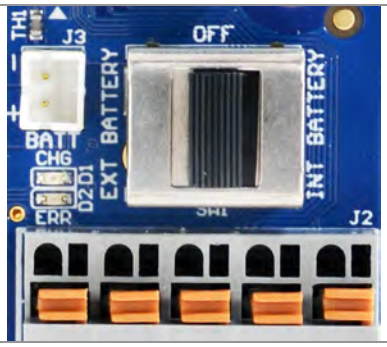

FIGURE 14: *Cellular Gateway Battery Switch*

- Local Gateway 890X-XX-SUP-232, 890X-XX-SUP-USB

  Move the battery select switch to either the ALKALINE or LITHIUM position depending on the type of battery being used.

  Align the positive (**+**) side of the batteries with the **+** indicator in the battery holder. Push the batteries straight down into the holder.

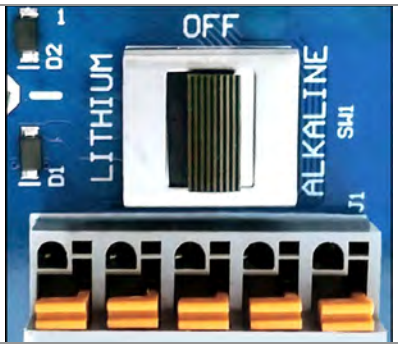

FIGURE 15: *Local Gateway Battery Switch*

FIGURE 16: *Battery Switch Location Detail*

3.2.3 SEAL THE GATEWAY

1. Place the supplied desiccant packs inside the enclosure.
2. Ensure the cover gasket and the mating ridge on the enclosure are clean, and that the gasket is properly seated inside the groove on the cover. Place the cover on the unit.

3. Tighten the cover screws slowly. If an electric screwdriver is used, **do not** fully tighten the screws; do the final tightening by hand. Work in a diagonal pattern.

Important! Make sure the cover seals tightly and evenly.

3.2.4 SET THE NETWORK TIME

A Cellular Gateway will set the network time automatically when it connects to the cellular network. A Local Gateway must have its time set manually using GEOKON's "Agent" data collection software.

Connect the Local Gateway to the computer using the GEOKON-supplied USB cable. For RS-232 models, connect the USB cable using the GEOKON-supplied RS-232 adapter.

Note: For details on setting up a Network in Agent, watch the Agent software tutorial or refer to the Agent instruction manual. The network will not begin collecting data until the network time is set.

3.2.5 VERIFY THE NETWORK TIME

Press the Status button to verify that the network time is set. The LEDs should flash both green and red. If only the red LED flashes:

- For a Cellular Gateway, wait several minutes and try again.
- For Local Gateway, set the network time using Agent.

3.2.6 RECORD THE GATEWAY SERIAL NUMBER

The serial number of the gateway is required when using Agent software and when commissioning the gateway.

3.3 ACTIVATE THE NETWORK

3.3.1 POWER THE LOGGERS

Power the loggers in a manner similar to the process of powering the gateway. Do the following:

1. Move the battery select switch to either the ALKALINE or LITHIUM position depending on the type of battery being used.
2. Align the positive (**+**) side of batteries with the **+** indicator in the battery holder. Push the batteries down into the holder.

An LED will flash twice, indicating the unit has power.

3.3.2 VERIFY THE NETWORK CONNECTION OF THE LOGGERS

If the gateway is in Deployment mode, the loggers will join the network about 30 seconds after power up, as indicated by the LED(s) on the loggers flashing in unison with the gateway.

Verify that the LED indicators on the loggers and the gateway are flashing green only. This may take several minutes depending on network configuration.

DEPLOY THE NETWORK

3.4 MOUNTING THE DEVICES

The attached mounting bracket is designed to be used with U-bolts, hose clamps, screws, etc. Mount all devices vertically, with the antenna pointing up.

GEOKON recommends a mounting height of at least two meters. Lower than two meters may compromise performance; as a rule, higher is usually better.

3.4.1 MOUNTING LOCATION CONSIDERATIONS

Select the mounting location with care. Certain mounting configurations can hinder or even completely block wireless signal transmission, or can introduce electrical noise to the signal.

Common mounting mistakes include the following:

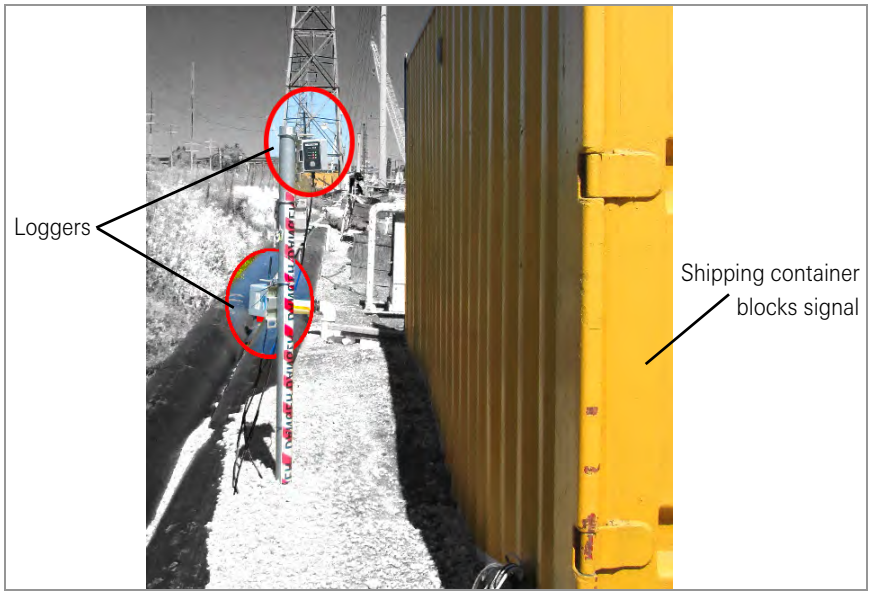

FIGURE 17: *Installing Near a Large Object*

FIGURE 18: *Installing Close to Buildings or Fences/Walls, and/or Horizontally*

FIGURE 19: *Mounting onto a Metal Plate and/or Inside an Enclosure*

Large structures, such as walls, buildings, hills, etc. can block and/or reflect RF signals. Tips include:

- Mount antennas above metallic structures.
- Keep in mind that loggers communicate with each other, not just with the gateway.
- A high Received Signal Strength Indicator (RSSI) level does not guarantee trouble-free communication.
- Mount devices such that their antennas are on top, pointing upward.

3.4.2 GROUND THE GATEWAY AND LOGGERS

Install a grounding rod and cable, or other suitable ground, at a location near each device. Cellular Gateways and multiple-channel loggers come equipped with a copper grounding lug to which you can connect the grounding cable. Ground Local Gateways and loggers by connecting the grounding cable to the mounting bracket.

3.5 CONNECT THE SENSORS TO LOGGERS

3.5.1 MAKING CABLE GLAND CONNECTIONS

To connect a device using a cable gland connection:

1. Loosen the nut on the cable fitting and remove the white plastic dowel.
2. Slide the transducer cable through the cable gland nut and fitting.
3. Insert the lead wires into the terminal block as shown in Figure 20 and Table 6. Press down on the orange tab, insert the bare end of the wire into the terminal block, and then release the tab.
4. Pull gently on each conductor to ensure it is secure.
5. Tighten the cable gland nut until it firmly grips the outer jacket of the cable. The cable gland nut must be properly tightened to prevent water entry. Do not over-tighten, as this might strip the plastic threads.
6. Pull gently on the gauge cable to ensure it is held in place by the cable gland.
7. Repeat these steps for each gauge cable to be connected.

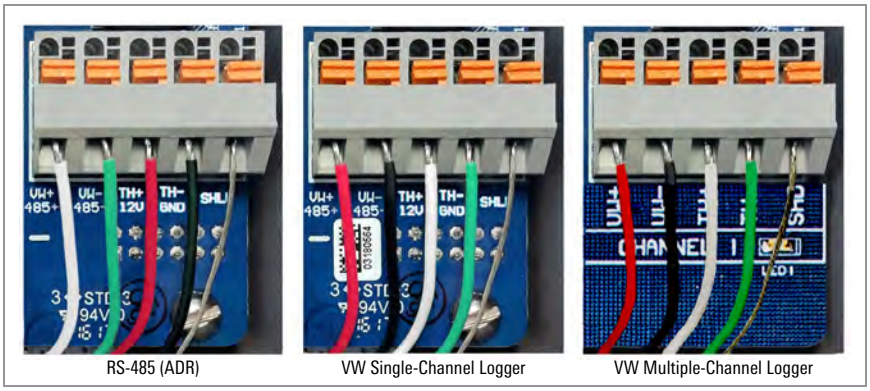

FIGURE 20: *Terminal Connections*

To prevent a short circuit, do not allow bare leads to touch each other during or after wiring.

RS-485 (Mesh Addressable Logger)		
Position	**Color**	**Description**
485+	WHITE	RS-485 Data +
485–	GREEN	RS-485 Data –
12V	RED	12 Volt Bus
GND	BLACK	Bus Ground
SHD	BARE	Analog Ground (shield)

Single/Multiple-Channel Mesh VW Logger		
Position	**Color**	**Description**
VW+	RED	Vibrating Wire +
VW–	BLACK	Vibrating Wire –
TH+	WHITE	Thermistor +
TH–	GREEN	Thermistor –
SHD	BARE	Analog Ground (shield)

TABLE 6: *Logger Wiring*

3.5.2 MAKING 10-PIN CABLE CONNECTIONS

To connect a device using a 10-pin connection:

1. Remove the cover from the 10-pin connector.
2. Align the grooves on the sensor connector (male), with the connector on the logger (female).
3. Push the connector into place and then twist the outer ring of the male connector until it locks.

3.5.3 NOTES ABOUT MULTIPLE-CHANNEL AND ADDRESSABLE LOGGERS

- For ease of wiring, sensor cables should be inserted into the cable glands on multiple-channel loggers from left to right.
- Sensors should be wired into the channels of a logger in sequence starting with Channel 1.
- **Do not** wire sensors into the terminal blocks marked '485 IN' and '485 OUT' on a multiple-channel logger.
- Multiple-channel loggers and addressable loggers stop trying to read an empty channel after two attempts. The logger will read all channels at the top of every hour; it will resume sampling when it detects a sensor.

3.5.4 SEAL THE LOGGERS

Seal the loggers using the instructions in Section 3.2.3.

Important! Make sure the cover seals tightly and evenly.

WARNING: Single-channel enclosure lids are square but not symmetrical. They must be oriented correctly; attempting to seal a misaligned lid could strip the threads and/or allow moisture to enter the enclosure.

3.5.5 RECORD LOGGER AND SENSOR SERIAL NUMBERS

Record the serial numbers of both the loggers and of the attached sensors.

For multiple-channel loggers, also record the channel to which each sensor has been connected.

The serial numbers are required when using Agent software and when commissioning the Cellular Gateway.

3.6 CELLULAR GATEWAY COMMISSIONING

Commissioning allows the Cellular Gateway to account for all of the loggers in the network. For ease of setup, make sure all loggers have been added to the network before commissioning the gateway.

Note: The Cellular Gateway cannot account for loggers added to the network after the commissioning process has been completed. Run the commissioning process again when adding new loggers.

To commission the Cellular Gateway, do the following:

1. Display https://api.geokon.com in a Web browser.

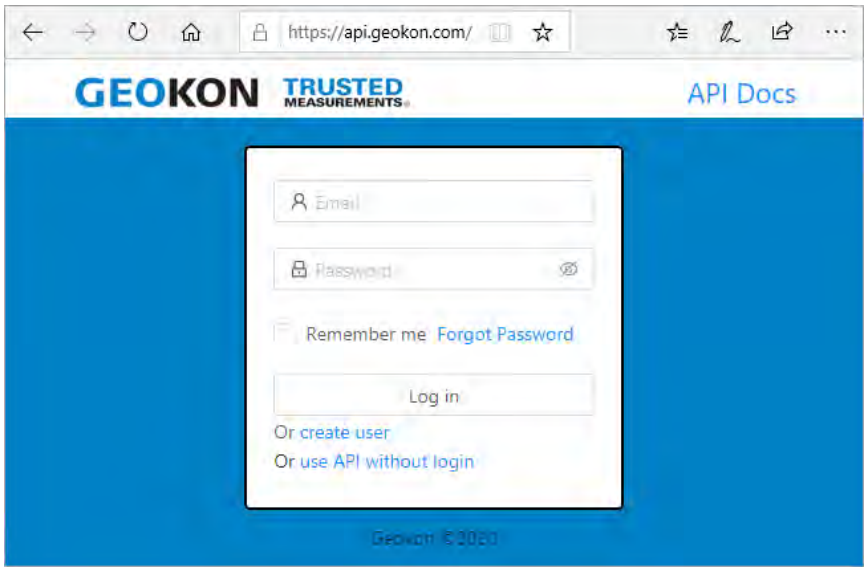

FIGURE 21: *Accessing the Cloud*

2. Click "create user".

   Note: To access your data using an API, click "use API without login".

3. Enter your credentials and read/agree to the terms of service.

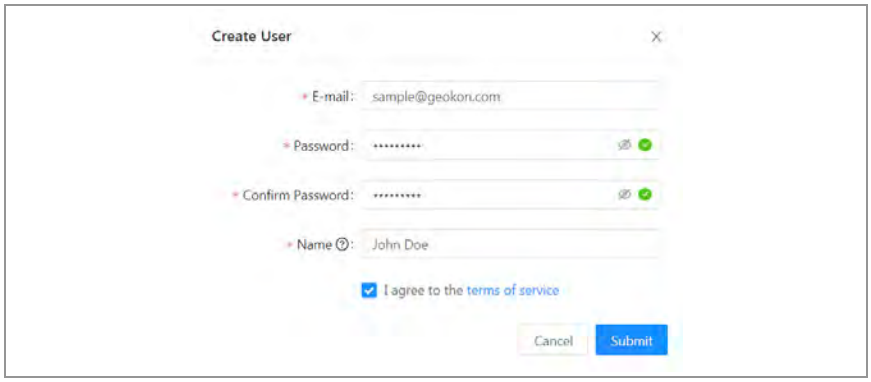

FIGURE 22: *Create a User*

4. Click Submit.
5. Log in using your email address and password.
6. Click "Add account".

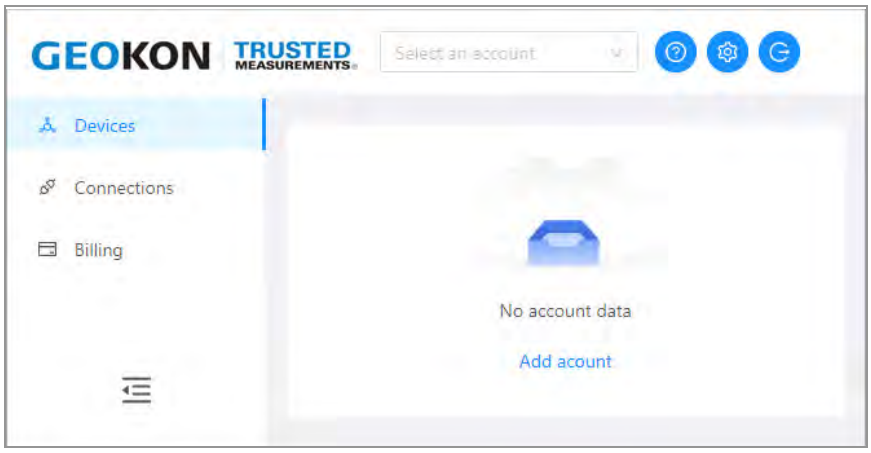

FIGURE 23: *Add an Account*

7. Click "create new account".

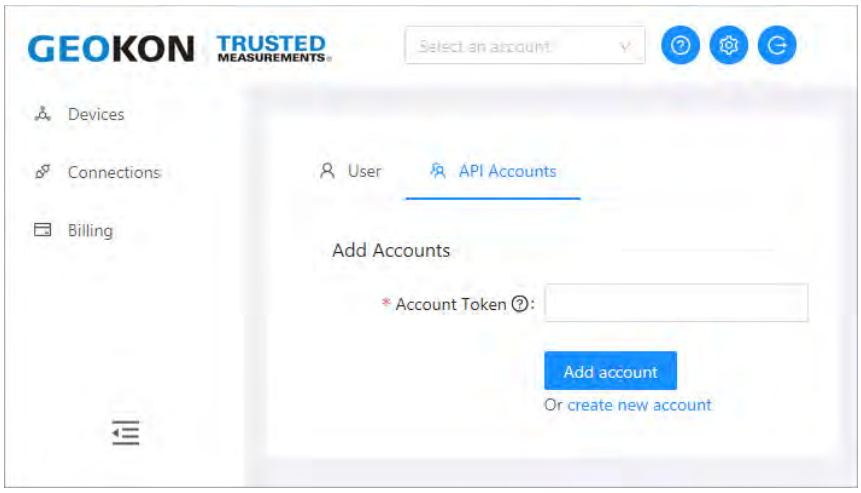

FIGURE 24: *API Accounts*

8. Enter your credentials and credit card information, then click Submit. A copy of the account token will be emailed to the address associated with the account as a receipt.

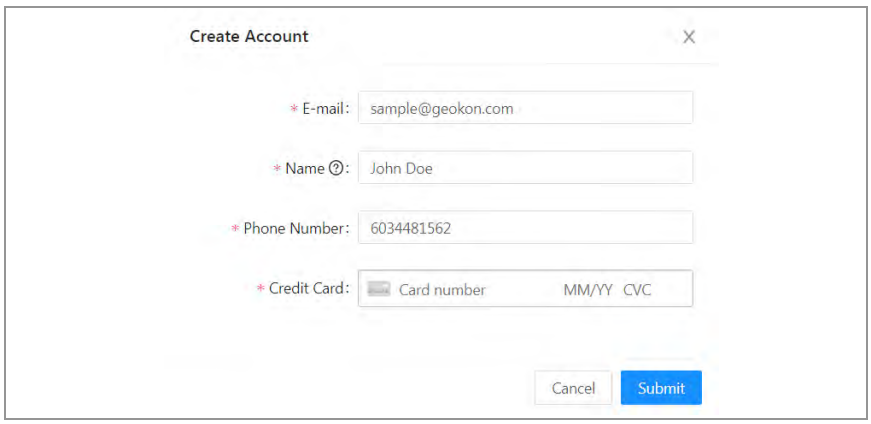

FIGURE 25: *Enter your Credentials*

9. Click Devices, then enter the serial number of the Cellular Gateway.

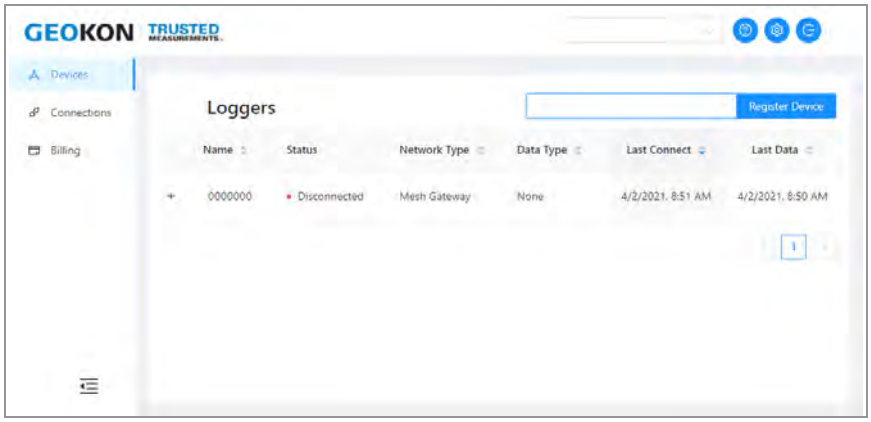

FIGURE 26: *Enter the Serial Number*

10. Click Register Device.
11. Click the button next to Activate Cellular Service to activate the Cellular Gateway.

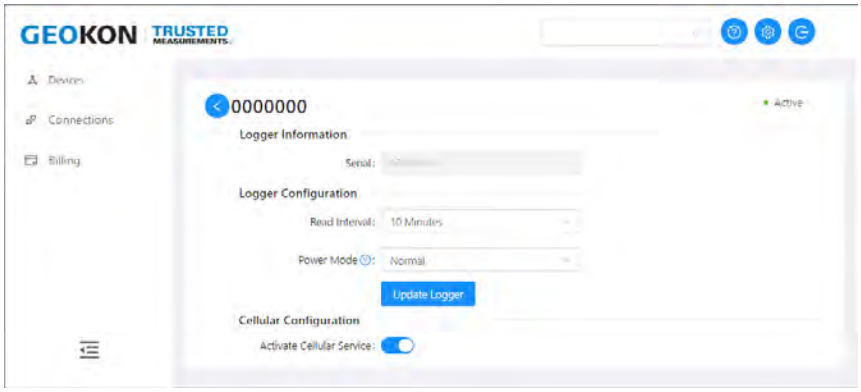

FIGURE 27: *Activate Cellular Service*

12. Add logger(s) to the gateway by clicking the + sign next to the Cellular Gateway name. Populate the fields that display.
13. Add sensors to the logger(s) by clicking the + sign next to a logger, then enter the serial number(s) of the sensor(s) attached to the logger, one per channel.

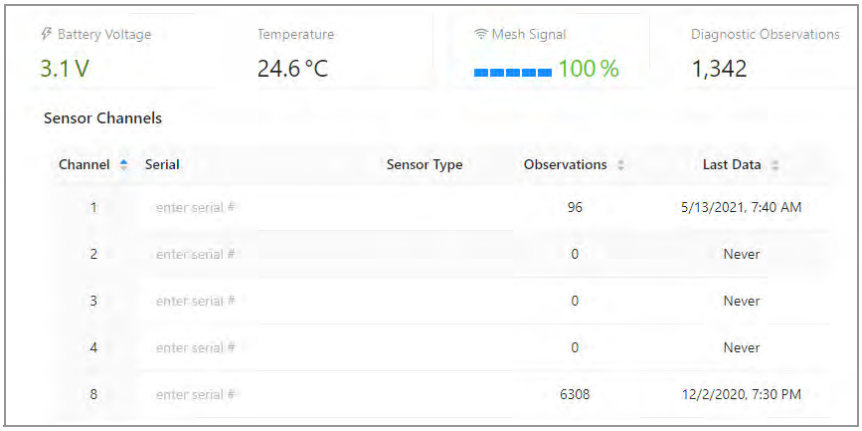

FIGURE 28: *Enter Sensor Serial Numbers*

14. Click Update Info to save the sensor configuration.

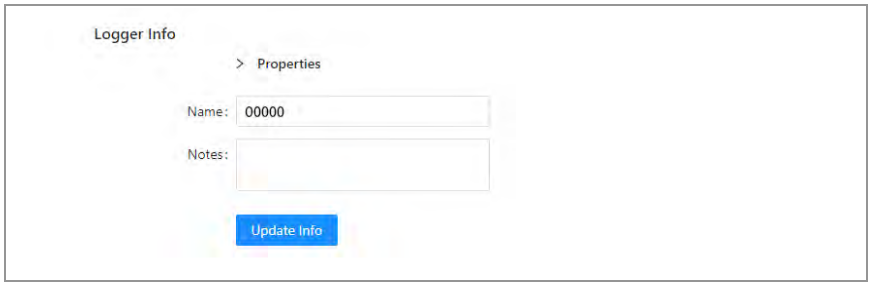

FIGURE 29: *Update the Sensor Configuration*

15. Repeat steps 12 – 14 for all loggers on the Network.
16. Click Connections, then enter a token name in the Create Token field.
17. Click Create Token. A new token entry displays.
18. Click the blue token to copy it to the Windows Clipboard.

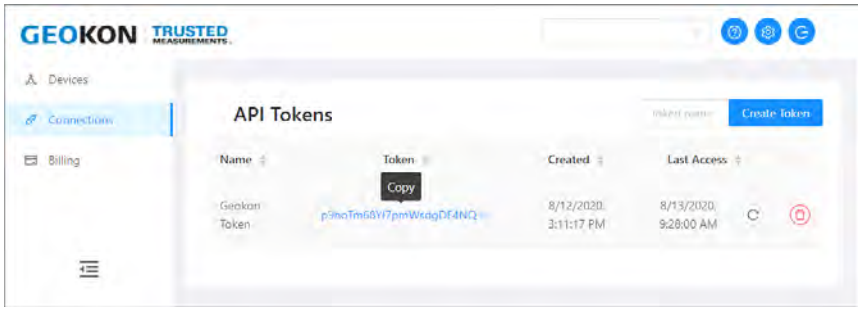

FIGURE 30: *Copy the Token*

19. Paste the token into GEOKON's data collection software, "Agent", to commission the Cellular Gateway and retrieve data.

3.7 DEPLOYMENT MODE

There are two modes of operation: Deployment mode and Normal mode. Deployment mode allows loggers to be quickly added to a network and verified.

Put the gateway into Deployment mode before making any changes, such as adding loggers (during initial setup or later), resetting loggers, or resetting the gateway.

The gateway enters Deployment mode upon power up, pressing the Status button, or system reset.

- To start Deployment mode, press and release the Status button on the gateway.
- To reset the system, **press and hold the Status button for 10 seconds**.

CAUTION! DO NOT reset the gateway unless it is in Deployment mode.

For information on the function of the Status button, see Section 3.8.

When the network is in Deployment mode, the network status will be indicated by the LEDs on the gateway approximately every 10-15 seconds.

Under normal Deployment mode radio conditions, the gateway and logger units will find each other in less than three minutes; this establishes the network.

Once the network is established and the network time is set, the gateway's green LED will flash simultaneously with the green LEDs on the loggers. If the network time has not been set, the gateway's red LED will blink in unison with the loggers. In that case the time must then be set using the Agent software.

IMPORTANT: Deployment mode will cease automatically after one hour, at which time Normal mode will being.

If the correct lights do not illuminate, or if the network has exited Deployment mode, press the Status button on the gateway to restart Deployment mode.

3.7.1 PLACING THE GATEWAY AND ADDING LOGGERS

Place the gateway in a location central to the distribution of the loggers, if possible (see Figure 31 below). Doing so will minimize the number of hops, which will improve battery life.

While in Deployment mode, loggers may be added simply by turning them on within radio range. When adding loggers, **start with those closest to the gateway.**

Watch the LEDs while moving the loggers, to ensure the signal isn't lost.

After 10 minutes, the LEDs on the loggers will stop indicating their status, to conserve batteries. Pressing the Status button on a logger will reactivate the LEDs for another 10 minutes.

By default, a network will remain in Deployment mode for one hour. When a new logger joins the network the timer will reset, extending the deployment period for another hour. If more time is needed while deploying loggers, the default deployment timeout may be changed using Agent software.

If isolated from the rest of the network, a logger will continue to sample and store data. When communication is reestablished, it will "catch up" by sending all collected data to the gateway.

For networks with a Local Gateway, data will not be collected until the network time is set. To do this, use the Agent software. The default scan interval for data collection is 10 minutes.

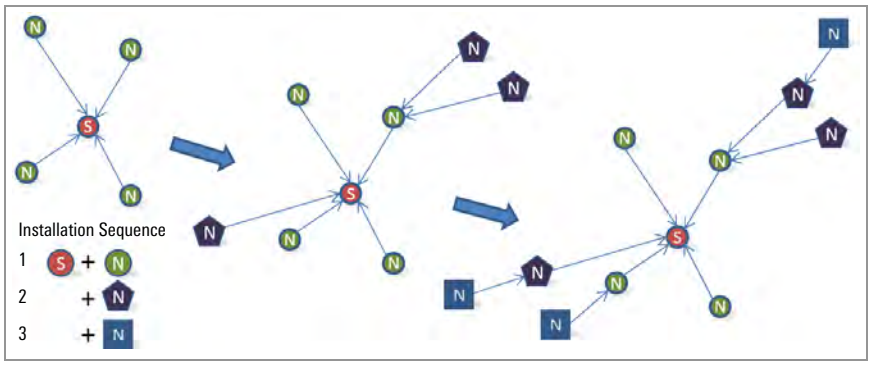

FIGURE 31: *Installation Sequence*

3.8 STATUS BUTTON FUNCTIONALITY

All GeoNet devices have red and green LED indicators to display their status. A reference key is printed on the side of each unit, below the LEDs. When pressed, the Status button triggers the appropriate LED indicators to briefly illuminate.

The table below shows the meaning of the various LED indications.

LEDs		Gateway	Loggers
Green		Time set, Loggers present	GOOD: Radio signal > 30%
Green	Red	Time set, no Loggers present	MARGINAL: Radio signal < 30%
	Red	Network time not set	BAD: No radio signal

TABLE 7: *LED Indicator Meaning*

When the Status button is pressed on the gateway, the LEDs briefly display the network status. If the network is in Deployment mode when the button is pressed, the Deployment mode timer will reset. If the network is not in Deployment mode, it will enter Deployment mode on the following radio cycle. This could take up to six minutes, as changes to the radio settings can only occur when all the radios in the network are awake. In order to provide timely feedback to the user, the network parameters are set to a 10-second radio interval while the gateway is in Deployment mode.

When the Status button is pressed on a logger, the LEDs briefly display the radio signal status. The logger will indicate the status of the radio signal after each radio transmission for a period of 10 minutes. If a logger has not yet joined the network, it will change its radio interval to approximately one second and search for an available network.

Device	Function	Status Button Action
Gateway or Logger	Reset	Press and hold until both LEDs illuminate (~10 seconds)
Gateway	Put the network into Deployment mode/extend Deployment mode. Display the current status.	Press and release
Gateway	Take a reading and send existing data immediately	Press and release
Logger	Display the current status, then indicate signal strength every radio cycle for 10 minutes	Press and release

TABLE 8: *Status Button Functions*

4. MAINTENANCE

All GeoNet devices are designed to operate in field environments with minimal upkeep; nevertheless, there are some basic maintenance procedures that should be followed to ensure maximum reliability and functionality.

4.1 PREVENTING WATER FROM ENTERING THE ENCLOSURES

GeoNet devices are designed to be splash proof and rain proof, but are not submersible.

GeoNet devices MUST be mounted vertically

These units are sealed by a gasket preventing water entry, so long as the screws that hold the lid in place are properly tightened and the gasket inside the lid is properly aligned. It is also very important to ensure that all the cable fittings are securely tightened. Models that feature a 10-pin connector are equipped with a watertight cap, which must be installed when the connector is not in use.

Despite these precautions, the loggers may encounter leakage along the cable if the cable is cut, or if the unit is installed in an especially humid environment. In this type of environment, GEOKON recommends that the internal desiccant packs be replaced at intervals to prevent condensation from corroding or shorting out the internal electronics.

4.2 BATTERY LIFE

Battery life is affected by the quantity and physical configuration of the loggers, along with weather conditions and the radio environment (as related to retries).

Loggers that are the only communication link between other loggers and the gateway will have a shorter battery life than those that have no routing responsibility.

Table 9 below shows an estimate of battery life in a network of fewer than 20 loggers based on the number of readings collected and forwarded to the gateway. More than 1,000 days of battery life are possible when using a scan rate of one hour or higher, with only one hop. A more frequent scan rate will reduce this estimate. If greater battery life is needed, a 12-volt nominal input is available from GEOKON.

	Alkaline	**Lithium**
Readings Transmitted	25,000	70,000
Radio Cycles	500,000	1,400,000
Scan Rates (minutes)	**Days**	**Days**
12	208	583
20	347	972
30	521	1458
60	1042	2915

TABLE 9: *Battery Life Estimates*

4.3 REPLACING BATTERIES

The network must be put into deployment mode prior to replacing the batteries in the gateway. This is also best practice when replacing batteries in loggers.

Replace D cell batteries when their measured voltage drops below 2.0 VDC. Replace external 12-volt batteries when the measured voltage drops below 11 VDC.

All data is retained in nonvolatile flash memory. Data will not be lost even if the batteries are removed for an extended period (e.g., years).

REPLACE THE BATTERIES AS FOLLOWS:

1. Place the network in deployment mode by pressing the status button on the gateway. Within six minutes the green LED will begin flashing every 10 seconds.
2. Open the logger by unscrewing the four captive screws on the front of the enclosure. Make sure that no dirt, water or other contaminants are allowed to enter the enclosure.
3. Set the battery select switch to the OFF (middle) position.
4. Remove the existing batteries, if installed.
5. Install the batteries by aligning the positive (**+**) side of the D cells with the (**+**) indicator in the battery holder. Push the batteries straight down into the holder.
6. For Move the battery select switch to either the Alkaline or Lithium position depending on the type of battery being used. An LED will flash on the right side of the box indicating the unit has power. Once the logger reconnects to the network, the green LED will blink every 10 seconds in unison with the LED on the gateway.

   Note: If replacing the batteries in a network gateway and power is restored promptly, the gateway will remain active. If power is not restored promptly the network time will be lost and must be reset using the Agent software. The loggers within the network will reconnect automatically.

4.4 LIGHTNING PROTECTION

Each vibrating wire (VW) channel is protected by a 230V gas discharge tube, followed by a high-speed surge protector and a transient voltage suppression diode. Each thermistor (TH) channel is protected by a 230V gas discharge tube, followed by an inductor (lower resistance than high-speed surge protectors) and a transient voltage suppression diode.

For these components to safely divert lightning energy to ground, a solid electrical connection to earth ground is required. A copper grounding rod at least six feet in length should be driven into the soil to a minimum depth of three feet, as close to the device as possible. Alternatively, any other suitable earth ground attachment may be used. Connect the grounding rod to the copper grounding lug on the exterior of the device (if equipped) with a 12 AWG or larger wire. This will provide a path from the device to earth ground in the event of a lightning strike.

5. MODEL 8800-2-4B ADD-ON MODULE

5.1 INTRODUCTION

Model 8800-2-4B (Ethernet compatibility) is an add-on module for the gateway to allow the end user to easily add remote communications and data download functionality.

Each module comprises a weather proof enclosure 305 x 254 x 152 mm (12" x 10" × 6") in size, a 7 amp hour rechargeable battery, a charger, and the necessary cables to interface with a GeoNet gateway.

When an add-on module is paired with a gateway, the gateway is powered by the rechargeable battery inside the module. The charge level of the battery can be monitored using the Agent software.

5.2 INSTALLATION OVERVIEW

Modules are shipped with the batteries uninstalled and the fuse distribution board switch in the OFF position. To deploy modules, install the batteries and set the switch to the ON position.

Install D cell batteries in the gateway and set the battery switch to the appropriate setting to ensure communication between the gateway and the loggers will not be interrupted if the battery level drops. See Section 3.2.1.

5.3 IP ADDRESS CONFIGURATION

GEOKON sets the module to communicate with a GeoNet gateway; however, the user must finish the setup so that it works with their network. Configure an IP address by following the instructions below.

Note: The following steps should only be performed by your network administrator. NPort Administrator (on CD) should be installed and used to configure the required IP changes.

1. Connect a computer to the module via the Ethernet Port.
2. Open NPort Administrator and click *Search*. (By default, the MOXA 5110A IP Address 192.168.127.254 will be displayed.)
3. Double-click on the *IP Address* under the configuration window.
4. In the configuration window, click on the Network tab.
5. Check the boxes next to *Modify IP address* and *Modify Netmask*.

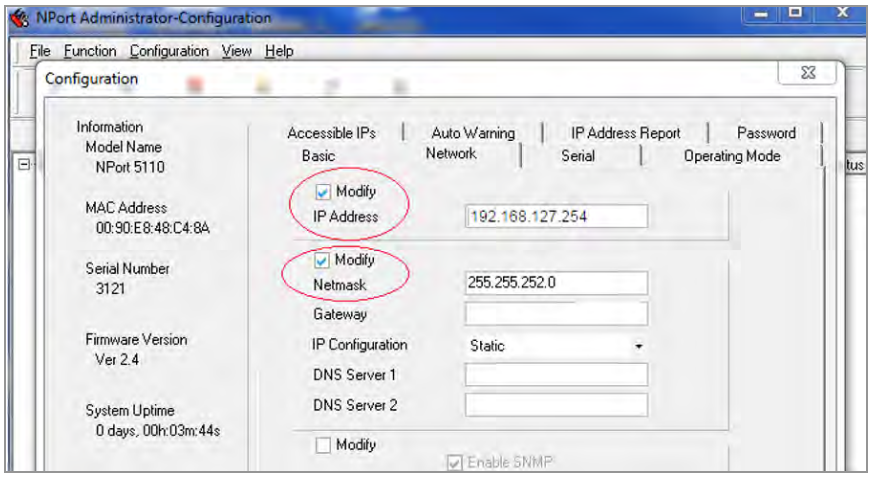

FIGURE 32: *Nport Configuration*

6. Update the *IP Address*, *Netmask*, *Gateway*, and *DNS Server 1* fields to match your network.

Note: Do not make any other changes to the settings because it may hinder proper communications with the gateway.

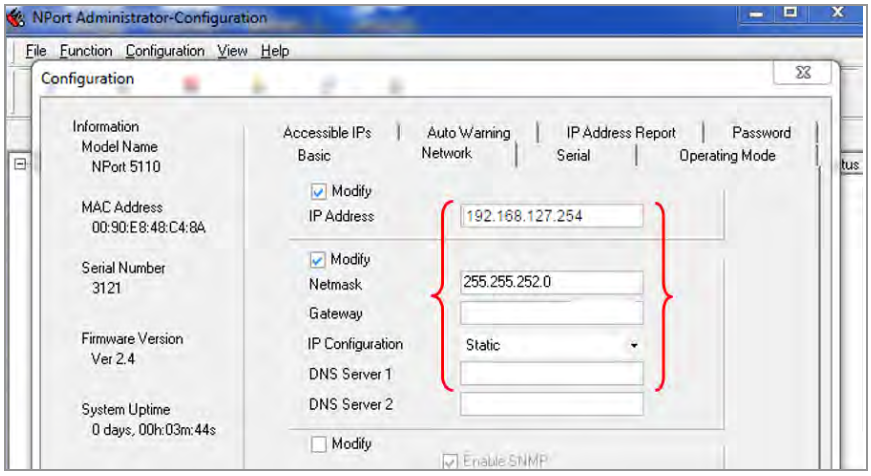

FIGURE 33: *Update Fields*

7. Click *OK*.
8. Use the ON/OFF switch to restart the module.
9. Connect the add-on Module to the gateway.
10. Enter the new IP address followed by **:4001** in the *Network Address* field in Agent software.

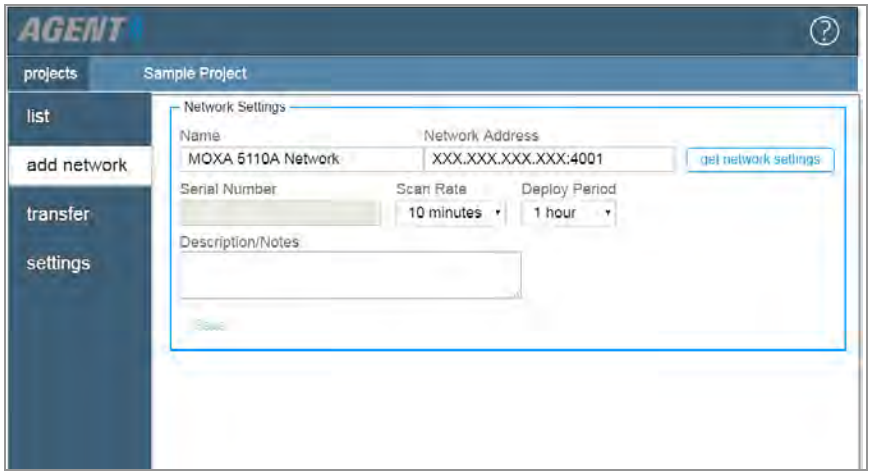

FIGURE 34: *Enter the IP address followed by :4001*

For more information on using Agent software, please refer to the Agent Software Program instruction manual, available at https://www.geokon.com.

APPENDIX A. SPECIFICATIONS

A.1 GATEWAY SPECIFICATIONS

Data Memory	32 MB
Storage Capacity	> 1.04 M Arrays
Communication Type	USB, RS-232
Communication Speed	115.2 kBits/second
Communication Parameters	8,N,1 (data bits, parity, stop bits)
Scan Interval	10-1440 Minutes
USB Driver	FTDI
Power Supply	Cellular Gateway: Battery pack, or 9-24V DC external Local Gateway: D cell, alkaline or lithium (2x), or 12V external
Operating Time	Please contact GEOKON
Operating Temperature	–40 °C to +85 °C
(L×W×H)	Cellular Gateway: 160 × 260 × 91 mm Local Gateway: 120 × 122 × 91 mm

TABLE 10: *Gateway Specifications*

A.2 LOGGER SPECIFICATIONS

Data Memory	32 MB
Storage Capacity	Varies by model
Trueness	0.082 Hz
Frequency Precision	±0.146Hz (99% CI)
Frequency Resolution	±0.002 Hz
Thermistor Accuracy	External thermistor: ±0.5 °C On-board sensor: ±0.4 °C
Thermistor Resolution	External thermistor: ±0.032 °C On-board sensor: ±0.1 °C
Scan Interval	10-1440 Minutes
Power Supply	D cell, Alkaline or Lithium (2x), or 12V external
Operating Temperature	–40 °C to +85 °C
VW Excitation Peak Current	25 mA (max)
VW Frequency Range	400 Hz - 5000 Hz
Sweep/Read Duration/Channel	< 500 mS
Battery Life	Refer to Section 4.2
Dimensions (L×W×H)	120 × 122 × 91 mm (single-channel) 160 × 260 × 91 mm (four-channel) 180 × 280 × 101 mm (eight-channel)
Vibrating Wire Channel Lightning Protection	Gas discharge tube High-speed surge protector Transient voltage suppression diode
Thermistor Channel	Gas discharge tube Inductor (lower resistance than high-speed surge protectors) Transient voltage suppression diode

TABLE 11: *Logger Specifications*

A.3 NETWORK SPECIFICATIONS

Network	**8901-NA**	**8901-BZ**	**8903-EU**
Radio Frequency, ISM Band	902 – 928 MHz	902 – 906, 915 – 928 MHz	863 – 870 MHz
Topology	Star/Mesh/Cluster Tree (Automatic)		
Radio Technology	FHSS		
Channels	12		
Range[1]	Up to 60 km (15 km x 4 hops)		Up to 22 km (5.5 km x 4 hops)
Transmit Power	1 W		20 mW
Receiver Sensitivity	–106 dBm		–106 dBm
Antenna (Half-Wave Dipole)	2.1 dBi		1.6 dBi

[1]Line-of-sight, maximum 4 hops

TABLE 12: *Network Specifications*

A.4 MESH TILT LOGGER SPECIFICATIONS

Precision	±26.9 [0.0075°]	Arcseconds [Degrees]
Nonlinearity	±0.005° across ±30° range (0.09 mm/m)	Arcseconds [Degrees]
Temperature-Dependent Uncertainty	68.8 [0.019°]	Arcseconds [Degrees] / °C
Angle Resolution	0.9 [0.00025°]	Arcseconds [Degrees]
Tilt Range	±90°	Degrees
Axes	2	

TABLE 13: *Mesh Tilt Logger Specifications*

APPENDIX B. CONNECTOR PINOUTS

B.1 GAUGE CABLE

B.1.1 GLAND SEAL MESH VW LOGGERS (890X-XX-01C-CBL)

Terminal Strip Position	Description	Cable Wire Color
VW+	Vibrating Wire+	RED
VW–	Vibrating Wire–	BLACK
TH+	Thermistor+	WHITE
TH–	Thermistor–	GREEN
S	Analog Ground (shield)	BARE WIRE

TABLE 14: *Mesh VW Logger Cable Connections (Gland Seal)*

B.1.2 10-PIN BULKHEAD MESH VW LOGGERS (890X-XX-01C-10P)

10-Pin Bulkhead	Internal Wire Color	Description	Cable Wire Color
A	Brown	Vibrating Wire+	RED
B	Red	Vibrating Wire–	BLACK
C	Orange	Thermistor+	WHITE
D	Yellow	Thermistor–	GREEN
E	Green	Analog Ground (shield)	BARE WIRE
F	Blue	+VCC Supply	N/A
G	Violet	Digital Ground	N/A
H	Grey	Mux Reset	N/A
J	White	Mux Clock	N/A
K	Black	Digital Ground	N/A

TABLE 15: *Mesh VW Logger Cable Connections (10-Pin Bulkhead)*

B.1.3 MESH ADDRESSABLE LOGGERS (890X-XX-ADR-CBL)

Terminal Strip Position	Description	Cable Wire Color
485+	RS-485 Data+	WHITE
485-	RS-485 Data-	GREEN
12V	12 Volt Bus	RED
GND	Bus Ground	BLACK
S	Analog Ground (shield)	BARE WIRE

TABLE 16: *Mesh Addressable Logger Cable Connections (Gland Seal)*

B.2 COMMUNICATION CONNECTIONS

B.2.1 RS-232 (890X-XX-SUP-232)

10-Pin Bulkhead	Internal Wire Color	Description	Connection
A	Brown	GND	J1-1
	Green		J1-5
B	Red	RX	J1-2
C	Yellow	TX	J1-4
J	Red and Black (twisted pair)	12V Aux In (Red)	J3-1
K		GND (Black)	J3-2

TABLE 17: *Communication Connections (RS-232)*

B.2.2 USB (890X-XX-SUP-USB)

10-Pin Bulkhead	Internal Wire Color	Description	J9
A	Red	+5V	2
B	Orange	D–	3
C	Yellow	D+	4
D	Brown	GND	1
	Green		5

TABLE 18: *Communications Connections (USB)*

APPENDIX C. THERMISTOR TEMPERATURE DERIVATION

3KΩ THERMISTOR RESISTANCE

Thermistor Types:

- YSI 44005, Dale #1C3001–B3, Alpha #13A3001–B3
- Honeywell 192–302LET–A01

Resistance to Temperature Equation:

$$T = \frac{1}{A+B(LnR)+C(LnR^3)} - 273.15$$

EQUATION 1: *3kΩ Thermistor Resistance*

Where:

T = Temperature in °C

LnR = Natural Log of Thermistor Resistance

$A = 1.4051 \times 10^{-3}$

$B = 2.369 \times 10^{-4}$

$C = 1.019 \times 10^{-7}$

Note: Coefficients calculated over the –50 to +150 °C span.

Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp
201.1K	-50	15.72K	-9	2221	32	474.7	73	137.2	114
187.3K	-49	14.90K	-8	2130	33	459.0	74	133.6	115
174.5K	-48	14.12K	-7	2042	34	444.0	75	130.0	116
162.7K	-47	13.39K	-6	1959	35	429.5	76	126.5	117
151.7K	-46	12.70K	-5	1880	36	415.6	77	123.2	118
141.6K	-45	12.05K	-4	1805	37	402.2	78	119.9	119
132.2K	-44	11.44K	-3	1733	38	389.3	79	116.8	120
123.5K	-43	10.86K	-2	1664	39	376.9	80	113.8	121
115.4K	-42	10.31K	-1	1598	40	364.9	81	110.8	122
107.9K	-41	9796	0	1535	41	353.4	82	107.9	123
101.0K	-40	9310	1	1475	42	342.2	83	105.2	124
94.48K	-39	8851	2	1418	43	331.5	84	102.5	125
88.46K	-38	8417	3	1363	44	321.2	85	99.9	126
82.87K	-37	8006	4	1310	45	311.3	86	97.3	127
77.66K	-36	7618	5	1260	46	301.7	87	94.9	128
72.81K	-35	7252	6	1212	47	292.4	88	92.5	129
68.30K	-34	6905	7	1167	48	283.5	89	90.2	130
64.09K	-33	6576	8	1123	49	274.9	90	87.9	131
60.17K	-32	6265	9	1081	50	266.6	91	85.7	132
56.51K	-31	5971	10	1040	51	258.6	92	83.6	133
53.10K	-30	5692	11	1002	52	250.9	93	81.6	134
49.91K	-29	5427	12	965.0	53	243.4	94	79.6	135
46.94K	-28	5177	13	929.6	54	236.2	95	77.6	136
44.16K	-27	4939	14	895.8	55	229.3	96	75.8	137
41.56K	-26	4714	15	863.3	56	222.6	97	73.9	138
39.13K	-25	4500	16	832.2	57	216.1	98	72.2	139
36.86K	-24	4297	17	802.3	58	209.8	99	70.4	140
34.73K	-23	4105	18	773.7	59	203.8	100	68.8	141
32.74K	-22	3922	19	746.3	60	197.9	101	67.1	142
30.87K	-21	3748	20	719.9	61	192.2	102	65.5	143
29.13K	-20	3583	21	694.7	62	186.8	103	64.0	144
27.49K	-19	3426	22	670.4	63	181.5	104	62.5	145
25.95K	-18	3277	23	647.1	64	176.4	105	61.1	146
24.51K	-17	3135	24	624.7	65	171.4	106	59.6	147
23.16K	-16	**3000**	**25**	603.3	66	166.7	107	58.3	148
21.89K	-15	2872	26	582.6	67	162.0	108	56.8	149
20.70K	-14	2750	27	562.8	68	157.6	109	55.6	150
19.58K	-13	2633	28	543.7	69	153.2	110		
18.52K	-12	2523	29	525.4	70	149.0	111		
17.53K	-11	2417	30	507.8	71	145.0	112		
16.60K	-10	2317	31	490.9	72	141.1	113		

TABLE 19: *3KΩ Thermistor Resistance*

APPENDIX D. TROUBLESHOOTING

Listed below are a few commonly experienced problems and remedial action. These topics are also covered in the **Troubleshooting GeoNet Networks**, **Agent Software Tutorial**, and in the **GeoNet Troubleshooting Guide**, all of which are available at GEOKON's website, https://www.geokon.com. Contact GEOKON if additional assistance is needed.

SYMPTOM: UNIT WILL NOT RESPOND TO COMMUNICATIONS

- ☐ Wrong connection type, or incorrect address specified in Agent software.
- ☐ The batteries may be improperly installed. Check their placement.
- ☐ The batteries inside the unit may be dead. Replace the batteries.

SYMPTOM: DATA PRESENT (E.G., BATTERY/SIGNAL STRENGTH) BUT NO VW GAUGE DATA AVAILABLE

- ☐ Verify that the gauge leads are wired correctly inside the logger. Refer to the gauge manual for wiring information, or to Section 3.5.1.
- ☐ Check the gauge for proper operation with an independent readout, such as a GK-404, GK-405, or GK-406. Gauge operation can also be checked by using an ohmmeter to measure the resistance between the VW gauge leads. Very high (megohms) or infinite resistance may indicate cable damage; very low resistance (<20Ω) may indicate a short between conductors.
- ☐ For long cables, add cable resistance of 14.7Ω per 1000 ft (48.5Ω per km) at 20 °C. Multiply this factor by two to account for both directions.

SYMPTOM: VW GAUGE READING IS UNSTABLE

- ☐ Move any sources of electrical noise away from the transducer cable, such as generators, motors, arc welding equipment, high voltage lines, etc.

SYMPTOM: THERMISTOR DISPLAY SHOWS -273.15 DEGREES C°

- ☐ This indicates an open circuit to thermistor leads. Verify that the thermistor leads are properly connected inside the logger. For wiring information, refer to Section 3.5.1, or to the gauge manual for wiring information.
- ☐ Check the thermistor for proper operation by using an ohmmeter to measure the resistance between the thermistor leads. Resistance should be between 10KΩ and 2.4KΩ when the ambient temperature is between 0 and +30 °C. Appendix C details the resistance versus temperature relationship. Very high or infinite resistance may indicate cable damage, very low resistance may indicate a short between conductors.

SYMPTOM: LOGGER HAS WEAK COMMUNICATION

- ☐ If the signal is consistently weak (indicated by red and green LEDs illuminated at the same time) but not intermittently red, proceed with the installation. If the signal is frequently lost (red flash) it will be necessary to improve it. Try to get the logger as high as possible, with plenty of clear space around the antenna. Extending the sensor cable may enable moving the logger to a better location. If the signal does not improve, a higher gain directional antenna may be necessary. Contact GEOKON for assistance.

SYMPTOM: LOGGER DOES NOT HAVE POWER

- ☐ Ensure that the polarity of the batteries matches the diagram on the battery holder. Also check that the batteries are firmly seated.
- ☐ The batteries may be improperly installed. Check their placement.
- ☐ The batteries inside the unit may be dead. Replace the batteries.

SYMPTOM: LOGGER WILL NOT SYNCHRONIZE WITH NETWORK

- ☐ If the red status light on a logger is flashing at 10 second intervals, it means the logger was once connected to a network, but the network is not present now, or the gateway has been reset, resulting in an equal but not overlapping radio cycle.
- ☐ Ensure that the network is functioning in deployment mode (red light flashing every 10 seconds on the gateway), and that the channel setting is correct. Follow the steps in Section 4.3 to remove and reinsert the batteries in the logger.

SYMPTOM: NO DATA FROM LOGGER

- ☐ Be sure logger is powered.
- ☐ With network in deploy mode, observe either red and green lights only, or green lights every 10 seconds, on the logger.
- ☐ Make sure network time is set.

SYMPTOM: GREEN LIGHT FLASHES SLOWLY (ONCE PER SECOND)

Bootloader is activated, complete the following:

1. Change channel switches to a valid setting.
2. Press the Reset button on the circuit board.

SYMPTOM: GREEN AND RED LIGHT ALTERNATING

- ☐ Device malfunction, contact GEOKON.

APPENDIX E. FIRMWARE UPDATE

WARNING! Performing a firmware update on a logger might reset the logger memory. **Retrieve all data from the network prior to performing a firmware update.**

E.1 PROCEDURE

1. Put the network in deployment mode by pressing the Status button on the gateway. For more information on deployment mode see Section 3.7.

   Within three minutes the green LED will flash once every 10 seconds.

2. For RS-232 gateways:

   a. Connect the COM-108 (RS-232 cable) to the 10-pin connector on the gateway.

   b. Connect the 8001-7 (USB to RS-232 adapter) to the COM-108.

   c. Connect the 8001-7 to the PC. The figure below shows the completed connection.

FIGURE 35: *RS-232 Cable Connection*

3. For all other loggers/gateways, connect the COM-166 (Mini USB to STD A cable) to the USB connector on the bottom of enclosure.

FIGURE 36: *USB Cable Connection*

4. Download the '8800 GeoNet Firmware Update Package' from the GEOKON website (https://www.geokon.com/software).

5. Right-click on the downloaded file and choose 'Extract All...' from the menu.

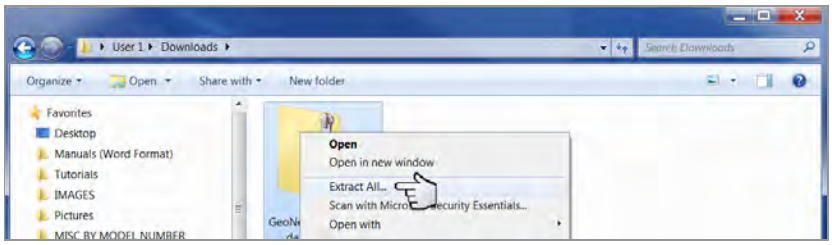

FIGURE 37: *Choose the 'Extract All' Menu Option*

6. When prompted click 'Extract All'.

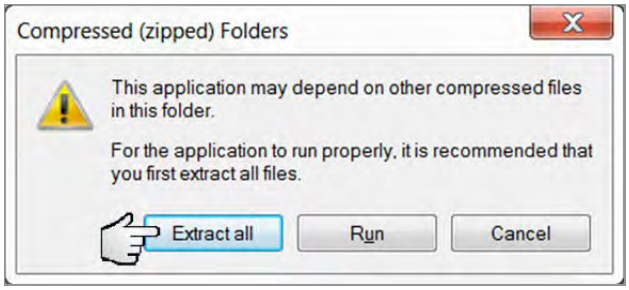

FIGURE 38: *Click the 'Extract All' Button*

7. Select a destination for the files and then click 'Extract'.

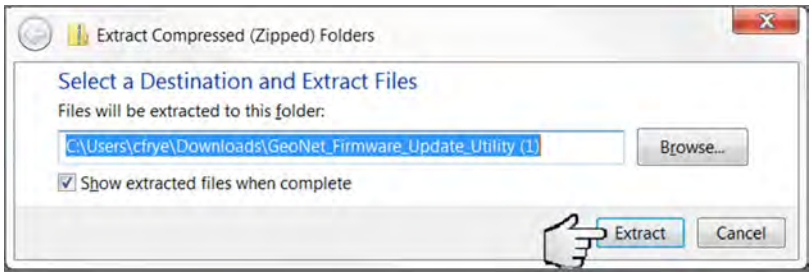

FIGURE 39: *Select the Destination then click the 'Extract' Button*

8. Open 'GeoNetUpdateUtility.exe'. If a security warning appears, click 'Run'.

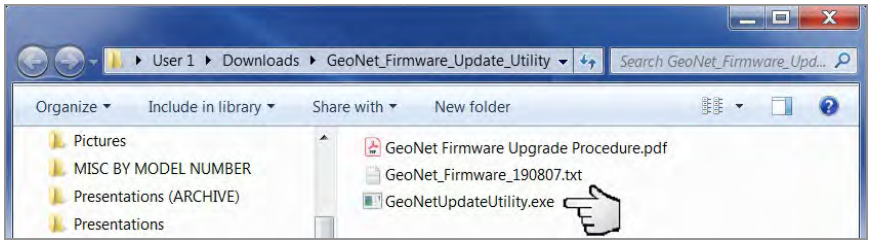

FIGURE 40: *Open the* GEOKON *Update Utility*

9. Click 'Select File'.

FIGURE 41: *Click the 'Select File' Button*

10. Double click the .txt firmware file. Firmware files are named in the following format: *GeoNet_Firmware_YYMMDD.txt*, where *YY* is the last two digits of the year, *MM* is the month, and *DD* is the day of the month.

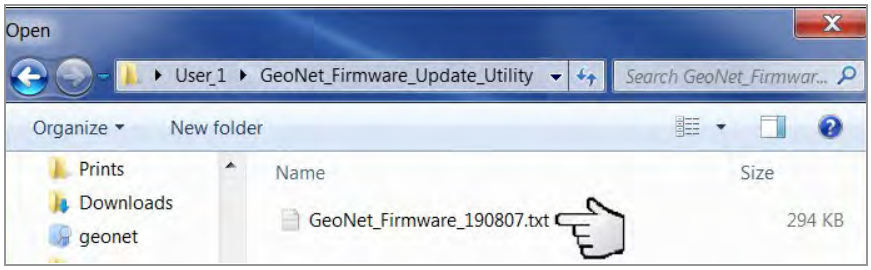

FIGURE 42: *Select the Firmware Text File*

11. Using the drop-down box below the 'Select File' button, select the correct serial port for the 8001-7 or COM-166 cable. To identify which serial port the unit is connected to, complete the following:
    a. Unplug the 8001-7 or COM-166 cable from the PC.
    b. Go to the Control Panel then open Device Manager.
    c. Click on the triangle to the left of Ports (COM & LPT) to expand the list.
    d. Plug the cable back into the computer and the port will appear in the list.

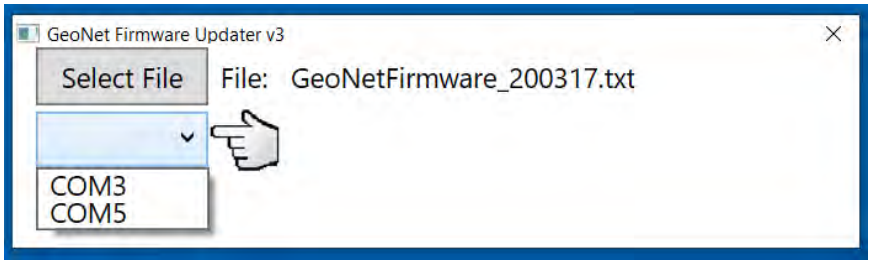

FIGURE 43: *Select the COM Port*

12. Click 'Program'.

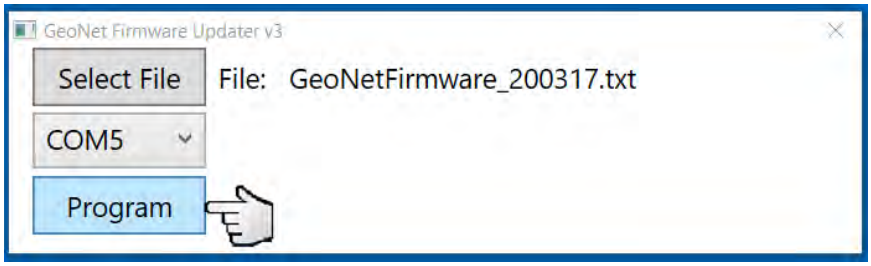

FIGURE 44: *Click the 'Program' Button*

13. A progress bar will appear. The update process will normally take one to two minutes.
14. Once the update has finished, operation will return to normal.
15. Repeat the above process with all the loggers in the network.

The firmware update is now complete.

E.2 FIRMWARE TROUBLESHOOTING

☐ Perform updates using the GEOKON-provided 8001-7 USB to RS-232 adapter. Other adapters and native serial ports have been unreliable. Make sure the batteries are fresh.

APPENDIX F. SOLAR PANEL KIT

The GEOKON Solar Panel Kit enables you to power a Cellular Gateway in an area that has no access to mains / domestic power.

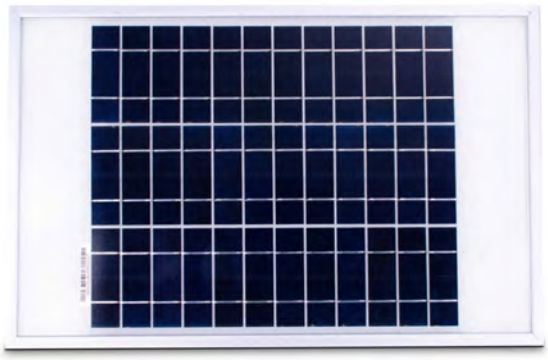

FIGURE 45: *Solar Panel 8900-SOL-10W-BRJ*

Inside the kit box are the following:

- One envelope containing technical documents and instructions
- One mounting bracket
- One solar panel complete with power regulation circuitry and power cable

FIGURE 46: *Solar Panel Kit Box Contents*

INSTALLATION OVERVIEW

The general installation steps are as follows:

1. Select a location for the solar panel.
2. Assemble and adjust the mounting bracket to the proper angle.
3. Install the mounting bracket.
4. Secure the solar panel to the mounting bracket.
5. Connect the power cable to the gateway.

F.1 SELECT A LOCATION

Choose a location for the solar panel that is clear of obstructions and anything that might cast a shadow on the panel.

F.2 ASSEMBLE THE MOUNTING BRACKET

When assembling the two sections of the mounting bracket, be sure to set the sections to the desired angle before tightening the nuts. The angle of the mounting bracket will dictate the angle of the solar panel.

- Ensure the angle is at least 10 degrees, to aid in water control.
- In general, choose the best angle for the latitude of your location.
- Mounting on a horizontal surface will require a reverse configuration of the two sections compared to mounting vertically. See the figure below.

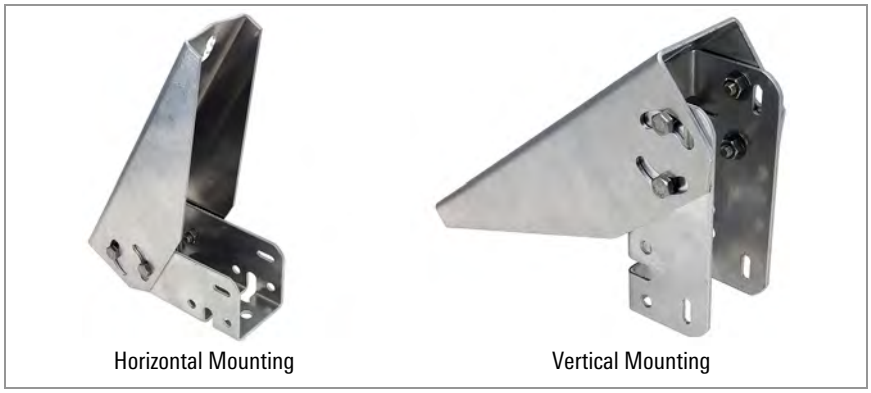

FIGURE 47: *Mounting Options*

F.3 INSTALL THE MOUNTING BRACKET

Mount the bracket on a flat surface (roof, wall, etc.) using locally-supplied bolts or lag screws. If mounting to a pole, use locally-supplied U-bolts and retaining clamps.

F.4 SECURE THE SOLAR PANEL TO THE MOUNTING BRACKET

Use the included nuts and screws to secure the solar panel to the mounting bracket. Use the centrally-located holes provided for this purpose on the back of the solar panel.

Note: Be sure to mount the solar panel with the cable coming out the bottom of the panel, as shown below.

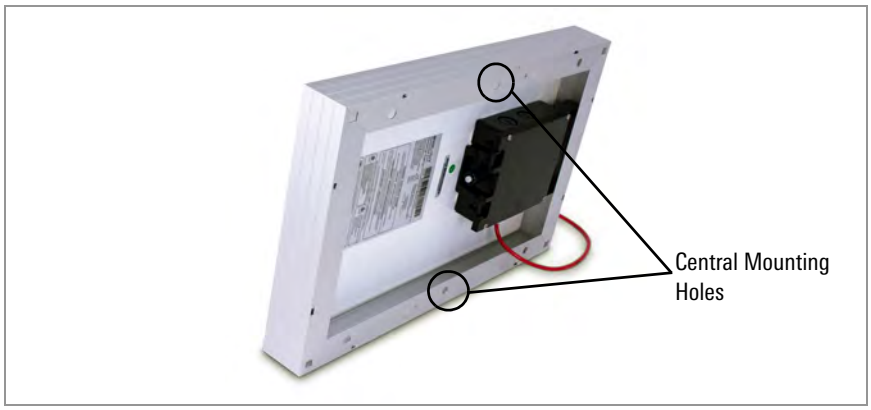

FIGURE 48: *Centrally-Located Mounting Holes*

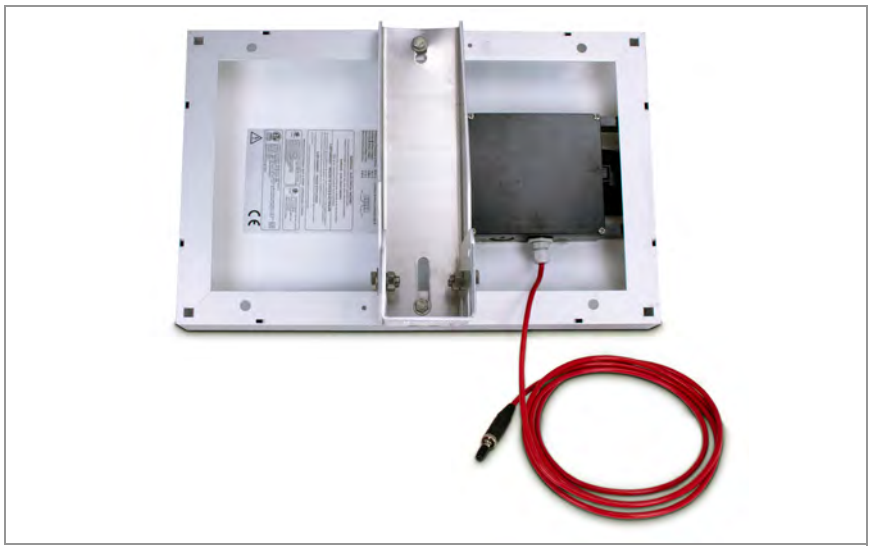

FIGURE 49: *Mounting Bracket Fastened Centrally*

F.5 CONNECT THE POWER CABLE

F.5.1 BATTERY SWITCH

Before connecting the power cable, be sure you have set the battery switch appropriately, as indicated in Section 3.2.2.

- When not using an external battery, set the battery switch inside the gateway to the INT BATTERY setting.
- When using an external battery between the solar panel and the Cellular Gateway, set the battery switch inside the gateway to the EXT BATTERY setting.

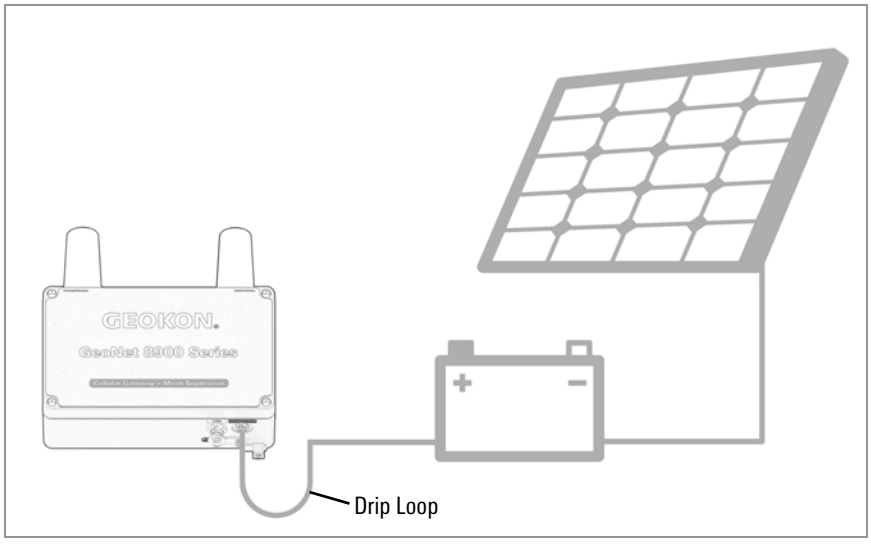

FIGURE 50: *Solar Panel with External Battery*

F.5.2 MAKING THE CONNECTION

Remove the plastic cap from the cable connector, then attach it to the EXT BATTERY plug on the Cellular Gateway. Tighten the retaining ring on the EXT BATTERY plug, for strain relief.

Note: Be sure to implement a drip loop, as indicated in the previous figure, to prevent water ingress through the power connector.

APPENDIX G. CERTIFICATIONS

1 Assessment

The following device as further described in section 3 of this report meets applicable criteria specified in the Code of Federal Regulations Title 47 parts 15B and ICES-003 Issue 6, as it has been evaluated against the standards mentioned above under this section.

No deficiencies were ascertained.

Company	Description	Model
Geokon	Low power, wireless, data acquisition network	Geonet 8900

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2019-04-23	Compliance	Cindy Li (Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
2019-04-23	Compliance	Chin Ming Lui (Associate EMC Engineer)	

The test results of this test report relate exclusively to the test item specified in Section3. CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

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Department:	Compliance
Street Address:	411 Dixon Landing Road
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Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
EMC Lab Manager:	Cindy Li
Responsible Project Leader:	Isabel Wang

2.1 Identification of the Client

Applicant's Name:	Geokon
Street Address:	48 Spencer Street
City/Zip Code	Lebanon, NH 03766
Country	USA

2.2 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	----------
City/Zip Code	----------
Country	----------

3 Equipment under Test (EUT)

3.1 EUT Specifications

Marketing name:	Geonet 8900
Power Supply/ Rated Operating Voltage Range:	Low 2.0 VDC, Nominal 3.3 VDC, High 12 VDC
Operating Temperature Range:	Low -40 °C, High 85 °C
Radios included in the device:	❖ IEEE 802.15.4 FHSS: • Module name: Digi X-Bee-PRO 900 HP • Model number: XBP9B-DMUT-002 • FCC ID: MCQ-XB900HP • IC ID: 1846A-XB900HP • Main Antenna: ▪ Type: Half-wave dipole ▪ Location: External ▪ Gain: 2.1 dBi
Radios Co-location:	NO
Sample Revision:	☐Prototype Unit; ☐Production Unit; ■Pre-Production
EUT Dimensions [mm]:	122 X 120 X 91
Weight [grams]:	1000
EUT Diameter:	■ < 60 cm ☐ Other:_____

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