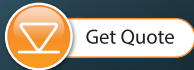


User Guide

STS Telemetry System

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October 20, 2022



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1.0 Introduction to STS Telemetry

Solinst STS Telemetry Systems provide an economical and efficient method to access remote water data instantly. They provide two-way communication between field located dataloggers and a Home Station computer. STS Telemetry Systems are designed specifically for high quality Solinst dataloggers. Up to four Solinst dataloggers can be connected to one STS.

Note: See the Levellogger and Vented Dataloggers User Guides for more information on datalogger specifications, operation, and deployment.

STS Systems operate on two basic schedules. A linear “Sample Rate” is set, at which the STS Remote Station records a real-time reading from each attached datalogger. A “Report Rate” is set to establish the frequency that the data is sent from the Remote Station to the Home Station Computer. Optionally, dataloggers themselves can be set up to record and store data independently of the STS System. This provides a reliable back-up if circumstances require it.



Figure 1-1 STS Remote Communication

STS Telemetry Systems can be set up using 4G LTE cellular communication. Data is ‘pushed’ from the STS Remote Station to the Home Station using IP (Internet Protocol), and therefore, dial-up or timing issues are not a problem. The STS stores data in its memory until it has been successfully uploaded by the Home Station computer.

There is also the option to connect an RRL (Remote Radio Link) network to your STS Remote Station.

STS Telemetry Systems come with standardized hardware options and use Solinst Telemetry Software, which allows easy setup, operation, and management of data. Features such as alarm notification, diagnostic reporting and firmware updating make it easy to maintain your system, while simplifying data collection.

This manual focuses on configuration, programming, and installation of STS Telemetry Systems using cellular communications. It includes instructions for installing and using Solinst Telemetry Software to set up data collection schedules, bridge RRL networks, manage data, perform diagnostic checks, and firmware updates.

STS Telemetry System Specifications	
Enclosure Material:	NEMA 4X
Enclosure Internal dimensions:	~ 30 cm x 15 cm x 35.5 cm
IP Rating:	IP66 (dust and water proof, can not be submerged)
Operating Temperature:	-40°C to 50°C
Clock Accuracy:	±2 seconds/day @ 25°C
STS Memory Capacity: (Between Reports)	16MB
Power Source:	12 Volt, 12-30 AHR deep-cycle, rechargeable sealed lead-acid battery
Power Consumption:	Average 23 mA @ 12 V (4 Loggers with 1 hour sampling rate and 1 day data report rate).
Power Input:	10 V - 16 V DC, 15W (2 pin block terminal)
Over-current Protection:	Built-in auto-reset breaker for modem
Modem:	Digi IX20 Cat 4 North America (LTE Bands B2, B4, B5, B12, B13, B14) or, Digi IX20 Cat 4 Global (EMEA/APAC LTE Bands B1, B2, B3, B4, B5, B7, B8, B12, B13, B18, B19, B20, B25, B26, B28, B39, B40, B41).
Modem Connection:	RS-232 port configured as DTE with a DB-9 Male connector or Ethernet when RRL Network is connected.
Antennas:	700/850 MHz BLADE SMA Male

Table 1-1 STS Telemetry System Specifications

1.1 Compatibility

Each STS can connect up to four Solinst dataloggers. STS Telemetry is compatible with the Levellogger 5, Barologger 5, Levellogger 5 Junior, Levellogger 5 LTC, Rainlogger 5, Levelvent 5, as well as Levellogger Edge, Barologger Edge, Levellogger Junior Edge, LTC Levellogger Edge, Rainlogger Edge, LevelVent, and Gold series dataloggers using the following firmware versions (or higher):

Datalogger	Firmware Version
Levellogger 5 / Barologger 5	1.005
Levellogger 5 Junior	1.005
Levellogger 5 LTC	1.005
Rainlogger 5	1.005
LevelVent 5	1.005
Levellogger Edge / Barologger Edge	3.004
Levellogger Junior Edge	3.004
LTC Levellogger Edge	1.003
Rainlogger Edge	3.001
LevelVent	1.000

Table 1-2 Compatible Datalogger Firmware Versions

It is also important to ensure you are using the most recent STS firmware version, with the most recent Solinst Telemetry Software. To check this, go to <https://downloads.solinst.com>

Note: To determine what software version you are using, use the Help menu in the STS/RRL Administrator (see Section 4.1). To determine what firmware version your STS is using, see Section 4.8.

Note: See previous User Guide for Gold series datalogger's compatible firmware versions.

2.0 Home Station Hardware Setup

When using cellular modem communication, an Internet connection with a **static IP** address is required at the Home Station computer (STS Remote Stations use a dynamic IP address). You may have to request a static IP (hard IP) to be allocated to the Home Station from your IT department.

Note: Cellular Home Stations require a static IP address. STS Remote Stations have a dynamic IP address.

2.1 Network Considerations

In some situations when using a cellular modem, the Home Station computer may be connected to a network, which is protected by firewalls. In these instances the static IP address may be connected into a router, which splits the Internet connection between all networked computers. Under these circumstances, you may require the assistance of your IT department with the installation and network configuration aspects.

If the static IP is first connected to a router, the router must be accessed to allow for “**port forwarding**” at the Port you are using for communication. (Port 49200 is recommended for PCs using Windows 10). This function is largely available on most makes and models of commercial routers.

In the event that your network has strict firewalls, the security software may need to be accessed to allow for STS communication permissions. You may also have to set port rules and change firewall settings on your PC.

2.2 Solinst Telemetry Software

The Home Station computer requires **STS/RRL Administrator Software**. The software provides an easy-to-use graphical interface to set up remote sites, specify communication intervals, define sampling rates for attached dataloggers, determine alarm settings, and perform remote and firmware updates. Collected data is stored and viewed using the software; it can also be exported for use in other programs.

Note: You must have administrator privileges on your PC to install Solinst Telemetry Software.

The **STS/RRL Communication Agent** is automatically installed with the STS/RRL Administrator (see Section 4.7). It is used to view communication activity, and **must** remain open (can be minimized) in order to receive real-time reports at the Home Station.

The **STS Field Utility** is also automatically installed. It is used to perform diagnostics, control the modem, and initialize your STS Telemetry System. It is useful to have on a portable laptop, as it provides a convenient way to communicate with STS Remote Stations in your office or in the field (see Section 4.8).

2.2.1 System Requirements

The minimal hardware and software requirements for software installation and system operation are:

Hardware	Software
Memory: 256MB or more	OS: Windows: 10 & 11
Display: VGA: 800 x 600 pixels, 256 colour	
Ports: USB, Ethernet	
Hard Drive space: 64MB	

Table 2-1 Minimal Hardware and Software Requirements

2.2.2 Software Installation

Web Download

Download the newest version of the Solinst Telemetry Software by visiting <https://downloads.solinst.com>

The STS/RRL Administrator, STS/RRL Communication Agent and STS Field Utility are automatically installed.

3.0 STS Telemetry Hardware

STS Telemetry Systems come with standardized equipment configurations; the STS, modem with antennas and required cables, Internal Battery Cable, USB Programming Cable, NEMA 4X enclosure, armored protective conduit, and 3 NPT weatherproof fittings.

STS Systems are powered by a user-supplied 12V sealed lead-acid battery. Dataloggers and their connection cables are also purchased separately. The following figures show the standard setups and cables:

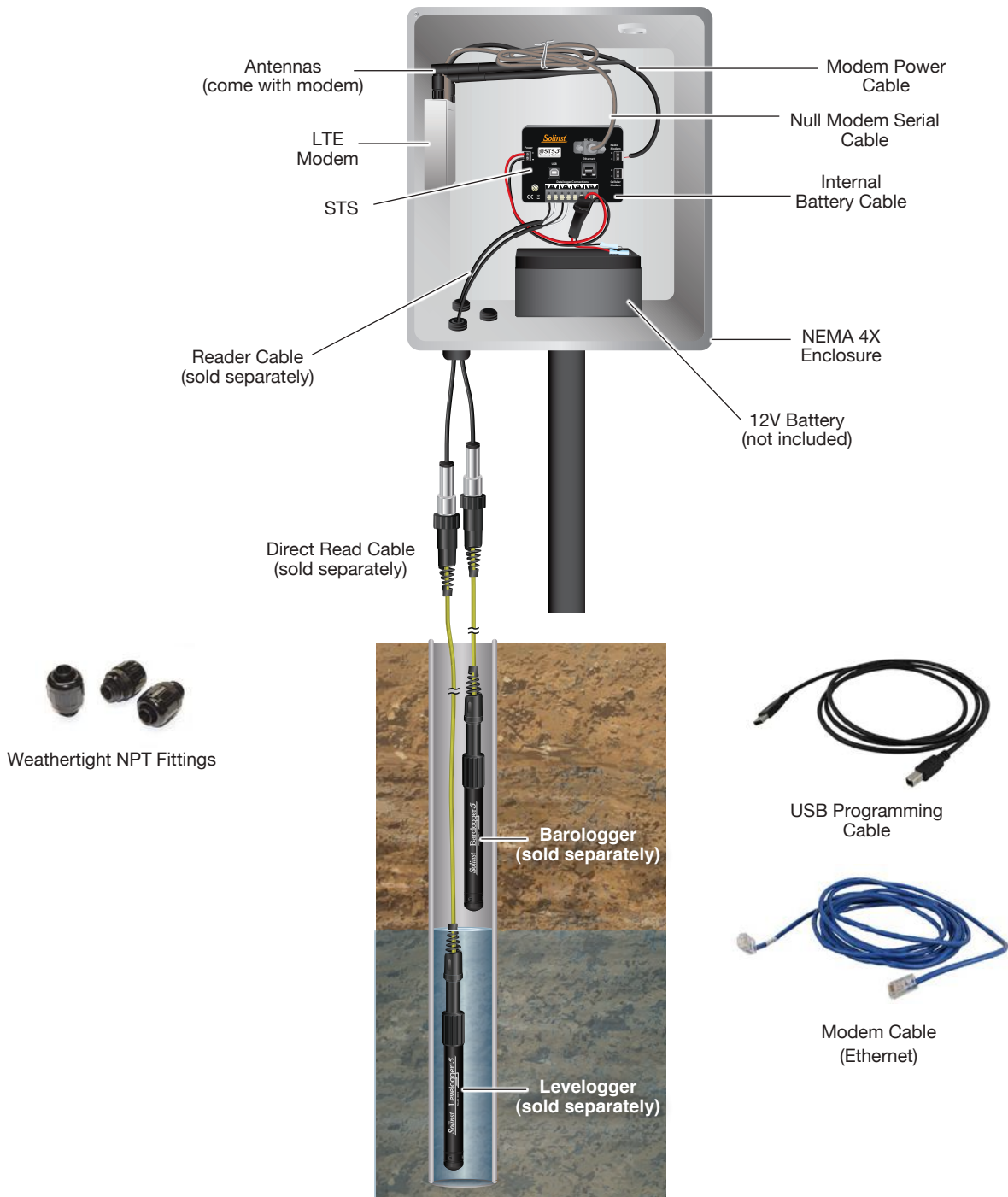


Figure 3-1 STS Telemetry System (#114231) - Levelogger Connected

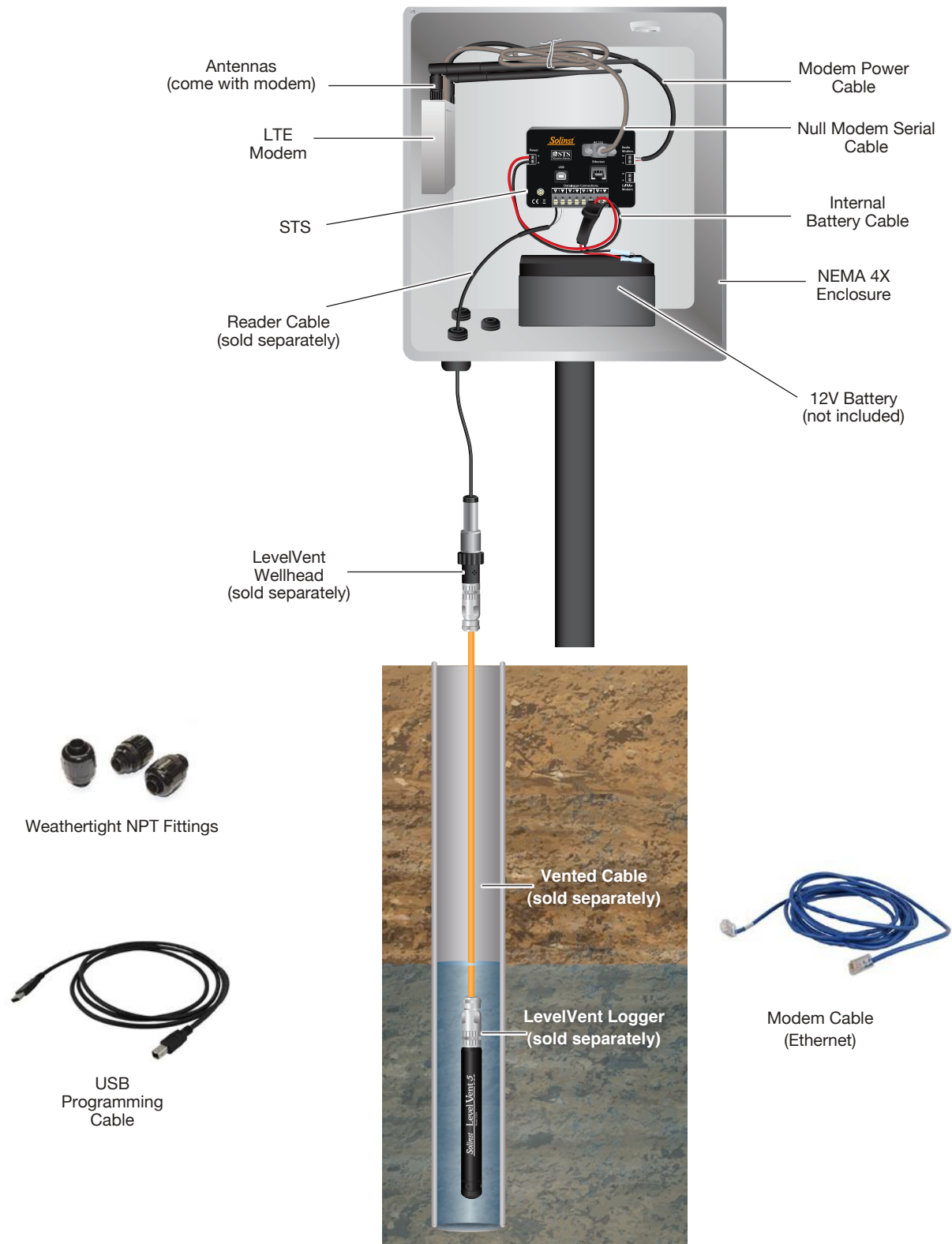


Figure 3-2 STS Telemetry System (#114231) - LevelVent Connected

Note: See Section 4.6 for setup when bridging an RRL Network.

3.1 STS Remote Stations

The STS collects, stores, and sends data from the remote dataloggers to the Home Station computer. Up to 16MB of data can be stored in the STS non-volatile memory, until a specified time when it ‘sends’ the data to the Home Station, where all the accumulated data is uploaded. If there are cellular service disruptions, the STS Remote Station will store all the data internally until it has been successfully uploaded to the Home Station computer.

The STS features powerful processors to monitor the battery, control the modem power, perform Built-In-Test (BIT) functions and select the datalogger communication channels. It contains a built-in auto-reset breaker for over-current protection of the modem. The STS also has an onboard GPS receiver with internal antenna.

The STS has labeled connections for a 12V sealed lead-acid battery or External Power Regulator Assembly (Power), the modem (RS 232 or Ethernet), modem power (Cellular Modem), and USB Programming Cable (USB). The two-wire connectors for four dataloggers (Datalogger Connections) are also clearly indicated.

Note: When an RRL Network is connected to an STS, the RRL Station connects to the RS-232 connection, and the modem connects to the Ethernet connection. The RRL Home Station is also connected to the radio power (Radio Modem) connection. See Section 4.5 for set up.



Figure 3-3 STS

3.1.1 LED Light Identification

The STS has an LED light that indicates the operation and status of the STS system:

Blue: STS is powered up and connected to a PC using the USB Programming Cable.

Flashing yellow: STS has been programmed and is waiting to start at a scheduled Future Start time.

Flashing green: STS has been programmed and is running on schedule.

Flashing white: STS is uploading data from the connected dataloggers.

Flashing red: A failure has been detected.

Note: if you restore the STS factory settings using the STS Field Utility (see Section 4.8.1) the LED will be tested by cycling through all the colours, including red. This red light does not indicate an error.

The following are possible errors that may have occurred, if the LED is flashing red:

- 1) The battery voltage/power is too low (i.e. < 10V)
- 2) Modem power issue

First, check to see if the battery needs recharging or changing. Check the connections to the STS.

Check modem and wiring for short circuits.

You can reset the LED by “Restoring Factory Settings”, stopping logging and restarting, or testing the Home Station connection in the STS Field Utility. See Section 4.8.

If the LED is still red, contact Solinst for further assistance.

3.2 Datalogger Connection

Up to four Solinst dataloggers can be connected to one STS.

3.2.1 Levelogger Connection

Leveloggers are connected to the STS using a Reader Cable and Direct Read Cable.

The Reader Cables are attached to the STS using a two-wire connection. The black and white triangles shown at the connections, indicate which colour wire from the Reader Cable to connect. Simply push the connector pins on each wire into the appropriate opening.

The Reader Cable is then connected to the Levelogger's Direct Read Cable by twisting the Reader Cable coupling onto the Direct Read Cable connector.

Note: A Direct Read to Optical Adaptor can be used in place of a Direct Read Cable when installing a Barologger. The Adaptor can not be submerged.

Note: See the Levelogger User Guide for more information on connecting Direct Read Cables to your Leveloggers.

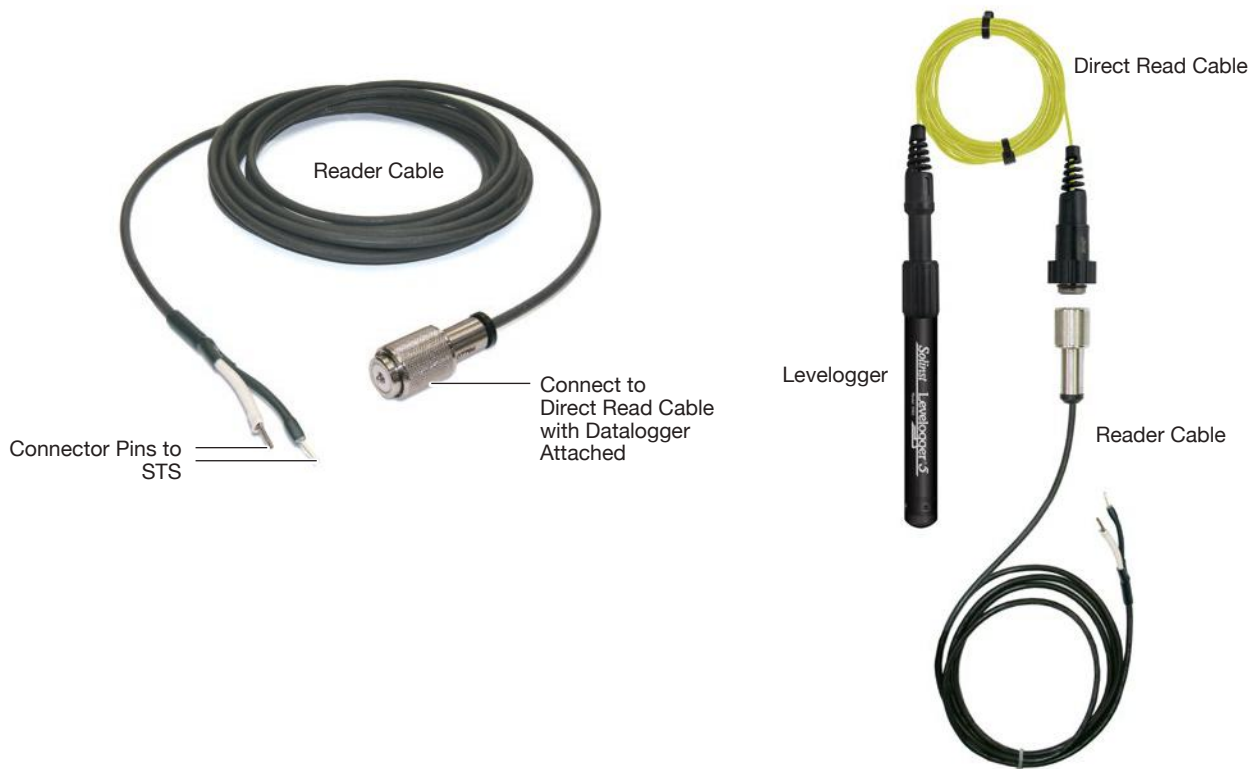


Figure 3-4 Levelogger Connection

Note: To remove the Reader Cable connector pins from the STS, press the white plugs above each connection into the STS, while pulling the connector pins out.

3.2.2 LevelVent Connection

LevelVent dataloggers are connected to the STS using a Reader Cable connected to the LevelVent Wellhead.

The Reader Cables are attached to the STS using a two-wire connection. The black and white triangles shown at the connections, indicate which colour wire from the Reader Cable to connect. Simply push the connector pins on each wire into the appropriate opening.

The Reader Cable is then connected to a LevelVent Wellhead by twisting the Reader Cable coupling onto the Wellhead.

Note: See the Vented Dataloggers User Guide for more information on connecting LevelVent loggers to the LevelVent Wellhead using Vented Cables.

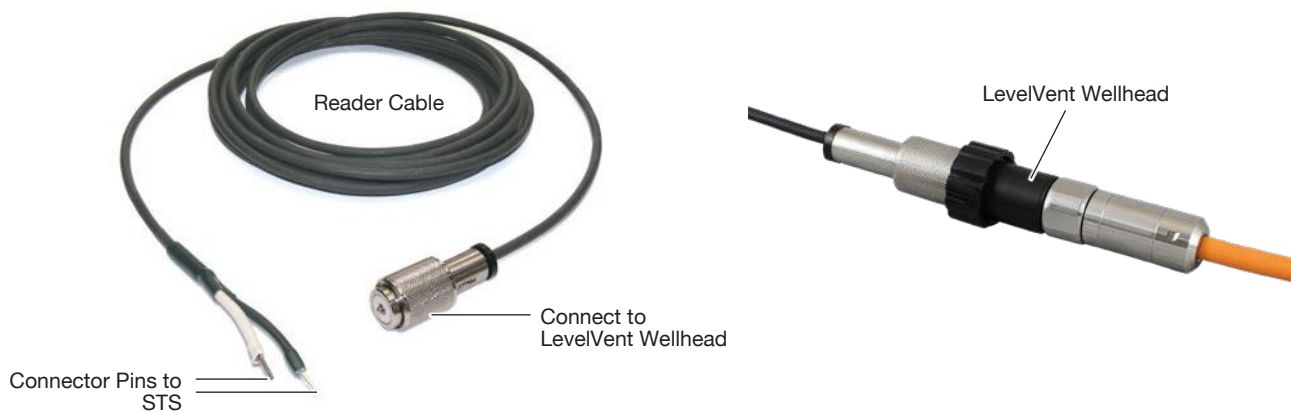


Figure 3-5 LevelVent Connection

Note: To remove the Reader Cable connector pins from the STS, press the white plugs above each connection into the STS, while pulling the connector pins out.

3.3 Power Source

STS Telemetry Systems use a 12V battery to operate. Solinst recommends using a 12-30 AHr deep-cycle, rechargeable sealed lead-acid battery. The STS Assembly is configured in the enclosure to fit a battery up to 7.5" (190 mm) across, 6.0" (152 mm) deep into the enclosure, and 6.5" (165 mm) in height.

The battery is connected to the "Power" connection on the STS Remote Station, using the Solinst supplied Internal Battery Cable, complete with an 8 Amp SLO-BLO fuse. The red wire is connected to the positive terminal on the battery, and the black wire to the negative terminal. **You will require a small flat screwdriver to connect the Battery Cable to the STS.**

Battery life estimates are discussed in Section 7.2.1.

Solinst also offers an External Power Regulator Assembly, which allows the connection of a user-supplied external battery, AC power adaptor, AC battery charger, or solar panel. Power options are discussed in Section 7.2.2.

3.4 STS Cellular Modem

The standard modems used for STS are the Digi IX20 Cat 4 North America (LTE Bands B2, B4, B5, B12, B13, B14) or the Digi IX20 Cat 4 Global (EMEA/APAC LTE Bands B1, B2, B3, B4, B5, B7, B8, B12, B13, B18, B19, B20, B25, B26, B28, B39, B40, B41).

The modems come with two 700/850MHz BLADE SMA Male antennas.

The Modem connects to the STS using the supplied Null Modem Serial Cable (female DE9 connections) and Modem Power Cable. The connections are clearly labelled on the STS. **You will require a small flat screwdriver to connect the Modem Power Cable to the STS and modem.**

Note: See www.digi.com for modem specifications.



Image credit: Digi International

Figure 3-6 STS Modem

3.4.1 Wireless Carrier Requirements

STS operation requires setting up a cellular account with Solinst (discussed below), or a wireless carrier of your choice. Request a data usage service plan for a 4G LTE network. They will provide you with an activated SIM card.

You will require:

- Monthly data plan – no voice access or voice features, no text messaging required
- A dynamic IP address is required for each STS Remote Station (assigned to the modem)

Solinst offers a SIM card that is set up based on your data needs. The Solinst SIM card scans multiple service providers and automatically connects to the strongest network in your area. Solinst offers low cost, data-only cellular plans that are managed and billed directly, monthly or annually by Solinst.

Note: Before starting your modem setup, read the highlighted note on Page 12.

3.4.2 Modem Setup

To activate the modem, you will require a dynamic IP Address supplied by the service carrier to be assigned to the modem. They will also provide you with an activated SIM card and an APN (Access Point Name).

Note: refer to the online instructions to complete the physical set up of the modem, including antenna connection and SIM card installation: www.DIGI.COM/IX20/START

The following are the steps required to set up the modem:

- 1) Attach the antennas to the modem.
- 2) Insert your SIM card into the top (SIM 1) spot of the modem, contacts facing down (see illustration).



Image credit: Digi International

Figure 3-7 Inserting SIM Card

Note: There are two SIM card slots in the modem. Install the SIM card in the left slot, with the chamfered corner inserted first. The contacts should be face down.

- 3) To turn the modem on, you will need to use the STS Field Utility. The modem will need to be connected to the STS using the Modem Power Cable, the 12V battery connected to the STS, and the STS connected to the PC using the USB Programming Cable. See Section 4.8.1 for instructions to turn on the modem using the STS Field Utility.
- 4) When the modem is powered-up, the LEDs illuminate and a series of diagnostic self-tests is initiated. When the flashing stops, the self-test diagnostic is complete and the modem is ready to be configured.
- 5) Turn the WiFi off on your PC. Connect the Ethernet cable from the ETH2 port on the modem to a LAN port on your PC. IP should be set to Automatic (the modem sets the IP of the PC).

Note: To avoid extra cellular data charges caused by connected PC data transmission through the modem over the Internet during setup, do the following: The default subnet of the modem is 192.168.2.0/24, and its default configuration page is 192,168.2.1. So set the PC to manual IP mode, and set its default gateway so that it points AWAY from 192,168.2.1.

- 6) Open your web browser and enter the IP Address “192.168.2.1” in the URL address bar. The ‘Getting Started Wizard’ for the modem will open.
- 7) Enter the default Username: Admin, and the Password for the modem that is on the label on the bottom of the modem, or a sticker affixed to the inside of the STS NEMA enclosure.

Note: If there is trouble logging in, push the (hidden) ERASE button on the modem with a paper clip to restore the default password. Enter a new password for the administrator and click Apply.

8) The main Dashboard provides a summary of the current configuration.

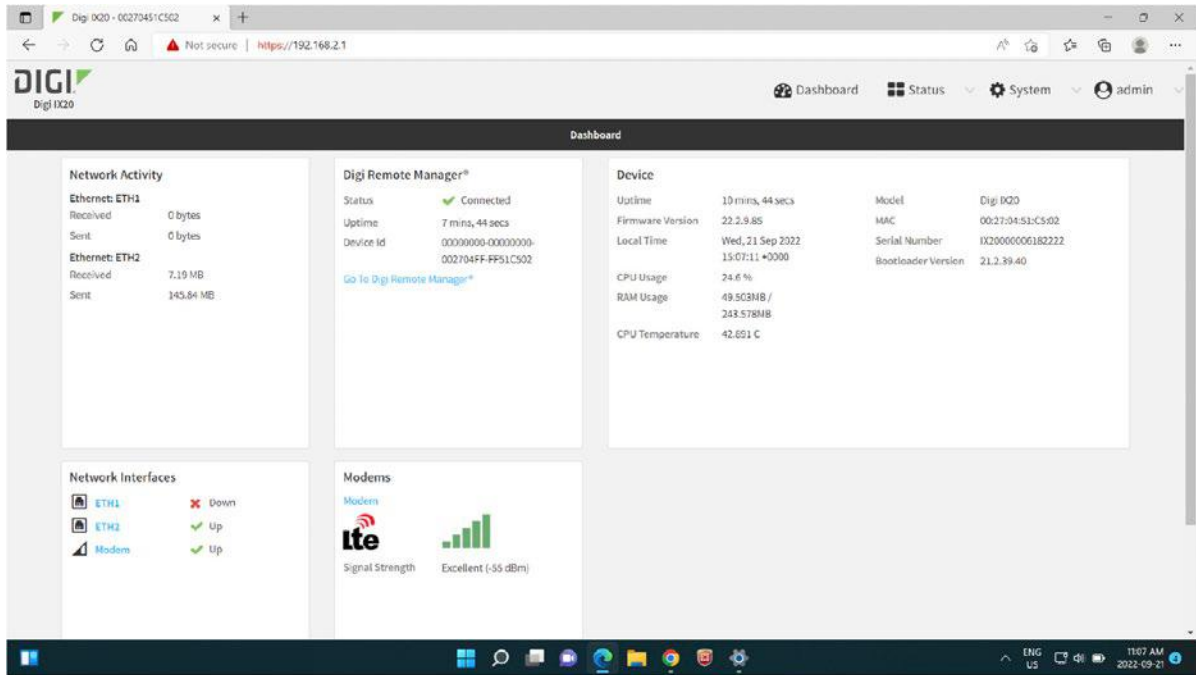


Figure 3-8 Main dashboard

9) Go to “Network Interfaces” then “Modem”. Enable “APN list only”. Add the APN of your SIM card to the list, then click Apply. The APN will be provided by your service carrier. The APN for Solinst SIM cards is *globaldata.net*.

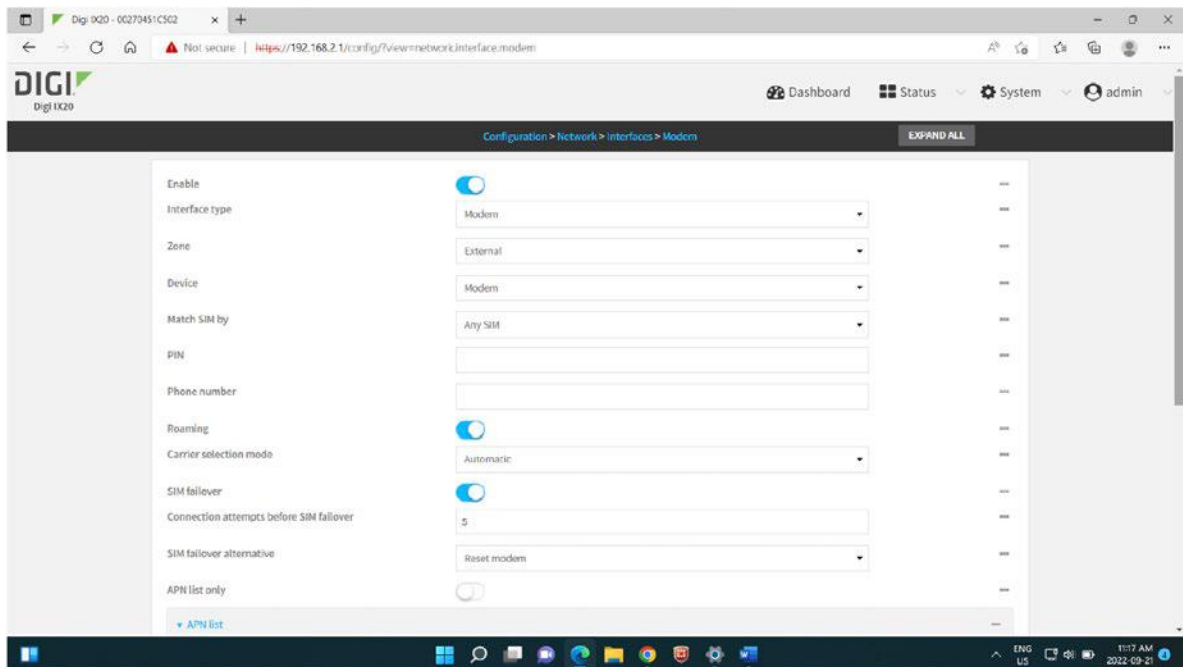


Figure 3-9 Modem Settings

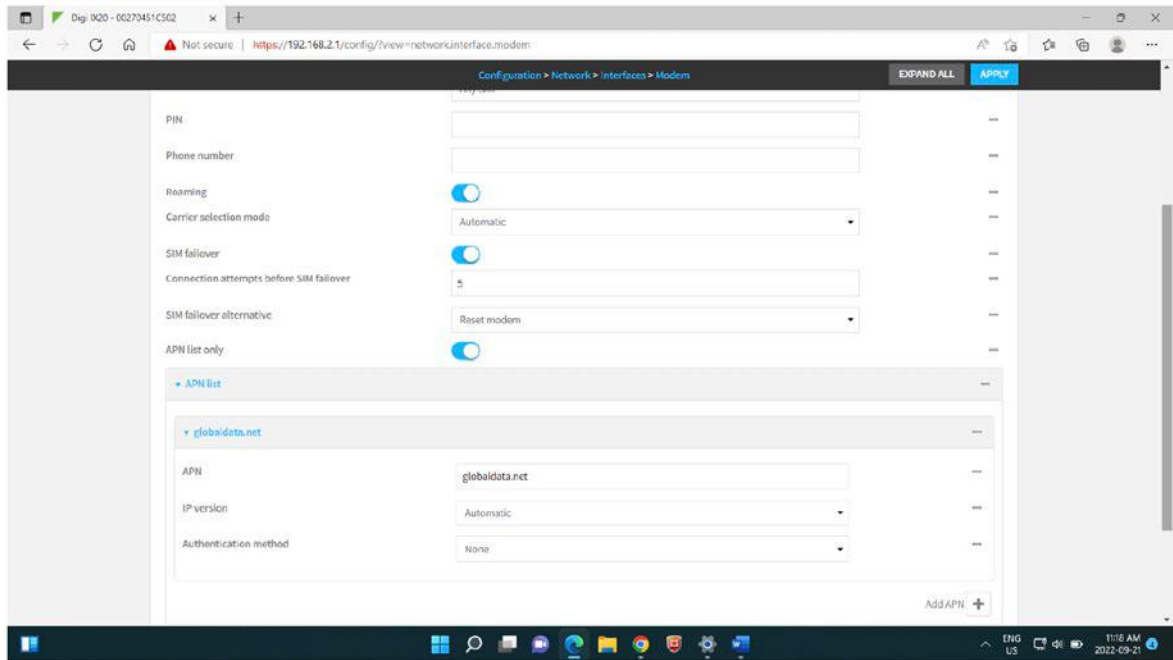


Figure 3-10 APN Setting

If the modem firmware is not version 21.5 or higher (this can be found on the Dashboard) then it must be updated from the Digi website, and then the APN set up repeated.

- 10) Steps 11-13 are needed if the STS will be connected to the modem via a Serial (RS 232) cable. If using an Ethernet connection (for Bridging) from the STS to the modem, then the settings will automatically be applied.
- 11) From the Dashboard, go to “System” then “Serial Configuration”.

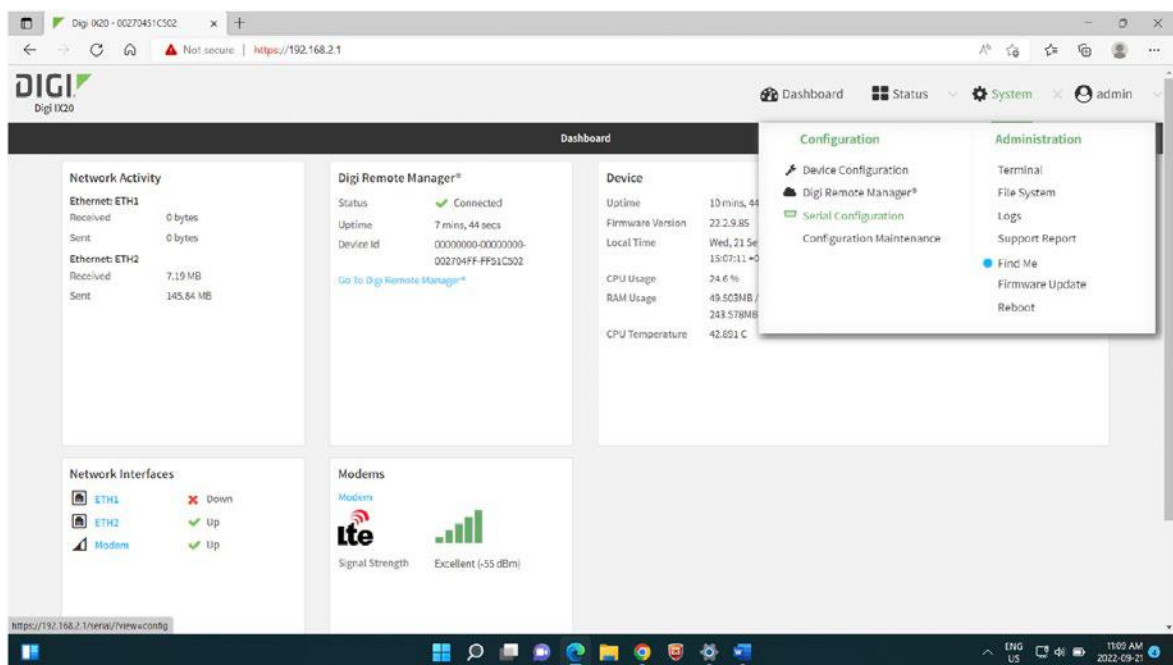


Figure 3-11 Serial Configuration

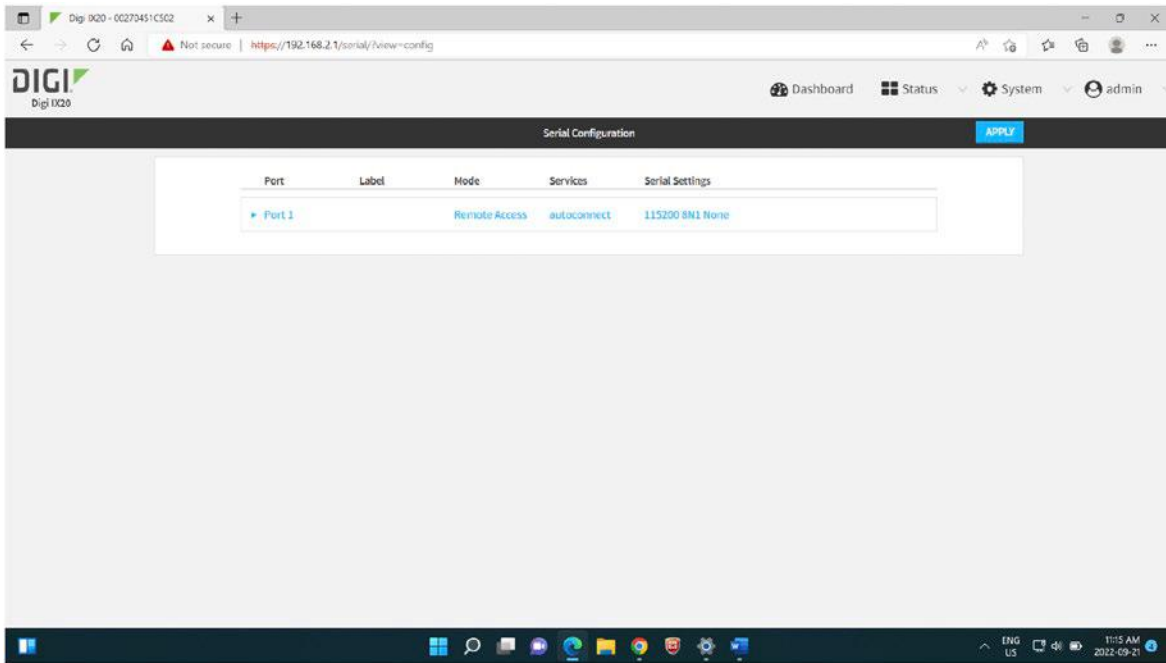


Figure 3-12 Serial Port Configuration

- 12) Enable “Port 1”.
- 13) Scroll down to “Serial Settings” . The following settings should be entered and Applied:
 - Baud Rate: 115200 bits/second
 - Data Bits: 8
 - Parity: None
 - Stop Bits: 1
 - Flow Control: None

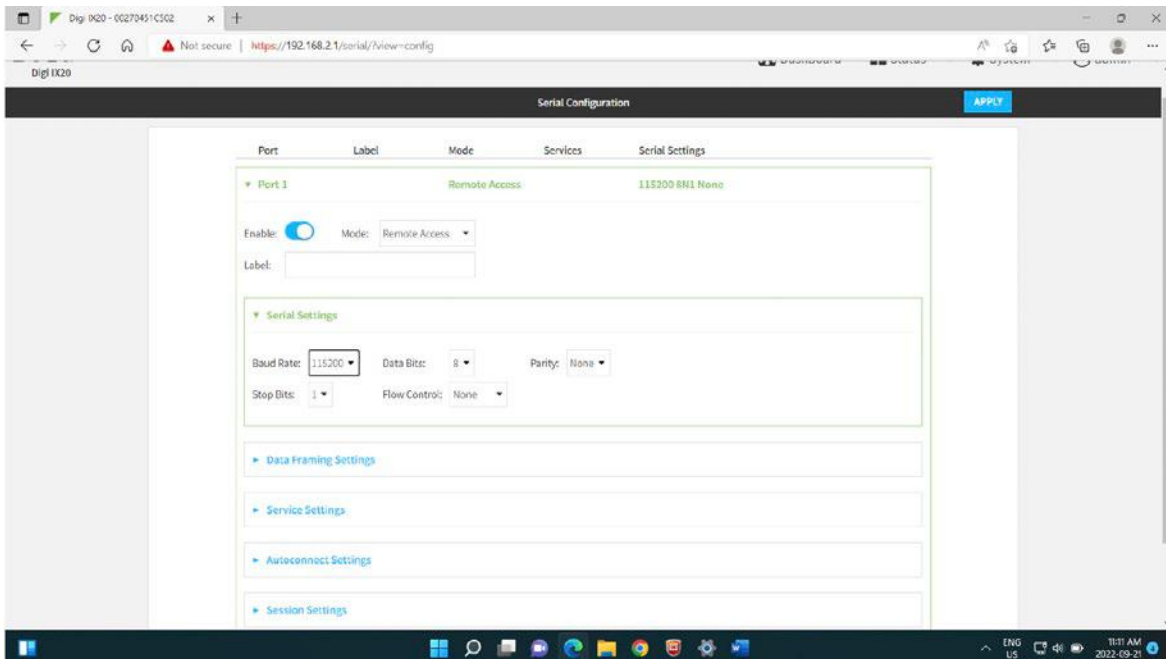


Figure 3-13 Serial Settings

14) Scroll down to “Autoconnect Settings” and enable.

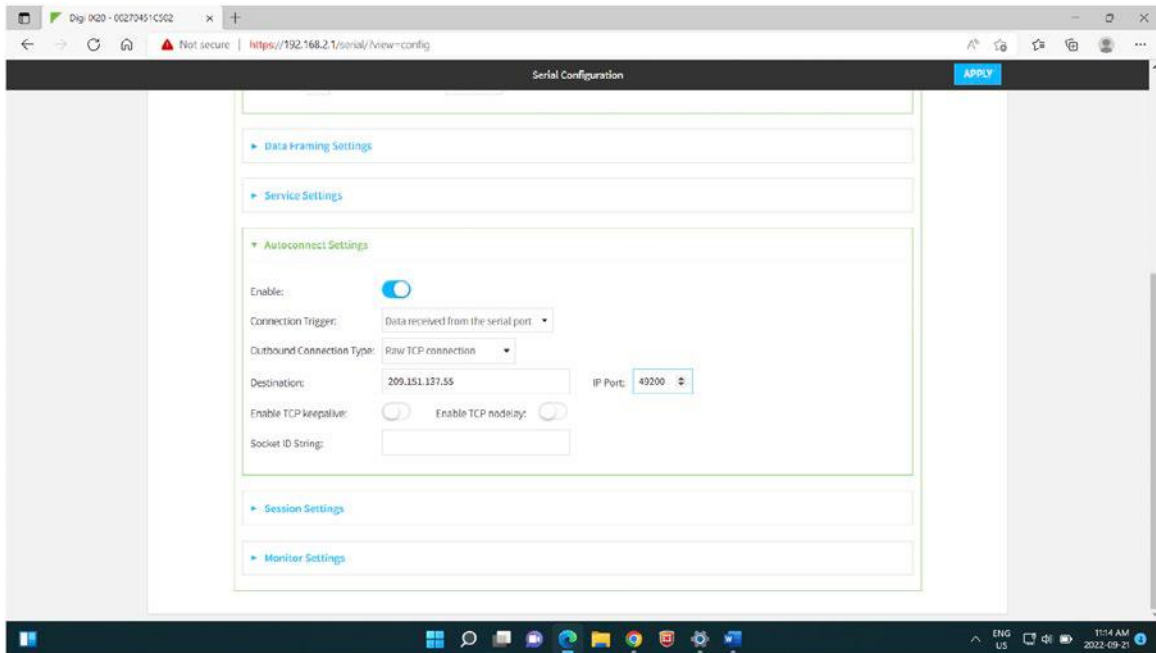


Figure 3-14 Autoconnect Settings

15) Set Connection Trigger to “Data received from the serial port”, the Outbound Connection Type to “Raw TCP Connection”, and set the Destination (Static IP) and IP Port number to the public IP of the PC running the STS home station Communication Agent. Click Apply to save the settings.

Note: It is recommended to set the TCP Port to 49200.

If the modem set up is successful, it is recommended to power cycle the modem, test the new password, and possibly test Internet access.

Note: Internet access will only work after restoring the default gateway IP of the PC, if it was modified.

- 16) Disconnect the PC, and connect the STS to the Serial port or ETH2 of the modem.
- 17) Use STS Field Utility to set up the STS through the USB port. Set the desired communication mode along with the related parameters. For Serial (RS 232) mode, use settings that match what the modem was set to. For Ethernet mode or Bridging mode, use the port number as selected in the STS Administrator Software, and with the Public IP address of the PC on which the Communication Agent will be running.
- 18) Power up the modem and wait for connection, then do a Home Station communication test via the Field Utility. If that fails, try power cycling the STS (which also powers the modem), and try again after they boot up (4 minutes).

4.0 Program Your STS System

To start the Solinst Telemetry Software, click  on your desktop.

4.1 STS Administrator

After the Solinst Telemetry Software has been started, the STS/RRL Administrator window will open. From here, you can create new STS sites, edit existing sites (remote updates), delete existing sites, set up barometric compensation, and open site data.

Note: STS Gold Sites and RRL Radio Networks will also be listed in this window. See separate User Guides for more information on setting these up. See Section 4.6 for bridging and RRL Network.

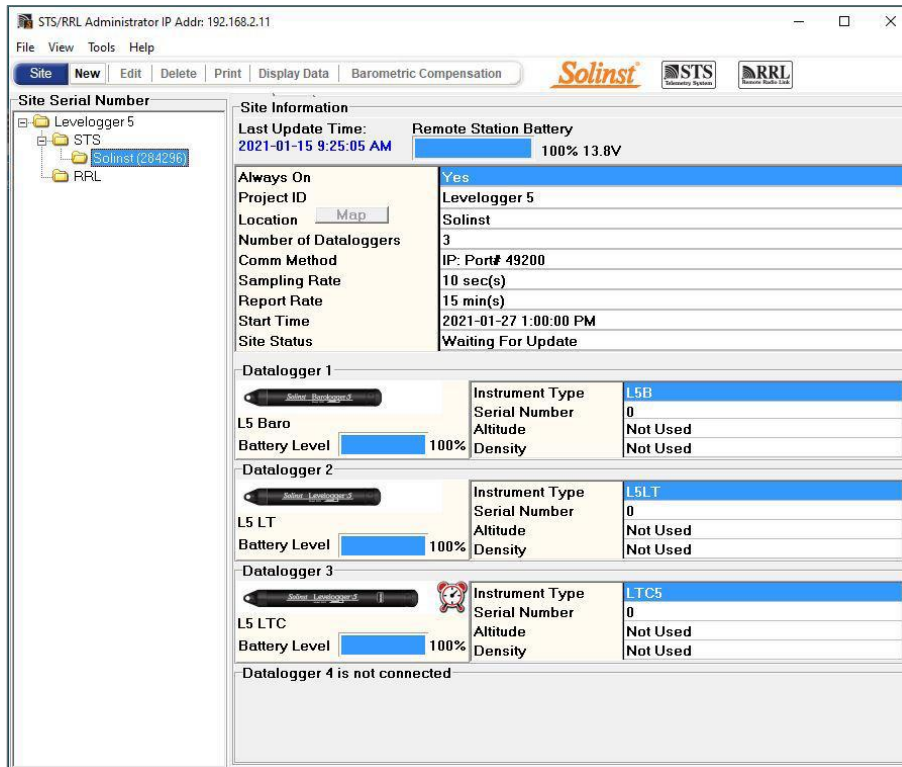


Figure 4-1 Administrator Window

Note: An alarm clock icon shown beside a datalogger on the Administrator window indicates that an alarm condition has been set for this datalogger. It does not mean an alarm condition has been met.

The Site Serial Number window on the left of the screen lists each project and each existing STS Site by Serial Number (number located on the STS).

Selecting a site from the list will display information on the site Remote Station Battery Strength, Last Update Time, and site details (including Project ID, Location, Number of Dataloggers, etc). Information for each datalogger connected to the site is displayed, including instrument type, and battery strength.

- **Last Update Time**, shows the last time the Remote Station contacted the Home Station.
- **Remote Station Battery**, percentage of strength and voltage left in the Remote Station battery.
- **Always On**, indicates that the Remote Station has been set to be always on or not (see Section 4.2).
- **Project ID**, your own identification system that you input.
- **Location**, specific site / location information you input. Clicking the “**Map**” button will show the location of the STS based on its GPS coordinates – if enabled using the STS Field Utility (see Section 4.8.1) and “Refresh GPS Coordinates” was selected when setting up the STS (see Section 4.2).

Note: If you update the GPS coordinates in the STS Field Utility, you will have to “Refresh GPS Coordinates” by editing the STS Site (see Section 6.0).

Note: GPS location for an STS can also be disabled using the STS Field Utility, see Section 4.8.1.

- **Number of Dataloggers**, the number of dataloggers that are connected to the Remote Station.
- **Comm Method**, indicates that the site is using an IP modem and the Port # being used for communication.
- **Sampling Rate**, shows the rate the STS Remote Station is polling the field located dataloggers for readings.
- **Report Rate**, shows the rate that the STS Remote Station is reporting data back to the Home Station.
- **Start Time**, shows the date and time the STS Remote Station started logging.
- **Site Status**, will show the status of the STS Remote Station, i.e. “Logging”, “Waiting for Update”.

Note: To delete a site from the list, click to highlight the site serial number, and select Delete from the main menu bar.

4.2 Create New Remote Site

Selecting New opens the Network Setup window. It will also open when the software first starts. Choose to set up an STS Edge Site, RRL Network, or STS Gold Site (see separate User Guides for RRL Networks and STS Gold Sites).

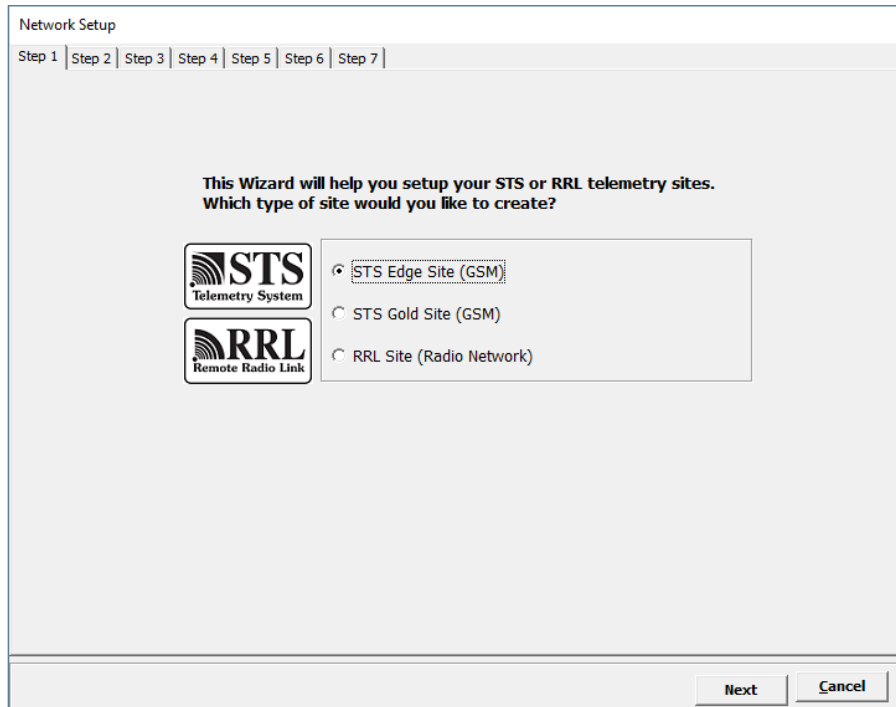


Figure 4-2 Network Setup Window

Selecting an STS Edge Site opens the STS Edge Information window.

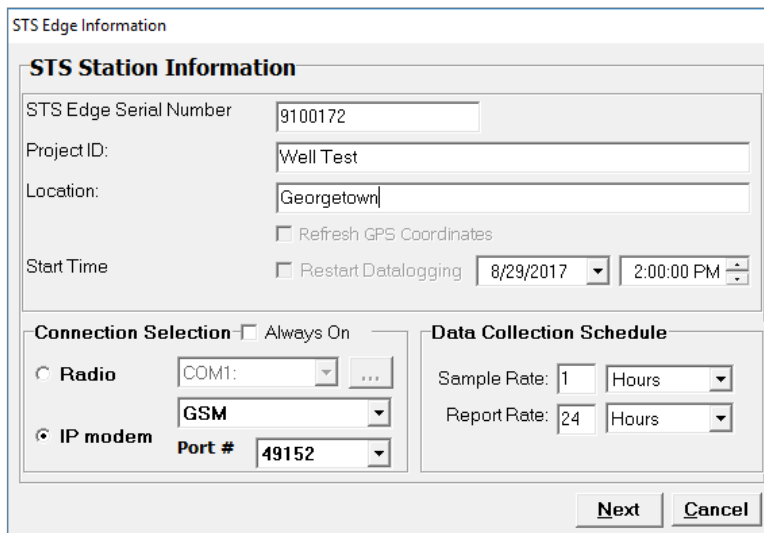


Figure 4-3 STS Edge Information Window

In the STS Station Information section, enter the Serial Number of the STS (located on its side), the unique name you choose to identify the site (Project ID), and the Location of the site. Set a start date and time to begin data collection.

- **Project ID:** input your own identification system.
- **Location:** input specific site / location information.
- **Refresh GPS Coordinates:** select this option to get the location of the Remote STS Station. GPS must be enabled using the STS Field Utility in order to get the location (see Section 4.8.1) when “Map” is selected in the Administrator window.

In the Connection Selection section, you will select IP modem as your communication method, and GSM (LTE). Select the Port number you are using for IP communication. Port #49200 is recommended for PCs using Windows 10.

Program your Data Collection Schedule. A Sample Rate and Report Rate are selected.

- **Sample Rate** is the rate the STS collects a real-time reading from the attached dataloggers. Sample Rate can be set from 10 seconds to 99 hours.
- **Report Rate** is the rate at which stored data is sent from the STS to the Home Station computer. With each report to the Home Station, the Remote Station time and Home Station time are synchronized, and battery and signal strength at the Remote Station is sent along with the data collected from the dataloggers. The STS will also check for any site updates (Edits) made at the Home Station. Report Rate can be set from 5 minutes to 1 week.

If you select a Sample Rate less than 15 minutes and a Report Rate less than 30 minutes, your system will default to “**Always On**”. You can also choose to set your system in this mode. This mode ensures the Remote Station is continuously running and the modem and STS are ready to collect and send data.

If connecting an RRL Network to your STS, you **must** select the STS to be “Always On”. See Section 4.6 for more information on bridging an RRL Network.

Note: “Always On” means you will be using Remote Station power continuously. Ensure you have sufficient power supply. See Section 7.2.

With less frequent Sample and Report Rates, you do not need to check “Always On”. The Remote Station will be idle between data sampling and reporting to conserve battery power. More frequent Sample and Report Rates do not allow sufficient time for the modem to shut down and “wake-up” between data collection and send events.

Note: If connecting an RRL Network to your STS, you must select the STS to be “Always On”. See Section 4.6 for more information on bridging an RRL Network.

After all STS Edge Information is entered, select Next to open the Datalogger Setup window.

4.3 Assign Dataloggers to Remote Station

The Datalogger Setup window allows you to enter the type of datalogger that will be connected to each of the four positions on the STS. After selecting the datalogger type from the drop down menu, an image of the selected datalogger will be displayed.

Note: The firmware versions shown in red for each datalogger are the Firmware Versions that will work with the current Solinst Telemetry Software version.



Figure 4-4 Datalogger Setup Window

If there are not four dataloggers connected, select NONE from the drop-down menu for each of the positions with no datalogger connected. System initialization will not be successful if a datalogger type is selected, but is not physically attached.

To optionally set each datalogger to record in their internal memory, select **Logger Settings** to begin entering data collection information.

Note: Dataloggers programmed to record and store readings in their internal, non-volatile memory, provide reliable back-up data. This will, however, cause their internal battery to be used up more quickly.

You **must** program a Rainlogger in order to enter a Rainfall Calibration Constant (the amount of rainfall per tip of the connected rain gauge), but you do not have to set it to record independently.

Select Next, without entering any Logger Settings, if you do not want to set your dataloggers to record independently.

4.3.1 Levellogger Information Settings

STS Edge - Position 2

Datalogger Information

Serial Number: 0

Well Location: MW 01

Memory Mode Selection

Slate Datalogging Mode Continuous Datalogging Mode

Sample Rate: Minute(s) 15

LEVEL | TEMPERATURE

Identification: LEVEL

Unit: m

Offset: 0.000000 m


Load Settings Save Settings OK Cancel

Independent Logging - Started
Click the icon to stop

Figure 4-5 Datalogger Information Window

If you select to enter settings for a datalogger, the Datalogger Information window will open. It includes datalogger Serial Number, Well Location, Altitude and Density Adjustment (used for Levellogger Gold and Junior Models only), Sample Rate, and Memory Mode Selection.

If you do not require independent logging, select  and the STS Remote Station will only collect a real-time reading from the datalogger at the scheduled STS Sample Rate. There is no need to enter a Sample Rate.

If you want your datalogger to record and store readings in its internal memory, independent of STS operation, fill in the Sample Rate and Memory Mode Selection fields, and select  if independent logging has been stopped.

- **Serial Number**, your datalogger Serial Number will display **after** the System is initialized (See Section 5.0).
- **Well Location**, input specific site / location information.
- **Density Adjustment** (Levellogger Gold Models only) is used to adjust the range of the Levellogger based on the sample fluid density. The range for the density adjustment is from 0.9 kg/L to 1.1 kg/L. Deselect the Density Adjustment field to disable the Density Adjustment function.
- **Altitude** (Levellogger Gold Models only) in feet or meters above sea level, at which the logger is actually deployed, is input in the altitude field. Water column equivalent pressure decreases with altitude at a rate of approximately 1.2:1000 in the lower atmosphere below 5000 m. You can compensate for this by entering an elevation between -1000 ft below sea level and 16,400 ft (or -300 m and 5000 m) above sea level. The readings will then be automatically compensated for elevation.

Note: Altitude and Density Adjustments are made post data collection for the Levellogger 5 and Edge Series dataloggers See the Levellogger User Guide for more details.

- **Sample Rate**, is linear. Linear refers to a set time interval between collection of readings. The default Sample Rate is set to 15 minutes.

- **Memory Mode Selection**, there is a choice of Continuous Logging (wrap around) or Slate Logging. In Continuous Logging, the new log is started at the end of any previous log and continues logging, eventually recording over the first logged data. As one of the download options is to ‘Append Data’, Continuous Logging can be a preferred choice when logging long-term. In Slate Logging, the new log is also started at the end of any previous log, but will stop recording when the memory is full, so that the beginning of the current log will not be written over.

Note: In Slate Logging, the datalogger will stop recording readings after its memory is full. Therefore, Continuous Logging is recommended for long term monitoring applications.

Please refer to the table below for a summary of the available sampling and memory options for each datalogger type (See the Levelogger User Guide for previous version dataloggers).







Datalogger Programming Options			
Datalogger Type	Linear Sampling	Memory	Battery Life
Levelogger 5/ Barologger 5  	0.125 second to 99 hours	150,000 sets of readings in Slate or Continuous Mode	10 years based on 1 reading per minute
Levelogger 5 Junior 	0.5 second to 99 hours	75,000 sets of readings in Slate or Continuous Mode	5 years based on 1 reading per minute
Levelogger 5 LTC 	2 seconds to 99 hours	100,000 sets of readings in Slate or Continuous Mode	8 years based on 1 reading every 5 minutes
Rainlogger 5 	Event Based (records tips from tipping-bucket rain gauge)	Up to 100,000 tip time logs in Slate or Continuous Mode	10 years based on 2 parameters logged every 10 minutes
LevelVent 5 	0.125 second to 99 hours	150,000 sets of readings in Slate or Continuous Mode	10 years based on 1 reading per minute

Table 4-1 Datalogger Programming Options

4.3.2 Set Up Levelogger Measurement Parameters

In the lower portion of the Datalogger Information screen is the window for setting channel parameters. The software will detect the available channels when the Datalogger Information settings are read.

The Level Channel

- **Identification** describes the measurement parameter of the channel and has already been configured as ‘LEVEL’. The Level Channel monitors water column equivalent pressure. The Identification field will be the data column heading and graph line name when viewing the data.
- **Units** refers to the channel’s units of measurement. There are six units of measure available for the user to select: m (default), cm, ft, kPa, mbar, and psi. When using a Barologger 5, the options are kPa (default), mbar, and psi. (There fewer options for Levelogger Gold and Junior Models).

- **Offset** refers to an offset correction, such as the distance between the tip of the datalogger and the monitoring well cap or static water level. It is recommended that the value of 0.00 be used for offset as this keeps all subsequent readings relative to the tip of the datalogger. The offset range is -1000 to 16400 ft or -300 m to 5000 m.

The Temperature Channel

- **Identification** describes the measurement parameter of the channel and has already been configured as 'TEMPERATURE'
- **Units** refers to the channel's units of measurement. The temperature channel can be set to °C (default) or °F. (Some Levelogger Gold Models measure in °C only).

Figure 4-6 Temperature Channel

The Conductivity Channel

The conductivity channel will only be shown for the Levelogger 5 LTC, LTC Levelogger Edge and LTC Levelogger Junior.

- **Identification** describes the measurement parameter of the channel and has already been configured as 'Conductivity'. The Identification field will be the channel heading, data column heading and graph line name when viewing the data.
- **Unit** refers to the channel's units of measurement. There are two units of measure available for the user to select: mS/cm or µS/cm.
- **Temperature Coefficient** (for LTC Levelogger Junior only) allows you to choose the actual conductivity ('Conductivity') at the current temperature or select Specific Conductance ('Spec. Cond'.) measurement in which the conductivity reading is temperature compensated to the standard of 25°C. The Temperature Coefficient default is 2.00 for Specific Conductance readings. The Temperature Coefficient should not be adjusted, unless you know the value specific to the solution you are measuring.

Figure 4-7 Conductivity Channel

Rainlogger Measurement Parameters

Note: You **must** program your Rainloggers in order to enter a Rainfall Cal Constant (the amount of rainfall per tip of the rain gauge), but you do not have to set them to record independently.

There is one channel of measurement for Rainloggers. The 'RainFall' Channel records each tip time by the connected tipping-bucket and outputs the amount of rainfall per tip (input Rainfall Cal Constant). When an STS reports Rainlogger data to the Home Station, it will send the accumulated rainfall amount per sample period (based on STS Sample Rate). To determine the exact time that a tip occurred, the Rainlogger would have to be set to record in its own internal memory, which stores each tip event.

- **Identification** describes the measurement parameter of the channel and has already been configured as 'RainFall'. The channel can be re-named to suit each project. The Identification field will be the channel heading, data column heading and graph line name when viewing the data. Identification is limited to 32 characters.
- **Units** refers to the channel's unit of measurement. There are two units of measure available for the user to select: mm or in.
- **The Rainfall Cal Constant** field allows you to enter the calibration factor for the tipping-bucket you will be using. The calibration factor is the amount of rainfall depth (mm, in) per tip. The calibration factor should be indicated on a label on the tipping-bucket device or in the manufacturer's documentation. Input the calibration factor in mm or inches.

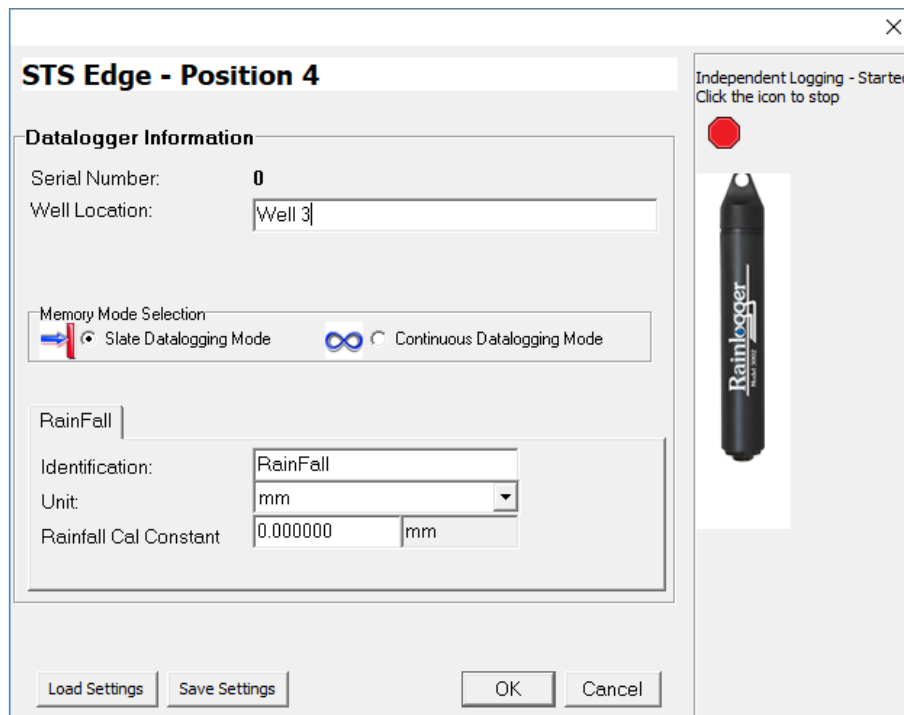


Figure 4-8 Rainlogger Settings

Note: When an STS reports Rainlogger data to the Home Station, it will send the accumulated rainfall per sample period (based on STS Sample Rate).

After filling out the required fields, click Save Settings and OK to apply the information. The Datalogger Setup window will again be shown.

Continue entering information for each of the attached dataloggers. When each datalogger has been programmed, click Next on the Datalogger Setup window. The Alarms Setup window will open.

4.4 Alarm Setup

The Alarm Setup window allows you to set specific alarm conditions for each of the attached dataloggers.

Alarm messages will be sent when the power at the Remote Station drops below 10 Volts, only if you set up an email to receive alarm messages. (See Figure 4-10).

For each channel parameter (level, temperature, conductivity) you can set a “High Limit”, “Low Limit”, and “% Change” alarm. The “High Limit” sets a value, that if exceeded by a datalogger reading, will result in an alarm condition being met. The “Low Limit” alarm condition is met when a reading taken by the datalogger goes below the set value. A “% Change” alarm condition is met when a reading taken by the datalogger changes by the set percentage, from the last recorded reading.

Note: Rainloggers only allow a “High Limit” alarm to be set.

By entering a value in the “for__times” field, you can set how many consecutive readings, which meet an alarm condition, must be met before an actual email notification is sent. If set as 1, you will be notified the first time an alarm condition occurs.

Note: The value entered in the “for__times” field sets the number of times an alarm condition is met for a parameter, before an email is sent. Example, if you input 3, then only on the third time that the alarm condition is met, will an email be sent. Ten is the maximum number of alarm notifications that can be sent to your email address after an alarm condition is met.

Note: The frequency that alarm conditions can be reported is based on the Sampling Rate set for the Remote Station.

Figure 4-9 Alarm Setup Screen

In the bottom section of the window, you enter an email address to receive messages if an alarm condition is met. An SMTP (Simple Mail Transfer Protocol) must be set up. Click **Setup** to do this. The outgoing mail SMTP server used by the Home Station computer will have to be entered to enable an alarm message to be sent to the desired email address. You will enter the email address you want alarm messages sent to, and your user name and password. Click OK when finished. Your outgoing mail server may require additional authentication information; check with your IT Department.

Note: Contact your IT Department if you do not know your user name, password, or the SMTP Server your Home Station Computer is using to send an outgoing email.

By entering your email, you will also receive alarm messages when the Remote Station power goes below 10 Volts.

Note: Multiple email addresses can be notified of alarms by entering each address, separated by a comma “,”.

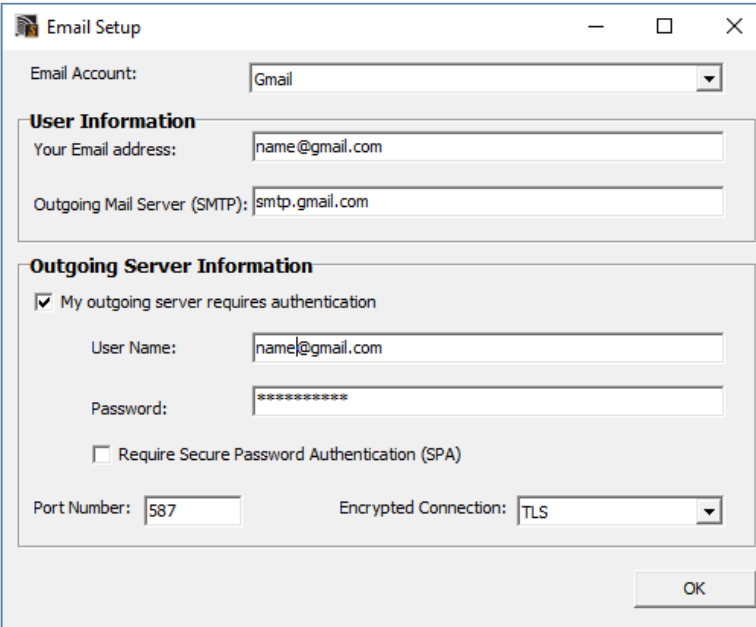


Figure 4-10 SMTP Setup

You will also set the maximum number of notifications to be sent to the address after an alarm condition has been met, or until it has been reset in the software. A maximum of 10 email messages can be sent for one alarm condition.

Selecting **Test** ensures the address entered is correct, by sending a test message to your email account.

After you have entered settings for each datalogger, as desired, click Finish.

The STS/RRL Administrator will again be shown, with all of the entered information shown for the STS Site.

The STS/RRL Communication Agent will open automatically.

Although the STS settings have been programmed, you will still need to initialize the system to apply the settings and start the system logging. After all hardware had been set up, see Section 5.0 for instructions to initialize your system.

4.5 Barometric Compensation Setup

Submersed Leveloggers measure total or absolute pressure (water column equivalent + barometric pressure). In order to accurately determine the true changes in water level only, Levellogger data must be barometrically compensated. Compensation simply involves subtraction of the barometric reading from the corresponding Levellogger reading. LevelVent dataloggers do not require barometric compensation.

Levellogger data can be barometrically compensated using data from a local Barologger (one Barologger can cover all Leveloggers within a 20 mile/30 km radius or per 1000 ft/300 m change in elevation) using the Barometric Compensation application in the STS /RRL Administrator.

The Levellogger and Barologger must have the same time stamp in order for the compensation to be successful. A Barologger 5, Barologger Edge or Barologger Gold can be used to compensate the data from any version of Levellogger.

Note: Alternatively, STS data files can be exported using the STS/RRL Administrator as *.xle or *.lev files and opened in Levellogger Software for barometric compensation. See the Levellogger User Guide for more details.

To begin the compensation, click the **Barometric Compensation** tab on the STS/RRL Administrator window.

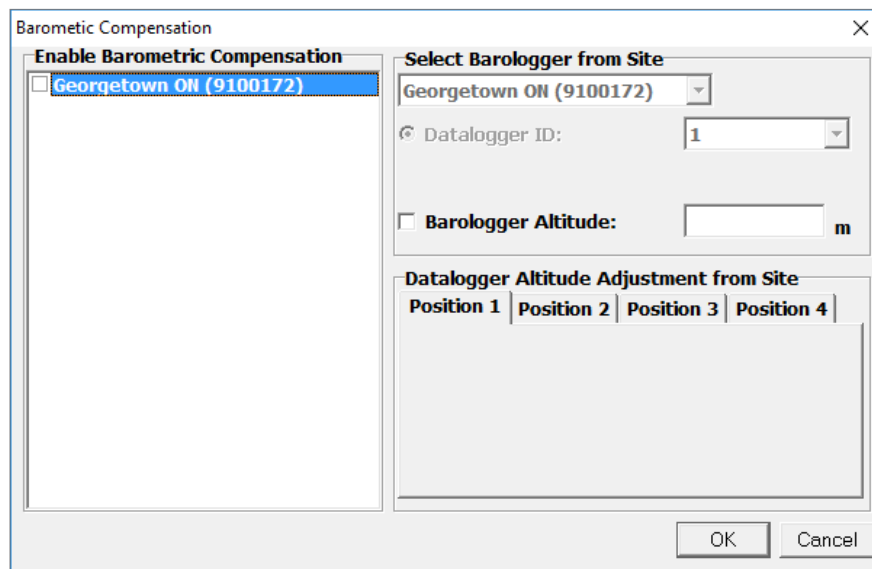


Figure 4-11 Barometric Compensation Window

In the Barometric Compensation window, from the “Enable Barometric Compensation” list, check the STS Site that you wish to compensate, and the STS Site (or RRL Station) that will provide the Barologger for the compensation.

In the “Select Barologger from Site” section, select the STS Site (or RRL Station) that contains the Barologger you wish to use for the compensation, and identify the Barologger by its position (Datalogger ID) on the STS Site (or RRL Station).

The Levellogger and Barologger must have the same time stamp in order for the compensation to be successful.

To account for different deployment altitudes in your compensation, you can choose to enter an altitude for your Barologger and each datalogger.

Click OK to complete the barometric compensation set up.

To view compensated data, see Section 8.2.1.

4.6 Bridge an RRL (Remote Radio Link) Network

Note: Levelogger 5 Series Dataloggers are not compatible with the RRL.

An STS Edge Remote Station can be used in place of a Home Station PC to connect an RRL Network. All RRL Stations in the Network will report to the Home Station RRL, which then reports all data to the STS Edge it is connected to. The STS Edge sends all data to the Home Station PC using the modem.

Note: See Separate User Guide for more information on RRL Station hardware and setup.

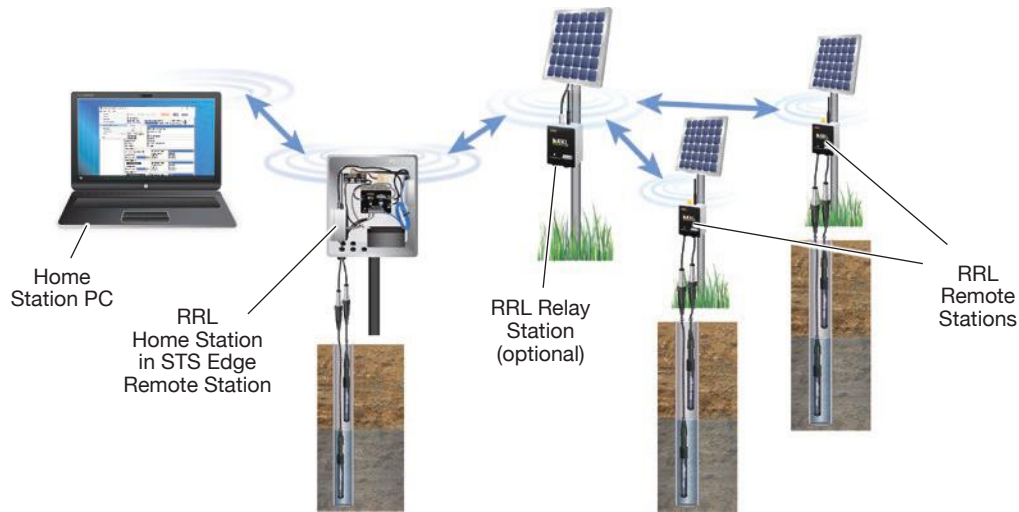


Figure 4-12 Bridging an RRL Network

To connect an RRL Home Station to the STS Edge, use the RS-232 Cable and a 12V Power Cable Assembly (sold separately). The standard modem is connected to the STS Edge using the Ethernet cable.

When bridging an RRL Network to an STS Edge, the STS Edge **must** be set to “Always On” (see Section 4.2) and have an external power supply in addition to the standard 12V battery. See Section 7.2 for power options.

The following figure shows a standard setup for connecting an RRL Home Station.

Note: To make more room in the NEMA enclosure, only the primary antenna is required for the GSM modem.

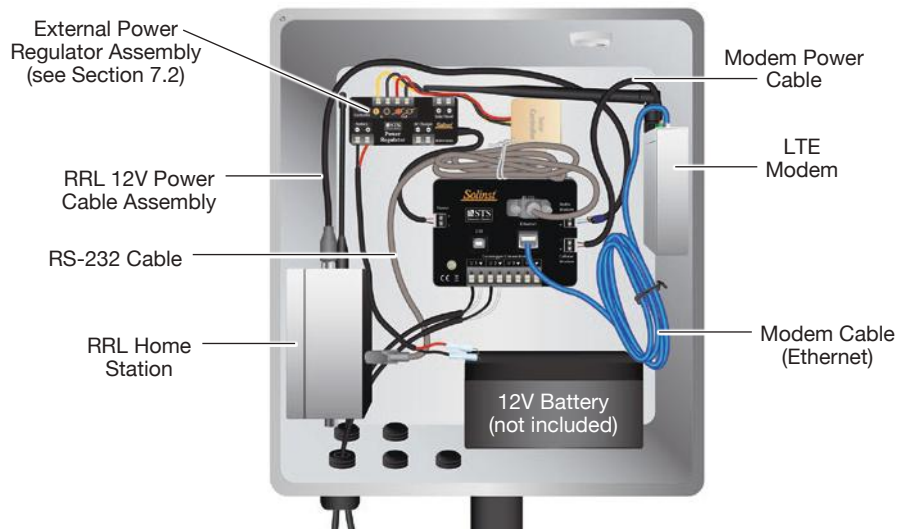


Figure 4-13 RRL Home Station Connection to STS Edge

To bridge an RRL Network, you must first set up your STS Edge Site that will act as the Home Station for the RRL Network (see Sections 4.1 to 4.5). The STS Edge Site **must** be set to “Always On” (see Section 4.2).

After you have completed your STS Edge Site setup, you will then set up your RRL Network. Do this by selecting New from the STS Administrator window. This opens the Network Setup window. Choose to set up an RRL Site (Radio Network).

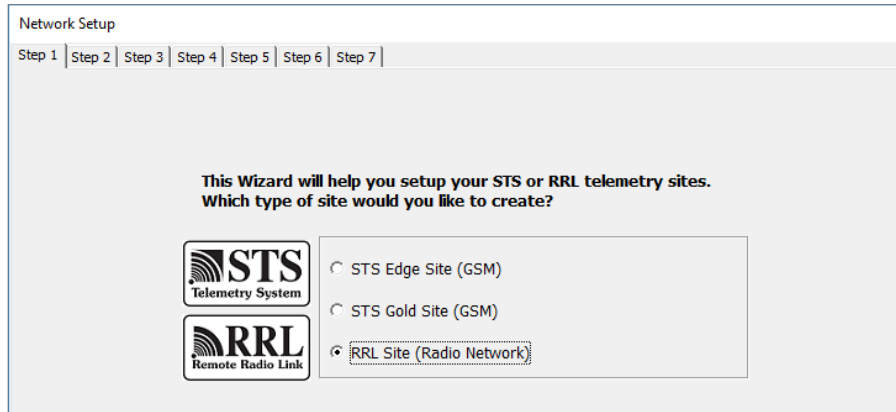


Figure 4-14 Network Setup Window

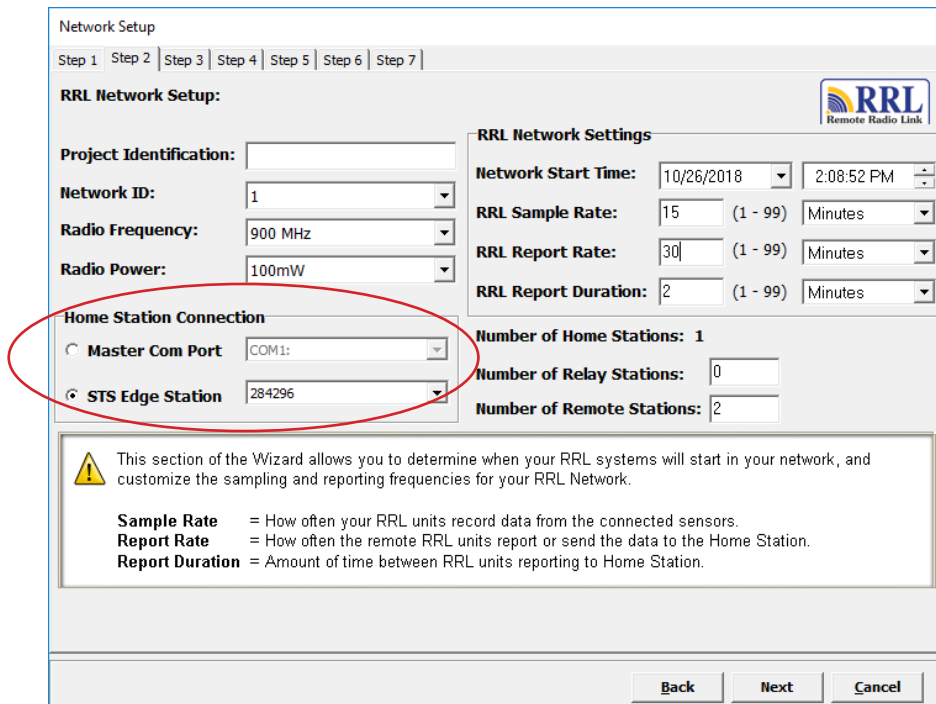


Figure 4-15 RRL Network Setup

Under Home Station Connection, select the STS Edge Station that you are connecting your RRL Network to. See the 9200 RRL User Guide for full details on the remaining steps to set up your RRL Network.

4.7 Communication Agent

The STS/RRL Communication Agent is included with the Solinst Telemetry Software package. The Communication Agent is an information window that will display all activity that has occurred between a Remote Station and the Home Station. This application is used to view activity, and monitor communication.

The Communication Agent must always remain open while your STS System is in operation and during initialization, however, it can be minimized. If the Communication Agent is closed, the STS Remote Station will save data until the Communication Agent is reopened. The accumulated data will then be sent with the next scheduled Report.

To open the STS Communication Agent, click  on your desktop.

The Communication Agent will open automatically, after you have finished setting up a new STS Site. The Communication Agent can be left open, and minimized even after the STS/RRL Administrator has been closed.

Note: If you change a Port setting or add a new site with a different Port setup, you will have to restart the Communication Agent in order to see the data from that Port.

In the Messages tab, the serial number of each datalogger and STS will be shown to indicate which communication has come from that site. Each report will be time and date stamped. By clicking the Save icon, at any time you can save the log file on your Home Station computer for your record or for diagnostic purposes. If a station is stopped, when started again, the data will be appended to the same log file. Saved log files can be retrieved from the following location:

<C:\Program Files\Solinst\STS_Gold\log>

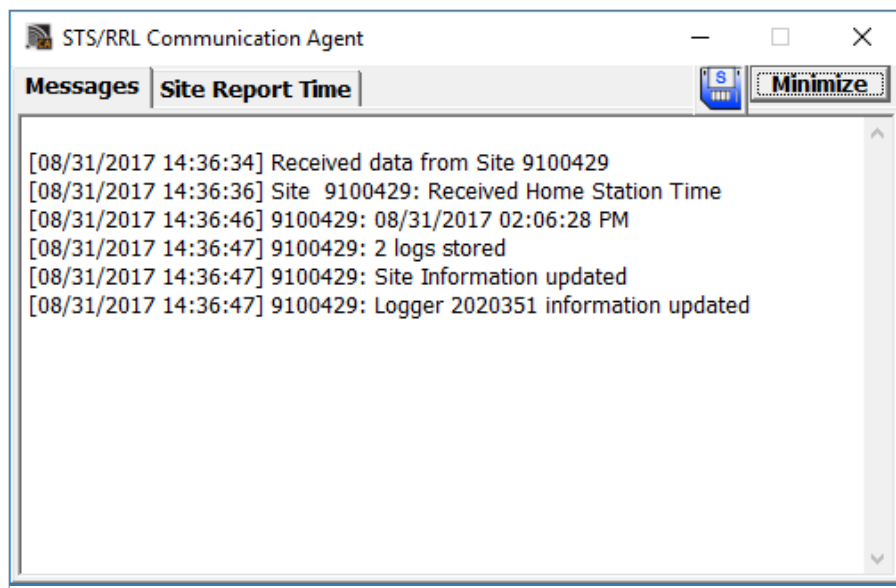


Figure 4-16 Communication Agent - Messages

The Site Report Time tab lists each STS by serial number and shows the next time it is scheduled to report to the Home Station.

If there is a communication conflict, and the STS Remote Station does not report when scheduled, a timeout message will be shown in the Communication Agent Messages. To stop receiving timeout messages from an STS (you may be aware of what is causing the communication issue, and do not need the messages any longer), deselect the box beside the STS.

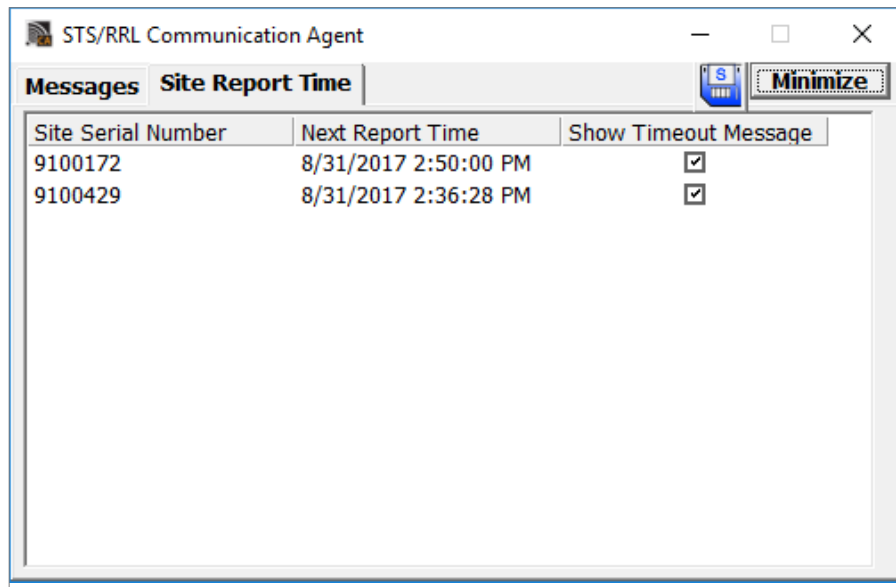


Figure 4-17 Communication Agent - Site Report Time

4.8 STS Field Utility

The STS Field Utility is included with the Solinst Telemetry Software package. It is used to perform diagnostics, control the modem, and initialize your STS Telemetry System (see Section 5.0). It is useful to install on a portable laptop, as it provides a convenient way to communicate with an STS in the field.

To communicate with the STS Field Utility, you will need to connect the STS to your PC using the USB Programming Cable. The connection is labeled “USB” on the STS.

To open the STS Field Utility, use the **Tools** menu in the STS/RRL Administrator.

Select the appropriate USB or Com Port for the connected STS from the drop-down menu.

Click  to retrieve information and settings from the connected STS.

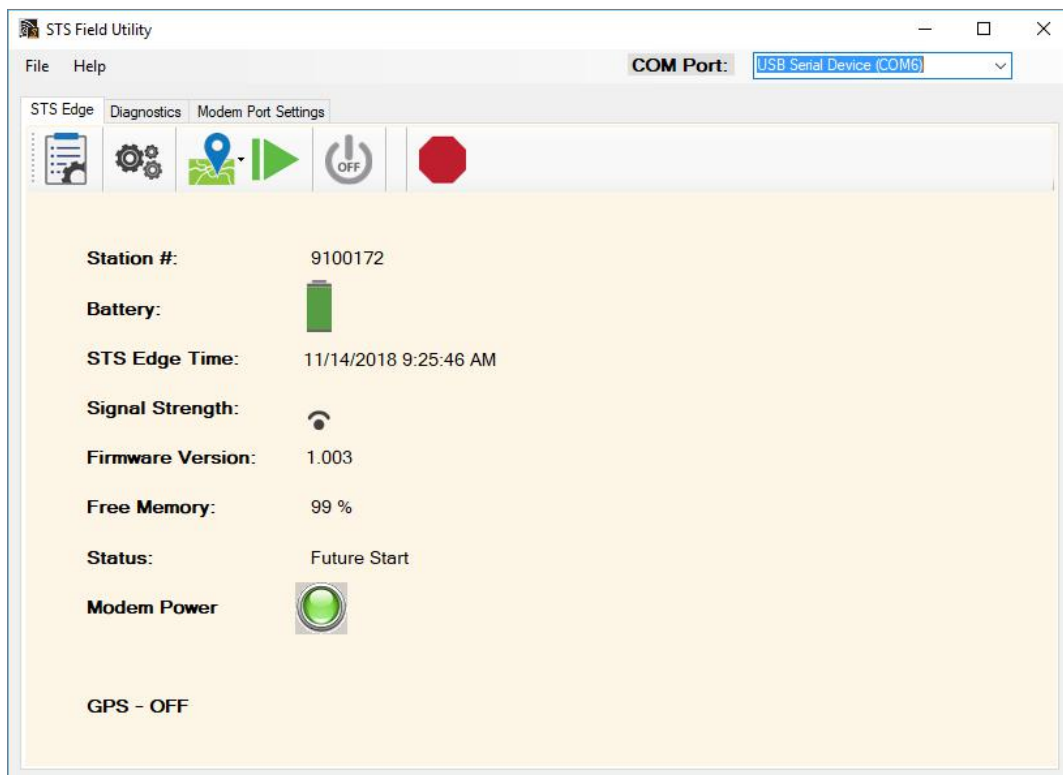


Figure 4-18 STS Field Utility

4.8.1 STS Edge Tab

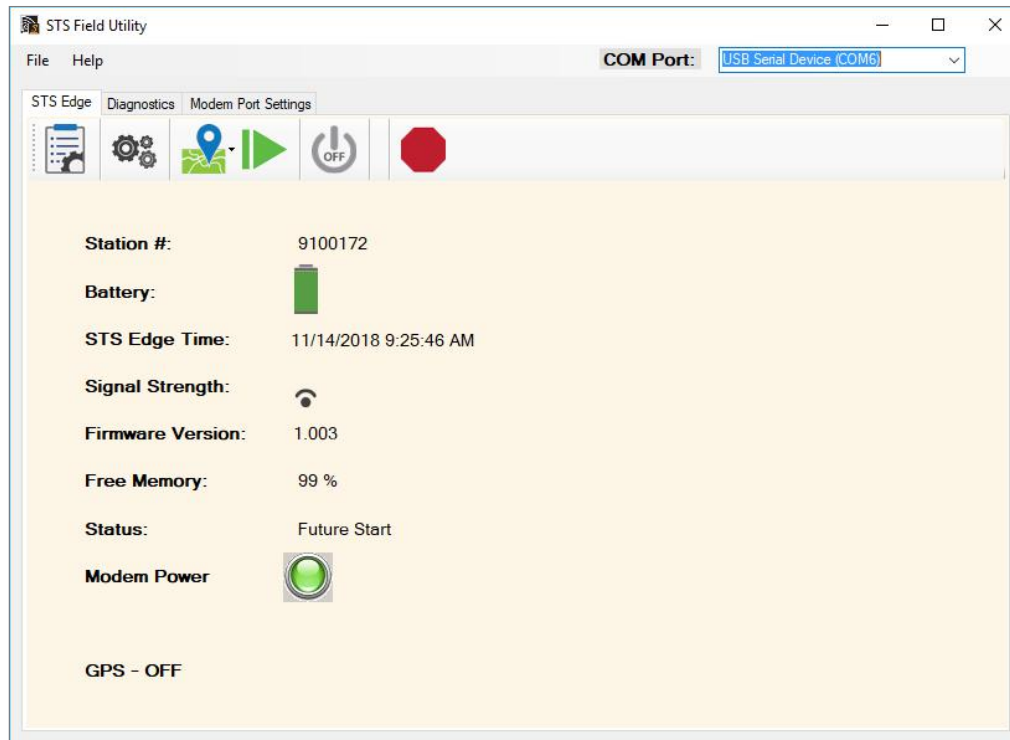


Figure 4-19 STS Edge Tab

The STS Edge tab will display the Serial Number of the connected STS, the battery level of the Remote Station, The STS Edge Time, the Signal Strength of the modem, the STS Firmware Version, the percentage of remaining Free Memory in the STS, the STS System Status, and the Modem Power and GPS status.

STS **Status** descriptions are as follows:

- **Idle** – indicates that the STS is idle and waiting for initialization.
- **Init** – shows that the STS is going through the initialization process (initialization is discussed in Section 5.0).
- **Logging** – indicates that the STS is collecting data from dataloggers.
- **Future Start** – indicates that the STS has been programmed with the future start option.

In the STS Edge tab, you can turn a connected modem on or off by clicking,  or .

You can restore the factory settings of the STS by clicking . Sampling and reporting is stopped. This may be useful before you want to reprogram your STS for a new site.

You can disable or enable GPS location for the STS by clicking . Select “Get Location” from the  drop-down menu to display a map with the STS location based on its GPS coordinates.

Note: You may have to turn off the modem to obtain more accurate GPS coordinates.

You can stop a programmed STS from sampling and reporting by selecting .

Note: To restart an STS, you have to use the STS/RRL Administrator. See Section 6.

The STS Edge tab is also used to initialize your STS Telemetry System, after all programming and hardware setup is complete. See Section 5 for initialization instructions.

4.8.2 STS Diagnostics

The Diagnostics tab is used to verify the STS connection with the Home Station and dataloggers, and to test the battery.

Click to retrieve information and settings from the connected STS.

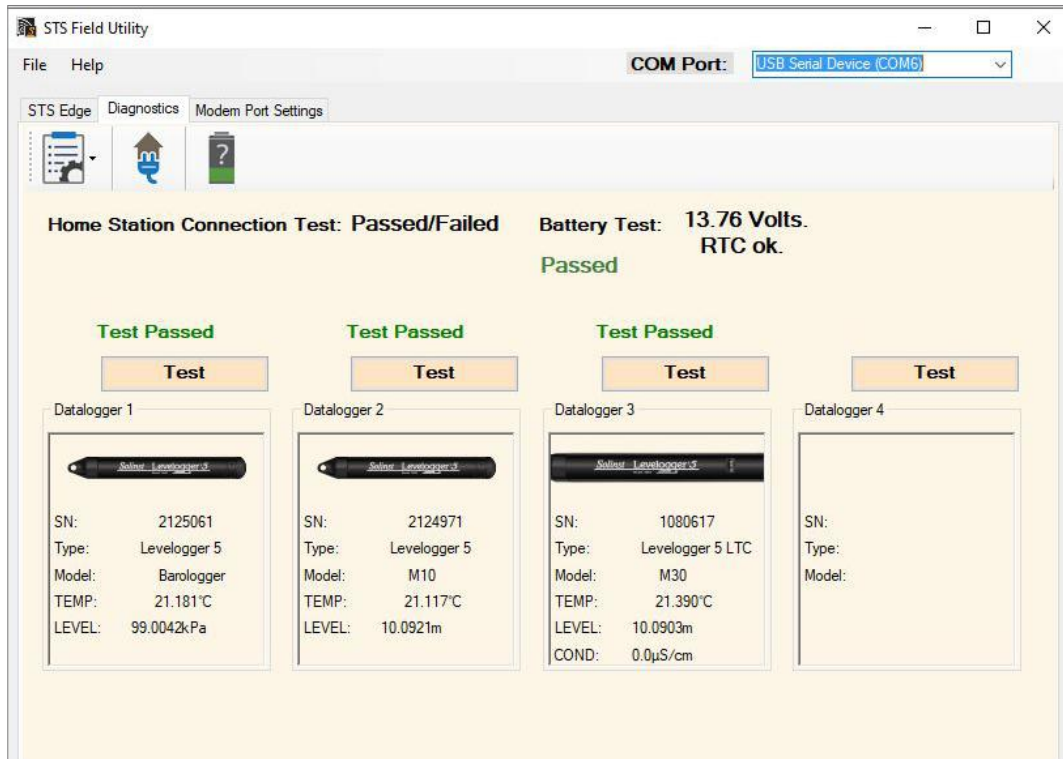


Figure 4-20 Diagnostics Tab

Click to test the STS connection with the Home Station.

Click to check the STS Remote Station battery voltage.

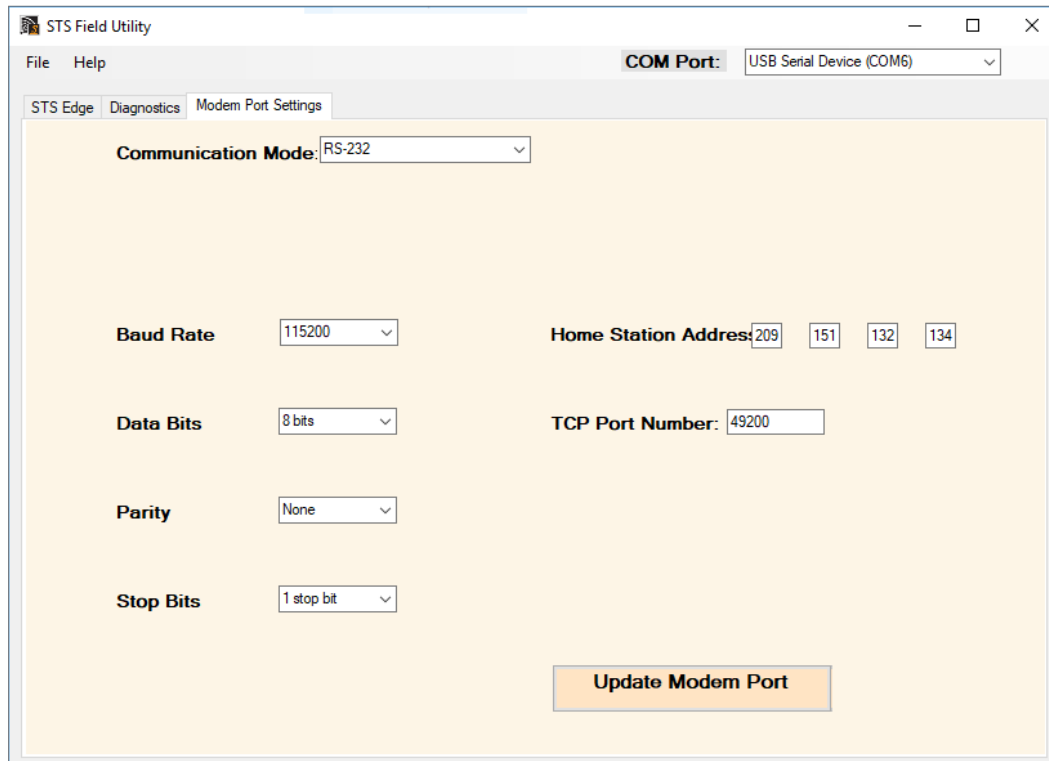
For each datalogger connected, click Test. If successful, information about each connected datalogger will be displayed. Real-time readings from the dataloggers will also be shown.

Note: You can also test each datalogger by using the drop-down menu.

4.8.2 STS Modem Port Settings

In the Modem Port Settings tab, select the Communication Mode you are using to connect to your modem from the drop-down menu. The options are:

- RS-232 – your modem is connected to the STS using the Serial (RS-232) cable.
- Ethernet – your modem is connected to the STS using the Ethernet cable.
- RRL Bridging – you have connected the modem to the STS Edge using the Ethernet cable, and have connected a Home Station RRL to the STS Edge using the RS-232 cable.



The screenshot shows the 'STS Field Utility' application window. The 'Modem Port Settings' tab is active. The 'COM Port' is set to 'USB Serial Device (COM6)'. The 'Communication Mode' is set to 'RS-232'. The 'Baud Rate' is set to '115200'. The 'Data Bits' are set to '8 bits'. The 'Parity' is set to 'None'. The 'Stop Bits' are set to '1 stop bit'. The 'Home Station Address' is set to '209 151 132 134'. The 'TCP Port Number' is set to '49200'. An 'Update Modem Port' button is located at the bottom right of the settings area.

Figure 4-21 Modem Port Setup

Ensure that you have configured your modem with the same communications and port setup you enter when programming the modem, including the Baud Rate, Data Bits, Parity, Stop Bits, Home Station static IP Address, and TCP Port Number. See Section 3.4. Update the modem port settings to match, if required.

Note: When using the RS-232 Communication Mode, the Baud Rate must be 115200. When using the RRL Bridging Communication Mode, the Baud Rate must be 9600.

5.0 Initialize Your STS Telemetry System

After all settings in the Solinst Telemetry Software are programmed, modem set up, and connections made to the STS, the STS Field Utility is used to “initialize” the STS System. Initializing the system applies all of the settings programmed in the software to the STS and the attached dataloggers. If all the hardware components in the Remote Station and dataloggers are properly connected, the STS System will begin operation, and data collection starts at the programmed time.

The system can be initialized in the office or in the field, whichever suits the application. Initialization can be performed more than once as required. The STS System can be initialized in the office for a quick check, and again when it is installed in the field. With each initialization, the Home Station time is synchronized with the Remote Station time of the STS.

Note: STS /RRL Administrator and Communication Agent Software must be running on the Home Station computer during the initialization process. The computer must not be in sleep mode.

- 1) Once all physical connections are made to the STS Remote Station, connect the STS to your PC using the USB Programming Cable. The connection is labeled “USB” on the STS.
- 2) Open the STS Field Utility using the **Tools** menu in the STS/RRL Administrator.

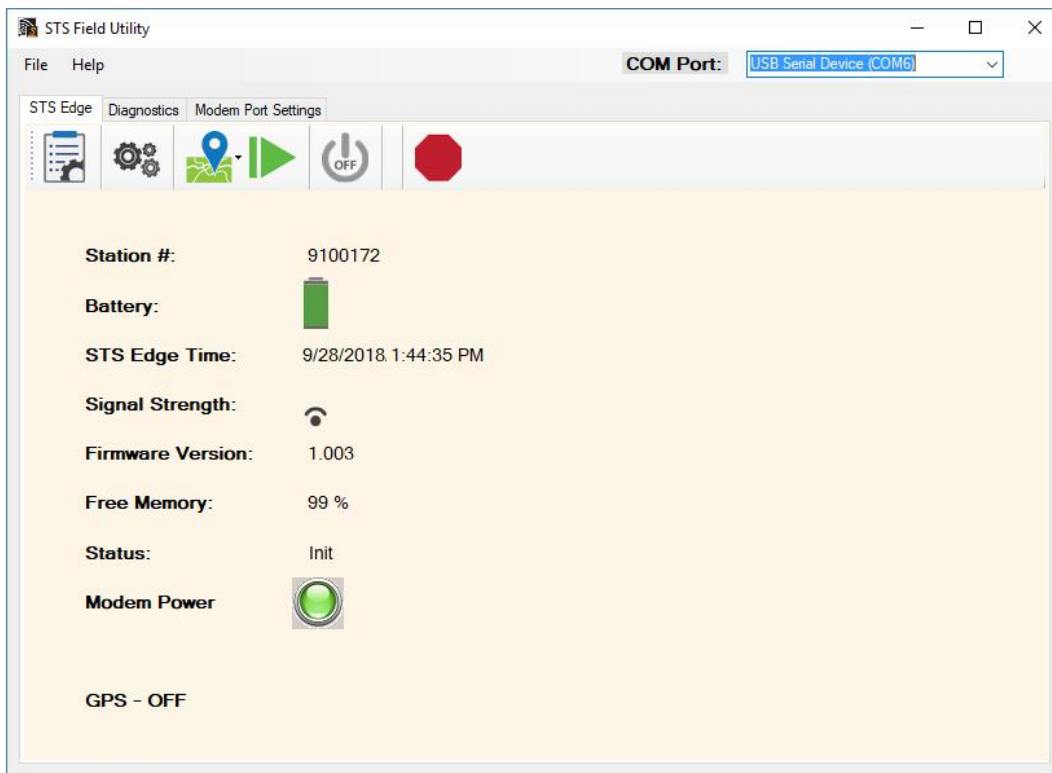






Figure 5-1 STS Field Utility

- 3) Select the appropriate USB or Com Port for the connected STS from the drop-down menu.
- 4) Click  to retrieve the information and settings from the connected STS.
- 5) Use the  icon to turn the modem off. Disconnect the battery/power. Wait a few seconds, then re-connect the battery/power. The LED on the STS should be blue. Turn the modem back on, by clicking . The green lights on the modem should flash to indicate that it is working.

- 6) At the Home Station, shut down, then restart the STS/RRL Administration Software and the STS/RRL Communication Agent. After the software has been restarted, the STS/RRL Administrator window should show the message “Waiting for Update” in the Site Status field.
- 7) Before completing the initialization process, perform a test to ensure the Home Station and Remote Station are communicating properly. This can be done using the Diagnostic tab in the STS Field Utility (see Section 4.8.2). If the test is successful, begin the initialization process.

Note: You can also use the Diagnostics tab to test the connection of each datalogger and the battery level of the remote station before initializing.

- 8) The initialization process is started by simply clicking  in the STS Edge tab of the STS Field Utility. The STS/RRL Administrator and Communication Agent Software must be running on the Home Station computer during the initialization process.

Note: After you start initialization, a message may ask if you want to stop the dataloggers from recording, if you have previously set them to start logging. This is a precaution, as the internal battery will be used if the dataloggers are set to record independent of the STS System.

- 9) A Window will open showing the progress of the initialization process. The initialization process should only take a few minutes. During the process, the status of the STS will change from “Idle” to “Init”. If initialization is successful, a message will be given and the STS status will change from “Init” to “Logging” or “Future.Start”.
- 10) Click OK in the Initialize Home Station Window, and the STS System will start collecting data at the specified time. Figure 5-2 shows a successful initialization.

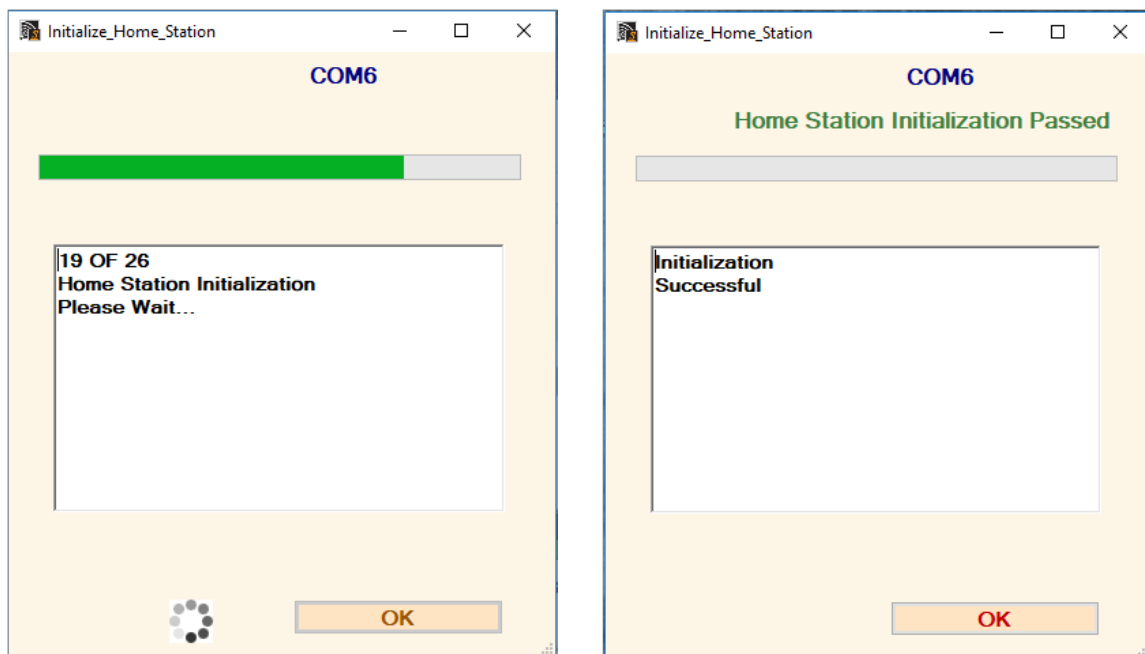


Figure 5-2 STS System Initialization

6.0 Remote STS Updates

If you need to make changes to an STS Remote Station, while it is still operating in the field, you can use the Edit tab in the STS/RRL Administrator.

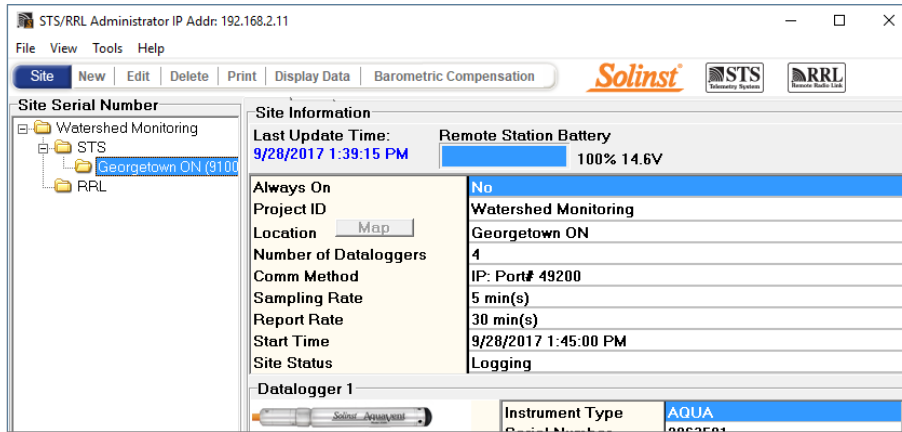


Figure 6-1 STS/RRL Administrator Window

To make changes to an STS set up, select the site from the list, click to highlight the site serial number, and select Edit from the main menu bar.

The Edit Site Information window will open first. You can update your Project ID, Location, Sample and Report Rates, and Communication options (see Section 4.2). You can refresh the GPS Coordinates if you have moved the location of the STS Remote Station. You can also restart at a specific time if you have stopped the system.

Note: If you change a Port setting, you will have to restart the STS/RRL Communication Agent in order to see the data from that Port.

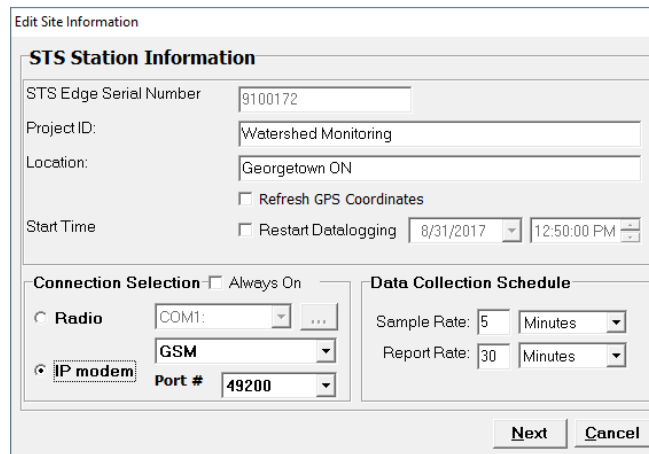


Figure 6-2 Edit Site Information Window

The Datalogger Setup window will open next. You can add or remove a datalogger if you have recently made changes in the field. You can start or stop a datalogger from recording independently in its internal memory, and change the datalogger sampling rate (see Section 4.3).

The Alarm Setup window will open last. You can set new alarms or delete an existing alarm for the connected dataloggers (see Section 4.4).

Click Finish. The **changes will be applied to the STS Remote Station at its next scheduled Report interval.**

7.0 Configure Your Remote Station in Field

Ensure you have connected all hardware components in the STS Remote Station. To make sure everything is connected properly and working correctly, you may want to initialize and test the system before you bring it to the field (see Section 5).

The NEMA 4X enclosure can be mounted anywhere that suits your application. Connect the enclosure to a user-supplied bracket and mast, or any support that suits your needs.

See the Levellogger and Vented Dataloggers User Guides for details on proper deployment of these instruments.

7.1 Cellular Signal Strength

Received Signal Strength Indicator (RSSI) is the measure of RF signal strength between the Remote Station modem and a base station, expressed in dBm. The signal strength should be no less than -100 dBm (considered weak coverage), -50 dBm is considered full signal strength.

A site survey can be performed prior to installation, to determine the signal strength on site. This can be done using a cellular device.

For STS modems, a general indication of the signal strength can be determined from the number of LEDs that light up on the modem:

- 0-1 LEDs (-101 dBm or less) = unacceptable coverage
- 1-2 LEDs (-100 dBm to -91 dBm) = weak coverage
- 2-3 LEDs (-90 dBm to -81 dBm) = moderate coverage
- 4 LEDs (-80 dBm or greater) = good coverage

Signal strength can be increased by adding an optional antenna, or by simply relocating the Remote Station to an area with maximum signal strength on site.

7.1.1 Optional Antennas

Where greater range is required, a higher gain antenna can be used. Select a quad band antenna, or one with 850 - 1900 MHz range in North America; a 900 - 1800 MHz range elsewhere. An omni-directional antenna with a dBi level of 5 or more, or directional yogi type antenna, may increase communication range. The antenna must have a SMA connector to link to the STS modem. In order to accommodate an extended antenna cable, the NPT plug on the top of the enclosure will need to be removed (using an Allen Key), and a weathertight fitting threaded in its place.

7.2 Power Options

7.2.1 Battery Life Estimates

STS Telemetry Systems use a 12V sealed lead-acid battery (not supplied by Solinst, see Section 3.3 for battery specifications), which connects to the STS. The life-time of the battery varies depending on the frequency of your Sample and Report Rates. The following are estimates based on a minimum power source using a 12V battery, with four dataloggers connected to the System. With only one datalogger connected, battery life estimates will be approximately 10% longer. The battery life estimates assume the STS and modem are NOT set to be “Always On”.

Note: Solinst recommends using a 12-30 Ahr deep-cycle, rechargeable sealed lead-acid battery.

Note: If you choose a Sample Rate less than 15 minutes and a Report Rate less than 30 minutes, “Always On” will default, as the entire System has to be active (see Section 4.2).

Sample Rate	Report Rate	Battery Life Estimates
Every 15 Minutes	Every 6 Hours	7 Months
Every Hour	Every 24 Hours	1 Year
Every 6 Hours	Every 3 Days	1.3 Years
Every 24 Hours	Every 7 Days	1.4 Years

Table 7-1 Battery Life Estimates Using a Minimum Power Source 12V Battery

Battery re-charging should be done on regular scheduled intervals, based on the battery life estimates. It is recommended to recharge the battery once it reaches 10 Volts. Recharging is especially important in the fall, if the winter temperatures are cold. Replace existing lead-acid batteries every 3-5 years.

7.2.2 Solar and AC Power Options

Solinst offers an External Power Regulator Assembly, which allows the connection of a user-supplied external battery, AC power adaptor, AC battery charger, or solar panel. **See Table 7-2 for power connection options.**



Figure 7-1 External Power Regulator Assembly (#113534)

To connect wires to the External Power Regulator Assembly, press down on the white buttons above each connection, insert the wires, then release the buttons. **You will require a small flat screwdriver to connect the External Power Regulator Assembly to the STS.** The assembly is connected to the STS “Power” connection. (The red wire goes to the positive terminal and the black wire to the negative.)

When connecting an external battery, AC power adaptor, or AC battery charger, the solar panel regulator must be removed from the assembly. To remove the wires, press the white buttons above each connection, while pulling the connector pins out.

To accommodate any external cables through the enclosure, the second NPT plug on the base of the enclosure will need to be removed (using an Allen Key), and a weathertight fitting, supplied by Solinst, threaded in its place.





		External Power Regulator Assembly Connections					
Power Mode	Battery Cable	Battery	Solar Controller		Solar Panel	AC Charger	Comments
			In	Out			
Battery Only	 Internal (Solinst supplied), External or Custom	Internal or External, 10-16V battery, any type	Not Used	Not Used	Not Used	Not Used	Solinst recommends using a 12V, 12-30 Ahr deep-cycle, rechargeable sealed lead-acid battery. (user supplied) If connecting an Internal battery, the Solinst supplied Internal Battery Cable can be used to connect directly to the STS (standard setup). Ensure the battery is rated for the temperatures you expect in the field.
AC Adaptor	Not Used	Not Used	Not Used	Not Used	Not Used	AC Adaptor, 10-16VDC, ≥2.5A (can also be connected directly to the STS)	Not recommended unless connected to an uninterrupted power supply. Ensure the AC adaptor is rated for the temperatures you expect in the field. (user supplied)
AC Charger	 Internal (Solinst supplied)	Internal, 3-10Ahr sealed lead-acid battery	Not Used	Not Used	Not Used	Any 12V charger rated ≥2A for a lead acid battery	Ensure the AC charger is rated for the temperatures you expect in the field. (user supplied)
Solar Panel* (built-in regulator) (low power demands)	 Internal (Solinst supplied)	Internal, 5-12Ahr sealed lead-acid battery	Not Used	>5W, 13-14V, regulated	Not Used	>5W, 14-15V, regulated	Connect solar panel output to "Solar Controller - Out" or "AC Charger" depending on output voltage rating. Use for systems with a low reporting rate, i.e. <7 per week.
Solar Panel* (unregulated) and Solar Charger (low power demands)	 Internal (Solinst supplied)	Internal, 5-12Ahr sealed lead-acid battery	>1A or regulator supplied connected to the assembly		>5W, 16-35V, unregulated	Not Used	Open circuit voltage must be 16-35V. Use for systems with a low reporting rate, i.e. <7 per week.
Solar Panel* (unregulated) and Solar Charger (high power demands)	External	External, 20-80Ahr sealed lead-acid, deep-cycle battery	>3A or regulator supplied connected to the assembly		>30W, 16-35V, unregulated	Not Used	Open circuit voltage must be 16-35V. Optional External Battery Cable available through Solinst. Use for systems with a high reporting rate, i.e. >2 per day.

Table 7-2 Power Connection Options

*Solar Panel not supplied by Solinst.

7.3 Datalogger Deployment

The dataloggers are installed using a Reader Cable, which is connected to one of four terminals on the STS (see Section 3.2 for complete connection details).

An NPT plug in the base of the Remote Station enclosure will need to be removed (using an Allen Key), and a weathertight fitting threaded in its place. The Reader Cables are fed through armored protective conduit (supplied with the STS System) and into the base of the Nema 4X Enclosure through the weathertight fitting. The two wires at the end of the Reader Cable are inserted into the labeled terminals on the STS. A nut is threaded onto the fitting to anchor and seal the protective armored conduit to the STS enclosure. A Direct Read Cable with the Levelogger connected, LevelVent Wellhead is threaded onto the other end of the Reader Cable.



Figure 7-2
Protective Armored Conduit and NPT Fitting on the STS Enclosure

See the Levelogger and Vented Dataloggers User Guides for detailed information on deploying your dataloggers.

8.0 Access Your Data

8.1 Access Database

Data received in each report from the STS is placed in a Microsoft® Access® database (*.mdb file) on the Home Station computer. New data is appended to the existing database. The program will save data downloaded to the following default directory: < C:\Users\[user name]\AppData\Local\VirtualStore\Program Files (x86)\Solinst\STS_Gold\db>. The location of the default directory may vary for different Windows operating systems.

Note: The *.mdb file may be located in a different directory than the default location. To easily find the location of the *.mdb file, search for “sts_gold.mdb” in the C drive.

The Access database can be queried by your own macros or applications, to automatically check for updates and display the data in your own program, on a website, or in any way you choose.

The screenshot shows the Microsoft Access interface with the 'logger_data' table open in Datasheet View. The table contains the following data:

ID	site_serial	Date_time	ch1_data_P	ch2_data_P	ch3_data_P	ch4_data_P	ch1_data_T	ch2_data_T
14181	9100429	8/31/2017 11:14:17 AM	98.774597	0	0	0	23.077999	0
14182	9100429	8/31/2017 11:36:28 AM	98.777298	0	0	0	23.203999	0
14183	9100429	8/31/2017 12:06:28 PM	98.775101	0	0	0	23.23	0
14184	9100429	8/31/2017 12:36:28 PM	98.761299	0	0	0	23.282999	0
14185	9100429	8/31/2017 1:06:28 PM	98.753098	0	0	0	23.399	0
14186	9100429	8/31/2017 1:36:28 PM	98.758499	0	0	0	23.469	0
14187	9100429	8/31/2017 2:06:28 PM	98.7612	0	0	0	23.466999	0
14188	9100429	8/31/2017 2:36:28 PM	98.759895	0	0	0	23.452999	0
*(New)	0			0	0	0	0	0

Figure 8-1 STS Access Data

8.2 View Using Solinst Telemetry Software

The STS/RRL Administrator can be used for a quick check of the latest readings. Data can also be exported as *.csv, *.xle, or *.lev files for use in other programs.

To view data from a specific site, click Display Data. Select the site from the list that opens and click OK.

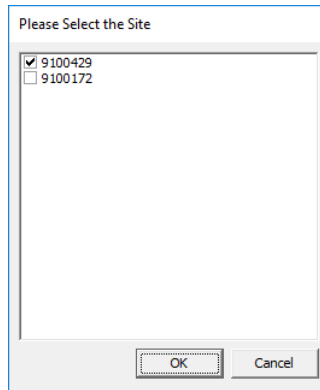


Figure 8-2 Select STS Site

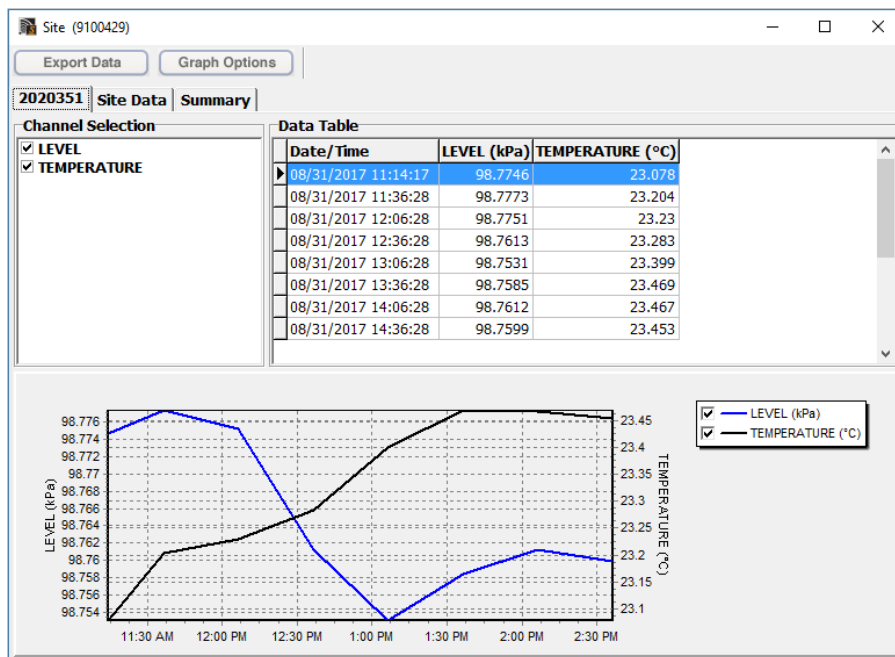


Figure 8-3 STS Site Data Screen

The data will be displayed in a table at the top of the window, the bottom portion of the window will show the data graphed. Data from each datalogger is shown in a separate tab (identified by serial number), Remote Site Data, including battery voltage is also displayed in a separate tab.

8.2.1 View Compensated Data

If you have set up barometric compensation (see Section 4.5), check “Show Compensated Data” to view the automatically compensated data.

The compensated data will be in the units that the Levelogger was programmed to record in. E.g.: if your Barologger was set to record in psi and your Levelogger was set to record in feet, the compensated data will automatically be converted to feet.

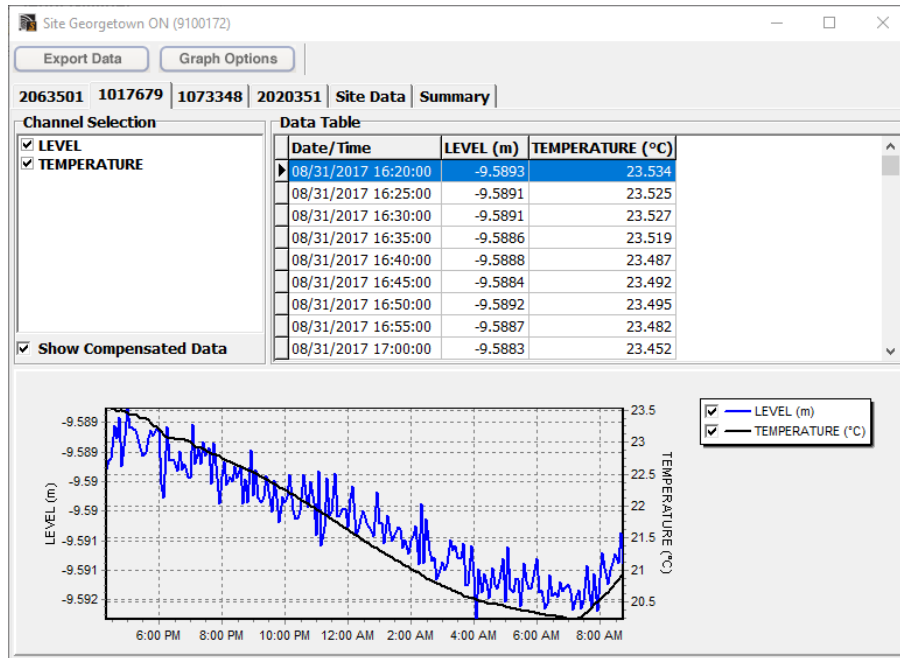


Figure 8-4 View Compensated Data

8.2.2 Graphing Options

Click Graph Options to open the Graph Option Dialog.

The Line Option is used to adjust the style and colour of the line in the graph for each channel. The user can also select the shape of the data marker or remove the data marker.

The Title and Axis Option is used to enter the title of the graph and change the Y-axis label or user selected scale. Check the Best Fit box to enable the software to determine the best-fit scale. If the Best Fit box is not checked, the user has to enter a maximum and minimum value of the selected channel. The X-axis is logging time.

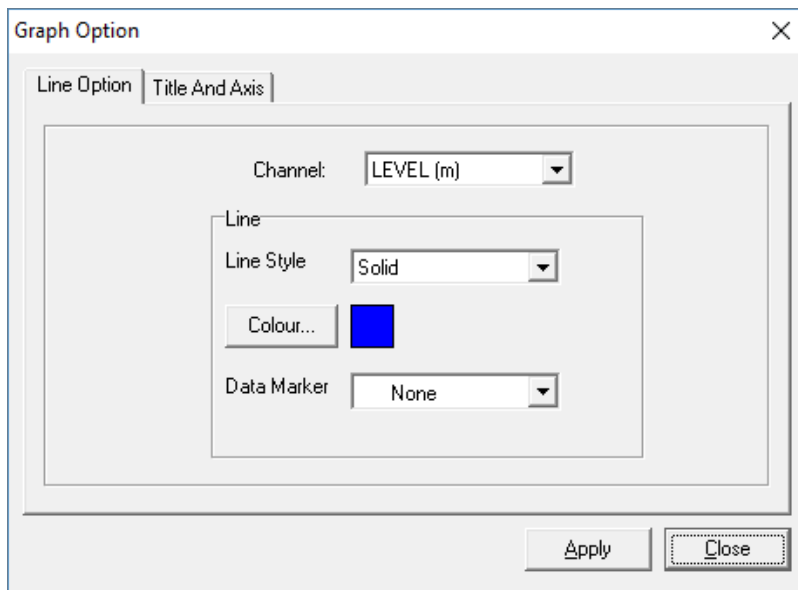


Figure 8-5 Graph Option Dialog

8.3 File Export

Data can be exported in *.csv (comma separated value), *.xle or *.lev (Levellogger/LevelVent) file formats by clicking Export Data while viewing the site data. The *.csv file format is supported and can be imported by most spreadsheet programs, *.xle files can be imported by Levellogger Software Version 4.0 and up, and *.lev files can be imported by any Levellogger Software Version, where data compensations can be performed.

Note: For more information on data compensations using Levellogger Software, see separate User Guides.

Note: You can not export Rainlogger data as a *.lev file.

Clicking Export Data will display a drop down menu where you can select to export as a *.csv, *.xle , or *.lev file.

Exporting allows you to select a specific datalogger File. Choose the desired file from the list. The file name will include the datalogger serial number, and can be saved in a folder of your choice. You can also choose to rename the files. The files can be imported by the Levellogger Software, where barometric and other compensations can be performed.

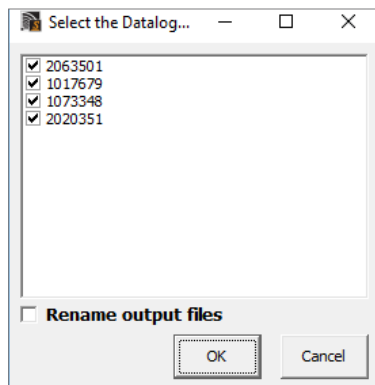


Figure 8-6 Select Datalogger

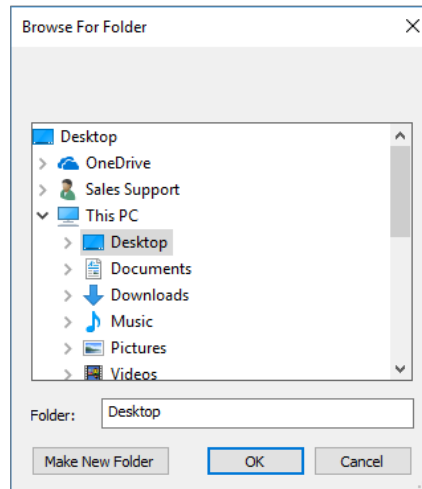


Figure 8-7 Save Data

8.3.1 Export All Data

Data from all STS Sites and RRL Stations can be exported at one time, using the “Export all Stations Data” function in the File menu. There is the option to save all the data in *.csv, *.xle , or *.lev files.

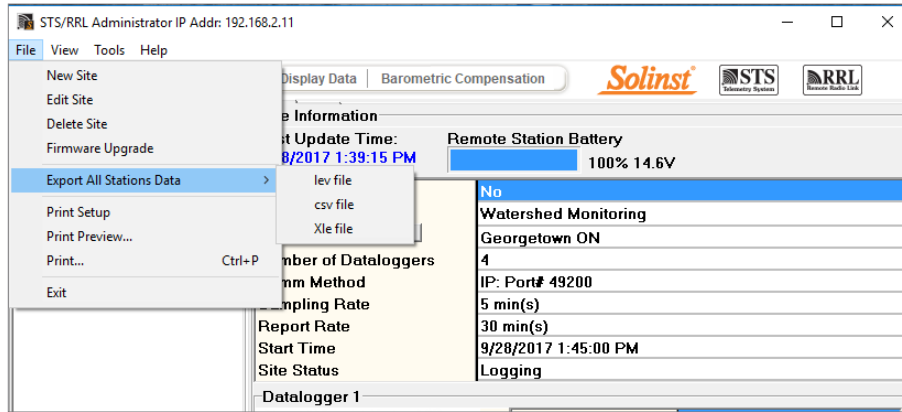


Figure 8-8 Export All Stations Data

9.0 Maintenance

As with any groundwater or surface water monitoring project, you should select the proper equipment and determine a maintenance schedule based on the monitoring environment specific to your application.

For the Levellogger and LevelVent this means selecting the appropriate pressure range, ensuring the monitoring temperatures are within the instruments specifications, and making sure the wetted materials are compatible with site chemistry. See the Levellogger and Vented Dataloggers User Guides for important information about maintaining your dataloggers.

Battery re-charging should be done on regular scheduled intervals, based on the battery life estimates shown in Table 7-1. It is recommended to recharge the battery once it reaches 9 Volts. Recharging is especially important in the fall, if the winter temperatures are cold. Replace existing lead-acid batteries every 3-5 years.

9.1 System Diagnostics

Each data report from an STS to the Home Station includes System information on battery level, signal strength, and datalogger status. This information can help maintain the System without having to visit the site. It can also help determine the cause, if a data disruption does occur.

If the Remote Station battery goes below 10 Volts, an alarm will be sent to a selected e-mail address, if the Alarm Setup section in the STS Software is used. (See Section 4.4).

The STS Field Utility is useful in the field to directly test the Home Station and datalogger connections, and check battery strength. See Section 4.8.

9.2 Firmware Updates

The STS has been designed with firmware that is easy to update whenever useful new functions or other improvements become available, as with software releases. You can update firmware in the field at the Remote Station, or remotely from the Home Station.

To update the firmware in your STS, go to the Solinst Website at: <https://downloads.solinst.com> where you can access the STS firmware update file.

9.2.1 Update In the Field

- 1) Use the USB Programming Cable to connect the STS to your PC.
- 2) Open the 'Field Firmware Upgrade Utility', which is located in the **Tools** menu of the STS/RRL Administrator.
- 3) Choose the COM port to which the STS is connected. Make sure the Baud Rate is set to 115200.
- 4) Click the leftmost 'Open' button, which should open a file dialog asking for the firmware file (*.ssf) to upload. Navigate to the directory where the firmware file is located then click on the file and click 'Open'.
- 5) Check the 'File Information' box to make sure that the opened file is the right one.
- 6) Click the 'Upload Firmware' button, which is the second button from the left, to start the firmware upload process.
- 7) If a communication error occurs and is indicated in the 'Datalogger Status' box either before or after the "Verifying Firmware" and "Loading Firmware to Datalogger" messages, then restart the upgrade process.

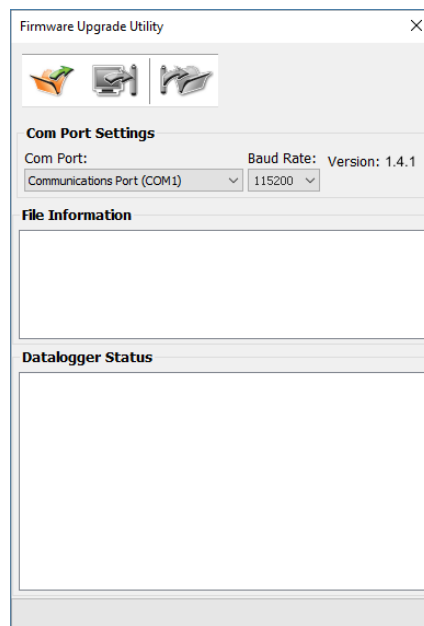


Figure 9-1 Firmware Upgrade Utility

Note: When conducting a firmware upgrade, DO NOT interrupt the process prior to completion (This may take 3 minutes). If the notice "The firmware version in the STS is more recent, continue the firmware updated?" appears, you must select "Continue". Selecting "No" or otherwise interrupting the upgrade process will make the STS unable to communicate with STS software. To correct this, the firmware must be re-upgraded, and allowed to fully complete installation. Installation is not complete until a note appears at the base of the program window indicating "Firmware Upgrade Completed".

9.2.2 Remote Firmware Updates

Note: Remote Firmware Upgrades are only supported using Solinst Telemetry Software Version 1.5.1 and above.

Under the **File** menu of the STS/RRL Administrator, choose “Remote Firmware Upgrade”. The STS Firmware Upgrade Window will display.

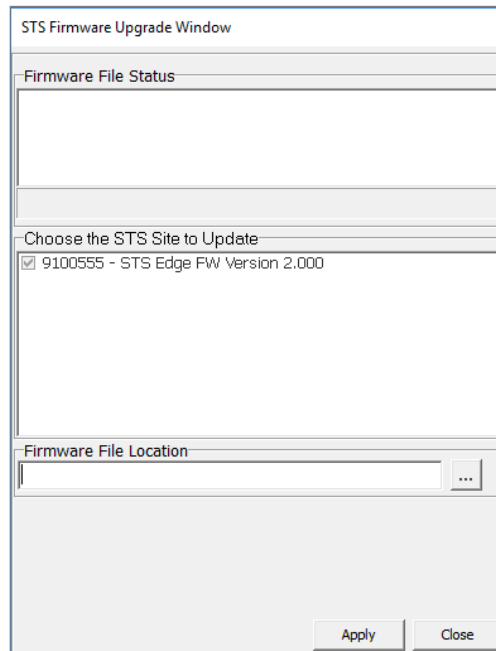


Figure 9-2 STS Firmware Upgrade Window

Go to: <https://downloads.solinst.com> and download the firmware version on your Home Station computer.

Copy the file location and enter it in the ‘Firmware File Location’ bar, or browse your computer to find the file location. Each STS and its current firmware version will be listed. Check the sites that need to be updated, and click Apply.

Note: The new firmware will be uploaded to the STS the next time it reports to the Home Station.

The Site Status on the STS/RRL Administrator screen should indicate the upgrade is being performed. Also, the Communication Agent will display the progress of the upgrade and notify when it is complete.

The new firmware will be uploaded to the STS the next time it reports to the Home Station.

Glossary of Terms

APN (Access Point Name) - The gateway between a mobile network and another computer network.

CDMA (Code Division Multiple Access) - A form of wireless communication, in which data is sent over multiple frequencies simultaneously, optimizing the use of available bandwidth. 800 MHz - 1.9 GHz.

Dynamic IP Address - A type of IP address that is temporarily assigned by a service provider, and can change as frequently as every hour.

GSM (Global System for Mobile Communications) - A form of wireless communication, in which data is digitized and compressed, and sent down a channel with two other streams of user data, each in its own time slot. 900 MHz or 1800 MHz.

TCP/IP (Transmission Control Protocol/Internet Protocol) - Is the basic communication protocol of the Internet.

IP Address - A unique identifier given to each IP network device.

LAN (Local-Area Network) - a computer network that interconnects computers within a limited area.

MDN (Mobile Directory Number) - Ten-digit telephone number assigned to your modem, including the area code (also just referred to as phone number)

MIN/MSID (Mobile Identification Number/Mobile Station ID) - A number given by a wireless operator, to identify a mobile user.

RF - Radio Frequency.

RSSI (Received Signal Strength indicator) - is the measurement of RF signal strength between the remote modem and a base station.

SIM (Subscriber Identity Module) - Stores data for GSM modems and phones, such as user identity, location, phone number, network, etc.

SMA (SubMiniature version A) - A coaxial Radio Frequency connector.

SMS (Short Message Service) - A communication protocol allowing short text messages sent between mobile telephone devices.

SMTP (Simple Mail Transfer Protocol) - The standard protocol for e-mail transmissions across the Internet.

Static IP Address - A type of IP Address that does not change over time.

WAN (Wide Area Network) - A geographically dispersed telecommunications network.

Note: Some definitions were sourced through Wikipedia.



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