Solinst Remote Radio Link (RRL)

User Guide
November 6, 2018

1 Introduction

Solinst Telemetry Systems provide an economical and efficient method to access remote data instantly. They provide communication between field located dataloggers and a Home Station computer.

Solinst Telemetry Systems are designed specifically for the high quality Solinst dataloggers. Up to four Solinst dataloggers can be connected to one Remote Station, in any combination of the Levelogger Edge, Barologger Edge, Levelogger Junior Edge, LTC Levelogger Edge, Rainlogger Edge, LevelVent, AquaVent, Levelogger Gold, Barologger Gold, Levelogger Junior, LTC Levelogger Junior and Rainlogger. (See Levelogger or Vented Datalogger User Guides for more information on each datalogger).

Systems operate on two basic schedules. A linear "Sample Rate" is set, at which a 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 a Remote Station to the Home Station PC. Optionally, dataloggers themselves can be set up to record and store data independently of the Telemetry System. This provides a reliable back-up if circumstances require it.

This manual focuses on configuration, programming, and installation of Remote Radio Link (RRL) Systems. It also discusses the various options to power the Systems. It includes instructions for installing and using Solinst Telemetry Software to set up data collection schedules, manage data, and perform remote diagnostic checks.

Note: You can bridge an RRL Network with an STS Edge Telemetry System (which uses cellular communication). See the STS Edge User Guide for more details.
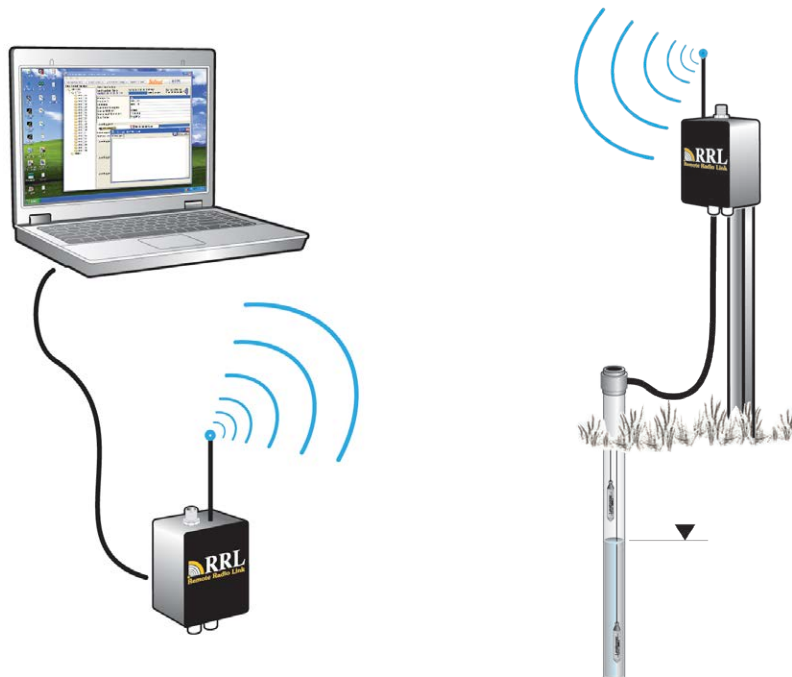

Figure 1-1 RRL System

Remote Radio Link Specifications	
Communication:	900 MHz radio
Antenna:	6" (15 cm) half wave, (2.1dBi) non-articulating
Sampling Interval:	10 seconds - 99 hours
Reporting Interval:	1 minute - 99 hours
Power Supply:	6 3.6V AA replaceable lithium batteries
Battery Life Example:	680 days based on hourly sampling and reporting twice a day (1 Watt setting)
Memory Capacity: (Between Reports)	128 KB (13,000 LT or 10,000 LTC readings)
Operating Temperature:	-20ºC to 50ºC
Size:	Fits in a 4.5" diameter well
IP Rating:	IP66 (dust and water proof, can not be submerged)

Table 1-1 Remote Radio Link Specifications

1.1 RRL Compatibility

Each RRL Station can connect up to four Solinst dataloggers. RRL Systems are compatible with the Levelogger Edge, Barologger Edge, Levelogger Junior Edge, LTC Levelogger Edge, Rainlogger Edge, LevelVent, and AquaVent, as well as the Levelogger Gold, Barologger Gold, Levelogger Junior, LTC Levelogger Junior and Rainlogger dataloggers using the following firmware versions (or higher):

Datalogger	Firmware Version
Levelogger Edge	3.004
Barologger Edge	3.004
Levelogger Junior Edge	3.004
LTC Levelogger Edge	1.003
Rainlogger Edge	3.001
LevelVent	1.000
AquaVent	1.000
Levelogger Gold	2.007
Barologger Gold	2.007
Levelogger Junior	2.007
LTC Levelogger Junior	2.005
Rainlogger	2.000

Table 1-2 Compatible Datalogger Firmware Versions

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

Note: To determine the current firmware version on an RRL unit, connect it to the PC with a RS232 cable and open the RRL Remote Utility. See Section 5.2.

Note: To determine what software version you are using, use the Help menu in the STS/RRL Administrator.

2 RRL Overview

The Solinst RRL System offers a very simple and inexpensive method of local telemetry. The wireless system is designed to collect real-time data and send it via radio to your Home Station. The RRL is excellent for small, closed-loop networks such as mine sites and landfill monitoring networks.

RRL Stations work with omnidirectional antennas line-of-sight transmission, therefore, can communicate over distances up to 20 miles (30 km) with 900 MHz radios. Optional antennas and using some stations as repeaters can maximize distances.

Note: To increase communication distances, you can bridge an RRL Network with an STS Edge Telemetry System (which uses cellular communication). See the STS Edge User Guide for more details.

2.1 RRL Stations

All RRL Stations use the same hardware, and are programmed using a wizard in the Solinst Telemetry Software as a Home Station, Remote Station or Relay Station. As such, RRL Stations are interchangeable as required.
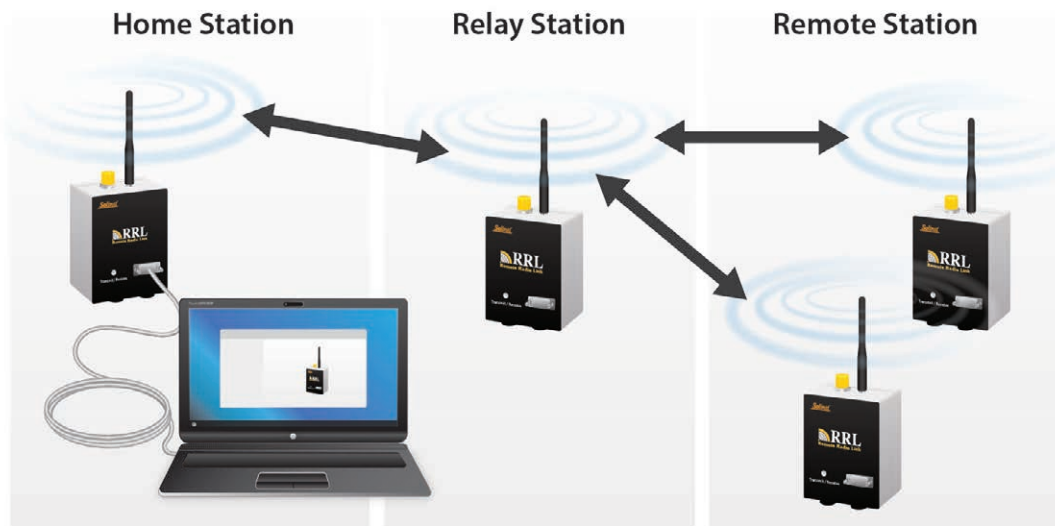

Figure 2-1 RRL Network

Home Station: Each RRL Network will have one Home Station. The Home Station is connected to a PC using an RS232 cable and requires an external power supply, as well as the internal batteries, to operate.

Note: The RRL Home Station and Relay Stations require an external power supply, as well as the internal batteries.

Note: You can connect your RRL Home Station to a remote STS Edge Telemetry System instead of a PC. See the STS Edge User Guide for more details on bridging the two systems.

Relay Station: When a Remote Station cannot communicate to the Home Station directly, due to distance or line-of-sight issues, a Relay Station can be used to transmit the data. Data from attached datalogger is stored at a Relay Station. However, with no dataloggers attached, data is not stored, it is only re-transmitted. The radio at a Relay Station is always on, therefore a continuous external power supply is required, in addition to the internal batteries.

Remote Station: The Remote Station will turn the radio module on and off based on the Report Rate scheduled. The Remote Station does not require an external power supply, unless there is a frequent Report Rate programmed.
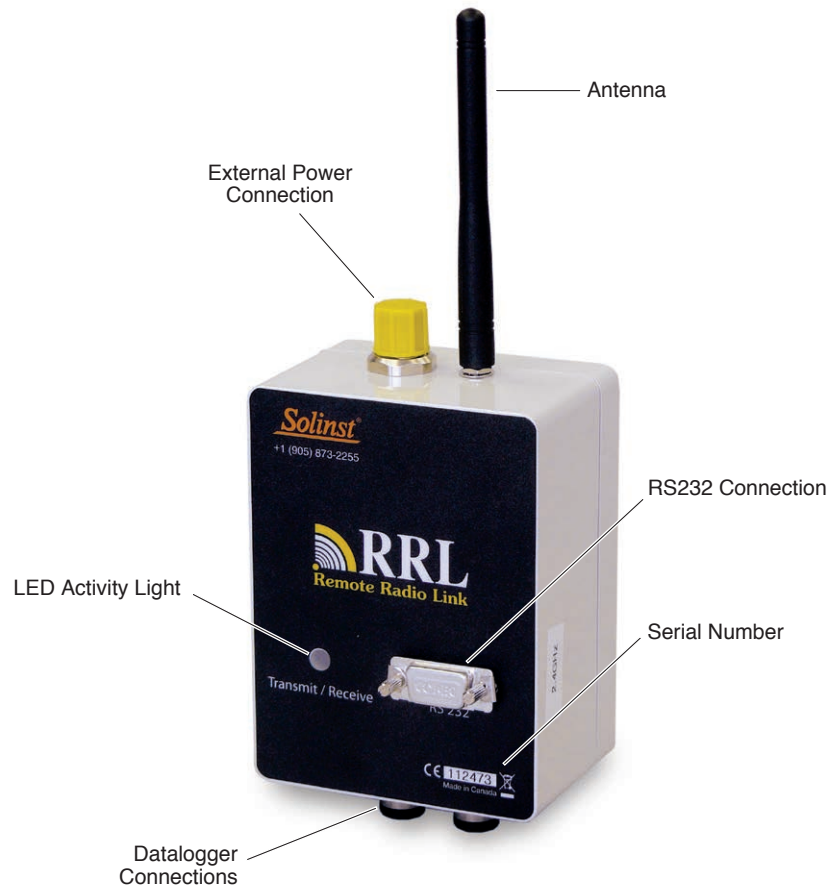
Figure 2-2 RRL Station

A 900 MHz radio module is used in RRL Stations. RRL Stations come standard with six (6) 3.6V AA replaceable lithium batteries and antenna. There is input for two dataloggers, with the option of using Splitters to allow the connection of up to four dataloggers. There is a connection for an external power supply; the RS232 connection on each RRL Station is used for diagnostic, firmware updates and programming purposes.

Dataloggers, Direct Read Cables, Wellhead Cables and Reader Cables to be used with the System are purchased separately. External power cables, RS232 cable, higher gain antenna and Splitters are optional extras. External power sources (such as solar panels) are user supplied, as are other installation housings and requirements.

RRL Stations are designed to fit into 4.5" (115 mm) diameter wells for discrete placement. The case is rugged and waterproof with an IP66 rating and has an operating temperature range between -20 to +50 degrees Celsius.

RRL Stations have a non-volatile internal memory of 128 KB (13,000 sets of LT readings or 10,000 sets of LTC readings). A Remote Station stores collected data in its memory until the Home Station has been successfully contacted. The light on the RRL Station flashes with every transmission activity.

2.1.1 Installing Batteries

RRL Stations are shipped with separate batteries, which must be installed before programming the Station. Each RRL Station uses six (6) 3.6V AA replaceable lithium batteries.

To install the batteries, follow the steps below:

1) Use a Phillips screwdriver to undo the four screws from the back of the RRL unit.
2) Carefully remove the back of the RRL unit.
3) Install the batteries in the battery holder. Ensure proper polarity.
4) Replace the back of the RRL unit ensuring all wires are inside. Reinstall the four screws.

Note: It is recommended to replace the batteries when the Remote Station Battery indicator reaches 30% in the STS/RRL Administrator. See Section 4.1.

Note: When replacing the lithium batteries, wait 1 minute after removing the old batteries before installing the new batteries. Do not wait more than three minutes before installing the new batteries.
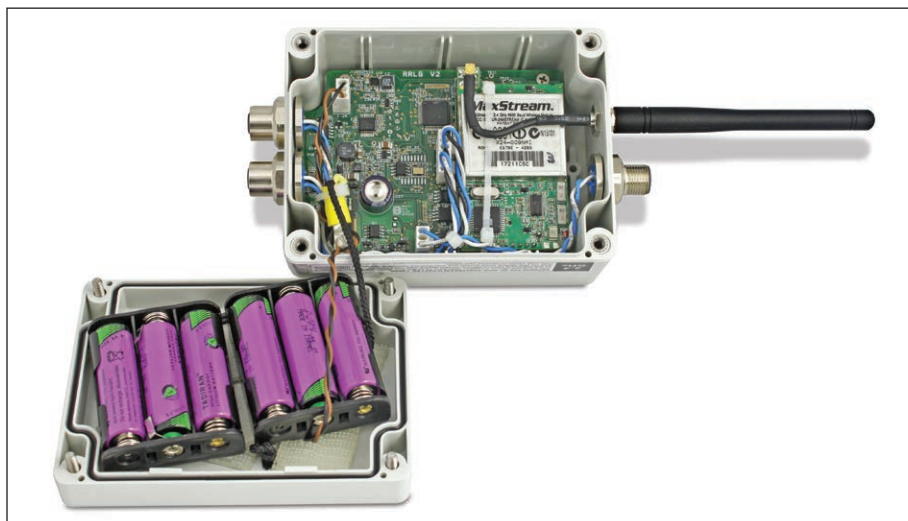

Figure 2-3 Installing RRL Batteries

2.2 Connecting Dataloggers and Splitters

There are two connections for dataloggers on each RRL Station using Reader Cables. To connect the Reader Cables to the RRL Station, remove the black dust cap from the connection on the RRL Station, line up the holes in the connectors, push the Reader Cable connector into the connection on the RRL Station and screw the Reader Cable onto the RRL connection until finger-tight.

Figure 2-4 Reader Cable
(pt# 109428)

2.2.1 Connecting Leveloggers

Leveloggers are connected to the station using a Reader Cable, which connects to a Direct Read Cable threaded onto the Levelogger.

Note: For more information on installing Leveloggers in the field, see the Levelogger User Guide.

Direct Read Cable

Reader Cable

Levelogger

Figure 2-5 Connecting Leveloggers

2.2.2 Connecting LevelVent Dataloggers

LevelVent dataloggers are connected to the station using a Reader Cable, which connects directly to a LevelVent Wellhead (which is connected to the LevelVent Vented Cable and Datalogger).

Note: For more information on installing LevelVent dataloggers in the field, see the Vented Dataloggers User Guide.
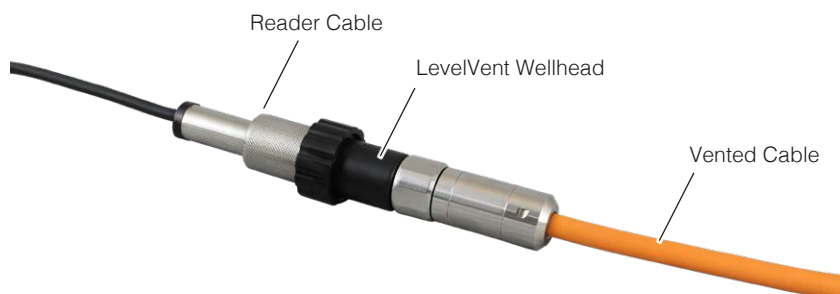

Reader Cable

LevelVent Wellhead

Vented Cable

Figure 2-6 Connecting LevelVent Dataloggers

2.2.3 Connecting AquaVent Dataloggers

AquaVent dataloggers are connected to the station using a Reader Cable connected to an AquaVent Wellhead Connector Cable, which is connected to the Aquavent Wellhead (which is connected to the AquaVent Vented Cable and Datalogger).

Note: For more information on installing AquaVent dataloggers in the field, see the Vented Dataloggers User Guide.

Figure 2-7 Connecting AquaVent Dataloggers

2.2.4 Splitters

Splitters allow the connection of up to four dataloggers to each RRL Station. One or two Splitters can be used, each allowing the connection of two dataloggers. To connect a Splitter to the RRL Station, remove the black dust cap line up the holes in the connectors and screw the Splitter onto the RRL connection until finger-tight.

Reader Cables are connected to the Splitters in the same manner they are connected directly to the RRL Station.

Figure 2-8 Splitter (pt# 109427)

Figure 2-9 Splitter Connection

3 Solinst Telemetry Software

The Home Station computer requires the latest version of **Solinst Telemetry Software**. The **STS/RRL Administrator Software** provides an easy-to-use graphical interface to set up each RRL Station, specify communication intervals, and define sampling rates for attached dataloggers. 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 Software, and is used to view communication activity. It **must** remain open (can be minimized) in order to receive real-time reports at the Home Station.

Note: The STS/RRL Communication Agent should always remain open when the RRL System is in operation. It may be closed, but the data can not be sent to the Home Station Computer. The data will be stored in the RRL Remote Station until the Agent is re-opened, and not until the next scheduled report .

The **RRL Remote Utility** is useful to install on a portable laptop, as it provides a convenient way to communicate with programmed RRL Stations in your office or in the field, as well as perform remote diagnostic checks and firmware updates. See Section 5 for more information on the Remote Utility.

3.1 System Requirements

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

Hardware	Software
Memory: 256MB or more	OS: Windows 7,8, and 10
Display: VGA: 800 x 600 pixels, 256 colour	
Ports: RS232 Serial Port	
Hard Drive space: 64MB	

3.2 Software Installation

Web Download

Download the newest version of the Solinst Telemetry Software and the RRL Remote Utility by visiting www.solinst.com/downloads/
The STS/RRL Communication Agent automatically installs with the STS/RRL Administrator.

Note: Solinst Telemetry Software is also used to program STS Telemetry Systems. See separate User Guide for more information.

Note: When installing the software, the STS Field Utility is also installed. This program is not required for setting up RRL Systems.

CD Installation

1) Insert the software CD provided.
2) If the installer does not automatically start, to activate the software install click on the 'setup.exe' file located on the software CD.
3) The Software Installation Wizard will guide you through the remaining installation process. The STS/RRL Administrator, STS/RRL Communication Agent, and RRL Remote Utility are all automatically installed.
4) Restart the computer after installation is completed. Default Directory is <C:\Program Files\Solinst\STS_Gold>

4 RRL Network Configuration

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

4.1 Software Administrator Window

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

Note: When opening the Software for the first time, you will be prompted to the Network Setup screen before the Administrator is shown.
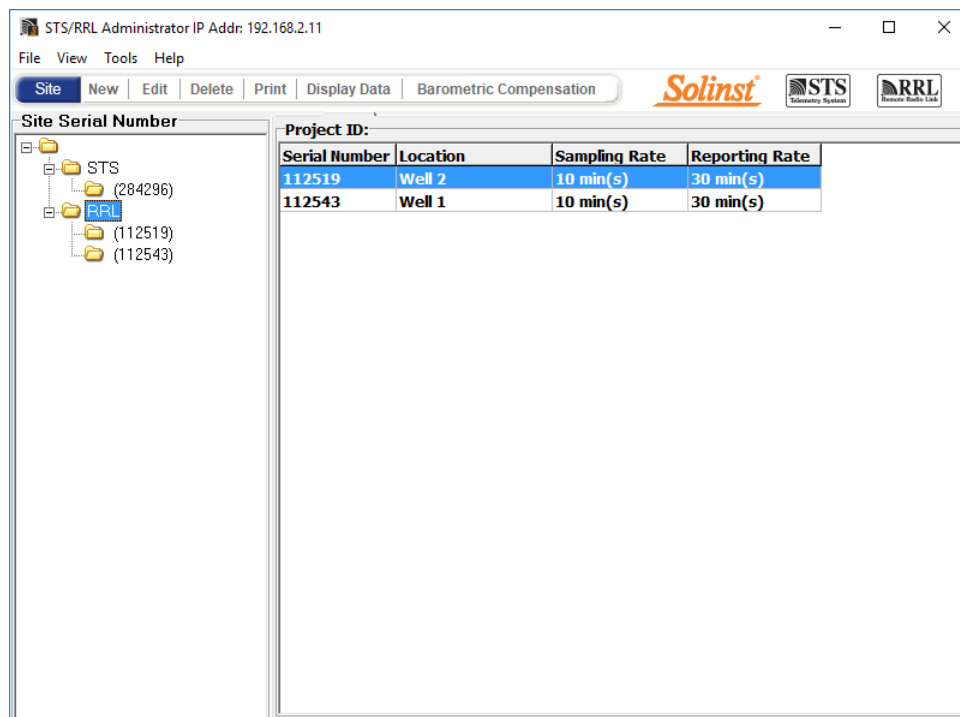

Figure 4-1 Administrator Window - Network Information

The Menu on the left of the window lists each existing RRL Network by its project identification and each RRL Station in the network by its location and serial number (number located on each RRL unit).

Note: STS Telemetry Sites will also be listed in the Administrator Window. See separate User Guides for more information on STS Telemetry Systems.

Selecting a network from the list will display all of the stations in the network, along with the report and sampling rates. Selecting a station from the list will display information on the Station Battery Strength, Station Signal Strength, Last Update Time and network 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.

Note: Selecting "Delete" when a RRL Network is highlighted, will not allow you to delete that network, until all stations in that network are deleted first. To delete a RRL Station from the list, click to highlight the serial number, and select "Delete" from the main menu bar.
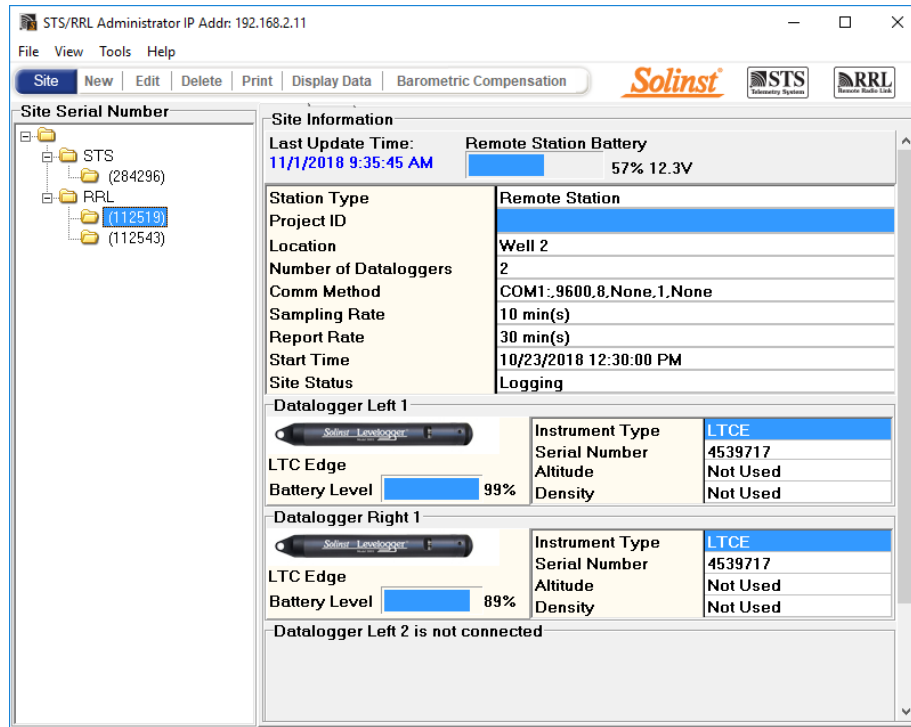
Figure 4-2 Administrator Window - Station Information

Note: When setting up your RRL Network, it is recommended you print each Station Information Screen for your records.

- **Last Update Time**: Shows the last time the Home Station was contacted
- **Remote Station Battery:** Percentage of strength left in the RRL Station battery and battery voltage at the RRL Station.
  Note: It is recommended to replace the batteries when the Remote Station Battery indicator reaches 30%.
- **Remote Station Signal Strength**: Signal strength of the radio at the RRL Station.
- **Station Type**: Identifies whether the station has been programmed as a Remote Station, Relay Station, or Home Station.
- **Project ID**: Your own identification system that you input.
- **Location**: Specific site / location information you input.
- **Number of Dataloggers**: The number of dataloggers that are connected to the RRL Station.
- **Comm Method**: Indicates the COM Port that is being used at the Home Station computer for communication.
- **Sampling Information**: Shows the Sample Rate of the RRL Station.
- **Site Status**: Will show the status of the RRL Station, i.e. "Logging", "Waiting for Update".

4.2 Programming a RRL Network (Software Wizard)

Step 1: Create New Site

Selecting "New" in the Administrator window main menu opens the Network Setup Screen. It will also open when the software is started for the first time. This is where you choose to set up an STS Site or RRL Network, which will start the software wizard.
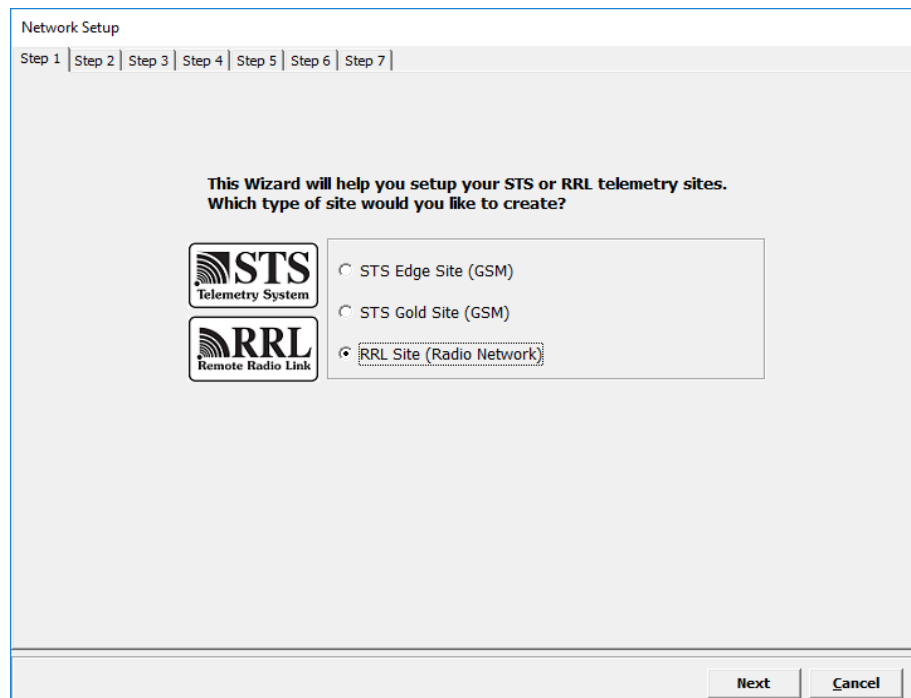

Figure 4-3 Network Setup Screen

Step 2: Network Configuration

After you select "RRL Site", the RRL Network Setup screen will open. In this screen you will enter the settings for your RRL Network.

- **Project Identification**: Input the unique name you choose to identify your project/site.
- **Network ID**: Select a number to identify the network. There may be more than one network reporting to the same Home Station computer. There can be a maximum of 5 networks reporting to the same Home Station. This is to avoid radio communication conflict between adjacent networks. Each RRL Station in the same network should use the same ID number.
- **Radio Frequency**: Select the frequency of your RRL radio modules. RRL Stations use a 900 MHz radio module.

Figure 4-4 RRL Network Setup Screen

- **Radio Power:** Selecting a lower power setting can reduce power consumption, however, the communication distance is directly proportional to the radio power. Choose 100 mW to maximize battery life. Choose 1W to maximize the communication distance.

   Note: If a higher Radio Power setting is selected, the battery at the RRL Station will be drained more quickly, therefore you may require an external power source.

   Note: If the highest Radio Power setting is still not adequate to communicate the distance required, you may need a more sensitive antenna or the addition of a Relay Station.

- **Home Station Connection:**
   – When connecting your RRL Home Station to a PC, identify the **Master Com Port** being used for communication between the computer and the RRL Home Station.
   – If you are connecting your RRL Home Station to an **STS Edge Station**, identify the serial number of the STS Edge you are connecting to. See the STS Edge User Guide for more information on bridging your RRL Network with an STS Edge Telemetry System.

- **Number of Home Stations:** This is always 1.

- **Number of Relay Stations:** Enter the number of Relay Stations in your network.

- **Number of Remote Stations:** Enter the number of Remote Stations in your network.

- **Network Start Time:** Enter the date and time your RRL Remote Stations will begin collecting data from the attached dataloggers.

- **Sample Rate:** Is the frequency the RRL Remote Stations collect real-time readings from each of the attached dataloggers. The Sample Rate can be set from 10 seconds to 99 hours. You can choose to set each station with a different Sample Rate. This can be done in Step 4 when you are setting up each individual station, otherwise all stations will have the same sampling rate as set in this step.

Report Rate and Report Duration are important if multiple RRL Stations will be reporting to one Home Station. Setting up a schedule will avoid conflicts that may occur if more than one RRL Station contacts the Home Station at the same time.

- **Report Rate** is the rate at which stored data is sent from a Remote Station to the Home Station. The Report Rate can be set from 1 minute to 99 hours.

  Note: Longer Report Rate intervals will conserve battery power at Remote Stations.

  Note: If your Reporting Rate is less than 3 hours, an external power source is recommended.

- **Report Duration** is the maximum span of time that a Remote Station will be in contact with the Home Station during the transfer of data. The minimum Report Duration is 1 minute.

Example:

If you have three Remote Stations reporting to one Home Station, all with a Report Rate of 15 minutes, you will want to set a Report Duration of 5 minutes (or less) for each RRL Station. This ensures that each Remote Station has enough time to send the data within the 15 minutes allotted on the Home Station.

If you have set a Network Start Time of 12:00 PM, your RRL Remote Stations will begin collecting data at 12:00 PM. At 12:15, the first Remote Station will report its data; the second will report data at 12:20 PM, and the third at 12:25.
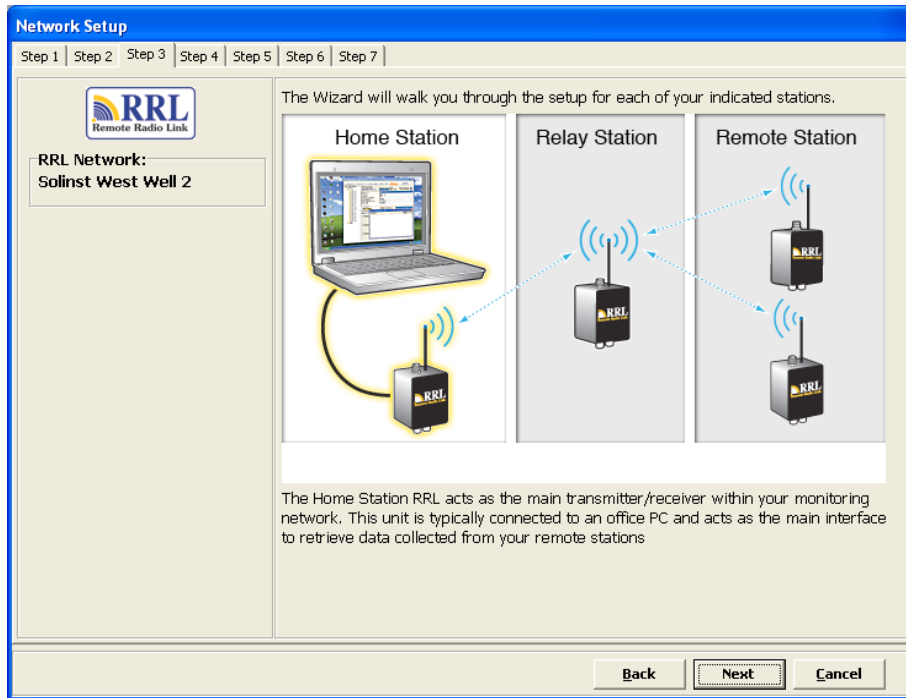
Step 3: Configuration Progress

Figure 4-5 RRL Software Wizard Transition Screen

Step 3 is a transition screen. At this point you should connect the RRL Station you are about to program to the Home Station computer using an RS232 cable (#106811). This screen will identify that you are about to program the Home Station, a Relay Station or Remote Station. Programming the Home Station is always first. This screen will show you your progress in configuring your RRL Network. It will indicate which RRL Stations have been programmed and which RRL Stations are left to program.

Note: It is recommended you connect your dataloggers to each RRL Station before programming.

Figure 4-6 RRL Station Connected to a PC

Step 4: Programming Your RRL Station

In Step 4, enter the serial number of the RRL Station you are programming; the Location of the Station, i.e.: "Home Station", "Well 1", "Relay Station 2"; the Com Port being used to program the RRL Station; and the Sample Rate for that station (if different from the one set in Step 2).

If you are programming the Home Station, you will select whether there is a datalogger connected to the station. If there is not, you will skip to Step 6. If there is a datalogger connected, or you are programming a Remote Station, you will proceed to Step 5.
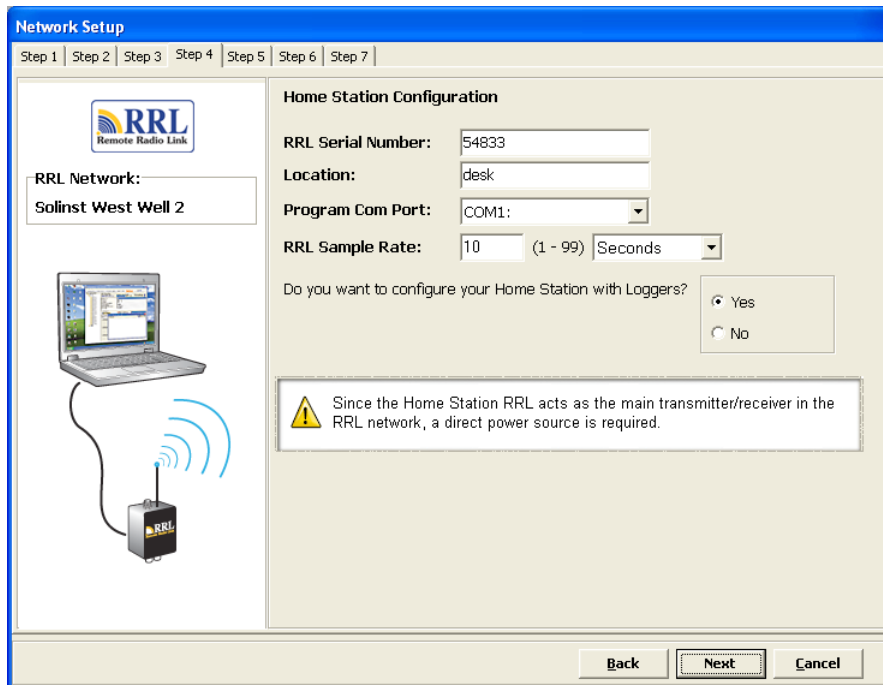
Figure 4-7 Programming a RRL Station

Step 5: Configuring Attached Dataloggers

In this step you will select the number and types of dataloggers connected to the RRL Station.

The connectors for dataloggers on the RRL Stations are identified as Right and Left. This assumes the RRL Station is facing with the black label towards you. If using a Splitter, the number 1 or 2 will identify the dataloggers. The numbers 1 and 2 are labeled directly on the connections of each Splitter.

For each connection you will select the type of datalogger attached. Select 'NONE' for connectors with no datalogger attached. 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.

To optionally set each datalogger to record in their internal memory, select **Edit** 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 editing any datalogger settings, if you do not want to set your dataloggers to record independently.
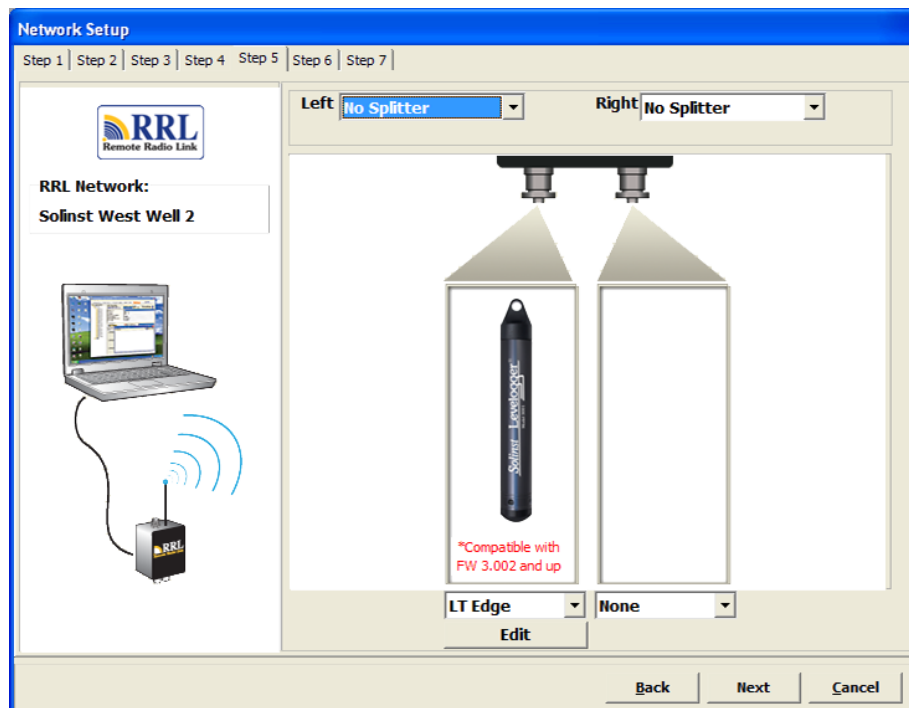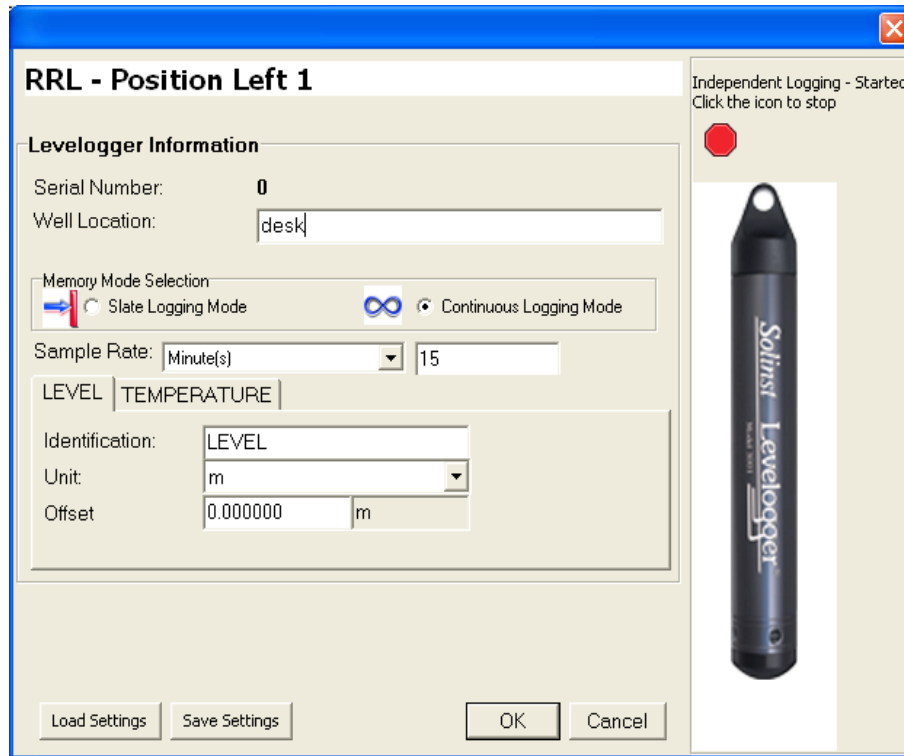

Figure 4-8 Adding Dataloggers

Figure 4-9 Datalogger Information Window

4.2.1 Editing Datalogger Information

The Datalogger Information window includes Datalogger Serial Number, Well Location, Altitude and Density Adjustment (Levelogger Gold models only), Sample Rate, and Memory Mode Selection.

If you do not require independent logging, select ⬤ and the RRL Station will only collect a real-time reading from the datalogger at the scheduled 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 RRL 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 started.
- **Well Location**: Input specific site / location information.
- **Density Adjustment:** (Levelogger Gold models only) Is used to adjust the range of the datalogger based on the sample fluid density. The range for the density adjustment is from 0.9 kg/L to 1.1 kg/L. Uncheck the Density Adjustment field to disable the Density Adjustment function.
- **Altitude:** (Levelogger 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: The Levelogger Edge, Levelogger Junior Edge, LTC Levelogger Edge and Barologger Edge can be adjusted for Altitude and Density post data collection using the Data Compensation Wizard in the Levelogger Software.

- **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 recordings when the memory is full, so that the beginning of the current log will not be written over. Rainloggers record in Slate mode only.

    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 chart below for a summary of the available sampling and memory options for each datalogger type (See the Levelogger User Guide for older Levelogger Gold Models).

Datalogger Programming Options			
Datalogger Type	**Linear Sampling**	**Memory**	**Battery Life**
Levelogger Edge/ Barologger Edge	0.125 second to 99 hours	40,000 sets of readings in Slate or Continuous Mode	10 years based on 1 reading per minute
Levelogger Junior Edge	0.5 second to 99 hours	40,000 sets of readings in Slate or Continuous Mode	5 years based on 1 reading per minute
LTC Levelogger Edge	2 seconds to 99 hours	27,000 sets of readings in Slate or Continuous Mode	8 years based on 1 reading every 5 minutes
Rainlogger Edge	Event Based (records tips from tipping-bucket rain gauge)	Up to 60,000 tip time logs in Slate or Continuous Mode	10 years based on 2 parameters logged every 10 minutes
LevelVent	0.125 second to 99 hours	40,000 sets of readings in Slate or Continuous Mode	10 years based on 1 reading per minute
AquaVent	0.125 second to 99 hours	40,000 sets of readings in Slate or Continuous Mode	8 years based on 1 reading per minute

Table 4-1 Datalogger Programming Options

Note: If you are programming a number of dataloggers with the same settings, select "Save Settings" after programming the first datalogger. Select "Load Settings" when starting to set up your next datalogger to apply the saved settings.
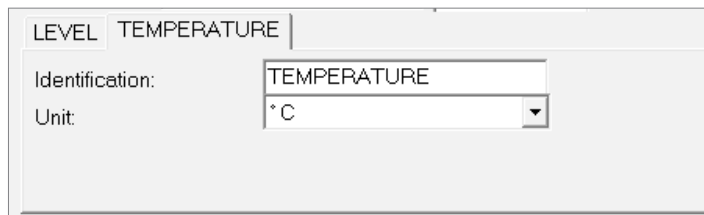
Setting Up Datalogger Measurement Parameters

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.

For the Level Channel, you can set the following parameters:

- **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 Edge, the options are kPa (default), mbar, and psi. (There are 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 includes the following parameters:

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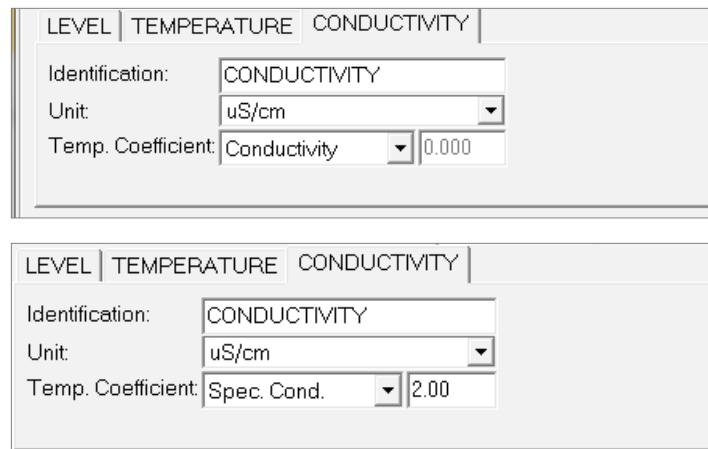

Figure 4-10 The Temperature Channel

The Conductivity Channel includes the following parameters:

- **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.
- **The Temperature Coefficient** (LTC Levelogger Junior only) field 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 4-11 LTC Levelogger Measurement Parameters

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 RRL Remote Station reports Rainlogger data to the Home Station, it will send the accumulated rainfall amount per sample period (based on RRL Station 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.
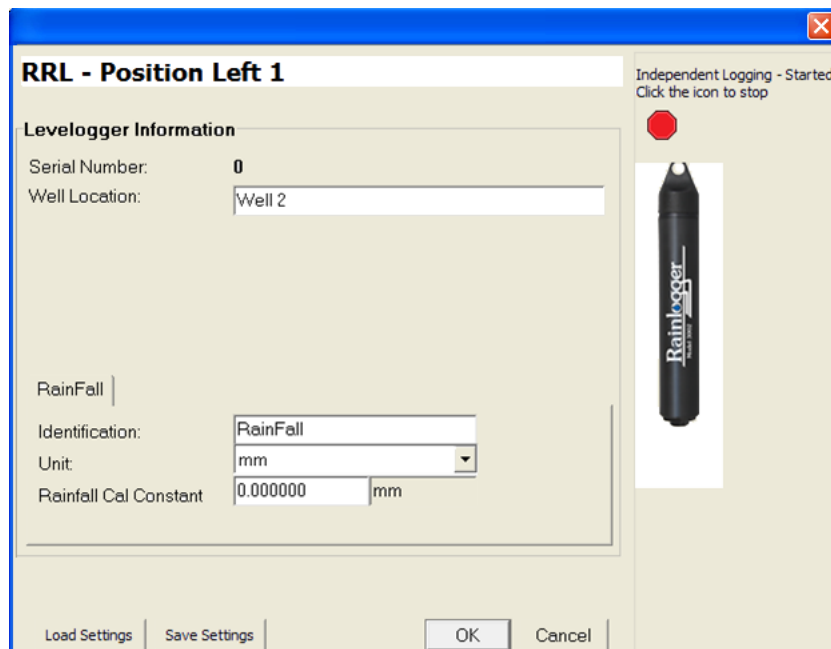

Figure 4-12 Rainlogger Measurement Parameters

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

After all dataloggers have been entered and programmed as desired, proceed to Step 6.

Step 6: Confirm Station Settings

In this step, select "Retrieve RRL Info". This will apply all the settings to the RRL Station and retrieve information from that station to confirm it has been successfully programmed.
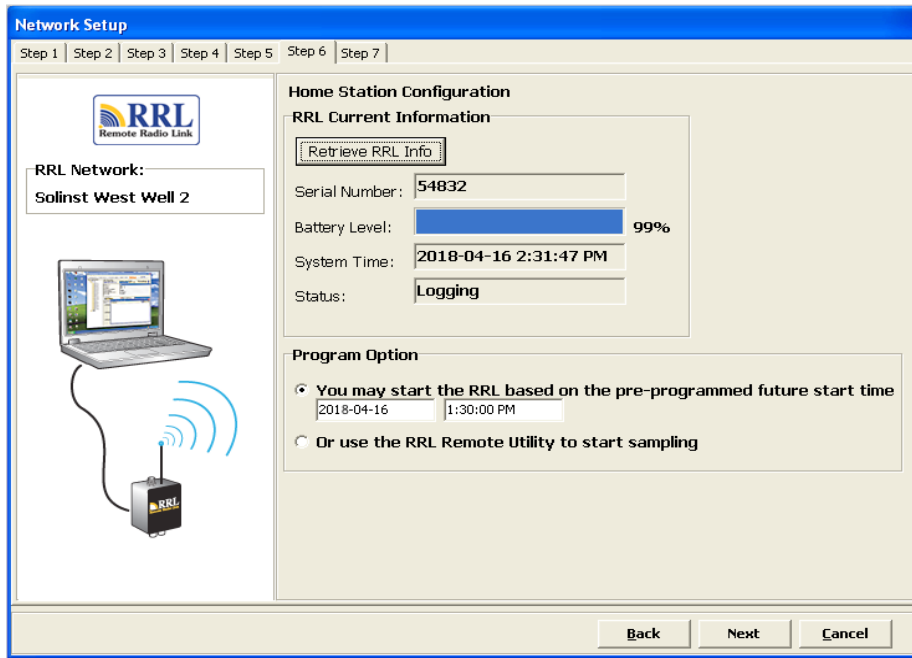

Figure 4-13 RRL Station Information

- **Serial Number**: Should match the serial number you entered in Step 2.
- **Battery Level**: The internal battery level of the RRL Station
- **System Time**: The internal system time of the RRL Station
- **Status:** The RRL Station is "Logging" or "Waiting for Update".

You will also select whether you wish to start this station using the Programmed Start Time entered in Step 2, or use the Remote Utility to start the station at a different time (see Section 5).

- **Sampling based on the Future Start Time:** The RRL Station will start sampling based on the start time you set in Step 2.
- **Use RRL Remote Utility to Start Sampling:** The RRL Station will stay in stop mode. To start sampling, you have to use the RRL Remote Utility (see Section 5).

If you are programming the Home Station or one of multiple Remote or Relay Stations, you will be prompted to the transition screen in Step 3. This will show which stations have been programmed, and which stations are left to program. Stations that have been programmed will be identified as "Done".

You will proceed through Steps 3 to 6 until all stations have been programmed. See Figures 4-14 and 4-15.
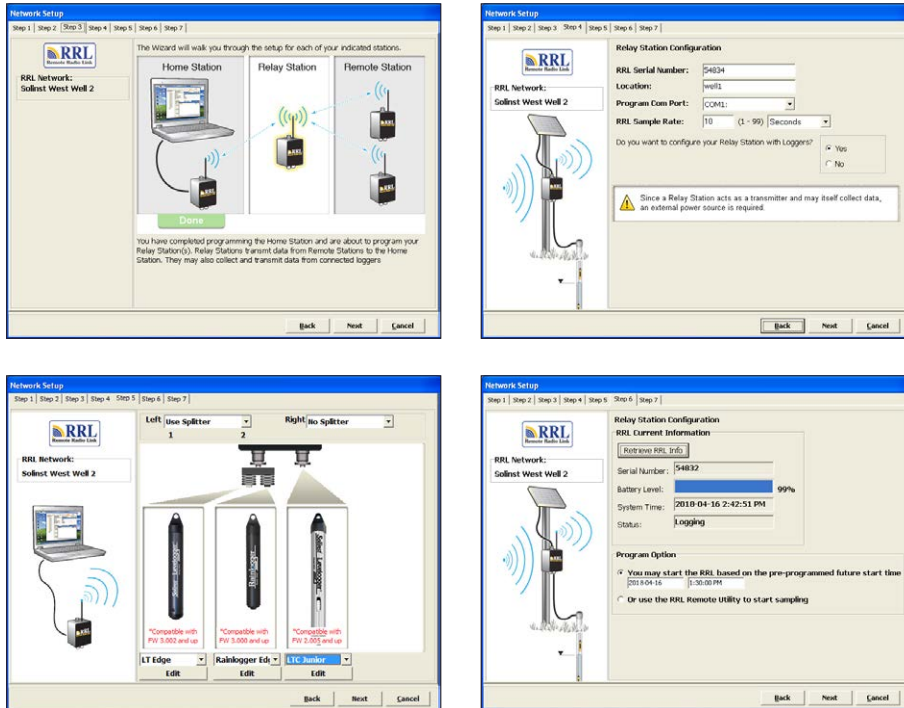
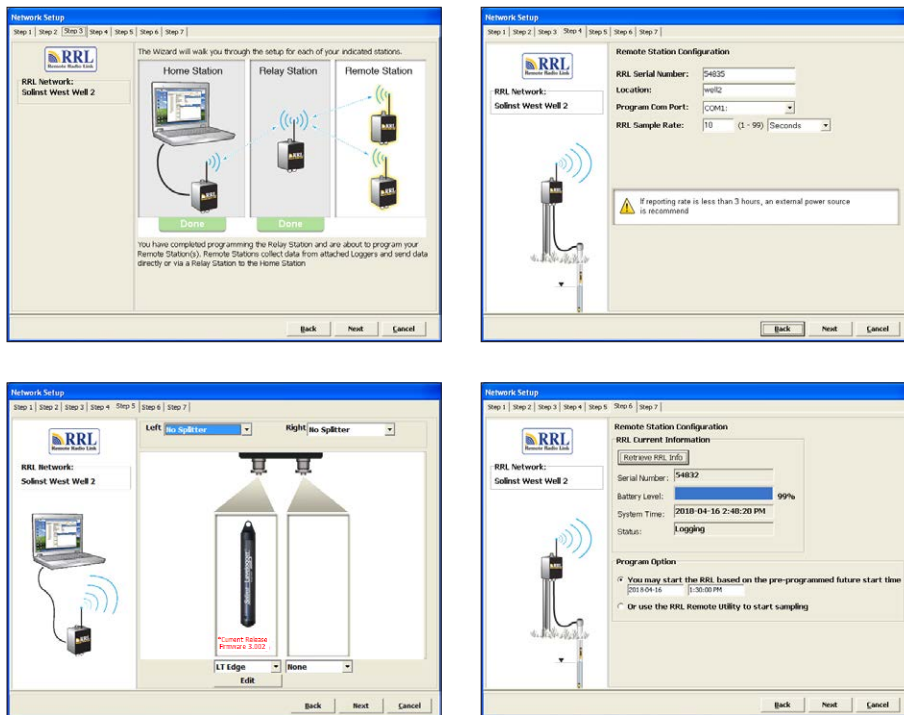Figure 4-14 Configuring a Relay Station

Figure 4-15 Configuring a Remote Station

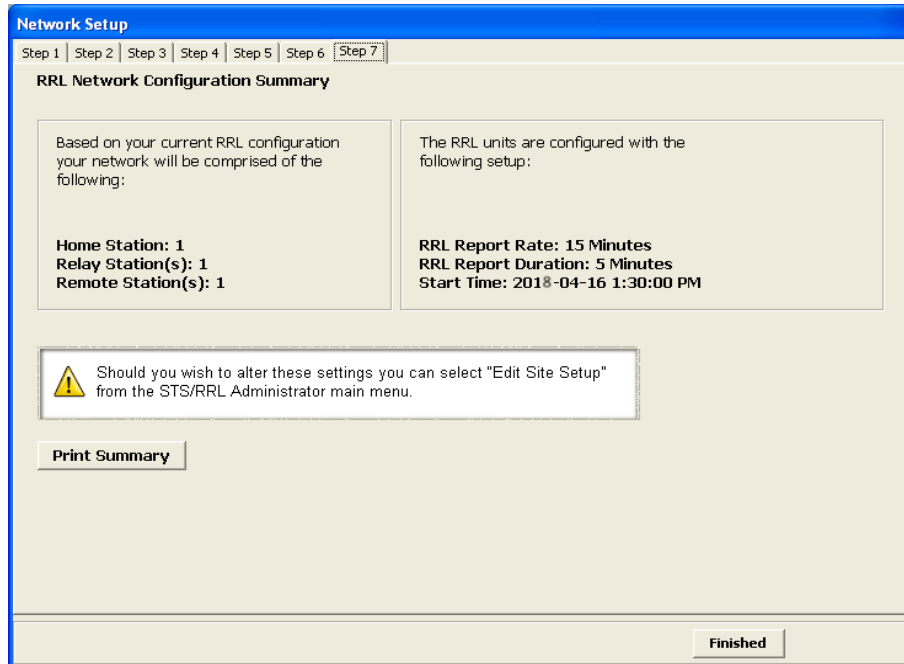Step 7: RRL Network Configuration Summary

Figure 4-16 RRL Network Configuration Summary

After all settings have been programmed for each RRL Station in the network, Step 7 will display a summary of all the settings. You can print a copy of this summary for your records.

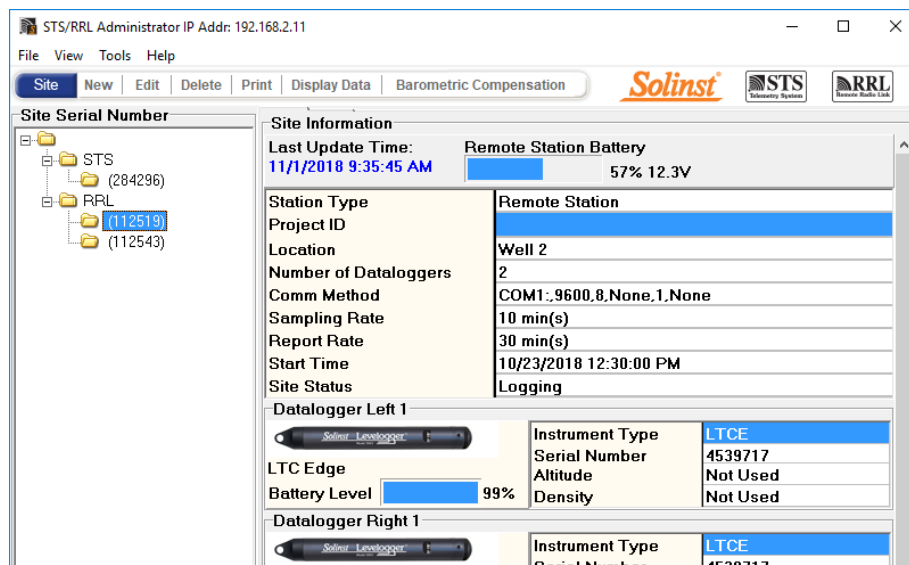Selecting 'Finished' will open the STS Administrator window and start the Communication Agent.

Figure 4-17 RRL Network in Administrator Window

Note: Once all stations have been programmed, it is recommended you start each station logging as a test in the office. This can be done using the Remote Utility (see Section 5). After each station is started, and has contacted the Home Station, the serial numbers and types of dataloggers connected to the station will be shown in the Administrator Window. You can print a copy of this screen for each station as a record, and refer to it when installing your stations in the field.

4.2.2 Editing RRL Networks

Editing the Network Setup

When you select a RRL Network from the list in the STS Administrator window, choosing "Edit Site Setup" will allow you to "Edit Network Setup" or "Add new Site to Network".
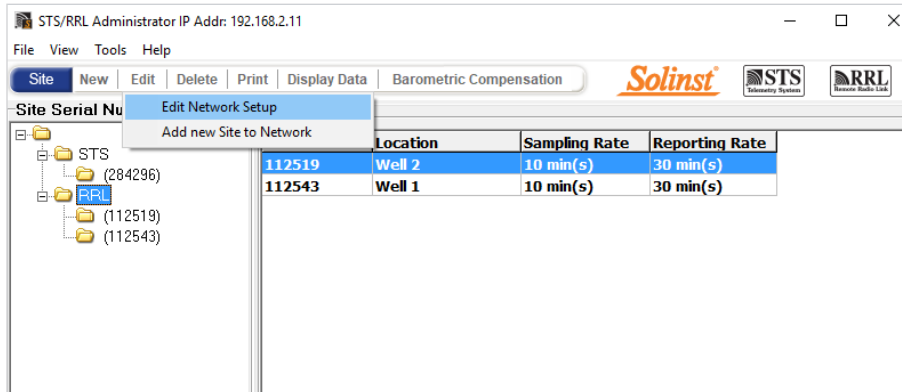

Figure 4-18 Editing a RRL Network

When you select "Edit Network Setup" there are two options. You can choose to update each RRL Station in the network by connecting them to the PC through the RS232 Port, or the "Remote Schedule Update" allows you to make the changes in the software, and the new settings will be applied to each RRL Station with their next scheduled report to the Home Station.

Note: Selecting "Delete" when a RRL Network is highlighted, will not allow you to delete that network, until all stations in that network are deleted first. To delete a RRL Station from the list, click to highlight the serial number, and select "Delete" from the main menu bar.

If you choose "Remote Schedule Update", there are two steps. Step 1 allows you to make changes to the network settings, including: Project Identification, Network ID, and Radio Power. You can also restart the network with a new Sampling Rate, Report Rate, and Report Duration.
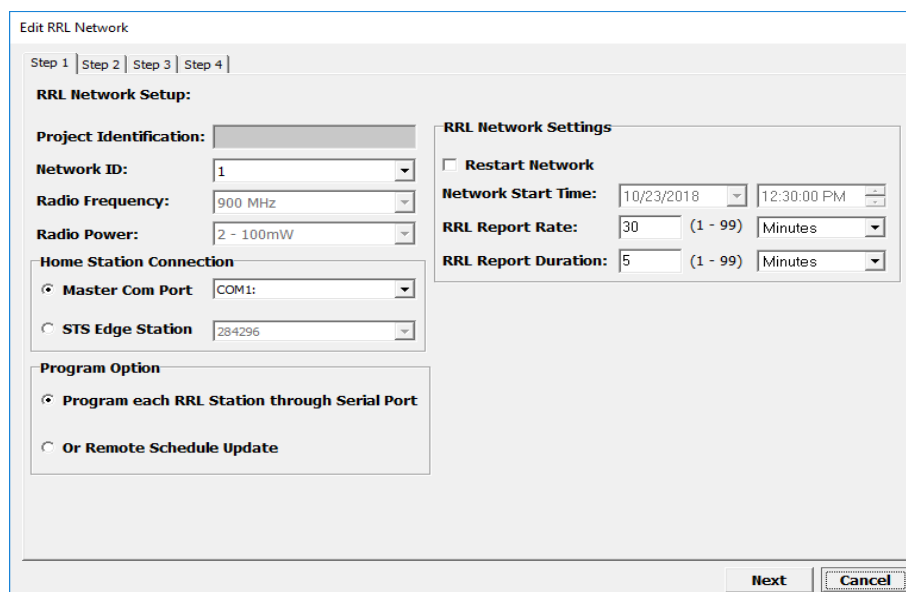

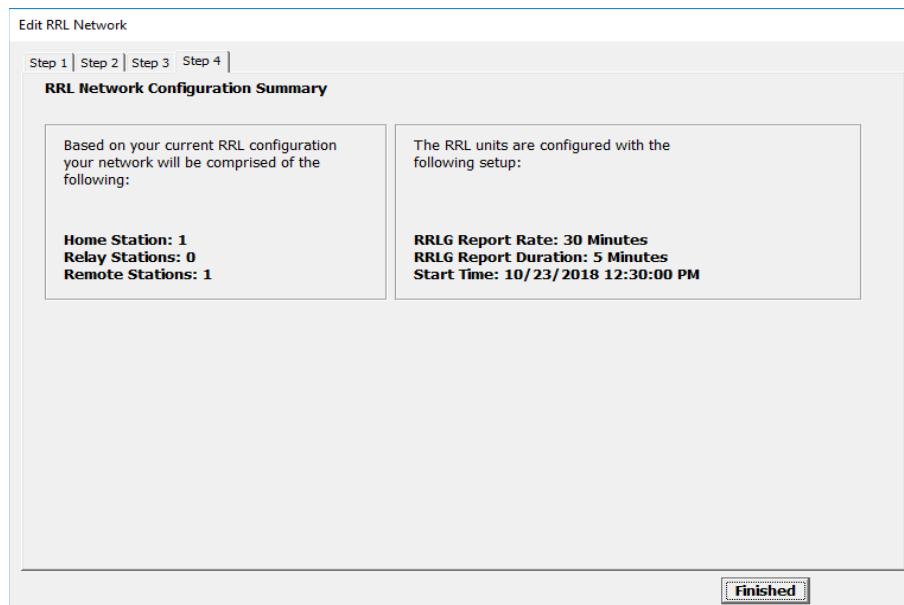Figure 4-19 Editing a RRL Network - Step 1

Figure 4-20 Editing a RRL Network - Step 2

Note: Figure 4-20 shows 4 steps. This is because the option to update each RRL Station through the serial port was selected. Steps 2 and 3 in this case are for connecting the two Remote RRL Stations in the network, to the PC and updating their settings. Step 4 provides the summary.

Step 2 will provide you with a new Network Configuration Summary that you can print for your records.

If you select to update each RRL Station through the serial port, after changing the setting in Step 1, you will be prompted to connect each RRL Station to the Home Station PC with an RS232 cable, and update them with the new network settings. The last step will provide you with a Network Configuration Summary for your records.

When you select "Add new Site to Network", you will be prompted though Steps 2 through 7 of the software wizard.

Editing RRL Stations

When you select a specific RRL Station from the list in the STS Administrator window, choosing "Edit Site Setup" will allow you to edit the settings for that RRL Station.
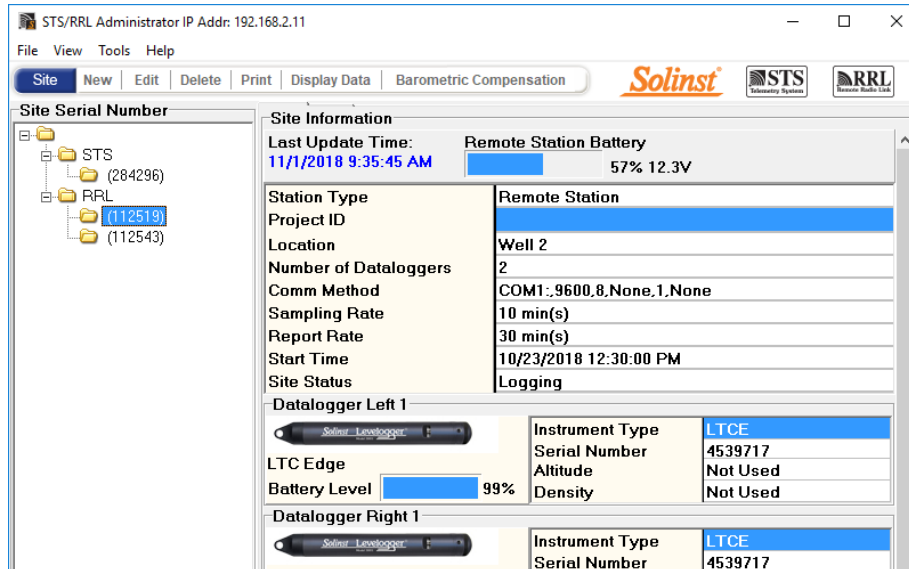

Figure 4-21 Editing a RRL Station

Note: Selecting "Delete" when a RRL Station is highlighted will prompt a window asking if you are sure you want to delete that station. You must delete all stations in a site before the entire network can be deleted.

There are three steps when editing a RRL Station's settings. Step 1 allows you to enter a new Location, Program Com Port and Sample Rate. Step 2 allows you to add or edit the attached dataloggers and their settings. Step 3 retrieves the new settings and allows you to choose between applying the changes to the RRL Station by connecting it to the PC, or the "Remote Schedule Update" allows you to make the changes in the software, and the new settings will be applied to the RRL Station with its next scheduled report to the Home Station.
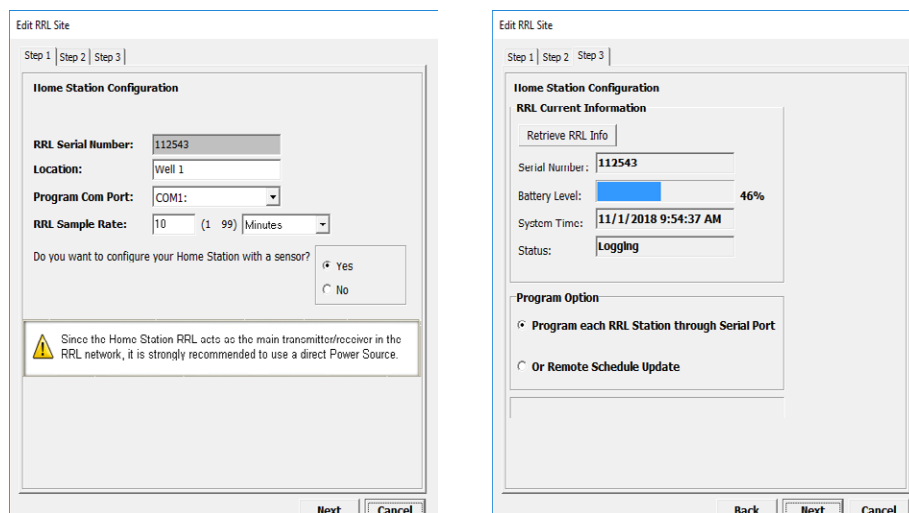

Figure 4-22 Editing a RRL Station - Steps 1 and 3

4.3 Barometric Compensation

Submersed Leveloggers measure total or absolute pressure (water column equivalent + barometric pressure). In order to accurately determine the true changes in water level only, Levelogger data must be barometrically compensated. Compensation simply involves subtraction of the barometric reading from the corresponding Levelogger reading.

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

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

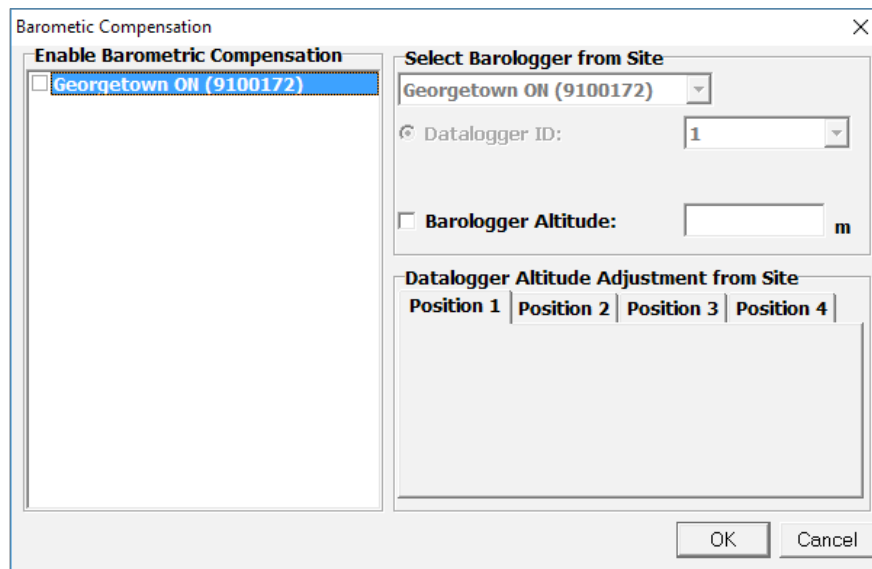To begin the compensation, click the **Barometric Compensation** tab on the STS/RRL Administrator window.

Figure 4-23 Barometric Compensation Window

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

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

The Levelogger 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 7.2.1

4.4 Communication Agent

The Communication Agent is an information window that will display all communication activity that has occurred between a RRL Station and the Home Station computer. This application is used to view activity, and monitor communication for diagnostic purposes.

To open the Communication Agent, click ![icon] , on your desktop.

The Communication Agent must be opened before your RRL Network starts logging and must remain running while the RRL System is in operation. If the Communication Agent is closed, the Remote Station will save data until the Communication Agent is reopened. The accumulated data will then be sent with the next scheduled report.

The Communication Agent will automatically open after you have finished configuring your RRL Network. The Communication Agent can be left open, and minimized even after the STS/RRL Administrator Software has been closed.

In the Messages tab, the serial number of each RRL Station and datalogger will be shown to indicate which communication has come from that site. Each report will be time and date stamped. Log files for each RRL Station are automatically saved on your Home Station PC, and can be retrieved from the following location: <C:\Program Files\Solinst\STS_Gold\log> If a station is stopped, when started again, the data will be appended to the same log file. At any time, clicking the Save icon will save a log file of all RRL Stations on your Home Station PC for record or for diagnostic purposes.
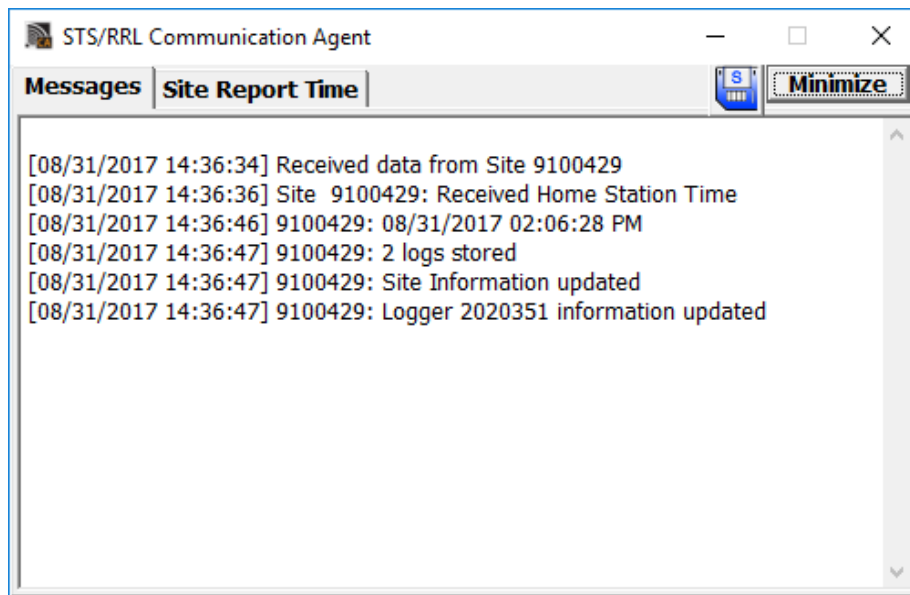

Figure 4-24 Communication Window

The Site Report Time tab lists each RRL Station 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 Remote Station does not report when scheduled, a timeout message will be shown in the Communication Agent Messages. To stop receiving timeout messages from a station (you may be aware of what is causing the communication issue, and do not need the messages any longer), uncheck the box beside the Station.
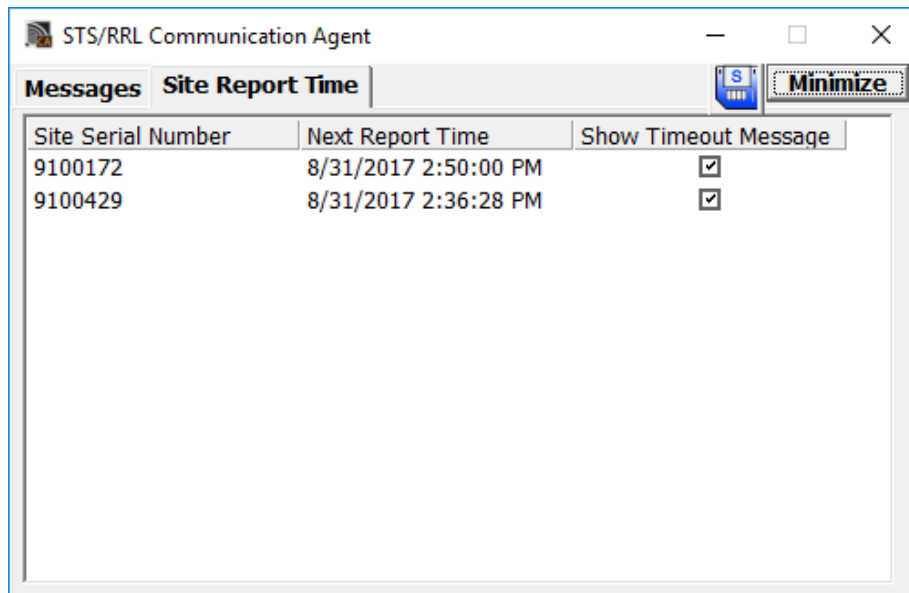

Figure 4-25 Communication Window - Site Report Time

5 RRL Remote Utility

The RRL Remote Utility provides a convenient way to communicate with programmed RRL Stations in your office or in the field, as well as perform diagnostic checks and firmware updates.
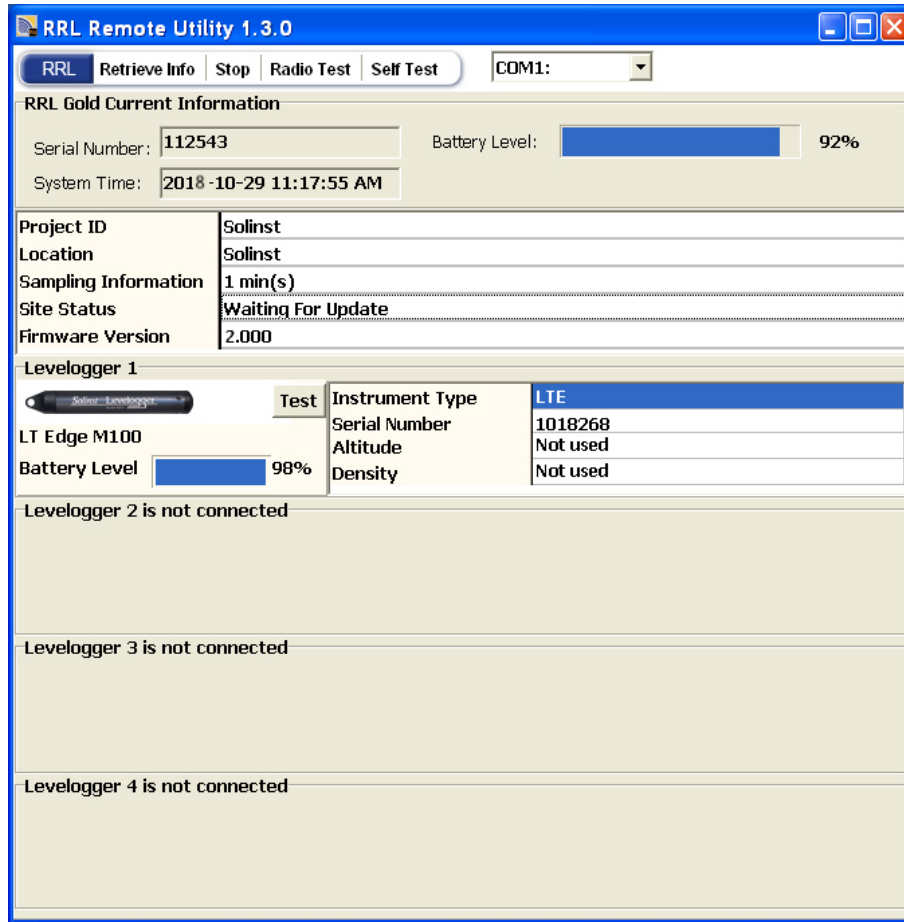

Figure 5-1 RRL Remote Utility

To open the RRL Remote Utility, click [icon] on your desktop.

The RRL Remote Utility can be used to test radio communication between a Remote or Relay Station and the Home Station, check RRL Station settings and status, test communication with the attached dataloggers, and stop or start the RRL Station logging (when selected in Step 2 of the software wizard).

The Remote Utility also includes a self-test function. The function performs a series of self-tests on a RRL Station to check for problems with the battery, memory, etc.

To use the RRL Remote Utility, connect the RRL Station to a PC with a RS232 cable, select the COM port to which the Station is connected and click "Retrieve Info" to display the settings from the RRL Station.

The Remote Utility has the following functions:

- **Radio Communication Test:** Click "Radio Test" to initiate the test. If the communication between the RRL Station and the Home Station is successful, the "Home Station Communication Test Passed" message will be shown.

  Note: The Radio Communication Test is a convenient tool when determining the final location of you Remote Station in the field and the proper Radio Power setting for that station.

Figure 5-2 Home Station Communication Test

- **Datalogger Communication Test**: Click the Test button beside the datalogger image to initiate the test. If the communication is successful, the "Probe Communication Test Passed" message will be shown.
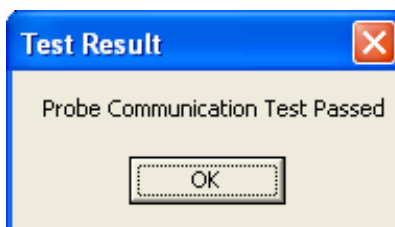

Figure 5-3 Datalogger Communication Test

- **Start Logging**: If the RRL Station is in idle mode "Start" will be displayed in the Remote Utility main menu. To start logging, click "Start", and "Stop" will then be displayed to indicate that the RRL Station is in logging mode.

- **Stop Logging**: If the RRL Station is in logging mode "Stop" will be displayed in the Remote Utility main menu. To stop logging, click "Stop". A message "Data Logging and Reporting will be terminated. Do you want to continue?" will be shown. Click Yes to continue. "Start" will be displayed to indicate that the RRL Station is in idle mode.

5.1 Self Test

The Remote Utility also includes a self-test function. The function performs a series of tests on a RRL Station to check for problems with the battery, memory, etc. If any of these tests fail, then a report should be created and sent to Solinst Technical Support. To execute this function, select "Self Test".
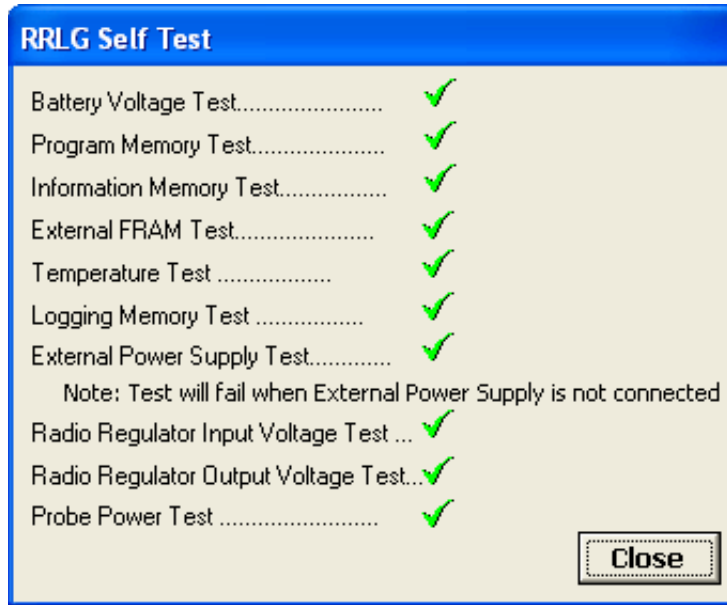

Figure 5-4 RRL Station Self Test

5.2 Firmware Upgrade Instructions

RRL Stations have been designed with firmware that is easy to update whenever useful new functions or other improvements become available, as with software releases. To determine the current firmware version on an RRL unit, connect it to the PC with a RS232 cable and open the RRL Remote Utility. Select the COM port to which the unit is connected and click "Retrieve Info" to display the settings, including firmware version, from the RRL Station.

To update the firmware in your RRL Station, go to the Solinst Website at: https://www.solinst.com/downloads/ where you can obtain a link to the RRL firmware update file that is contained within a Zip Archive. Ensure you unzip the archive to access the *.ssf firmware file.

1) Use an RS232 serial cable to connect the RRL Station to the PC.
2) Ensure you have installed the RRL Remote Utility Software on your PC. There will be a Firmware Upgrade Utility shortcut added to your desktop.
3) Open the Firmware Upgrade Utility and make sure the Baud Rate is set to 9600.
4) Click the 'Open' button, which should open a file dialog asking for the firmware file (*.ssf) to upload. Navigate to where the firmware file was saved on your PC, 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 to start the firmware upload process.
7) If a communication error occurs and is indicated in the 'Datalogger Status' box either before the "Verified Program Checksum" message or after the "Program Information Section", then restart the upgrade process.
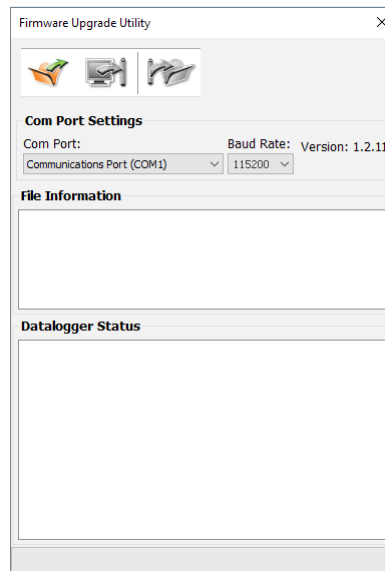

Figure 5-5 Firmware Upgrade Utility

Note: When conducting a firmware upgrade, DO NOT interrupt the process prior to completion (This may take 30 minutes). If the notice "The firmware version in the RRL is more recent, continue the firmware updated?" appears, you must select "Continue". Selecting "No" or otherwise interrupting the upgrade process will make the RRL Station unable to communicate with STS/RRL 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".

6 RRL Station Hardware Setup

RRL Stations come standard with a built-in 900 MHz radio module. Also standard is a 6" half wave (2.1 dBi) antenna, six (6) 3.6V AA lithium batteries, and dust caps to protect connections when not in use.
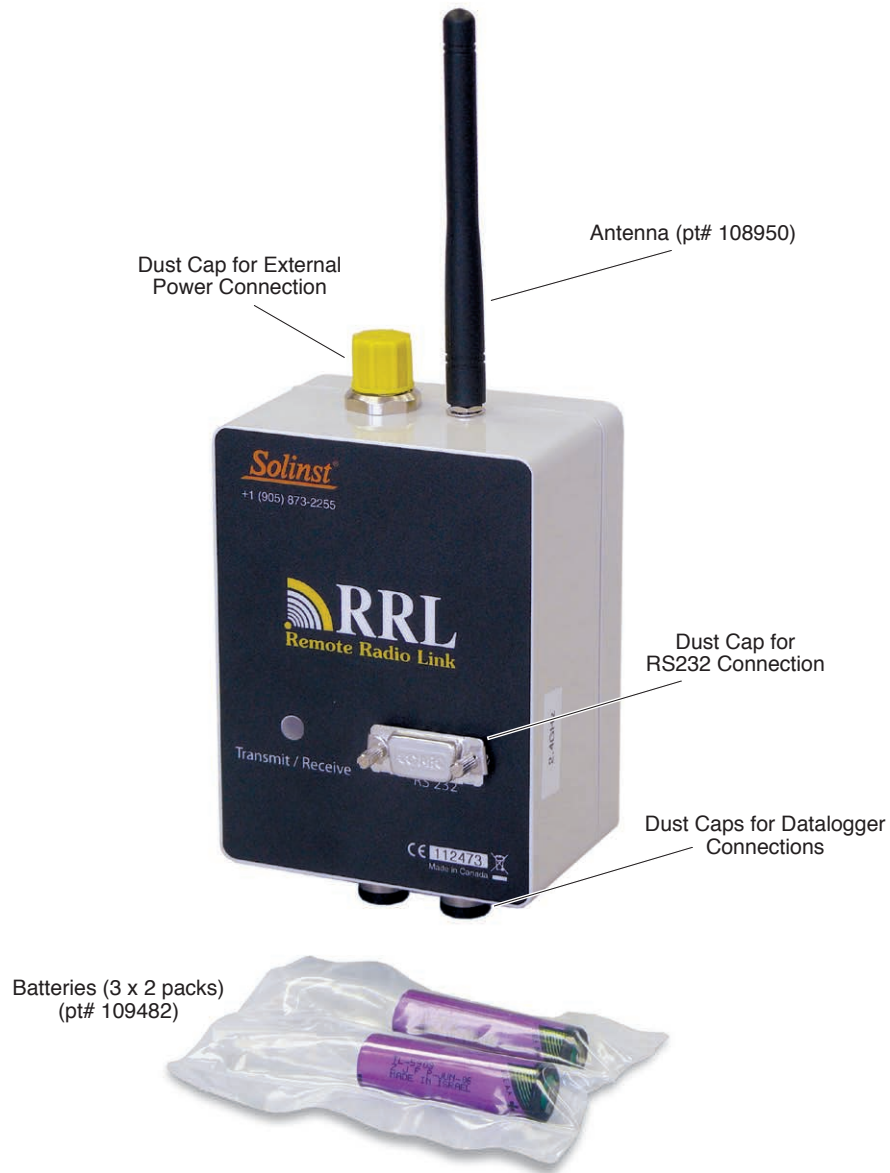

Dust Cap for External Power Connection

Antenna (pt# 108950)

Dust Cap for RS232 Connection

Dust Caps for Datalogger Connections

Batteries (3 x 2 packs) (pt# 109482)

Figure 6-1 RRL Station (pt# 109236)

Note: See Section 2.2 for connecting dataloggers and Splitters.

6.1 Power Sources and Antennas

6.1.1 Power Supply

RRL Stations come standard with six (6) 3.6V AA lithium batteries. **The batteries must be installed for proper operation**, even if you use an additional external power source. The life of the battery varies depending on the frequency of your Sample and Report Rates. The following are estimates based on the standard lithium batteries, with the Radio Power setting at 1 Watt. With the Radio Power set at 100 mW, the battery life increases by about 10% of the estimates below. RRL Stations can also be powered by six (6) user-supplied 1.5V AA alkaline batteries. With alkaline batteries, the battery life will be about 40% of the estimates below.

Sample Rate	Report Rate	Battery Life
Every 5 Minutes	Every Hour	114 Days
Every 15 Minutes	Every 6 Hours	425 Days
Every Hour	Every 12 Hours	680 Days
Every 12 Hours	Every Day	895 Days
Every 15 Minutes	Every 3 Days	810 days
Every Hour	Every 7 Days	1078 Days
Every 12 Hours	Every 14 Days	1200 Days

Table 6-1 Battery Life Estimates (6 AA lithium batteries at 1 Watt setting)

Note: Where possible, use lower Radio Power settings and/or longer Report intervals to conserve Remote Station Battery life.

Note: If your Reporting Rate is less than 3 hours, an external power source is recommended.

Note: It is recommended to replace the batteries when the Remote Station Battery indicator reaches 30% in the STS/RRL Administrator. See Section 4.1.

RRL Home Stations and Relay Stations require an external power supply. Remote Stations may also require an external power supply, depending on your Sample and Report Rates and site needs. Solinst supplies a cable for connecting to an AC power source and a cable to connect to a user-supplied 12V battery or solar panel. Cables are connected to the RRL Station beside the antenna connection (see Figure 6-2).

Note: Rechargeable batteries can not be used inside any RRL Units (Home, Relay, Remote), as the voltage would be to low.

Figure 6-2 External Power Cable Connection

RRL Stations can be powered by:

1. External AC (mains) power. Simply use the Solinst supplied adaptor cable (pt#109720 - North American) shown in Figure 6-3 to connect the RRL to an AC power source. The adaptor has input from 90 - 246VAC. See connection diagram in Figure 6-4.

Note: The six (6) 3.6V AA batteries must be installed for proper operation, even if using an additional external power source.

Figure 6-3 AC Power Adaptor Cable Assembly (pt# 109720)

#109720

Figure 6-4 Direct AC (mains) Connection

2. Using the Solinst-supplied Solar/12 Volt Cable Assembly (pt# 109452), shown in Figure 6-5, to connect to a user-supplied external 12V lead-acid battery (minimum 60 Amp-hour). See connection diagram in Figure 6-6.

Note: The external 12V battery should have a minimum 60 Amp-hour rating. It is recommended you have a higher Amp-hour rating if you have a high report rate, or if your station is in a very remote location and you are not able to replace the battery easily.
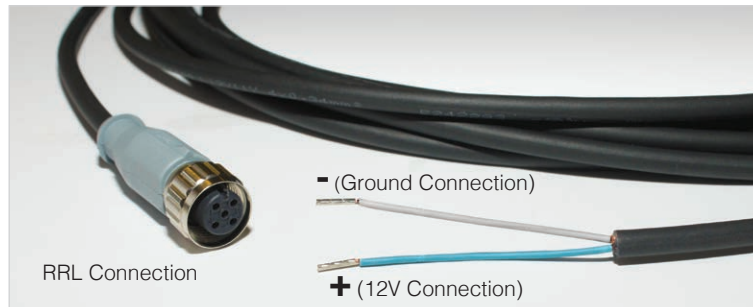

Figure 6-5 Solar/12V Cable Assembly (pt# 109452)
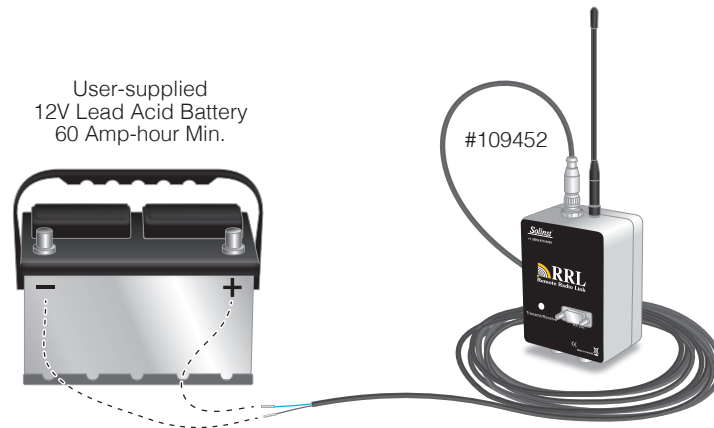
Figure 6-6 External 12V Lead-Acid Battery Connection

3. Using the Solar/12 Volt Cable Assembly (pt# 109452) to connect to a user-supplied Solar Panel (minimum 15 watt) with a built-in regulator for 12V. See Figure 6-7 for the connection diagrams.

Note: Solar panel power will not be available at night or during very cloudy conditions. If Reporting sessions are scheduled for these times, the internal batteries will be used.
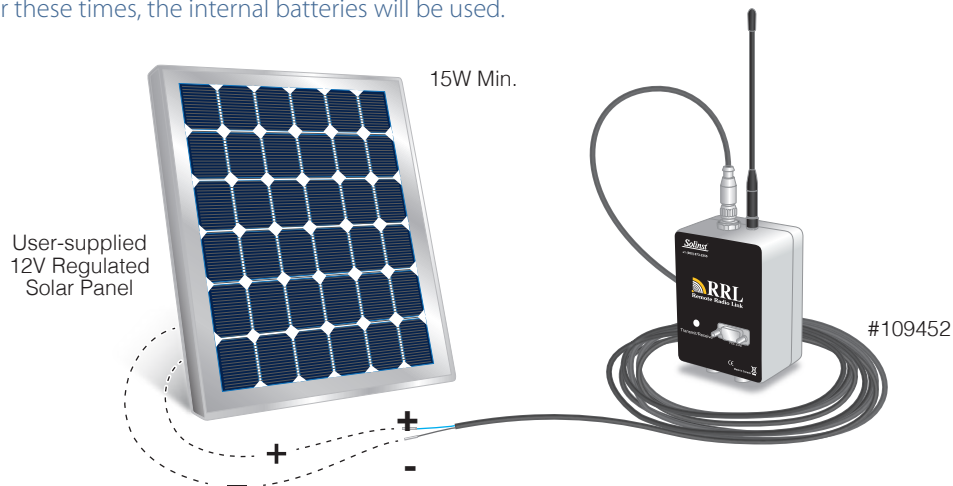

Figure 6-7 External Solar Panel Connection

4. Using the Solar/12 Volt Cable Assembly (pt# 109452) to connect to an external user-supplied 12V lead-acid battery (minimum 12 Amp-hour rating), trickle charged with a Solar Panel (minimum 15 W with a regulator for 12V). See connection diagram in Figure 6-8.
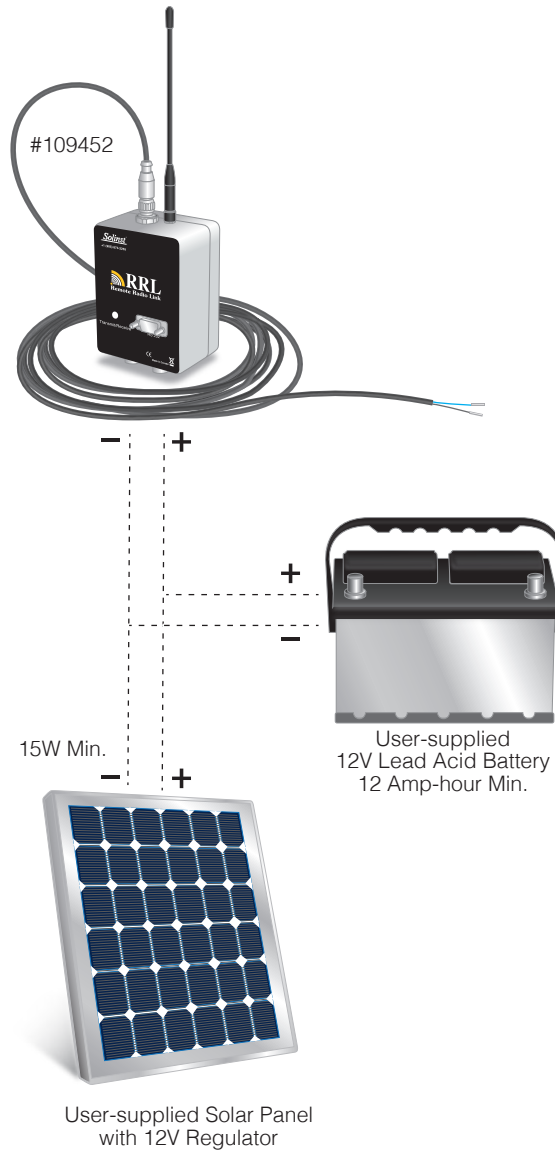

#109452

＋

User-supplied
12V Lead Acid Battery
12 Amp-hour Min.

15W Min.

User-supplied Solar Panel
with 12V Regulator

Figure 6-8 External 12V Lead-Acid Battery with Solar Panel Connection

6.1.2 Solar Panels

A solar panel is connected to a RRL station using the Solar/12 Volt Cable Assembly (see Figure 6-7). The solar panel is user-supplied. The panel should output a minimum of 13V open circuit in order to effectively re-charge the batteries. As a guideline, the solar panel should be at least 15 Watts. Higher wattage panels are also suitable. The solar panel must also include a regulator to handle external battery charging cycle.

6.1.3 Antennas

RRL Stations come standard with an omnidirectional antenna. The antenna should always be mounted on the outside of any enclosure for maximum communication distance, as they communicate via line-of-sight transmission. 900 MHz radios can communicate over distances up to 20 miles (30 km). To maximize communication distances between RRL Stations, an optional High Gain Antenna is available (pt# 108987).

Before sourcing any other power accessories or antennas to use with RRL Stations, refer to the radio module manufacturer's product manuals for approved devices at: http://www.digi.com.

6.2 Installing RRL Stations in the Field

RRL Stations are designed to fit inside 4.5" (115 mm) diameter wells for discrete placement.

Note: For more information on installing Leveloggers in the field, see the Levelogger User Guide.

Location and Communication Considerations

When using radio communication, you must take extra care when locating the Remote Stations. RRL radios communicate with each other via line-of-sight. They must be able to "see" each other in order to have effective communication. The path between radio antennas should not be through trees or perpendicular to the sides of flat buildings.

The communication distances given for each radio module, with standard antennas, are guidelines. Each project is site specific, and will require testing and planning before installing a RRL Network.

A communication range test can be performed prior to installation between the Home Station and the Remote or Relay Station using the RRL Remote Utility (see Section 5). Tests can be done using different Radio Power settings (see Section 4.1) to determine the ideal setup for your site. Always start with the lowest Radio Power setting, as this will conserve battery power. (Longer Report intervals will also conserve battery power).

Field tests will allow you to determine if you need an additional power source due to a higher Radio Power setting, or the addition of a higher gain antenna to increase communication distances. Adding a Relay Station should be the last option to increase your communication distance, or if there is an obstacle (such as buildings or trees) that you have to get your RF signal around.

7 Viewing Site Data

7.1 Access Database

Data received in each report from a RRL Station is placed in a Microsoft® Access® database (.mdb files) 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:\Program Files\Solinst\STS_Gold\db> The location of the default directory may vary for different Windows operating systems.

Note: if using Windows 7 or 8, the *.mdb file may be located in a different directory than the default location. It is often found under your User account instead of Program Files. To easily find the location of the *.mdb file, search for "sts_gold.mdb" in the C drive.

Figure 7-1 RRL Access Data

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.

7.2 View Using STS/RRL Software

The Solinst Telemetry Software can be used for a quick check of the latest readings. Data can also be exported using the Software as *.xle, *.lev or *.csv files for use in other programs.

To view data from a specific site using the Solinst Telemetry Software, open the Administrator window and select a RRL Network or station from the list. Click on "Display Data".

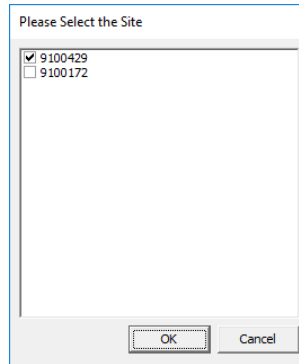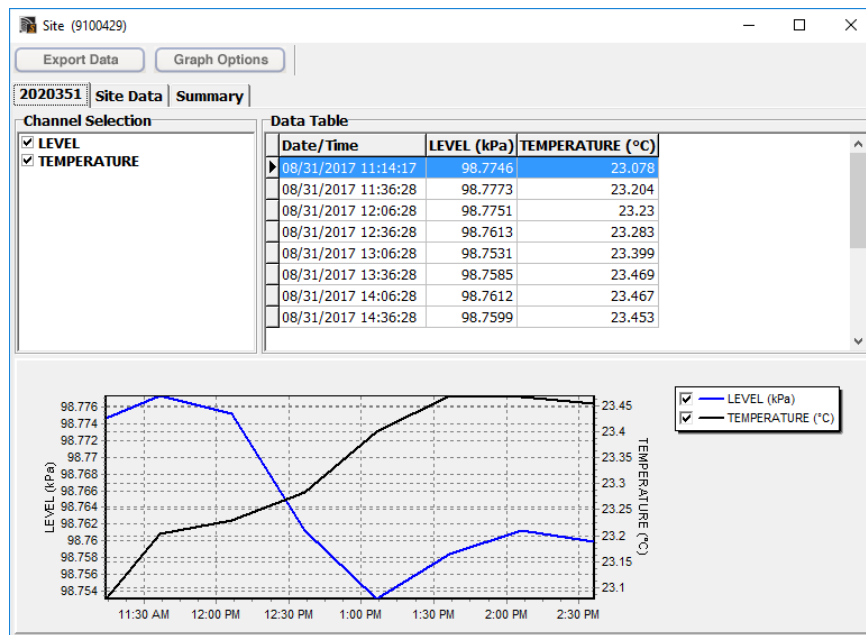Select the RRL Station from the list that opens and click OK.

Figure 7-2 Select RRL Station

Figure 7-3 RRL Station Data Window

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), Station data, including battery voltage is also displayed in a separate tab. A summary of all data is in a separate tab.

7.2.1 View Compensated Data

If you have set up barometric compensation (see Section 4.3), 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.

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 Levelogger is shown in a separate tab (identified by serial number). To view raw Levelogger data (uncompensated), uncheck "Show Compensated Data".
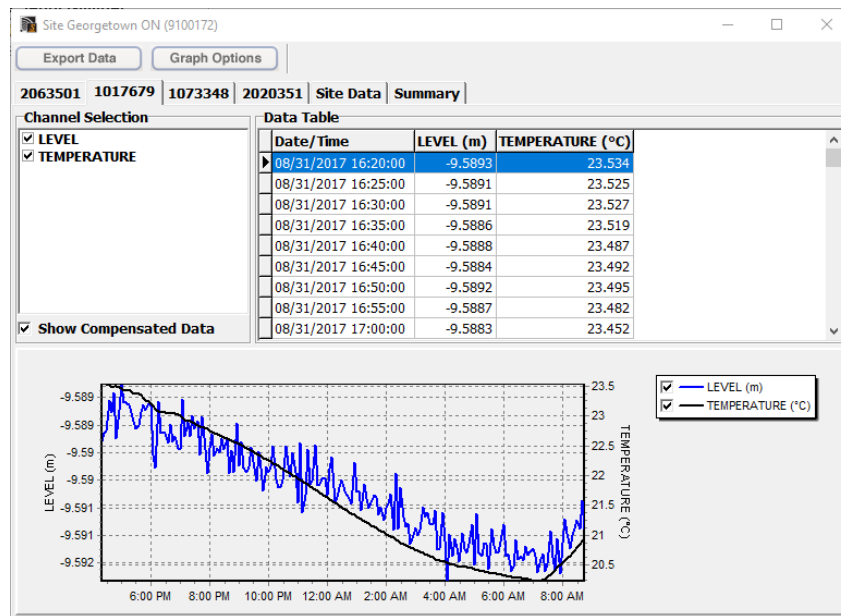

Figure 7-4 View Compensated Data

7.2.2 Graphing Options

Click the Graph Option icon to open the Graph Option Dialog. The Graph Dialog is shown in Figure 7-8.

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.
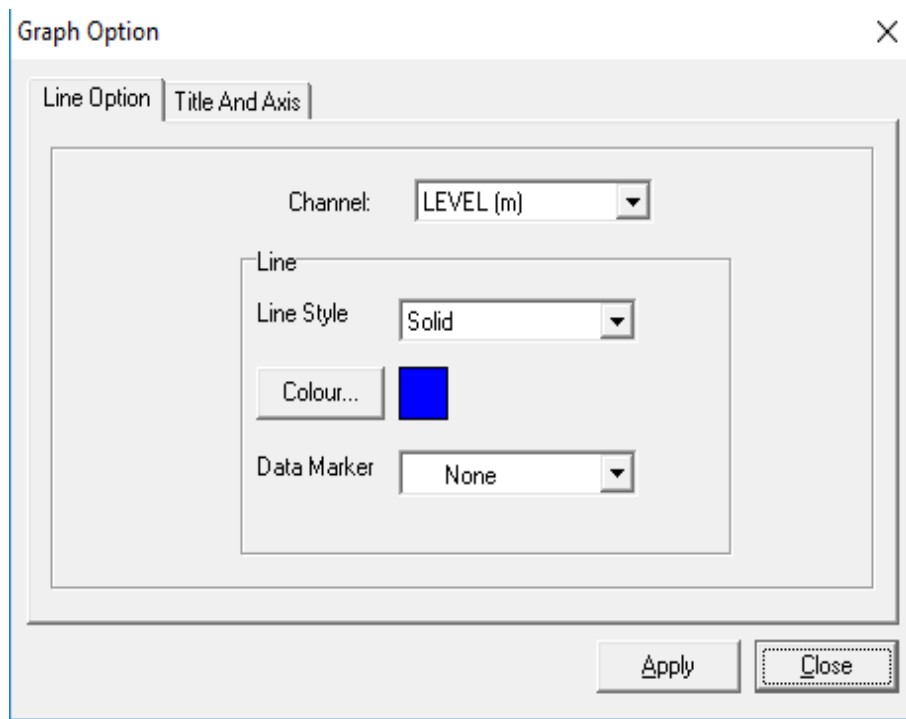

Figure 7-5 Graph Option Dialog Box

7.3 File Export

Data can be exported in *.csv (comma separated value), *.xle or *.lev (Levelogger/LevelVent/AquaVent) 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 Levelogger Software Version 4.0 and up, and *.lev files can be imported by any Levelogger Software Version, where data compensations can be performed.

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

Note: You can not export Rainlogger Data as a .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 Levelogger Software, where barometric and other compensations can be performed.

Note: For more information on data compensations using Levelogger Software, see separate User Guide.
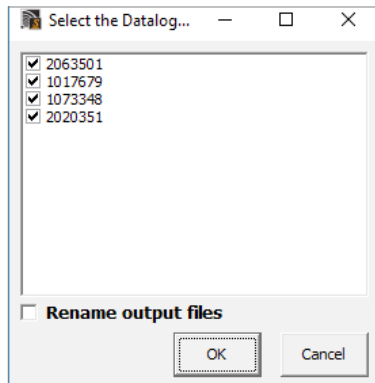

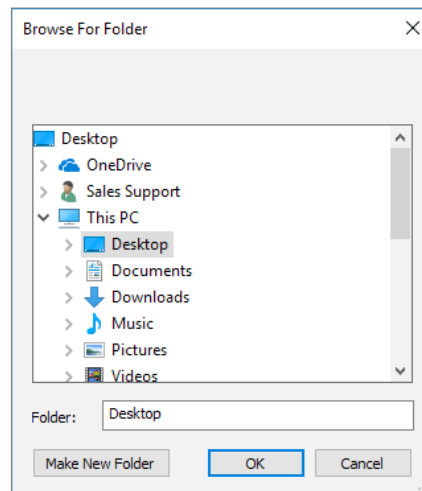Figure 7-6 Select Datalogger

Figure 7-7 Save Data

7.3.1 Export All Data

Data from all STS Edge Sites and RRL Edge Stations can be exported at one time, using the "Export all Stations Data" function in the File menu.

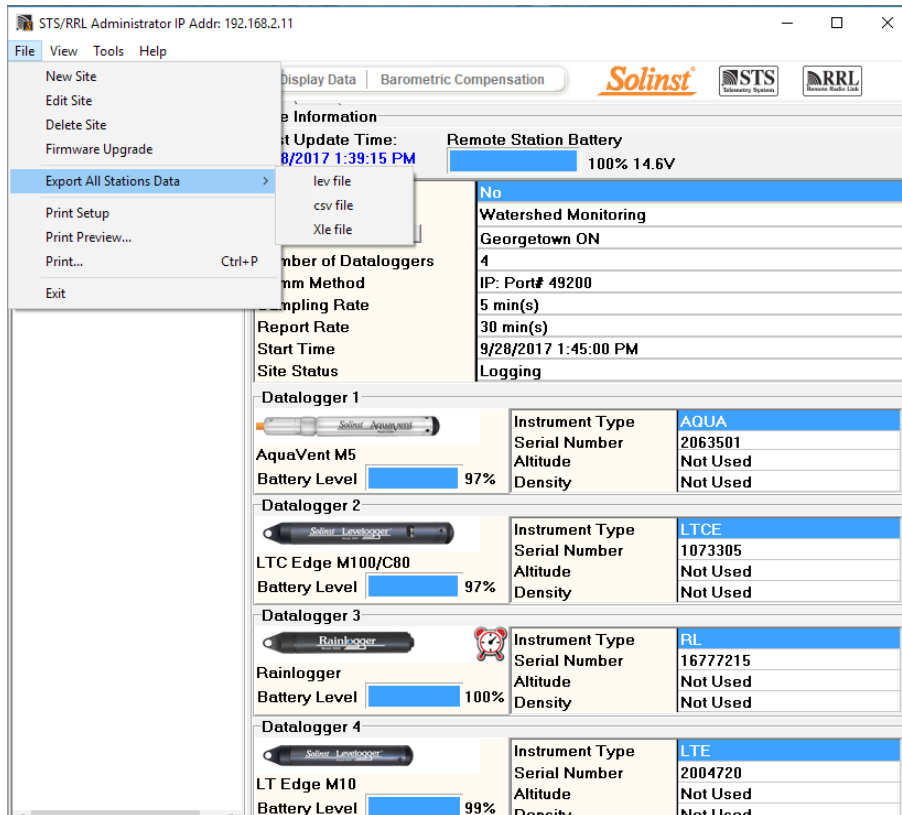There is the option to save all the data in *.csv, *.xle , or *.lev files.

Figure 7-8 Export All Stations Data