User Guide

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Model 9500

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LevelSender 5 User Guide Table of Contents

1.0 Introduction

The purpose of this User Guide is to describe the operation of a LevelSender 5 telemetry system, including programing using LevelSender PC Software Utility, installation, and data collection.

Note: LevelSender Telemetry can also be set up using the Solinst Cloud. See the Solinst Cloud User Guide.

LevelSender 5 telemetry is a simple, low cost system designed to wirelessly send data from Solinst dataloggers in the field, via 4G LTE cellular communication, to an FTP server, and/or multiple emails and an SMS (text) recipient, as well as the "Home Station" PC.

Initial setup for each LevelSender 5 remote station is done using the LevelSender PC Software Utility and a USB connection. Each LevelSender is programmed with a "Sampling Rate", the rate at which the LevelSender collects data from the attached datalogger(s), and a "Reporting Rate", the rate at which the LevelSender reports the collected data via FTP, email and SMS. Optionally, dataloggers themselves can be set up to record and store data independently of the LevelSender as a backup. High and low level alarms can also be set.

With each report, data is sent to an FTP server as text or *.csv files, and/or as text to the email and SMS recipients. Data is automatically saved to a SQLite database on the Home Station PC, which the user can access for use in their own customized database. Data can also be imported by LevelSender Software at the Home Station, where email can be viewed and saved as files, and data exported as *.csv files or *.xle files for use in Levelogger Software. An internal barometer allows barometrically compensated water level data to be reported.

Changes to the sampling and reporting schedule can be done directly through a USB cable and the LevelSender Software. Alternatively, remote schedule changes can be sent to individual LevelSender 5 stations using the LevelSender Software (via email).

1.1 Compatibility

Each LevelSender 5 station can connect up to two Solinst dataloggers (using a splitter). LevelSender 5 telemetry is compatible with the Levelogger 5, Barologger 5, Levelogger 5 Junior, Levelogger 5 LTC, Rainlogger 5 and LevelVent 5, as well as Levelogger Edge series dataloggers and LevelVent using the following firmware versions (or higher):

Datalogger	Firmware Version
Levelogger 5	1.006
Barologger 5	1.006
Levelogger 5 Junior	1.006
Levelogger 5 LTC	1.006
Rainlogger 5	1.006
LevelVent 5	1.006
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

Table 1-1 Compatible Datalogger Firmware Versions

Note: See the Levelogger and Vented Dataloggers User Guides for more information on the dataloggers.

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

Note: To determine what firmware version your LevelSender is using, you can check using LevelSender Software, see Section 3.4.

2.0 LevelSender Overview

The LevelSender 5 is a simple, low cost device designed to wirelessly send data from Solinst dataloggers in the field, via 4G LTE cellular communication, to a Home Station PC, FTP server, and/or multiple emails and an SMS cellular phone number.

Note: LevelSender Telemetry can also be set up using the Solinst Cloud. See the Solinst Cloud User Guide.

2.1 LevelSender Remote Stations

LevelSender 5 remote stations are designed to be placed in a 2" diameter well (4" with adaptor), but can also be used in other applications. Each LevelSender comes with a 2" Well Cap Assembly and a Support Hanger Bracket (see Section 6 for installation instructions). LevelSender stations are constructed from robust Delrin®, and have an IP rating of 67 (dust proof and can withstand immersion up to 1 meter depth for up to 30 minutes).

Each station includes a built-in modem, an antenna, and an LED that flashes with operation. There is a USB connection for programming the LevelSender using the LevelSender PC Software, a compartment for three 1.5V AA replaceable lithium batteries, and a SIM card slot (when ordered, Solinst SIM cards are pre-installed, activated, and ready for use—contact Solinst for plan options). An internal barometer allows barometrically compensated water level data to be reported. Each LevelSender 5 station can connect up to two dataloggers (using a splitter).

Note: USB Cable for programming the LevelSender, and Reader Cables and Levelogger Direct Read Cables to connect to dataloggers are available separately.

Antenna

Battery Compartment

Phillips Screws (x3)

LED Activity Light

Top Cap

SIM Card Slot

USB-C Connection

LED Activity Light

Battery Compartment

Top Cap

Reader Cable/ Splitter Connection

Barometer Sensor Opening

Figure 2-1 LevelSender 5 Station

LevelSender 5 Specifications	
Materials:	Black Delrin, 316 stainless steel
IP Rating:	IP67
Operating Temperature:	-20ºC to 60ºC
Barometer Range:	30 kPa – 120 kPa
Barometer Accuracy:	±0.2 kPa (2 cm)
Memory Capacity: (Between Reports)	Up to 40,000 LT logs, or 28,000 LTC logs
Size:	2.5" x 9.375" (with antenna folded down)
Weight:	16.9 oz. (478 grams)
Batteries:	3 x 1.5V AA replaceable lithium batteries (alkaline can also be used)
Antenna:	SMA Male Monopole 2dBi
Optional Antenna:	LTE Omni Wall/Pole Mount 790–960MHz, 1710–2690MHz and 3400–3800MHz with 10ft cable (IP68 seal kit available)
Modem:	4G LTE UE Category M1 device (700/800/850/900/1700/1800/1900/2100 MHz)

Table 2-1 LevelSender Specifications

2.1.1 LED Light Identification

LevelSender is awake and performing a task.

Startup LED cycles through red, green and blue, then solid green, and then off. If there is an error, the LED will flash red three times.

2.1.2 LevelSender Antenna

The LevelSender 5 comes with a SMA male monopole 2dBi antenna. To attach the antenna:

1.   Use a Phillips screwdriver to remove the three screws from the top of the LevelSender.
2.   Pull the top cap off the LevelSender.
3.   Line up the antenna connector and screw it onto the connection on the top of the LevelSender.

Note: With the top cap removed, see Section 2.2.1 to install the SIM card.

The antenna bends to accommodate well cap installation. The antenna for the LevelSender uses an SMA connection, therefore, you can source other antennas or an antenna cable extension with an SMA male connector, if required.

Note: See Section 6.4.1 for information on an optional external antenna.

Note: If you need to remove the top cap with the antenna already installed, you will have to loosen the nut and remove it and the antenna from the top cap.

Figure 2-2 LevelSender 5 Antenna

2.2 Wireless Carrier Requirements

Note: The LevelSender system supports using dynamic IPs for the Home Station and the remote LevelSender stations.

LevelSender 5 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-M network. The LevelSender 5 uses a 4G LTE UE Category M1 device (700/800/850/900/1700/1800/1900/2100 MHz).

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: If setting up your LevelSender using Solinst Cloud, you will use a Solinst SIM and data plan.

You do not require voice access or voice features. If you plan on sending SMS reports, you will require text messaging, but ensure texting charges do not apply (i.e. unlimited texting). Your cellular service provider will give to you an activated SIM card, APN (Access Point Name), account type, user name, and password.

Note: See our LevelSender Preparation Guide for more information on cellular service plan requirements.

Note: You will also require an email account dedicated to sending and receiving email at the Home Station, as well as separate, unique email addresses for each LevelSender station, if not using the FTP option. A LevelSender email address is also required if you would like to allow remote updates. This can be set-up on your own, or with the help of your IT department.

2.2.1 Installing the SIM Card

Note: Solinst SIM cards come pre-installed, if ordered with the LevelSender.

Note: The LevelSender uses a standard/mini size SIM card (15 mm x 25 mm). A SIM card adaptor can be used, if required.

To install the SIM Card:

1. With the top cap removed (see Section 2.1.2), insert the SIM card into the slot on the top of the LevelSender as shown in the photo, with the chip/metal contact towards the battery sleeve and beveled edge first.

Note: To remove the SIM card, press down on the card and it will spring up and out of the slot.

2. Lower the top cap over the installed antenna (see Section 2.1.2). Push the top cap into place. This may take some force, as there is an o-ring on the top of the LevelSender.

3. Replace the three screws to secure the top cap.

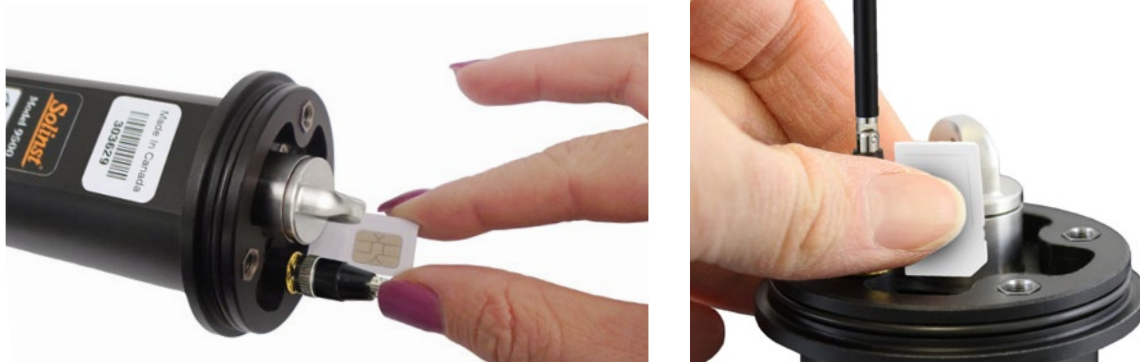4. Ensure the grommet is in the nut and install the nut over the antenna and thread onto the top cap.

Figure 2-3 Installing the SIM Card

2.3 LevelSender Batteries

A LevelSender 5 uses three 1.5V AA replaceable lithium batteries to operate. Batteries need to be installed before programming.

Note: Alkaline batteries can also be used, but battery life estimates will be reduced. They may also reduce the operating temperature range.

2.3.1 Installing LevelSender Batteries

To install the batteries:

1. Unscrew the stainless steel cap from the LevelSender to access the battery compartment.
2. Install the three batteries with the positive ends first/down, in the battery compartment.
3. Replace the stainless steel cap.

Note: If you are not using your LevelSender for more than two months, Solinst recommends removing the batteries for long term storage.

Figure 2-4 Installing the Batteries

2.3.2 LevelSender Battery Life Estimates

Sample Rate	Report Rate	Battery Life Estimates	
		One Datalogger Connected	**Two Dataloggers Connected**
Every Hour	Every Day	433 Days	429 Days
Every Hour	Every 6 Hours	177 Days	176 days
Every 15 Minutes	Every Hour	35 Days	35 Days

Table 2-2 LevelSender Battery Life Estimates

Note: Estimates are based on three 1.5V AA lithium batteries.

Note: The LevelSender will use battery power each time it samples, reports, and checks for updates. As such, more frequent intervals will drain the battery more quickly.

2.4 Connecting Dataloggers

Each LevelSender 5 has a single port to connect one datalogger. An optional splitter allows the connection of a second datalogger.

2.4.1 Connecting Leveloggers

Leveloggers are connected to the LevelSender 5 using a 3 foot long Reader Cable connected to the Levelogger's Direct Read Cable.

To connect a Reader Cable to the LevelSender 5 station, remove the black dust cap from the connection on the LevelSender, line up the holes in the connectors, push the Reader Cable connector into the connection on the LevelSender and screw the Reader Cable into the LevelSender until finger-tight. Connect the other end of the Reader Cable to the top end of the Levelogger's Direct Read Cable.

Note: An L5 Threaded 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 2-5 Connecting Leveloggers

2.4.2 Connecting a LevelVent

A LevelVent is connected to the LevelSender 5 using a 3 foot long Reader Cable connected to the LevelVent Wellhead.

To connect a Reader Cable to the LevelSender 5 station, remove the black dust cap from the connection on the LevelSender, line up the holes in the connectors, push the Reader Cable connector into the connection on the LevelSender and screw the Reader Cable into the LevelSender until finger-tight. Connect the other end of the Reader Cable to the LevelVent Wellhead.

Note: See the Vented Dataloggers User Guide for more information on LevelVent components and connections.

Reader Cable

Reader Cable

LevelVent Wellhead

Figure 2-6 Connecting a LevelVent

2.4.3 Splitters

Splitters allow the connection of two dataloggers to each LevelSender 5. To connect a Splitter to the LevelSender, remove the black dust cap, line up the holes in the connectors, and screw the Splitter into the LevelSender connection until finger-tight. Reader Cables are connected to the Splitters in the same manner they are connected directly to the LevelSender.

Splitter

Figure 2-7 Connecting Splitters

Note: When using a Splitter, the number 1 or 2 will identify the Dataloggers in LevelSender Software. The numbers are labeled directly on the Splitter.

3.0 LevelSender Software

The LevelSender PC Software provides an easy-to-use graphical interface to configure the Home Station email, program LevelSender 5 remote stations with cellular settings, data sampling and reporting schedules, alarm notifications, and set up FTP information, email addresses and/or an SMS contact to receive the data.

Note: LevelSender Telemetry Systems can also be set up using the Solinst Cloud. This eliminates the use of a dedicated PC "Home Station" and emails. See Solinst Cloud User Guide.

LevelSender Software can be used to program a LevelSender 5 directly through a USB cable; in addition, a LevelSender email address can be set up in the software for each LevelSender station, which is used to remotely receive data schedule changes.

LevelSender Software can also be used to receive data at the Home Station, and export it for use in other programs, including Levelogger PC Software for data compensation.

Note: Data files are also automatically saved on the Home Station PC as a back-up (see Section 5.3).

The software can also perform communication tests between the Home Station and a remote LevelSender station, and between a remote LevelSender station and the connected datalogger(s). It can also perform diagnostic tests on a USB connected LevelSender station.

Note: LevelSender Software Version 1.3.0 is compatible with LevelSender 5 Firmware Version 2.200 and up.

3.1 System Requirements

The minimal hardware and software requirements for LevelSender PC Software installation and operation are:

Hardware	Software
1 GHz Processor	Windows 10 & 11
1 GB RAM	
2 GB available disk space	
USB and Internet connections	

Table 3-1 System Requirements

Note: You will also require an email account dedicated to sending and receiving email at the Home Station, as well as separate, unique email addresses for each LevelSender 5 station if not using the FTP option, and/or you would like to perform remote updates.

Note: If using Solinst Cloud to set up your LevelSender, you will not require any email addresses set up. See Solinst Cloud User Guide.

3.2 Software Installation

Download the newest version of LevelSender Software by visiting:
https://downloads.solinst.com

After opening the setup.exe file, the Software Installation Wizard will guide you through the installation process.

Default Directory is <C:\Program Files\Solinst\LevelSender>

3.3 LevelSender Software Communication

For initial setup and direct communication with LevelSender PC Software (or Solinst Cloud), the LevelSender 5 must be connected to the PC using a USB cable (available from Solinst).

To access the USB-C connection on the LevelSender 5:

1. Use a Phillips screwdriver to remove the three screws from the top of the LevelSender.
2. If installed, loosen the antenna by unthreading the nut from around it.
3. Pull off the top cap of the LevelSender along with the antenna.
4. Connect the USB cable to the USB-C connection in the LevelSender.
5. When finished communicating with the PC Software, unplug the USB cable.
6. Line up the antenna connector and screw it back onto the connection on the top of the LevelSender.
7. Lower the top cap over the installed antenna, Push the top cap into place. This may take some force, as there is an o-ring on the top of the LevelSender.
8. Replace the three screws to secure the top cap.
9. Ensure the grommet is in the nut and install the nut over the antenna and thread onto the top cap.

USB Cable

Figure 3-1 USB Cable Connection

3.4 LevelSender Software Main Window

To start the LevelSender Software, click on your desktop, or click the Start button and select: Programs > Solinst > LevelSender.

The LevelSender Software main window will be displayed. From here you can set up the Home Station email, view LevelSender settings, set up new LevelSender remote stations, edit existing LevelSender settings, and receive and open LevelSender email and data.
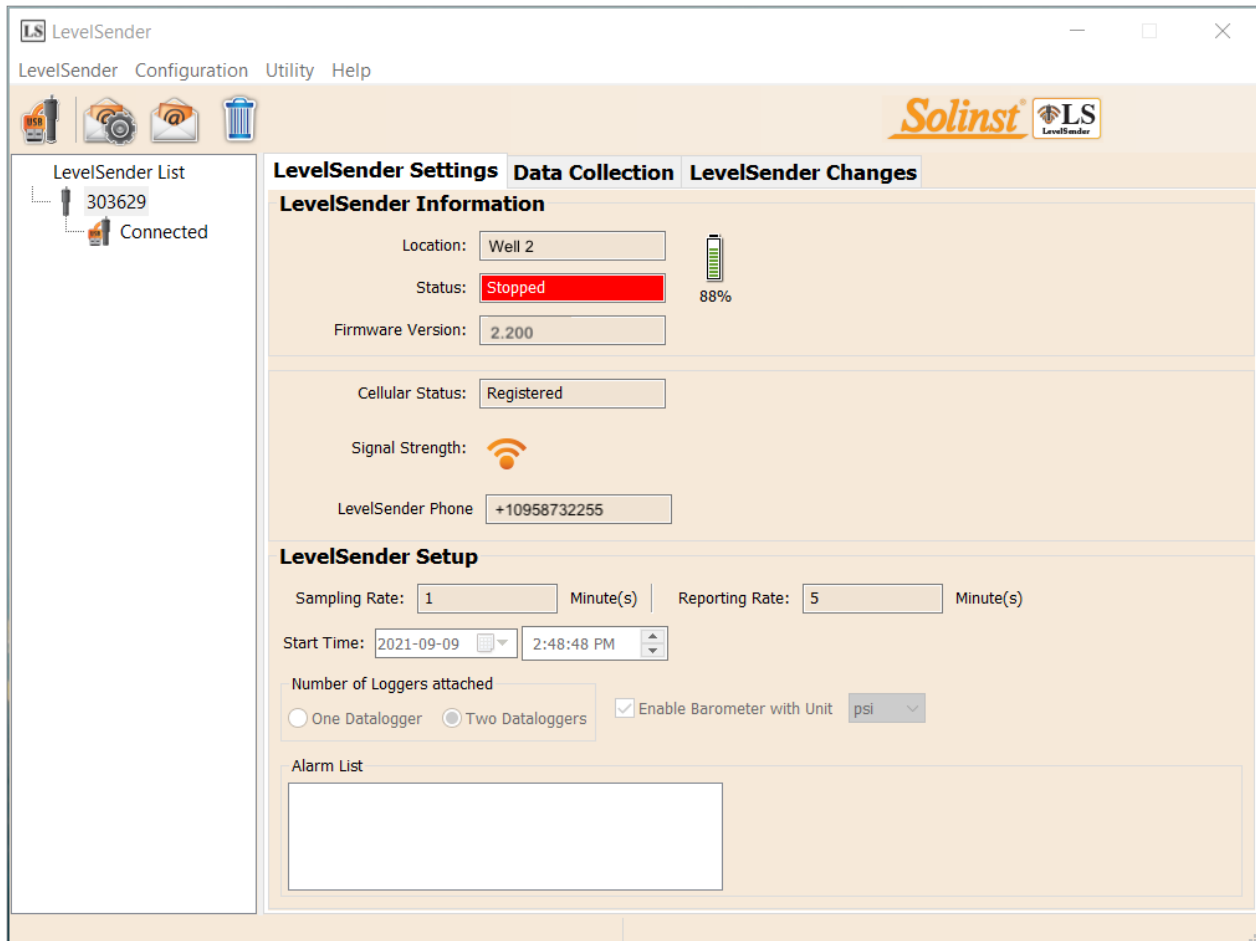
Figure 3-2 LevelSender Settings

If the software is running, connecting a new LevelSender station using the USB cable will automatically start the LevelSender Setup Wizard. See Section 4.2.

The window on the left of the Software lists each programmed LevelSender station by its serial number. If the LevelSender station is connected to the Home Station PC using a USB cable, it will be identified with "Connected" and an icon below it.

To delete a LevelSender station, click to highlight it in the list, then click the delete icon .

3.4.1 LevelSender Software Options

Selecting the serial number of a programmed remote (or connected) LevelSender station from the list will display the **LevelSender Settings:**

LevelSender Information

- **Location:** specific site / location information that you input to identify each LevelSender station.
- **Status:** the LevelSender will either be "Started" with a previously programmed data collection schedule, "Stopped", or "Waiting to Start" at a programmed future start time.

Note: The status will update after the first report. Before that, the status will be "Waiting to Start".

- **LevelSender Time:** the real-time, internal clock of the LevelSender.
- **Firmware Version:** the firmware version of the LevelSender station will be displayed.
- **Cellular Status:** the LevelSender will either be "Registered" and properly setup with the wireless carrier, or "Not Registered" – the LevelSender does not have the wireless carrier properly set up, or there is a communication problem with the carrier.
- **Signal Strength:** the signal strength of the LevelSender modem will be displayed.
- **LevelSender Phone Number:** the phone number associated with your cellular account.

LevelSender Setup

- **Sampling Rate:** the rate that the LevelSender station collects data from the connected datalogger(s).
- **Reporting Rate:** the rate that the LevelSender station reports collected data via email/SMS.
- **Start Time:** the date and time the LevelSender started collecting data (or date and time the LevelSender is programmed to start).
- **Number of Dataloggers Attached:** either one or two dataloggers will be attached.
- **Enable Barometer with Unit:** if checked, indicates that the internal barometer is used to compensate water level readings in the units shown.
- **Alarm List:** the alarm settings you have applied to each of the attached dataloggers.

The **Data Collection** and **LevelSender Changes** tabs will also be available. See Sections 5.3 and 4.3 for the functions of these tabs.

3.4.2 Connected LevelSender Software Options

Selecting "Connected" below a programmed LevelSender [icon] from the list will display the **Sim Card Settings**, **LevelSender Email Setup**, **Data Recipient Setup**, and **Diagnostic Information** tabs.

The function of the first three tabs is to review the settings that have previously been applied to the connected LevelSender station. See Section 8.1 for an overview of the Diagnostics Information tab.
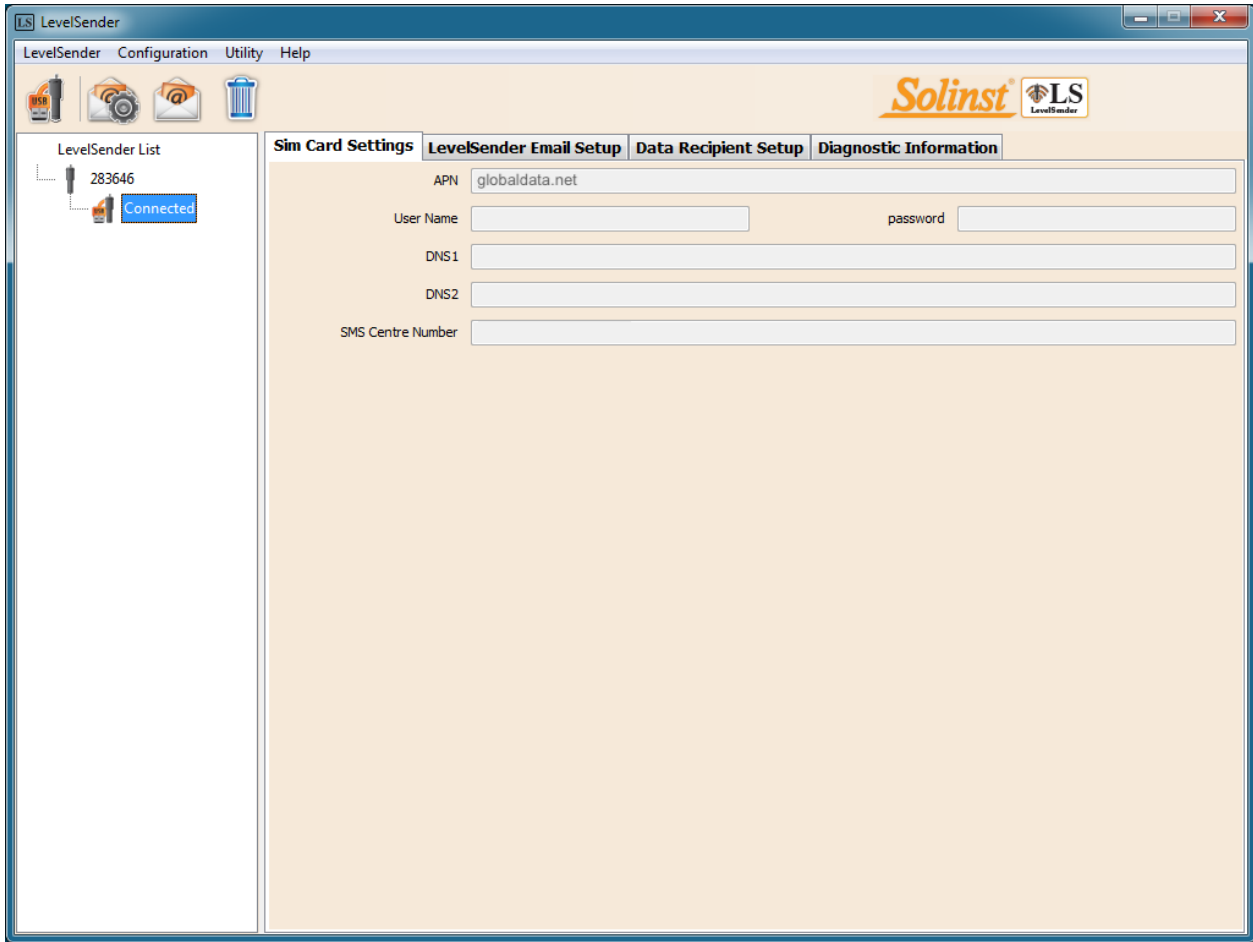

Figure 3-3 Connected LevelSender Tabs

4.0 LevelSender Configuration

4.1 Home Station Email Setup

Note: If using Solinst Cloud to set up your LevelSender, you will not require any email addresses set up. See Solinst Cloud User Guide.

To enable your Home Station to receive email and data, and send remote updates, you must set up a Home Station email. Multiple LevelSender stations can report to one Home Station email. **It is recommended that a unique, dedicated email address be set up for your Home Station.**

Note: If you open data report messages sent to the Home Station email using the email program and not LevelSender Software, those reports will not be listed in the Received Email window. Only "unread" messages will be listed. This is why a dedicated, unique email address is recommended for the Home Station.

To set up an email for your Home Station, click [icon]. You can also go to the **Configuration** menu and select **Email Account Configuration**.

Figure 4-1 Home Station Email Account Configuration
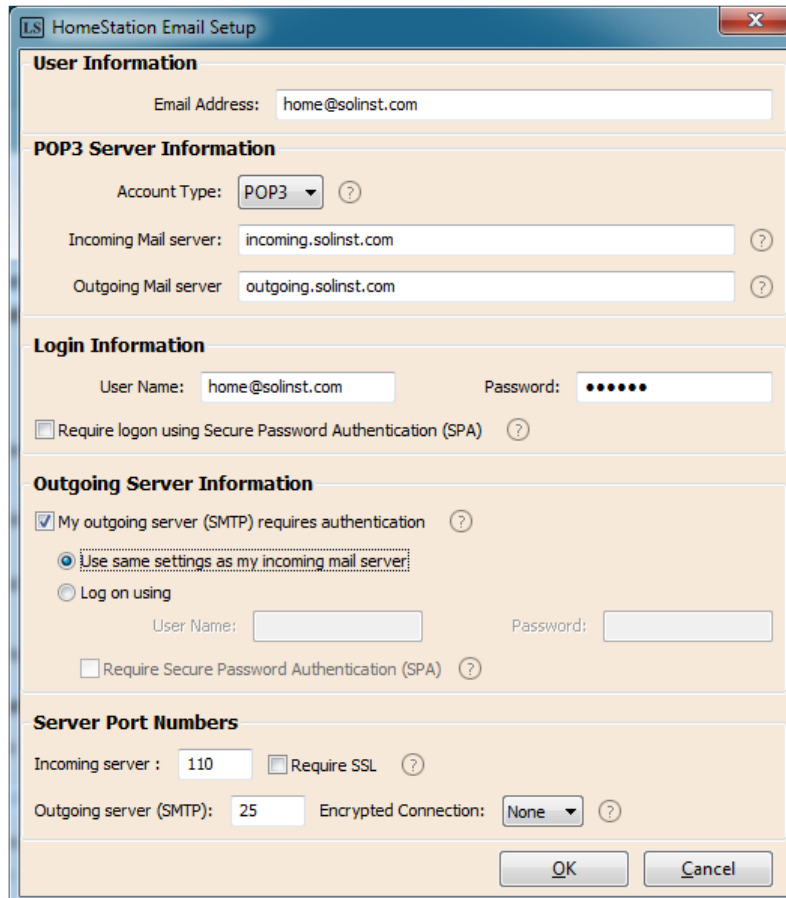
Enter the following information:

Note: You may require your IT department to help determine some of the following information.

Note: See the Appendix for Gmail and Yahoo email setup information.

User Information

- **Email Address:** the email address you wish to use for your Home Station to receive data and send remote updates using LevelSender Software.

Mail Server Information

- **Account Type:** the protocol your server uses to receive mail, either POP3 or IMAP.
- **Incoming Mail server:** the name (access domain) of your incoming mail server (e.g. pop.gmail.com).
- **Outgoing Mail server (SMTP):** the name (access domain) of your outgoing mail (SMTP) server (e.g. smtp.gmail.com).

Login Information

- **User Name:** the user name associated with the email account (usually the full email address).
- **Password:** the password used to access the email account.

Note: Gmail security settings have recently changed. If using Gmail, the password to be entered here is now called an App Password, which is auto-generated by Gmail. You must enable the App Password, then copy and paste the generated password into this field. See Section 9.1.3 in the Appendix for instructions.

- **Require logon using Secure Password Authentication (SPA):** check this box only if your service provider requires you to. Few service providers use this setting.

Outgoing Server Information

- Enter the security information for your outgoing mail server. Your email service provider may require you to provide more authentication information on the SMTP server.

Server Port Number

- **Incoming server/Outgoing server (SMTP):** the email service provider may require a different server port number for sending and receiving email (e.g. Gmail, See Appendix for more information).
- **Require SSL**: check this box if the email server requires SSL
- **Encrypted Connection:** the encryption option for the outgoing server (SSL, TLS and AUTO)

Click OK once you are finished entering all of your Home Station email account information.

4.1.1 Checking Home Station Email

Once you have set up your Home Station email, you can test that the settings you entered are correct by clicking [icon].

This will open the LevelSender Email Client. The LevelSender Email Client will indicate whether an email was received by the Home Station.

Note: If the test email was not successful, go to Section 8.3 for troubleshooting options.

You can access the LevelSender Email Client at any time to view all email received or sent by the Home Station, including test emails.
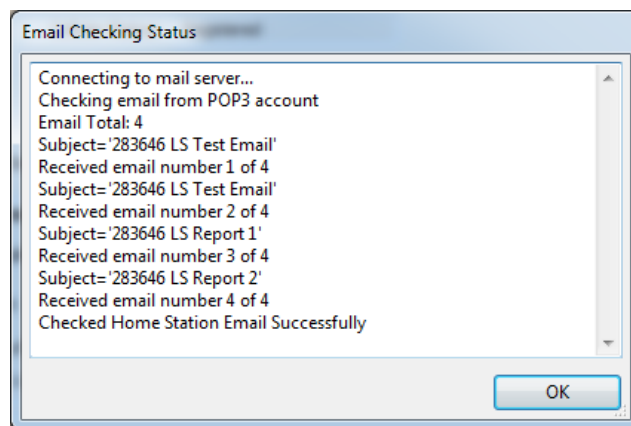
Figure 4-2 LevelSender Email Client

Using **Preferences** under the **Configuration** menu, you can also set a schedule at which the LevelSender Software will check the Home Station email for any sent or received email. Select "Check Email for *every*" and enter how often you want the email checked (See Section 5 for information on the Default File Output Directory and FTP Export Settings.)

Note: You can also enable FTP export of the data during initial set up of your LevelSender. See Section 4.2.4.
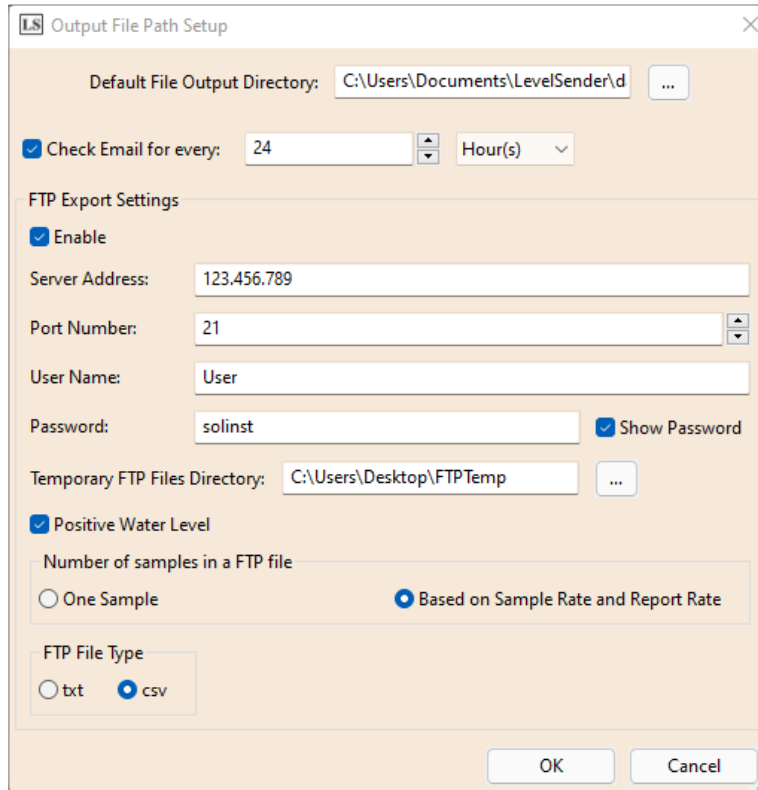
Figure 4-3 LevelSender Email Client Schedule Setup

4.2 LevelSender Setup Wizard

Connect your LevelSender 5 station to your PC using the USB cable.

If this is a new LevelSender station, the LevelSender Setup Wizard will automatically start if the LevelSender Software is open, or click   to start the Wizard.

Note: You can only set up one LevelSender station at a time.

4.2.1 Connecting to the LevelSender

Once the connected LevelSender is detected by the Wizard (this may take a few seconds), click **Next** to continue the setup. Click **Cancel** to exit the Wizard at any time.
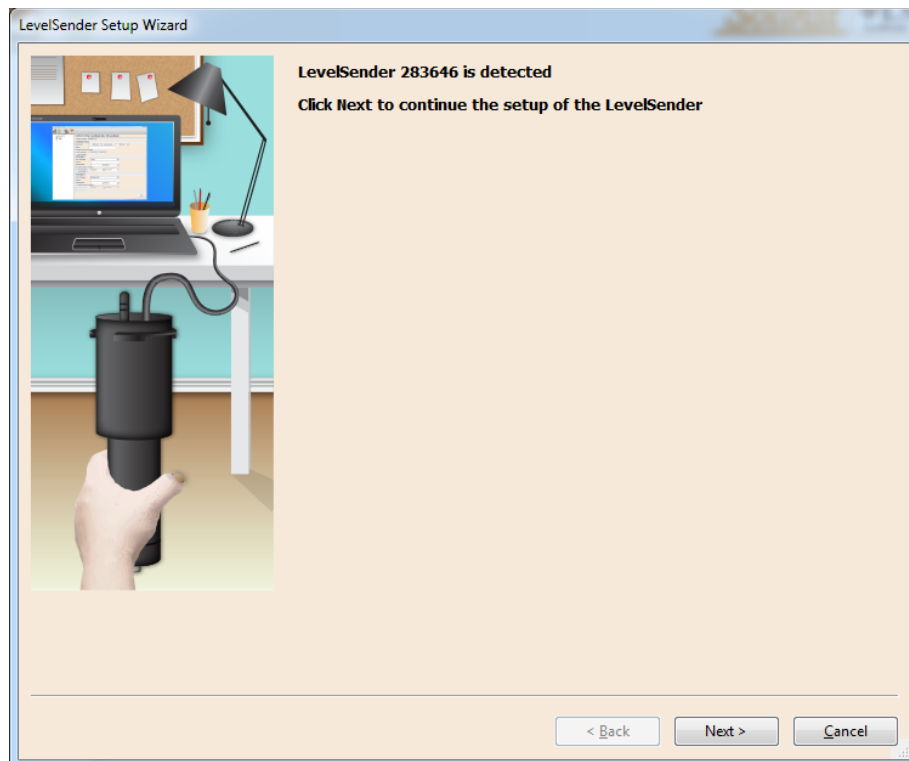
Figure 4-4 LevelSender Detected

Note: If you are having issues connecting to LevelSender Software, see Section 8.2 for Troubleshooting options.

4.2.2 SIM Card Settings

In this step enter the following information to set up your wireless network. This information is provided to you by your wireless carrier, and is associated with the SIM card you obtained from the carrier.

Note: If you ordered a Solinst SIM card with your LevelSender, this information will also be provided.

APN (Access Point Name): associated with your cellular account, provided by the wireless carrier. Each carrier has their own unique APN (e.g. globaldata.com).

User Name: the user name for the cellular account.
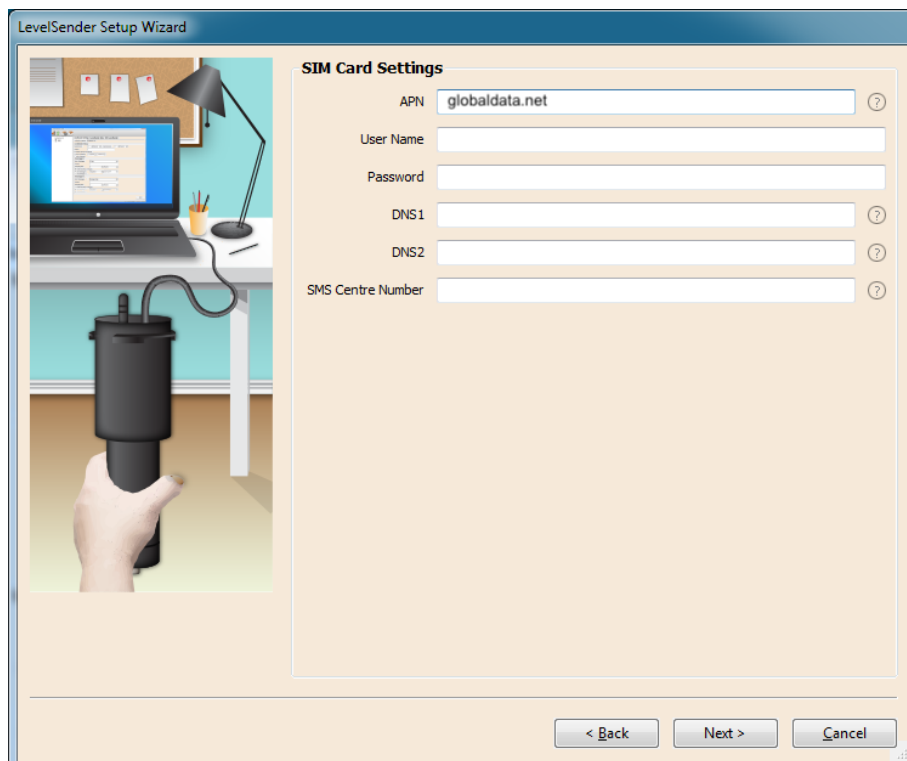
Password: the password that was set for the cellular account.

DNS1/DNS2: the wireless carrier DNS (Domain Name Server) address, e.g. 207.181.101.4.

Note: User Name, Password, and DNS addresses may not be required for your particular service provider (e.g. it may be a public account)

SMS Centre Number: a Short Message Service Centre number is responsible for delivering the SMS text messages from your mobile device network to the destination mobile device network.

Click **Next** to continue the setup.

Figure 4-5 LevelSender SIM Card Settings

4.2.3 LevelSender Email Setup

Note: If using Solinst Cloud to set up your LevelSender, you will not require any email addresses set up. See Solinst Cloud User Guide.

In this step you will program the LevelSender 5 with an email address it can use to send data and receive remote updates. **It must be different from the Home Station email address.** Each LevelSender must have a unique email address.

There is also the option to skip this step, if you are only going to use FTP data transfer and/or you do not require remote updates. You can also set up both, as the LevelSender can simultaneously push data to the FTP server and a designated email address.

Note: Each LevelSender must have a unique, dedicated email address. Solinst recommends creating a new email address for each LevelSender.

Note: The LevelSender is not compatible with Microsoft® email accounts.

Enter the incoming and outgoing mail server information for the email account, as well as the user name and password associated with the account. See Section 4.1 for a description of each parameter required.

Note: When using a Gmail account, use App Passwords to generate a passcode to be used for the Password input field. See Section 9.1.3 in the Appendix for instructions.

If you are using an email account with encrypted TLS (e.g. port 587) for the LevelSender email (e.g. outlook. com, hotmail.com) you will not be able to enter additional email recipients to receive the data (see Section 4.2.4).
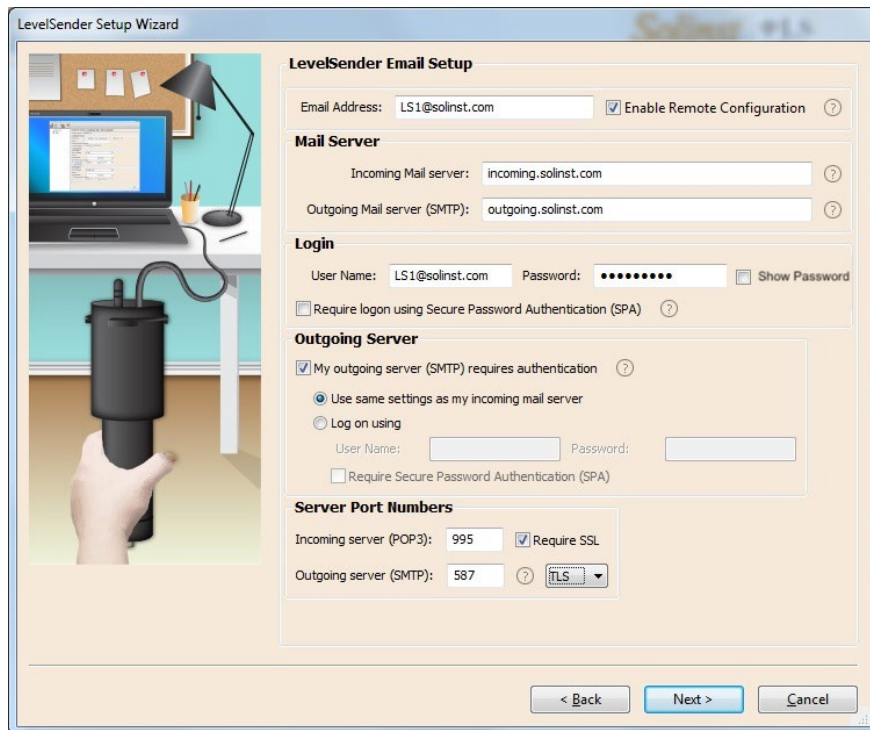
Figure 4-6 LevelSender Email Setup - TLS Enabled

Older LevelSender units may not be compatible with email accounts using encrypted TLS email (e.g. port 587) for the LevelSender email (e.g. outlook.com, hotmail.com); however, they can be used for the Home Station email. If you have one of these units, there will be no option to select TLS when programming the LevelSender email (see Figure 4-6).
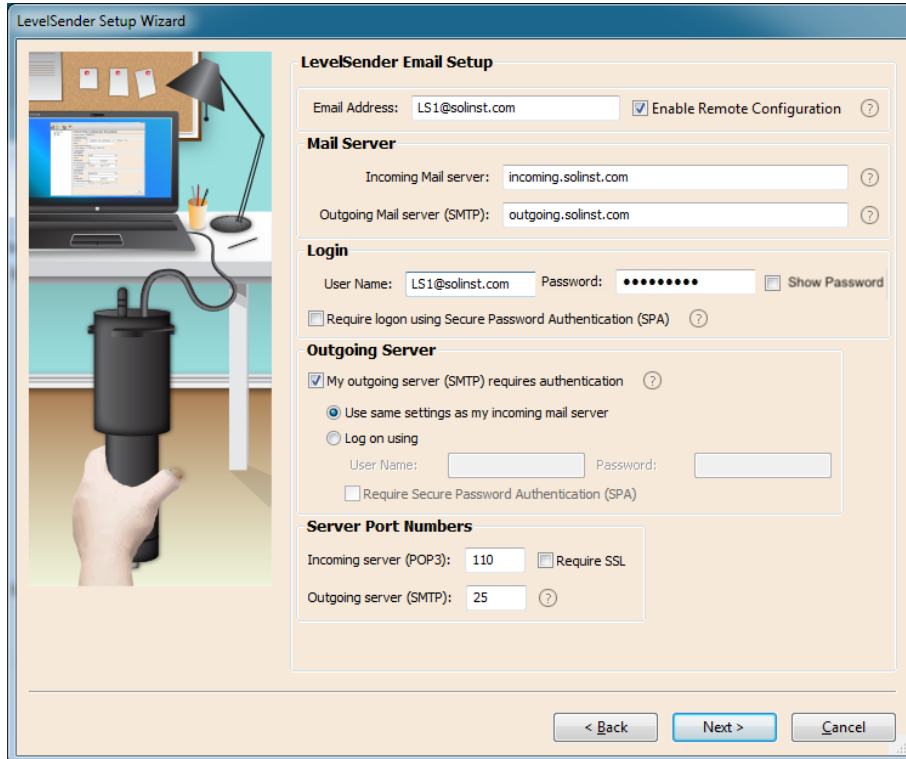
Figure 4-7 LevelSender Email Setup - No TLS Option

To enable the LevelSender station to receive remote updates from the Home Station, ensure you check **Enable Remote Configuration.**

Click **Next** to continue the setup.

Note: To enable the LevelSender station to receive remote updates from the Home Station, ensure you check **Enable Remote Configuration.**

4.2.4 Data Recipient Setup

In this step you will enter the recipients of the data reports sent from the LevelSender station.

Home Station Email: enter the email address that was setup for your Home Station. This allows data to be sent to the Home Station PC database and viewed in LevelSender Software.

Email Recipients: to add an email recipient, enter the First Name, Last Name, and Email Address of the recipient, then click ADD. You can add up to 5 email addresses, including the Home Station recipient.

Figure 4-8 Data Recipient Setup
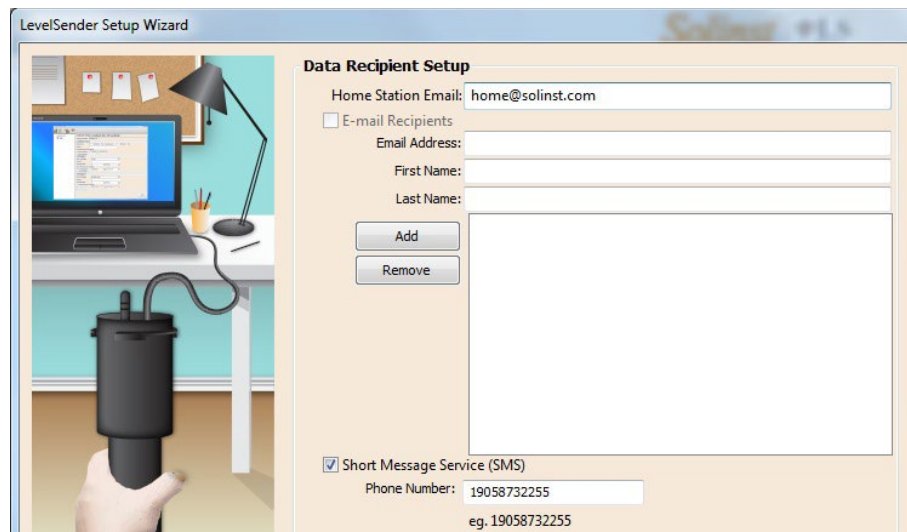
Figure 4-9 Data Recipient Setup - TLS Selected – Additional Email Recipients Not Available

If you are using an email account with encrypted TLS (e.g. port 587) for the LevelSender email (e.g. outlook. com, hotmail.com) you will not be able to enter additional email recipients to receive the data. Data can only be received by the Home Station email.

Note: To remove a recipient from the list, click to highlight it, then click Remove.

Short Message Service (SMS): enter the cellular Phone Number on which to receive text messages containing data. The number must be entered in the following format: 19058732255

Note: If adding an SMS recipient, an unlimited texting plan is recommended for the account associated with the phone number.

FTP Option:

The LevelSender supports data transfer to FTP and FTPS servers.

For FTP file transfer, only a Home Station email address is required. This setup benefits customers with multiple LevelSender stations, reducing the email management workload. This can be useful for large-scale water monitoring and telemetry reporting where email management might not be effective.

Note: Remote changes in LevelSender settings are only possible if a designated email address is assigned.

Steps for FTP setup:

Select to enable file transfer to an FTP/FTPS Server. Enter the settings for your FTP Server, including the Server Subfolder location, Port information, and your User Name and Password. Select your preferred data output format: *.txt or *.csv files.

Note: When using FTPS, ensure the box is checked to enable the Encryption option.

Note: See Section 5.5 for examples of the FTP file output types.

Click **Next** to continue the setup.

Note: Ensure you have added all of the recipients, as you can only make changes to this list when the LevelSender is connected to the PC with the USB cable, they can not be done remotely.

4.2.5 LevelSender Setup

In this step you will set up your LevelSender 5 station Sampling and Reporting Schedule.

- **Location:** enter specific site / location information to identify each LevelSender station.
- **Sampling Rate:** the rate that the LevelSender station collects data from the connected datalogger(s). Sampling Rate can be set from 1 minute to 99 hours.
- **Reporting Rate:** the rate that the LevelSender station reports collected data via email/SMS. Reporting rate can be set from 5 minutes to 99 hours. With each report, the LevelSender will also check for remote updates from the Home Station. Remember to check **Enable Remote Configuration** in Step 3 (Section 4.2.3) of the LevelSender Setup Wizard to allow remote updates from the Home Station.

Note: The LevelSender will use battery power each time it samples, reports, and checks for updates. As such, more frequent intervals will drain the battery more quickly. See Section 2.3.2 for battery life estimates.

- **Start Time:** set a date and time for the LevelSender to start collecting data.

Note: If the start time is earlier than the current time, the LevelSender will start immediately.

- **Number of Dataloggers Attached:** select one or two dataloggers.

Figure 4-10 LevelSender Setup

You can optionally select and program the connected Dataloggers to record simultaneously in there own internal memory as a back-up. Check the box to select independent logging and enter the following details:

Note: When using a Splitter, the number 1 or 2 will identify the Dataloggers in LevelSender Software. The numbers are labeled directly on the Splitter.

- **Select Logger:** select the type of datalogger connected, e.g. Levelogger 5, Barologger 5, etc.

- **Location:** specific site / location information that you input to identify each datalogger.

- **Sample Rate:** the rate at which the datalogger records in its internal memory. Sampling rate depends on the type of datalogger connected.

- **Start Time:** set a date and time for the datalogger to start independent logging.

Note: Programming independent logging in the dataloggers can also be done after setting up the LevelSender station, by sending a remote change via LevelSender Changes tab (Section 4.3).

Note: If the connected dataloggers are already logging, they will be stopped with the startup of the LevelSender, and restarted if you selected the option described above. It is recommended to download the data in the datalogger before connecting to the LevelSender. If you do not enter any settings for the loggers or select the "Start Datalogger" box, the datalogger will automatically be stopped with LevelSender startup and independent logging will not start.

See Section 7 in the Levelogger Series User Guide for instructions on how to download the data from the Levelogger's internal memory using Levelogger PC Software.

To enable the internal barometer to automatically barometrically compensated the water level readings being reported, check off **"Enable Barometer with Unit"**, and select the unit of measurement you would like to use for the pressure reading. Options are psi, kPa, and mbar.

Click **Next** to continue the setup.

4.2.6 Alarm Setup

The Alarm Setup window allows you to set specific alarm conditions for each of the attached dataloggers. An email will be sent to all email recipients, if an alarm condition is met.

Note: An automatic alarm will be sent if the LevelSender battery falls below 60% (2.7 Volts).

For each channel parameter (level, temperature, conductivity) you can set a "High Limit", "Low Limit", and "% Change" alarm event. 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.

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

You will also set the **Maximum Number of Notifications** to be sent 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.

Note: Setting up alarms can also be done after setting up the LevelSender station, and going to the LevelSender Changes tab (Section 4.3).

Figure 4-11 Alarm Setup

Click **Next** to continue the setup.

4.2.7 Pre-Start Diagnostics

The Pre-Start Diagnostic tests are done automatically when you reach this step.

Test LevelSender Battery: this test will fail if the LevelSender battery is below 2.5 volts.

Test Mobile Connection: checks if the LevelSender is connected to the mobile carrier. The possible causes of failure are: improperly inserted SIM Card, low signal strength or power failure.

Send Test Email: If set up, sends a test email through the LevelSender email to the Home Station and recipients.

Note: If the test email was not successful, go to Section 8.3 for troubleshooting options.

Test FTP: If enabled, tests the FTP file transfer.

Test Datalogger: tests the communication on the attached datalogger(s).
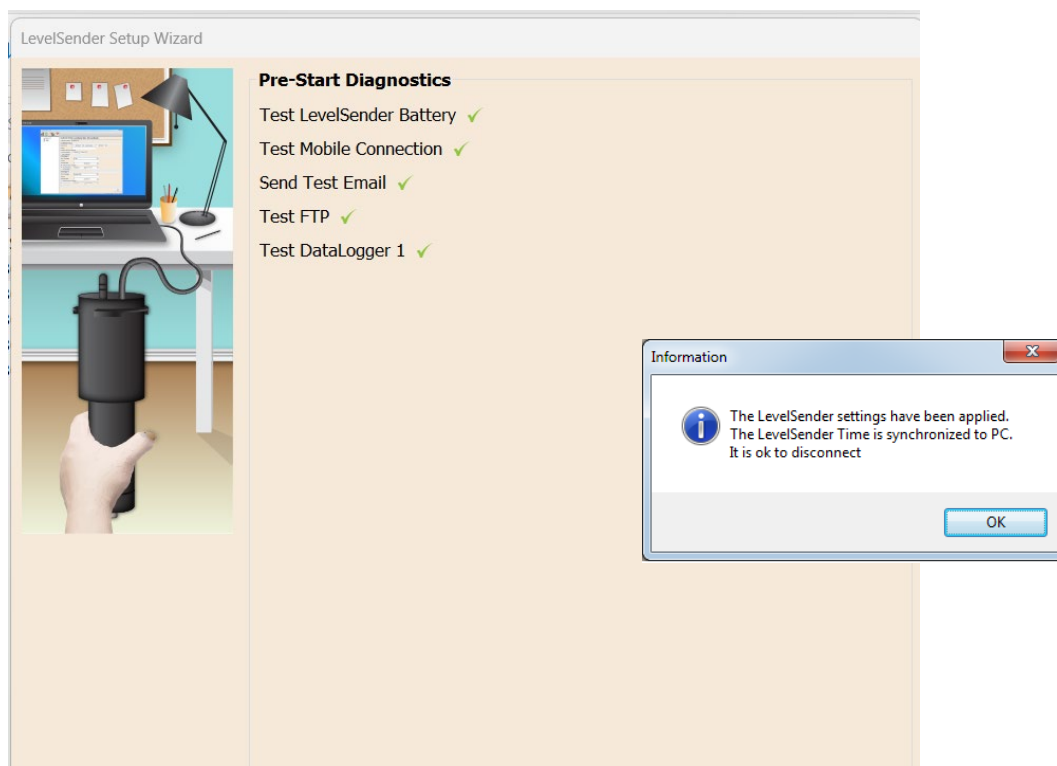
Figure 4-12 LevelSender Pre-Start Diagnostics

When all the tests are passed, click **Start LevelSender** to complete the setup of your LevelSender station. You should receive a message that programming was successful, and that you may disconnect the USB cable. Click OK, and the LevelSender station will start collecting data at programmed start time.

Note: A LevelSender station can be stopped from sampling/reporting by going to the Diagnostic Information tab (Section 8.1), or remotely using the LevelSender Changes tab if the Enable Remote Configuration box was selected during the initial setup, see Section 4.2.3 (will still check for remote updates at report rate, see Section 4.3).

You can check to see that the test emails and text messages were received by the programmed recipients, including the Home Station email, by clicking   .

4.3 LevelSender Changes

A LevelSender 5 can be updated with changes in two ways:

- Directly, by connecting it to a PC with the USB cable and using the LevelSender Software.
- Remotely, by using the LevelSender Changes tab in the LevelSender Software (if enabled – see Section 4.2.3).

Note: You can also send some remote commands using a plain text email to the LevelSender email address (see Section 8.6).

4.3.1 LevelSender Updates via USB

If you need to make changes to the SIM card settings, LevelSender Email, or data recipients, you will need to do this by connecting to the PC with the USB cable and using the LevelSender Setup Wizard.

Select the LevelSender station from the list in the LevelSender Software, click　　　to start the Setup Wizard. See Section 4.2.

If you want to stop the LevelSender, use the **Diagnostic Information** tab (see Section 8.1).

You can use the **LevelSender Changes** tab to remotely update the sampling/reporting schedule for a LevelSender (see Section 4.3.2). You can also update or set up your connected dataloggers to record independently and send alerts for alarm conditions, and enable barometric compensation. You can update data recipients by sending a remote email command (see Section 8.6).

4.3.2 Remote LevelSender Updates

To make changes to a remote LevelSender 5 station, click the LevelSender from the list in the LevelSender Software, then click on the **LevelSender Changes** tab.

The unique email that you set to be associated with the LevelSender will appear in the **LevelSender Email** field (see Section 4.2.3).
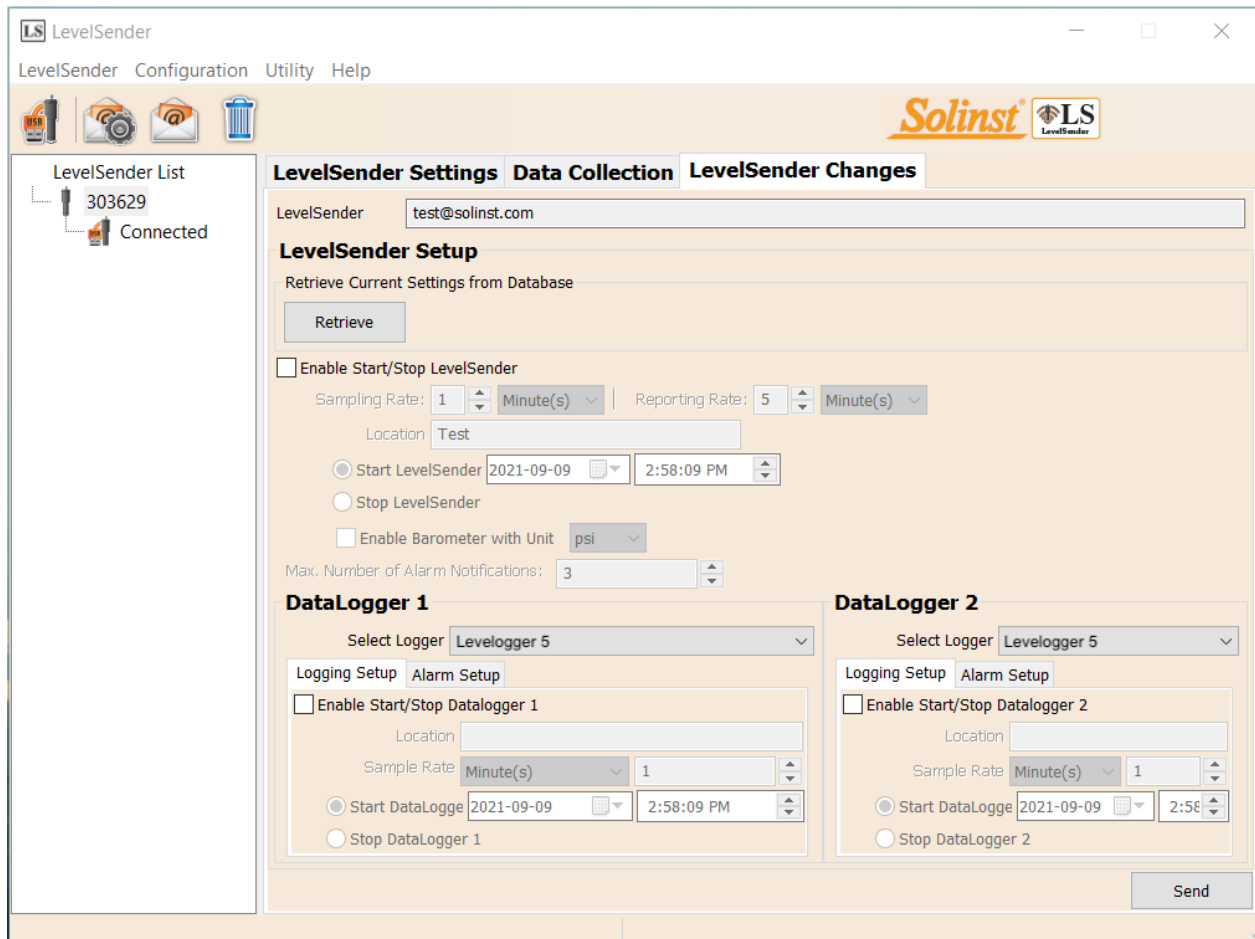
Figure 4-13 LevelSender Changes Tab

Click the **Retrieve** button to obtain the current LevelSender and datalogger settings. The datalogger settings are only available after the LevelSender Software has received at least one data email.

From here, you can edit the LevelSender Setup, including Sampling Rate, Reporting Rate, and Location.

You can set a new Start time for the LevelSender, or Stop a LevelSender from sampling/reporting.

Note: If you Stop a LevelSender, it will stop sampling/reporting, but will continue to check for remote email updates (e.g. a new start time) from the Home Station at the set reporting rate. It will use a small amount of battery and data during these checks.

Note: To stop your LevelSender from reporting **and** checking for updates, it must be done with the LevelSender directly connected to the LevelSender Software using the USB cable and the Diagnostics Info tab (See Section 8.1).

Note: Any changes made in this tab will not be applied to the remote LevelSender until after its next report (they will not occur right away). You should know your LevelSender schedule so you can apply changes at an appropriate time.

There is also the option to enable, or disable the internal barometer (see Section 4.2.5).

You can update or set the connected dataloggers to record independently in their own internal memory. Check the box to enable updates to the datalogger. You can program the following for each connected datalogger:

- **Select Logger:** select the type of datalogger connected, e.g. Levelogger 5, Barologger 5, etc.
- **Location:** specific site / location information that you input to identify each datalogger.
- **Sampling Rate:** the rate at which the datalogger records in its internal memory. Sampling rate depends on the type of datalogger connected.
- **Start Datalogger:** set a date and time for the datalogger to start recording, or select to **Stop** the datalogger from recording if it is already logging.

Note: When using a Splitter, the number 1 or 2 will identify the Dataloggers in LevelSender Software. The numbers are labeled directly on the Splitter.

There is also the option to update or add alarm settings for the connected dataloggers (see Section 4.2.6).

Note: See the Levelogger and Vented Dataloggers User Guides for more information on each datalogger type, and their logging capabilities.

Once you have finished editing the LevelSender settings, click **Send**. You should get a message that the configuration email was successfully sent to the remote LevelSender station.

A copy of this remote LevelSender update configuration email can be viewed in the Sent Email tab in the Data Collection tab (see Section 5.3).

These changes will be applied to the remote LevelSender station at its next scheduled report interval (as set in Step 5 of the LevelSender Setup Wizard (see Section 4.2.5)).

Once the new settings have been applied, an email will be sent from the LevelSender to the Home Station.
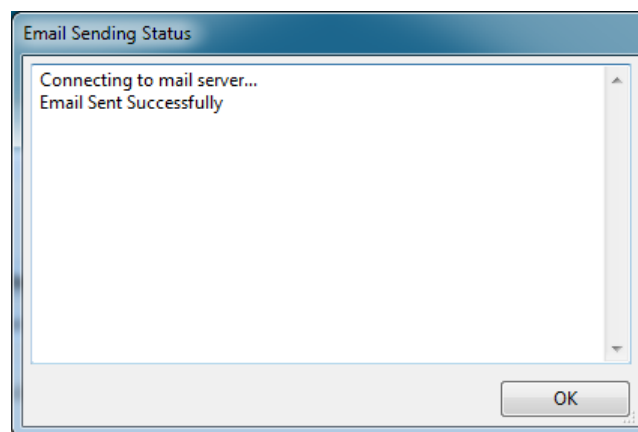

Figure 4-14 Successful Configuration Email Send

5.0 LevelSender Data

Data sent in each LevelSender 5 report can be viewed/accessed in five different ways:

- As an email
- As an SMS (text) message
- Using the LevelSender Software
- In the SQLite database on the Home Station PC
- Your own FTP Server setup

Note: *xle data files are also automatically saved on the Home Station PC in this default location: <C:\Users\Name\Documents\LevelSender\Data> (See Section 5.3.2).

Note: If using Solinst Cloud, data is sent and accessed from the online application simply using your browser. See Solinst Cloud User Guide.

5.1 Data From Email

Data is sent to each Email Recipient at the set Reporting Rate. Each report includes the LevelSender serial number, report number, location, battery life, sampling/reporting schedule, status and report time.

Information about each connected datalogger is also included, such as battery life, total logs in memory, and logging information if they have been set to record independently.

The data from each datalogger sample is then listed. Summary messages are included at the end of the email.

```
283647 LS Report 1


LevelSender                          Logger 1 Samples
Serial: 283647                       Time, Temperature(Deg C), Level(m)
Location: Well 2                     19/08/2021 12:03:20, 23.6470, 0.4508
Battery: 89%                         19/08/2021 12:04:20, 23.6400, 0.4506
Sample Rate: 1 minutes               19/08/2021 12:05:20, 23.6360, 0.4502
Report Rate: 5 minutes               19/08/2021 12:06:20, 23.6310, 0.4504
State: reporting                     19/08/2021 12:07:20, 23.6200, 0.4506
Start Report: 19/08/2021 12:03:20
                                     Logger 2 Samples
Logger 1                             Time, Temperature( C), Level(m)
Location: aug8test1                  19/08/2021 12:03:20, 23.5340, 10.0094
Type: Levelogger 5                   19/08/2021 12:04:20, 23.5390, 10.0095
Serial: 1018258                      19/08/2021 12:05:20, 23.5380, 10.0093
Battery: 98%                         19/08/2021 12:06:20, 23.5350, 10.0097
Total Logs: 60 of 40000              19/08/2021 12:07:20, 23.5300, 10.0098
Log Rate: 0 seconds
Memory Mode: slate                   MESSAGES: Email+SMS report 1, LS reporting, L1 stopped, L2 stopped, commands received 1,
Log Type: linear
State: stopped
Start Logger: 09/08/2021 10:07:45


Logger 2
Location: aug8test1
Type: Levelogger 5
Serial: 2010162
Battery: 96%
Total Logs: 1 of 25000
Log Rate: 60 seconds
Memory Mode: slate
Log Type: event
State: stopped
Start Logger: 09/08/2021 10:02:49
```

Figure 5-1 LevelSender Email Message

5.2 Data From SMS

Data is sent to one SMS Recipient at the set Reporting Rate. The same information that is sent to the email recipients, is seen in the SMS message (see Section 5.1).

LevelSender
Serial: 283647
Location: Well 2
Battery: 89%
Sample Rate: 1 minutes
Report Rate: 5 minutes
State: reporting
Start Report: 19/08/2020
12:03:20

Logger 1
Location: aug8test1
Type: Levelogger 5
Serial: 1018258
Battery: 98%
Total Logs: 60 of 40000
Log Rate: 0 seconds
Memory Mode: slate
Log Type: linear
State: stopped
Start Logger: 09/08/2020

Enter message
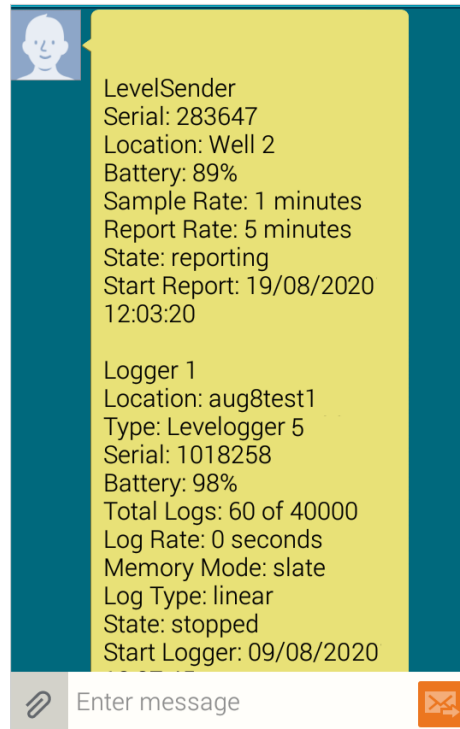
Figure 5-2 LevelSender SMS Message

5.3 Data From LevelSender Software

To access emails and data files, select the station from the LevelSender List in the LevelSender Software, then click on the **Data Collection** tab.
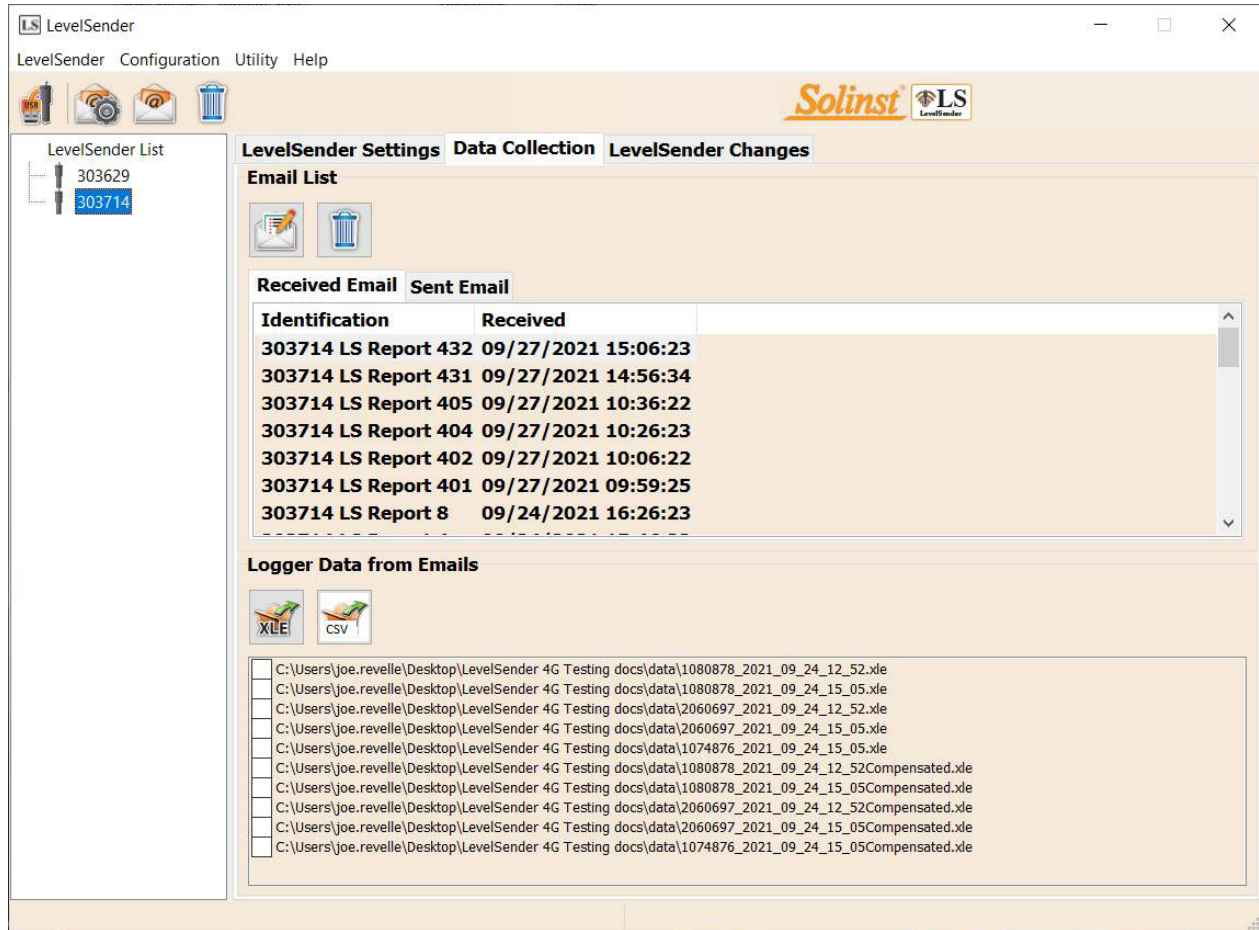
Figure 5-3 LevelSender Data Collection Tab

5.3.1 Viewing Emails

The **Email List** window will display all of the Received Email (Reports) from the selected LevelSender Station. Each Received Email is identified by the LevelSender serial number, report number, and the date/time that it was received.

Sent emails (remote LevelSender update configuration emails) will be displayed in the Sent Email tab. Each Sent Email is identified by the LevelSender serial number, and the date that the update email was sent.

Note: If you open data report messages sent to the Home Station email using the email program and not LevelSender Software, those reports will not be listed in the Received Email window. Only "unread" messages will be listed.

Note: Click to check the Home Station email in the Level Sender Software.

Click ![icon] , or double-click the email in the list, to open the email in a text editor program.

Click ![icon] to delete the selected email.

```
┌─────────────────────────────────────────┐
│ 283647 LS Report 3                  ✕    │
├─────────────────────────────────────────┤
│ │                                    ▲   │
│                                          │
│ LevelSender                              │
│ Serial: 283647                           │
│ Location: aug18_testing                  │
│ Battery: 88%                             │
│ Sample Rate: 1 minutes                   │
│ Report Rate: 5 minutes                   │
│ State: reporting                         │
│ Start Report: 19/08/2020 09:30:36    ▤   │
│                                          │
│ Logger 1                                 │
│ Location: aug8test1                      │
│ Type: Levelogger 5                       │
│ Serial: 1018258                          │
│ Battery: 98%                             │
│ Total Logs: 60 of 40000                  │
│ Log Rate: 0 seconds                      │
│ Memory Mode: slate                       │
│ Log Type: linear                         │
│ State: stopped                           │
│ Start Logger: 09/08/2020 10:07:45        │
│                                          │
│ Logger 2                                 │
│ Location: aug8test1                      │
│ Type: Levelogger 5                       │
│ Serial: 2010162                          │
│ Battery: 96%                             │
│ Total Logs: 1 of 25000                   │
│ Log Rate: 60 seconds                     │
│ Memory Mode: slate                       │
│ Log Type: event                      ▼   │
│                            ┌─────────┐   │
│                            │  Close  │   │
│                            └─────────┘   │
└─────────────────────────────────────────┘
```

```
┌─────────────────────────────────────────┐
│ 283646 Configuration                ✕    │
├─────────────────────────────────────────┤
│ stop report                         ▲   │
│ Stop Logger 1                            │
│ Location: Well 2                         │
│ Sample Rate: 1 minutes                   │
│ Report Rate: 10 minutes                  │
│ Mail Rate: 10 minutes                    │
│ Start Report: 24/10/2020 11:45:01        │
│ Logger 1                                 │
│ Location:  Solinst                       │
│ Log Rate: 15 minutes                     │
│ Start Logger: 1 24/10/2020 11:45:01      │
│                                          │
│                                          │
│                                          │
│                                      ▼   │
│                            ┌─────────┐   │
│                            │  Close  │   │
│                            └─────────┘   │
└─────────────────────────────────────────┘
```
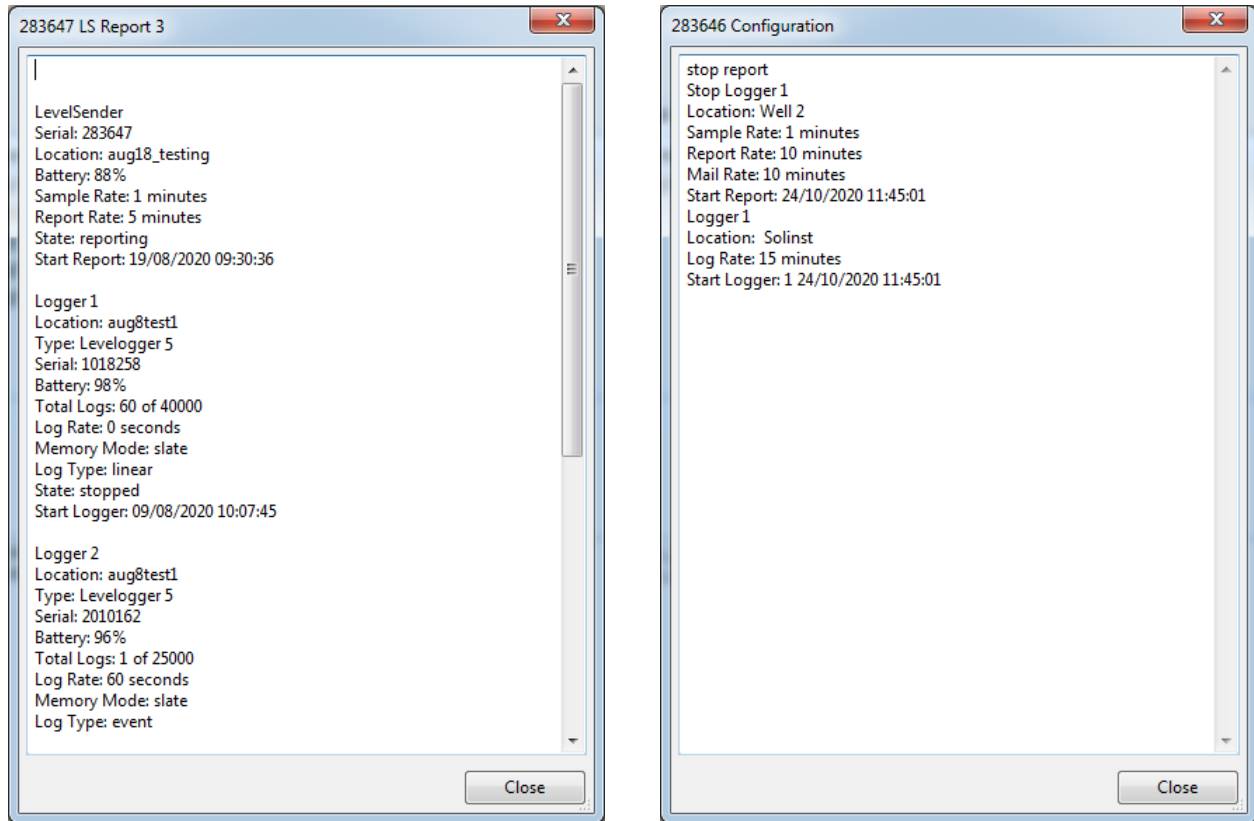
Figure 5-4 LevelSender Data Text File and Configuration Email Text File

Reports from a LevelSender that is using an email account with TLS encryption may come in as multiple Received Emails due to character limitations. The series of reports will be identified by the LevelSender serial number, report number, the date/time the report was received, as well as the datalogger serial number the report contains information/data for. Data from each separate report will still be saved in a single *.xle data file for each datalogger (see Section 5.3.2).
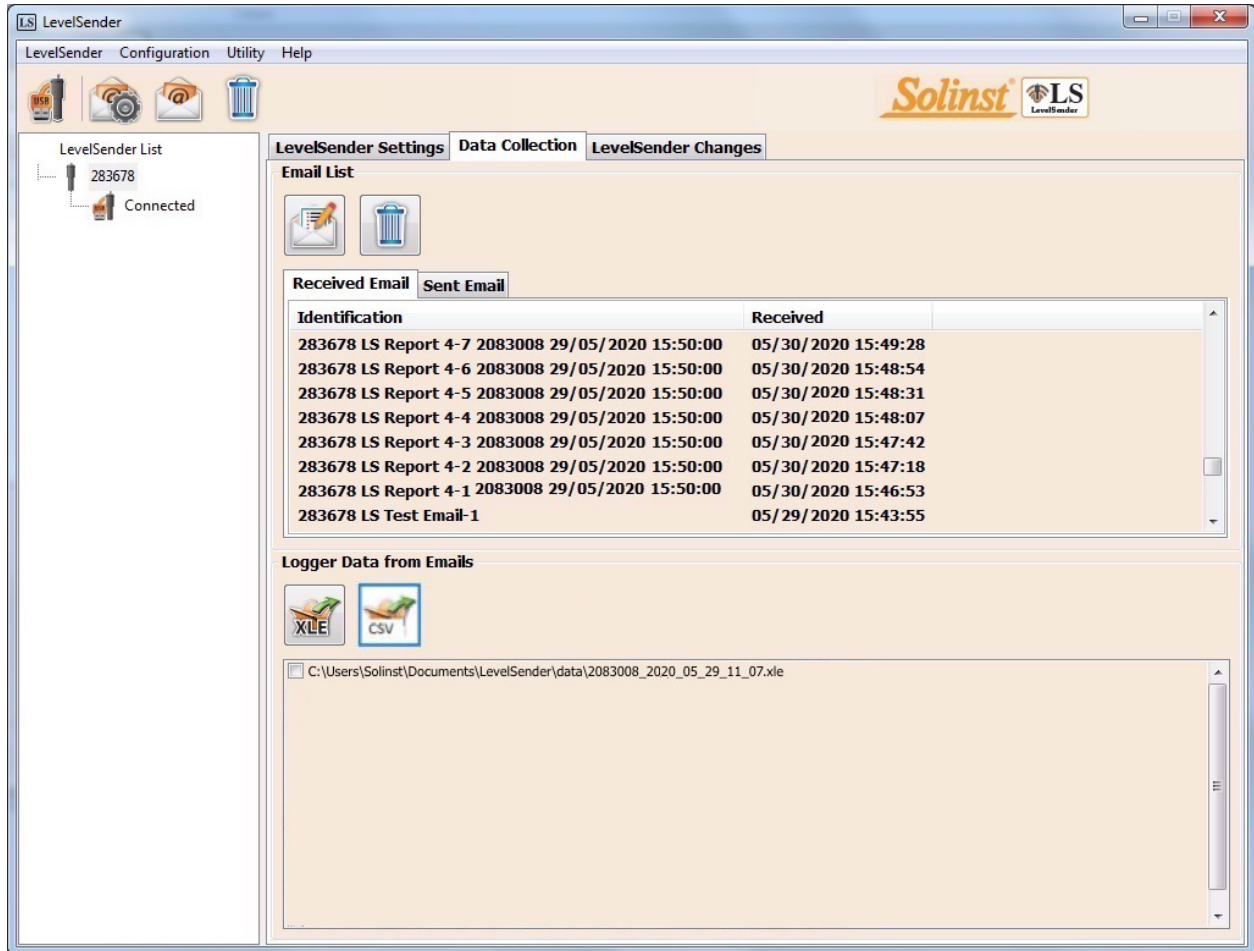

Figure 5-5 LevelSender Data Collection – Email with TLS Encryption

5.3.2 Viewing and Exporting Data Files

Based on the Levelogger data from each Received Email, *xle files are created and listed in **Logger Data from Emails** window.

The files are also automatically saved on the Home Station PC in this default location:
<C:\Users\Name\Documents\LevelSender\Data>

You can change the default location by going to **Preferences** under the **Configuration** menu and selecting a file destination.
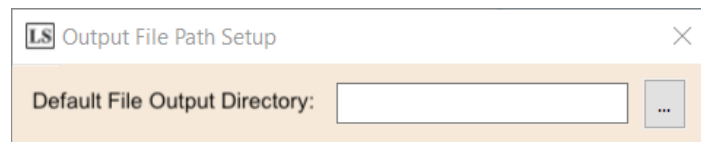

Figure 5-6 Configure Output File Path

Select an *xle file and click to export and save the *.xle file to a different location.

These data files can be opened using Solinst Levelogger Software. See the Levelogger User Guide for more information.

Select an *xle file and click to export and save the file as a *.csv file. These data files can be opened using other programs.
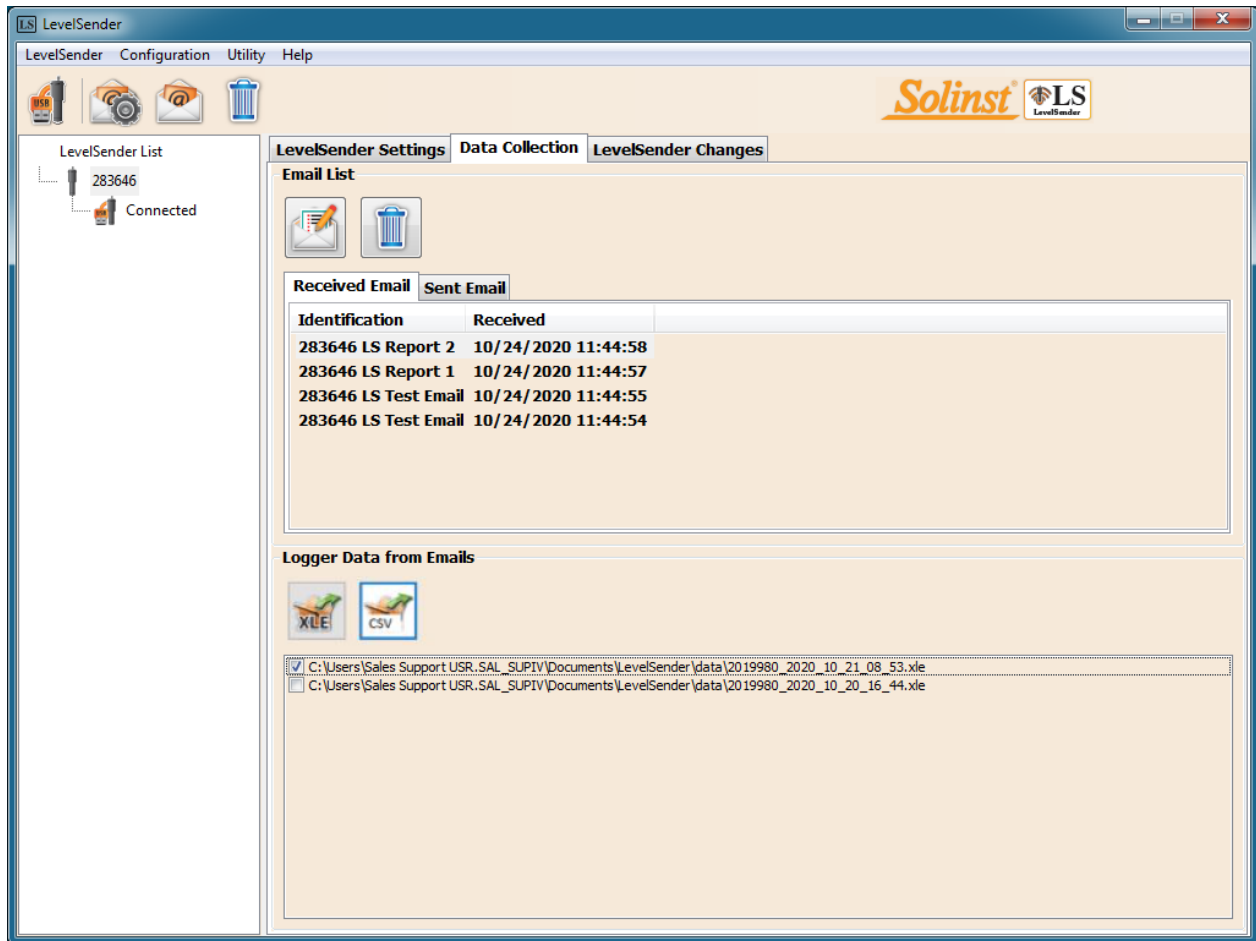

Figure 5-7 Exporting Files

5.4 Home Station Database

Data received in each report from a LevelSender 5 station is placed in a SQLite database (*sqlite file) on the Home Station computer. New data is appended to the existing database. The program will save data to a folder that will automatically be created in your Documents folder on your PC. Typical default directory: <C:\Users\Name\Documents\LevelSender\db>

The SQLite 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.

5.5 FTP Export Settings

Using **Preferences** under the **Configuration** menu, you can set up the transfer of log files to a FTP Folder on your Home Station PC, which will then be transferred to your own FTP Server. You can also enable FTP export of the data during initial set up of your LevelSender. See Section 4.2.4.

Figure 5-8 FTP Export Settings

Select to enable the file transfer, and enter the settings for your FTP Server. Select the location on your Home Station PC for the FTP Folder/Temporary FTP File Directory.

You can also select if the compensated water level (barometer must be enabled) is received as a positive or negative value in the FTP file.

Select the number of samples in the FTP file, e.g. one file per sample (One Sample) or one file containing all samples Based on the Sample Rate and Report Rate. Select whether you'd like to receive the FTP files as *.txt or *.csv files, then click OK to finish the setup.

Note: Text reports can be viewed in a text app (like Notepad or MS Word) or as a CSV document in MS Excel.

Text reports are identified by the LevelSender serial number, report number, and the date/time the report was received. CSV reports are identified by the LevelSender serial number, datalogger serial number the report contains information/data for, and the date/time the report was received.

Figure 5-9 FTP Text Report Example – Opened in MS Excel

Figure 5-10 FTP CSV Report Example – Column Format

6.0 LevelSender Installation

The LevelSender 5 is designed to be conveniently installed in a 2" well casing (4" with an adaptor). However, other installations are acceptable, if proper precautions are followed.

The LevelSender 5 has an IP rating of 67 (dust proof and can withstand immersion up to 1 meter depth for up to 30 minutes), so should not be submerged for longer periods. The operating temperature range is -20 to 60°C.

You should have already installed the SIM card and batteries before configuring the LevelSender 5 using the PC Software, as well as the antenna (see Section 2).

Note: You may want to consider the use of an extended top cap style protective well head. This would allow full access to the LevelSender components at the top of the monitoring well. If made of a plastic, it would eliminate signal interference that protective metal casing can cause.

6.1 Installing a LevelSender in a Well

Each LevelSender 5 station comes with a 2" Well Cap Assembly and a Support Hanger Bracket. To accommodate 4" wells, an optional adaptor is available for use with the 2" well cap base.

The Support Hanger Bracket is recommended to add extra security to the Reader Cable(s) when deployed.

Support Hanger Bracket

Base

Cap

2" Well Cap Assembly

Adaptor

Optional 4" Adaptor
(Does not include the Cap
and Base)

Figure 6-1 LevelSender 5 Installation Accessories

The following is the recommended method for installing a LevelSender 5 in a 2" well with one Levelogger:

1. If you are connecting a LevelSender to a Levelogger already installed in the field with a Direct Read Cable and Solinst Well Cap Assembly, you will need to remove the installation from the well. You may save the well cap base, but you do not need the well cap insert.

Note: Each LevelSender comes with a 2" Well Cap Assembly, without the insert.

Remove Existing Levelogger Installation | Remove the Well Cap Insert from the Well Cap Base

Figure 6-2 Remove Existing Installation

Note: If you are installing a Levelogger and a Barologger in the same well, you will need a splitter to connect both dataloggers to the LevelSender. See Section 2.4.1.

2. Install the well cap base on the well casing.

Figure 6-3 Install the Well Cap Base

3. Wrap the Reader Cable around the Support Hanger Bracket, similar to what is shown in the photo below, leaving about 6" of slack above the top of the bracket. Use zip ties to secure the cable to the bracket.

Note: Providing enough slack above the bracket allows you to lift the LevelSender from the well cap base to make room for a Water Level Meter for periodic depth to water measurements, without disturbing the datalogger(s) from their downhole position.

If installing a Barologger, secure the second Reader Cable to the Support Hanger Bracket using the same method.

The length of Reader Cable wrapped around the Support Hanger Bracket will depend on your application. If you are installing a Barologger in the same well, the Reader Cable/Direct Read Cable connection will need to be staggered from the Leveloggers connection in order to fit in a 2" well casing. Staggering the connections also allows more space for a Water Level Meter for periodic manual depth to water measurements. See Section 6.2.

Note: Ensure the weight of the reader cable is not resting on a zip tie, but instead supported by one of the cutouts in the bracket.

Figure 6-4 Secure the Reader Cable to the Support Hanger Bracket

4. Connect the Levelogger to the Direct Read Cable (see Levelogger User Guide for more information, if required). Connect the Direct Read Cable to the Reader Cable. See Section 2.4 for more details. Slowly lower the datalogger(s) down the well.

Figure 6-5 Connect the Direct Read Cable and Levelogger

5. Lower the assembly until the Support Hanger Bracket seats on the shoulder in the well cap base.

Figure 6-6 Lower the Assembly into the Well

Note: There are three holes in the top of the Support Hanger Bracket the can be used to secure it in the well cap base with flat head screws.

6. Connect the top end of the Reader Cable to the LevelSender (or Splitter). See Section 2.4 for more details.

Figure 6-7 Connect the Reader Cable to the LevelSender

Note: Providing enough slack at the top of the well allows you to lift the LevelSender from the well cap base, in order to make room for a Water Level Meter for periodic depth to water measurements, without disturbing the datalogger(s) from the downhole position.

7. Carefully push the excess Reader Cable(s) into the well, while lowering the LevelSender into position. The LevelSender has flat sides so it fits alongside the Support Hanger Bracket. The LevelSender will seat on the shoulder in the well cap base.

Figure 6-8 Lower the LevelSender into Position

8. With the antenna in a bent position, you can install the well cap onto the well cap base.

Figure 6-9 Install the Well Cap

Note: See the Levelogger User Guide for more specific details on installing Leveloggers and Barologgers.
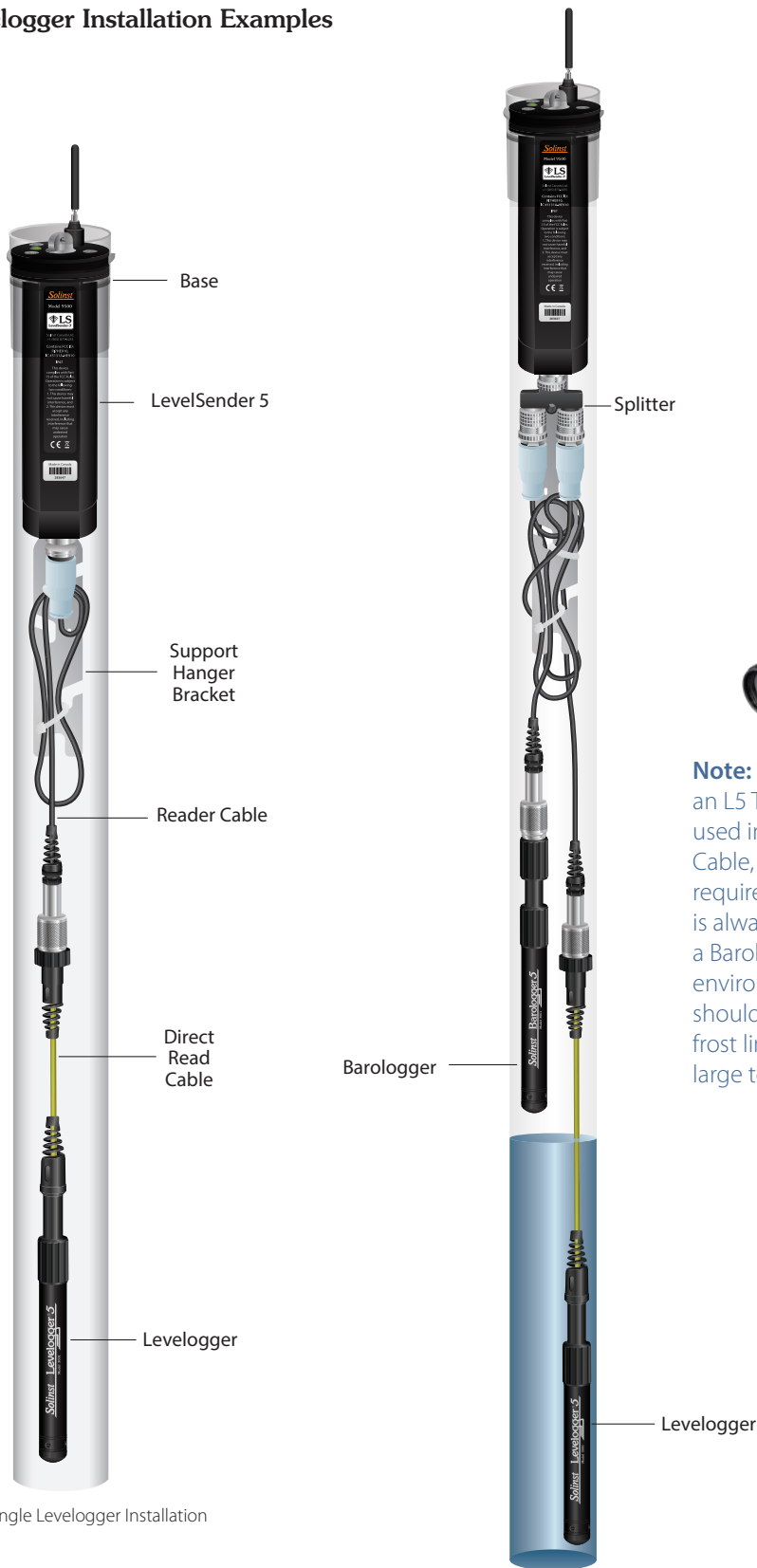
6.2 Levelogger Installation Examples

Base

LevelSender 5

Support
Hanger
Bracket

Reader Cable

Direct
Read
Cable

Levelogger

Figure 6-10 Single Levelogger Installation

Splitter

Barologger

Levelogger

L5 Threaded Adaptor

Note: When installing a Barologger, an L5 Threaded Adaptor can be used in place of a Direct Read Cable, if extra cable length is not required. However, keep in mind, It is always recommended to install a Barologger in a similar thermal environment as the Levelogger, and should be suspended beyond the frost line and deep enough to avoid large temperature fluctuations.

Figure 6-11 Levelogger and Barologger Installation
(Reader Cable Connections Staggered)
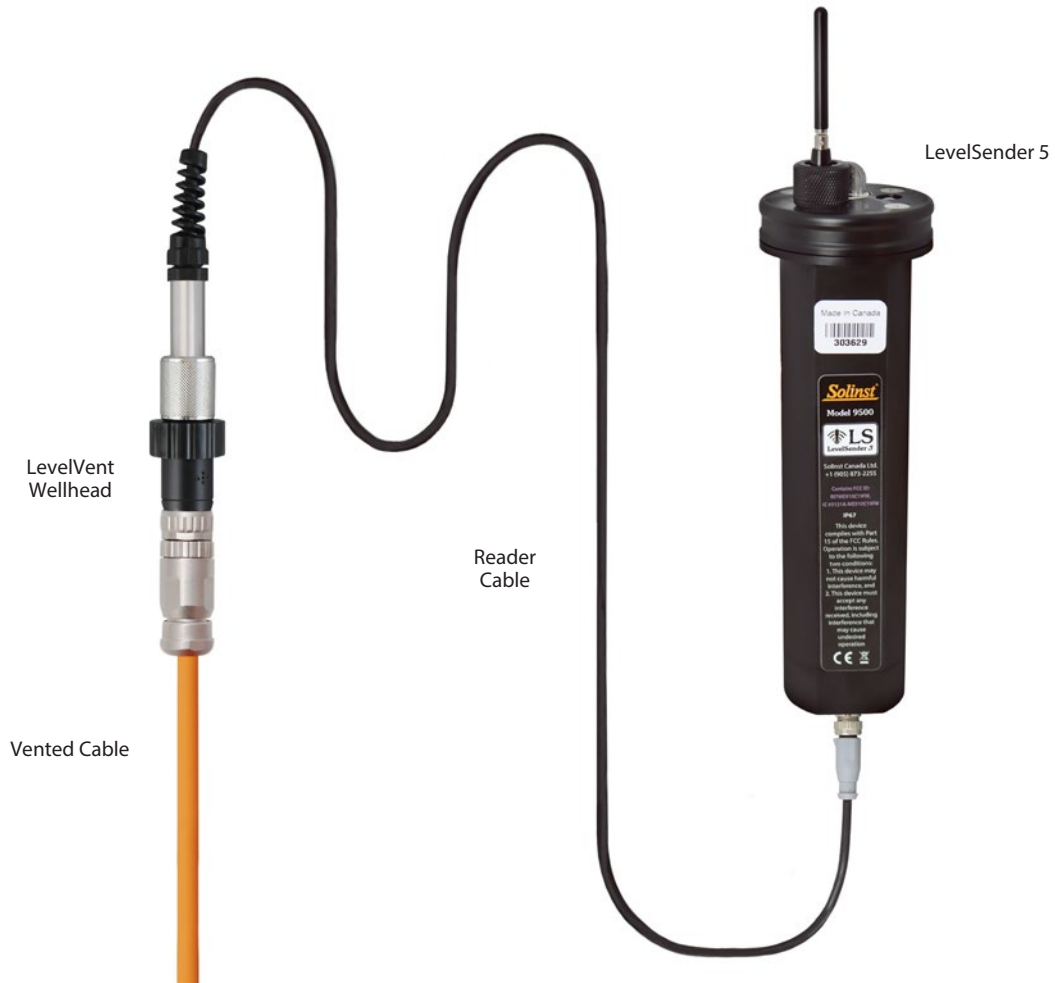
6.3 LevelVent Installation

Figure 6-12 LevelVent Installation

Note: See the Vented Dataloggers User Guide for more specific details on proper installation of the LevelVent.

6.4 Signal Strength and Antenna Considerations

You should consider testing the cellular strength at the site before installing your LevelSender 5. You can use your cellular phone to get an idea.

In general:

1-2 bars means there may be issues with data transmission. You may want to consider an alternate antenna, or adding an antenna extension cable so you can install it outside the enclosure you are using. You may also want to consider moving to a location with a better signal on site.

Note: The type of enclosure planned for the LevelSender could affect the signal strength, e.g. a steel protective well casing can cause signal interference. Mounting the antenna on the outside of the enclosure could resolve this.

3-4 bars is good to excellent strength — there should not be any transmission problems.

6.4.1 Optional Antenna

If a higher gain antenna is required, Solinst offers a LTE Omni wall/pole mount antenna (790–860MHz, 1710–2690MHz and 3400–3800MHz) with a N (female) connector. It is connected to the LevelSender using a 10 ft antenna cable (RG-174 – SMA male to N type male plug). See section 2.1.2 for instructions to access the antenna connection on the LevelSender. The antenna assembly comes with a mounting bracket and gear clamps for connection to a pole/wall or installation of your choice.

Solinst also offers a recommended antenna cable seal kit for ensuring an IP68 rating when using this alternate antenna and cable. See separate full instructions for installing with the seal kit.

Figure 6-13 Connecting an External Antenna with Cable

7.0 LevelSender 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 LevelSender 5, Levelogger 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 Levelogger and Vented Dataloggers User Guides for important information about maintaining your dataloggers.

Replacing the LevelSender batteries will have to be done on a regular basis, and is based on usage. See Section 2.3 for battery life estimates and installation instructions. Battery life percentage is sent with each LevelSender report to allow remote battery level monitoring. **It is recommended to replace the batteries when the percentage reaches 60%.**

When not in use, the Reader Cable should be disconnected and the dust cap replaced on the LevelSender datalogger connection. Batteries and SIM cards should be removed from the LevelSender during storage.

Note: To access the SIM card, you must remove the top cap of the LevelSender. To do this, remove the three screws using a Phillips screwdriver. Loosen the antenna by its base, three full turns. Pull the top cap to remove it along with the antenna.

7.1 Firmware Updates

The Firmware Upgrade Utility is used to upload new firmware files to a LevelSender. The Firmware Upgrade Utility can be launched from the **Utilities** menu at the top of the LevelSender Software.

The zipped firmware file can be obtained from: https://downloads.solinst.com

Make sure to unzip the firmware file after you have downloaded it, so you can access the *.ssf file.

To upload new firmware to a LevelSender, follow these steps:

1. Connect the LevelSender station to the PC using the USB cable (ensure the Reader Cable/Splitter is disconnected and the LevelSender has been stopped – see Section 8.1). Once the LevelSender is connected, check the LevelSender Settings tab to ensure that the battery percentage is above 60% - see Section 3.4).

2. Open the Solinst Firmware Upgrade Utility from the Utilities menu in the main LevelSender Software window. Pick the Com Port to which the LevelSender is connected.

3. Click the 'Open' button, which should open a file dialog asking for the firmware file (*.ssf) to upload. Navigate to the directory where the firmware file was saved on your PC, then click on the file and click 'Open'.

4. Check the 'File Information' box to make sure the opened firmware file is correct.

5. Click the 'Upload Firmware' button, to start the firmware upload process.

6. 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.

7. If, however, a communication error occurs between the "Verifying Firmware" and the "Loading Firmware to Datalogger" messages, then please contact Solinst. You will need to give the Serial Number and explain the exact positioning of the error message.
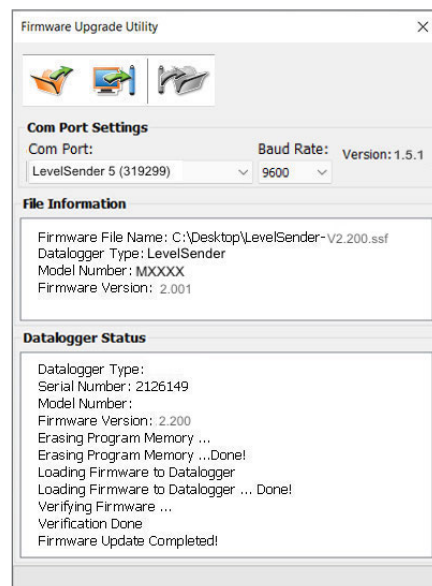

Figure 7-1 LevelSender 5 Firmware Upgrade

Note: It is important that the communication between the PC and the LevelSender is not interrupted during a firmware upload, so please make sure to close any other running programs, including screen savers, and do not disconnect the LevelSender before the upload is finished.

8.0 LevelSender Troubleshooting

Battery life percentage is sent with each LevelSender 5 report to allow for remote monitoring.

8.1 LevelSender Diagnostic Information

The **Diagnostic Information** tab can be used to perform individual diagnostic tests when the LevelSender is connected to the PC with the USB cable.

Test LevelSender Battery: this test will fail if the LevelSender battery is below 2.5 volts.

Test Mobile Connection: checks if the LevelSender is connected to the mobile carrier. The possible causes of failure are: improperly inserted SIM Card, low signal strength or power failure.

Send Test Email: Sends a test email through the LevelSender email.

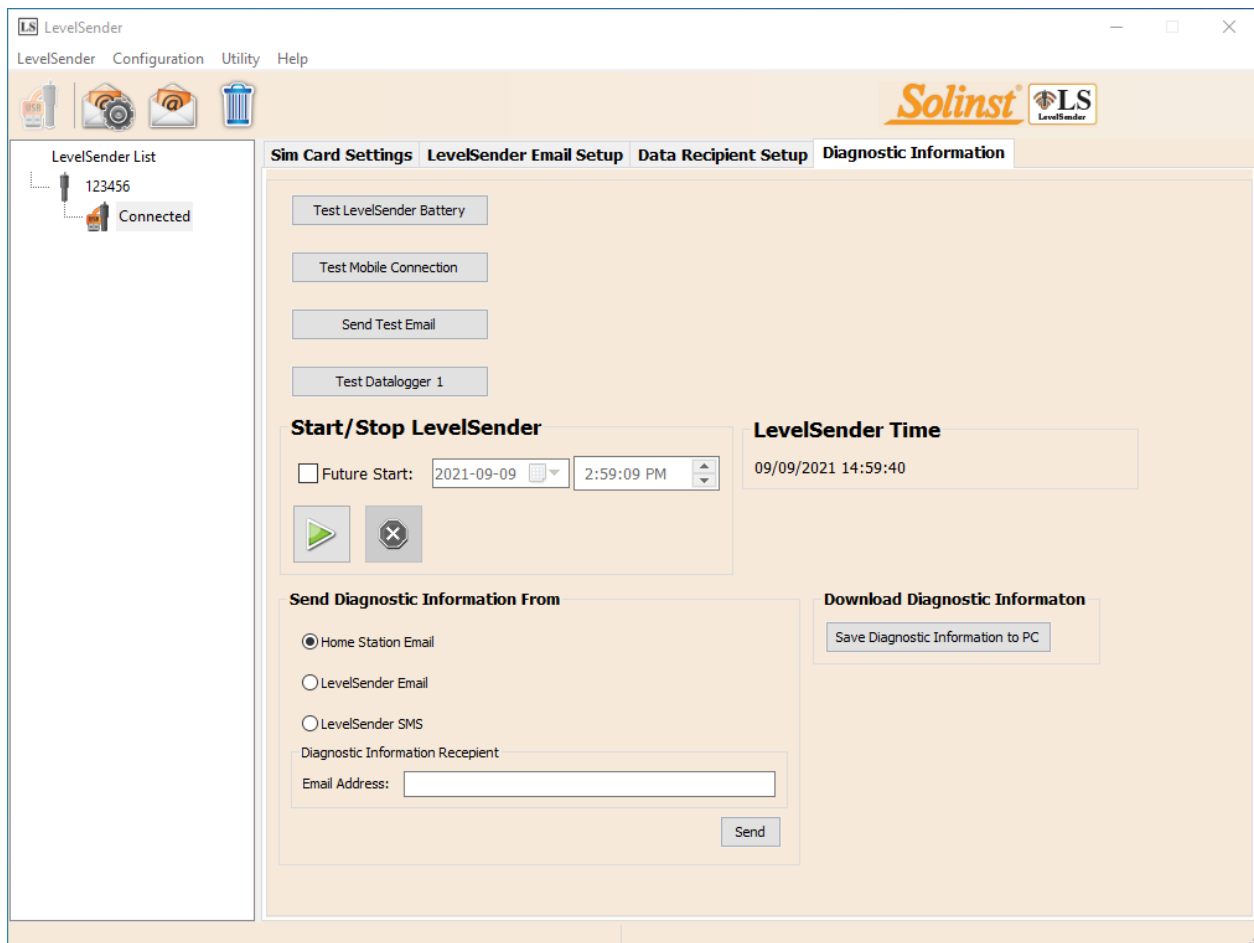**Test Datalogger:** tests the communication on the attached datalogger(s).

Figure 8-1 LevelSender Diagnostic Information

From this tab you can also stop ⊗ or start ▷ a LevelSender immediately, or set a future start time by checking the box, setting the time, and clicking the start button.

After performing all of the tests, you can send a diagnostic report from the Home Station email, LevelSender Email, or LevelSender SMS to an email recipient of your choice. You can also save the information to your PC.

The report can be used for your own purposes, or sent to Solinst for further assistance.

Note: Also for diagnostic purposes, a log file with any reported errors can be found on the Home Station PC. Typical default directory: <C:\Users\Name\Documents\LevelSender\log>

```
283646 Configuration


LS SETTINGS
Serial Number: 283646
Software Version: 1.2.1
Software Build: 811.000
Hardware Version: 2.003
Battery Voltage: 4.9482
State: stop
Report Port: email
Started: 24/10/2020 11:45:58
Stopped: 24/10/2020 11:36:42
Reports Sent: 0
Samples Taken: 0
Emails Sent: 1
Emails Received: 0
SMS Sent: 1
SMS Received: 0
Mail Rate (min): 10
Reply Anyone: on
User Password: off
Admin Password: off
Detail: off
Startup: report
AutoTime: 1
Radio Timing1: TimeOut(ms)=150 Retries=3 Delay(ms)=50 PowerUp(ms)=16000
Radio Timing2: DataTime(ms)=500 UseRxTimers=1 DropTime(ms)=111
Mail Timing: SMSDelay(ms)=3000 MaxMail=20 MailDelay(ms)=0 MailLines=100
Logger Timing: RxTimeOut(ms)=500 Retries=3 Delay(ms)=10 TxTimeOut(ms)=2
Prompt: 0
SMS Report: on
Clear Inbox: 3
DCO: 243
Time Compensation: 0


LevelSender
Serial: 283646
Location: Well 2
Battery: 86%
Sample Rate: 1 minutes
Report Rate: 10 minutes
State: stopped
Start Report: 24/10/2020 11:45:58

Logger 1
Location: remote change test
Type: Levelogger Edge, M5, 3.0040
Serial: 2019980
Battery: 66%
Total Logs: 661 of 40000
Log Rate: 10 seconds
Memory Mode: slate
Log Type: linear
State: stopped
Start Logger: 12/10/2020 12:13:07
```

Figure 8-2 LevelSender Diagnostic Report Example

8.2 Can Not Communicate with LevelSender Software

Download the latest version of LevelSender Software from https://downloads.solinst.com. The most recent version of Software contains the USB drivers required for your Leveloggers to communicate with your PC using USB connected devices (such as the LevelSender). Ensure your LevelSender is using the most recent firmware version found on https://downloads.solinst.com.

8.3 Test Email Failed During Setup

If a test email fails during the initial setup of your LevelSender, check the following:

1. The email settings are correct. Ensure you have selected the proper Server and Login information for the email you are using.
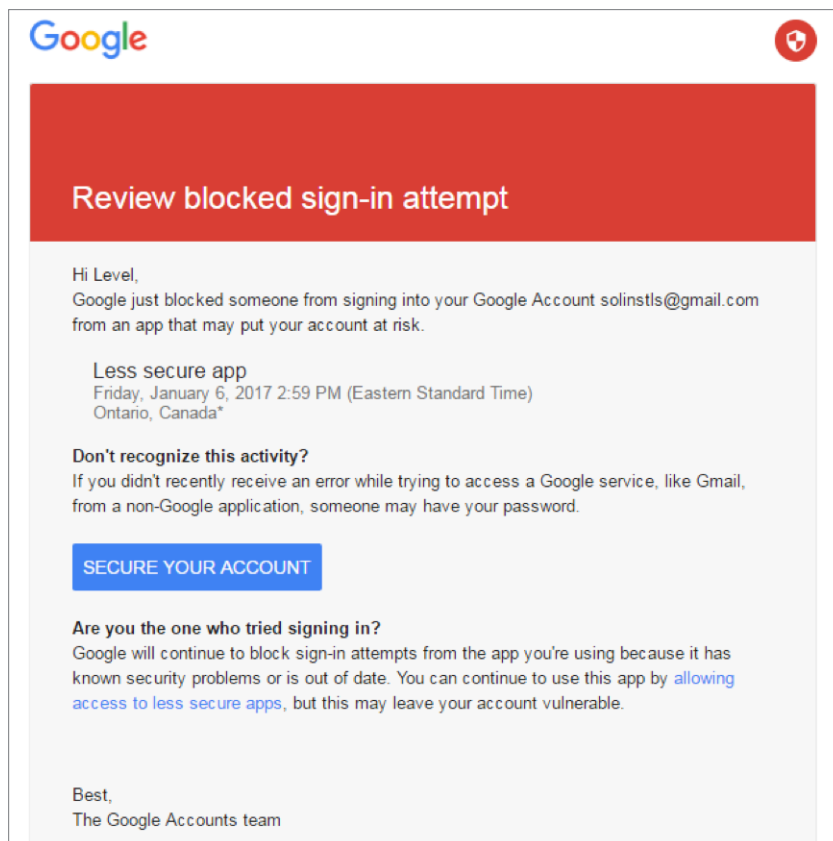2. Refer to Section 9.1.3 for setting up a required App Password.

Figure 8-3 Gmail Warning Email Example

8.4 Home Station Not Receiving Reports

If you are not receiving reports at the Home Station, the following may be causes:

1. You have opened the email report using the email program/app before viewing it in the LevelSender Software. Only 'unread' messages will show up in LevelSender Software.
2. The LevelSender battery has drained. Check the battery percentage from the last LevelSender report. Batteries should be replaced at 60%.
3. The SIM card has been removed, or it is not functioning properly.
4. Installing the LevelSender in a steel enclosure can block the cellular signal. Similarly, something else may be blocking the cellular signal from transmitting properly.
5. The Home Station email settings may have changed. Ensure they match what you have programmed in the LevelSender Software.

8.5 Receiving Erroneous Data Reports

If your reports contain time-stamped data points reading 999999.0, this indicates that the connection between the LevelSender and the Levelogger has been disrupted. This could mean a non-functioning Levelogger, or an issue with the LevelSender Reader Cable or Direct Read Cable/L5 Threaded Adaptor.

```
LevelSender
Serial: 1003
Location: test
Battery: 78%
Sample Rate: 1 minutes
Report Rate: 5 minutes
State: reporting
Start Report: 15/12/2020 16:30:45

Logger 1
NA

Logger 2
NA


Logger 1 Samples
Time, Measurement(units), Measurement(units)...
15/12/2020 16:30:45, 999999.0, 999999.0
15/12/2020 16:31:45, 999999.0, 999999.0
15/12/2020 16:32:45, 999999.0, 999999.0
15/12/2020 16:33:45, 999999.0, 999999.0
15/12/2020 16:34:45, 999999.0, 999999.0

MESSAGES: Email report 1, LS reporting, L1 stopped, L2 off, commands received 1, lost samples 5,
```

Figure 8-4 Example of Report Containing Data Points Showing 999999.0

8.6 Remote Email Commands

Remote commands can be emailed directly to a LevelSender. This can be done through a plain text email sent to the LevelSender email address. No subject header or signature is required. The following table outlines the remote commands available:

Remote Command	Command Syntax
LevelSender Settings – reports the LevelSender settings	LS SETTINGS
Add SMS Recipient and Report – turns on SMS reporting and adds the SMS recipient phone number (both commands required)	SMS RECIPIENT *add phone number* SMS REPORT ON
Change Email Recipient(s) – update the recipients who receive data reports (up to five total) ***ensure all email addresses, including the Home Station email address, are listed as this command resets the entire list	SMTP RECIPIENT: *add email address(es)* (separate each email with a comma)

Table 8-1 Remote Email Commands

9.0 Appendix

9.1 Gmail Setup Information

9.1.1 IMAP Setup

Note: IMAP can be used for the Home Station Email setup. If you use IMAP for the LevelSender Email, the Remote Changes will not work. To accept Remote Changes the LevelSender only accepts POP.

Enable IMAP in your Gmail settings:

1. Sign in to Gmail.
2. Click the gear in the top right ⚙.
3. Select Settings.
4. Click Forwarding and POP/IMAP.
5. Select Enable IMAP.
6. Click Save Changes.

Incoming Mail (IMAP) Server - Requires SSL

- imap.gmail.com
- Port: 993
- Requires SSL:Yes

Outgoing Mail (SMTP) Server - Requires TLS

- smtp.gmail.com
- Port: 465 or 587
- Requires SSL: Yes
- Requires authentication: Yes
- Use same settings as incoming mail server

Full Name or Display Name: [your name]

Account Name or User Name: your full Gmail address (username@gmail.com). Google Apps users, please enter username@your_domain.com

Email address: your full Gmail address (username@gmail.com) Google Apps users, please enter username@your_domain.com

Password: your Gmail password (see Section 9.1.3)

If your client does not support SMTP authentication, you will not be able to send mail through your client using your Gmail address.

Also, if you are having trouble sending mail but have confirmed that encryption is active for SMTP in your mail client, try to configure your SMTP server on a different port: 465 or 587.

9.1.2 POP Setup

Note: Use POP when setting up the LevelSender Email account so it will allow Remote Changes.

Here is how to enable POP in Gmail:

1. Sign in to Gmail.
2. Click the gear in the top right ⚙.
3. Select Settings.
4. Click Forwarding and POP/IMAP.
5. Select Enable POP for all mail or Enable POP for mail that arrives from now on.
6. Choose what to do with your messages after your POP client or device receives them.
7. Click Save Changes.

Although the radio button next to your selected option may not stay selected, Gmail displays the status next to 'POP Status:.' When you enable POP, your settings display 'POP Status: POP is enabled.'

If your POP settings are turned off, the status will indicate that POP is disabled.

Standard configuration instructions:

Incoming Mail (POP3) Server - requires SSL:	pop.gmail.com **Use SSL:** Yes **Port:** 995
Outgoing Mail (SMTP) Server - requires TLS or SSL:	smtp.gmail.com **Use Authentication:** Yes **Port for TLS/STARTTLS:** 587 **Port for SSL:** 465
Server timeouts	Greater than 1 minute, we recommend 5
Full Name or Display Name:	[your name]
Account Name or User Name:	your full email address (including @gmail.com or @your_domain.com)
Email Address:	your email address (username@gmail.com or username@your_domain.com)
Password:	your Gmail password (see Section 9.1.3)

Unless you are using recent mode to download mail to multiple clients, make sure you have opted not to leave messages on the server. Your POP settings in Gmail settings are what determines whether or not messages stay on the server, so this setting in your client will not affect how Gmail handles your mail.

If your client does not support SMTP authentication, you will not be able to send mail through your client using your Gmail address.

If you are having trouble sending mail but have confirmed that encryption is active for SMTP in your mail client, try to configure your SMTP server on a different port (465 or 587).

9.1.3 App Passwords in Gmail Accounts

An App Password is a 16-digit passcode that gives a less secure app or device permission to access your Google Account. App Passwords can only be used with accounts that have 2-Step Verification turned on. The LevelSender does not offer a "Sign in with Google" option, so you can use App Passwords.

How to create and use App Passwords:

If you use 2-Step Verification and get a "password incorrect" error when you sign in, you can try to use an App Password.

1. Go to your Google Account.
2. Select Security.
3. Under "Signing in to Google", select App Passwords. You may need to sign in. If you do not have this option, it may be because 2-Step Verification is not set up for your Account. Ensure it is enabled.
4. At the bottom of the screen, choose Select App and select the app you are using – choose Other (custom made), add a name (e.g. LevelSender 123456), and tap Generate.
5. The App Password is the 16-character code in the yellow bar on your device. Copy and paste this password into the Home Station/LevelSender Email Setup window Login (Information) section Password input field (Sections 4.1 and 4.2.3).
6. Tap Done.

Usually, you will only be required to enter an App Password once per app or device.

IMPORTANT: Remember to check all email alerts in your inbox, and click on Check Activity to reply "Yes, it was me" to any alert email.

9.2 Yahoo Mail Setup Information

9.2.1 IMAP Setup

Here are the settings you will need to configure your mail client or app.

Incoming Mail (IMAP) Server

- Server - imap.mail.yahoo.com
- Port - 993
- Requires SSL - Yes

Outgoing Mail (SMTP) Server

- Server - smtp.mail.yahoo.com
- Port - 465 or 587
- Requires SSL - Yes
- Requires authentication - Yes

Your login info

Email address - Your full email address (name@domain.com)
Password - Your account's password
Requires authentication - Yes

9.2.2 POP Setup

Here are the settings you will need to configure your mail client or app.

Incoming Mail (POP) Server

- Server - pop.mail.yahoo.com
- Port - 995
- Requires SSL - Yes

Outgoing Mail (SMTP) Server

- Server - smtp.mail.yahoo.com
- Port - 465 or 587
- Requires SSL - Yes
- Requires TLS - Yes (if available)
- Requires authentication - Yes

Your login info

- Email address - Your full email address (name@domain.com.)
- Password - Your account's password.
- Requires authentication – Yes

9.3 Additional Email Notes

If you are using an email account with encrypted TLS (e.g. port 587) for the LevelSender email (e.g. outlook.com, hotmail.com) you will not be able to enter additional email recipients to receive the data. Data can only be received by the Home Station Email.

Reports from a LevelSender that is using an email account with TLS encryption may come in as multiple Received Emails in the Data Collection tab.

Older LevelSender units may not be compatible with email accounts using encrypted TLS email (e.g. port 587) for the LevelSender email (e.g. outlook.com, hotmail.com); however, they can be used for the Home Station email.