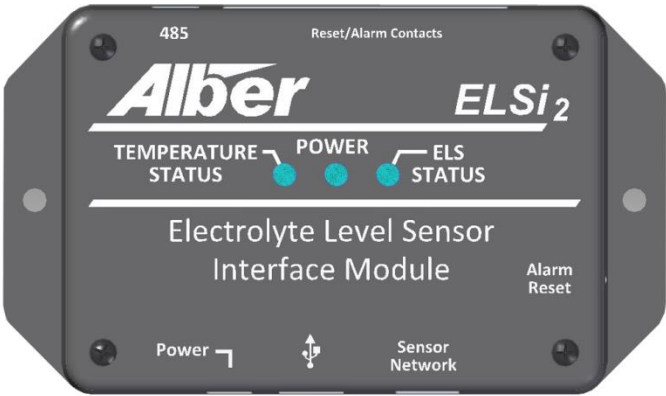# ELS₂ Electrolyte Level Sensor and ELSi₂ Electrolyte Level Sensor Interface

Product Description and Installation Guide

Vertiv Corporation
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1. Product Safety Practices

The following describe safety practices particular to the installation or operation of the product.

Equipment Service

Proper installation and testing are essential to the correct functioning of the system. If you have questions, contact Vertiv and request monitor assistance. Except as explained in this manual, do not attempt to service Vertiv equipment.
Any adjustment, maintenance or repair of this product must be performed by qualified personnel. Contact a Vertiv customer service engineer and request assistance. Only qualified and trained personnel may perform the operations described in this manual. All safety information must be read, understood, and strictly adhered to before installing, powering up or using the equipment or software (the "system".)

Equipment Operation

The protective features of this product may be compromised if it is used in a manner not specified in this guide and/or related operation or installation instructions. This manual describes general installation of the system. If the system has features or accessories not described in this manual, contact Vertiv.

Fuses

For continued protection, fuses with the required rated current, voltage, and type, such as normal, slow blow, fast blow or time delay, must be used.

Operating Damaged Equipment

Do not operate damaged equipment. Equipment that appears damaged or defective must be made inoperative and secured against unintended operation until repaired by qualified service personnel. Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture or any other reason, remove power and do not use the product until safe operation can be verified by qualified service personnel. If necessary, contact Vertiv to ensure the safety features are maintained.

Substituting Parts or Modifying Equipment

The power cord should only be replaced by an equivalent of the same type and rating. Contact Vertiv if a replacement power cord is needed. Do not replace with an inadequately rated power cord.

Do not substitute parts or modify equipment. Due to the possibility of introducing additional hazards, do not substitute parts or perform any unauthorized modification to the product. If necessary, contact Vertiv to ensure the safety features are maintained.

Insulation Rating For Wires

Use only wire supplied with the installation kit.

2. Product Description

The ELS$_2$ Electrolyte Level Sensor is a non-invasive level sensor with incorporated temperature monitoring designed for quick installation and easy set up. This device complies with the NERC PRC-005 requirements for electrolyte level inspection. With this sensor, you eliminate unnecessary remote site visits and will eliminate the required quarterly inspection of battery electrolyte level in your battery string.

An ELS$_2$ system will include one sensor module to be attached to each cell for monitoring electrolyte level and temperature. Each of these modules will be connected back to a system interface module called the ELSi$_2$ for processing of data for alarm analysis and reporting.

3. Features

3.1 ELS$_2$ Sensor Module System Features

An ELS$_2$ is mounted on each cell to monitor electrolyte level and temperature. Features for the ELS$_2$ Sensor module include:

- Monitors electrolyte level and temperature of each individual cell within the string
- Electrolyte/Temperature Alarm LED indicates one of the following conditions:
  - Low Electrolyte Level Alarm
  - Critical Alarm (Incremental Electrolyte reduction beyond Low level; or possible attachment issue detected)
  - Sensor Detachment (Fallen Off) Alarm
  - Temperature Alarm
- Power/status LED
- Designed for simple field installation or replacement
- Firmware upgradable
- Demo/diagnostic mode button

3.2 ELSi$_2$ Interface Module System Features

One ELSi$_2$ module is required for every 62cell group and will include the following features:

- Fault LEDs for cell level (incudes Low electrolyte, Critical alarm, sensor detachment), temperature and hardware failures (includes Sensor not responding, Network not responding or detached network cable)
- Form C relays for cell level, temperature and hardware failures
- Configurable alarms for latching and non-latching
- USB interface for viewing real-time data and configuring system
- RS-485 interface for connecting to Vertiv battery monitors or customer owned building management systems
- Communicates Modbus protocol
- Provide power to all ELS$_2$ modules
- Alarm reset button
- Remote alarm reset using wet contacts or via Modbus

4. Materials Received List

4.1 Parts List

The following is a list of all the parts associated with the ELS_2 Electrolyte Level System installation. If any parts are missing please contact your Vertiv representative.

Part Number	Photo/Drawing	Description
1008-251		ELS_2 - Electrolyte level sensor module Up to 62 modules per system Ref dwg with dimensions
1008-250		$ELSi_2$ - Interface module for ELS_2 One module per 62 cells/ELS_2 sensors Ref dwg with dimensions
1108-100		ELS_2 – Sensor Mounting Cradle Assembly One Cradle and One Cable Lock per Sensor Module
1408-151		ELS_2 – Cradle Installation Alignment Tool
1108-170-R6 1108-170-R8 1108-170-R10 1108-170-R18 1108-170-01 1108-170-02 1108-170-03 1108-170-04 1108-170-05 1108-170-06 1108-170-10 1108-170-15		Cable, ELS_2 Sensor and $ELSi_2$ Interconnect Lengths and quantity vary depending on string configuration 1108-170-XXX RXX = Length in inches XX = Length in feet

1108-170-20 1108-170-25 1108-170-35		
1108-171-02 1108-171-10 1108-171-25 1108-171-50 1108-171-100		Cable, ELSi$_2$ to BDS-256 alarm interface 1108-171-XXX XXX = Length in feet
1108-172-10 1108-172-25 1108-172-50 1108-172-100		Cable, ELSi$_2$ to UXIM alarm interface XXX = Length in feet
1108-173-10 1108-173-25 1108-173-50		Cable, ELSi2 alarm interface Open 1108-173-XX XX = Length in feet
1108-176-50 1108-176-100		RS-485 Cable
KIT-1208-100		ELS2 Communication Interface Kit: • 2140-036: Term BLK 11Pos.200 CTR • 2140-048: PLUG 2POS .150 CENT. • 2025-108: USB Cable
KIT-4000-101		ELSi$_2$ Power Kit: • 4000-101: 12VDC power supply • 6003-001: AC power cable
KIT-4000-099		BDS-256XL/ELSi2 Power Kit • 4000-099: 24V to 12VDC Inverter • 6003-029: 12V Power Cable • 6003-080: 50' Zip Cord
4200-217		ELS$_2$ Documentation KIT • 590-2117-501A/SL-29432/4200-140: ELS$_2$ PDG/Installation Guide

		• 2027-040: CD Software Configurator ELS$_2$
5400-017		Plastic Scraper
1608-001		Cleaning Wipes
2400-114		Replacement Cell Labels •

Table 2 - Inventory List (Continued)

5. ELSi$_2$ Interface and ELS$_2$ Sensor Module Installation

5.1 Overview

The following diagram illustrates how the ELSi$_2$ interface module and ELS$_2$ sensor modules are connected on a string of batteries. The supplied cables are determined at time of ordering and are tailored for a specific string configuration. Refer to the following sections for detailed information on installing the ELS$_2$ system.
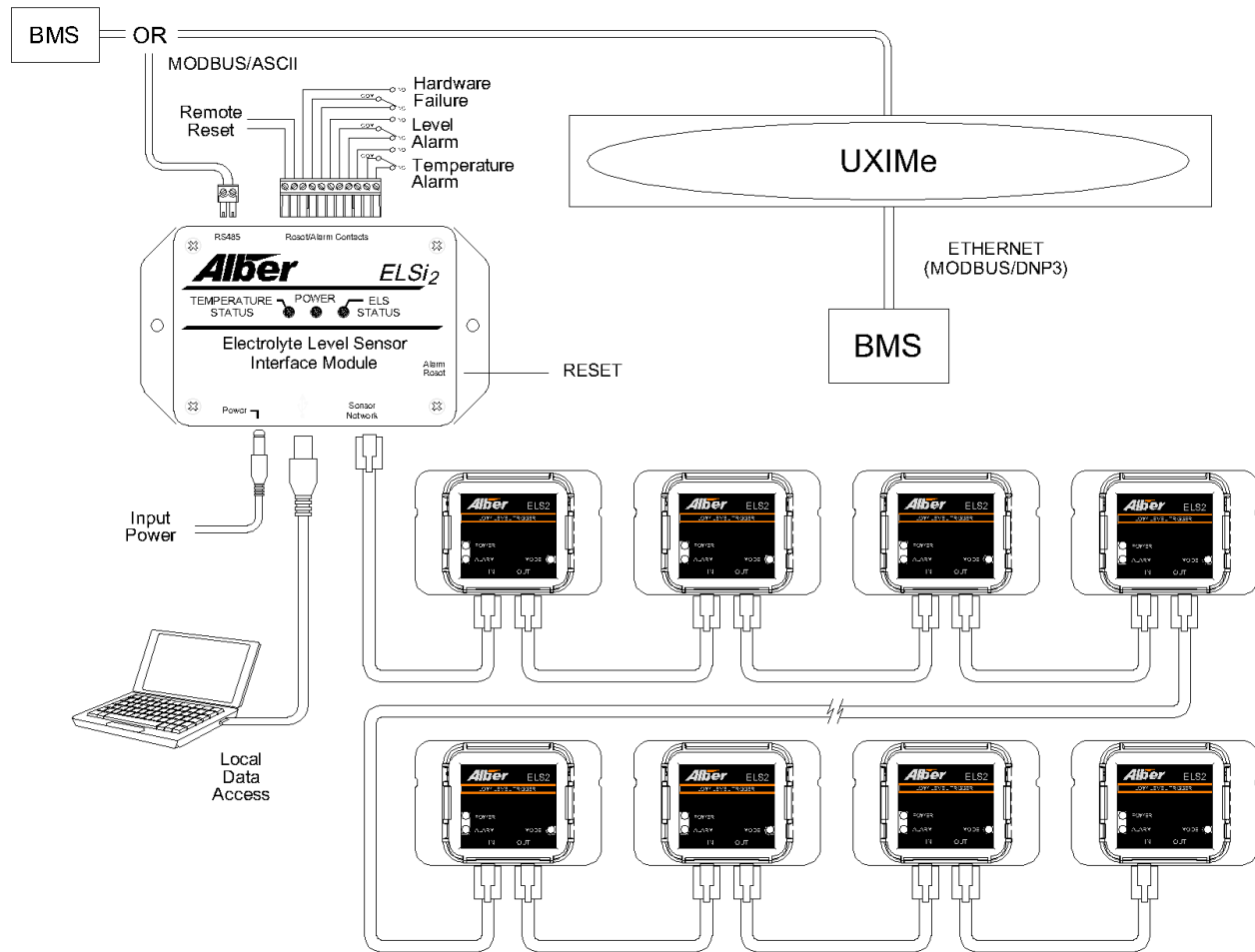
Figure 1 - ELSi₂ Interface and ELS₂ Sensor Module Connections

5.2   ELSi₂ Interface Module Installation

Mount the ELSi₂ module securely on the wall or some other surface suitable that will allow access to the module for viewing the LEDs or gaining access to the USB for connecting to a PC. Two 3/16" mounting holes are provided. Ensure that the location selected is within the distance of the supplied interface cables. This cable length is specified at time of ordering and will be one of the 1108-170-XX cables. One ELSi2 module is required for every 62 ELS₂ sensor modules.

Note: The alarm reset button allows to manually resetting the alarms on the ELSi₂ interface module by pressing the button on the right side of the module for 5 seconds or by providing 5V on the alarm reset input. All alarms on the ELS2 sensor modules must be cleared before resetting the alarm on the ELSi₂ interface module.

The table below describes the connections on the ELSi₂ interface module.

Figure 2 - ELSi₂ Interface Module

Power source	12VDC. Connect the supplied power supply to the power jack on the side. If integrating to a UXIMe, this power connection can be made directly from that unit
USB	The USB connection is for connecting a computer to configure the system or to view data real-time.
ELS₂ "Sensor Network" Connection	The RJ11 ELS₂ jack connects the four conductor CAT5 cable from the ELSi₂ interface module to the "In" jack on the first ELS₂ sensor module. ⚠️ **Warning**: Verify that the <u>output</u> of the ELSi is connected to an ELS <u>input.</u> <u>Do not connect the RJ11 output jack to the output of any ELS.</u>
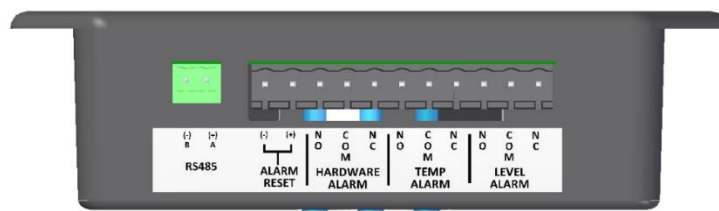
Figure 3 - ELSi₂ Interface Module Alarm Contacts Jack

RS-485	The RS485 connection is used for connecting directly to the UXIMe battery monitor or a customer building management system. Refer to the UXIM(e) PDG for the RS-485 connection description.
Reset/Alarm Contacts	There are three sets of form "C" Contacts and can be connected directly to an Vertiv monitoring system or Building Management

Connection	System. See figure 3 ELSi$_2$ Interface Module Alarm Contacts Jack for more detail. **Note:** • For connecting to BDS-256XL battery monitors, the optional digital input module will need to be installed on the BDS-256XL Controller. • For connecting to UXIM or UXTM battery monitors, the digital inputs should be configured as dry contact inputs. Refer to the PDG of the respective product for digital input the connection description.
Remote Alarm Reset	Allows an external set of contacts to remotely reset the alarms by providing a logic level of 5V between these two pins. What is this?
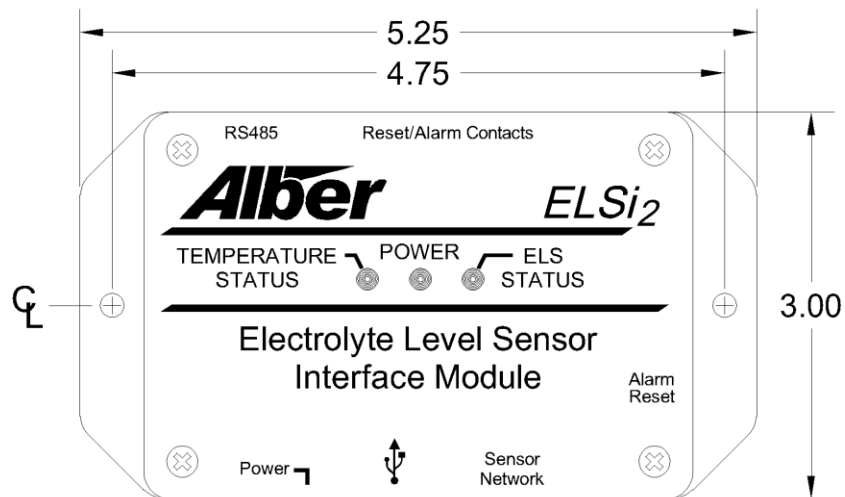
5.3   Mounting the ELS$_2$ Sensor on the Battery Case

⚠️ **Important**: Surface preparation is extremely important, and should be carried out to Vertiv's specification.

If existing cell number labels need to be relocated, use the provided plastic scraper to remove the existing labels.

Replacement Battery Numbering Labels are available.

⚠️ **Important**: The ELS$_2$ sensors will not function properly if mounted on stickers or labels.

If the cell has electrolyte levels affixed with lables, then try relocating the ELS sensor.

If relocation of the ELS$_2$ is not possible, then the electrolyte level stickers will have to be removed using the provided plastic scraper.

Use the provided cradle and alignment tool to place the sensor's cradle in the correct position for electrolyte level monitoring.

Use the alignment tool inserted inside the sensor cradle as shown in Figure 4

Figure 4 - Alignment tool in Cradle.

For mounting the ELS$_2$ sensor cradle, follow these steps:
1. **Verify the electrolyte level in the battery is over the middle level between the low and high-level lines. If the electrolyte is below the average level, add more distilled water.**
1. Clean battery case surface where sensor will be mounted.
    a. If the cells are excessively dirty, Vertiv recommends using NAB Citrus Cleaner Concentrate (https://northamericanbio.com) cleaning solution as an alternative to the wipes included in the kit. This solution cannot be used in the concentrated form and requires dilution (8oz per 1 gallon for dilution). After use the battery surface must be wiped off with water using a new rag.

⚠️ **Important**: First clean all the cells comprising the battery to allow for the required drying time.

The closed-cell 3M adhesive attached to the cradle will not function properly if the cells are not dry prior to mounting the cradle.
Do not mount the cradles until all the cells have been cleaned with the provided wipes.
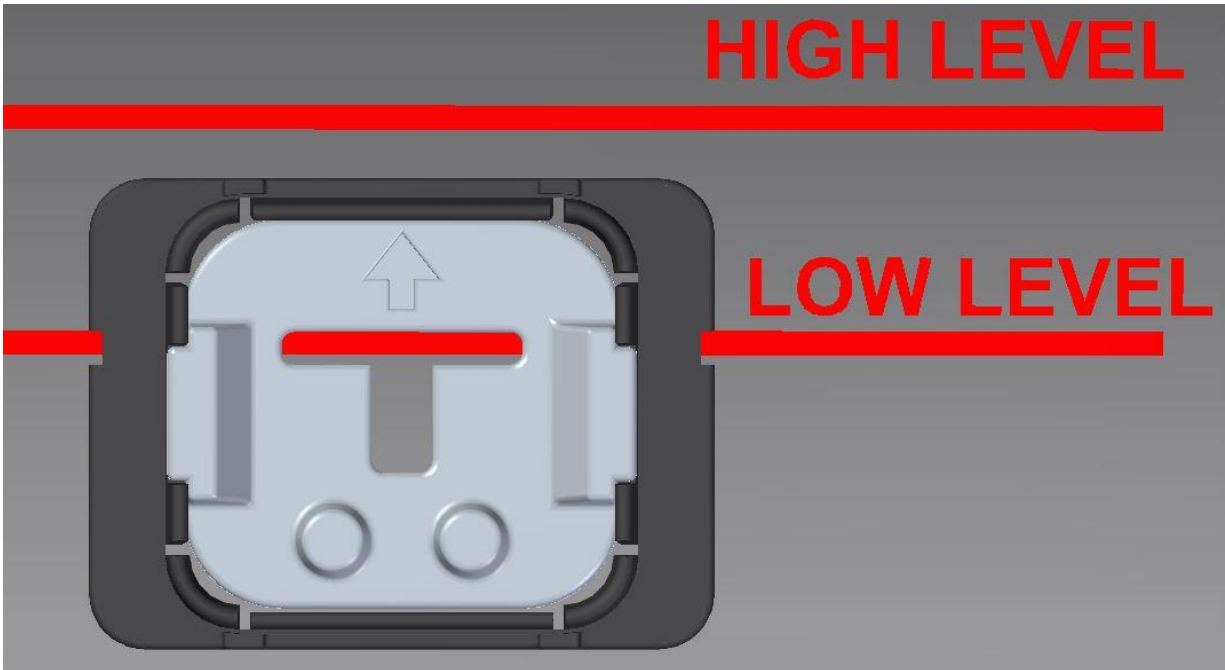
Figure 5 - Alignment Tool

2. Peel off the protective cover on cradle's double side adhesive tape.
3. Place the alignment tool inside the cradle and find the right position of the cradle in the battery case. Do not allow the cradle to touch the battery case until the cradle is in the right position.
   a. Move the cradle until the alignment tool top opening shows alignment with the battery case low level line bottom edge as shown in Figure 5.
   b. ⚠️ **Important**: Make sure that no paint, scratches of opaque labels are visible through alignment tool openings.
   c. Apply a firm pressure on the cradle to fasten on the battery case using the cradle's adhesive tape.
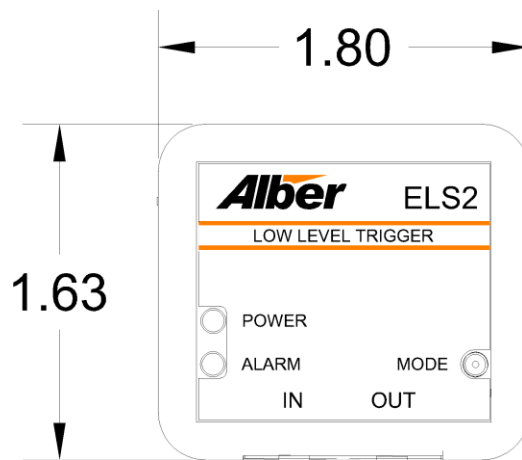
5.4   Connecting the ELS$_2$ Sensor Modules

⚠️ **Warning**: Remove the power to the ELSi$_2$ prior to connecting the ELS$_2$ sensors.

⚠️ Important: Total length of sensor interconnecting cable network should not exceed 165 ft (with 62 sensor network).

Do not change ELS$_2$ sensors with power applied to the ELSi$_2$.

The following table describes where the connections go on the ELS$_2$ sensor module.

Figure 6 - ELS$_2$ Sensor Module Connectors

"In" jack	The RJ11 "In" jack on the first ELS$_2$ sensor module connects the four conductor CAT5 cable from the ELSi$_2$ interface module "Sensor Network" jack.
"Out" jack	The RJ11 "Out" jack connects the four conductor CAT5 cable from the first ELS$_2$ sensor module to the "In" jack on the second ELS$_2$ sensor module. This is the same for each additional ELS$_2$ sensor module on the battery string. For example, The "Out" jack on the second ELS$_2$ sensor module goes to the "In" jack on the third ELS$_2$ sensor module.
Mode Button	Reserved for future use

The Sensor will now snap fit into the Sensor Cradle.

5.5   Network discovery

When all the sensors are interconnected and the first sensor is connected to the ELSi$_2$ module, use the ELS Configurator Software to setup the sensor's network and verify the sensors' operation.

To discover ELS sensors:

1. Connect the ELSi$_2$ module to a computer via the USB connector.

2. Power on the ELSi$_2$ module.

3. Launch the ELSi Configurator Software and press **Connect to Monitor**.

4. Click **Tools – Device information – Discover Sensors** to see a list of connected sensors and each sensor's MAC address and operational status. If the number of sensors discovered is lower than the number of connected sensors go to chapter 5.8 in order to troubleshoot the network connection.

5.6   Using the ELSi Configurator

⚠ **Important: Visit** www.vertivco.com/en-us/products-catalog/monitoring-control-and-management/software/alber-software/ **to guarantee that the software is up to date.**

From the ELSi Configurator, you can configure the ELSi$_2$ module for sensor alarm thresholds, monitor battery cell temperatures and levels; view the status of the sensor alarms, view device and sensor information, run reports, and upgrade the firmware on the ELSi$_2$ module or the ELS sensors.

To view real-time statistics:

Click **Real-Time Data – Temperature** for the temperature readings or click **Real-Time Data – Level** for the electrolyte level readings.
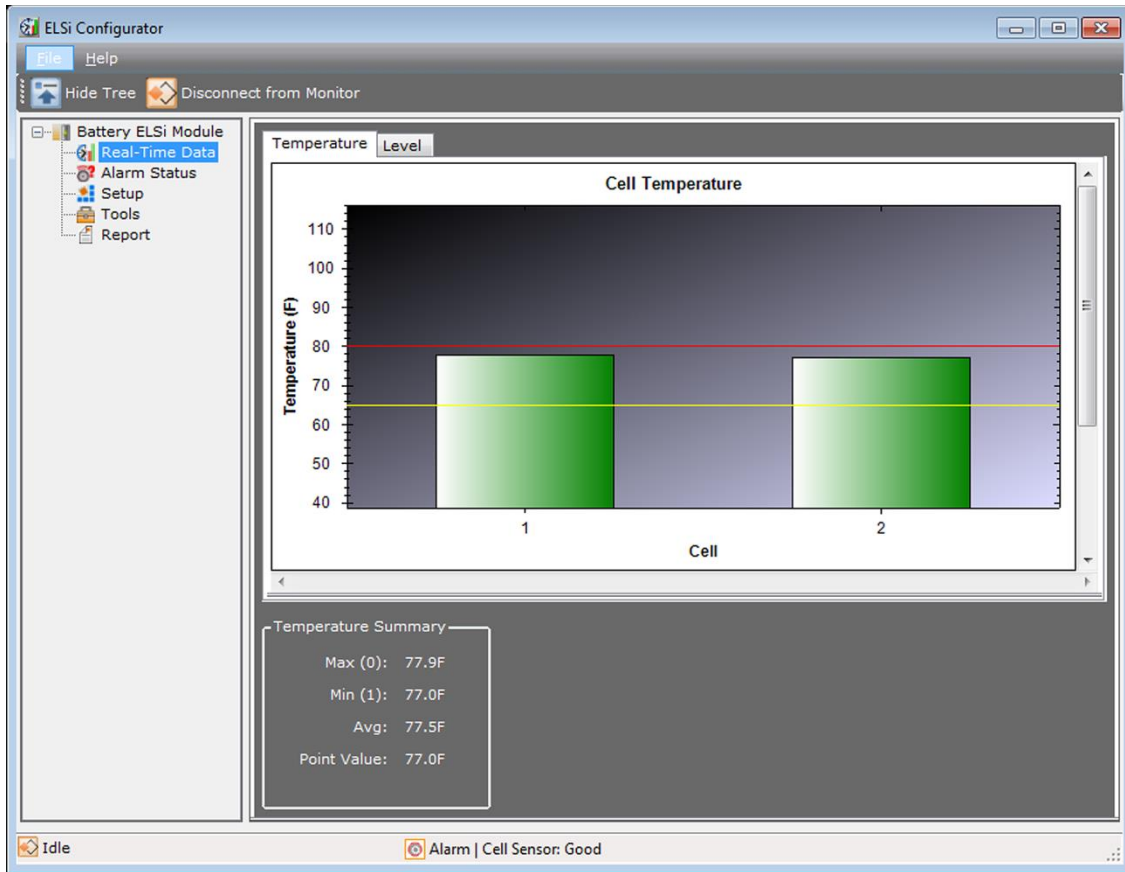
Figure 7 - Real-Time Data Screen

NOTE: The color of the bars indicating cell temperature levels can be red, yellow or green. Red indicates that the cell temperature is beyond the high threshold, yellow indicates that the cell is beyond the low threshold and green indicates that cell temperature is within the threshold limitsCell electrolyte bars on the graph appear "green" when the level is normal and "Yellow" and will shrink to half of the height when the electrolyte level is low or critical. The cell level bar will be missing if the sensor is detached from the battery surface.
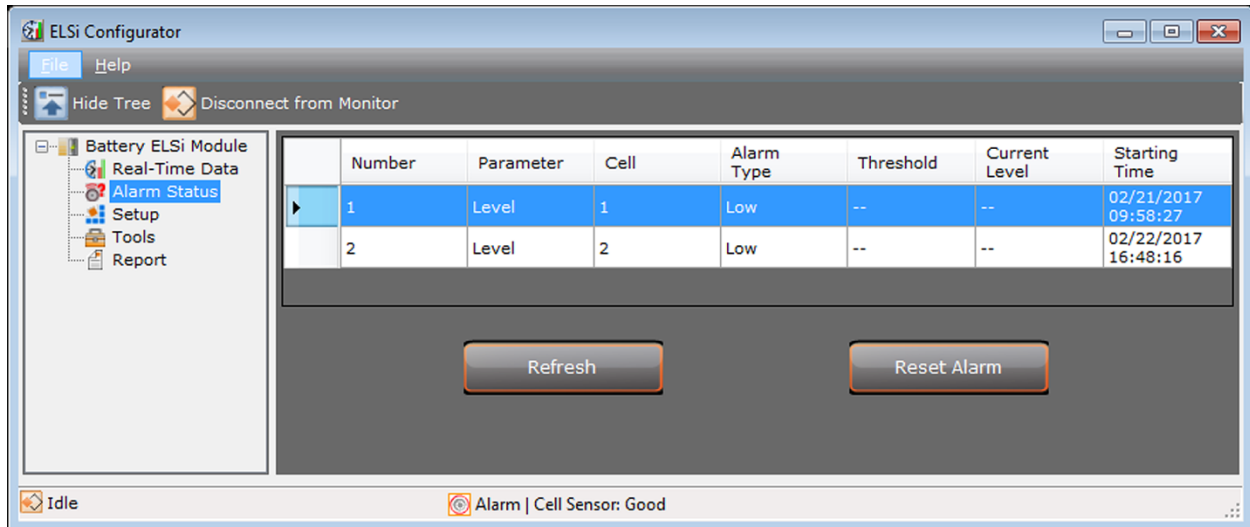
To view and reset a sensor alarm:

1. Click **Alarm Status**.

2. Click **Refresh** to reload the sensor status page.

   -or-

   Select a sensor and click **Reset Alarm** to reset the sensor.

   Alarm reset is a global command. It will reset all the alarms for all the sensors.

Figure 8 - Alarm Status Screen

To view and configure the ELSi₂:

1. Click **Setup – General**.

2. Select the installation date from the Install Date drop-down field.

3. Select the RS-485 protocol and enter the RS-485 or MODBUS Address.

NOTE: Standalone units use MODBUS protocol. If you are using the ELSi₂ module with another monitoring unit, select Integrated. The system will send temperature and level readings to the UXIMe monitor to handle alarms.

4. Select the temperature unit and select the Normal mode, then click **Apply**.

   -or-

   Click **Factory Default** to reset the ELSi₂ module.

   Unit needs to be set to operate in "Normal" mode. Normal mode is for regular monitoring and Test mode is for testing purpose.

To view and configure alarm temperature thresholds:

1. Click **Setup – Alarm Thresholds**.

2. Enter the maximum and minimum temperature thresholds.

3. Select Enable or Latch and click **Apply**.
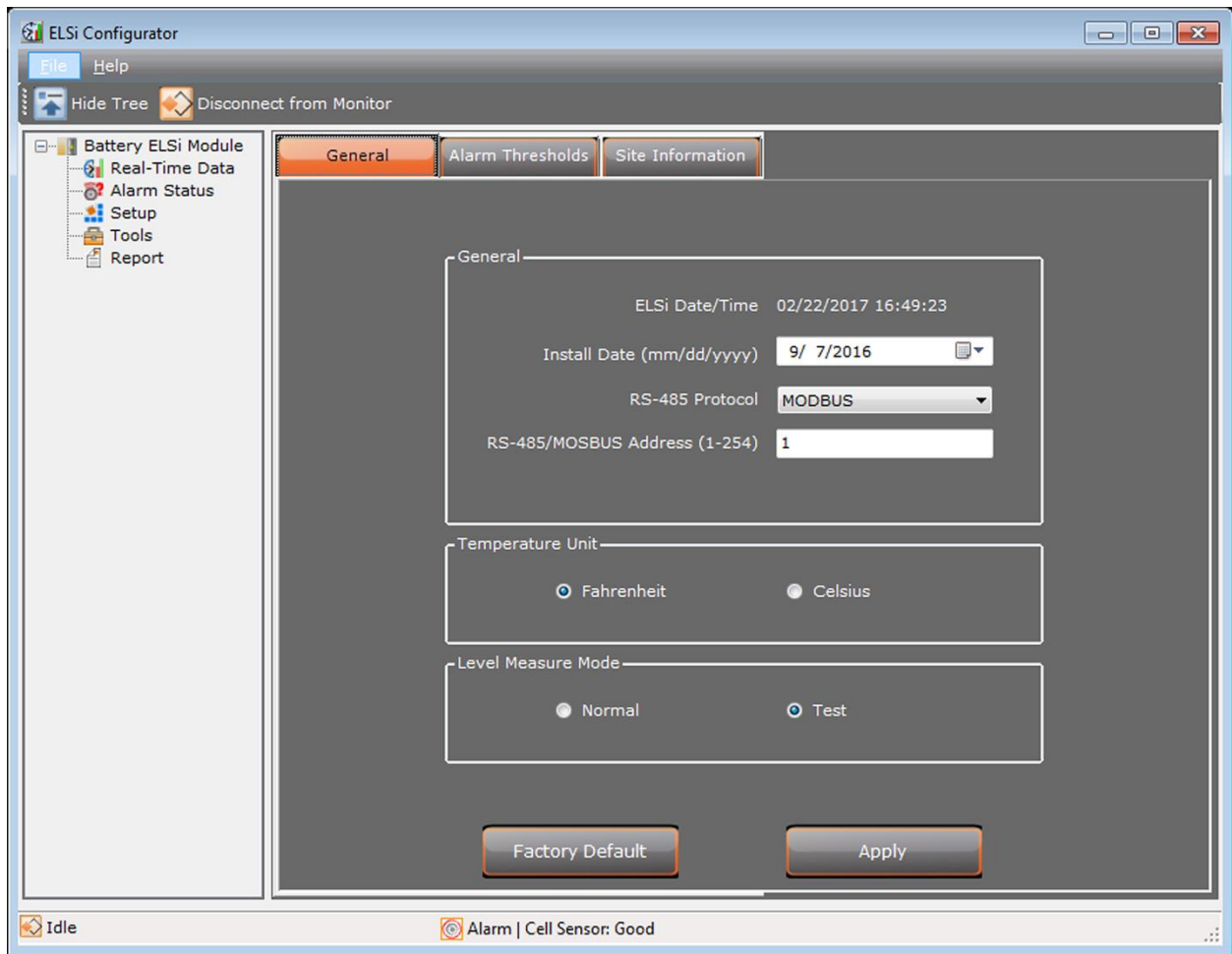
NOTE: Pressing the Refresh button will read threshold information from the monitor.

NOTE: You must manually clear a latched alarm.

To view and configure site information:

1. Click **General - Site Information**.

2. Enter the site location name, battery name, string name and click **Apply**.

3. Enter the equipment identification and click **Apply**.

Figure 9 - Setup Screen

To view and configure module and sensor information or to discover sensors:

1. Click **Tools – General** to view module information.

2. Click **Device Information** to view sensor information and discover the sensor network.

3. Click **Diagnostic** to troubleshoot the system.

4.   Click **Boot log** to view ELSi2 boot statistics.
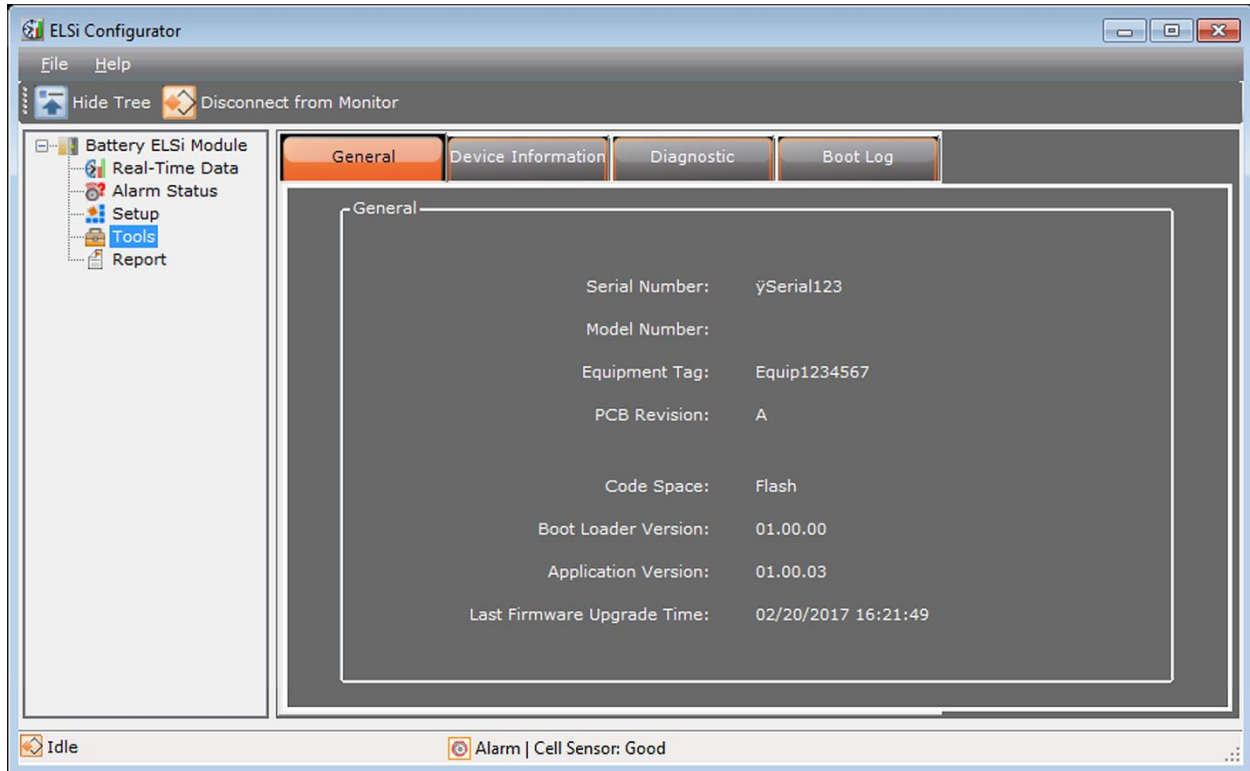
Figure 10 - Tools Screen

To upgrade ELSi₂ firmware or ELS2 Sensor firmware:

⚠️ **Important: Visit** https://www.vertivco.com/en-us/products-catalog/monitoring-control-and-management/software/alber-software/ **to guarantee that the software is up to date.**

Note: PC settings should disallow interruptions (like lockout) during the FW Upgrade or the the FW Upgrade may fail.

1. Click **File – Firmware** Upgrade.

2. Select either ELSi or ELS Sensors and click **Yes**.

3. Browse to and select the firmware file, and click **Open**.

4. Click **OK** when the upgrade process is complete.

To create a report:

⚠️ **Important: Always generate a report as part of a complete commissioning procedure.**

1. Complete the fields and click **Create Report**.
2. Type a name for the file in the Save As window.

Figure 11 - Report Screen

5.7   Testing the ELS$_2$ Sensor Module

The electrolyte level sensor module has two operational modes: Normal and Diagnostic mode. Diagnostic mode is also known as Demo mode. Normal mode is the default operational mode.
In Normal mode, each sensor remains in stand by and performs an electrolyte and temperature reading only when commanded by the ELSi$_2$ module. The ELSi$_2$ scans all sensors every 3 minutes. When an alarm condition is detected by a sensor, it indicates the condition to the ELSi$_2$ and it stores, analyzes and commands the corresponding sensor to indicate the alarm condition on its LED.
In demo or diagnostic mode, the sensor operates in standalone mode. It performs a level and temperature reading every 5 seconds and indicates the alarm condition on the alarm LED. In this mode the sensor can be removed from the cradle and moved over and under the electrolyte level line to test the detection capability. There is no communication between ELS$_2$ and ELSi$_2$ in this operational mode.
To enter in demo mode:
Apply power to the sensor while holding the Mode button pressed power LED blinks.
To leave demo mode:
Cycle power to the unit.

5.8   Troubleshooting

The electrolyte level system features several diagnostic tools that will be useful to troubleshoot and identify the source of issues during installation of the ELS system.
In order to verify the electrolyte level detection capability of the sensors, use the Demo/Diagnostic mode.
The ELSi configurator software also offers a diagnostic tool that will become handy when diagnosing connectivity issues as well as a mean to verify LEDs, Relays and buttons on both ELSi$_2$ and ELS$_2$ modules.
In order to access these tools navigate to the screen: Tools> Diagnostic. In this screen the operator can exercise the different LEDs in the ELSi$_2$ and ELS$_2$ modules, the Relay outputs on the ELSi$_2$ modules as well as test functionality of the remote and local reset alarm switches in the ELSi$_2$
One example of the use of this tool is during the network discovery. In case that the number of discovered sensors is smaller than the number of sensors connected the user can turn ON any LED on the last sensor discovered and this will make it easier to locate the sensor on the string and verify/reseat the connections on the following sensor.

6. Monitoring the ELSi₂ Interface Module and ELS₂ Sensor Configuration

6.1   ELSi₂ Interface Module and ELS₂ Sensor Configuration Diagram

This diagram shows how the ELS$_2$ sensor indicates an alarm when the electrolyte level in the battery gets too low.

⚠️ **Important: The worst case electrolyte level below the Low Level line is 150-mils.**

All ELS$_2$ sensors will have a low level alarm when the electrolyte drops 150-mils below the Low Level line.

There is no requirement for the electrolyte level above the Low Level line, but it is recommened to maintain the electrolyte level per the battery manufacturer's specification.

Figure 12 - ELSi2 Interface and ELS2 Sensor Module Configuration Diagram

The following Monitoring scenarios will occur after the installation is complete.

On the ELSi$_2$ interface module, the panel indicators will show the following:

- **Power LED**:
  - o   Pulsing Green when the unit is in normal operation during normal scan.
  - o   Pulsing Amber-Red when there is a hardware alarm in the systems (usually a network communication error).
- **Temperature Status**:
  - o   Solid Green when all temperature sensor readings are between the alarms thresholds.
  - o   Solid Red when one or more sensors in the string have a temperature reading outside or the predefined thresholds.
- **Level Status**:
  - o   Solid Green when all level readings are Normal.
  - o   Solid Red when one or more sensors in the string indicate a low level condition.

On the ELS$_2$ sensor module, the panel indicators will show the following:

- **Green LED** – Pulsing green LED indicates proper operation of the ELS$_2$ sensor module. Every 3 minutes the green LED stays lit to show that the ELS$_2$ sensor module is taking an electrolyte and temperature reading.
- **Red LED** – Indicates that the battery does not have the proper electrolyte level or temperature reading.

6.2   Remote Monitoring and Control

The system can be integrated to one of Vertiv's battery monitors by connecting the ELS2's alarm relay outputs to the monitor's digital inputs.

- For BDS-256XL monitor Integration:
    - o The optional digital input module will need to be installed on the BDS-256XL Controller.
    - o The alarm cable provided with the ELS2 system (1108-171-XX) should be connected between the ELSi2 relay outputs and the BDS-256XL digital inputs.
        - The mapping of the digital inputs in the monitor is as follows:
            - Digital Input 1: Level Alarm – NO
            - Digital Input 2: Temperature Alarm – NO
            - Digital input 3: Hardware Alarm – NO

- For UXIM/UXIMe Monitor Integration:
    - o The digital inputs on the monitor must be configured as DRY CONTACTS.
    - o The alarm cable provided with the ELS2system (1108-172-XX) should be connected between the ELSi2 relay outputs and the UXIM/UXIMe digital inputs.
        - The mapping of the digital inputs in the monitor is as follows:
            - Digital Input 1: Level Alarm – NO
            - Digital Input 2: Temperature Alarm – NO
            - Digital input 3: Hardware Alarm – NO

The ELS2 system can be also connected via RS-485 to the user's Building Management System by using MODBUS protocol.

7. Specifications

7.1 ELSi$_2$ Interface Module

LEDs

Red LED – System Alarm
Green LED – Status/Power

Alarms

2 Form C relay contacts (2A at 30Vdc)
Alarm reset button

Input Power

12VDC, 0.75A Max
(Powered from 100-240VAC using supplied AC-DC Adapter)

        AC-DC Adapter
        Input   85 – 264VAC, 47 to 63Hz
        Output   12V DC, 18W max

Communications

RJ11 to ELSi2 interface module

Packaging

ABS Plastic Housing
4.25" W (5.25" w/flange) x 1.45" H x 3.00" D
Mounting: Two .18" holes located 4.75"apart.

7.2 ELS$_2$ Sensor Module

LEDs

Red LED – Low Level Alarm
Green LED – Status / Power

Input Power

12VDC, 300mA via RJ11 from the ELSi$_2$ interface module

Communications

RJ11 to ELS$_2$ sensor module

Packaging
ABS Plastic Housing
1.80" W x 1.59" H x 0.5" D

7.3   System Specifications

Safety Approvals
   UL61010-1
   EN61010-1
   IEC61010-1

EMC Approvals
   EN61326-1
   FCC part 15 class A

Operating Environment

Temperature range:	0°C to 50°C (32°F to 122°F)
Humidity range:	0% to 80% RH (non condensing) at 10°C to 31°C.
	0% to 50% RH (non condensing) at 32°C to 50°C.

For Indoor use only.