Alber™ Battery Capacity Tester Integrated (BCTI) System

Installer/User Guide

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/en-us/support/ for additional assistance.

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1 Product Safety

The following sections describe safety practices for the installation and operation of the Vertiv Alber Battery Capacity Tester Integrated (BCTI) system.

1.1 Equipment Service

Proper installation and testing are essential to the correct performance of the BCTI system. If you have questions, contact Vertiv and request monitor assistance. Except as explained in this user guide, do not attempt to service equipment.

Any adjustment, maintenance or repair of this product must be performed by qualified and trained personnel. Contact a Vertiv customer service engineer and request assistance. All safety information must be read, understood, and strictly adhered to before installing, turning on or using the BCTI system.

1.2 Equipment Operation

The protective features of this BCTI system can be compromised if used in a manner not specified in this guide and/or related installation guides. This user guide describes the general operation of the BCTI system. If the BCTI system has features or accessories not described in this user guide, contact Vertiv.

The BCTI system is intended to be operated indoors.

1.3 Fuses

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

1.4 Operating Damaged Equipment

CAUTION: Do not operate damaged equipment.

The operation of damaged or defective equipment and secured against unintended operation until repaired by qualified service personnel. Whenever the safety protection features built into this product have been impaired - either through physical damage, excessive moisture, or any other reason remove the 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.

1.5 Modifying Equipment

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

CAUTION: Do not substitute parts or the modify equipment.

Do not substitute parts or perform any unauthorized modification to the product, to avoid introducing additional hazards. If necessary, contact Vertiv to ensure the safety features are maintained.

1.6 Insulation Rating for Wires

Use only wires supplied with the installation kit.

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2 Product Overview

The BCTI system helps ensure the reliability of the DC bus by determining weaknesses in the battery string and estimating when the battery should be replaced. Capacity testing is the only proven way to determine where the battery is in its life cycle. With the BCTI system, you can determine the capacity of the battery. The BCTI system can detect weak cells in the battery string.

The BCTI system module is a separate device that provides Vertiv™ Alber™ Universal Xplorer Industrial Monitor (UXIME) battery monitors the ability to control the Vertiv™ Alber™ Continuous Load Unit (CLU). With the BCTI module, battery capacity tests can be pre-programmed, controlled, and monitored by installed Vertiv™ Alber™ UXIME battery monitor units.

Load Banks are used for testing battery strings connected to the critical equipment in substations and are required per NERC PRC-005. This device complies with the NERC PRC-005 requirements for capacity load testing.

During a battery discharge test, the BCTI system module continuously records and displays individual cell voltages, overall battery voltage, current, and alarm parameters. Test data can be printed using the report generator or exported to other programs.

The BCTI system monitors and displays the voltage up to 62 cells or modules on a single battery string. It can be programmed to discharge a battery under constant current or variable current (user-defined) profile conditions, and has programmable alarm warning and shut down levels. The BCTI system controls battery discharge tests at currents up to 4000 amps, and can generate data reports upon completion of the discharge test.

2.1 Features and Benefits

BCTI system functions include:

- Serves as an isolated interface between the Vertiv™ Alber™ UXIME battery monitor and a Load Bank.
- Provides galvanically isolated power to the relay control board inside the Load Bank.
- Provides galvanically isolated RS-485 and USB communication ports.
- Receives commands from the Vertiv™ Alber™ UXIME battery monitor via an RS-485 interface.
- Transmits status, load current, and other information to the Vertiv™ Alber™ UXIME battery monitor via an RS-485 interface.
- Measures the shunt current of a Load Bank using a 16-bit isolated A/D converter.

2.2 BCTI System Module Overview

Figure 2.1 BCTI System Module Front and Back Panels

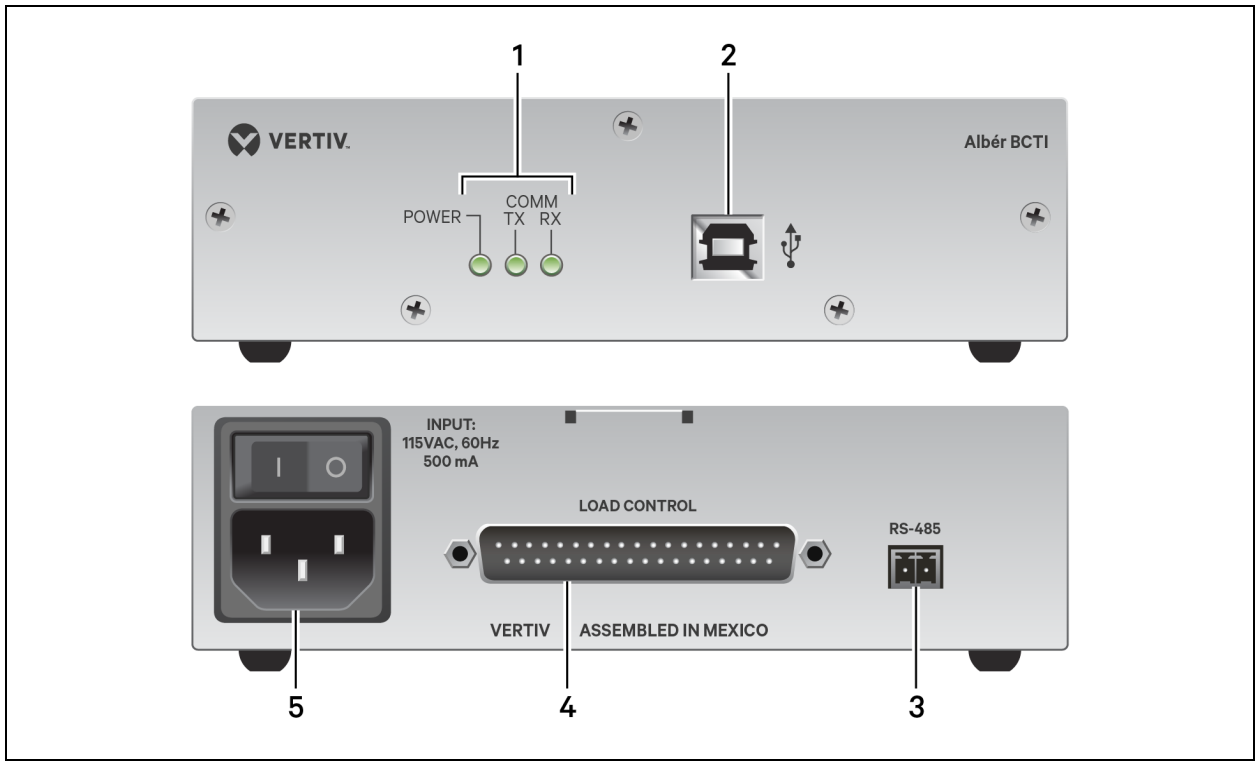

Table 2.1 BCTI System Module Panel

Item	Description
1	LEDs to indicate power and communication status **NOTE: When the unit is operating normally during a standard scan, the Power LED is continuously green and the TX and RX communication LEDs pulsate green.**
2	USB port **NOTE: This port should only be used by Vertiv technicans.**
3	RS-485 port to connect to the Vertiv™ Alber™ UXIME battery monitor
4	Vertiv™ Alber™ CLU port
5	Power input

2.3 BCTI System Configuration

Figure 2.2 BCTI System Configuration

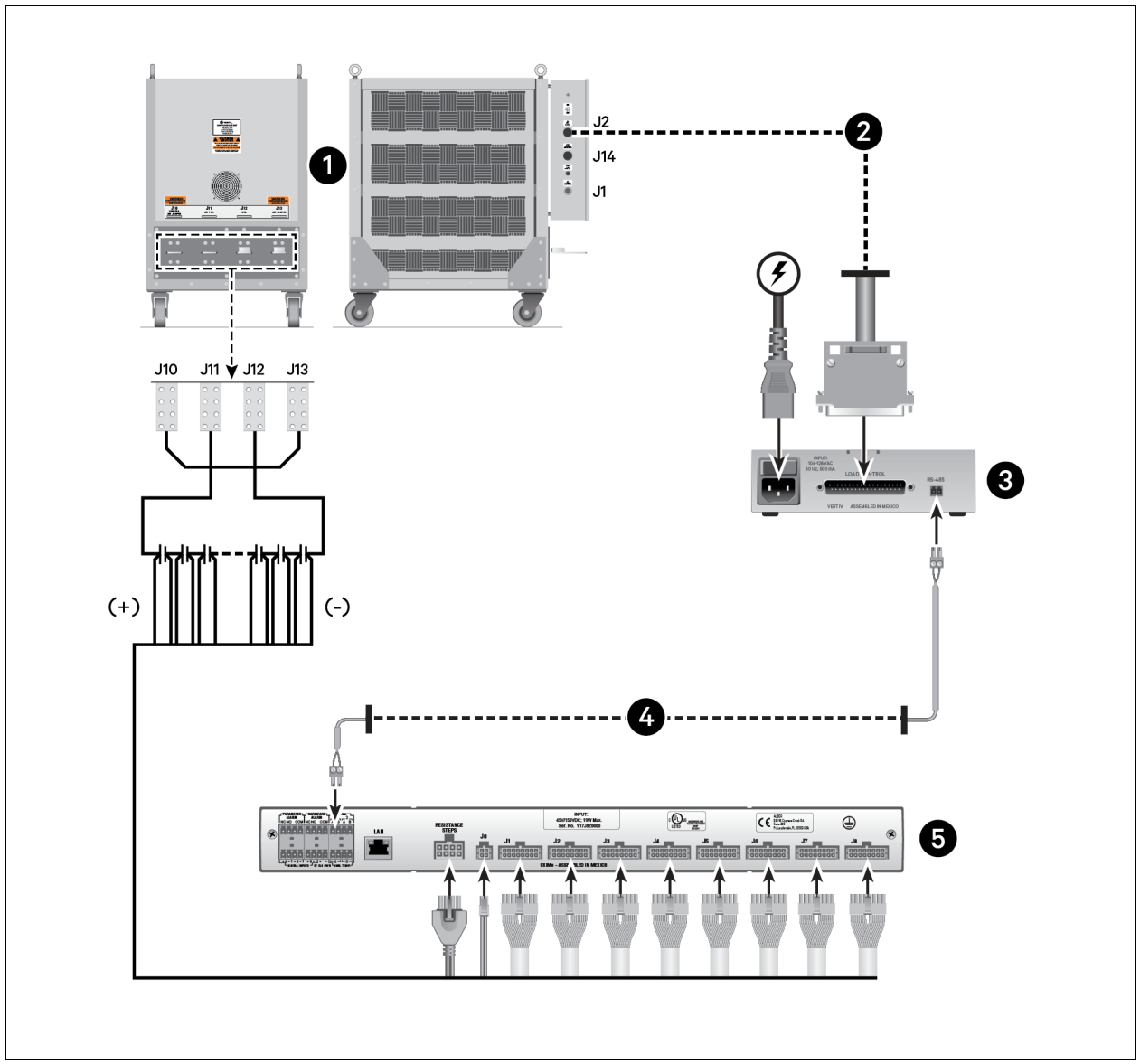

Table 2.2 BCTI System Configuration

Item	Description
1	Vertiv™ Alber™ CLU
2	Connection between Vertiv™ Alber™ CLU and BCTI system module
3	BCTI system module
4	Connection from the BCTI system to the Vertiv™ Alber™ UXIME battery monitor
5	Vertiv™ Alber™ UXIME battery monitor

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3 Software Setup

3.1 Pre-requisites and Installation

The BCTI system software is an embedded component within the Vertiv™ Alber™ UXIME Configurator software that allows you to perform battery tests, generate reports and run diagnostics as needed. Prior to accessing the BCTI system software, complete the following steps:

- Verify you have completed the BCTI system configuration and connection steps provided in the quick installation guide provided with your BCTI system module.
- Ensure the Vertiv™ Alber™ UXIME Configurator software is installed. Installation instructions for the Vertiv™ Alber™ UXIME Configurator software are available in the Getting Started Guide for the Vertiv™ Alber™ Universal Xplorer Industrial Monitor (UXIM/UXIME) and Telecom Monitors (UXTM) battery monitoring systems. This document is available on the Vertiv™ Alber™ UXIME battery monitor product page on www.vertiv.com.
- Ensure that Microsoft Access 2013 Runtime is installed on your system. This platform should already be installed during the initial installation of the Vertiv™ Alber™ UXIME Configurator software. However, if it fails to install during that process, visit the Microsoft Download Center http://www.microsoft.com/en-us/download to download and install it manually.
- Verify you are using the latest version of the BCTI system software. The most current software version is available on visiting the BCTI system product page on www.vertiv.com and selecting the *Software Download* option in the Documents & Downloads section of the web page.
- Verify that the Vertiv™ Alber™ UXIME battery monitor unit is connected (via its front panel USB port) to your computer. Instructions on connecting the Vertiv™ Alber™ UXIME battery monitor unit to a computer are available in the Getting Started Guide for the Vertiv™ Alber™ Universal Xplorer Industrial Monitor (UXIM/UXIME) and Telecom Monitors (UXTM) battery monitoring systems. This document is available on the Vertiv™ Alber™ UXIME battery monitor product page on www.vertiv.com.

3.2 Accessing the BCTI System Software

When the pre-requisites are completed, you must launch the Vertiv™ Alber™ UXIME Configurator software and establish a connection from the Configurator software to the Vertiv™ Alber™ UXIME battery monitor unit. After the connection is established, you will be able to access to the BCTI system software from the Configurator software's Navigation Pane.

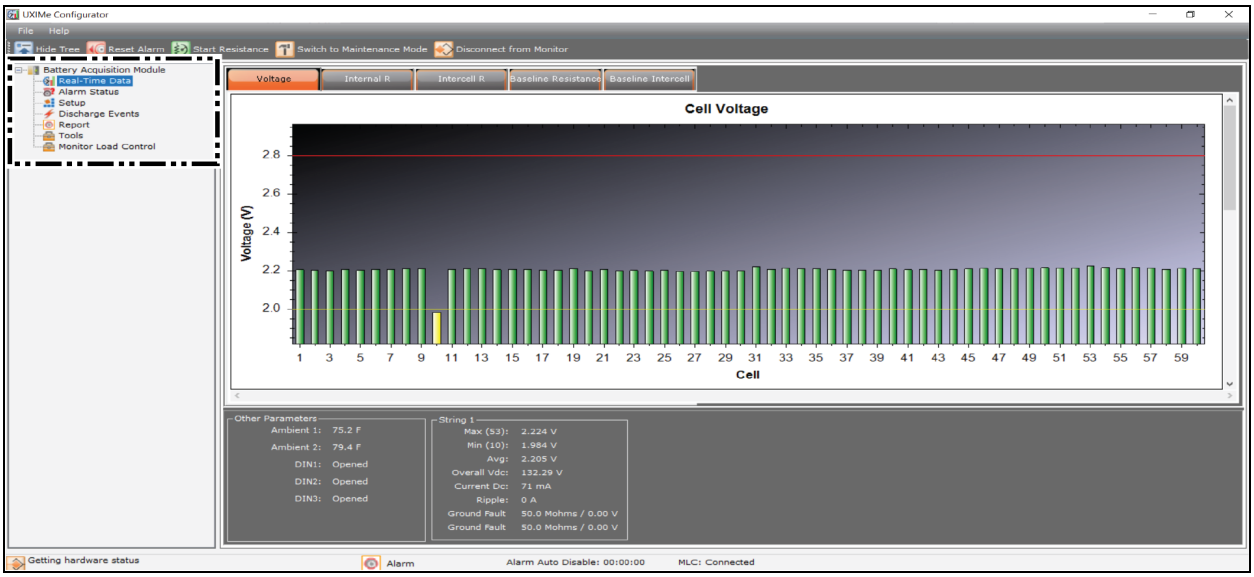
To launch the configurator software:

Double-click the Vertiv™ Alber™ UXIME Configurator software icon to launch it; the Navigation Pane appears.

3.2.1 Navigation pane overview

The Vertiv™ Alber™ UXIME Configurator software Navigation Pane provides top menu options as well as left-side node selections that allow you to choose which actions you would like to perform with your system. When you choose node options, specific menus appear with tabs at the top to give you additional options to select. The BCTI system software is embedded within the Monitor Load Control node.

Figure 3.1 Vertiv™ Alber™ UXIME Configurator Navigation Pane



3.2.2 Establishing a software connection

When the Navigation Pane opens for the first time, you must establish a connection from the Vertiv™ Alber™ UXIME Configurator software to the Vertiv™ Alber™ UXIME battery monitor unit.

To establish a connection to the software:

Select *Connect to Monitor* in the Navigation Pane top menu bar, then click the USB radio button and *Connect*.

3.2.3 Monitor load control node

To access the BCTI system software:

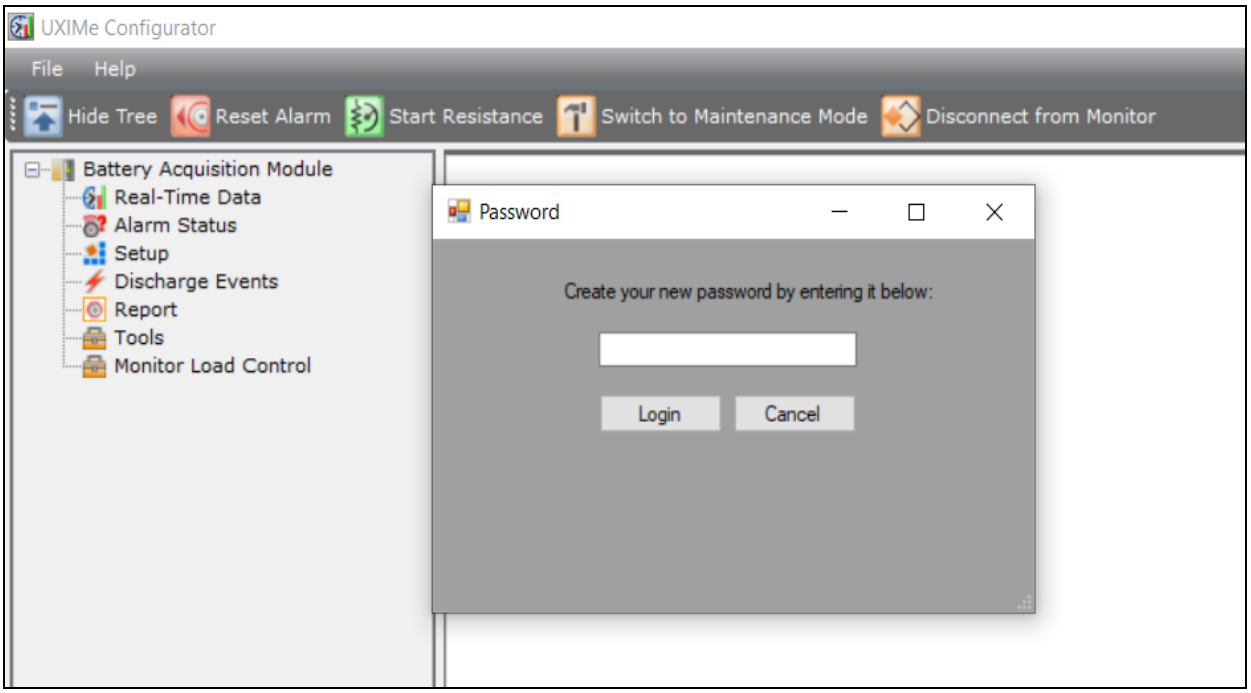
In the Navigation Pane, click on the *Battery Acquisition Module* to expand it. The BCTI system software is accessed when you select the *Monitor Load Control* node from the list.

3.3 Password and License Management

To create a password:

1. Select *Monitor Load Control* in the Navigation Pane.
2. At the password prompt, enter a new password and click *Login*. You are then redirected to the License Management tab.
3. After the license key is applied to the product, you need to associate with Vertiv™ Alber™ UXIME battery monitor with an entitlement key. BCTI will be shipped with an entitlement key which need to be associated with the connected Vertiv™ Alber™ UXIME battery monitor.

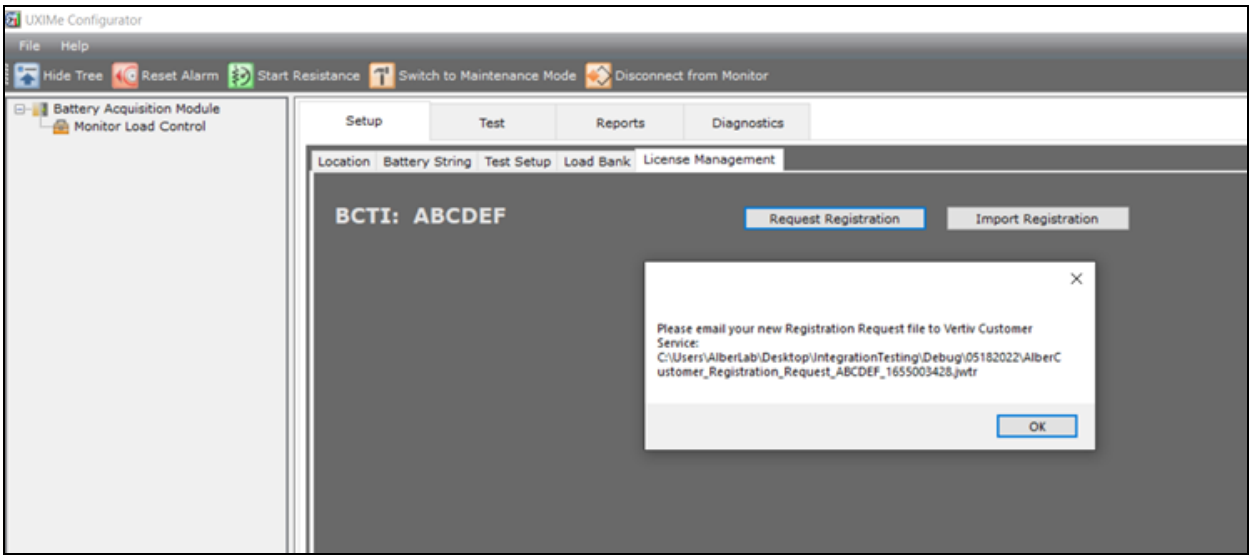
Figure 3.2 New Password Dialog Box



To request licenses and registration:

1. In the License Management tab, select *Request Registration*. A dialog box appears with instructions, note this information.
2. Click *OK* to dismiss the dialog box, then send your Registration Request file to Vertiv Customer Service to register the product and receive the necessary licenses.

Figure 3.3 Registration Request File Dialog Box

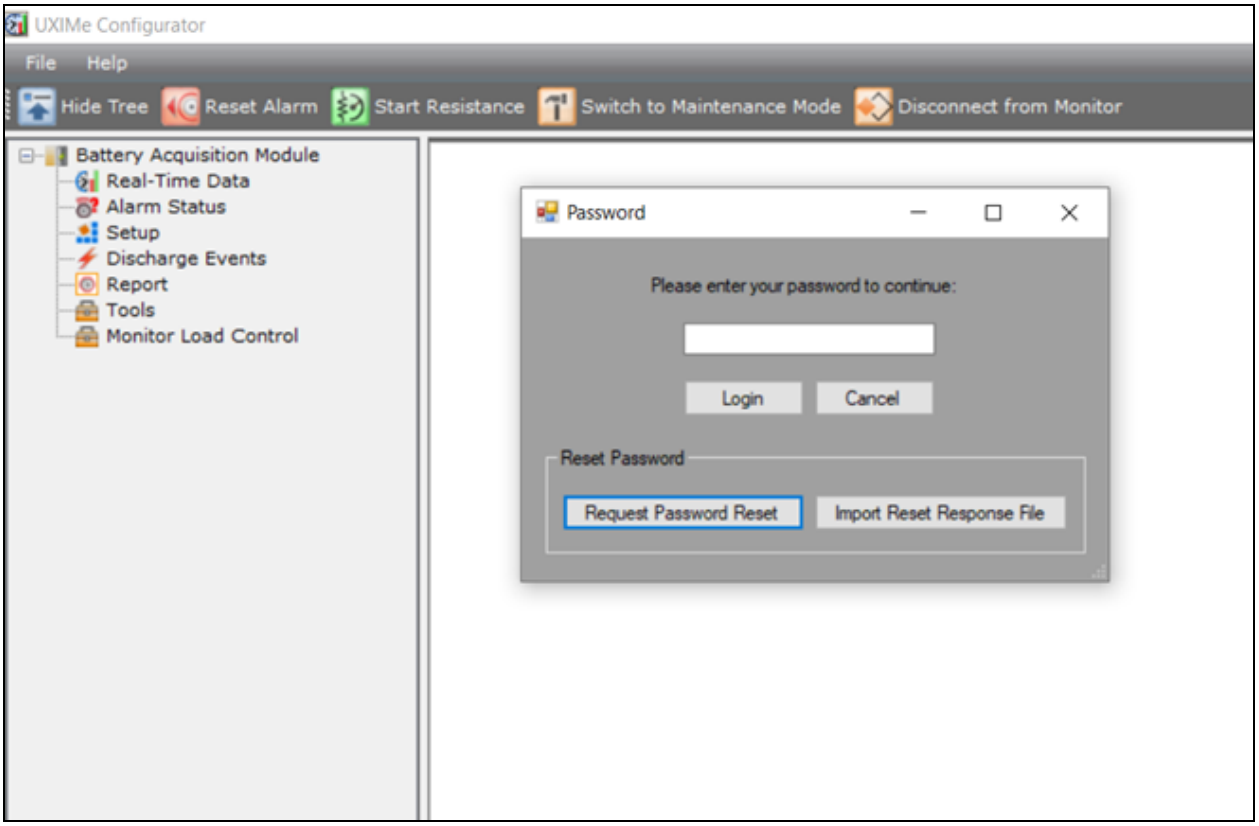


To reset a password:

1. If you need to reset your password, select *Request Password Reset* when prompted to enter your password.

2. Save the password request file you receive and send it to Vertiv Customer Service. Vertiv will send a password reset response file.
3. Select *Import Reset Response File* to import the response file, you will then be allowed to create a new password.

Figure 3.4 Password Reset Dialog Box



4 Operation

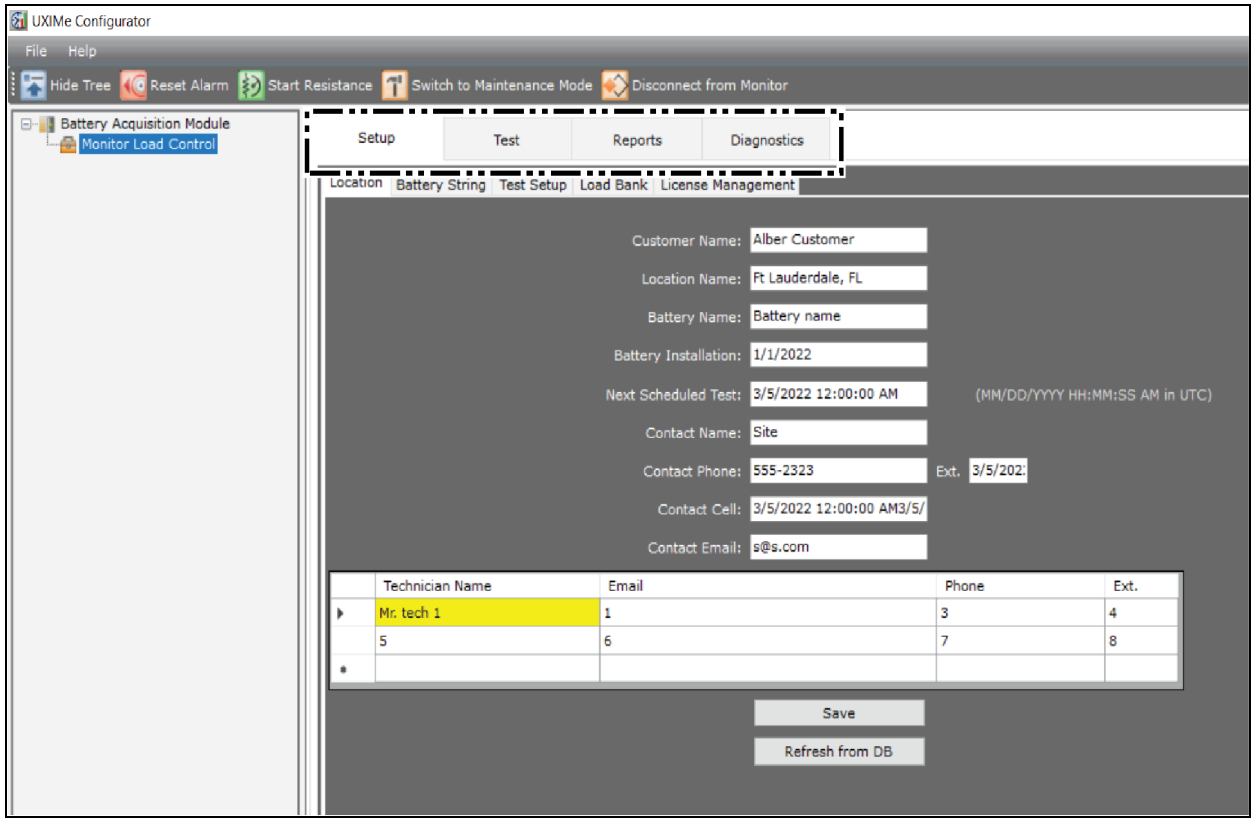
The following sections describe how to operate the BCTI system software.

CAUTION: If you plan to run any battery capacity tests, you must disable power management modes in Windows and ensure your computer is continuously powered throughout any tests.

4.1 Monitor Load Control Node

BCTI system software operations are executed from the Monitor Load Control node on the left-side of the Vertiv™ Alber™ UXIME Configurator software Navigation Pane. Select *Monitor Load Control* to access the main menu that allows you to set up system operations, control and run tests. generate reports and run diagnostics.

Figure 4.1 Monitor Load Control (BCTI System Software) Main Menu



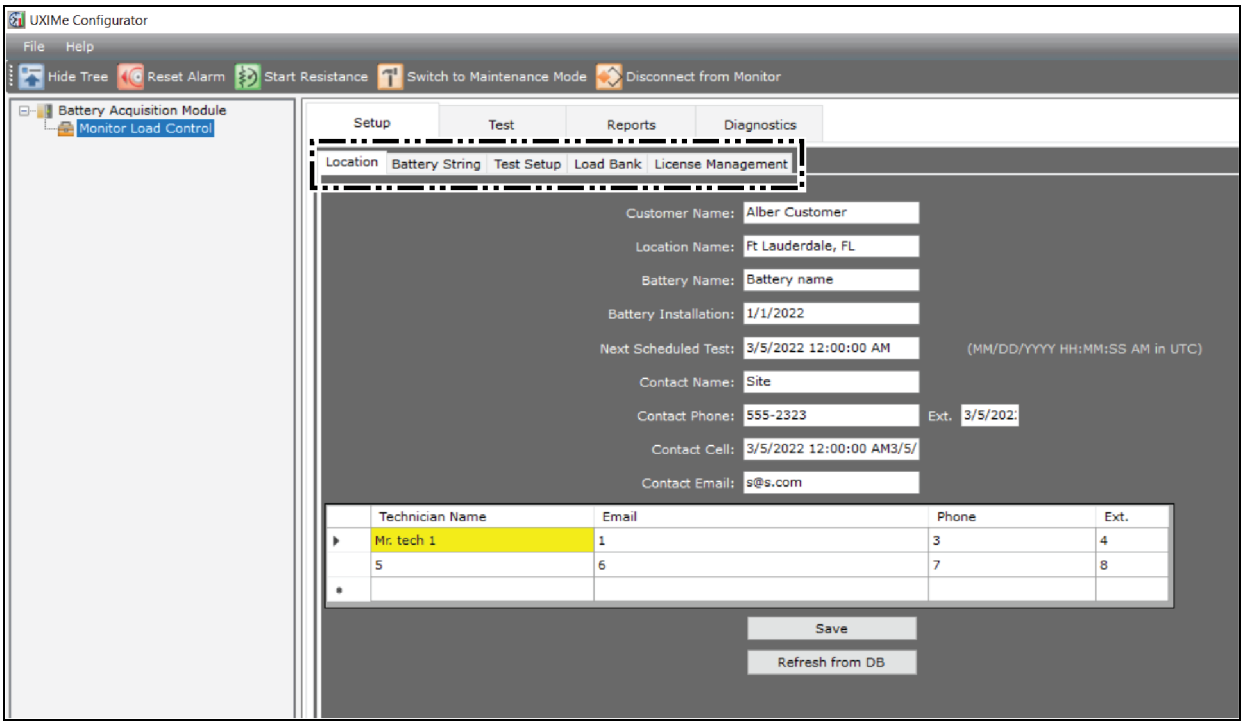
The Setup, Test, Reports and Diagnostics tabs at the top of the main menu allow you to enter data and customize information as needed. The following sections provide overviews of the options available when selecting each tab.

4.1.1 Setup

Selecting *Setup* provides access to additional tabs with information determining BCTI system operation and control of tests. Information that you enter in the Location, Battery Strings, Test Setup, Load Bank, and License Management tabs must be correctly entered for the BCTI system to run properly. Selections within these tabs allow you to input battery test information and parameters such as voltage alarms, cells tested, and Test Types.

NOTE: Prior to running a test or using the system for data retrieval, open each Setup tab and verify the data listed is correct.

Figure 4.2 Setup Menu

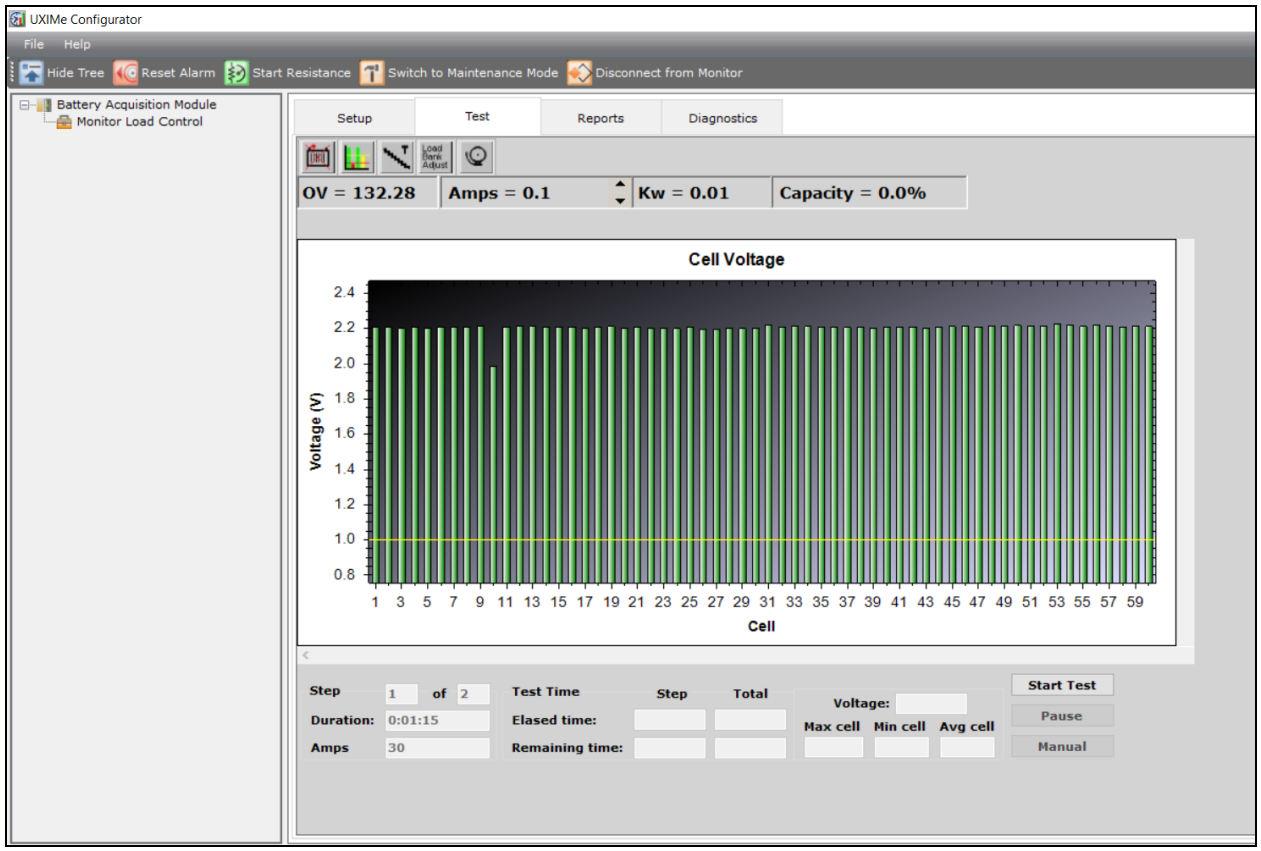


4.1.2 Test

The Test window displays information for monitoring test progress in real time. The window indicates battery OV (overall voltage), load in amps, power in watts/kilowatts, and capacity if activated. Individual cell or module activity displays as a bar graph.

The window also displays step information such as active step duration, value, step number, and total test times. The Status area indicates the currently selected cell voltage. The maximum, minimum, and average cell voltages appear below the status area.

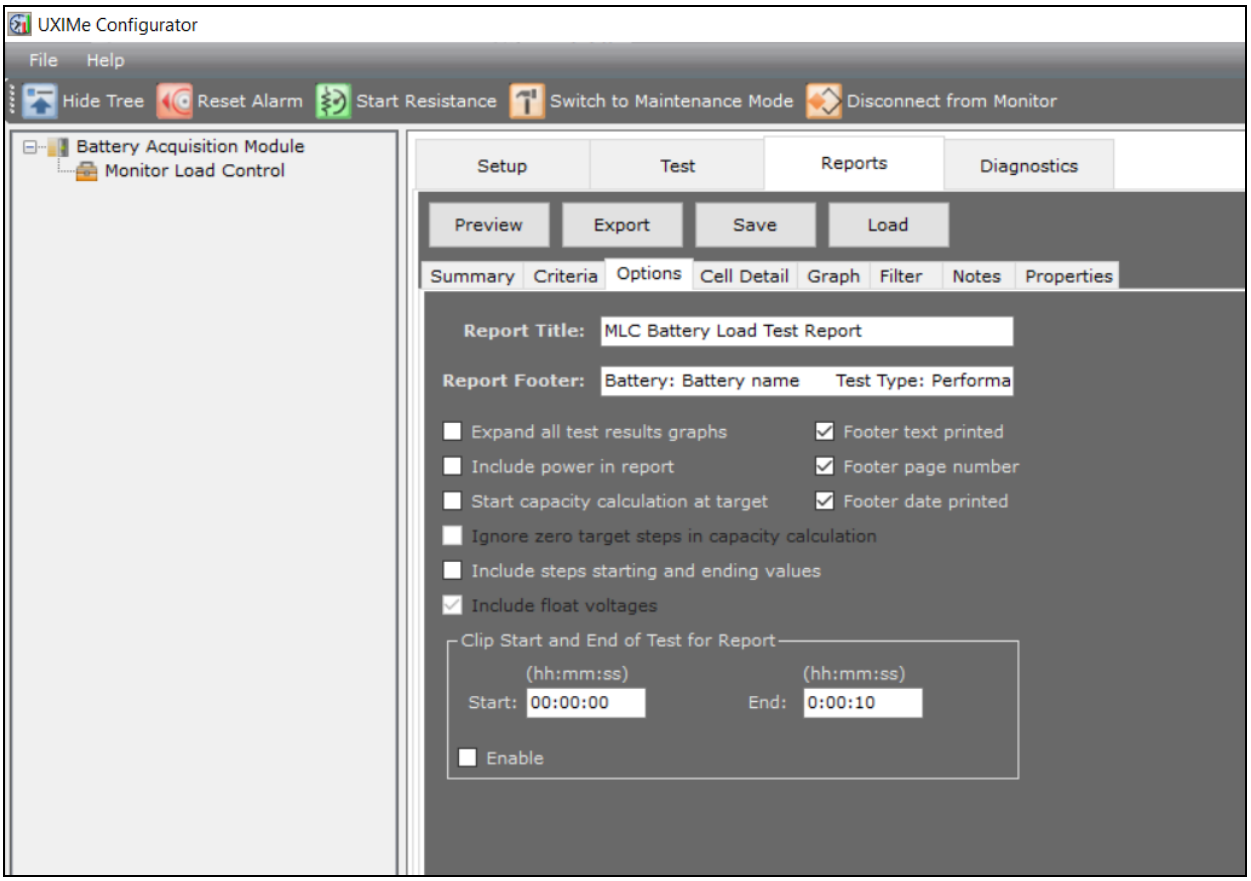
Figure 4.3 Test View



4.1.3 Reports

The Report Generator creates a report of a completed test, transfers test data to a file, and then provides a final report. The types of reports and options for creating reports are described in the Report Generator on page 30. Report options include Summary, Criteria, Options, Cell Detail, Graph, Filter, Notes, and Properties. Report files reside in the sub directory, selected at the time the test occurs.

Figure 4.4 Report Options



4.1.4 Diagnostics

WARNING! Dangerous voltages can exist inside BCTI system equipment. As a result, Diagnostics must only be performed by qualified personnel who understand battery technology and are trained in using Vertiv™ Alber™ CLU equipment. Use extreme caution when servicing equipment, connecting equipment or performing diagnostics.

The Diagnostics tab should only be used when encountering a problem or performing technical checks with the assistance of Vertiv Technical Support. Diagnostics allows selection of the Load Bank, Connectivity, Correlation, and Temperature (while Vertiv™ Alber™ Electrolyte Level Sensor (ELS2) is connected to Vertiv™ Alber™ UXIME battery monitor unit) tabs and related dialog boxes, from which BCTI system and load control system diagnostics are performed, See Load Bank Diagnostics on page 47.

4.2 Recommended Tests

Prior to performing any type of battery test, you must review the battery manufacturer's maintenance and test procedures. Vertiv strongly recommends following the IEEE Std 450 publication on battery maintenance and testing for flooded cells, and IEEE Std 1188 or VRLA batteries. By using the battery manufacturer's suggested testing procedures and those issued by IEEE, you can ensure a safe, effective load test.

Before performing a load test, determine the type of test to perform, the length of the test, and where to locate the equipment during the testing. A well-ventilated area is required to disperse heat from the resistive Load Bank.

WARNING! Do not place the Load Bank in a room that has an automatic fire system. The heat generated by the Load Bank could inadvertently trigger the fire system. Either place the Load Banks in a safe area without such a system or take other measures to prevent the inadvertent activation of the automatic system.

Vertiv recommends performing the following tests on the battery, before connecting the BCTI system to the battery being tested, and prior to any load testing.

4.2.1 Micro-ohmmeter

During the battery discharge test, the test system discharges the battery at a high current rate. Ohm's Law shows that a high rate of current through a highly resistive connection results in a large amount of power being dissipated through the connection. This could cause excessive heat build-up and result in premature termination of the test. Therefore, use a micro-ohmmeter to ensure there are no highly resistive connections between individual cells, modules or intertier connections. Refer to the battery manufacturer's maintenance instructions for a safe range of readings.

4.2.2 Hydrometer

Prior to load testing, read the specific gravity of the sample electrolyte to confirm the battery is fully charged. Reading cannot be performed on sealed cells but can easily be done on wet cell batteries. Although this data is not entered into the BCTI system software, you can want to add it to the notes section of the report. Specific gravity is a good indicator of the present charge of the battery. If all cell float voltage readings are within normal limits, you can limit the hydrometer readings to a 10% sample.

4.2.3 Electrolyte temperature

While taking specific gravity readings, measure the electrolyte temperature of each cell. If an Vertiv™ Alber™ Electrolyte Level Sensor (ELS2) system is integrated with Vertiv™ Alber™ UXIME battery monitors, then the cell temperature reading will automatically be captured.

4.2.4 Ambient temperature

Record the ambient temperature of the battery room prior to testing. This data is entered into the BCTI system software, and the load can be temperature corrected to IEEE standards.

NOTE: The BCTI system software requires the temperature be entered for all tests.

4.2.5 Equalize charging

IEEE Std 450 for flooded cells and Std 1188 for VRLA cells, and most battery manufacturers, recommend that a battery be equalize charged at least seven days before performing a discharge test, and the battery be allowed 72 hours of float condition prior to testing. This charging action should provide optimum capacity results. Contact individual battery companies for their recommendations on this practice.

To test the battery in an as-found state, occasionally load test the battery in its normal float state, without any prior charging or preparation. This as-found testing checks the effectiveness of the battery maintenance program. (done as a service test on the BCTI system module).

4.2.6 Test history

Analyze test results from previous tests to determine faulty conditions that can become apparent during the load test. Doing this permits closer observation of cells that were weak, which could cause potential of problems or failures. Correct any problems that stopped prior tests before further testing and putting the battery back into service.

4.3 Connecting the Load Bank to the BCTI System

After performing all preparatory tests as mentioned in Recommended Tests on page 14, prepare and connect the BCTI system.

4.3.1 Connecting the Load Bank

NOTE: Please refer to the Vertiv™ Alber™ UXIM/UXIME and UXTM battery monitor Getting Started Guide for Vertiv™ Alber™ UXIME battery monitor usage information.

To connect Vertiv Load Banks:

1. Connect the load control cable from the BCTI system module Load Control port to the Load Control Input on the side of the Vertiv™ Alber™ CLU. This connector is usually labeled as J2, however, refer to the drawings that are received with the Vertiv™ Alber™ CLU.
2. Connect the load cables from the Vertiv™ Alber™ CLU to the battery as shown in the drawings that are received with the Vertiv™ Alber™ CLU.
3. Connect the RS-485 cable between the RS-485 port on the BCTI system module and RS-485 port 1 on the Vertiv™ Alber™ UXIME battery monitor.
4. The BCTI system is now ready to perform the desired load test.
5. Turn on all equipment except the Vertiv™ Alber™ CLU.
6. Connect the Vertiv™ Alber™ UXIME battery monitor to the computer where Vertiv™ Alber™ UXIME integrated Configurator software is installed.
7. Start the Vertiv™ Alber™ UXIME integrated Configurator software and select the *USB* option.
8. From the Navigation Pane on the left-hand side, click on *Monitor Load Control*, and verify that all tabs are loading and there are no errors.
9. After the BCTI system has initialized, turn on the Vertiv™ Alber™ CLU.
10. When disconnecting any equipment, turn off the Vertiv™ Alber™ CLU first, then turn off the rest of the system.

4.4 Setting up the BCTI System for Load Test

The BCTI system allows you to use their computer to set up all test parameters. Refer to the following Setup dialog box descriptions to program the test parameters. On the Monitor Load Control menu, click *Setup*. A tab with Location, Battery Strings, Test Setup, Load Bank, and License Management appears. Complete each item as described in the following.

4.4.1 Location

From the Setup menu, click *Location*. you needs to ensure the Customer Site and Battery information and Technician details are entered in the given text boxes. This information will be printed with each test report and permanently saved in the Vertiv™ Alber™ UXIME battery monitor data file. Confirm all text boxes before performing any test or else reports can have incorrect or missing data.

Customer name

Customer name and Location information is automatically retrieved from the Vertiv™ Alber™ UXIME battery monitor. Verify the information is correct before proceeding.

Location name

Verify the location name displayed on the screen is correct. Location name, battery name and string name are used with each other to identify the string and hardware to which the monitor is connected.

Battery name and dates

Verify the battery name, installation date and the next test date in the mm/dd/yyyy format appear in the boxes below the battery name are correct.

4.4.2 Battery String

From the Setup menu, click *Battery String*. The Battery String tab shows the string name and total number of cells in that string.

4.4.3 Test Setup

From the Setup tab, click *Test Setup*. The Test Setup screen allows selection of test type, discharge to perform, length of the discharge and load to be applied.

4.4.4 Test Types

You can select and configure either Performance or, Modified Performance test. Each type saves specific parameters and test steps. Select a test from the Test Type drop-down list before running a test. Each test is briefly described in the following sections, refer to IEEE 450 for more information. The areas enabled on the dialog boxes depend on the test type selected.

Performance

Also known as a capacity test, the Performance test uses a programmed constant current load to project reliability and remaining battery life before replacement is necessary.

NOTE: A Performance test has only one step.

Modified performance

A Modified Performance test, tests the battery capacity (similar to a Performance test) and the ability of the battery to provide a high-rate, and in the short-duration load cycle.

NOTE: This test can be done in place of a Service test. If you types 0 (zero) for Rated Time, the test does not calculate battery capacity.

4.4.5 Test Setup parameters

The following items are available on the Test Setup dialog boxes depending on the test type selected.

Rated time for Test Types (performance and modified performance)

Type the manufacturer's specified rated time in the Rated Time box in the hh:mm:ss time format. This value is important for the on-line capacity calculation performed during a capacity test.

Temperate and correction for Test Types (performance and modified performance)

Temperature, °F and °C (Fahrenheit and Celsius

Click °F or °C then, in the Temperature box, type the average electrolyte temperature of the sample number of cells. The program automatically calculates between °C and °F. For example, if you select °C after typing a Fahrenheit value, the value converts to Celsius.

NOTE: To minimize rounding errors, type the value in the known format. For example, if the temperature is in °C , select C before typing the value.

Correction, None and IEEE

If you enter a temperature other than 77 °F (25 °C), you can select *IEEE* temperature correction of the load. To automatically correct to IEEE-450, click *IEEE* in the Correction area. For no correction, click *None*. If the IEEE correction option is enabled and the temperature is later changed, all programmed steps are automatically corrected, and all loads are compensated throughout the test program. For more information on temperature compensation, refer to IEEE Std 450.

Alarm Levels for Test Types (performance and modified performance)

In the Alarm Levels area, type voltage levels that issue warning or shutdown alarms during testing. it allows you to set warning and shutdown levels for cells and OV. When an alarm condition occurs, an alarm sounds, the failing cell is logged and the graph or display area changes color. A beeping alarm from the BCTI system indicates a warning alarm and a solid tone indicates a shutdown alarm. See Viewing alarms during a test on page 22.

You can change the warning and shutdown test levels for cells and OV when the test is running. Changes are recorded in the test activities portion of the report. See Alarm levels on page 26.

NOTE: When cell warning or shutdown levels are changed, the OV warning or shutdown levels are automatically adjusted by the number of cells in the string times the changed level. To disable any of the following warning or shutdown levels, type 0 (zero) in the box.

Warning Cells

Type the alarm voltage level of the individual cell or module to be alarmed. For example, if testing to an average end voltage of 1.75 volts per cell, type **1.75**. When any cell falls below 1.75V, an alarm condition occurs. If values are set to 0 (zero), the warning is not active.

Shutdown Cells

Type the voltage of an individual cell to pause the test. For example, if discharging to 1.75 volts per cell average, the you can want to pause the test if any cell falls below 1.65V. In this case, type **1.65** to pause the test when any cell falls below this voltage. If values are set to 0 (zero), the shutdown is not active.

NOTE: As per IEEE450 requirement, you can pause the test for up to 10% of the test time or 6 minutes, whichever is shorter before shutting down the test.

Warning OV

This box defines the overall battery voltage warning level. Type the overall voltage warning level. For example, if testing 60 cells to an average of 1.75 volts per cell, you can want to be warned when battery voltage is approaching shutdown. If values are set to 0 (zero), the warning is not active.

Shutdown OV

In most cases, this value determines the end of the test. Type the overall battery end voltage. For example, if testing a 60 cell battery to 1.65 volts per cell, type 99.0 in the box (60 cells x 1.65 volts per cell = 99.0 volts). The system pauses the test when the overall voltage falls below 99.0 volts. If values are set to 0 (zero), the shutdown is not active.

Test Steps for Test Types (performance and modified performance)

Step

Each step is programmed individually, with a maximum of 99 steps allowed. If step 1 (or another desired step) is not displayed, scroll to the step, then click the step to highlight it. Exiting a field or pressing ENTER saves the data entered.

Duration

Double-click on the Duration field for the desired step and type the time the step is to operate, in hh:mm:ss.

NOTE: If running a capacity test where the battery must perform for a certain time at a single discharge rate, select a time at least 50% longer than the rated time. For example, if the rated time of the battery is 1 hour, enter a duration time of at least 1 hour 30 minutes. This ensures testing to at least 100% of capacity.

Add, Delete and Insert

Performance test consists of only 1 load step. Whereas Modified Performance, test, supports configuring additional load steps. To add more steps, click *Add*. A new load step appears in the list. To delete a load step, highlight the step to be deleted by clicking the *step*, then click *Delete*. To insert a step, highlight the step that will follow the new step, then click *Insert*.

NOTE: A load step is defined in terms of current or power draw required for a specific time.

Calculate Capacity at Target for Test Types (performance, modified performance)

Select the Calculate Capacity at Target checkbox to calculate the capacity when the target value is reached. The test time advances only when the target is reached. The test time, but not the test, stops if the load falls below target and resumes when the target is reached.

Ignore Zero Target Steps for Test Types (modified performance)

Ignore zero target steps in Capacity Calculation

Select this box to ignore steps when the load is targeted to 0 (zero) in the capacity calculation. For any steps targeted to zero, the time of that step will not be used in the capacity calculation.

Charger high/low voltage warning for Test Types (charger)

Charger high voltage warning and charger low voltage warning

Type values in these boxes to activate a warning when high or low voltage levels are exceeded. If values are set to 0, the warning is not active.

4.4.6 Load Bank

From the Setup menu, click *Load Bank* to open the Load Bank dialog box.

Load Bank SN/ID, add, and delete

The BCTI system can configure multiple Load Bank setups. To select a *setup*, click a *name* in the Load Bank SN/ID drop-down list. To add a setup name, click *Add*. The name "Load Bank n" appears in the Load Bank SN/ID box and in the drop-down list. To change this name, overwrite the name in the box with a new name. You can assign ratings and step weights to each Load Bank setup name. To delete a name in the Load Bank SN/ID box, click *Delete*.

Step weight

BCTI system software is loaded with Vertiv Load Banks with predefined load steps. you can also change any of the load steps by typing the step weight information for the selected bank load.

Shunt rating amps per mV

Assign the shunt rating in amps per millivolt. At the Shunt Rating amps and per mV boxes, type the shunt value from the Load Banks. For example if the shunt is stamped 600/100 (600 amps at 100mV), type 600 in the Shunt Rating amps box, then type 100 in the per mV box.

Auto detect step resistance

If selected, the BCTI system calculates the average resistance of all steps with weight information. The net effect of this occurs at the start of the test. The BCTI system assumes 0.5 amps per weight value. At 0.5 amps per weight value, the BCTI system turns on the steps needed to achieve the target load. Depending on the actual Load Banks, the first attempt can be off target by as much as half the desired target load. After these steps are set, the BCTI system waits for the next load and OV reading. Using the sum of the step weights first set, the BCTI system calculates the actual amps per weight value, then uses the OV to calculate each step resistance.

NOTE: These resistances are calculated, not actual. If there is a problem controlling the load, the actual resistance of one or more steps can be incorrect. See Load Bank Diagnostics on page 47.

If Auto Detect Step Resistance is selected, the BCTI system corrects the load steps at least one more time at the start of the test. If you do not want this to occur, do not select Auto Detect Step Resistance. In this case, select *Diagnostics* from the main menu, open the Load Bank dialog box and measure or type the Load Bank resistance values into only the active Steps boxes (Step 1 to Step 16, as required). See Figure B.1 on page 47 for the more information.

Advanced

If you have to adjust the control tolerance for the Load Bank, click the *Advanced* button to display the Load Bank Advance Setup window.

The default values are 1.50% and 2.50 amps and cannot be set less than these values. The value that the you types in the Amps box on the Load Bank Advance Setup window is derived from the highest Vernier Gap value plus 1. If the you experiences a problem controlling the Load Bank, increase the percent (%) and amp values. Click *Apply* to save the changes.

4.5 Running the Test

From the Monitor Load Control node, click *Test*. The BCTI system test window displays all relevant information for monitoring test progress and parameters in a real time mode.

4.5.1 OV, amps, kW, and capacity

The top of the window indicates battery OV (overall voltage), load in amps, power in kilowatts, and the present capacity of the battery.

NOTE: The capacity is calculated only during a Performance or Modified Performance test.

4.5.2 Nudge

Next to the amps value are arrows that slightly nudge (increase or decrease) the load within target when in the auto mode. When controlling the load, the BCTI system is considered on target when the target current plus control tolerance is achieved. For example, on a load of 500 amps, the BCTI system could set the load at 500 amps plus 1.5% (7.5 amps) plus 1.5 amps, or as high as 509 amps. The Nudge control allows you to change the load to move the current closer to 500 amps.

4.5.3 Duration and test time

Individual cells or modules are displayed in a bar graph format. Presently active step duration and target value, in amps or watts, are in the lower left of the window. The Test Time area displays the present step total test times.

4.5.4 Voltages

Clicking on a bar on the graph appears a cursor above the bar. The cursor denotes the cell on which the Status area (to the right of Test Time) is reporting. The Status area indicates the cell voltages. The maximum, minimum, and average cell voltages are displayed below the Status area.

4.5.5 Toolbar

Toolbar items at the top of the window are for excluding or including cells that went into shutdown, changing alarm levels, changing test step duration and load, adjusting the Load Bank tolerance during a test, changing the number of graph bar lines, zooming in on a bar line, and viewing the alarms list.

4.6 Starting the Test

Verify equipment connections are secure and equipment is in operating mode. If using Vertiv Load Banks, ensure the step weights are configured properly. Refer to the label on the Load Bank. Please contact Vertiv services for any questions.

4.6.1 Start test

If Load Banks are being used, set the Load Bank AC power switches to ON. If no problems are apparent, to start the test, click *Start Test* on the BCTI system Test window.

During the test, the cells degrade as the load is applied to the battery. Click a *bar graph* to cause a cursor to appear above the bar. The cursor denotes the cell on which the Status area (to the right of Test Time) is reporting. The Status area indicates the minimum and maximum cell voltages and average cell voltage. If the graph is in the active window, press the left or right arrow keys to move the cursor to the previous or next cell bar.

At the end of the test, a message indicates the load test is complete. When disconnecting any equipment, power down the continuous Load Bank first, then power down the rest of the system.

4.6.2 Load test control

Stop Test, Pause, Resume, and Manual are the options available while the test is running.

Stop test

To stop the test, click *Stop Test*. A message appears to confirm the test should be stopped.

Pause and Resume

To pause the test, click *Pause*. Pause allows you to make changes. Do not pause the test for extended periods of time during load testing, because the cells will recover during the idle period. When the test is paused, Pause changes to Resume.

4.6.3 Manual Load Bank control

Manual and auto

The system defaults to automatic control. For manual control, click *Manual* after the test has started. To return to automatic mode, click *Auto*.

Typically, select manual mode to control if there is a Load Bank problem. Manually selecting load step weights can help determine which step in the Load Bank is causing the problem.

NOTE: Do not confuse step weights in the Load Bank with test steps in the program.

When Manual is selected, a toolbar on the window allows control of the Load Bank.

User-defined weight buttons

The arrows to the right of the edit box are user-definable. To increase or decrease their load weight per step, type a weight in the box and click the *arrows* adjacent to the box. The maximum weight value is 200. To increase or decrease the load applied, click the *arrows*. As the value is changed, the 16 square step indicators change. The step enabled in the Load Bank is displayed as a binary count along the toolbar, when a square is black, that step is on in the Load Bank. To turn off all the steps, click *All Off*. When the test is running, you can click *Pause* to pause the test and remove the load.

NOTE: The value in amps of the load change depends on the type of Load Bank used. Typically, this value is less than one amp per step. For a larger increment, change the user-defined step size on the toolbar. To determine the actual amp value for each weight, divide the Load Bank's total amp capacity by the total weight count. See the Load Bank on page 19 window to determine the total weight count.

Instead of using the manual mode to change step weights, you can use the Test Steps dialog box to change the actual load current or power. See Test Steps for Test Types (performance and modified performance) on page 19.

4.6.4 Viewing alarms during a test

The Test window indicates real-time alarm conditions for cells and OV. During testing, to view the alarm history, click the *View Alarms* button. see View alarms on page 29.

Cell alarm

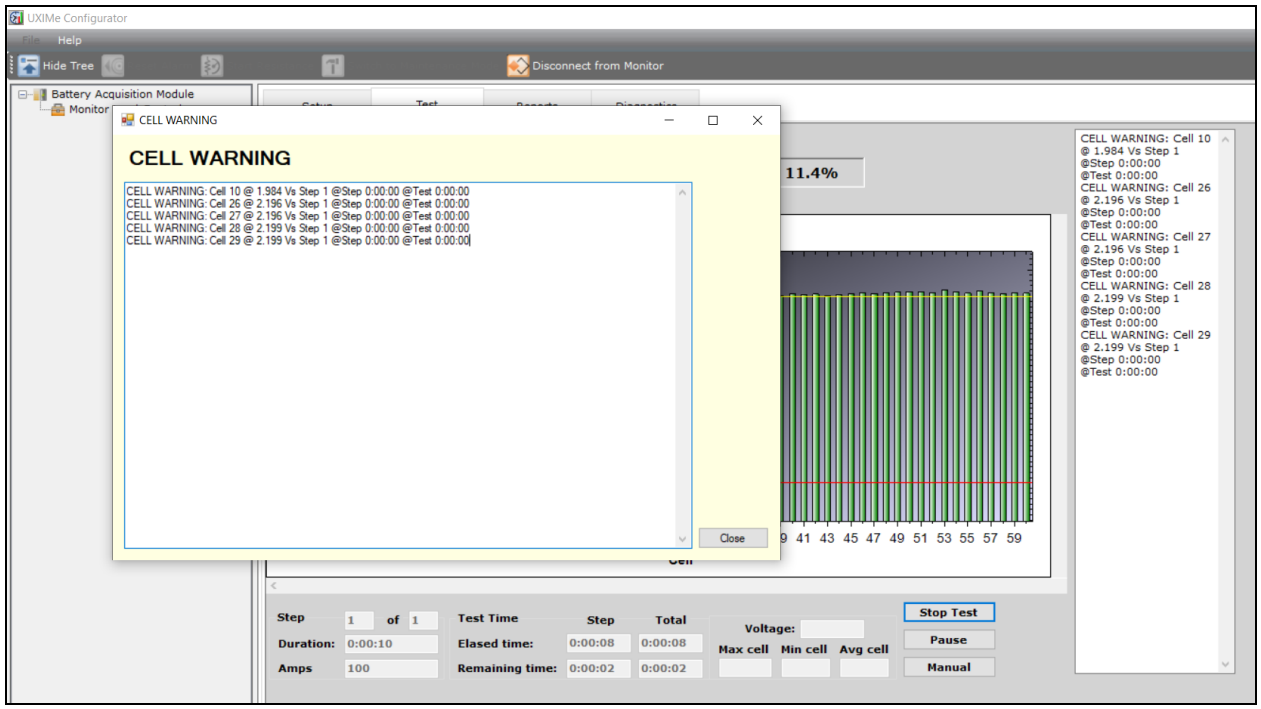
When a cell goes into alarm, the bar graph for the failing cell changes color, an alarm sounds from the PC, and the cell number and string designation are logged in the alarm history. A cell warning alarm occurs when the cell voltage drops below the programmed Cell Warning voltage level. The normal bar graph color is green, yellow indicates a warning condition, and red indicates a alarm and pauses (as mentioned in Shutdown Cells under Test Setup parameters on page 17 of this document) the test before shutting it down.

Cell warning

When a cell falls below a warning level, the alarm sounds BCTI system beeps, but the test does not pause. To silence the alarm, click *OK* in the Warning message box.

If the Cell Warning level is lowered, the cell comes out of warning and the bar graph returns to green, but the event is retained in the alarm history. Use the Adjust Alarm Levels toolbar button to change the level. See Alarm levels on page 26.

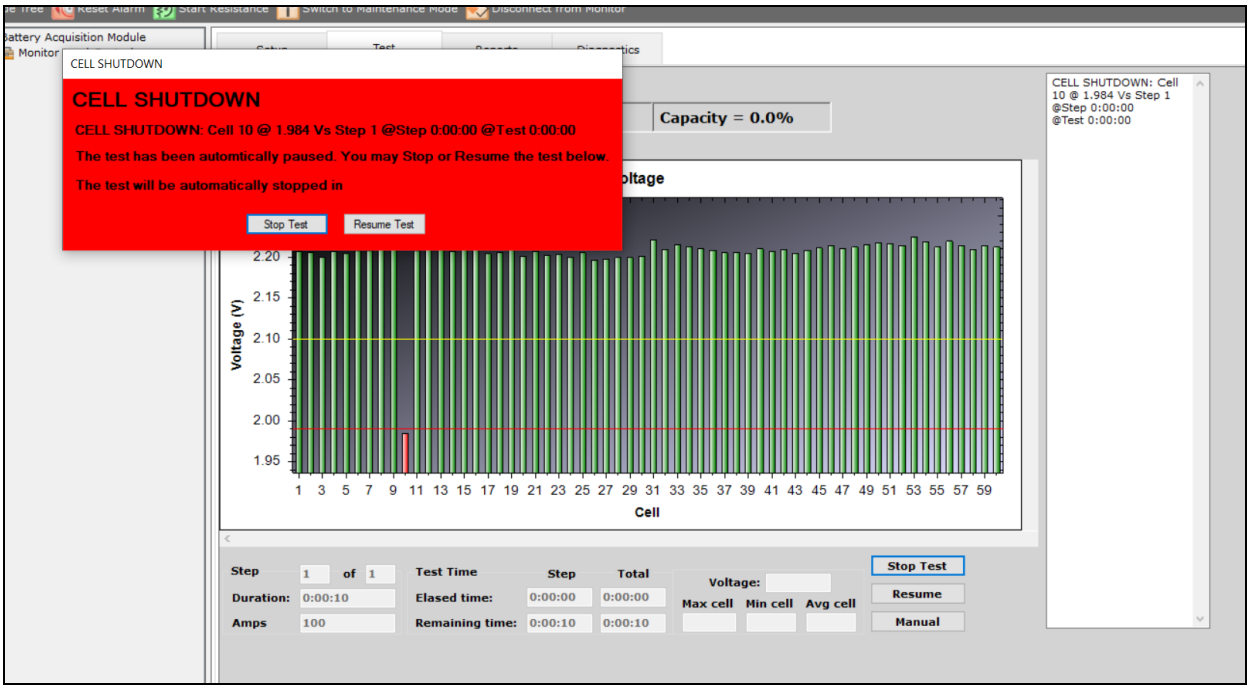
Figure 4.5 Cell Warning Message



Cell shutdown

When a cell falls below a shutdown level, the BCTI system sounds a continuous tone, the test pauses, and the Cell Exclusion message box appears.

Figure 4.6 Cell Exclusion Message



To silence the alarm and exclude the cell from the test, click *Yes* in the Cell Exclusion box. This also causes the bar graph for the cell to no longer be displayed. To silence the alarm and keep the cell in the test, click *No*. Resume the test if desired.

The faulty cell can be jumpered out and the test resumed. This allows all alarm parameters to disregard the faulty cell if it is excluded.

4.6.5 Overall voltage alarm

When the overall voltage goes into alarm, the OV display changes color, the BCTI system alarm sounds, and the OV event is logged in the alarm history. An OV alarm occurs when the overall voltage drops below the programmed Warning voltage level. The normal OV display color is the window background color, yellow indicates a warning condition, and red indicates a shutdown. The OV = V display is on the upper left of the Test window.

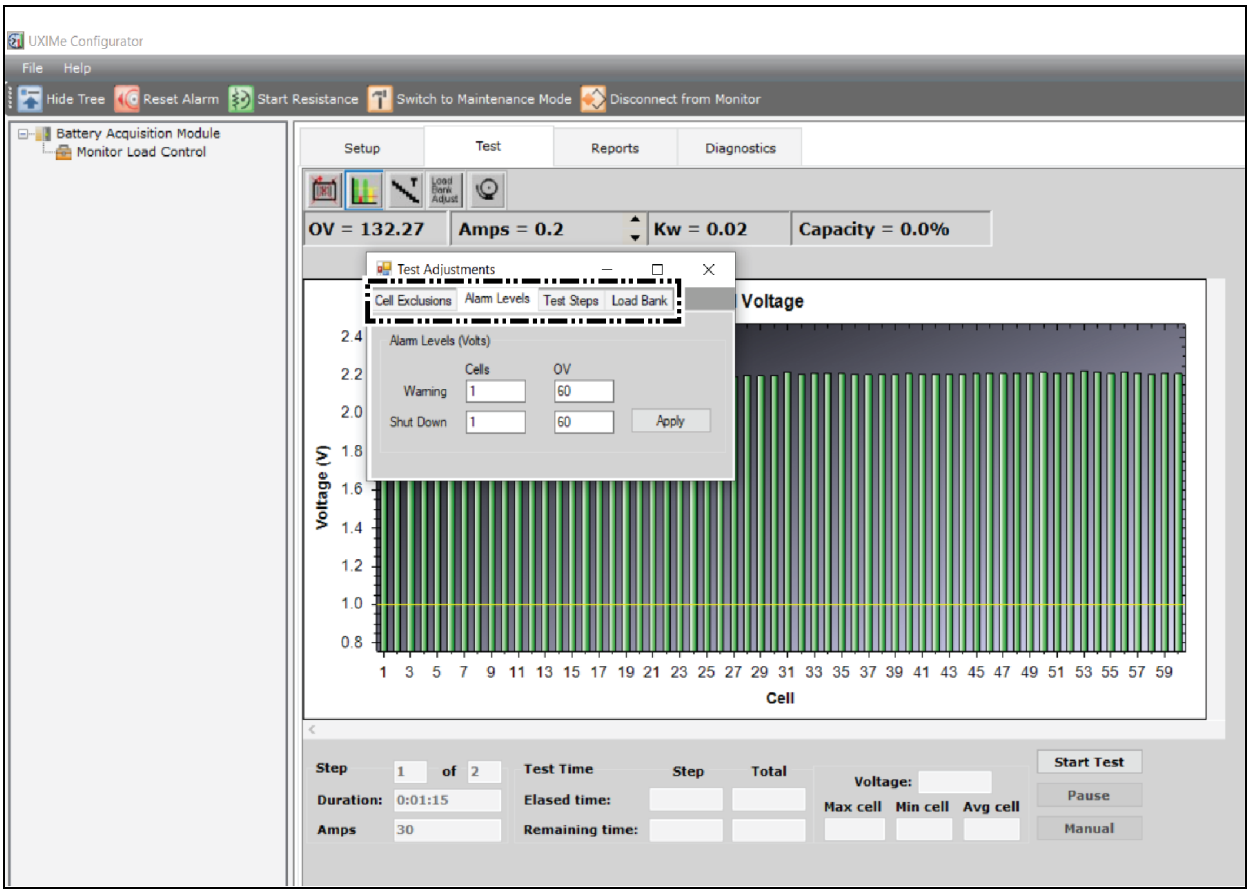
A beeping alarm indicates a warning, and a solid tone indicates a shutdown. To silence the warning alarm, close the warning message box. To silence a shutdown alarm, click *Resume* or *Stop Test*.

If the OV Warning level is lowered, the OV comes out of alarm and the OV display returns to background color, but the event is retained in the alarm history. Use the Adjust Alarm Levels toolbar button to change the level. See Alarm levels on page 26.

4.6.6 Test window toolbar

The Toolbar buttons that appear along the top of the BCTI system Test window are shown in the following figure.

Figure 4.7 BCTI System Test Toolbar



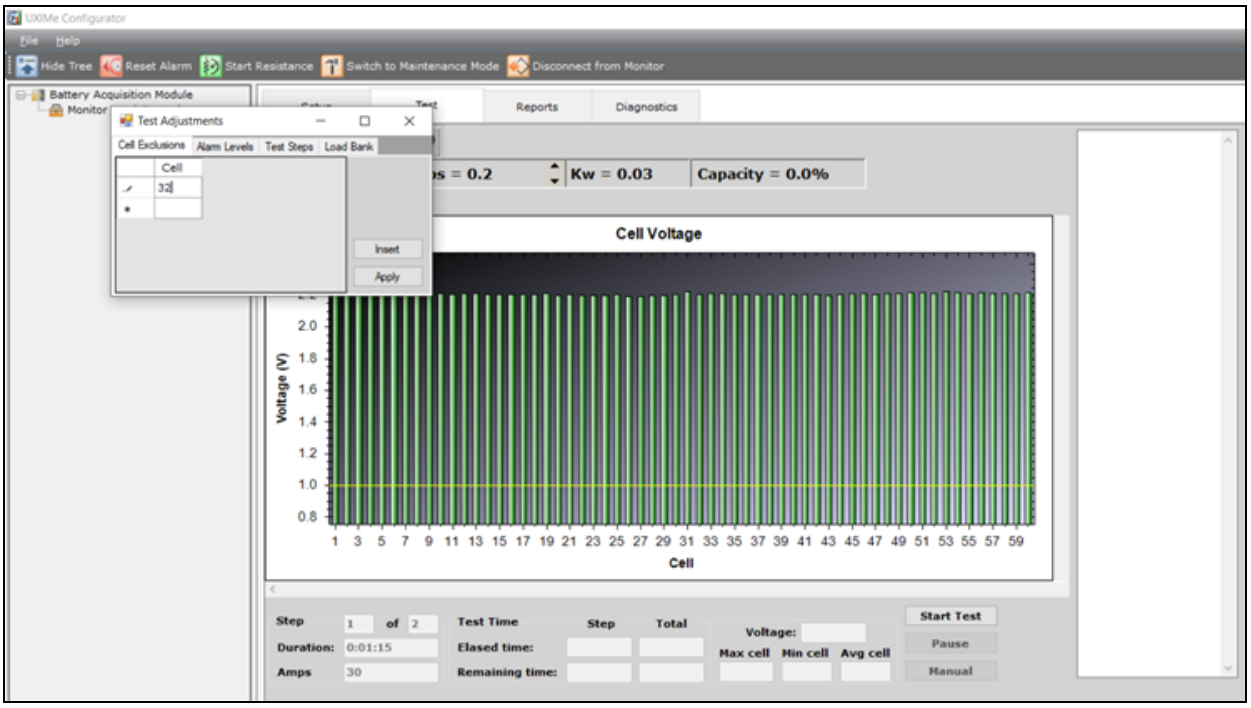
Use the buttons to exclude or include cells that went into shutdown, change the alarm levels, change test step duration and load, change the number of graph grid lines, zoom in on a bar axis, and view the alarms list. These buttons are described in the following sections.

Exclude cells

To remove a cell from the test, click the *Exclude Cells* button. In the Cell Exclusions dialog box, click Add *Cell*, type cell number, then click *Exclude*. The cell appear in the list in the Cell Exclusions dialog box. A box with a check mark indicates the cell is excluded from the test. To include an excluded cell back into the test, clear the checkbox. You can exclude cells before a test, and during a test without pausing the test. You can include them back during a test without pausing.

Excluding and including a cell from the test automatically adjusts battery alarm levels by changing the OV warning and shutdown values by one cell level. All items on the cell exclusion list are cleared when the test is exited.

Figure 4.8 Cell Exclusions

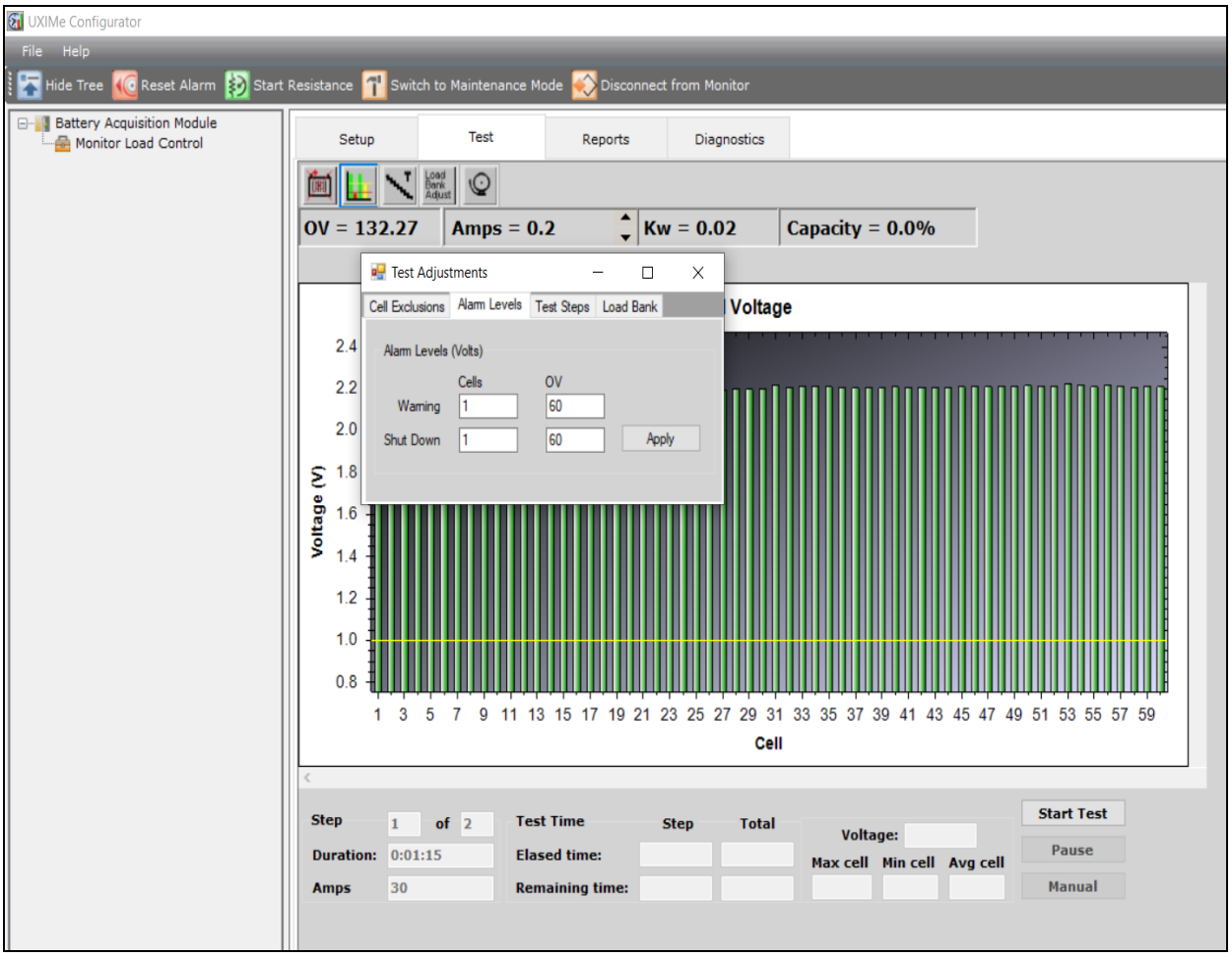


Alarm levels

You can change the warning and shutdown levels for cells and OV while the test is running. Click the *Adjust Alarm Levels* toolbar button. After changing a level, use the TAB or ENTER key or mouse to move to the next box. The new alarm level takes effect immediately. Changes are recorded in the test activities portion of the report.

NOTE: Changes made to the alarm levels and Test Steps using the Test Adjustments dialog boxes are valid only for the presently running test and do not permanently change the Test Setup information.

Figure 4.9 Alarm Levels

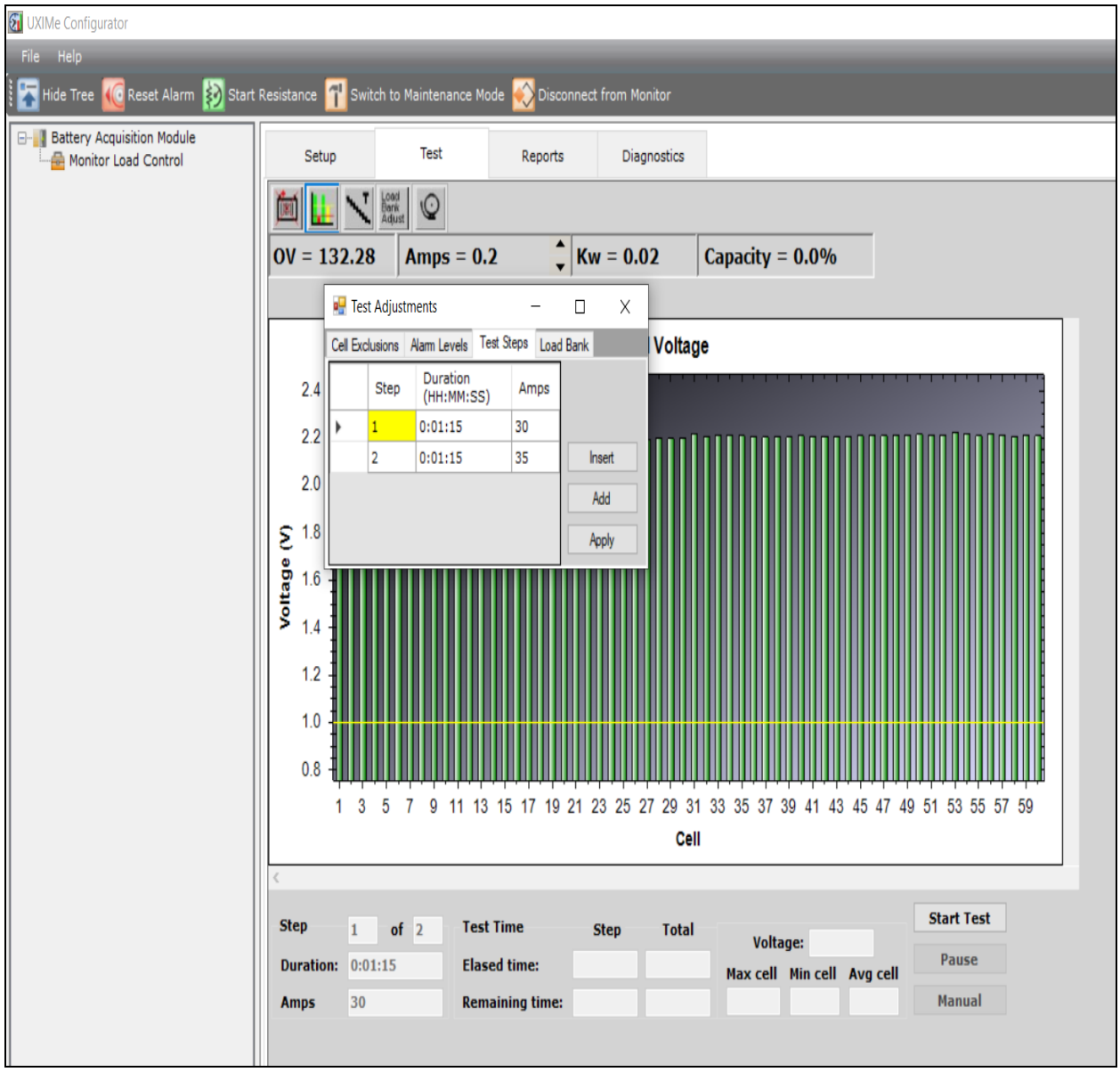


Adjust test steps

Click *Adjust Test Steps* to add new steps (Modified Performance test) or change the duration or load of the presently running step or subsequent steps (Modified Performance test).

NOTE: You cannot change the duration of a presently running step to less than the elapsed time of the step. In addition, steps that have already run cannot be changed. To add a new step, click *Add Step* (Modified Performance test).

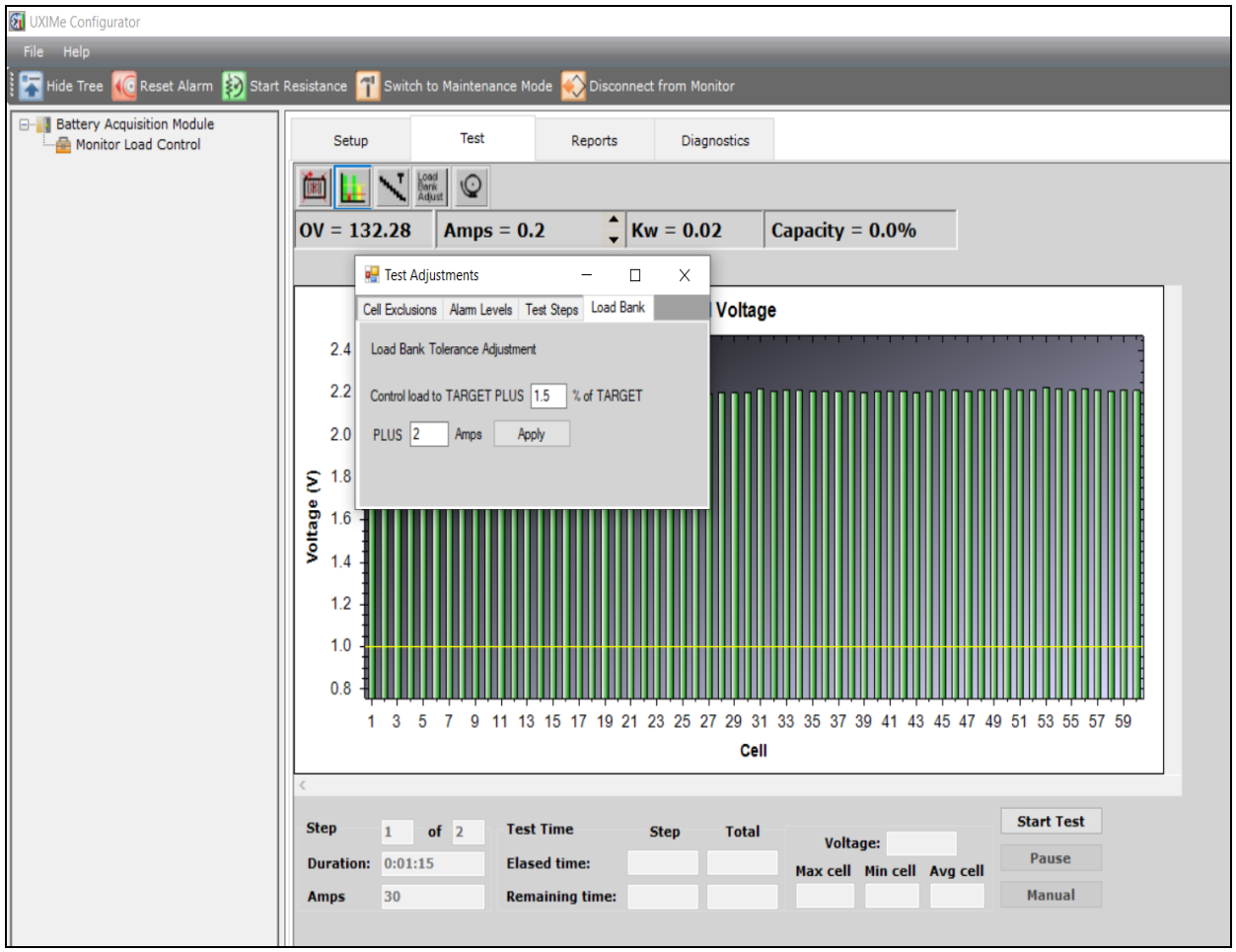
Figure 4.10 Adjust Test Steps



Load Bank adjust

Click the *Load Bank Adjust* button to adjust the Load Bank tolerance during a test. If you are experiencing load control problems during the test, increase the tolerance % (percent) or current (amps).

Figure 4.11 Test Adjustments



Modifying graph

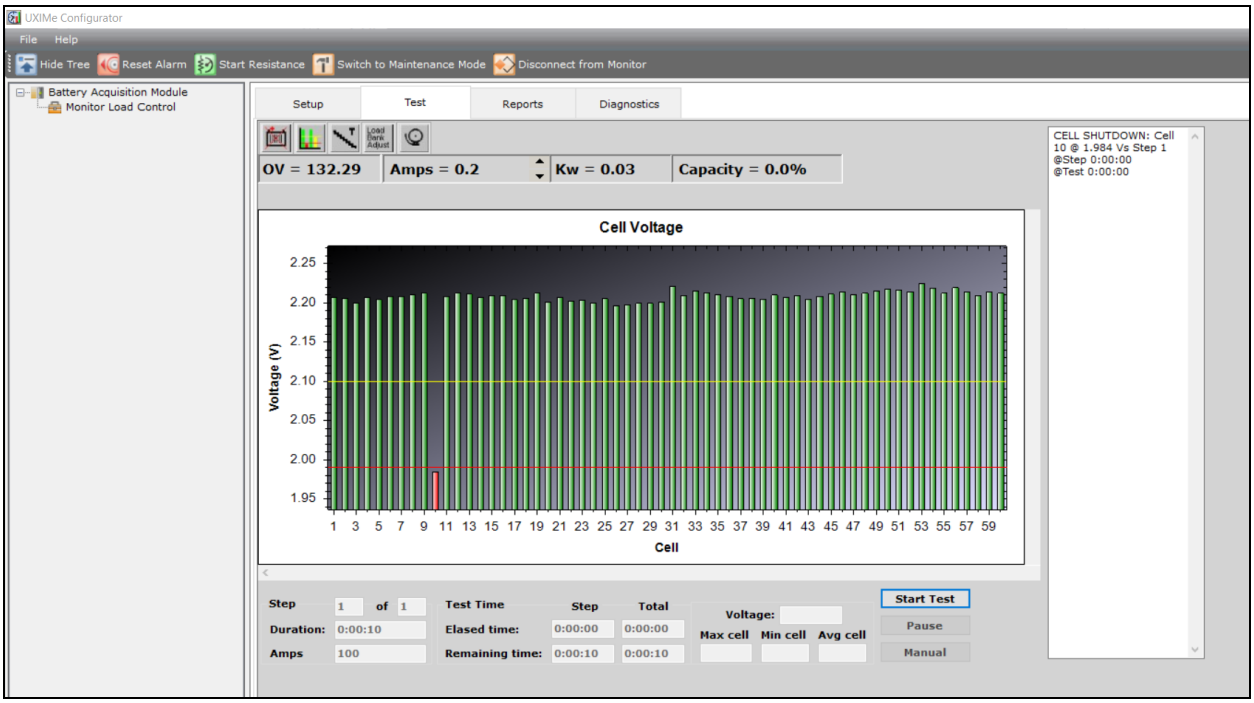
Use the Change Cell Axis Count or the Zoom on Cell Axis buttons to change the number of X-axis lines (graphs) displayed or to zoom in on a graph. Click *Change Cell Axis Count* to spread the cells over more than one X-axis. This is useful when there are more than 60 cells in a test.

When more than one X-axis is displayed, you can click *Zoom on Cell Axis* to increase the size of an axis display.

View alarms

Click the *View Alarms* button to open a box that lists all cell and OV alarms that are occurring or have occurred during the test.

Figure 4.12 View Alarms



4.6.7 Hardware failure

If the computer senses a board failure or loses communication with the BCTI system, the test pauses and the window displays an error message. If Load Banks are in use, the system shuts them down. Upon communication failure, all selected levels are voided.

Before doing any diagnostics, verify the Load Banks are powered off and no load is being applied to the battery. During the pause mode, check all cable connections and the equipment. After the problem is resolved, the testing can be resumed.

4.7 Report Generator

The BCTI system Report Generator program reads the test data files generated by the BCTI system test software and creates customized reports. After the BCTI system performs a load test, the test data is saved to a file. this data is presented in report format that battery test personnel rely on to analyze battery system performance. Using the Report Generator, you can display graphs, edit site information, add notes and customize report pages.

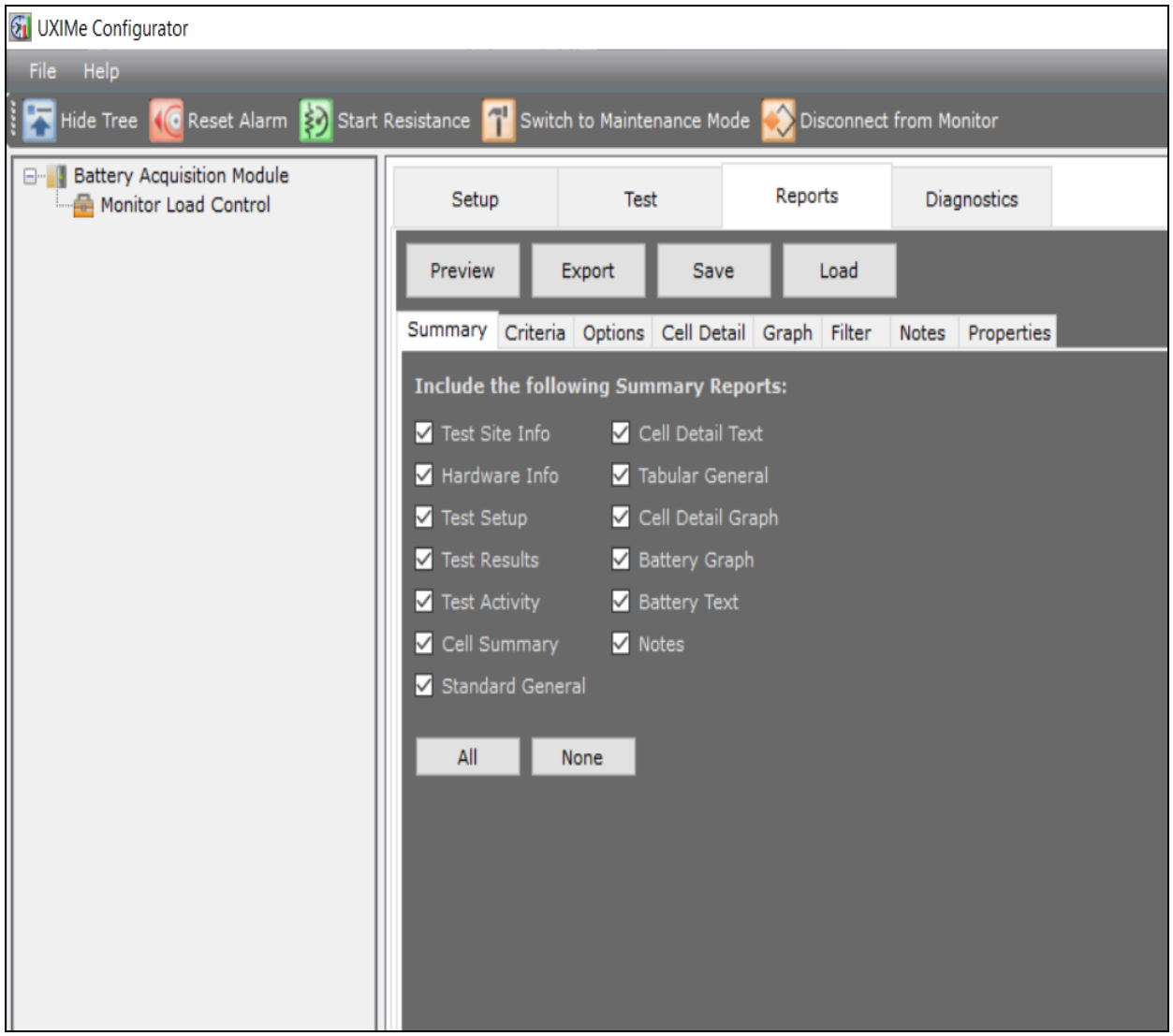
The Report Generator can save reports in several file formats. One format allows you to open the report at a later date and modify site information or appearance. Alternatively, you can save the report in the archive format, which protects the document against changes to ensure the integrity of the information. In Export mode, the Report Generator exports files in formats that can be used by commercial database programs or text editors.

Sample Data - Use the file reportdemo.btr to try the features in the Report Generator.

4.7.1 Starting the report generator

After the system performs a Load Test, you can generate a report for battery data analysis. To generate a report from a completed test, click *Reports* on the main menu, then open the file. The Reports main dialog box has four buttons and eight tabs.

Figure 4.13 Reports Main Window



Click a tab or button to open dialog boxes. The following sections describe the items in each dialog box. To exit the Report Generator, click the *X* in the upper right corner of the Reports main dialog box.

4.7.2 Opening a report

When the Report Generator is started, the Open dialog box appears.

The Files of Type drop-down list allows you to select BCTI text (.BTR or .BTRX) or binary (.BBR) files. The BCTI system test software generates BTR format files, the Report Generator saves the reports in BTRX format.

4.7.3 Loading a file

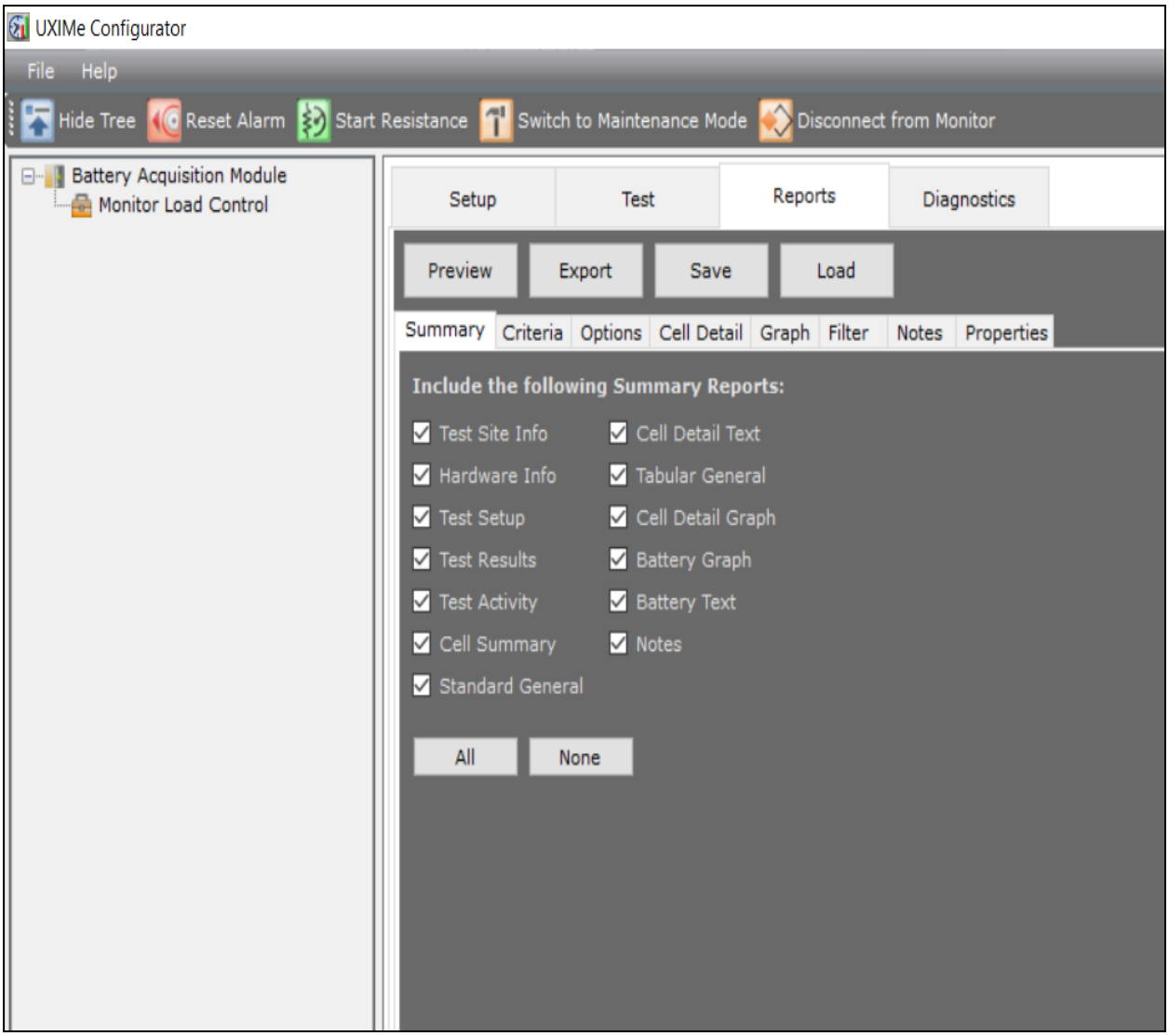
Load

When certain functions are selected and no file is open, a message indicates a file must be opened. To open a file after the Report Generator is started, click *Load* and select a file. You do not need to close the old file, as only one text or binary file can be open at a time. However, you can open an archive file while a text or binary file is open.

Summary window

After a file is opened, the Reports dialog box appears. Click the *Summary* tab to display the Summary dialog box. Items in this box depend on the type of report selected.

Figure 4.14 Summary Window



On the Summary box, select the items to include in the report. If a Charger test report is selected, Battery Graph and Battery Text change to Charger Graph and Charger Text. To select all the items in the Summary box, click *All*. To clear all the items, click *None*.

Table 4.1 Items on View Reports Form

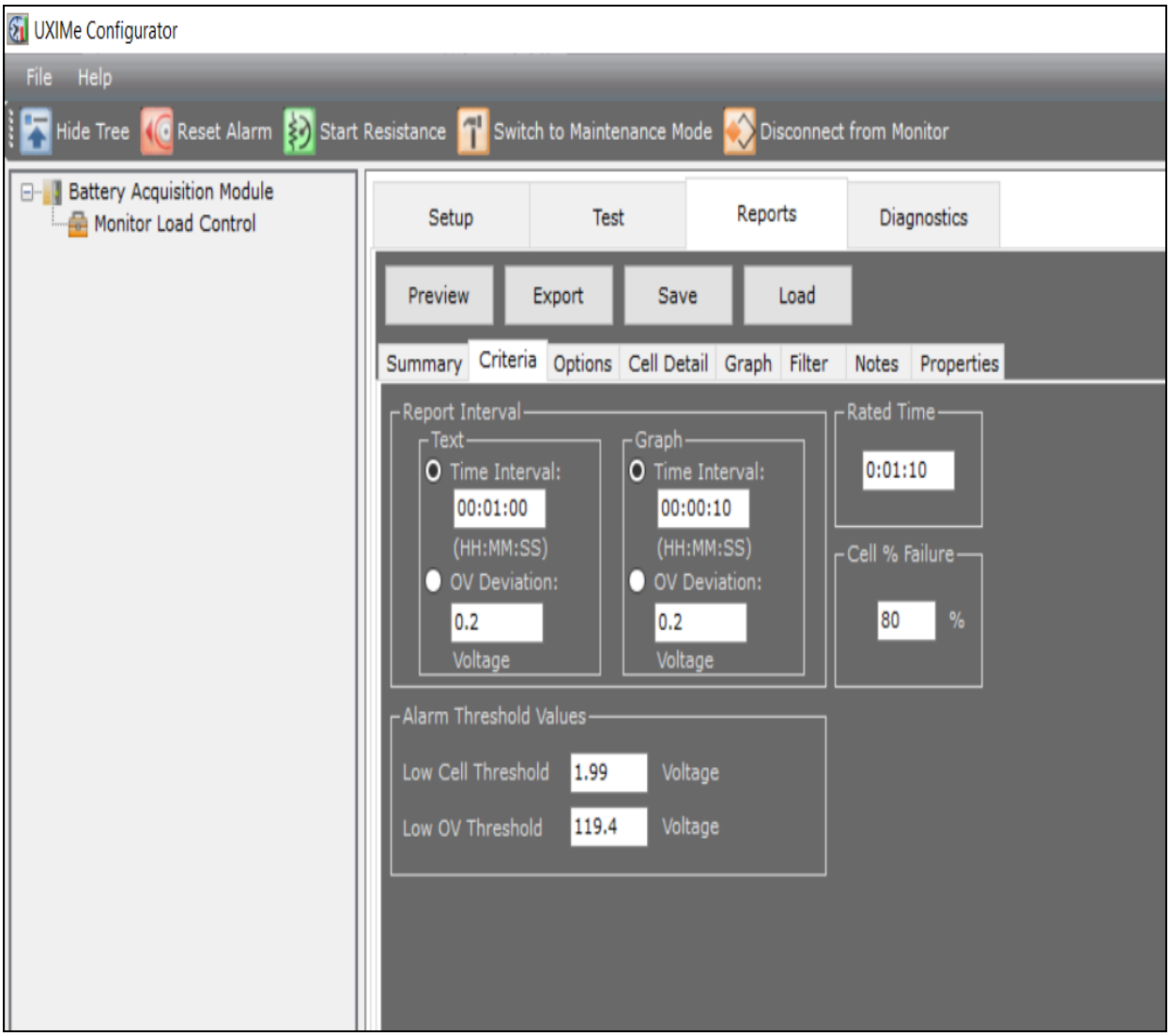
Items on View Items on View	Item on View Reports From Non-Charger Report	Item on View Reports From Charger Report
Test Site Info	Site	Site
Battery Name Info	Battery	Battery
Test Setup	Setup	Setup
Test Results	Results	NA
Test Activity	Activity	Activity
Cell Summary	Cell Summary	NA
Standard General	Standard	NA
Cell Detail Text	Cell Detail	NA
Tabular General	Tabular	NA
Cell Detail Graph	Detail Graph	NA
Battery Graph or Charger Graph	Battery Graph	Charger Graph
Battery Text or Charger Text	Battery Text	Charger Text
Notes	Notes	Notes

Each item selected in the Summary box results in a tab appearing on the View Reports Form window, which opens when *Preview* is clicked. See View reports form (preview) window on page 41.

Criteria window

Click the *Criteria* tab to display the Criteria dialog box.

Figure 4.15 Criteria Window



Time interval and OV deviation

Click *Time Interval* or *OV Deviation* and type a value, or click the time or voltage buttons next to the boxes. The Report Interval determines the frequency of report sampling. Specify time in hours, minutes, and seconds (10 second minimum) or OV deviation in volts (0.2 volt minimum).

Low cell threshold and low OV threshold

The Alarm Threshold Values area is enabled for all tests except Charger. The thresholds are the cell and OV shutdown levels entered in Test Setup, or the last levels entered during the test. On the report, values that violate these thresholds are printed in color and with brackets (< >) for black ink printers. These values can be changed if desired.

High voltage warning and low voltage warning

For the Charger test, the Alarm Threshold Values area changes to Charger Warning Levels. These are the warning levels entered in Test Setup, or the last levels entered during the test. On the report, values that violate these thresholds are printed in color and with brackets (< > for low threshold violation and > < for high threshold violation) for black ink printers. These values can be changed if desired.

Rated time

Rated Time is used by Capacity test reports and can be modified at report time.

Cell % failure

The percentage of cell failure is used by Capacity test reports and can be modified at report time. The value was previously fixed at 80% for reports, but can now be changed.

NOTE: Changing the threshold, rated time, and percentage failure values affects which cells are indicated on the report as failing.

Options window

Click the *Options* tab to display the Options dialog box.

Options window

Report title and report footer

Edit or add text in these boxes if required. The Report Title always prints (unless there is no title text), but you must select the Footer Text Printed checkbox to print the footer. To print the page number and date, select the Footer Page Number and Footer Date Printed checkboxes.

Expand all test results graphs

Select this box to display a Drill Down Report for each cell that fails minimum voltage threshold level. This report (graph) appears on windows under the Results tab on the View Reports Form window. To have the Results tab appear, select *Test Results* on the Summary dialog box. See Drill down reports on page 42.

Include power in report

Select this box to list power in reports, in addition to voltage and current.

Start capacity calculation at target

Select this box to calculate the capacity when the target value is found. All the test times in the report are adjusted by this time.

NOTE: For example, if it takes four seconds to find the target, then all the times in the test report will be minus four seconds. If Calculate Capacity at Target was selected during Test Setup, this option is not available.

Ignore zero target steps in capacity calculation

Select this box to ignore steps when the load is targeted to 0 (zero) in the capacity calculation. For any steps targeted to zero, the time of that step will not be used in the calculation.

Include steps starting and ending values

For a multi-step test, select this box to see the starting and ending values of the steps. The starting and ending times are included in the report.

Clip start and end of test for report

In the Start and End boxes, type the clip values for the start and end of a report in hh:mm:ss format. This is used when the BCTI system does not control the load, or there is no load interval or low load at the start and end of the test.

To determine the clip values, on the Criteria box, enable OV Deviation. On the Summary box, select only the battery text (.txt) report. To compile the report, click *Preview*. From the report, determine the time where the voltage drops or current is detected. This is the start clip time. The time where the voltage rises or current is no longer present is the end clip time. Set the end clip time on the Options box to one second less than the actual value found. For example, if the voltage rises at 13 minutes, 00 seconds, type 12 minutes, 59 seconds for the end clip time.

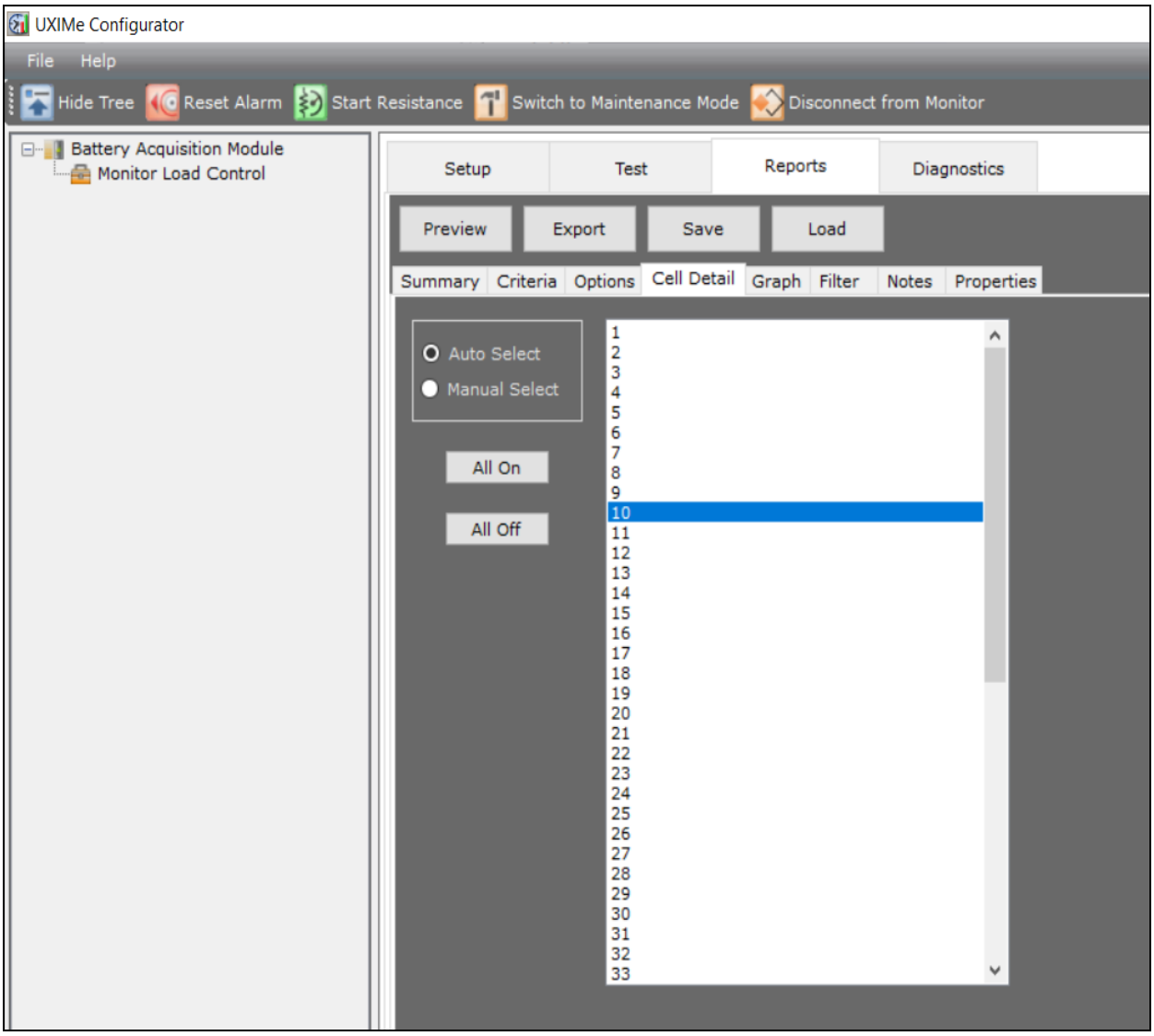
Enable

Select this box to clip the start and end times for the report.

Cell detail window

Click the *Cell Detail* tab to display the Cell Detail dialog box. This box allows you to automatically or manually select the cells included in the cell detail report.

Figure 4.16 Cell Detail Window



Auto select

Click *Auto Select* to select cells that were at or below the low threshold level. In auto select mode, you can manually select additional cells for the report by selecting checkboxes in the list. To clear a selection, select the box again. If you later change the low cell threshold on the Criteria box, cells that meet the new criteria are automatically selected, and cells manually selected before the threshold change are not selected.

Manual select

Click the *Manual Select* button to select cells manually for the report. Add cells to the report by selecting the checkboxes. To clear a selection, select the box again. Changing the low cell threshold does not change selected cells when in the manual mode.

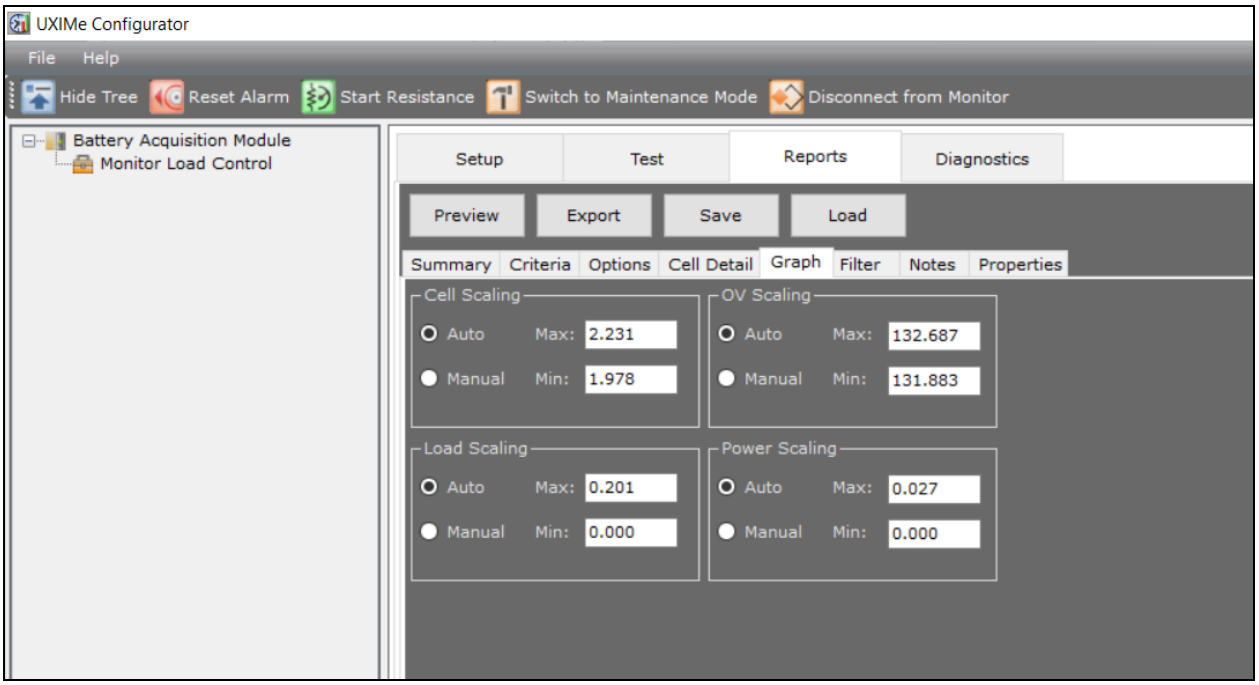
All On and All Off

Click *All On* to select all cells in the list. Click *All Off* to clear all cell selections. You can use this feature in auto or manual mode.

Graph window

Click the *Graph* tab to display the Graph dialog box. The values displayed are 10% below the minimum and 10% above the maximum values found during the test.

Figure 4.17 Graph Window



Manual

To change the minimum and maximum values displayed on report graphs, click *Manual* and select values. The Cell Scaling and OV Scaling values are in volts. Load Scaling is in amps, and Power Scaling is in watts.

Auto

If Auto is selected, the graphs are plotted to within 3% of the values.

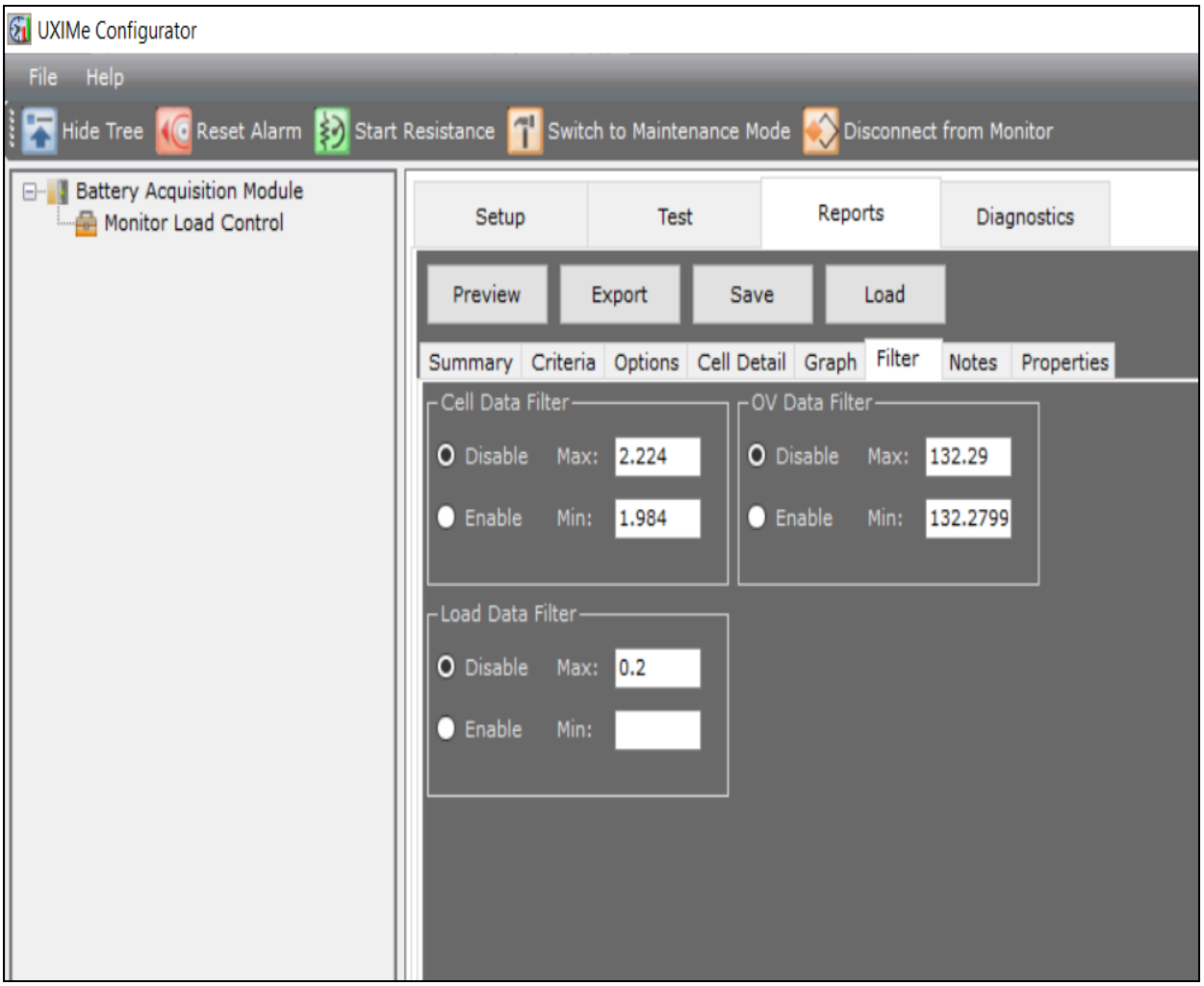
Low cell criteria label and low OV criteria label

You can type new graph names in these areas for report graphs.

Filter window

Click the *Filter* tab to display the Filter dialog box. The values displayed are the minimum and maximum values found during the test. This dialog box allows the you eliminate bad values, such as those caused when a clip lead falls off.

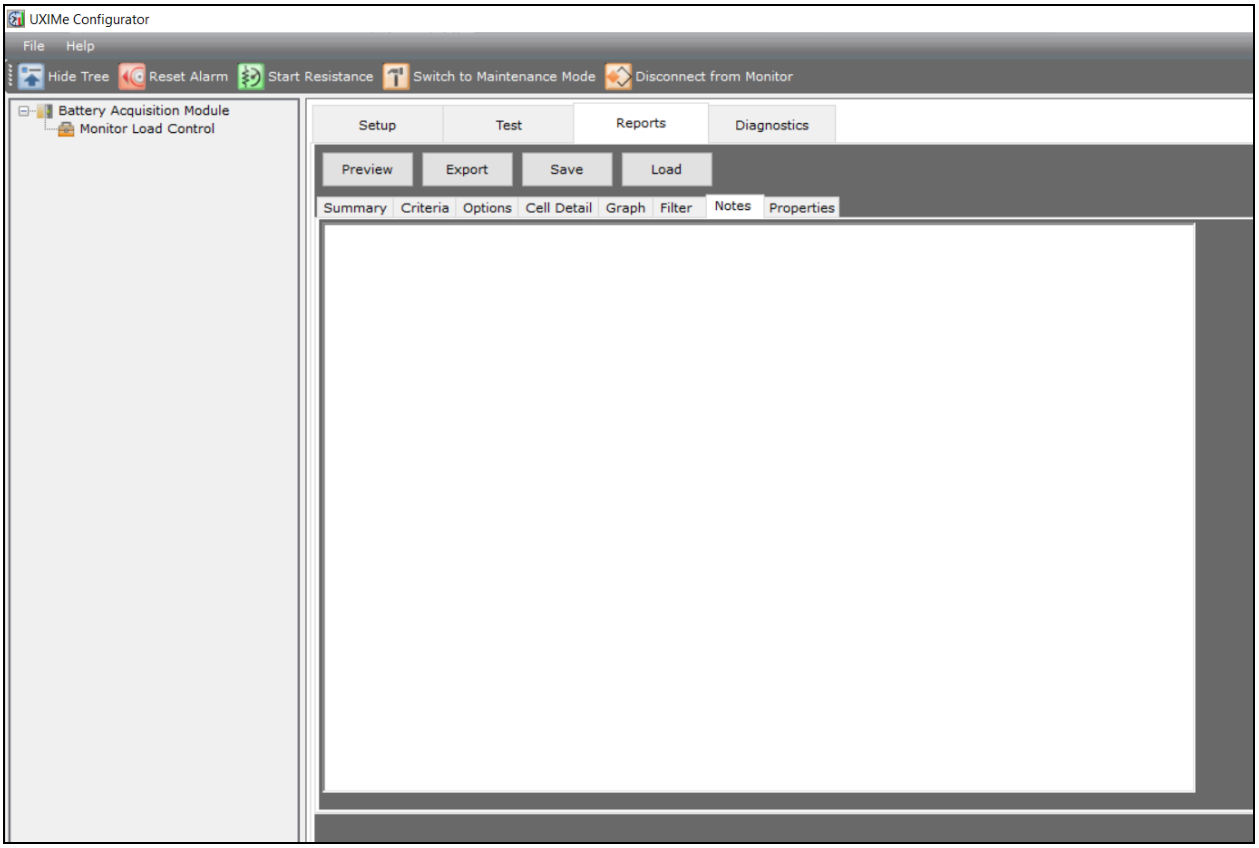
Figure 4.18 Filter Window



Disable is the default selection. To change values, click *Enable*, then type a value or select a value. Cell Data Filter and OV Data Filter values are in volts. The Load Data Filter is in watts.

Notes window

Figure 4.19 Notes Window

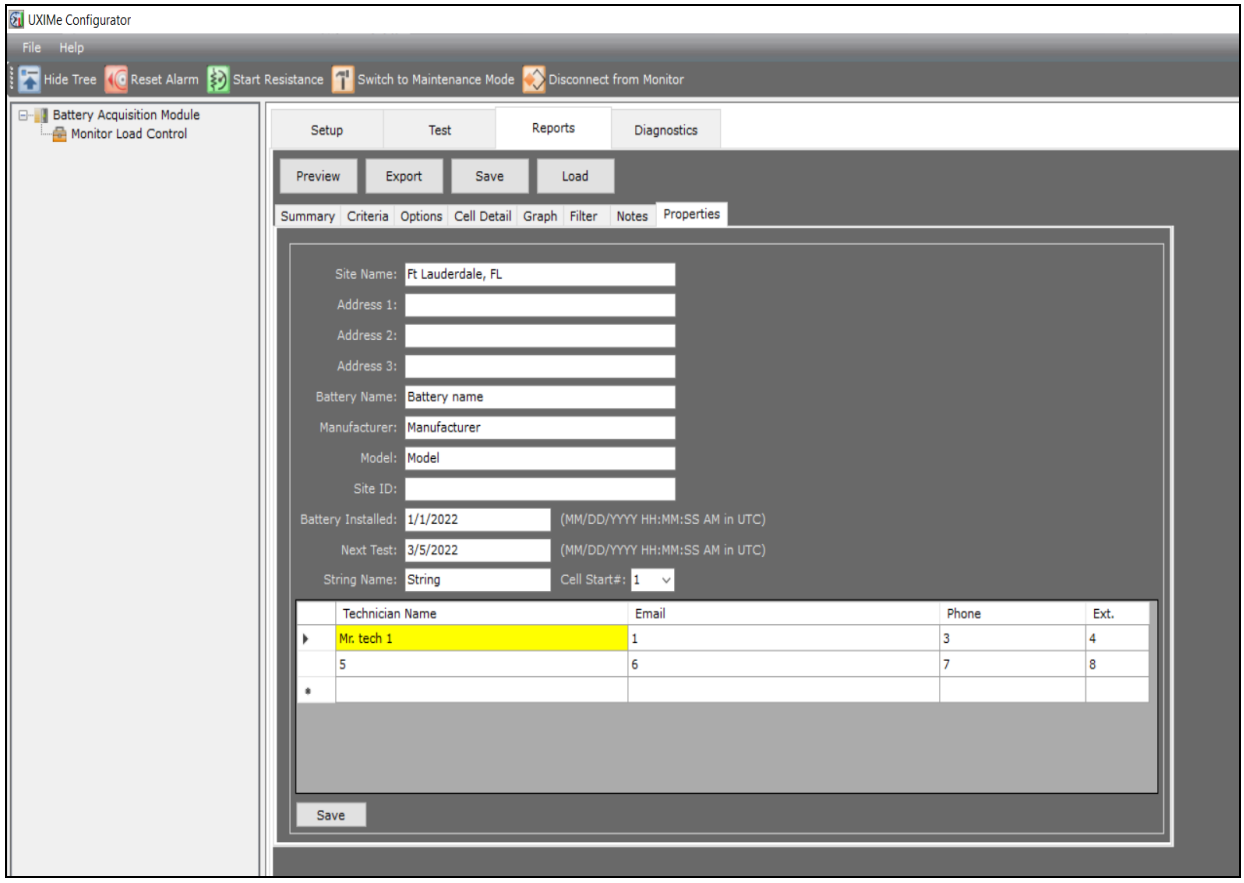


You can add notes to the report by typing them in this dialog box. Notes can include details about test results or equipment used, and they appear on the last page of the report. To make the notes permanent, save the file as a .BBR file. Click the *Notes* tab to display the Notes dialog box.

Report properties window

Click the *Properties* button to display the Report Properties dialog box.

Figure 4.20 Report Properties

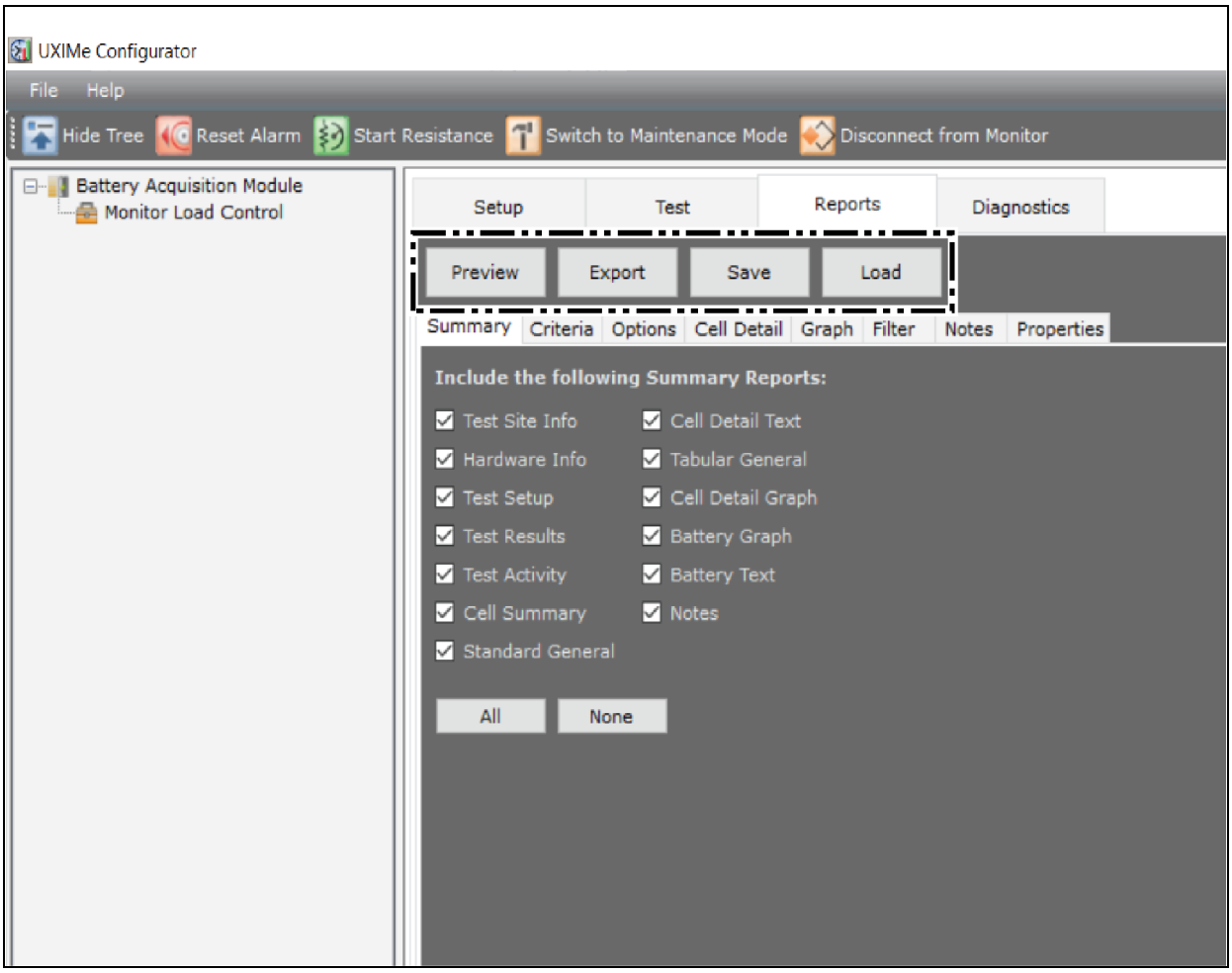


Use the Properties dialog box to edit site information, then click *Save* button to save the changes. Click the *X* in the upper right to close the window.

View reports form (preview) window

After all report parameters are selected, to view the report on the window, click *Preview*. Each section of the report is displayed one page at a time. To change the size of the page display, click *Page*, Width or Full. To view different pages in one section, click the first, previous, next or last page buttons at the top of the window.

Figure 4.21 View Reports Form



To view different sections of the report, click the tabs along the top of the window. A tab appears for each item selected in the Summary box. See Summary window on page 32.

Saving a report

You can use the Report Generator to open a BTR, BTRX, or a BBR file and customize a report. After customization, all reports will be saved as BTRX files. These reports can also be exported as pdf files. The BBR file is a legacy binary version of the BTRX file supported as read-only for compatibility purposes.

Save (in reports)

You can use the Report Generator to open a BTR, BTRX, and BBR file and customize a report. Select *options* in the Reports dialog box to create different styles of reports for the same data. To save a report in BTR or BTRX format, click *Save* in the Reports box. In the Save As box, select the folder, type the file name, and then click *Save*. BTR is report data, and BTRX also includes report settings. The BBR file is a legacy binary version of the BTRX supported as read-only for compatibility purposes.

Drill down reports

A drill down report (graph) displays the cell voltage versus test time. A report for each cell that fails minimum voltage threshold level can be automatically or manually displayed on the Test Results pages.

To automatically display the Drill Down Reports, select *Expand All Test Results Graphs* on the Reports Options dialog box.

To manually display a report, click *Preview* on the Reports dialog box, then click the *Results* tab to display the Test Results page. This page lists cells that fell below the minimum threshold voltage. Click on a cell description line to display a Drill Down Report for that cell. The report appears under the description line of the selected cell. You can display a report for each failing cell listed. To close a report, click on the same description line.

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Appendices

Appendix A: Technical Specifications

Table A.1 BCTI System Module Technical Specifications

Item	Value
LEDs	
Solid Green LED	Vertiv™ Alber™ CLU Power
Flashing Green LED	Communication Transmitted (TX)
Flashing Green LED	Communication Received (RX)
Power	
Input Power	120VAC, 0.75A Max
Input	85-264VAC, 47 to 63 Hz
Output	12V DC, 18W Max
Communications	RS485 to UXIME/BDS-256XL battery monitor
Physical	
Enclosure	Aluminum Alloy
Dimensions	6.21" W x 1.73" H x 8.00" D
Weight	1.5 pounds
Operating Environment	
Temperature Range	0- 50 °C (32 - 122 °F)
Humidity Range	0 to 80 % RH (non condensing) at 10 to 31 °C 0 to 50 % RH (non condensing) at 32 to 50 °C
	For Indoor Use Only
	Installation category II
	Pollution degree 2
	Altitude 0 to 2000 meters above sea level
Internal Battery	One CR2032 non-rechargeable Lithium Manganese Dioxide 3V coin cell battery on circuit board. **NOTE: The Coin cell battery in the circuits board is not user replaceable.**
Safety Approvals	UL61010-1 EN61010-1 IEC61010-1
EMC Approvals	FCC part 15 class A

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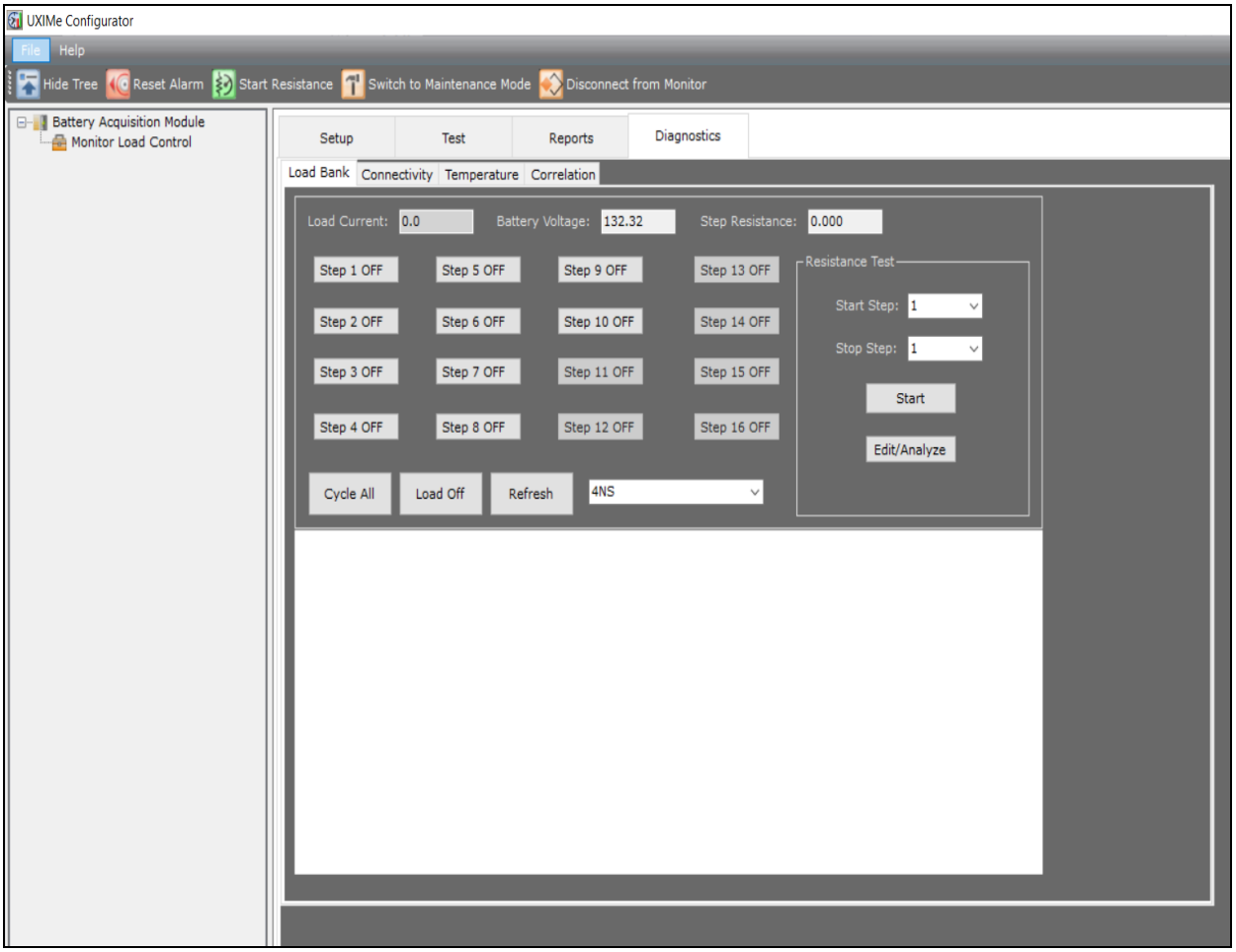
Appendix B: Load Bank Diagnostics

Load Bank diagnostics can be used in two ways. Click a single step on to display the load current, the battery voltage, and the step resistance, or perform a cumulative resistance test, which saves the individual step resistance to the setup file.

If you do not enable Auto Detect Step Resistance, See Load Bank on page 19, then you must enter the resistance for each step. There are two methods to obtain this information and a combination of the two can be necessary. After resistance values are entered, the data is saved with the Load Bank setup information for the currently selected Load Bank.

Figure B.1 Load Bank Diagnostics



The first method to obtain the step resistance is to use an ohmmeter to measure the resistance of the steps.

WARNING! Ensure power is removed from the Load Bank before measuring resistance values with an ohmmeter.

You can use an ohmmeter to measure the lower steps that have a higher resistance, but to get accurate readings, you should use a micro-ohmmeter to measure the upper steps that have lower resistance values of 20 ohms or less.

You can also use the BCTI system program to obtain step resistance values.

To set up the Load Bank resistance:

1. Select a *Start Step* in the Resistance Test group.

NOTE: Depending on shunt rating, selecting Start Step 3 or Step 4 is recommended, because lower steps produce very low voltages across the shunts, which can result in inaccurate readings.

2. Select a *Stop Step* in the Resistance Test group. Ensure there is sufficient current to drive the stop the step selected.
3. Verify the Battery Voltage box displays battery or charger voltage. If the voltage is not displayed, fix the electrical connections before continuing with the test.

To begin the Load Bank resistance test, click *Start*. The graph with resistance values appear. Observe the X- Axis of the graph. Plots on the graph alternately indicate the resistance of an individual step and the cumulative (parallel) resistance of the steps up to that step. Double-click the graph to maximize.

NOTE: If you do not enter the password, the test runs but the values are not saved.

When the test is complete, click *Edit/Analyze* to display the Steps Resistance box. See Figure B.1 on the previous page.

After running the load bank resistance test, the Step n boxes display the resistance values that were read. To edit steps with no resistance values, read the resistance value on the panel of the Load Bank and type it into the box for each step.

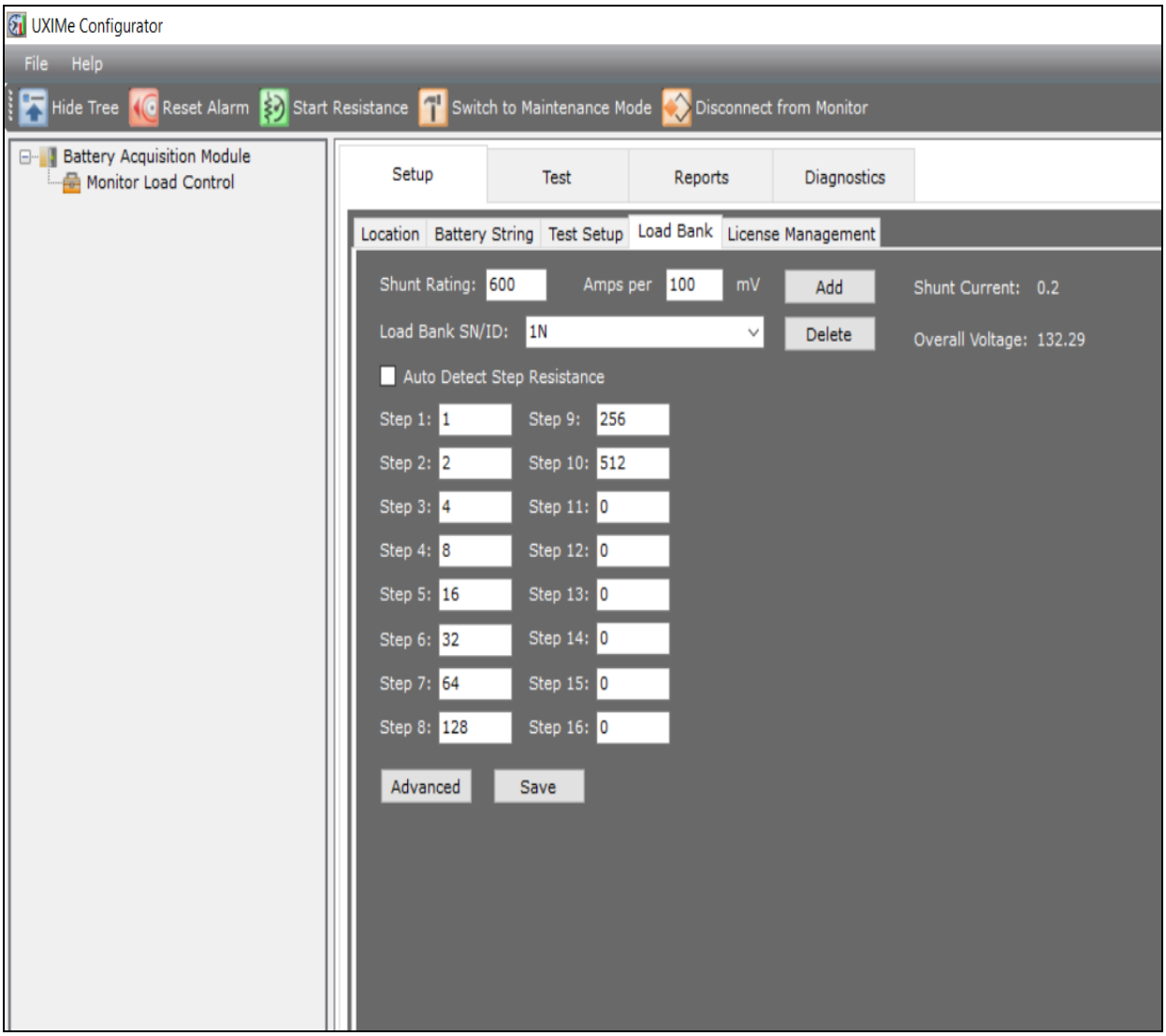
NOTE: Not all Load Banks will have this information.

You should run the Load Bank resistance test periodically, especially if there is a problem in controlling the load. The test verifies that no step resistance is too high or too low. Each step should be approximately half the resistance of the previous step, unless its weight value is not double the weight value of the previous step. See Load Bank on page 19.

IMPORTANT! If the Load Bank is used in low and high voltage modes, the values displayed are for the currently selected mode of operation (see the Load Banks panel for different voltage settings. If using both modes of the Load Bank, add another Load Bank to the setup (in *Setup – Load Bank* and repeat the test. Name the Load Banks Low Voltage and High Voltage. Assign the Load Bank used for each test type. Remember that values only need to be entered if Auto Detect Step Resistance is not enabled.

To analyze the Load Bank, click *Analyze* or, to close the Steps Resistance dialog box and return to the Diagnostics Load Bank dialog box, click *OK*. If you click *Analyze*, the Load Bank Analysis dialog box appears with values at zero. In the Max OV box, type the maximum overall voltage and click *Analyze*. The Load Bank is analyzed and values appear on the dialog box.

Figure B.2 Load Bank Analysis



The Load Bank Analysis dialog box has three columns of data for each Load Bank step, Load, Accumulative, and Vernier Gap. The Load column indicates how much current each step will draw, based on the maximum OV value entered. The Accumulative column is the total current draw of the steps up to that point. The Vernier Gap is the difference between the step Load value and the Accumulative value of the previous steps. The highest Vernier Gap number indicates the minimum tolerance (in amps) of the Load Bank. Type this value plus one on the Load Bank Advance Setup window under *Setup-Load Bank-Advance*.

To close the Load Bank analysis window:

Click *X* in the upper-right corner.

To close the steps resistance box:

Click *OK*.

Diagnostics Load Bank

On the Diagnostics Load Bank dialog box, click the appropriate Step 1 to Step 16 to turn on the step corresponding to the step number. If power is supplied to the load, the step resistance is displayed. Toggle the button to turn the step on or off. With no power to the Load Bank, you can use an ohmmeter to read each steps resistance. Results of the Load Bank diagnostics can be needed by Vertiv to assist in troubleshooting.

Resistance measurements

NOTE: Each Vertiv™ Alber™ CLU Model requires a specific load bank Worksheet to match the Vertiv™ Alber™ CLU model. Contact Vertiv Services to obtain the proper load bank Worksheet for the Vertiv™ Alber™ CLU model being verified.

Connect the BCTI system Load Control to J2 on the Load bank being verified.

Connect Power to the Test Equipment and the Load Bank and energize.

To verify step function:

Using the BCTI system in Diagnostic Mode, energize each step listed on the worksheet to verify that each step's relay or contactor(s) are being energized. This can be accomplished by hearing an audible energizing of the relay/contactor and by seeing the visual movement of the relay/contactor. Verify the LEDs on the Vertiv™ Alber™ CLU control P/C board are illuminated. Step 1 is physically the lowest LED and the subsequent steps follow upwards for each step.

To verify resistance:

1. Connect the Multi-Meter or Ohmmeter leads to the load connection bus bars labeled J10, J11, J12, and/or J13 on the Load Bank as directed on the load bank Worksheet.
2. Using the BCTI system, energize each step in sequence and record the readings on the load bank Worksheet. Compare each reading to see if the readings fall within the tolerances given. Note that it is critical that the meter used has milli-ohm sensitivity.
3. Repeat the same steps, following connection directives and record the readings on the load bank Worksheet for each page.

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