SuperSafe® iON SC1548P95DS

Lithium Battery Module User Guide

Effective: 01/2026

Read this document carefully.
Learn how to protect your equipment from damage and fully understand its functions.

NOTICE

The material contained in this document is for information only and is subject to change without notice.

Contents

1. Safety

Save these instructions

This document contains important safety instructions that must be followed during the installation, servicing, and maintenance of the product. Keep it in a safe place. If there are any questions regarding the safe installation or operation of this product, contact EnerSys or the nearest SuperSafe® iON battery representative.

1.1 Safety symbols

To reduce the risk of injury or death, and to ensure the continued safe operation of this product, the following symbols have been placed throughout this document. Where these symbols appear, use extra care and attention.

Symbol	Type	Description
	**WARNING**	Risk of serious injury or death Equipment in operation poses a potential electrical hazard which could result in serious injury or death to personnel. This hazard may continue even when power is disconnected.
	**CAUTION**	Cautions indicate the potential for injury to personnel.
	**CAUTION**	Risk of burns A device in operation can reach temperature levels which could cause burns.
	**ATTENTION**	The use of attention indicates specific regulatory or code requirements that may affect the placement of equipment or installation procedures. Follow the prescribed procedures to avoid equipment damage or service interruption.
	**GROUNDING**	This symbol indicates the location or terminal intended for the connection to protective earth.
	**NOTICE**	A notice provides additional information to help complete a specific task or procedure or general information about the product.

1.2 General warnings and cautions

ATTENTION

Failure to install or use this lithium battery module as instructed in this document can result in damage to the lithium battery module that may not be covered under the limited warranty.

WARNING

You must read and understand the following warnings before installing the lithium battery module and its components. Failure to do so could result in personal injury or death.

CAUTION

Follow all local safety practices and guidelines while lifting the lithium battery module.

ATTENTION

Battery safety data sheets

Read the battery safety data sheet (SDS) before installing lithium battery modules in the power system. The SDS provides important information including hazard identification, first aid measures, handling and storage, and personal protective equipment (PPE).

Instruction compliance

Carefully read and follow all instructions provided in this manual before handling, operating, or maintaining the lithium battery module.

Personnel requirements

All individuals involved in handling, operation, or maintenance must:

- Receive appropriate training.
- Use tools rated for electrical work.
- Wear suitable personal protective equipment (PPE).

Handling and lifting

Use proper lifting techniques when moving equipment, components, or lithium battery modules to prevent injury or damage.

Regulatory compliance

Adhere to all applicable local, regional, and national regulations for electrical systems.

Note: System voltage may affect which regulations apply.

Battery operation

- Do not overcharge or overdischarge lithium battery modules. Doing so may cause permanent damage or create safety hazards.
- Operate and store the lithium battery module only within the environmental and electrical limits specified in the Specifications section.

Heat and ignition sources

- Keep the lithium battery module away from heat sources and open flames.
- Maintain a minimum clearance of 1.2 inches (30 mm) between cables and any heat-emitting components to prevent deterioration.

Tool usage

- Use insulated hand tools only.
- Never place tools on top of lithium battery modules.

Hazardous environments

Do not operate the lithium battery module in environments classified as hazardous.

Fire safety

Store and operate lithium battery modules only in monitored areas equipped with appropriate fire suppression systems, in accordance with local fire safety regulations.

Electrical connections

- When installing copper busbars or interconnecting cables:
- Tighten all bolts to the specified torque values.
- Loose connections may result in excessive contact resistance, overheating, or fire.

Cleaning procedures

- Do not use solvents on electrical components.
- Clean using a dry towel or cloth only.

Power cable handling

- Always power down the lithium battery module before installing or removing the power cables.
- Never disconnect the power cables while the module is energized, as this may cause arcing or sparking.

Ventilation

Do not obstruct lithium battery module vents. Adequate airflow is essential for cooling and safe operation.

Hardware and software integrity

- Do not modify the lithium battery module's hardware or software.
- Only use EnerSys-approved interface devices for operation.

1.3 Risks posed during normal operation

Design and hazards

This lithium battery module is engineered for stability and reliability when used within the specified operating conditions. However, due to the nature of lithium technology, it still poses inherent safety risks.

WARNING

Terminal shorting warning

Never short-circuit the battery terminals. Because of the module's low internal resistance, a short can cause a surge of high current, leading to:

- Intense electric arc flashes (infrared, visible, and ultraviolet light).
- Ejection of molten or vaporized metal.
- Release of toxic fumes.
- Extremely hot components that may cause burns or ignite nearby materials.

Handling precautions

The lithium battery module is heavy and bulky, making it difficult to maneuver safely. Use appropriate lifting techniques and equipment when handling.

Restraint requirement

- Always secure the lithium battery module properly. If not restrained, it may shift or fall, potentially causing:
  - Injury to personnel through crushing or pinching.
  - Damage to surrounding equipment or infrastructure.

1.4 Damaged lithium battery modules

Operational limits and damage risk

- Operating or storing the lithium battery module outside its specified environmental or operational limits may result in significant damage.
- Do not assume damage will be visible—internal failures may not be immediately apparent.

Immediate shutdown criteria

- If the lithium battery module is exposed to conditions beyond the allowable limits defined in this manual, stop operation immediately and do not restart. Contact your EnerSys service representative for further guidance.
- If the module's mechanical integrity is compromised—such as a puncture, rupture, or deformation of the casing—cease operation and do not resume use. Contact EnerSys support.
- Discontinue use if power cables or connectors show signs of damage, including crushing, pinching, or cutting.

WARNING

Fire and thermal hazards

- Damaged lithium battery modules may ignite spontaneously. In such cases, they may release:
  - Jets of hot, flammable, corrosive, and toxic liquids and gases.
  - Smoke containing hazardous substances such as hydrofluoric acid and carbon monoxide.
- If a fire occurs:
  - Evacuate all personnel immediately.
  - Follow emergency procedures outlined in the SDS.

1.5 Thermal runaway safety protocol

In the rare event of a thermal runaway—characterized by visible gas release or heavy smoke from the lithium battery module—evacuate the area immediately and contact emergency services. Do not attempt to extinguish the fire or approach the module. If respiratory irritation occurs, seek medical attention without delay.

Firefighting must be conducted strictly according to the safety data sheet by trained personnel equipped with full protective gear and self-contained breathing apparatus. Inform responders that the lithium battery module uses $LiFePO_4$ chemistry.

Any signs of thermal runaway—such as heat, gas, vapor, or smoke—require immediate fire suppression. The absence of visible flames does not confirm the event has ended.

To contain and cool the module, large volumes of spray water may be used effectively. If the module has released gas or after fire suppression, relocate it to a secure outdoor location for at least 24 hours. Monitor its temperature regularly to detect any renewed heat activity. If thermal runaway recurs, repeat the same firefighting procedures.

2. Overview

SuperSafe® iON SC1548P95DS lithium battery modules combine advanced lithium prismatic cell technology with an integrated DC-DC bidirectional converter and intelligent energy management, making them ideal for modern reserve power and cycling applications in telecom, utilities, and industrial backup.

With compatibility for mixed chemistry installations; allowing seamless operation alongside both lead acid and other lithium battery chemistries; this lithium battery module offers a robust path to capacity expansion and infrastructure upgrades.

The integrated battery management system (BMS) ensures reliability, remote monitoring, and protection, supporting peak shaving, load shifting, and valley filling for operational and economic efficiency.

The following figure provides an overview of the physical components of the lithium battery module:

1. Dry contact definition
2. Status LED indicators
3. High temperature warning label
4. State of charge LED indicators
5. Alarm speaker
6. Battery handle
7. Ground bolt (M6)
8. Product logo
9. Power button
10. Power input and output bolts (M6)
11. Rack mount bracket (M6)
12. Dry contact interface (DO1, DO2, DI)
13. SNMP interface (optional)
14. RS485/CAN interface (shared connector)
15. GPS module (optional)

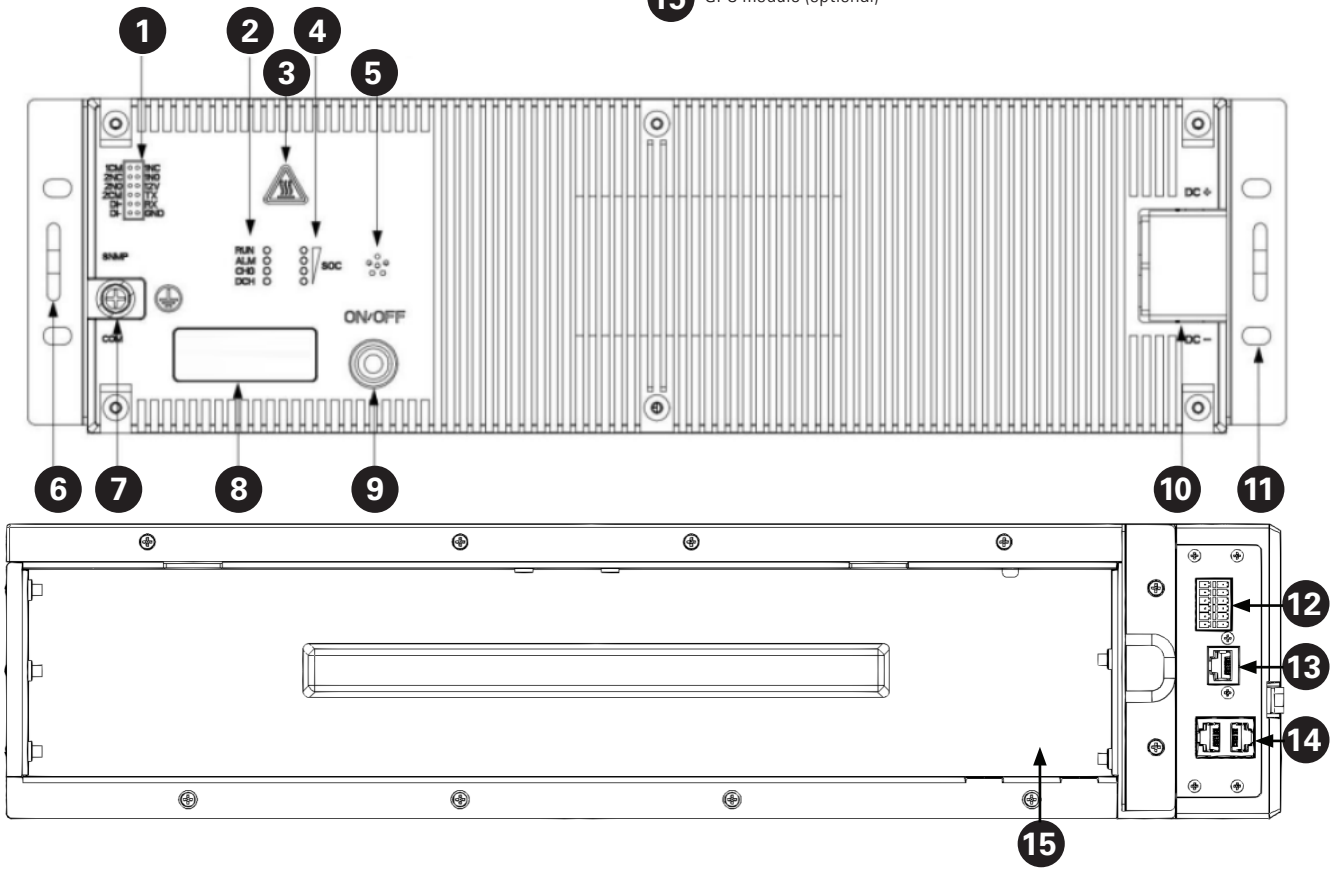


Figure 1: SuperSafe® iON SC1548P95DS lithium battery module overview (PN: SC1548P95DS)

3. Specifications

3.1 SuperSafe® iON SC1548P95DS Lithium Battery Module

Table A: SuperSafe® iON SC1548P95DS lithium battery module	
Electrical	
Nominal voltage	48 V
Nominal capacity	150 Ah at 0.5 C
Maximum power	4,800 W
Maximum charge current	100 A (0.67 C)
Rated discharge current	75 A
Maximum discharge current	100 A (0.67 C)
Recommended charge voltage	53 to 58 V
Design life	15 years
Cycle life	4,000 cycles at 0.5 C, 77°F (25°C), 80% DoD
Features	
Battery management system	Battery management system (BMS) with integrated DC-DC bidirectional converter
Battery chemistry and technology	Lithium with prismatic cell technology
Advanced energy management features	Peak shaving, load shifting, valley filling, mixed battery chemistry integration
Anti-theft protection	Tilt-angle and communication port anti-theft functions
Communication	RS485 (upstream)
	CAN for inter-module communications
	2 relay outputs, 1 digital input
	SNMP (optional)
Connections	**Power:** M6 bolt
	Signal: RS485/CAN
Mechanical	
Dimensions H × W × D[1]	5.1 × 17.4 × 22.13 in. (130 × 442 × 562 mm)
Net weight[2]	136 lb (61.7 kg)
Mounting	19-inch rack mounting
	The lithium battery module can be rack mounted using the mounting brackets (sold separately) or placed on a shelf.
	Vertical or horizontal orientation
Color	RAL9005 black

Environmental	
Recommended operating temperature	68 to 86°F (20 to 30°C)
Operating temperature (charge)	**15A:** 23 to 59°F (–5 to 15°C)
	50A: 122 to 131°F (50 to 55°C)
	100A: 59 to 122°F (15 to 50°C)
Operating temperature (discharge)	–4 to 149°F (–20 to 65°C)
Storage temperature[3]	59 to 95°F (15 to 35°C)
Relative humidity	5% to 95% non-condensing
IP rating	IP20
Cooling	Natural air cooling
Regulatory compliance	
EMC	IEC 61000
Safety	IEC 62619
Transportation regulation	UN 38.3
RoHS directive	RoHS 3 2011/65/EU and 2015/863/EU

[1] Dimensions do not include lugs or handles.
[2] Net weight is approximate ±1 kg.
[3] Long term storage (within six months).

NOTICE

0.67 C is the current in amps equal to the battery unit nominal capacity rating in Ah.

4. Features

4.1 Exceptional safety

The SuperSafe® iON lithium battery module with its prismatic cell technology provide exceptional safety. The battery cells are thermally stable, reducing the fire risk even under high temperatures or electrical stress. Lithium batteries are chemically more stable than cobalt or nickel-based alternatives.

4.1.1 Comprehensive protection

The lithium battery module includes a smart BMS module which protects the lithium battery module against a wide range of conditions, including:

- Overcurrent
- Overvoltage
- Undervoltage
- Overtemperature
- Undertemperature
- Overcharging
- Overdischarging
- Short-circuit
- Reverse polarity protection
- Cell imbalance.

4.1.2 Comprehensive monitoring

The BMS continuously monitors lithium battery module temperature, voltage, current, state of charge, state of health, cell temperature and voltage, bus current and voltage, and BMS temperature.

4.2 Compact design

The lithium battery module has a compact 3RU form factor, making it ideal for space-constrained applications without compromise on performance.

4.3 Modular design

The lithium battery module supports mixing with other battery chemistries including lead acid, making upgrades seamless.

4.4 SNMP interface support

An optional SNMP interface allows for full network integration.

4.5 Status and State of Charge LEDs

The front panel includes LEDs to indicate both lithium battery module status and state of charge. See the Lithium battery module status LEDs and State of Charge LEDs sections for more information.

4.6 Working modes

The lithium battery module supports three working modes:

- Lithium battery mode
- Smart management mode
- Boost management mode.

The factory default is smart management mode. The working mode can be configured in the ES BMS tool.

4.6.1 Lithium battery mode

In this mode, the bus voltage will follow the charge and discharge curves of the battery pack with a fixed offset to simulate a traditional 15 cell LFP battery.

4.6.2 Smart management mode

The DC-DC output automatically matches the system's bus voltage. This ensures the battery delivers a steady voltage in the 48 to 57V range.

It can operate alongside existing lead acid batteries. The lithium battery modules will discharge with priority, while the lead acid battery takes more of a backup role.

The lithium battery modules won't start charging until the BMS detects the system voltage above 51.5V for more than 10 seconds.

Charge 1

The DC-DC will accept a constant float voltage of 54.5V from the rectifier and regulate the charge into the pack for maximum current depending on conditions. (SoC and Temperature)

Discharge

When the BMS detects a drop in the float voltage of > 3V, 2 it will enter the discharge mode and set the DC-DC to boost the pack voltage to a usable and constant voltage ~53.5V. (float voltage minus 1V) 5

The 12S2P pack will discharge from ~43.2V 3 while the DC-DC will keep the bus bar voltage constant.

When DoD > "LLVD DoD" (~90% User adjustable), 6 DC-DC voltage will change to "LLVD Voltage" (~47V user adjustable) 7

When SoC = 0%, battery will shut down 8

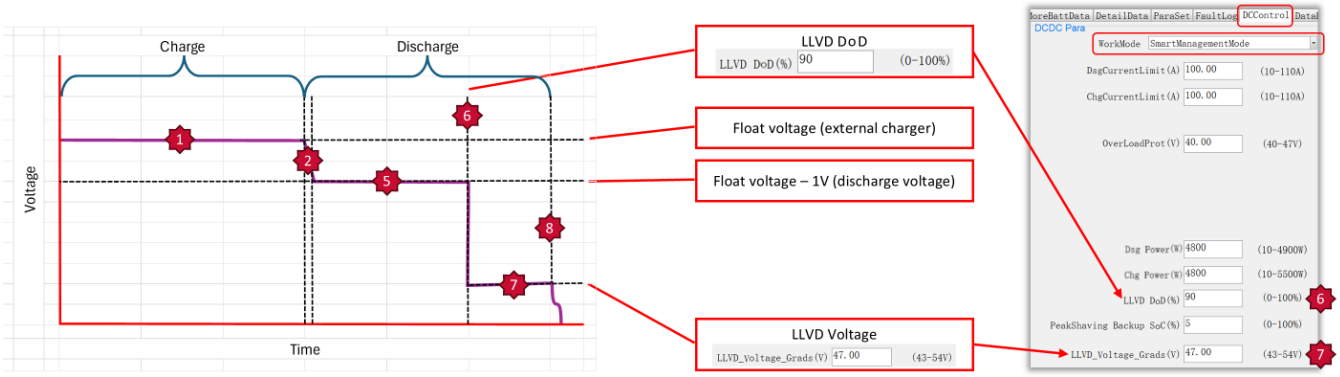


Figure 2: Smart management mode in detail

4.6.3 Boost management mode

The BMS can be configured for boost management mode via external communication. In this mode, the system operates with a constant discharge voltage in the range of 52 to 57 V, improving remote power supply capability.

Charging condition: Charging begins when the detected bus voltage is greater than the constant voltage discharge setting by +0.5 V.

Discharge transition: When the bus voltage drops by more than 0.5 V, the system will first discharge at the maximum allowable power. It will then adjust automatically to balance and equalize the current.

4.7 Anti-theft features

The SuperSafe® iON lithium battery module is equipped with both tilt-angle and communication port anti-theft features. These features can be configured, enabled, and disabled in the ES BMS tool.

Once enabled, if the lithium battery module tilt-angle exceeds 30 degrees (default value, can be configured in the ES BMS tool), the lithium battery module will enter an anti-theft state. The lithium battery module also includes anti-theft protection on the communication port. Similar to the tilt-angle protection, if the RS485 communication cable is unplugged for more than 10 minutes (default value, can be configured in the ES BMS tool), the lithium battery module enters into an anti-theft state.

At this time, the charging and discharging MOSFETS within the lithium battery module will enter an open state and the lithium battery module can not be charged and discharged. An alarm will sound and will continue until the protection state is changed from the ES BMS tool.

5. Handling

CAUTION

Follow all local safety practices and guidelines while lifting the lithium battery module.

5.1 General handling considerations

- Unpacking and handling the lithium battery module is only allowed by trained personnel that are familiar with the potential risks of lithium batteries and hazardous voltages.
- Avoid sudden accelerations, decelerations, drops, and other mechanical abuse conditions while handling the lithium battery module.
- Handling must only be performed after the lithium battery module is disconnected from all electrical loads and charge sources and verified in an **off** state.
- Prior to lifting, secure all connectors and cables so that they will not be crushed, pinched, or otherwise damaged during the lift. User interfaces should be removed prior to handling.
- Appropriate PPE must be worn during all lifts.
- Appropriate lifting methods and tools that can safely lift and control the load must be checked prior to all lifts. Tools must be properly rated for the weight.
- The lithium battery module must only be lifted vertically. Do not allow the lithium battery module to swing during lifting.
- The operational and safety instructions of the lifting gear documentation must be adhered to.

5.2 Notes

For transportation and storage safety reasons, all SuperSafe® iON lithium battery modules are shipped at a partial state of charge. Before the first operation or further storing the lithium battery module, it is required to check the state of charge and recharge the lithium battery module if needed.

6. Lithium battery module label description

6.1 Product label example

The product label is located on the top of the lithium battery module. It details important information about the lithium battery module including:

- Product name
- Product model
- Product type
- Nominal voltage
- Maximum charging current
- Maximum discharging current
- Rated capacity
- Operating ambient temperature range
- Weight
- Manufacturing date
- Product serial number.

6.2 Product safety label

The product safety label is located on the top of the lithium battery module. It details important safety information about the lithium battery module. The safety label contains a subset of warnings and cautions.

Always refer to the Safety section in the user guide prior to installation of the lithium battery module.

7. Inspection

7.1 Packaging materials

EnerSys is committed to providing products and services that meet our customers' needs and expectations in a sustainable manner, while complying with all relevant regulatory requirements. As such we strive to follow quality and environmental objectives from product supply and development through to the packaging for our products.

Lithium battery modules are shipped on pallets and are packaged according to the manufacturer's guidelines.

Almost all packaging material is from sustainable resources or is recyclable.

7.2 Returns for service

NOTICE

EnerSys is not responsible for damage caused by improper packaging of returned products.

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is unavailable, make sure that the product is packed with at least three inches of shock-absorbing material to prevent shipping damage.

See the Shipping section for more information.

7.3 Check for damage

Before unpacking the product, note any damage to the shipping container. Unpack the product and inspect the exterior for damage. If any damage is observed, contact the carrier immediately. Continue the inspection for any internal damage. In the unlikely event of internal damage, inform the carrier and contact us for advice on the impact of any damage.

7.4 General receipt of shipment

The inventory included with your shipment depends on the options you have ordered. The options are clearly marked on the shipping container labels and bill of materials.

7.5 Miscellaneous small parts

Review the packing slip and bill of materials to determine the part number of the configuration kits included with your system. Review the bill of materials to verify that all the small parts are included. Contact us if you have any questions before you proceed.

7.6 What's included

- Lithium battery module
- CAN cable
- Terminator plug
- Mounting hardware
- Mating connectors for dry contacts.

8. Installation

8.1 Site selection

Consider the following before installing the lithium battery module:

- Ensure the ambient temperature at the installation site falls within the operating range specified in the Specifications section. Using the lithium battery module outside this range may shorten its service life.
- Install the lithium battery module in a well-ventilated area, away from liquids, flammable gases, corrosive substances, and other hazardous materials.
- Avoid prolonged exposure to salt spray environments.
- Do not expose the lithium battery module to direct sunlight.
- In cold environments, condensation may occur. Make sure the lithium battery module is completely dry before installation and use to prevent electric shock.
- In case of emergency, immediately stop all charging and discharging activities and switch off the lithium battery module.
- All electrical outlets must be connected to a protective earth (ground) wire.

8.2 Installation tools

Various insulated tools are essential for the installation of the lithium battery module. Use this list as a guide:

- Lithium battery module lifting apparatus (if required)
- Various crimping tools and dies to match lugs used in installation
- Digital voltmeter equipped with test leads
- Cable Cutters and wire strippers
- Torque wrench: ¼ inch (7 mm) drive, 0 to 150 in-lb (0 to 17 Nm)
- Torque wrench: ⅜ inch (10 mm) drive, 0 to 100 ft-lb (0 to 135 Nm)
- Insulating canvases as required
- Insulated hand tools.

8.3 Required hardware components

The following hardware components are required to complete installation of the lithium battery module:

- SuperSafe® iON lithium battery module. The lithium battery module has an IN port for northbound communication and an OUT port for southbound communication.
- Microsoft® Windows management computer with the latest ES BMS tool installed.
- Generic USB to Modbus RS485 converter. This is used to establish communication between the management computer and the lithium battery module or the most northbound battery when there are multiple lithium battery modules daisy chained.

  Communication is half-duplex which means that only two wires are required, the A+ and B– line. Connect the USB to Modbus converter A+ pin to IN1 pin on the lithium battery module and connect B– to IN2. This will be identical for other USB to Modbus converters as well.
- Terminator plug. This is provided with the lithium battery module. It must be used on the OUT port of the most southbound lithium battery module.
- 12 inch (300 mm) straight-through data cable. This is used to daily chain multiple lithium battery modules.
- 40-inch (1 m) straight-through data cable. This is used to connected the management computer to the most northbound lithium battery module.

8.4 Mounting the lithium battery module

The lithium battery module can be mounted on a shelf or installed in a 19-inch rack using the optional mounting brackets. The lithium battery module is modular and scalable. It occupies 3RU of space which allows for compact setups and future lithium battery module expansion.

When installing the lithium battery module in a 19-inch rack, the battery weight must be fully supported on brackets or a shelf with the rack mount brackets used to secure against lateral movement. Brackets and shelves are purchased separately to match the rack system that the batteries are being installed into. See the Specifications section for more information.

For rack mounting with the optional rack mount brackets, the brackets are designed around the standard M6 hole and M6x10 bolts. A lithium battery module must be equipped with a tray to support the weight and prevent long term stress on the bolts.

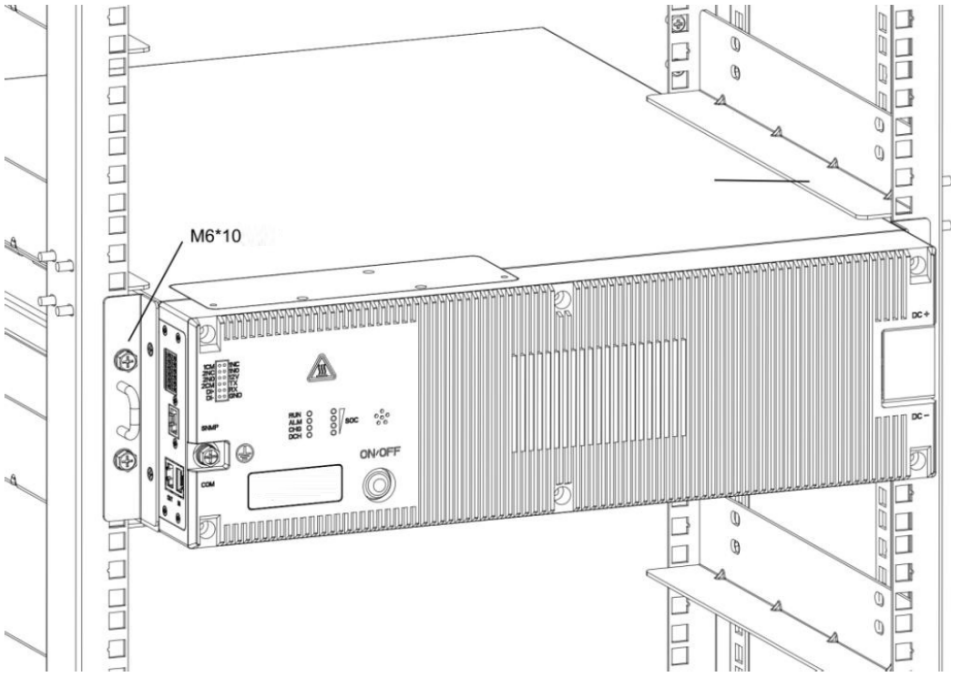


Figure 3: Rack mounting the lithium battery module

ATTENTION

To ensure proper thermal management and performance, a minimum clearance of 0.39 in. (10 mm) must be maintained between adjacent lithium battery modules when installed on standard 19-inch racks.

ATTENTION

When rack mounting the lithium battery module, a support bracket or shelf (not included) is required.

8.5 Lithium battery module orientation

The lithium battery module can be mounted in either a horizontal or vertical orientation depending on your use case requirements.

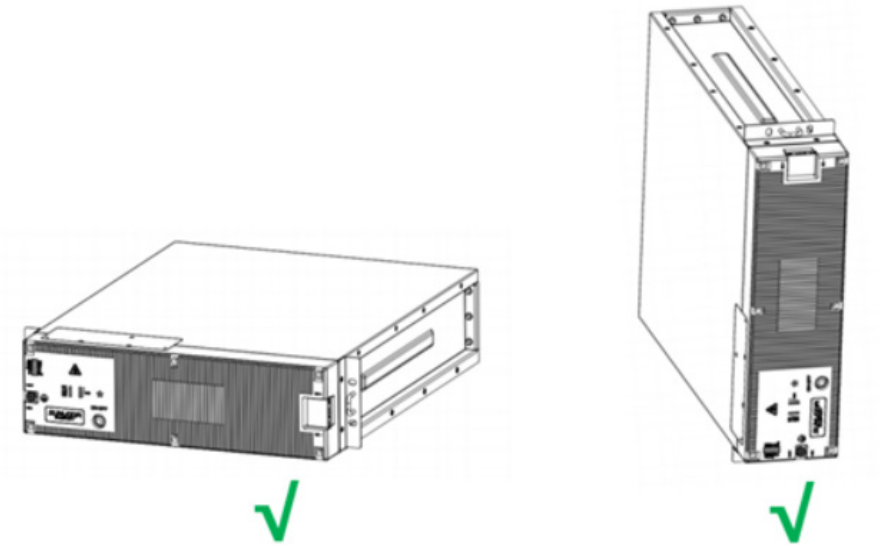


Figure 4: Lithium battery module orientation

8.6 Grounding the lithium battery module

WARNING

- Only qualified personnel should install and connect the power components within power system enclosures.
- A lithium battery module that is not properly grounded presents an electrical hazard and will likely result in premature equipment failure.
- A proper grounding system (ground electrode system) that meets or exceeds the specifications of the equipment must be designed and installed prior to or in conjunction with the installation. The ground system must be bonded to ensure a common or single-point ground.

ATTENTION

The wire size should be a minimum of 10 AWG (6 mm²), but the exact size depends on the system voltage, fault current potential, and local electrical codes.

The external ground bolt is located on the front panel of the lithium battery module for the site ground wire connection. Use the M6 screw terminal to connect a 10 AWG (6 mm²) solid wire. The recommended torque specification for this screw terminal is 44.25 in-lb (5 Nm).

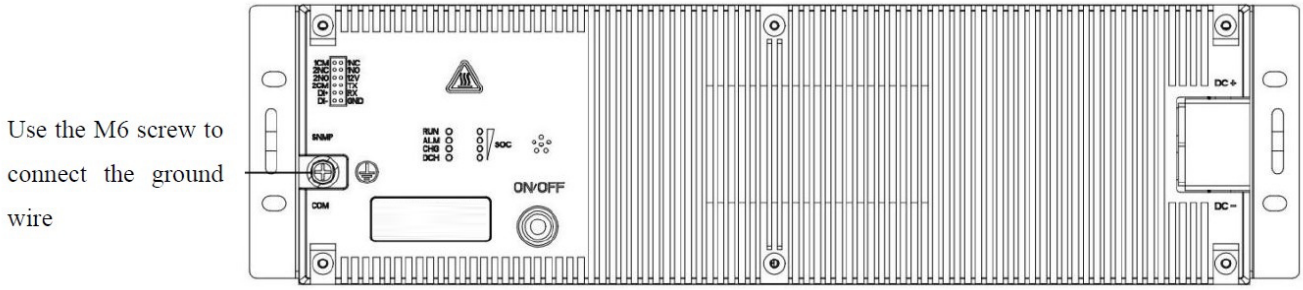


Figure 5: Grounding the lithium battery module

8.7 Input and output connections

The lithium battery module can be used as a standalone battery with the positive and negative poles connected with the corresponding equipment. The recommended torque specification for these terminals is 44.25 in-lb (5 Nm).

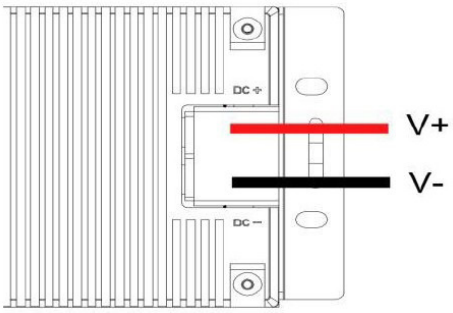


Figure 6: Input and output connections

Or the positive and negative poles can be connected in parallel via busbars. You can configure groups with up to 32 lithium battery modules in parallel.

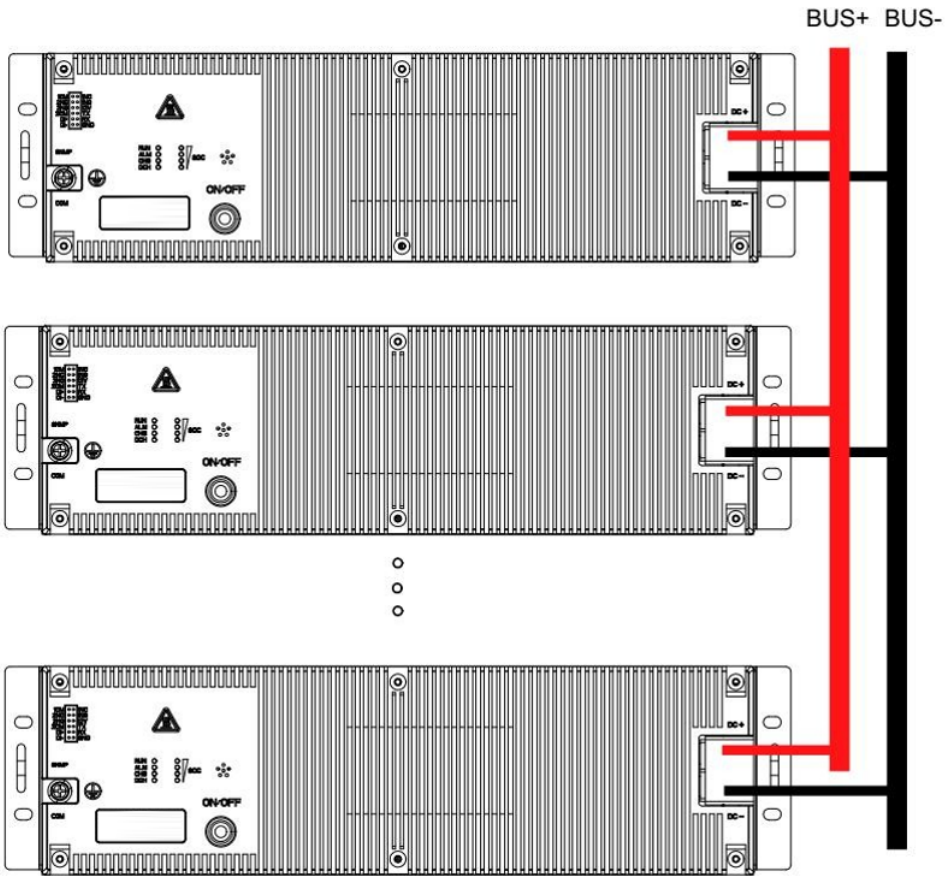


Figure 7: Parallel bus configuration

Table B: Parallel battery maximum power								
Number of lithium battery modules	2	3	4	5	6	7	...	32
Maximum power	9.6 kW	14.4 kW	19.2 kW	24 kW	24 kW	24 kW	...	24 kW

8.8 Communication connection

When the lithium battery module is used in a standalone mode, RS485 is used for commissioning and monitoring via the ES BMS tool on the management computer. See Figure 8 and Table C for pinout and definitions. When multiple lithium battery modules are used in parallel, CAN communication is used for parallel communication between lithium battery modules, and RS485 is used for commissioning and monitoring via the ES BMS tool on the management computer.

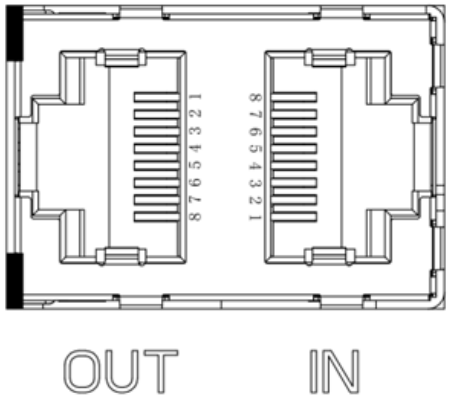


Figure 8: RS485/CAN interface

Table C: RS485/CAN interface definition

RJ45 pin		Definition
IN1	OUT1	RS485-A
IN2	OUT2	RS485-B
IN4		ADD IN
	OUT4	ADD OUT
IN7	OUT7	CAN-H
IN8	OUT8	CAN-L

8.8.1 Parallel bus configuration

The following figure shows a multiple computer parallel bus configuration example.

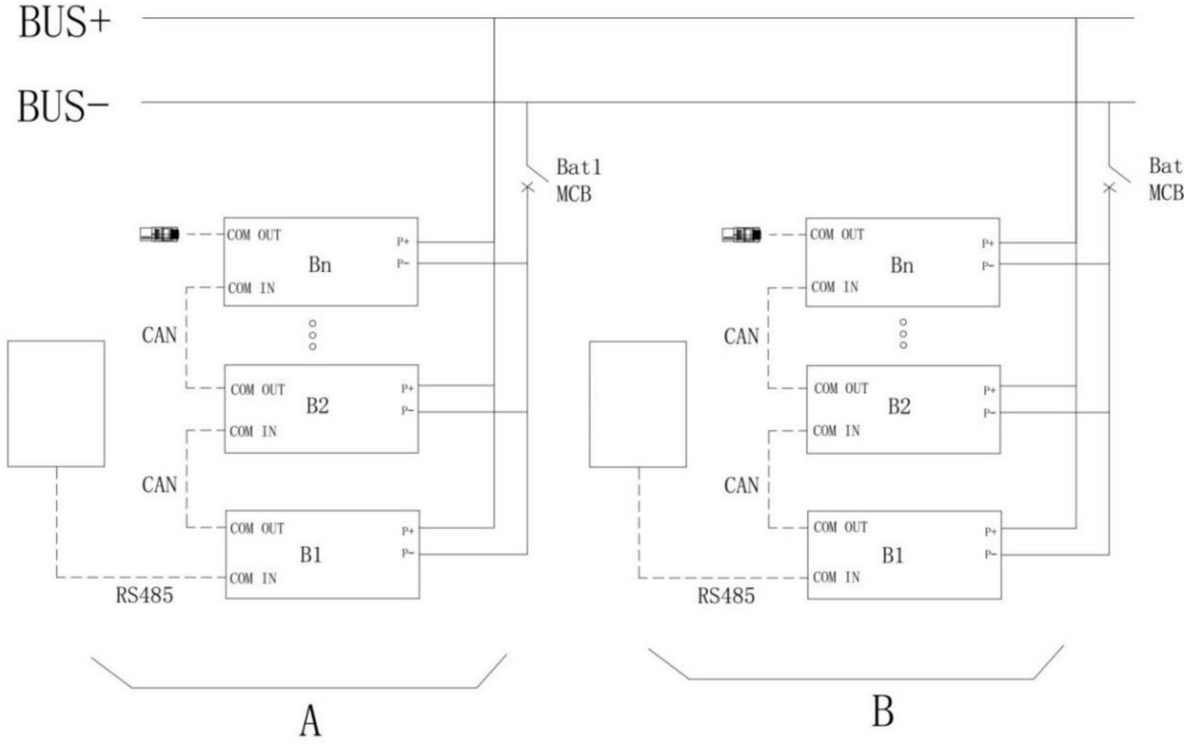


Figure 9: Parallel bus configuration

NOTICE

Group A does not communicate with Group B. Each group requires a terminator plug; approximately 120 ohm; to be inserted in the RJ45 (RS485) port of the last lithium battery module in the series.

8.9 Dry contacts

Dry contacts are used to signal the status of a device or system.

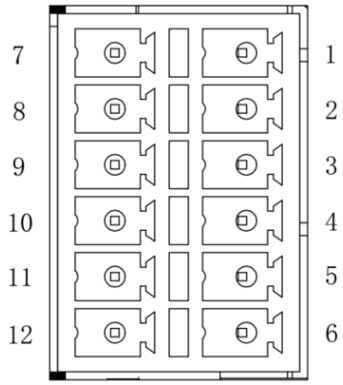
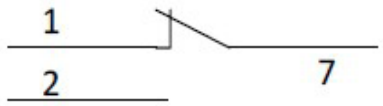
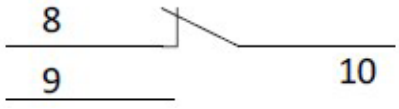
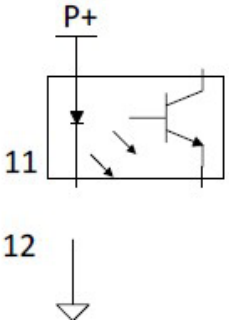


Figure 10: Dry contacts

Table D: Dry contact pin definition overview

Pin	Name	Definition
1	1NC	Normally closed lead 1
2	1NO	Normally open lead 1
3	12V	12V supply
4	TX	Transmitting lead
5	RX	Receiving lead
6	GND	Ground lead
7	1CM	Common lead 1
8	2NC	Normally closed lead 2
9	2NO	Normally open lead 2
10	2CM	Common lead 2
11	DI+	Digital input positive
12	DI–	Digital input negative

Table E: Dry contact pin definition in detail

Pin	Name	Definition	Diagram
1, 7	DO1 normally closed		
2, 7	DO1 normally open	Normal operation	
8, 10	DO2 normally closed		
9, 10	DO2 normally open	Normal operation	
11, 12	D1	External signal interaction, and customization is supported.	
3, 4, 5, 6	Reserved	N/A	N/A

8.10 SNMP interface (optional)

Table F: SNMP interface (optional)

RJ45 pin	Definition
1	TX+
2	TX–
3	RX+
6	RX–
4, 5, 7, 8	NC

9. Battery Management System tool

9.1 Launching the ES BMS tool

Launch the ES BMS tool by selecting the executable file. The tool is supported for Microsoft® Windows only.

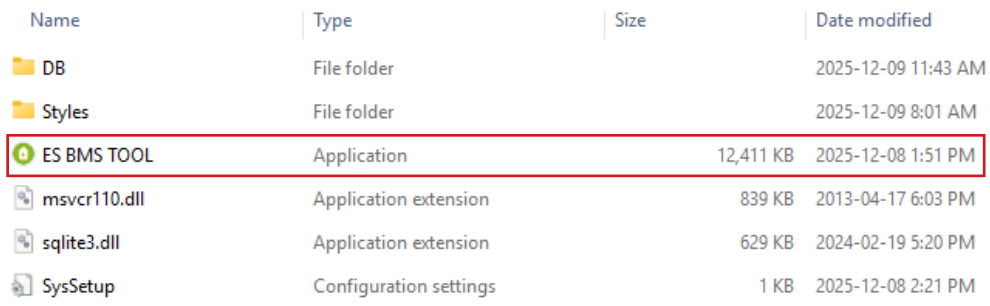


Figure 11: ES BMS tool file folder

9.2 Communication configuration

After launching the ES BMS tool, select the **CommConfig** button. The **CommConfig** window is displayed. Select the **Serial** button to view and configure serial port settings, and select the **Setup** button to save any changes.

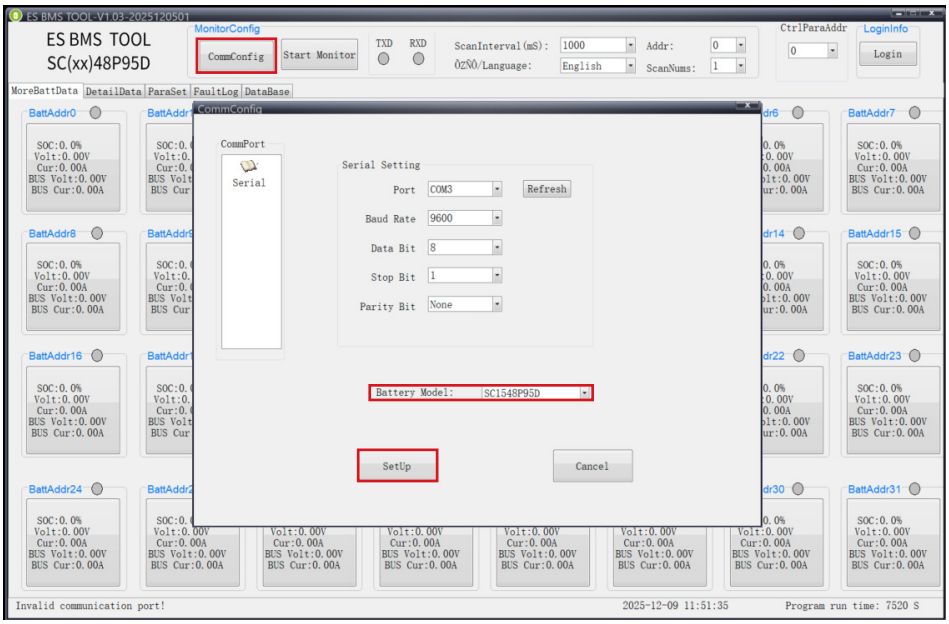


Figure 12: Main interface detail page

NOTICE

See the Commissioning section for more information on communication settings.

9.3 Access the ES BMS tool

To modify BMS settings, select the **Login** button and enter the default password: 88888888.

9.4 More battery data page

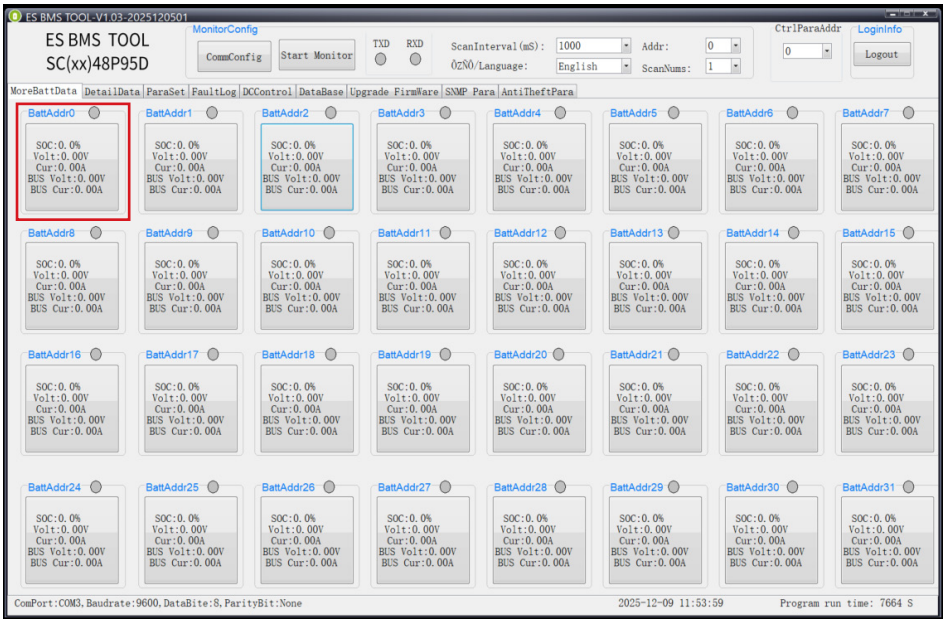


Figure 13: More battery data page

In the top toolbar, the following options are available:

Table G: More battery data page parameters

Parameter	Description
CommConfig	Select to configure communication port settings. Serial and SNMP (optional) are displayed in the pop-up window with additional configuration options. **Serial settings:** Port (COM13), Baud Rate (9600), Data Bits (8), Stop Bit (1), Parity Bit (None), Battery Model (SC1548P95DS).
Start Monitor	Select to start collecting data from connected lithium battery modules at regular intervals. Select the **Close Monitor** button to end the session with the selected lithium battery module.
TXD/RXD	When data is being sent and received normally, the status indicators will blink green. If there is an abnormal data transmission or receiving condition, the status indicators will blink red. Select the prompt for additional information.
ScanInterval	Select the scanning interval in milliseconds. The default is 1,000 ms.
Language	Select the display language. Currently only English and Chinese are supported.
Addr	Select the address of the lithium battery module to scan. The default value is 0. This is the starting address when the ES BMS tool polls the batteries. The ES BMS tool supports 32 batteries.
ScanNums	Select the number of connected lithium battery modules.
CtrlParaAddr	Select the address to read/write parameters of other interfaces.
Login/Logout	Select to sign in and out of the BMS.
Select each battery tile for a detailed view for the selected battery.	

Each connected lithium battery module will be displayed. For each lithium battery module, the state of charge, voltage, current, bus voltage, and bus current are displayed.

At the bottom of the page, the communication port settings are displayed along with the date and program run time.

9.5 Detail data page

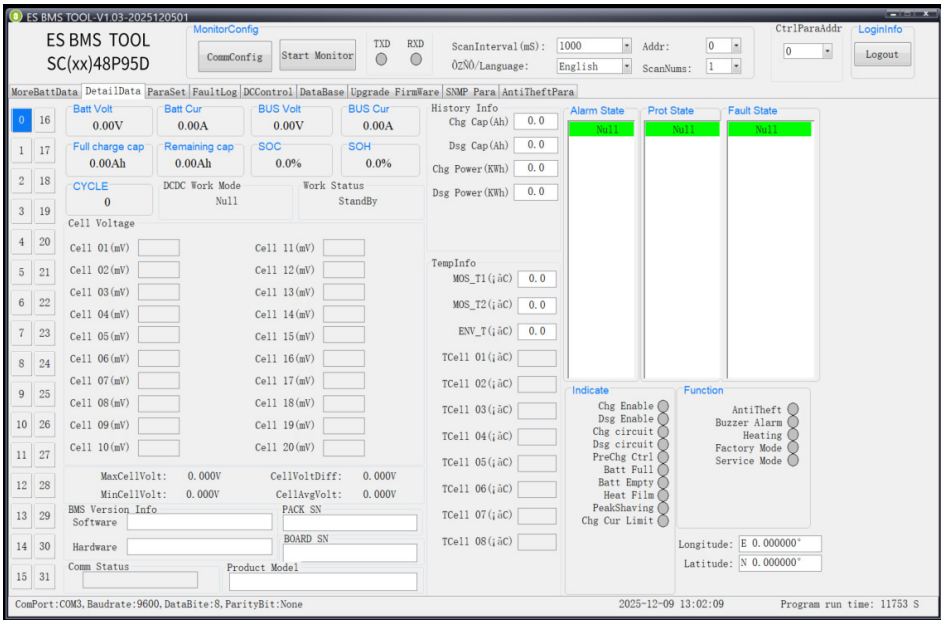


Figure 14: Detail data page

The detail data page provides in-depth information about the connected lithium battery modules. This includes:

Table H: Detail battery data page parameters

Parameter	Description
Battery voltage	The real-time voltage of the selected lithium battery module.
Battery current	The real-time current of the selected lithium battery module.
Bus voltage	The real-time bus voltage of the selected lithium battery module.
Bus current	The real-time bus current of the selected lithium battery module.
Full charge capacity	The real-time full charge capacity of the selected lithium battery module.
Remaining capacity	The real-time remaining capacity of the selected lithium battery module.
State of charge	The real-time state of charge of the selected lithium battery module.
State of health	The real-time state of health of the selected lithium battery module.
Cycle	The cycle count of the selected lithium battery module.
DC-DC work mode	This is the lithium battery module work mode configured on the **DCControl** tab. The work modes include **Lithium Battery Mode**, **Smart Management Mode**, and **Boost Management Mode**. The default working mode is **Smart Management Mode**.
Work status	This is the work status of the lithium battery module. The work status can be charging, discharging, or standby.
Cell voltage	This section lists all the cells within the selected lithium battery module. The cell voltage is presented in millivolts. This view allows you to verify that all cells in the lithium battery module are balanced.
Maximum cell voltage	Select a lithium battery module cell in the **Cell Voltage** section to view the maximum cell voltage in volts for the selected cell. This information is useful for tracking the health of the lithium battery module at the cell level. The cell with the highest voltage will be highlighted in dark blue.

Minimum cell voltage	Select a lithium battery module cell in the **Cell Voltage** section to view the minimum cell voltage in volts for the selected cell. This information is useful for tracking the health of the lithium battery module at the cell level. The cell with the lowest voltage will be highlighted in light blue.
Cell voltage difference	Select a lithium battery module cell in the **Cell Voltage** section to view the cell voltage difference in volts for the selected cell. This information is useful for tracking the health of the lithium battery module at the cell level. In a healthy lithium battery module, the cell voltage difference between cells is a smaller value indicating a balanced lithium battery module.
Cell average voltage	Select a lithium battery module cell in the **Cell Voltage** section to view the cell average voltage in volts for the selected cell. This information is useful for tracking the health of the lithium battery module at the cell level.
Historical information	This section displays historical information for the selected lithium battery module including the charge capacity (Ah), discharge capacity (Ah), charging energy (kWh), discharging energy (kWh), charge time (minutes), and discharge time (minutes).
Temperature information	Temperature information is provided for both MOSFETS and lithium battery module cells in addition to environmental temperature. Temperature information is displayed in Metric only. To convert Metric (degrees Celsius) to Imperial (degrees Fahrenheit) use the formula in this example, (0°C × 9/5) + 32 = 32°F.
Alarm state	The alarm state column will list various fault states with the connected lithium battery modules to help you diagnose any issues.
Protection state	The protection state column will list various fault states with the connected lithium battery modules to help you diagnose any issues. This mode is activated when the lithium battery module detects potentially harmful conditions such as overcharging, overdischarging, overcurrent, or extreme temperatures. The BMS acts as a safeguard, preventing the lithium battery module from operating outside its safe operating parameters and protecting it from damage.
Fault state	The fault state column will list various fault states with the connected lithium battery modules to help you diagnose any issues.
Indicators	The indicator section will indicate various lithium battery module conditions. These include charge enable, discharge enable, charging, discharging, precharge control, battery full, battery empty, heat film, peak shaving, and charge current. The circle beside the function will be green when the feature or condition is active.
Function	The function section will indicate which features or conditions are active. These include anti-theft mode, audible alarm, heating, factory mode, and service mode. The circle beside the function will be green when the feature or condition is active.
Location	Lithium battery module location information is presented in longitude and latitude values.

9.6 Parameter set page

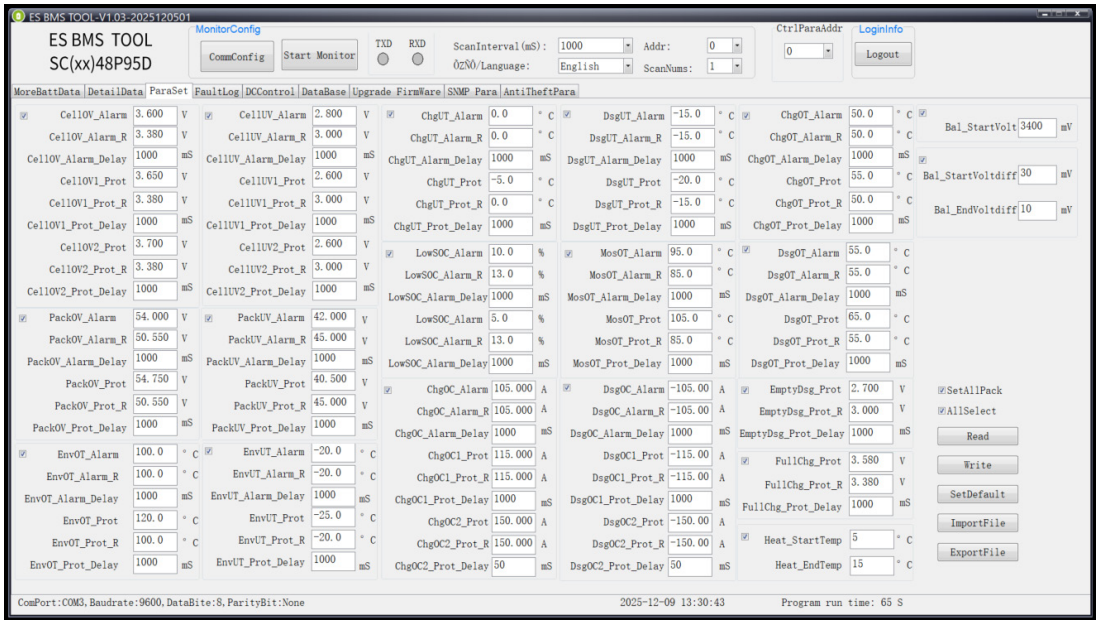


Figure 15: Parameter set page

NOTICE

The settings in the parameter set tab are intended for advanced users only. Please consult with EnerSys technical support if you have any questions regarding the various configurable parameters on this page.

Table I: Parameter set page parameters

Parameter	Description
CtrlParaAddr	Select the lithium battery module address in the drop-down menu. The ES BMS tool supports 32 batteries.
SetAllPack	Select the checkbox to push the setting to all connected lithium battery modules.
AllSelect	Select the checkbox to select all in this screen.
Read	Select to pull data from the currently selected lithium battery module to populate this page. When pushing new settings, use the **Read** button to confirm the settings have been applied.
Write	Select to push any changes made to the currently selected lithium battery module.
Set default	Select to restore the currently selected lithium battery module to factory default settings.
Import file	Select to import a lithium battery module parameters XML file.
Export file	Select to save the currently selected battery parameters to an XML file.

9.7 Fault log page

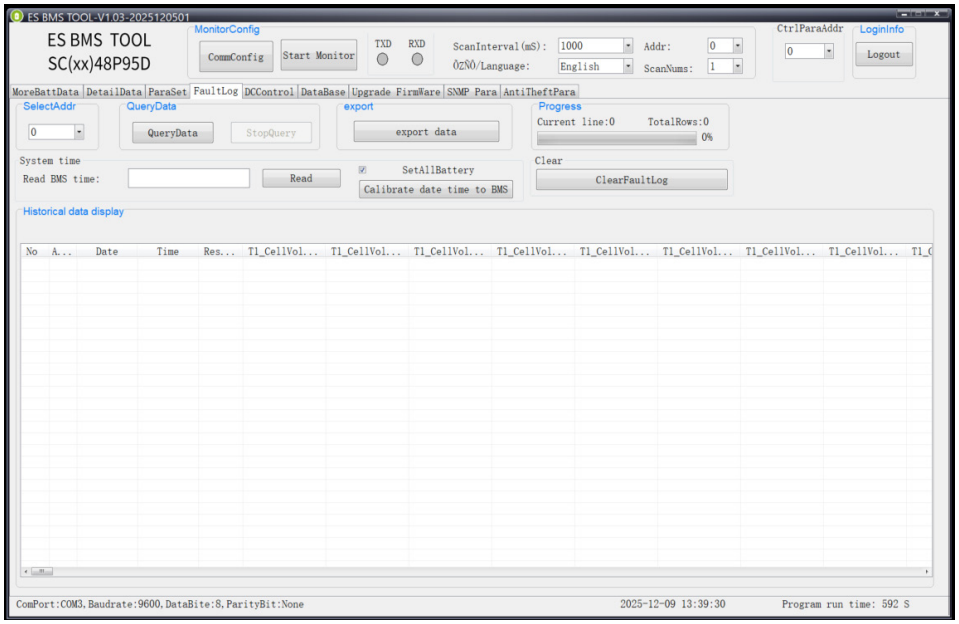


Figure 16: Fault log page

The fault log page provides access to query each connected lithium battery module to view and download any fault logs.

Table J: Fault log page parameters

Parameter	Description
SelectAddr	Select the battery address in the drop-down menu. The ES BMS tool supports 32 batteries.
QueryData	Select to pull information from the selected battery. Select the **StopQuery** button to stop the action.
export data	Select to export the fault log as an Excel spreadsheet file.
Read	Select to pull data from the currently selected battery to populate this page. When pushing new settings, use the **Read** button to confirm the settings have been applied.
SetAllBattery	Select the checkbox to push the setting to all connected lithium battery modules.
Calibrate date time to BMS	Select to align the lithium battery module date and time with the BMS.
ClearFaultLog	Select to clear the information pulled from the selected battery.

9.8 DC control page

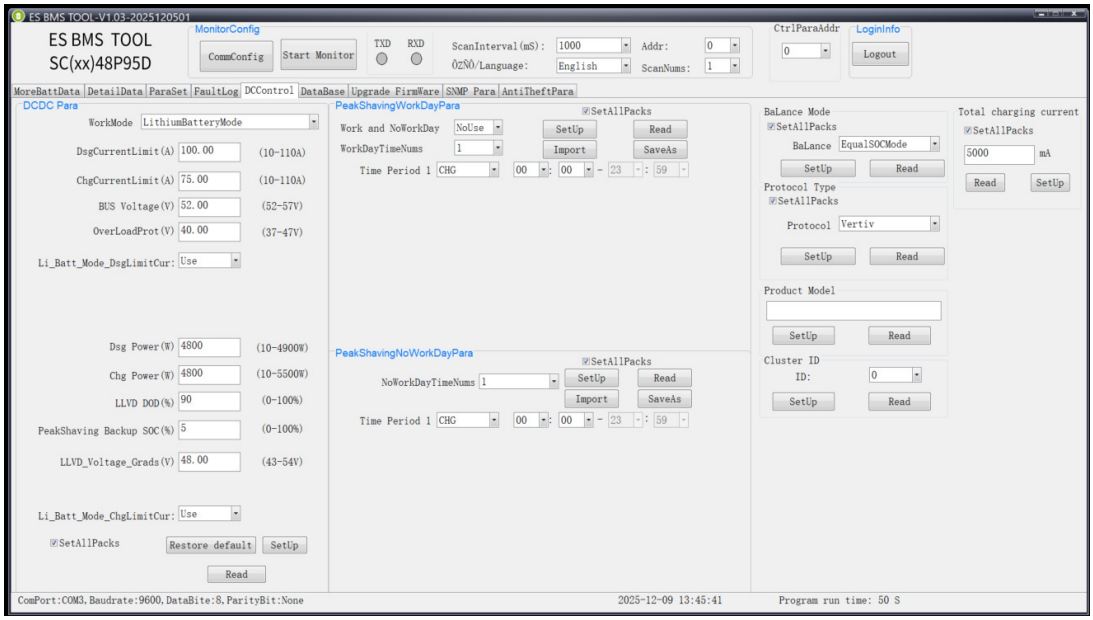


Figure 17: DC control page

To change the work mode, charge, and discharge settings, select the **DCControl** tab. The following DC-DC control parameters are available:

Table K: DC-DC control parameters

Parameter	Description
WorkMode	Select the battery work mode in the drop-down list. The work modes include **Lithium Battery Mode**, **Smart Management Mode**, and **Boost Management Mode**. The default working mode is **Smart Management Mode**.
DsgCurrentLimit	The discharging current limit in amps. Select a value between 10 to 110 A. The default value is 100 A.
	Parameter is available in Lithium Battery Mode, Smart Management Mode, and Boost Management Mode.
ChgCurrentLimit	The charging current limit in amps. Select a value between 10 to 110 A. The default value is 100 A.
	Parameter is available in Lithium Battery Mode, Smart Management Mode, and Boost Management Mode.
BUS Voltage	The bus voltage in volts.
	Parameter is available in Boost Management Mode.
OverLoadProt	The overload protection limit in volts. Select a value between 40 to 47V. The default value is 40V.
	Parameter is available in Lithium Battery Mode, Smart Management Mode, and Boost Management Mode.
Li_Batt_Mode_ DsgLimitCur	Select to use this feature in the dropdown menu.
	Parameter is available in Lithium Battery Mode.
Dsg Power	The discharging power in watts.
	Parameter is available in Lithium Battery Mode, Smart Management Mode, and Boost Management Mode.

Chg Power	The charging power in watts.
	Parameter is available in Lithium Battery Mode, Smart Management Mode, and Boost Management Mode.
LLVD DoD	Set the Load Low Voltage Disconnect depth of discharge.
	Parameter is available in Smart Management Mode.
PeakShaving Backup SoC	The peak shaving backup state of charge as a percentage. Select a value between 0 to 100 percent. The default value is 5 percent.
	Parameter is available in Lithium Battery Mode, Smart Management Mode, and Boost Management Mode.
LLVD_Voltage_Grads	Set the lithium battery module Load Low Voltage Disconnect voltage.
	Parameter is available in Smart Management Mode.
Li_Batt_Mode_ ChgLimitCur	Select to use this feature in the dropdown menu.
	Parameter is available in Lithium Battery Mode.
SetAllPacks	Select the checkbox to push the setting to all connected lithium battery modules.
Restore default	Select to restore the DC-DC parameters to factory default settings.
SetUp	Select to save the settings.
Read	Select to pull data from the currently selected battery to populate this page. When pushing new settings, use the **Read** button to confirm the settings have been applied.

The following peak shaving work day parameters are available:

Table L: Peak shaving work day parameters

Parameter	Description
SetAllPacks	Select the checkbox to push the setting to all connected lithium battery modules.
State	Select the peak shaving state in the drop-down list.
SetUp	Select to save the settings.
Read	Select to pull data from the currently selected battery to populate this page. When pushing new settings, use the **Read** button to confirm the settings have been applied.
Work and NoWorkDay	Select to use this feature in the dropdown menu.
WorkDayTimeNums	Select the number of days in the drop-down menu.
Import	Select to import an INI file with work day parameters.
SaveAs	Select to save the query as an XML file on the management computer.
Time Period 1	Select the time period type in the drop-down menu and configure the time frame.

The following peak shaving non-work day parameters are available:

Table M: Peak shaving non-work day parameters

Parameter	Description
NoWorkDayTimeNums	Select the number of days in the drop-down menu.
SetUp	Select to save the settings.
Read	Select to pull data from the currently selected battery to populate this page. When pushing new settings, use the **Read** button to confirm the settings have been applied.
Import	Select to import an INI file with non-work day parameters.

SaveAs	Select to save the query as an XML file on the management computer.
Time Period 1	Select the time period type in the drop-down menu and configure the time frame.

The following balance mode parameters are available:

Table N: Balance mode parameters

Parameter	Description
SetAllPacks	Select the checkbox to push the setting to all connected lithium battery modules.
BaLance	Select the balance mode in the drop-down menu. The available options include: • EqualSOCMode • EqualCurrentMode
SetUp	Select to save the settings.
Read	Select to pull data from the currently selected battery to populate this page. When pushing new settings, use the **Read** button to confirm the settings have been applied.

The following protocol type parameters are available:

Table O: Protocol type parameters

Parameter	Description
SetAllPacks	Select the checkbox to push the setting to all connected lithium battery modules.
Protocol	Select the protocol type in the drop-down menu. The available options include: • Vertiv • Enertek • IP • ZTE
SetUp	Select the **SetUp** button to save the settings.
Read	Select to pull data from the currently selected battery to populate this page. When pushing new settings, use the **Read** button to confirm the settings have been applied.
Product Model	Enter a name for the currently selected battery.
SetUp	Select to save the settings.
Read	Select to pull data from the currently selected battery to populate this page. When pushing new settings, use the **Read** button to confirm the settings have been applied.

The following total charging current parameters are available:

Table P: Total charging current parameters

Parameter	Description
SetAllPacks	Select the checkbox to push the setting to all connected lithium battery modules.
Total charging current	Set the total charging current in mA.
SetUp	Select to save the settings.
Read	Select to pull data from the currently selected battery to populate this page. When pushing new settings, use the **Read** button to confirm the settings have been applied.

9.9 Database page

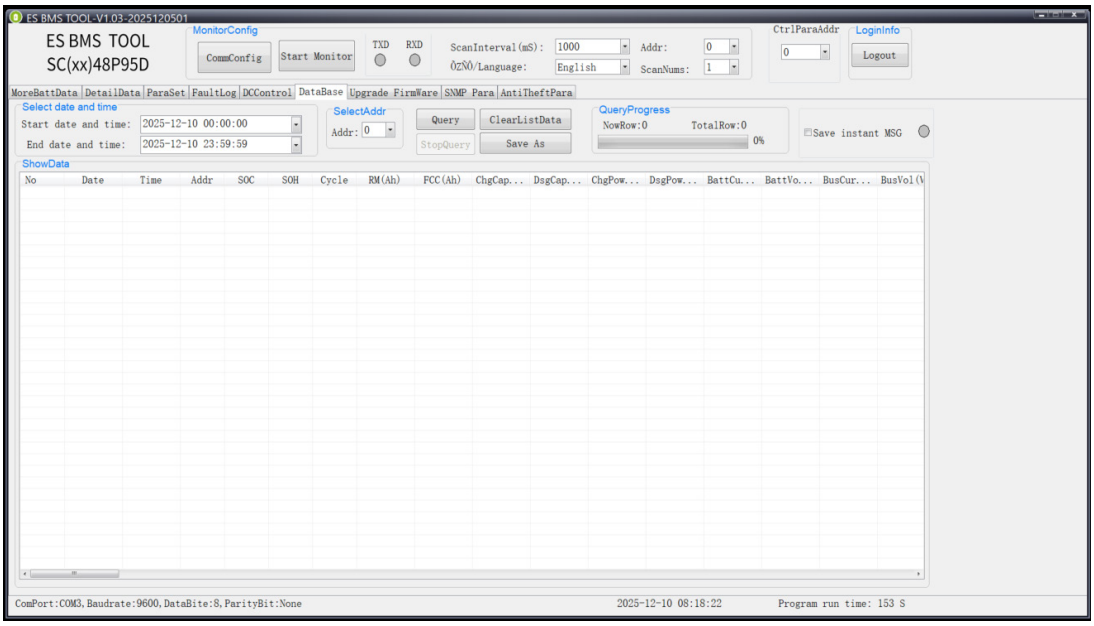


Figure 18: Database page

The database page provides an overview of the currently selected lithium battery module.

Table Q: Database page parameters

Parameter	Description
Start date and time	Select the start date and time in the drop-down menu.
End date and time	Select the end date and time in the drop-down menu.
Addr	Select the battery address in the drop-down menu. The ES BMS tool supports 32 batteries.
Query	Select to start pull the information from the selected battery for the time period specified.
StopQuery	Select to end the query session.
ClearListData	Select to clear the table.
Save As	Select to save the query as an XML file on the management computer.
QueryProgress	This section provides a visual indication of the state of the query in progress.
Save instant MSG	Select the checkbox to save the instant messaging record to the management computer.

9.10 Upgrade firmware page

On this page you can upgrade the firmware for the selected battery. Select the **SelectFile** button and select the firmware file on the management computer. Select the **Start Upgrade** button to proceed.

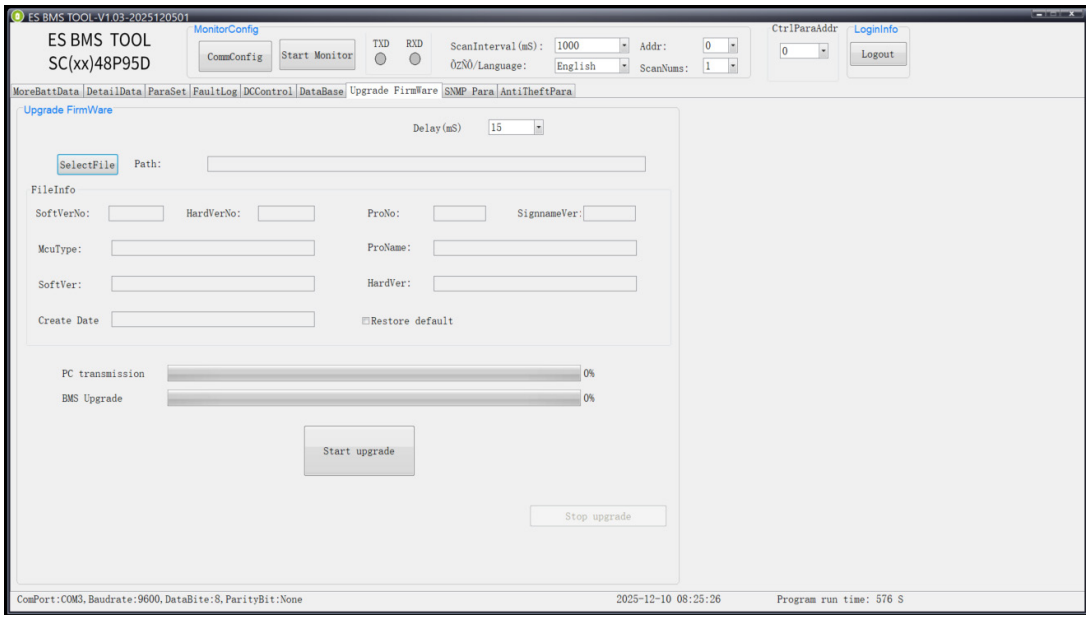


Figure 19: Firmware upgrade page

9.11 SNMP parameter page

For more information, see the SNMP interface (optional) section for more information.

9.12 Anti-theft parameter page

For more information, see the Anti-theft features section for more information.

10. Commissioning

10.1 Power on the lithium battery module

Connect the lithium battery module power cables and communication cables, verify the setup, then turn on the lithium battery module. Measure the voltage between the positive terminal and the negative terminal of the lithium battery module, it should be 40.5 to 57V. The lithium battery module status LEDs will illuminate as described in the Lithium battery module status LEDs and State of Charge LEDs sections.

10.2 Management computer communication settings

Use a USB to RS485 converter cable to connect the lithium battery module to the management computer.

Configure the management computer communication settings:

1. Sign in to the ES BMS tool.
2. Select the **MoreBattData** tab.
3. Select the **CommConfig** button and then select the **Start Monitor** button.

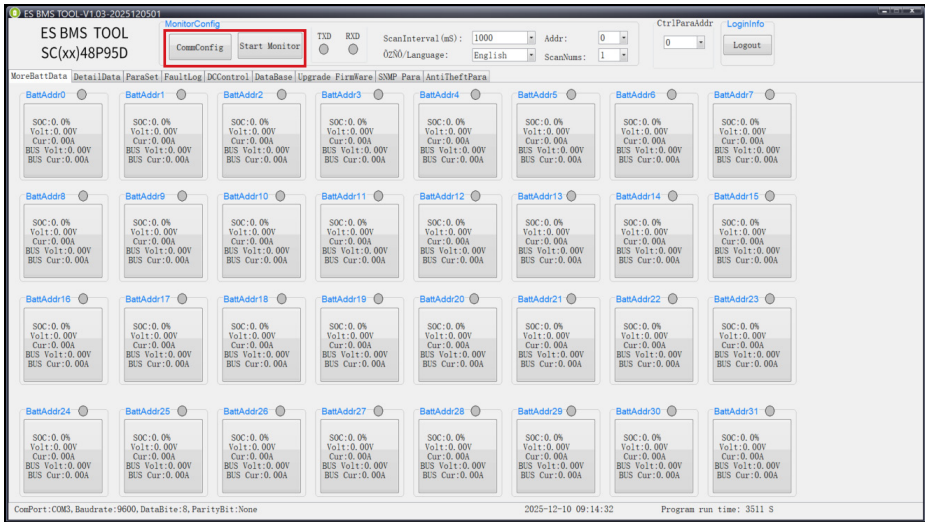


Figure 20: CommConfig and Start Monitor buttons

4. The **CommConfig** window will open. Select **Serial** from the left hand panel. Configure serial settings including Port, Baud Rate, Data Bit, Stop Bit, and Parity Bit. Select the **Setup** button to save the settings.

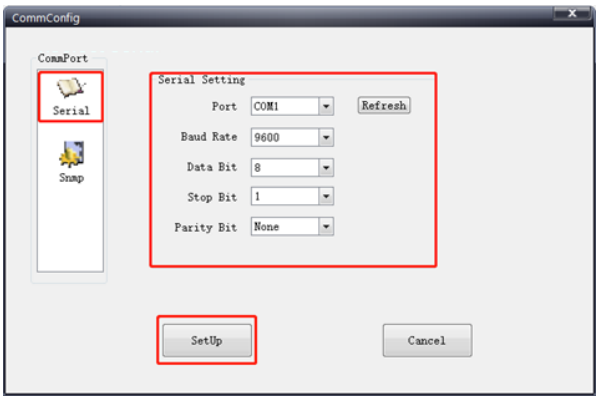


Figure 21: Configure serial port settings

10.3 SNMP function (optional)

The SNMP communication interface is an option for the SuperSafe® iON lithium battery module. SNMP allows for real-time monitoring of the lithium battery module.

To connect the lithium battery module to the management computer, use a standard network cable and a communication cable between the lithium battery module COM IN port and the computer serial port.

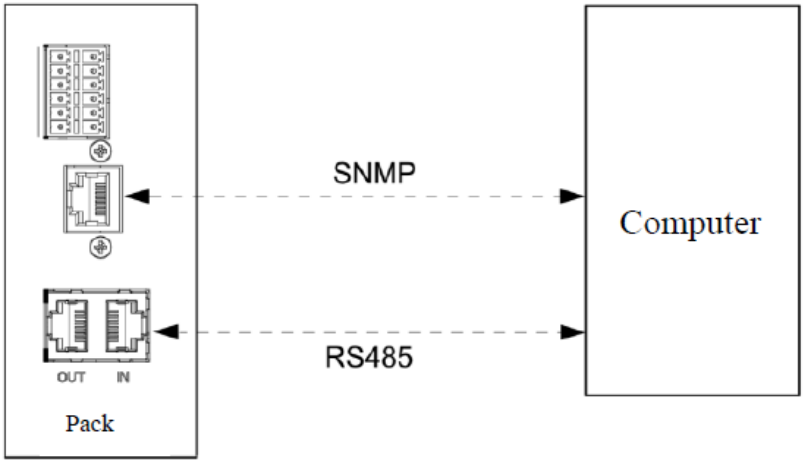


Figure 22: SNMP cabling

Configure SNMP parameters:

1. Sign in to the ES BMS tool.
2. Select the **SNMP Para** tab.
3. In the **State** drop-down menu, select **Enable**.
4. Select the **Get** button to fetch the management computer IP address.
5. Change the port value to 161 (agent) and 162 (traps).
6. Select the **Setup** button to save the settings.

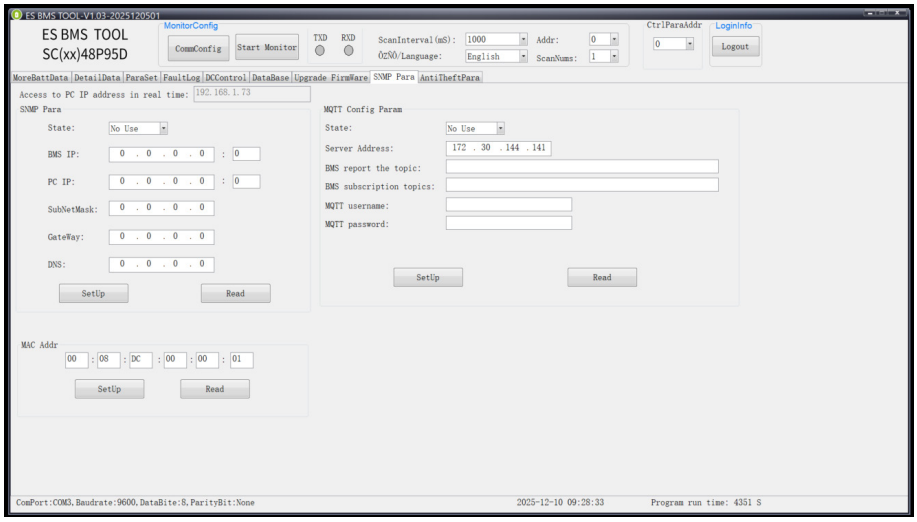


Figure 23: Configure SNMP parameters

Connecting to SNMP:

1. Sign in to the ES BMS tool.
2. Select the **SNMP Para** tab.
3. Select the CommConfig button.
4. Select **SNMP** from the left hand panel.
5. Select the **Get** button to fetch the management computer IP address.
6. Select the **SetUp** button to save the settings.

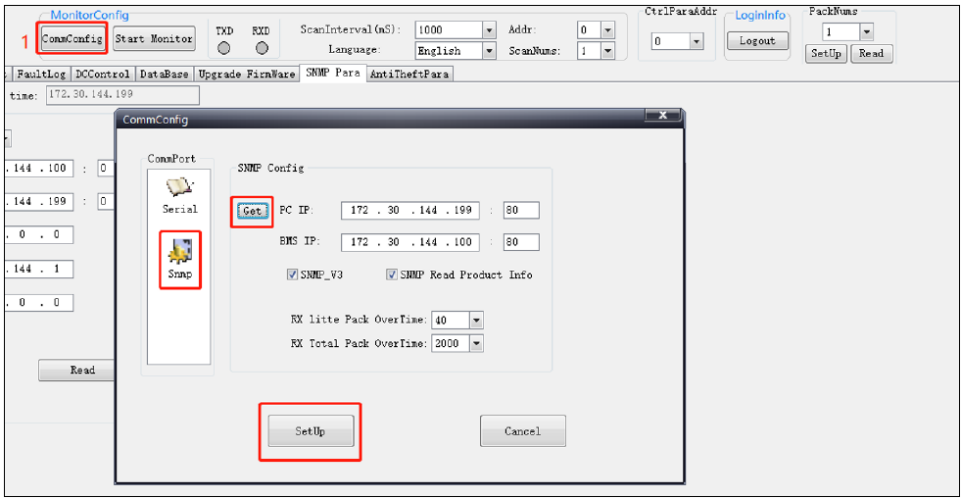


Figure 24: Configure SNMP parameters

10.4 Anti-theft features

Configure and enable the tilt-angle (gyroscope) anti-theft feature:

1. Sign in to the ES BMS tool.
2. Select the **AntiTheftPara** tab.
3. Select the **Log inAnti-Theft Setup** button.
   An **Anti-theft log in** window is displayed.
4. Set a password for this feature. This password is required to disable the anti-theft features or to end a false alarm. Select the **confirm** button to save the setting.

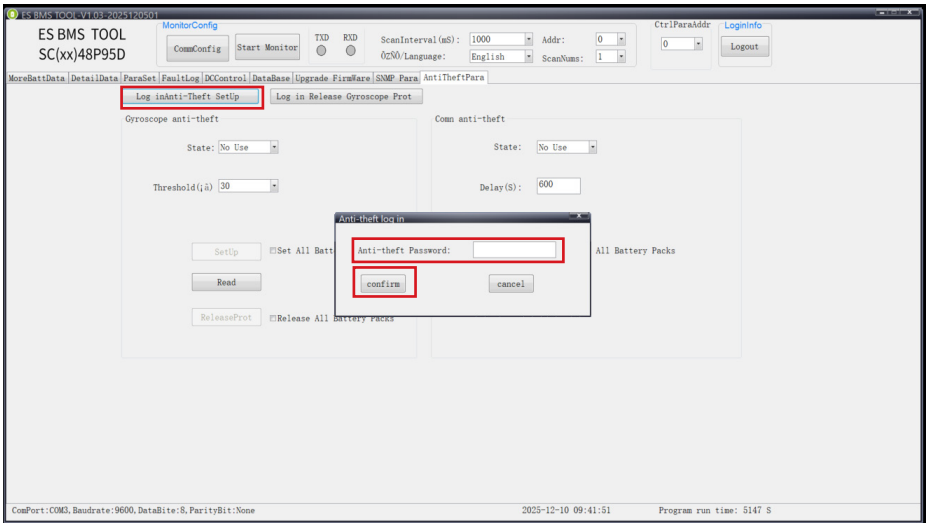


Figure 25: Set the anti-theft feature password

5. For the tilt-angle feature (gyroscope anti-theft), in the **State** drop-down menu, select **Use**.
6. In the **Threshold** drop-down menu, select the lean angle threshold (in degrees) required to trigger an alarm condition.
7. Select the checkbox if you want this feature to apply to all lithium battery modules.
8. Select the **SetUp** button to save the settings.
9. Select the **Read** button to confirm the settings are applied.

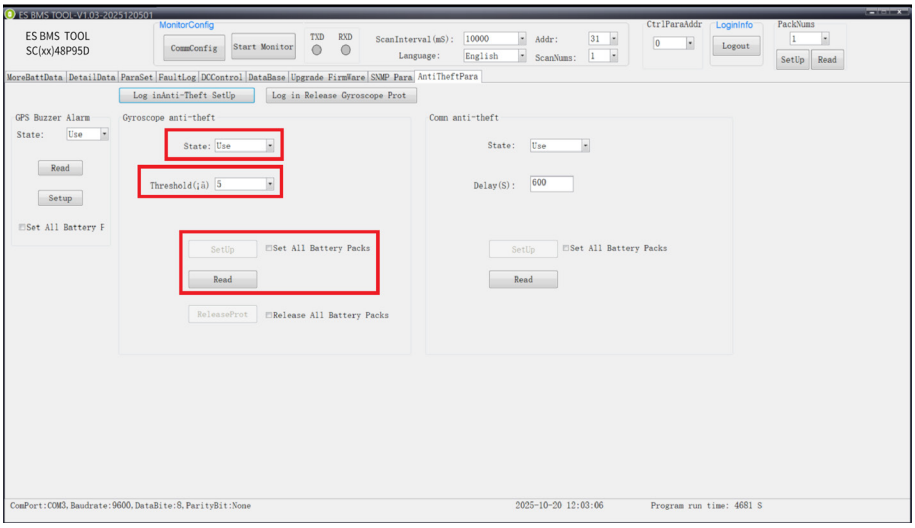


Figure 26: Configure the tilt-angle anti-theft feature

10. To disable the tilt-angle feature, select the **Log in Release Prot** button.
    A **Gyroscope Release Prot log in** window is displayed.
11. Enter the anti-theft password and select the **confirm** button.
12. Select the **ReleaseProt** button to disable the feature. Select the checkbox if you want to disable this feature for all lithium battery modules.

NOTICE

The communication port anti-theft feature follows the same logic as the anti-tilt (gyroscope) anti-theft feature. The key difference is that the threshold delay is in seconds. Meaning, after the configured delay, the MOSFETS will enter a open state and the alarm will sound until the feature is deactivated via the ES BMS tool. If the password is not entered, the lithium battery module will continue to be in a locked state until the password is entered.

ATTENTION

Keep the password in a secure location. For security reasons, a locked lithium battery module cannot be unlocked in the field without the configured password. If a password is lost or forgotten, only an authorized EnerSys service center can unlock the lithium battery module.

11. ES BMS tool default settings

The following table lists default values for the ES BMS tool.

11.1 Default settings

Table R: Default settings

Parameter	Alarm	Alarm recovery	Alarm delay	Protection	Protection recovery	Protection delay
Cell overvoltage	3.6V	3.38V	1,000 ms	3.65V	3.38V	1,000 ms
Cell undervoltage	2.8V	3V	1,000 ms	2.6V	3V	1,000 ms
Pack overvoltage	43.2V	40.44V	1,000 ms	43.8V	40.44V	1,000 ms
Pack undervoltage	33.6V	36V	1,000 ms	31.2V	36V	1,000 ms
Environment overtemperature	212°F (100°C)	212°F (100°C)	1,000 ms	248°F (120°C)	212°F (100°C)	1,000 ms
Environment undertemperature	–4°F (–20°C)	–4°F (–20°C)	1,000 ms	–13°F (–25°C)	–4°F (–20°C)	1,000 ms
Charging undertemperature	32°F (0°C)	32°F (0°C)	1,000 ms	23°F (–5°C)	32°F (0°C)	1,000 ms
Discharging undertemperature	5°F (–15°C)	5°F (–15°C)	1,000 ms	–4°F (–20°C)	5°F (–15°C)	1,000 ms
Low SoC	10%	13V	1,000 ms	5%	13V	1,000 ms
MOSFET oovertemperature	203°F (95°C)	185°F (85°C)	1,000 ms	221°F (105°C)	185°F (85°C)	1,000 ms
Charging overtemperature	122°F (50°C)	122°F (50°C)	1,000 ms	131°F (55°C)	122°F (50°C)	1,000 ms
Discharging overtemperature	131°F (55°C)	131°F (55°C)	1,000 ms	149°F (65°C)	131°F (55°C)	1,000 ms
Charging overcurrent	165A	165A	1,000 ms	180A	180A	1,000 ms
Discharging overcurrent	–165A	–165A	1,000 ms	–180A	–180A	1,000 ms
Charging overcurrent level 2	N/A	N/A	N/A	210A	210A	50 ms
Discharging overcurrent level 2	N/A	N/A	N/A	–400A	–400A	50 ms
Discharging - battery empty	N/A	N/A	N/A	2.7V	3V	1,000 ms
Charging - battery full	N/A	N/A	N/A	3.65V	3.38V	1,000 ms
Bus overtemperature	185°F (85°C)	185°F (85°C)	1,000 ms	203°F (95°C)	185°F (85°C)	1,000 ms
Heater	N/A	N/A	N/A	Start 41°F (5°C)	End 59°F (15°C)	N/A
Cell balancing	Start 3,400 mV	StartDiff 30 mV	N/A	EndDiff 10 mV	N/A	N/A

12. Battery application scenario

The following figure provides an example battery application scenario. This figure is provided to show power and communication cabling between the various components in a system.

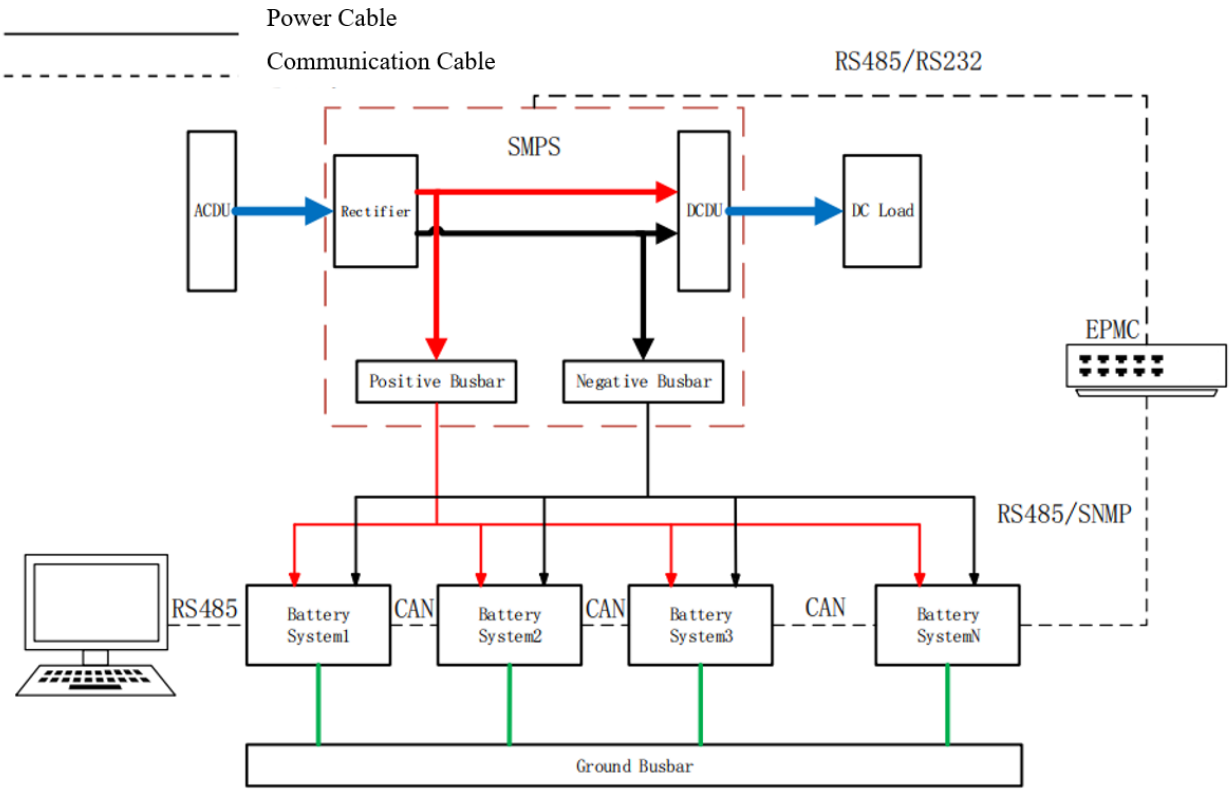


Figure 27: Example battery application

13. Maintenance

CAUTION

Ensure that the power supply or load is disconnected and the lithium battery module is turned off prior to any inspection or maintenance activities.

ATTENTION

Ensure redundant power or lithium battery modules are used to eliminate the threat of service interruptions while performing maintenance on the system's alarms and control settings.

Although very little maintenance is required with SuperSafe® iON lithium battery modules, routine checks and adjustments are recommended to ensure optimum performance. Qualified service personnel should do the repairs.

The following table lists a few maintenance procedures for this lithium battery module. These procedures should be performed at least once a year.

13.1 Routine maintenance

Table S: Lithium battery module maintenance

Routine maintenance	Operating environment	In order to improve the service life of the lithium battery module, the installation environment should be maintained in a good condition, which is generally required to avoid strong direct light for long periods of time or other radiation, and to avoid the entry of water, other liquids, dust, or soil.
		It is strictly prohibited to expose the lithium battery module to sunlight. An environment with too high ambient temperature will shorten the service life of lithium battery module.
	Fault message alarm handling	While using the lithium battery module, if there is a fault alarm prompt, you should refer to Lithium battery module fault alarm handling table.
	Charge/discharge	Avoid charging and discharging with high currents beyond the specifications.
		When the state of charge is low, the lithium battery module should be charged. Avoid long-term low-capacity storage of the lithium battery module.
Regular maintenance	When not in use, lithium battery modules should be in 25 to 75 percent state of charge. Do not store lithium battery modules for more than seven days in a discharged state.	
	When the lithium battery module is in use, if the power reserve time is shorter than expected, it could be that voltage between cells is not balanced. Contact EnerSys technical support for inspection or service.	
	Regularly check all connections. If any connection is loose, tighten to the torque value specified in this document.	
	Regularly check external output cables for wear. Replace as needed to avoid short-circuit issues.	

13.2 Fault alarm handling

Table T: Lithium battery module fault alarm handling

Fault	Possible causes	Solution
No response when pressing the power switch.	Internal malfunction	Contact EnerSys technical support.
The lithium battery module has a short discharge time.	Low state of charge	Keep the lithium battery module at 15A current continuous charging for more than six hours to let the lithium battery module fully charge.
	Overload or short circuit	Remove the load and verify that the load does not exceed the rated current of 100A and verify that there are no short circuit points. If the fault is removed, a low current charge can be used to continue operation.
	Lithium battery module aging and loss of capacity	If the lithium battery module's standby time is less than 80 percent of the initial standby time, contact EnerSys technical support for evaluation.
The lithium battery module has a short discharge time and cannot be charged or discharged.	Internal malfunction	Contact EnerSys technical support.
	Lithium battery module overheating	Allow the lithium battery module to cool down at room temperature for more than three hours.

CAUTION

If the lithium battery module fails, do not attempt to open the lithium battery module. Contact EnerSys technical support noting the product model, batch number, date of failure, and a complete description of the issue including any alarm information reported in the ES BMS tool.

Export the battery fault log:

1. Sign in to the ES BMS tool.
2. Select the **FaultLog** tab.
3. Select the address of the lithium battery module exhibiting the issue.
4. Select the **QueryData** button and then select the **export data** button.

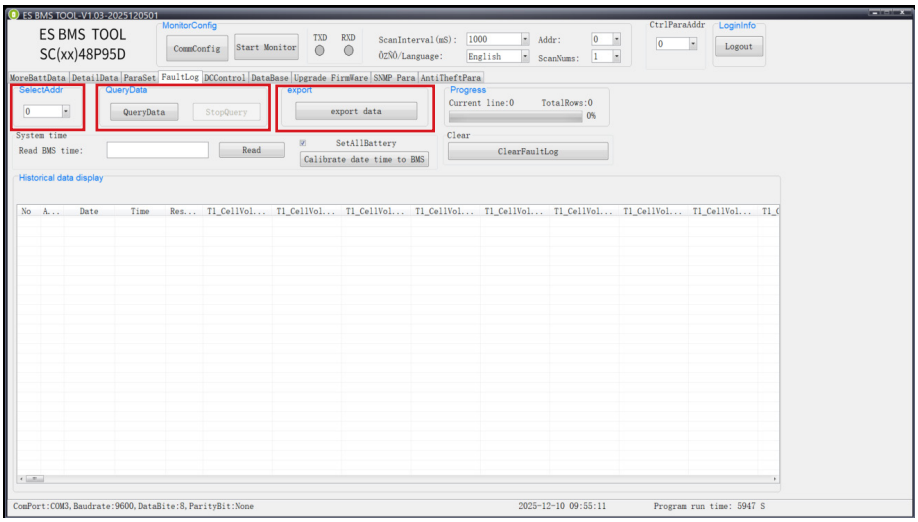


Figure 28: Export the battery fault log

The fault log will be saved to the management computer. Provide this log to EnerSys technical support.

14. Troubleshooting

Lithium battery modules are designed for simple installation and reliable, trouble-free operation.

In most cases lithium battery modules will recover from minor alarms and faults automatically. In the unlikely event of a lithium battery module failure, it may need replacement.

The following tables provide a quick reference of lithium battery module LEDs and the corresponding states.

14.1 Lithium battery module status LEDs

Table U: Lithium battery module status LED states

Status	State	RUN LED	ALM LED	CHG LED	DCH LED	State of charge LEDs			
						100%	75%	50%	25%
Power off	**Off**	Off	Off	Off	Off	Off	Off	Off	Off
Standby	**Normal**	Blink 1	Off	Off	Off	As per the State of Charge LEDs table.			
	Alarm								
	Protection								
Charging	**Normal**	On	Off	On	Off				
	Alarm								
	Protection								
Discharging	**Normal**	Blink 3	Off	Off	On				
	Alarm								
	Protection								
Alarm		Blink 1	On/Blink 2	Note 1	Note 2	Off	Off	Off	Off

Note 1: If there is a charging fault and there is an external charging voltage, the CHG LED will remain illuminated.

Note 2: If there is a discharging fault, the DCH LED will be illuminated.

Blink modes:
- Blink 1: On for 0.25 s, off for 3.75 s
- Blink 2: On for 0.5 s, off for 0.5 s
- Blink 3: On for 0.5 s, off for 1.5 s

NOTICE

Sign in to the ES BMS tool for more information on the lithium battery module state.

14.2 State of Charge LEDs

Table V: State of charge LED states

	Charge				Discharge/standby			
Capacity	**100%**	**75%**	**50%**	**25%**	**100%**	**75%**	**50%**	**25%**
0%	Off	Off	Off	Blink 2	Off	Off	Off	Off
0 to 25%	Off	Off	Off	Blink 2	Off	Off	Off	On
25 to 50%	Off	Off	Blink 2	On	Off	Off	On	On
50 to 75%	Off	Blink 2	On	On	Off	On	On	On
75 to 99.9%	Blink 2	On	On	On	On	On	On	On
100%	On	On	On	On	On	On	On	On

Blink modes:
- Blink 1: On for 0.25 s, off for 3.75 s
- Blink 2: On for 0.5 s, off for 0.5 s
- Blink 3: On for 0.5 s, off for 1.5 s

NOTICE

Sign in to the ES BMS tool for more information on the lithium battery module state.

15. Shipping

ATTENTION

The SuperSafe® iON lithium battery module complies with UN 38.3 for transportation of lithium battery modules and cells.

Because of their inherent stored energy and flammability, lithium battery modules are considered Dangerous Goods (UN 3480; lithium) and must be transported in accordance with all regulations. The classification for the lithium battery module is Class 9, according to UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, Chapter 38.3 (known as UN 38.3). Air shipment requires IATA PI 965-970 approval according to the local jurisdiction's department of transportation.

This lithium battery module complies with UN 38.3. Test summaries are available upon request.

Damaged lithium battery modules must be transported based on all applicable regulations for damaged lithium battery modules. These requirements are in addition to the standard UN 38.3 criteria. Contact your EnerSys service representative for assessment and support in transporting damaged lithium battery modules.

For further transport and regulatory information (USA and EU; classifications and labeling) refer to lithium battery SDS instructions or regulations by the International Civil Aviation Organization (ICAO), International Air Transport Association (IATA), International Maritime Dangerous Goods (IMDG) convention concerning the Carriage of Goods by Rail (CIM), and Annex A: International Regulations concerning the Carriage of Dangerous Goods by Rail (RID) codes. Other laws and regulatory requirements may apply.

ATTENTION

- All persons involved in shipping lithium battery modules must comply with all applicable regulations.
- All persons involved in shipping lithium battery modules must be trained as required by local regulations to ship hazardous goods.
- Unpacking and packing of lithium battery modules shall only be performed by electrically trained personnel.

16. Storage

To maintain battery health during storage, power on the lithium battery module at least once every six months to ensure the state of charge remains above 25 percent. If it falls below 40 percent, recharge the module to exceed 40 percent before returning it to storage.

The lithium battery module must be stored in a dry environment away from fire, sparks, and heat.

The allowable storage temperatures are 59 to 95°F (15 to 35°C). To ensure lithium battery module health and maximize service life, the maximum temperature of the long-term storage location should be less than 95°F (35°C).

The storage area must be compliant with local regulations (including fire, safety, and building regulations) for lithium battery modules.

The lithium battery module must only be stored in an upright position.

If the lithium battery module is removed from the application for storage, the lithium battery module terminals must be covered with insulation that can only be removed by the use of a tool, or the lithium battery module must be stored in a properly labeled, suitable container that can only be opened by using a tool or key.

When storing the lithium battery module for more than one month, it is essential to prevent deep discharge. Ensure the module is kept at 25 to 75 percent state of charge. Additionally, implement monitoring and recharging procedures to prevent the charge from dropping to 5 percent during the storage period.

Table W: Storage requirements

Specification	Value
Storage temperature	59 to 95°F (15 to 35°C)
Storage humidity	5 to 95% non-condensing
State of charge[1]	25 to 75% charge
	Requires recharge every six months
Other requirements	The lithium battery module should not be exposed to direct sunlight and should be a minimum distance of 6.6 feet (2 meters) from any heat source.
	When storing the lithium battery module, it should not be inverted. Avoid mechanical shock and heavy pressure.
	Do not short circuit the positive and negative terminals.

[1] The correct or compliant storage of lithium batteries may be subject to local laws, regulations and standards which take precedence over this document. Warranty and service life performance of these batteries are compromised unless the batteries are maintained within the storage requirements as outlined in this table.

17. Disposal and recycling

ATTENTION

Dispose of the lithium battery module in accordance with all local regulations relating to disposal of lithium battery modules. Failure to do so may result in serious harm.

Do not dismantle, incinerate, or crush lithium battery modules.

Dismantling the lithium battery module is not authorized except by qualified EnerSys personnel due to the numerous hazards involved with dismantling a lithium battery module.

In case of irreparable failure, the lithium battery module must be taken out of operation and your EnerSys service representative contacted.

Due to the risks posed by damaged lithium battery modules, damaged lithium battery modules require specialized handling and recycling. Do not dispose of this lithium battery module as unsorted municipal waste.

EnerSys, in line with local regulations, will accept SuperSafe® iON lithium battery modules at specific facilities for disposal. Contact your local EnerSys service representative for specific recycling instructions for your region.

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