# USER MANUAL
# LITHIUM BATTERY



# 12V 400Ah/24V 200Ah

![EG4 ELECTRONICS]

# 1. ABBREVIATIONS

AWG – American Wire Gauge

A – Amp(s)

Ah – Amp hour(s)

AC – Alternating Current

AFCI-Arc-Fault Circuit Interrupter

AHJ – Authority Having Jurisdiction

ANSI – American National Standards Institute

BAT-Battery

BMS – Battery Management System

COM-Communication

CT-Current Transformer

DC – Direct Current

DIP – Dual In-line Package

DOD – Depth of Discharge

EG – Equipment Ground

EGS – Equipment Grounding System

EMC-Electromagnetic Compatibility

EPS – Emergency Power System

ESS – Energy Storage System

E-Stop-Emergency Stop

E-Stop NO – Emergency Stop Normally Open

FCC-Federal Communication Commission

GE – Grounding Electrode

GEC – Grounding Electrode Conductor

GEN-Generator

GES – Grounding Electrode System

GFCI-Ground Fault Circuit Interrupter

GFDI-Ground Fault Detector/Interrupter

Imp – Maximum Power Point Current

IEEE-Institute of Electrical and Electronic Engineers

IP-Ingress Protection

Isc – Short-Circuit Current

In. lbs. – Inch Pounds

kW – Kilowatt

kWh – Kilowatt-hour

LCD-Liquid Crystal Display

LFP – Lithium Iron Phosphate or LiFePO4

L1-Line 1; Typically, a black wire

L2-Line 2; Typically, a red wire

mm – Millimeter(s)

MPPT-Maximum Power Point Tracking

mV – Millivolt(s)

N-Neutral; Typically, a white wire

NEC – National Electrical Code

NEMA- National Electrical Manufacturers Association

NFPA – National Fire Prevention Association

Nm – Newton Meters

NOCT-Normal Operating Cell Temperature

PC – Personal Computer

PCB – Printed Circuit Board

PE – Protective Earth (G or Ground);

Pnum-Parallel Number

PPE – Personal Protective Equipment

PV – Photovoltaic

RSD – Rapid Shut Down

SCC- Standards Council of Canada

SOC – State of Charge

STC – Standard Testing Conditions

UL-Underwriters Laboratories

UPS-Uninterrupted Power Supply

V – Volt(s)

VOC – Open-Circuit Voltage

VMP – Voltage Maximum Power

## 2. TECHNICAL SPECIFICATIONS

### 2.1 EG4 LL 12V 400AH SPECIFICATIONS

| MODULE OPERATING PARAMETERS | |
|---|---|
| Voltage | 12.8V |
| Capacity | 400Ah |
| Charging Voltage (Bulk/Absorb) | 14.0V (+/-0.2V) |
| Float | 13.5V (+/-0.2V) |
| Low DC Cutoff | 11.8 – 11.4V (depending on load – start high, lower if needed) |
| Charging Current | 100A (Max. Continuous) |
| Discharging Current | 100A (Max. Continuous) |

| ENVIRONMENTAL PARAMETERS | |
|---|---|
| Charging Range | 32°F - 113°F (0°C to 45°C) |
| Discharging Range | -4°F - 122°F (-20°C - 50°C) |
| Storage Range | -4°F - 122°F (-20°C - 50°C) |
| Ingress Protection | IP20 |

**BMS PARAMETERS**

| CHARGE | SPEC | DELAY | RECOVERY |
|---|---|---|---|
| Cell Voltage Protection | 3.8V | 1s | 3.45V |
| Module Voltage Protection | 15.0V | 1s | 13.8V |
| Over Charging Current 1 | >220A | 10s | - |
| Over Charging Current 2 | ≥250A | 3s | - |
| Temperature Protection | <23°F or >167°F <-5°C or >75°C | 1s | <41°F or >149°F >5°C or 65°C |

| DISCHARGE | SPEC | DELAY | RECOVERY |
|---|---|---|---|
| Cell Voltage Protection | 2.3V | 1s | 3.1V |
| Module Voltage Protection | 9.6V | 1s | 12.0V |
| Over Charging Current 1 | >220A | 30s | 60s |
| Over Charging Current 2 | >380A | 3s | 60s |
| Short-Circuit | >775A | <0.1mS | - |
| Temperature Protection | <-4°F or >167°F <-20°C or >75°C | 1s | >14°F or <149°F >-10°C or <65°C |
| PCB Temp Protection | >221°F (>105°C) | 1s | <176°F (<80°C) |

**GENERAL SPECIFICATIONS**

| PARAMETER | SPEC | | CONDITION |
|---|---|---|---|
| Cell Balance | 100mA | Passive Balance | Cell Voltage Difference >40mV |
| Temperature Accuracy | 3% | Cycle Measurement | Measuring Range -40°F – 212°F (-40°C – 100°C) |
| Voltage Accuracy | 0.5% | Cycle Measurement | For Cells/Module |
| Current Accuracy | 3% | Cycle Measurement | Measurement Range +/-200A |
| SOC | 5% | - | Integral Calculation |

| | | | |
|---|---|---|---|
| Power Consumption (Sleep & Off Mode) | <300uA | | Storage/Transport/ Standby |
| Power Consumption (Operating) | <14mA | | Charging/Discharging |
| Communication Ports | | RS485/CAN | Customizable |
| Bluetooth Monitoring | | | Customized EG4 App |
| Maximum Modules in Parallel | | 16 | |
| Dimension (H×W×D) | | 6.1 in×19 in×20.2 in (15.5 cm×48.2 cm×51.3 cm) | |
| Weight | | 98.1 lbs. (44.5 kg) | |

## 2.2 EG4 LL 24V 200AH SPECIFICATIONS

### MODULE OPERATING PARAMETERS

| | |
|---|---|
| Voltage | 25.6V |
| Capacity | 200Ah |
| Charging Voltage (Bulk/Absorb) | 28.1V (+/-0.2V) |
| Float | 27.0V (+/-0.2V) |
| Low DC Cutoff | 23.5 – 22V (depending on load – start high, lower if needed) |
| Charging Current | 200A (Max. Continuous) |
| Discharging Current | 200A (Max. Continuous) |

### ENVIRONMENTAL PARAMETERS

| | |
|---|---|
| Charging Range | 32°F - 113°F (0°C to 45°C) |
| Discharging Range | -4°F - 122°F (-20°C - 50°C) |
| Storage Range | -4°F - 122°F (-20°C - 50°C) |
| Ingress Protection | IP20 |

### BMS PARAMETERS

| CHARGE | SPEC | DELAY | RECOVERY |
|---|---|---|---|
| Cell Voltage Protection | 3.9V | 1s | 3.45V |
| Module Voltage Protection | 30.0V | 1s | 28.8V |
| Over Charging Current 1 | >102A | 10s | - |
| Over Charging Current 2 | ≥120A | 3s | - |
| Temperature Protection | <23°F or >158°F <-5°C or >70°C | 1s | <32°F or >140°F >0°C or <60°C |
| **DISCHARGE** | | | |
| Cell Voltage Protection | 2.3V | 1s | 3.1V |
| Module Voltage Protection | 20.8V | 1s | 22.4V |
| Over Charging Current 1 | >102A | 10s | 60s |
| Over Charging Current 2 | >150A | 3s | 60s |
| Short-Circuit | >250A | <0.1mS | - |
| Temperature Protection | <-4°F or >167°F <-20°C or >75°C | 1s | >14°F or <149°F >-10°C or <65°C |
| PCB Temp Protection | >221°F (>105°C) | 1s | <176°F (<80°C) |

### GENERAL SPECIFICATIONS

| PARAMETER | SPEC | | CONDITION |
|---|---|---|---|
| Cell Balance | 120mA | Passive Balance | Cell Voltage Difference >40mV |
| Temperature Accuracy | 3% | Cycle Measurement | Measuring Range -40°F – 212°F (-40°C – 100°C) |

| Voltage Accuracy | 0.5% | Cycle Measurement | For Cells/Module |
|---|---|---|---|
| Current Accuracy | 3% | Cycle Measurement | Measurement Range +/-200A |
| SOC | 5% | - | Integral Calculation |
| Power Consumption (Sleep & Off Mode) | <300uA | - | Storage/Transport |
| Power Consumption (Operating) | <20mA | - | Charging/Discharging |
| Communication Ports | RS485/CAN | | Customizable |
| Maximum Modules in Parallel | 16 | | |
| Dimension (H×W×D) | 6.1 in.×19 in.×20.2 in. (15.5 cm×48.2 cm×51.3 cm) | | |
| Weight | 99.2 lbs. (44.5 kg) | | |

⚠️ **DANGER!**
**AVERTISSEMENT!**

*Hazardous Voltage Circuits!*
*Circuits à tension élevée!*

## 3. SAFETY

### 3.1 SAFETY INSTRUCTIONS

International safety regulations have been strictly observed in the design and testing of the inverter. Before beginning any work, carefully read all safety instructions, and always observe them when working on or with the inverter. The installation must follow all Applicable national or local standards and regulations.

**Incorrect installation may cause:**

- *Injury or death to the installer, operator or third party*
- *Damage to the inverter or other attached equipment*

### 3.2 IMPORTANT SAFETY NOTIFICATIONS

There are various safety concerns that must be carefully observed before, during, and after the installation, as well as during future operation and maintenance. The following are important safety notifications for the installer and any end users of this product under normal operating conditions.

1. **Do not disassemble the battery.** Contact your distributor for any warranty issues in need of repair for proper handling instructions. Incorrect servicing or re-assembly may result in a risk of electric shock or fire and voiding of warranty.
2. **Use caution when working with metal tools on or around batteries and system**. Risk of electrical arcs and/or short circuiting of equipment can lead to severe injury or death and equipment damage.
3. **Beware of high battery current**. Please ensure that the battery module breakers and/or on/off switches are in the "open" or "off" position before installing or working on the inverter. Use a voltmeter to confirm there is no voltage present to avoid electric shock.
4. **Do not make any connections or disconnections to the system while the batteries are operating**. Damage to system components or risk of electrical shock may occur if working with energized batteries. Do not make any connections or disconnections (PV, battery, grid, communication, etc.) while the inverter is operating.
5. Make sure the battery and rack are properly grounded.
6. An installer should make sure to be well protected by reasonable and professional insulative equipment [e.g., personal protective equipment (PPE)].
7. Before installing, operating, or maintaining the system, it is important to inspect all existing wiring to ensure that it meets the appropriate specifications and conditions for use.
8. Ensure that the battery and system component connections are secure and proper to prevent damage or injuries caused by improper installation.

**WARNING:** *To reduce the risk of injury, read all instructions*
*Avertissement: Pour Prévenir les blessures, lire toutes les instructions*

1. **All work on this product (system design, installation, operation, setting, configuration, and maintenance) must be carried out by qualified personnel. To reduce the risk of electric shock, do not perform any servicing other than those specified in the operating instructions unless qualified to do so**.

2. Read all instructions before installing. For electrical work, follow all local and national wiring standards, regulations, and these installation instructions. All wiring should be in accordance with the National Electrical Code (NEC), ANSI/NFPA 70.

3. The battery and system can inter-connect with the utility grid only if the utility provider permits. Consult with the local AHJ (Authority Having Jurisdiction) before installing this product for any additional regulations and requirements for the area.

4. All warning labels and nameplates on this battery should be clearly visible and must not be removed or covered.

5. The installer should consider the safety of future users when choosing the battery's correct position and location as specified in this manual.

6. Please keep children away from touching or misusing the battery and relevant systems.

7. Never charge a battery below the specified minimum charging temperature or damage may occur. Please refer to this manual or spec sheet for charging parameters.

**DISCLAIMER**

EG4 reserves the right to make changes to the material herein at any time without notice.
Please refer to www.eg4electronics.com for the most updated version of our manuals/spec sheets.

# 4. BRIEF INTRODUCTION

The EG4 12V & 24V-LL rack-mounted lithium batteries are ideal for low-voltage energy storage system applications. These batteries use lithium iron phosphate cells with the highest safety performance and a battery management system (BMS) that can monitor and collect voltage, current, and temperature of each cell within the module in real time. The BMS also includes a passive balance function and an advanced battery control strategy, which can help improve the battery pack's performance. The battery includes dual, on board, fire-extinguishing modules for added safety.

# 5. INSTALLATION

## 5.1 PACKAGING LIST & PLACEMENT

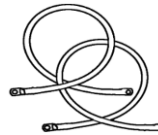When the product is unpacked, the contents should match those listed below:
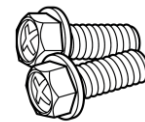


| (1) EG4-LL battery module | (1) Battery Parallel Cable | (1) Battery to PC – USB Cable | (1) Positive & (1) Negative Power Cable | (2) M8-1.25 Terminal Bolts |

## 5.2 LOCATION SELECTION AND INSTALLATION

### 5.2.1 STORAGE

There are a few steps you can take to ensure that batteries are stored safely and in a state that will ensure they are not damaged during storage. These are detailed below.

**Battery State**

The state of the battery when placed into storage will affect how long it can be stored as well as the battery's condition when it is brought out of storage. EG4 recommends that each battery is brought to a 100% SOC (state of charge) before placing it in storage. Lithium iron phosphate batteries will lose a certain percentage of their total charge while in storage, depending on how long they are stored and the conditions they are stored in. We recommend recharging the batteries after 8 – 9 months in prolonged storage.

**Environmental Factors**

The environment you store your EG4 battery in can greatly affect the health of the battery. **For best results**, the temperature should remain moderate, between 41°F and 68°F (5°C and 20°C). Keep the battery away from locations where it may get wet or locations with high humidity (>55%). Store the batteries away from combustible materials.

## 5.2.2 REQUIREMENTS FOR INSTALLATION

**WARNING**: Before using batteries, inspect them for signs of damage. Never use damaged or puffy batteries. Please contact the distributor if a battery is received in this state or experiences this issue.

**WARNING: Do not put EG4 LL batteries in series!** The BMS and internal components are not designed to handle this setup, which could cause the modules to fail leading to damage.

- Avoid exposing batteries to conductive materials, such as water, strong oxidizers, and strong acids.
- Avoid putting batteries in direct sunlight or on extremely hot surfaces.
- Keep all flammable materials out of the working area.
- Use caution when handling batteries and/or battery-powered devices to avoid damaging the battery casing or connections.

**IMPORTANT**: Never position the battery upside down or face down!
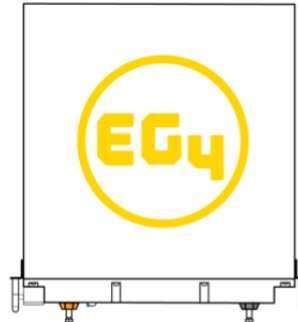


**Best**

**Acceptable**

**Acceptable**

## 5.2.3 INSTALLATION

| Cable Size | Min. Insulator Voltage | Torque Value | Distance |
|---|---|---|---|
| 2/0 AWG (min.) | 600V | 60 in. lbs. (7 Nm) | 10 ft. |
| 4/0 AWG | 600V | 60 in. lbs. (7 Nm) | 18 ft. |

**NOTE**: *This chart applies for a 200A continuous output (one battery). Where ambient temperature is above 86°F (30°C), cable size must be increased according to NEC 310. The 2 AWG cable included in the package is intended only for the connection from the module to an EG4 battery rack.*

**DANGER**: *When adding or removing a battery from any rack, cabinet, or busbar, turn off ALL batteries, and use a voltmeter to confirm there is no voltage present. This will prevent users from encountering live (powered) busbars by accident. Failure to do so can result in severe injury and/or death.*

### Tools Needed for Installation

The tools required may vary depending on how you choose to mount your battery. Typically, the following items are needed to install the battery into an EG4 battery rack solution or general racking.

1. 10mm socket and ratchet
2. Phillips head screwdriver
3. Torque wrench
4. M8-1.25 terminal bolts (included in package)

### Connecting Cables to the Battery Terminals and Busbars

1. Identify the positive and negative terminals on the battery. These are labeled and color coded (red for positive, black for negative).
2. Verify you have all hardware to attach the cable properly. Check to ensure the bolt threads fully into the terminal and can be tightened to the proper torque.
3. Connect the cables to your battery terminals by removing the M8 terminal bolts, inserting them through the eyelet of the proper cable, and reseating the bolt into the terminal block to the correct torque.
4. Connect the positive battery cables to your positive busbar by removing the bus bolts, inserting them through the eyelets of the proper cable, and reseating the bolt into the busbar to the proper torque value. Repeat with all negative cables.
5. **DO NOT** finger tighten the battery terminal bolts. They require a specific torque to ensure they do not loosen during operation. Failure to properly tighten the terminal bolts can result in serious damage and will void the warranty.

### 5.2.4 INSTALLATION IN EG4 BATTERY RACK

1. Insert the battery into the rack slot, beginning with the top slot and progressing downward. Slide in until the battery is firmly seated in the rack.
2. Follow steps 1-3 in *Connecting cables to the battery terminals and busbars* from *Section 3.2.3 - General Installation*.
   **Use the included 2 AWG power cable to connect each battery to the busbar.**
3. **DO NOT** finger tighten the battery or busbar terminal bolts. Both require a specific torque [60 in. lbs. (7Nm)] to ensure they do not loosen during operation. Failure to properly tighten the terminal bolts can result in serious damage and will void the warranty.
4. Clearly identify the location of the system's positive and negative terminals (red to the positive terminal and black to the negative) to ensure no connection errors. Then connect to the equipment or switch terminals.

### Grounding

You can attach a grounding wire from the rack/cabinet to an equipment grounding conductor, then terminate the EGC at a grounding electrode.

**WARNING:** *Do not ground rack/cabinet or door to negative or positive bus bars!*
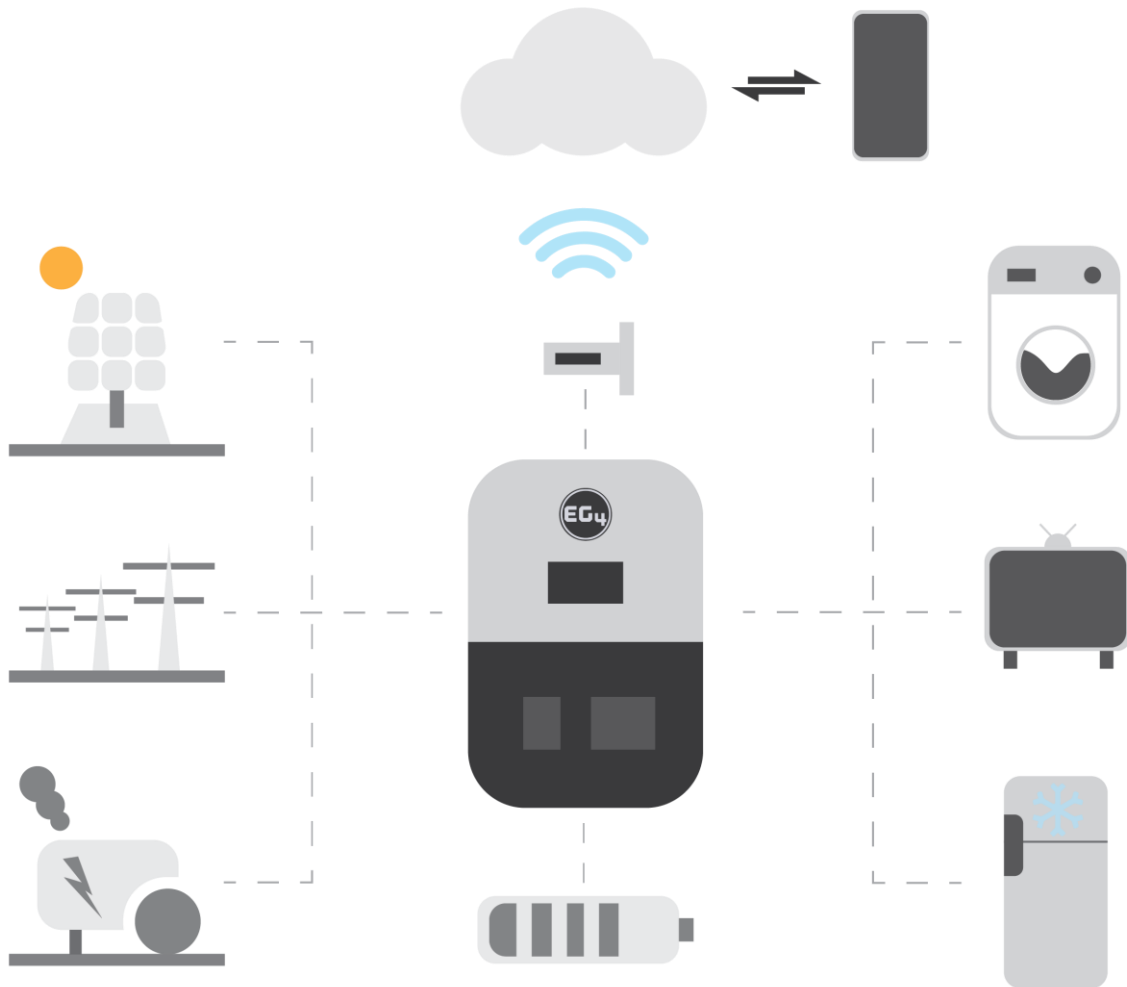
*For example, in this image, there are 6 EG4-LL 12V 400Ah batteries wired in parallel. This battery bank still maintains the appropriate 12V needed for a system. However, the Amp hour rating of this bank has increased to 2400Ah. In addition, the potential output amperage of the rack increases.* **Size main battery cables appropriately! Refer to an NEC approved ampacity chart for specifications.**
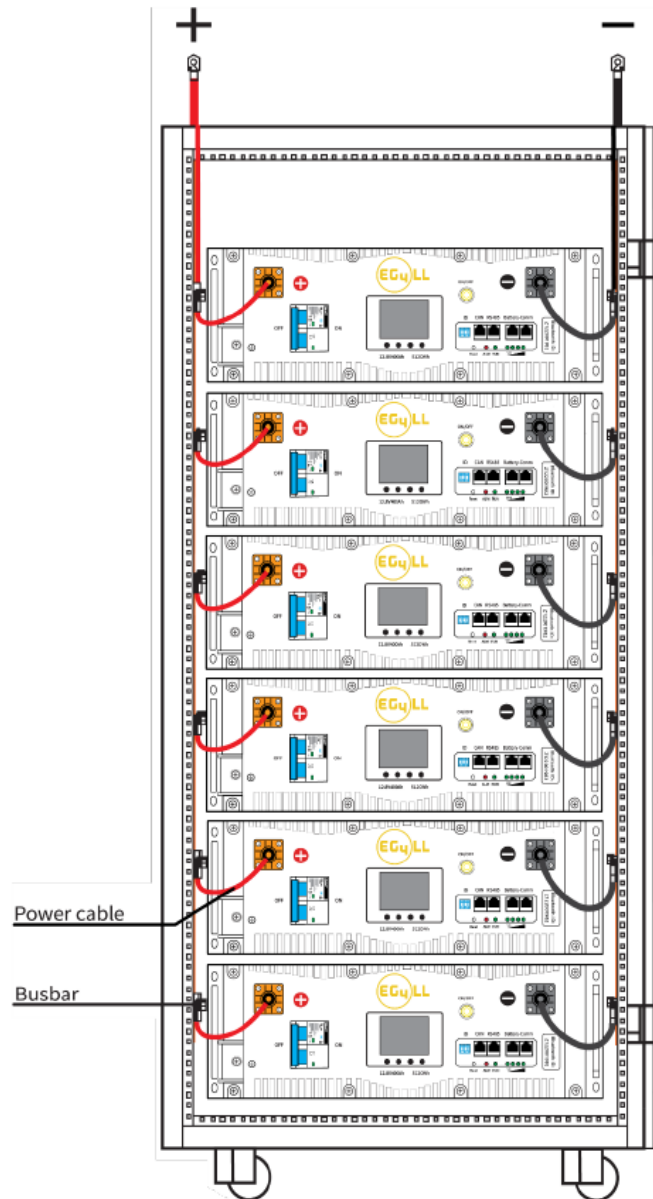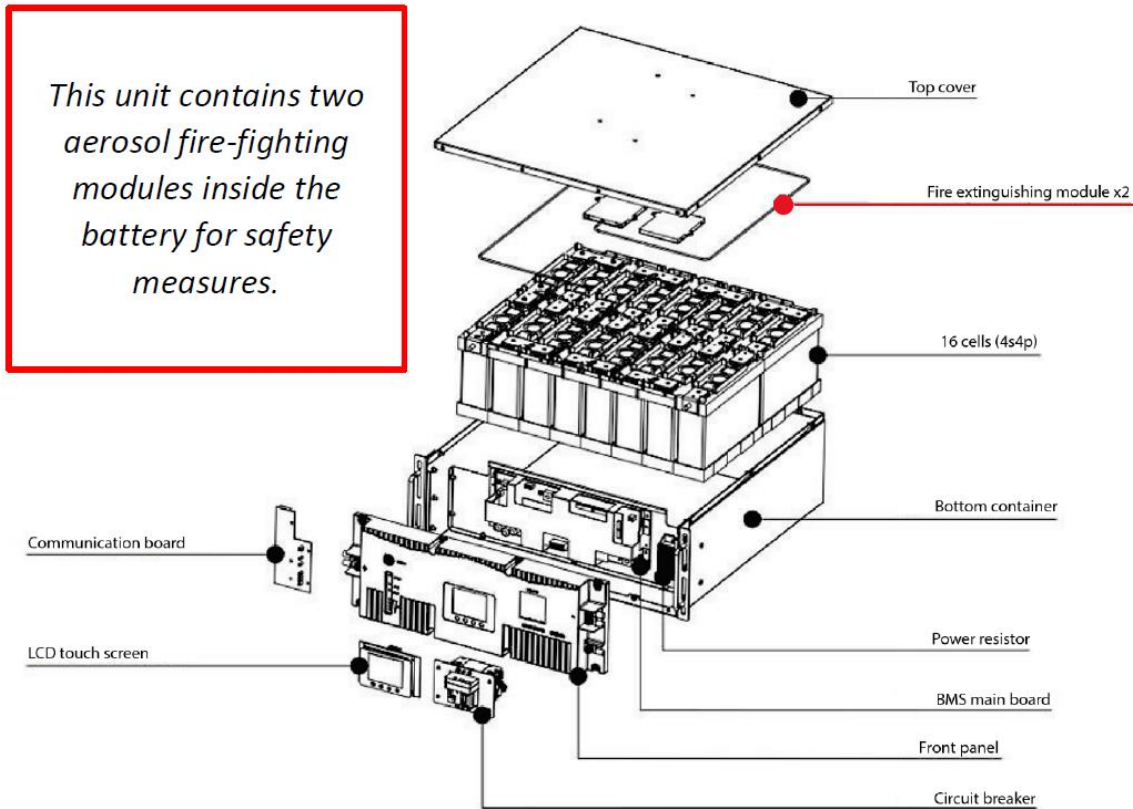
## 5.3 BATTERY OVERVIEW

### 5.3.1 SYSTEM CONNECTIONS

An example system connection diagram can be found below:

## Overview of System Components

This unit contains two aerosol fire-fighting modules inside the battery for safety measures.

Top cover

Fire extinguishing module x2

16 cells (4s4p)

Bottom container

Communication board

Power resistor

LCD touch screen

BMS main board

Front panel

Circuit breaker

The battery module is made up of sixteen "AAA" grade cells, a BMS, a housing, a breaker, and wire. It can be installed in a standard 19-inch cabinet and communicates with external devices via CAN/RS485 as well as with other EG4 batteries via RS485. The modules can be connected in parallel to meet expansion requirements. Inter-battery communications support a maximum of 16 modules.

**Battery Diagram**
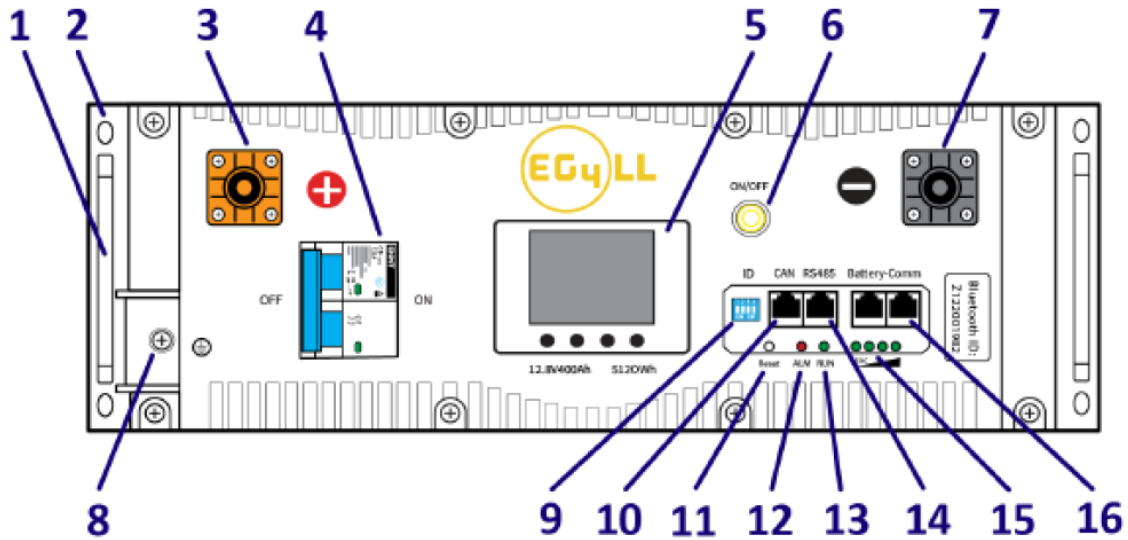


| No. | Item | Description | Remarks |
|---|---|---|---|
| 1 | Handle | Handle to carry module | |
| 2 | Rack mount ear | For rack mounting | |
| 3 | Battery positive terminal | Terminal M8 screw | |
| 4 | Circuit Breaker | Shuts down power supply | |
| 5 | HD LCD | HD touch screen | |
| 6 | ON/OFF Button | Button to turn BMS On/Off | |
| 7 | Battery negative terminal | Terminal M8 screw | |
| 8 | Ground Screw | Grounding point for chassis | |
| 9 | ID Board | DIP switch board for BMS | |
| 10 | CAN port | CAN bus port for communication | Pin 4 - CAN_H<br>Pin 5 – CAN_L |
| 11 | Reset Button | Emergency reset | |
| 12 | ALM LED | Alarm status LED | |
| 13 | RUN LED | Run status LED | |
| 14 | RS485 port | RS485 communication port | Pin 1 & Pin 8 – RS485_B<br>Pin 2 & Pin 7 – RS485_A |
| 15 | SOC LED | State of charge LED | |
| 16 | Battery-Comm ports | Parallel battery communication port | Pin 1 & Pin 8 – RS485_B<br>Pin 2 & Pin 7 – RS485_A |

# 6. OPERATION GUIDE

## 6.1 BATTERY COMMUNICATIONS

Each EG4 battery is designed with you in mind, displaying as much information as possible in the simplest manner. EG4 Electronics includes the option of connecting the battery to PC software to monitor the module status. This allows you to see and understand exactly what the battery is doing as well as troubleshoot if problems arise.

*When a single battery is used, it will communicate directly with the system via the RS485 or CAN port.*

### 6.1.1 CONNECTING MULTIPLE BATTERIES IN PARALLEL

1. Ensure all battery breakers and BMS are OFF.
2. Set the address code of each battery according to the DIP Switch ID Table (see the DIP Switch ID Table) making sure there are no duplicate addresses.
3. Establish communication between the batteries via the "*Battery-Comm*" ports starting with the right port on the last battery address and terminating on the left port of the host.
4. The battery with the No. 1 address (referred to as the host) connects to the system via communication cable using the RS485/CAN interface. *(See image to the right)*
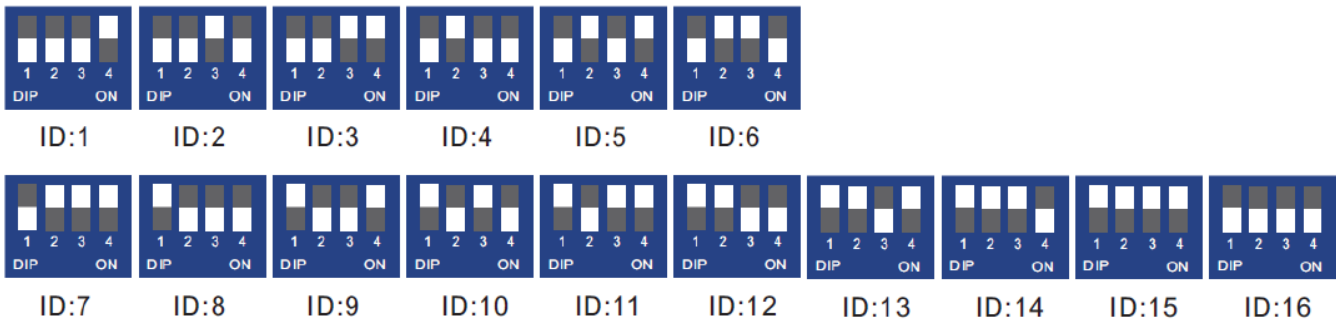5. Power on each battery breaker and BMS one at a time beginning with the host battery.

### 6.1.2 DIP SWITCH ID TABLE

EG4-LL batteries interface with an inverter by designating a "Host" battery (DIP switch ID No. 1). The ID code range is 1–16, and the communication mode can support up to 16 modules in parallel. The battery will connect directly via a battery communications cable or a standard CAT 5, 5e, or 6 cable (for closed loop communications with non-EG4 inverter types). *For Victron communication cables, contact your distributor.*
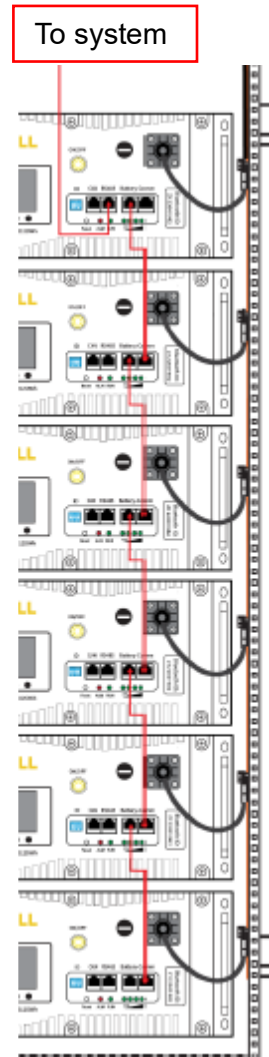
**REMINDER:** If you have multiple batteries, all DIP switch settings **must** be different from each other. This allows all equipment to see each battery in the bank separately.

**DIP Switch ID Table**

| ID:1 | ID:2 | ID:3 | ID:4 | ID:5 | ID:6 |
|------|------|------|------|------|------|

| ID:7 | ID:8 | ID:9 | ID:10 | ID:11 | ID:12 | ID:13 | ID:14 | ID:15 | ID:16 |
|------|------|------|-------|-------|-------|-------|-------|-------|-------|

## 6.2  LCD SCREEN

Each module has a built-in HD LCD touch screen used to display important information about the cells including voltage, current, temperature, SOC, and others.
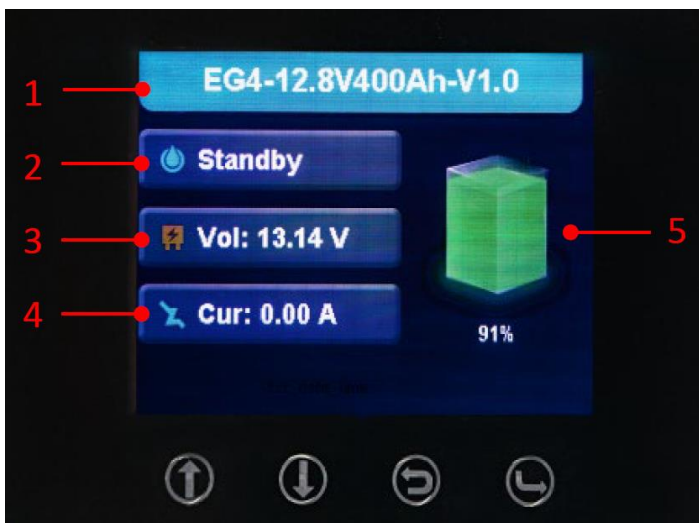
### 6.2.1  BUTTON DESCRIPTION

There are 4 function buttons below the display with detailed descriptions as shown in the table below.



| No. | Description |
| --- | --- |
| 1 | Up |
| 2 | Down |
| 3 | Return |
| 4 | Enter |

### 6.2.2  WAKING UP THE LCD SCREEN



Press any key to wake up the screen when the power is on, and the information will be shown on the display.

**Main Page Information**

| No. | Module Description |
| --- | --- |
| 1 | Name |
| 2 | Status |
| 3 | Voltage |
| 4 | Current |
| 5 | SOC |

### 6.2.3  CELL INFORMATION

Check individual cell voltage by pressing the "*Enter*" button on the main page *(shown in mV)*. There are 2 pages. Pressing "*Up*" and "*Down*" changes the page. **Note**: *12V modules only display 4 cells due to 4 packs being in parallel (4s4p config.).*



Page 1



Page 2

### 6.2.4 TEMPERATURE INFORMATION



Press "*Enter*" on the Cell Voltage page to view the temperature information of the PCB and the cells *(Shown in °C)*
**Note**: *There are only 2 temperature sensors distributed evenly among the 4 packs.*

## 6.3 COMMUNICATION PROTOCOL SELECTION

**IMPORTANT:** Only the host battery (Address 1) needs to be set to the inverter protocol; all other batteries must have unique addresses starting at address 2 and ascending in chronological order. You must connect the CAN/RS485 port of the host battery to your inverter's (or communication device's) BMS communication port.

### 6.3.1 PROTOCOL CHANGE/SELECTION PROCEDURE

1. Power off all battery DC breakers and BMS power buttons. Ensure that the voltage between positive and negative busbars is 0V.
2. The inverter protocol can only be changed with the host battery temporarily set to address 16 (all dials down). After the dial is changed, restart the battery (with only the BMS power button) for the settings to take effect. (See image on right.)
3. On the host battery, press and hold the "*Return*" key for 5 seconds to enter the "*Protocol Setting.*"
4. Select the corresponding RS485 program or CAN program, and press Enter.

### EG4 LL 24V RS485 Protocol List
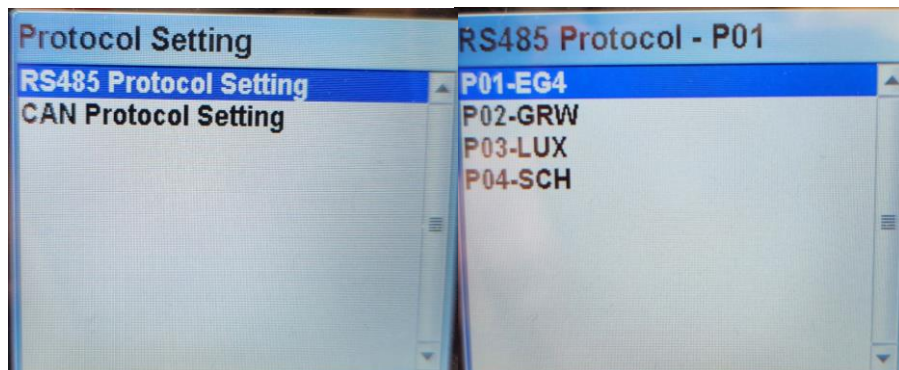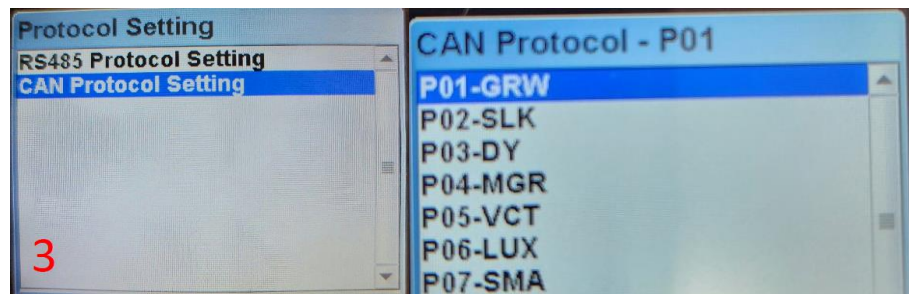


### EG4 LL 12V CAN Protocol List
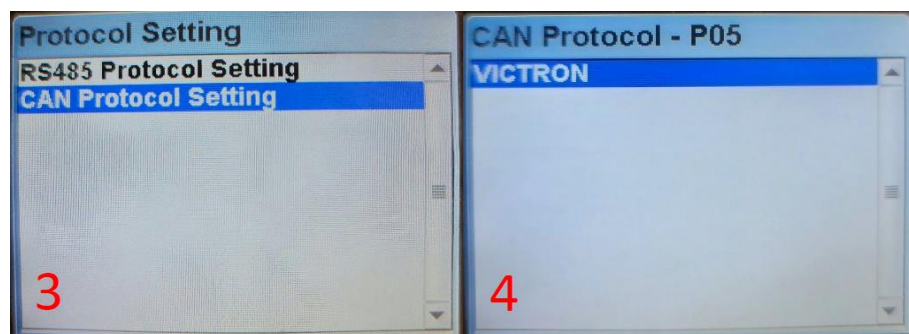


**NOTE:** The only supported 12V CAN protocol at this time is for 12V Victron systems.

### EG4 LL 24V CAN Protocol List



5. Press the "Return" key to return to the main interface.
6. Change the host DIP switch address back to address 1. (See image on right.)
7. Power cycle the host battery, and the BMS will correspond to the protocol selected.



ID:1

## 6.4   BMS TOOLS INSTALLATION AND INTERFACING

The PC software "*BMS Tools*" provides real-time battery analysis and diagnostics. The battery cannot communicate with BMS Tools and a closed loop inverter at the same time.

### 6.4.1   DOWNLOADING AND INSTALLING BMS TOOLS

1.  Visit https://eg4electronics.com/resources/software-drivers and navigate down to the BMS Tools section and click Download.
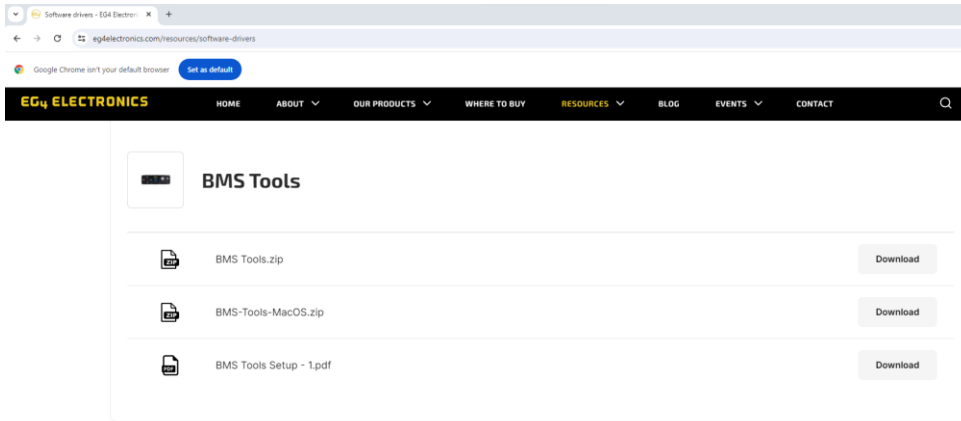


### 6.4.2   INTERFACING WITH BMS TOOLS

1.  While all power is off, set the DIP switch ID address of the battery to Address 16.
2.  Connect your USB cable to your PC and to the **RS485 port** on the battery.
3.  Power on the battery.
4.  Confirm the RS485 cable's COM is set correctly in the BMS Tools program. Refer to the Device Manager on the PC for more information.

![EG4 ELECTRONICS]
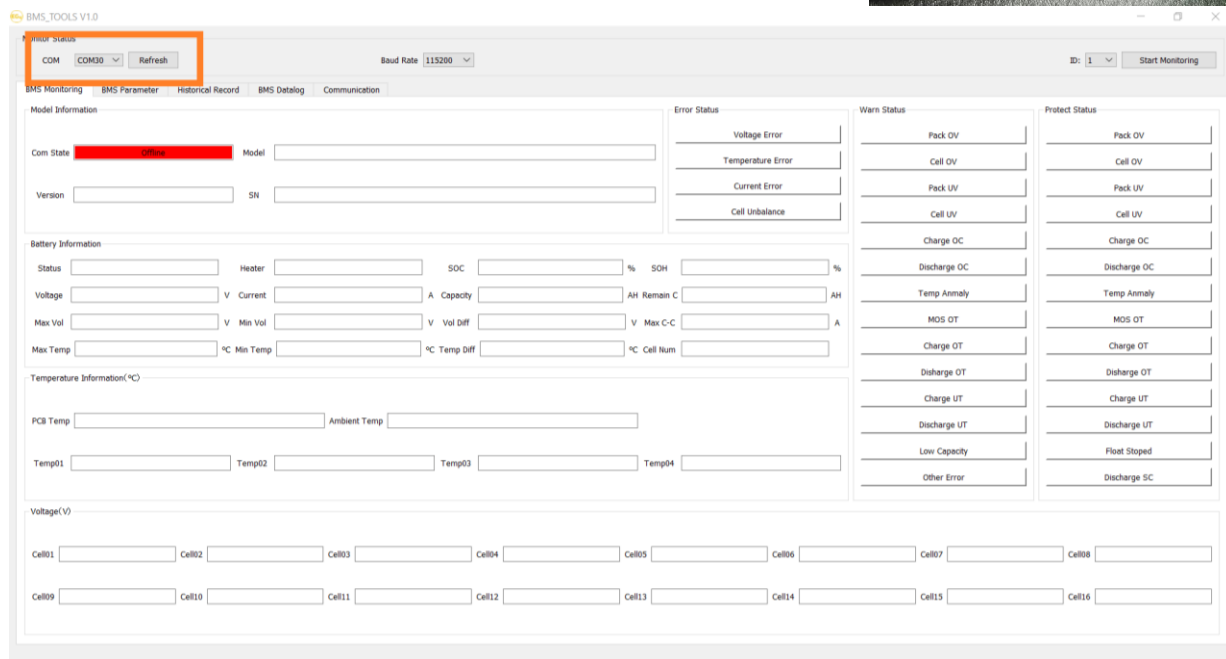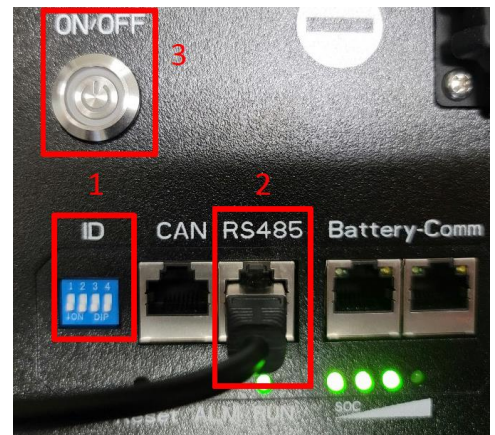
5. Change the Baud Rate to 9600.



6. Change the "ID" to 64.

7. Select, "Start Monitoring".



**Screenshot 1 (BMS_TOOLS V1.0):**

Monitor Status | COM COM30 Refresh | Baud Rate 9600 | ID: 64 | **Start Monitoring**

Tabs: BMS Monitoring | BMS Parameter | Historical Record | BMS Datalog | Communication

Model Information
- Com State: Offline
- Model:
- Version:
- SN:

Battery Information
- Status: | Heater: | SOC: % | SOH: %
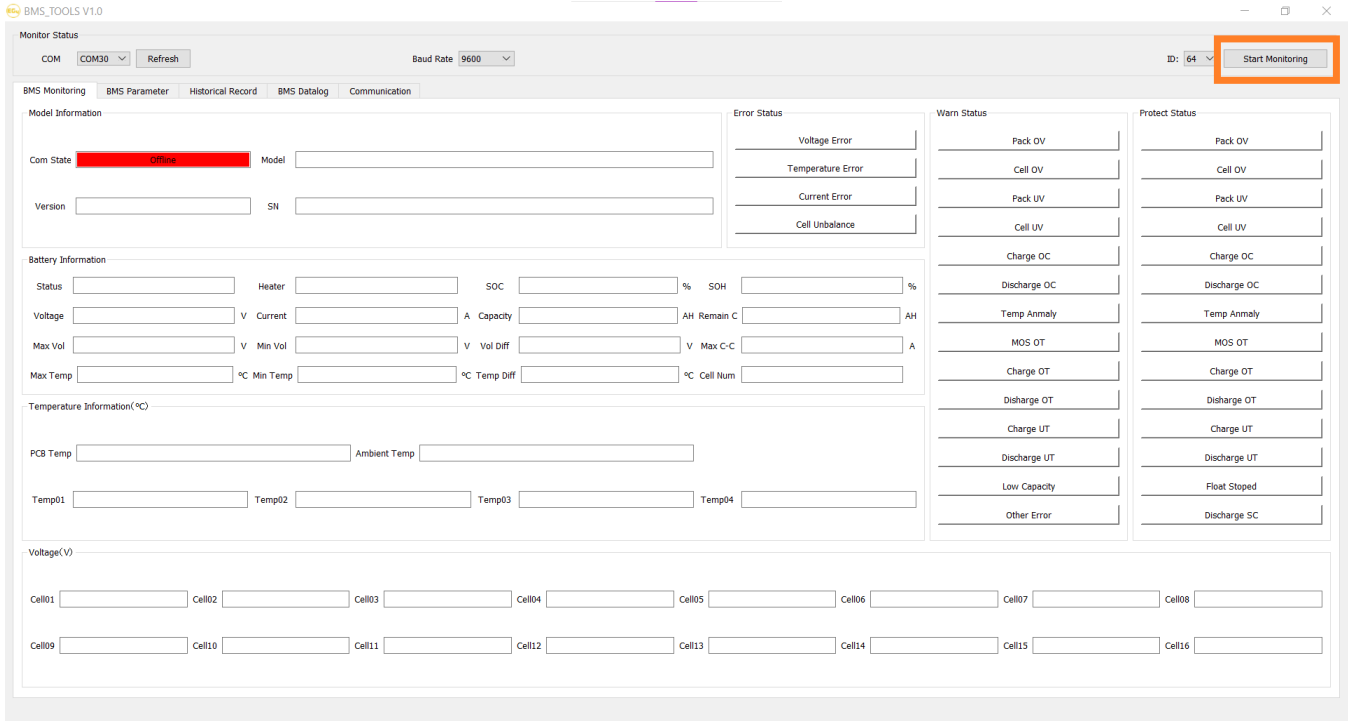- Voltage: V | Current: A | Capacity: AH | Remain C: AH
- Max Vol: V | Min Vol: V | Vol Diff: V | Max C-C: A
- Max Temp: °C | Min Temp: °C | Temp Diff: °C | Cell Num:

Temperature Information(°C)
- PCB Temp: | Ambient Temp:
- Temp01: | Temp02: | Temp03: | Temp04:

Error Status: Voltage Error | Temperature Error | Current Error | Cell Unbalance

Warn Status: Pack OV | Cell OV | Pack UV | Cell UV | Charge OC | Discharge OC | Temp Anmaly | MOS OT | Charge OT | Disharge OT | Charge UT | Discharge UT | Low Capacity | Other Error

Protect Status: Pack OV | Cell OV | Pack UV | Cell UV | Charge OC | Discharge OC | Temp Anmaly | MOS OT | Charge OT | Disharge OT | Charge UT | Discharge UT | Float Stoped | Discharge SC

Voltage(V)
- Cell01 | Cell02 | Cell03 | Cell04 | Cell05 | Cell06 | Cell07 | Cell08
- Cell09 | Cell10 | Cell11 | Cell12 | Cell13 | Cell14 | Cell15 | Cell16

8. The "Com State" will now change from "Offline" to "Online".
   The system will now monitor the battery's values in real time.



**Screenshot 2 (BMS_TOOLS V1.0):**

Monitor Status | COM COM30 Refresh | Baud Rate 9600 | ID: 64 | **Stop Monitoring**

Tabs: BMS Monitoring | BMS Parameter | Historical Record | BMS Datalog | Communication

Model Information
- Com State: Online
- Model: LFP-51.2V100Ah-V1.0
- Version: Z02T15
- SN: 2023-10-13

Battery Information
- Status: Standby | Heater: Heat off | SOC: 99 % | SOH: 100 %
- Voltage: 53.86 V | Current: 0.00 A | Capacity: 100 AH | Remain C: 99 AH
- Max Vol: 3.370 V | Min Vol: 3.365 V | Vol Diff: 0.005 V | Max C-C: 5 A
- Max Temp: 35 °C | Min Temp: 35 °C | Temp Diff: 0 °C | Cell Num: 16

Temperature Information(°C)
- PCB Temp: 35 | Ambient Temp: 34
- Temp01: 35 | Temp02: 35 | Temp03: 35 | Temp04: 34

Error Status: Voltage Error | Temperature Error | Current Error | Cell Unbalance

Warn Status: Pack OV | Cell OV | Pack UV | Cell UV | Charge OC | Discharge OC | Temp Anmaly | MOS OT | Charge OT | Disharge OT | Charge UT | Discharge UT | Low Capacity | Other Error

Protect Status: Pack OV | Cell OV | Pack UV | Cell UV | Charge OC | Discharge OC | Temp Anmaly | MOS OT | Charge OT | Disharge OT | Charge UT | Discharge UT | Float Stoped | Discharge SC

Voltage(V)
- Cell01 3.367 | Cell02 3.369 | Cell03 3.368 | Cell04 3.366 | Cell05 3.366 | Cell06 3.366 | Cell07 3.365 | Cell08 3.367
- Cell09 3.365 | Cell10 3.367 | Cell11 3.366 | Cell12 3.366 | Cell13 3.366 | Cell14 3.370 | Cell15 3.366 | Cell16 3.368

9. To review these steps, please watch our step-by-step guide at this link:
   https://www.youtube.com/watch?v=eHLefvjPN8c

### 6.4.3 INTERFACE MENU DEFINITION

**WARNING:** Although there are multiple tabs in the BMS Tools software, the following tabs should not be tampered with as any unauthorized changes will void the warranty of this product and risk damaging and/or rendering the product permanently inoperable.

- BMS Parameter
- BMS Control
- Software Parameter

If you are experiencing any issues with the battery module or the BMS, please contact your distributor for assistance or troubleshooting steps.

**Interface Menu Definition**
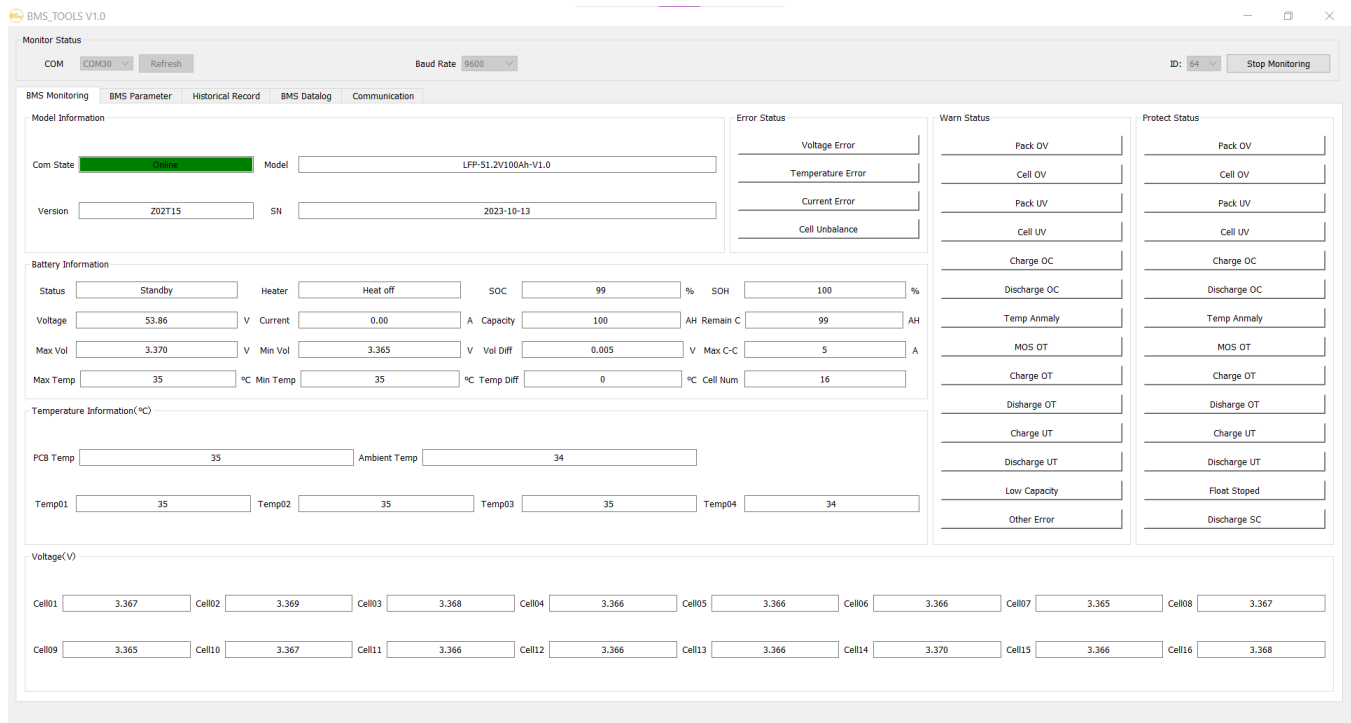


| Item | Definition |
|---|---|
| BMS Monitoring | Real-time data and status monitoring of the BMS |
| BMS Parameter | BMS parameter setting management **(restricted, unauthorized changes will void warranty)** |
| BMS Datalog | BMS operation data logging to PC (for manufacturer use) |
| Historical Record | Real time BMS operation data records *(exportable)* |
| Communication | Record of sending and receiving of battery pack data *(exportable)* |

## 6.5 BATTERY CHARGING

### 6.5.1 CHARGE CYCLE

Ensure the proper settings are set on the charge controller and/or inverter being used to avoid overcharging or damaging the module. (*Refer to the Technical Specifications for a full list of charging/discharging parameters.*)

⚠️ **IMPORTANT:** It is normal for LFP batteries that have their own internal BMS and that are wired in parallel to demonstrate a wide variety of SOC readings during any given charge or discharge cycle. **Variations of up to 10% are common.** This is not cause for concern or indication that the module is providing less than the maximum capacity. This is caused by even slight variations in wiring resistance to each battery, internal resistance, temperature differences, and even variations in each cell. Even a slight variation causes one battery to take more of the load or charge for a short time. Over the duration of the discharge or charge cycle, this will balance out with the lagging battery then taking the load or charge at the other end of the cycle resulting in recovering the full listed KWH capacity of the pack. The voltage differences created as batteries diverge in SOC will eventually cause them to converge at some point in the cycle.

# 7. TROUBLESHOOTING, MAINTENANCE & DISPOSAL

## 7.1 INTRODUCTION TO THE BMS

The BMS (Battery Management System) is intended to safeguard the battery and battery cells against a variety of situations that could damage or destroy system components. This protection also aids in keeping the battery and battery cells operational for a greater number of life cycles. Each EG4-LL battery is specifically configured to ensure peak performance and operation with any system.

### 7.1.1 BMS PROTECTION

**PCB Temperature Protection**

The BMS will ensure that the PCB (Printed Circuit Board) does not overheat. This is the part that houses most of the "brains" of the battery. This feature will turn off the battery if it begins to overheat.

**Cell Balance Protection**

Cell balance ensures that each cell is within a specific voltage range of each other. Cell balance is crucial for ensuring that the battery is operating properly for its lifespan. This is always done automatically.

**Environmental Temperature Protection**

It may be dangerous to attempt using the battery in extreme heat or cold. Continued operation in these conditions may result in permanent damage to the battery module and its components. To prevent this, the BMS is designed to measure the temperature while charging/discharging and will shut down the battery to prevent damage.

**Voltage Protection**

The BMS is designed to continuously monitor the voltage of each individual cell and ensure that they are not over/undercharged.

**Current Protection**

The BMS is designed to constantly monitor the charge/discharge amperage and has built-in safeguards against exceeding specific parameters. These include built-in timers that shut off quickly in the event of short circuits, extremely high amperage and delayed shut down for amperage that is only slightly above the maximum capacity.

## 7.2   TROUBLESHOOTING

### 7.2.1   ALARM DESCRIPTION AND TROUBLESHOOTING

When the ALM light on the battery control panel is on, it means that the battery has given an alarm or has been protected from potential damage. Please check the cause of the failure through the app or BMS Tools and take appropriate measures or go directly to the battery site to troubleshoot.

BMS Tools alarms are shown in the table below:

**Warning and Protect Status Definitions**

| Status | Name | Definition | Action |
|---|---|---|---|
| Warning /Protect | Pack OV | Pack over-voltage | Module needs to be discharged to lower its voltage. |
| | Cell OV | Cell over-voltage | Check individual cell voltage in BMS Tools. |
| | Pack UV | Pack under-voltage | Module needs to be charged. |
| | Cell UV | Cell under-voltage | Check individual cell voltage in BMS Tools. |
| | Charge OC | Charge over-current | Incoming current needs to be reduced. |
| | Discharge OC | Discharge over-current | Discharge current is too high; lower loads. |
| | Temp Anomaly | Temperature anomaly | Check ambient and module temperature. |
| | MOS OT | MOSFET over-temperature | BMS temperature is too high. Power off module and cool down location. |
| | Charge OT | Charge over-temperature | Power off module and cool down location. |
| | Discharge OT | Discharge over-temperature | Power off module and cool down location. |
| | Charge UT | Charge under-temperature | Power off module and warm up location. |
| | Discharge UT | Discharge under-temperature | Power off module and warm up location. |
| Warning | Low Capacity | Low battery capacity | Module needs to be charged. |
| Warning | Other Error | Error not listed | Contact the distributor |
| Protect | Float Stopped | Float Stopped | Contact the distributor |
| Protect | Discharge SC | Discharge short-circuit | Discharge current is too high, turn BMS and breaker off and back on to reset. Lower loads. |

**HELPFUL TIP:** *The "Historical Record" tab can indicate what occurred with the module before entering a warning or protection state. It is recommended to export this data into a text (.txt) file to provide to the distributor for any additional troubleshooting assistance.*

## Other Common Faults and Solutions

| Fault | Analysis | Action |
|---|---|---|
| Inverter communication failure | Check communication port connection, and battery ID setting. | Input proper "host" battery DIP switch address, and power cycle the battery. |
| No DC output | Open breaker, or battery voltage is too low. | Check battery breaker or charge the battery. |
| Power supply unstable | Battery capacity is not at full power. | Check for proper battery cable connection. |
| Battery can't be charged fully | DC output voltage is below the minimum charge voltage. | Check the charging settings on the inverter to ensure they match battery requirements. |
| *ALM* LED always on | Short circuit | Disconnect the power cable and check all cables. |
| The battery output voltage is unstable. | Battery management system does not operate normally. | Press the reset button to reset the battery, then reboot the |
| *ALM* LED flashes 20 times with SOC1 LED on. | Unbalanced voltage within a cell | Deep discharge the battery bank (<20% SOC), then charge battery bank fully. |
| *ALM* LED flashes 20 times with SOC2 LED on. | Unbalanced temperature | Contact the distributor. |
| *ALM* LED flashes 20 times with SOC 3/4 LED on. | BMS damaged | Contact the distributor. |
| Different SOC value of batteries in parallel operation. | No issue | Deep discharge the battery bank (<20% SOC), then charge battery bank fully. |
| Low voltage protection with no LED on | BMS is in low voltage protection, and is in sleep mode | Contact the distributor. |
| Deeply discharged with "*RUN*" LED on | The battery voltage is too low to start BMS. | Contact the distributor. |

**NOTE:** *If any of the warnings or faults from both tables persist, please contact the distributor for additional troubleshooting steps.*

### 7.3    BATTERY END OF LIFE

The EG4 LL battery is designed to last for *more than 15 years* when used correctly. We have worked tirelessly to ensure that our batteries will maintain a charge after thousands of cycles. However, when it does come time to retire the battery, there are a few things to consider.

Lithium iron phosphate batteries are considered a hazardous material and should not be disposed of by simply placing them in the trash. There are several websites and organizations that will accept this battery to recycle at little to no cost to its user. At EG4, we understand that we are working with customers across the United States and the world. Our recommendation is to get online and search the term "Lithium Battery Disposal Near Me." There will likely be an assortment of organizations that can safely dispose of LFP batteries. **We recommend calling ahead of time to ensure that the location is still open and accepting material.**

If, however, users are unable to locate a disposal location safely, EG4 is here to help. Before dumping the battery or disposing of it incorrectly, please contact our customer service team for assistance.

## 8.  EG4 WARRANTY

The warranty must be registered within the first year of purchase to remain valid. If users choose not to register the product, the warranty may be invalidated. This limited warranty is to the original purchaser of the product and not transferable to any other person or entity. All BMS and cell exchanges are covered throughout the warranty period. If a full replacement warranty is needed the warranty is prorated 1/9th per year after the first year at the current retail pricing.

### 8.1    WARRANTY EXCLUSIONS

Under this limited warranty, EG4 Electronics has no obligation to the product if it is subject to the following conditions, including but not limited to:

- Damages incurred during installation or removal
- Damages caused during mishandling of product
- Inappropriate environmental exposure
- Damages caused by improper maintenance
- Unauthorized tampering, altering, and/or disassembly of product
- Using the product for purposes other than those intended by the manufacturer
- Lightning, Fire, Flood, or Acts of God
- Any product whose serial number has been altered, defaced, or removed

The equipment sold by EG4 Electronics is designed to be installed only by licensed, trained, and insured solar electrical installation professionals. We strongly advise customers to seek the assistance of such a professional to implement these products, and we make no warranty of the purchaser's safety, success of equipment implementation, or compliance with local codes and regulations.

EG4 Electronics disclaims all additional warranties, expressed or implied, including but not limited to, any implied warranty with respect to the accuracy or completeness of the information they disseminate and /or fitness of the materials sold for a particular purpose. No warranty may be created or extended by sales or promotional materials on these items. Each party hereby irrevocably waives its rights to trial by jury in any action or proceeding arising out of this agreement or the transactions relating to its subject matter. All installation advice provided by EG4 before, during, or after purchase of solar equipment is purely for the purpose of general concept education and must not replace the expertise of a licensed and trained solar specialist. The Customer agrees to full indemnification for EG4 henceforth from any legal recourse relating to and arising out of losses, direct or consequential, from the installation of the products purchased by the customer more than the value of the equipment purchase price.

**Notes**

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