Elithium

EasyPower

Easy Power
54 Malta Rd, Cosmo Business Park
Johannesburg
Republic of South Africa
+27-117080254
www.easypowersolar.co.za

Table of Contents

ELithium Battery Storage System

1.Safety Instructions

1.1 Important Safety Instructions

This manual must be followed when installing and using this product.

The product is designed and tested in accordance with international safety requirements IEC 60364, but as with all electrical and electronic equipment, certain precautions must be observed when installing and/or operating the product. To reduce the risk of personal injury and ensure the safe installation and operation of the product, you must carefully read and follow all instructions, cautions and warnings in this manual.

1.2 Warnings in this Document

A warning describes a hazard to equipment or personnel. It calls attention to a procedure or practice, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all the EP equipment and/or other equipment connected to the EP equipment or personal injury.

Symbol	Description
	Caution, risk of electric shock
	Heavy enough may cause severe injure
	Keep the battery away from open flame or ignition sources
	Keep the battery away from children
	Do not dispose of the product with household waste
	Recycling
	Read this manual before installation and operation

For safety reasons, installers are responsible for familiarizing themselves with the contents of this manual and all warnings before installation. Failure to do so may result in product damage or injuries.

1.3 Battery handling guide

Use the battery pack only as directed. Battery must be transported always with its top side up and never upside down or on its side.

1.4 Response to emergency situations

The E-Lithium Residential ESS is designed with multiple safety strategies to prevent hazards resulting from failures. However, a residual risk will always exist due to the nature of the product, and these must be considered at the time of system design and installation.

1.4.1 Leaking batteries

If the battery pack leaks electrolyte, avoid contact with the leaking liquid or gas. Electrolyte is corrosive and contact may cause skin irritation and chemical burns. If one is exposed to the leaked substance, do these actions:

Inhalation: Evacuate the contaminated area and seek medical attention immediately.

Eyes contact: Rinse eyes with flowing water for 15 minutes and seek medical attention immediately.

Skin contact: Wash the affected area thoroughly with soap and water and seek medical attention immediately.

Ingestion: Induce vomiting as soon as possible and seek medical attention immediately.

1.4.2 Fire

In case of a fire, make sure that an ABC or carbon dioxide extinguisher is nearby and **do not use water** to extinguish the fire.

WARNING

The battery pack may catch fire when heated above 130°C.
If a fire breaks out where the battery is installed, do these actions:

1) Extinguish the fire before the battery catches fire.
2) If the battery has caught fire, do not try to extinguish the fire.
   Evacuate people immediately
   If the battery catches fire, it will produce poisonous gases.
   Do not approach.

1.4.3 Wet battery

If the battery is wet or submerged in water, do not try to access it. Contact our customer careline or your distributor for technical assistance.

1.4.4 Damaged battery

If the battery is damaged, please contact customer careline or your distributor for help as soon as possible. A damaged battery can be dangerous and must be handled with extreme caution. Damaged batteries are not suited for use and may pose a danger to people or property. If the battery seems to be damaged, return it to your distributor for inspection and assessment.

CAUTION
Damaged batteries might leak electrolyte or flammable gases, contact distributor for advice and information immediately.

1.4.5 Installers

While our E-Lithium storage systems have been designed to be simple to install and operate incorrect product installation may lead to equipment damage and potential safety risks. A properly trained person must install the equipment and is strongly suggested that the product is installed by a skilled electrician. A skilled electrician is defined as a person who had been trained to be a qualified electrician or has all the following skills and experience:

- Knowledge of the functional principles and operation of off-grid energy Storage systems.
- Knowledge of the dangers and risks associated with installing and using electrical devices and acceptable mitigation methods.
- Knowledge of the installation of electrical devices
- Knowledge of and adherence to this manual and all safety precautions and best practices.

1.4.6 Battery Disposal

Please follow your local regulations regarding disposal or recycling of Lithium Batteries.

1.5 Customer careline

Use the contacts below for technical assistance. This phone number is contactable only during business hours on weekdays.

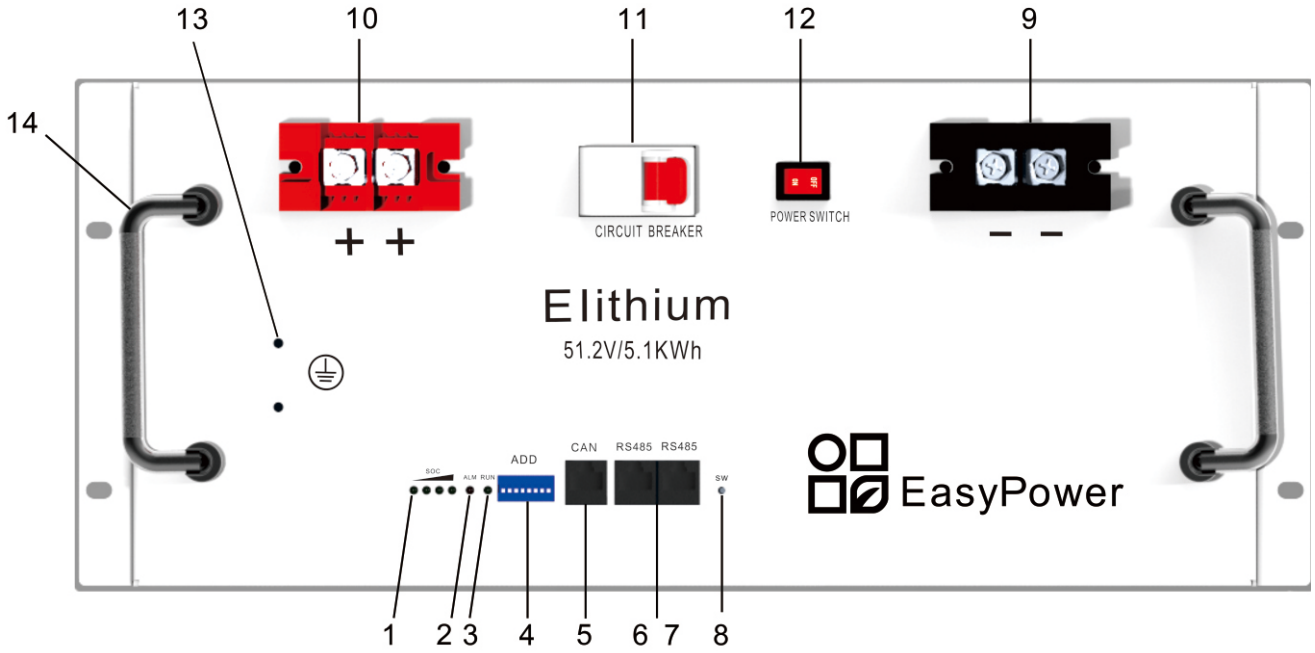
Customer careline	+27 (0)11 708 0254

2. Product Introduction

2.1 Technical data

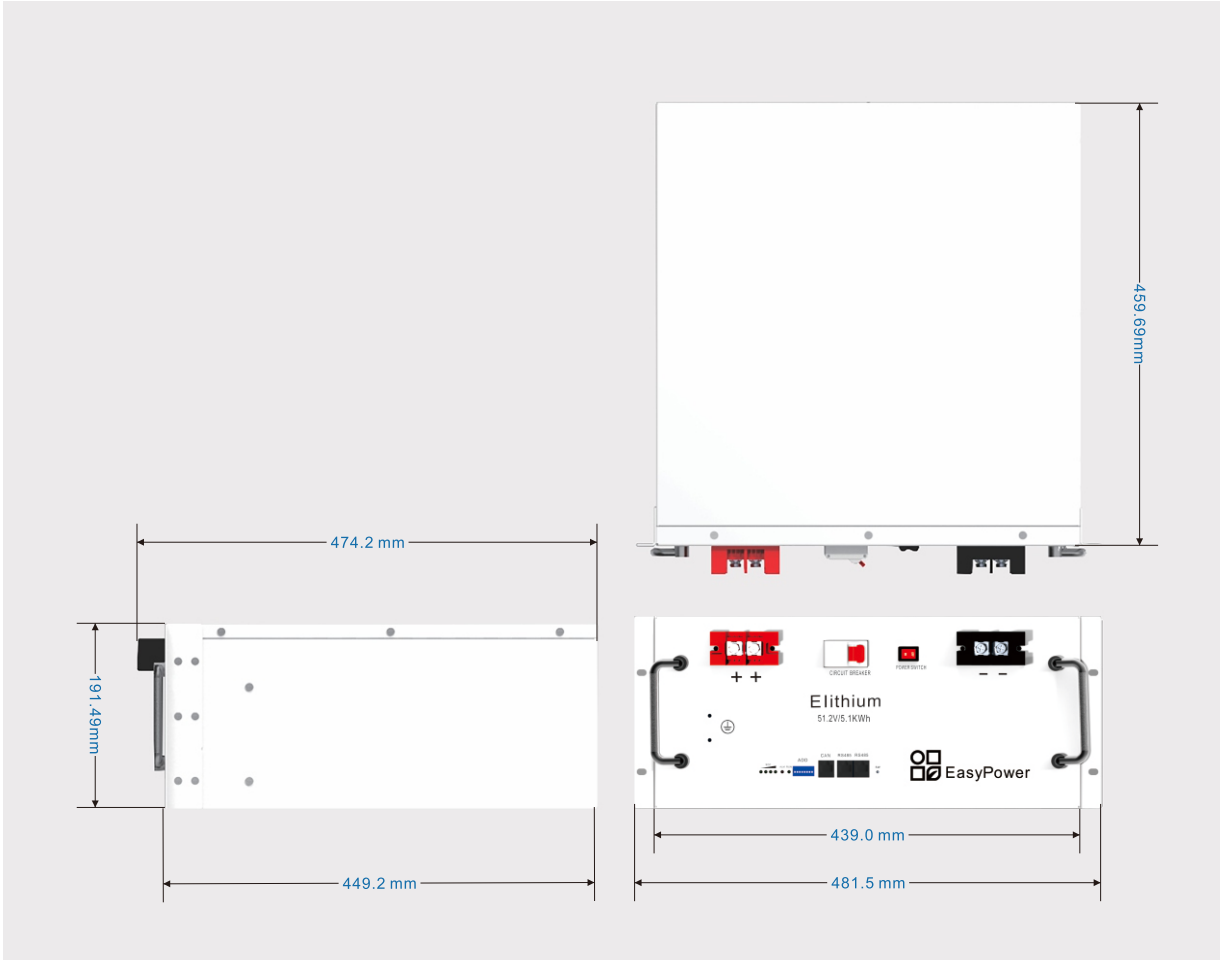
Model	E-Lithium 5.1Kwh
Total Energy*	5.1kWh
Net Energy *	4.8kWh
Nominal Charge/Discharge Power	5Kw
Normal Operational Voltage	48V-56Vdc
Nominal Voltage	51.2Vdc
Nominal Current	100A
Max. Charge Voltage	57.6V
Recommended Max DOD	80%
Operating Condition	Strictly Indoor
Operating Temperature Charge)	0~45℃
Operating Temperature Discharge)	-10~55℃
Dimensions (mm)	442*460*200mm
Weight	58Kg
Relative Humidity (R H)	20~60% (Not Condensing)
Cooling Type	Ambient cooling
Case Material	Metal
Color	White
Installation	Cabinet or Wall Mounting
IP Rating	IP20
Protective Class	I
Max. Units in parallel	16
Limited Warranty	5 Years
Communication	CAN/RS485
*Testing Conditions Based on Temperature 25℃ w/ zero cycle batteries	

2.2 Exploded views of battery



No	Name	Description
1	SOC Indicator LED	SOC Indicator lights, 25%/50%/75%/FULL
2	Alarm LED	Alarm/Fault/Protection Indicator
3	Run LED	Running/Standby Indicator
4	Address Dipswitch	Master Slave ID Configuration
5	CAN RJ45	RJ45 CAN Inverter Communication
6	RS485 RJ45	Serial Comm / To be used in between Batteries
7	RS485 RJ45	Serial Comm / To be used in between Batteries
8	Sleep/Wake Up	Pin Hole / Press >5Sec to Wakeup or Reset
9	Negative Battery	Negative battery Terminal
10	Positive Battery	Positive Battery Terminal
11	Master Breaker	Master Breaker and Contactor POS
12	Power Switch	Battery Switch ON OFF
13	Earthing Point	Casing Earth Point
14	Handles	Collapsible Handles

2.3 Battery Dimensions



2.4 Indicator and ports

There are two LED indicators on the front of the battery to show its operating status.

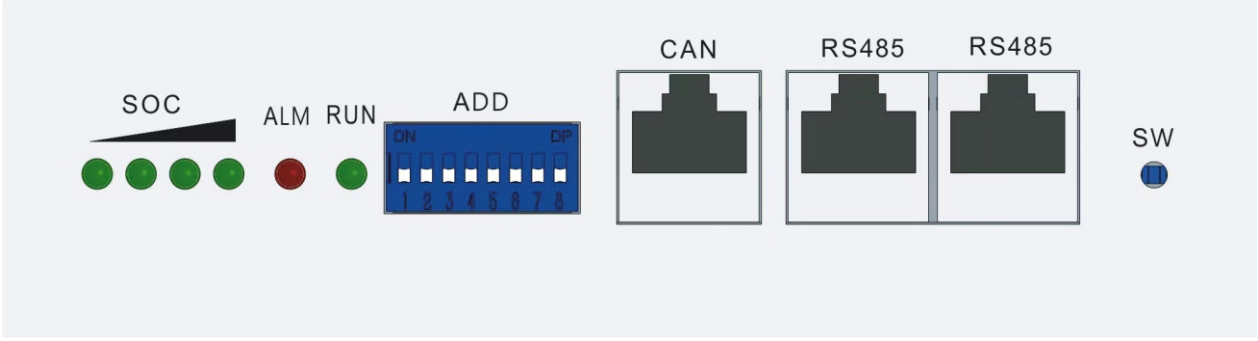
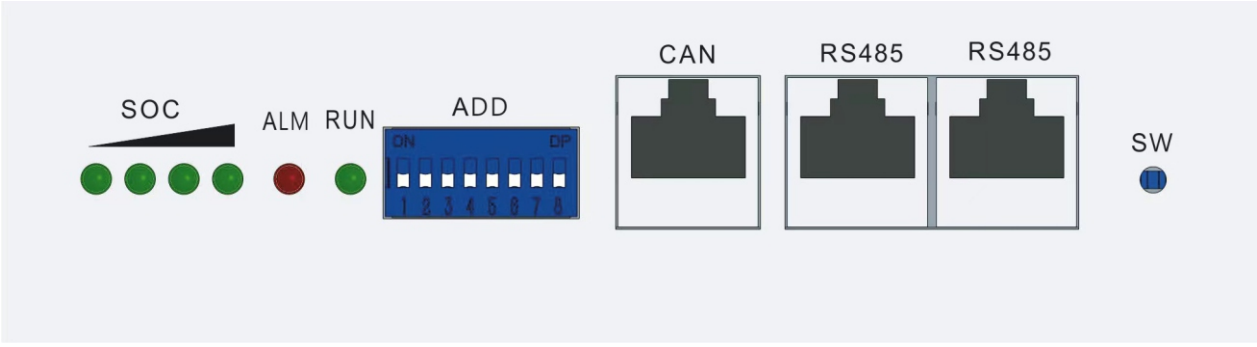


Table 2-1 Designations on the battery

Item	Designation	Definition
1	RUN	Battery normally working without fault
2	ALM	Battery is in a warning state, see Chapter 8

2.5 Communication interface



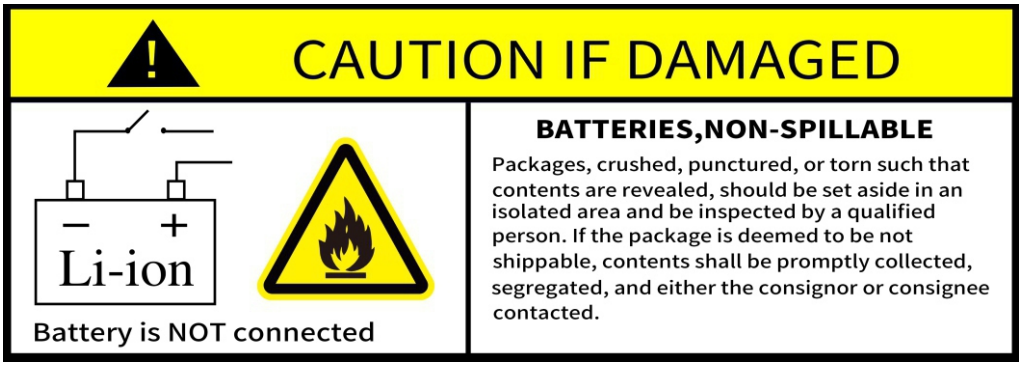
CAN	CAN communication interface
Rs485	Rs485 communication interface (External and Inter-Battery)
ADD	Battery Master Slave address setup
SW	Sleep and wake-up function -BMS Reset

CAN communication port uses pins 4 and 5 (Standard) and Serial communication ports (RS485) employs pins 7 and 8. Only battery setup with the Master Battery ID will communicate via the CAN port , this battery will poll and aggregate the entire battery bank Voltages and currents in one register for Inverter communication.

Only RS485 communication is possible by Daisy Chain of battery modules on the battery bank. In this case each battery needs to be setup with an Slave ID. Please note that in this mode each individual battery will have to be interrogated by a Modbus Master and no aggregation occurs on the batteries.

3. Guidance for battery inspection upon reception

1) Cartons that have been crushed, punctured, or torn in such a way that contents are revealed shall be set aside in an isolated area and inspected by a skilled person. If the package is deemed to be not shippable, the contents shall be promptly collected,segregated, and either the consignor or consignee contacted.
2) Batteries are shipped with half charge and its DC breaker in an OFF position. Batteries shall never be transported while the battery is energized.
3) A precautionary label had been affixed to the shipping carton to alert individuals as to the battery within the package have been disconnected; otherwise, the battery should not be transported.
4) We have conducted comprehensive tests to ensure the equipment is safe for transport. These products shall be handled with care and immediately inspected if visibly damaged. If the carton is visibly damaged, please contact your distributor to confirm whether the battery could be used safely or not.



4. Installation Pre-requisites

4.1 Installation location

Make sure that the installation location meets the following Conditions:

1. Avoid installation where batteries are exposed to salt water/slat spray and very high humidity. Batteries are rated IP20 and salty spray will condense inside the battery, causing corrosion on major components.
2. Installation must be indoors at an appropriate battery rack or using adequate wall fixation brackets. E-Lithium is only rated for IP20 uses, Outdoor installations are expressly forbidden.
3. Batteries ventilation is important, never install the batteries in a sealed enclosure without adequate ventilation.
4. Do not stack batteries on top of each other, the battery casing is not designed to support the weight of batteries sitting on top.
5. Never install near flammable or explosive materials.
6. Optimal ambient temperature / 15℃ and 30℃. If expected temperatures on the installation room will be close or below 0℃ please consult your distributor.
7. Minimal dust and dirt in the area. Excessive dust ingress into the batteries will accumulate and damage sensitive electrical equipment.
8. No corrosive gases present, including ammonia and acid vapors.

If the ambient temperature is outside the operating range, battery will protect itself by shutting down. The battery optimal operate temperature is 15°C to 30°C. Frequent exposure to severe operating condition will reduce the performance and lifetime of the battery.

4.2 Installation materials

The following installation materials are required for the installation:

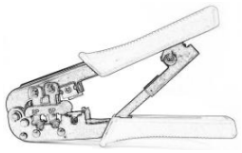
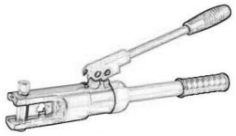
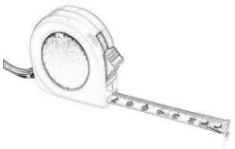
1. RJ45 Ethernet cable for inverter communication.
2. Battery Cable of adequate wire gauge with metal terminals
3. 2mm2 Earth wire
4. DC Isolator of DC fuses for

NOTICE

Make sure that the cross-sectional area of the battery cable is at least 25 to 35 mm^2.
A breaker or Fuses must be installed between E-Lithium battery and inverter,thebreaker/fuses min. current should be over 150A or as per your local regulations.

4.3 Tools

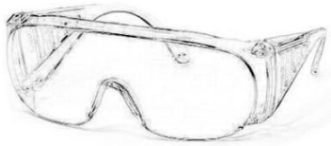
To install the battery pack, the following tools will be required:

			
Phillips screwdriver	Torque wrench	Cable crimper	Wire clamp
			
Voltmeter	Tape measure	Drill	Flat-head screwdriver

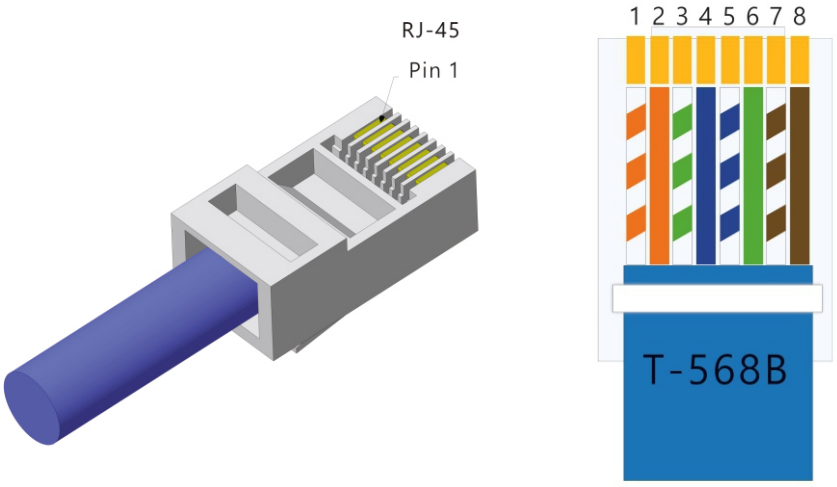
Please select and use suitable tools and measuring instruments that are certified for precision and accuracy for the installation.

4.4 Personal **protective** equipment

When manipulating the battery for installation the following personal protective equipment must be used. These comply with the relevant requirements of IEC 60364 or the domestic legislation and other relevant international standards.

		
Insulated glove	Safety goggles	Safety shoes

4.5 Communication Cables



E-Lithium uses RJ45 connector ports for all its communications, this facilitates using standard Ethernet cables for most communication methods. If needed, the network cable should be made like that diagram showed above with a T-568B configuration.

Please note that the CAN and RS485 communication ports use a standardized pin out which is compatible with most inverters, but not all. Pins 4/5 are used for CAN communication and 7/8 for RS485. If your inverter uses a different set of pins a customized cable will be necessary. When making a new cable by hand is advisable to have a Network cable tester on hand for testing.

4.6 Storage

If the battery is not to be installed immediately or removed from operation and needs to be stored for a long period, please choose an appropriate location to store it. Instructions for storage are:

- Do not stack more than 5 battery boxes.
- The temperature of battery stored recommended in the range of -20°C to 25° C.
- Do not expose to water

The battery box should be upright and not stacked upside down when storing the battery. If the battery needs to be stored over 3 months, the battery will discharge at a minimum rate and the capacity will degrade depending on storage time, the battery self-consumption is less than 5w. For long term storage is suggested to charge batteries to 90% capacity. Please note that batteries shall never be transported with over 50% of charge for safety reasons.

5. Battery Installation

5.1 Package Items

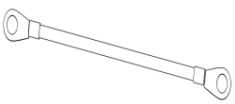
These items are included in the package.

Battery*1

Data Cable 1.5mtr*1

User Manual

Warranty



Battery link*2

Data Cable*1

5.2 Checks before installation

There are a few things to check before installing the battery to ensure that it has no defects.

Check item 1: Check the battery voltage.

WARNING

If this checking process is executed for any reason after the battery is installed, make sure that the inverter is turned off or open the connection between battery and inverter while checking the battery.

Press the SW button for 1 second so function lights will cycle, then turn on the master switch.Measure the voltage at the battery terminals with a voltmeter. If the voltage is lower than 48V it will require to be recharged prior to installation. Contact distributor for this. New batteries are shipped with in between 52-53VDC.

5.3 Battery Installation

NOTICE

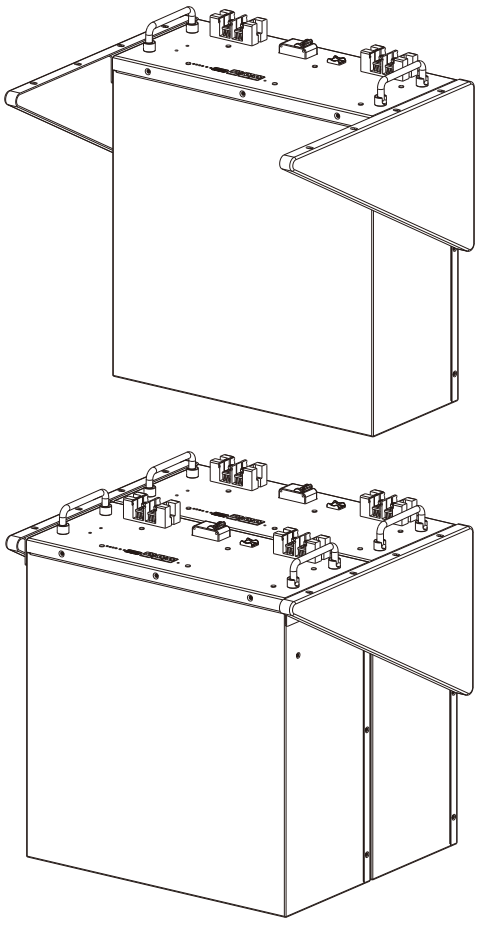
A protective earth symbol is visible at the front battery plate. Earthing shall be connected from Inverter to battery and in between batteries for multi-battery systems.

5.3.1 Battery Placement

5.3.1 Wall Mount Placement

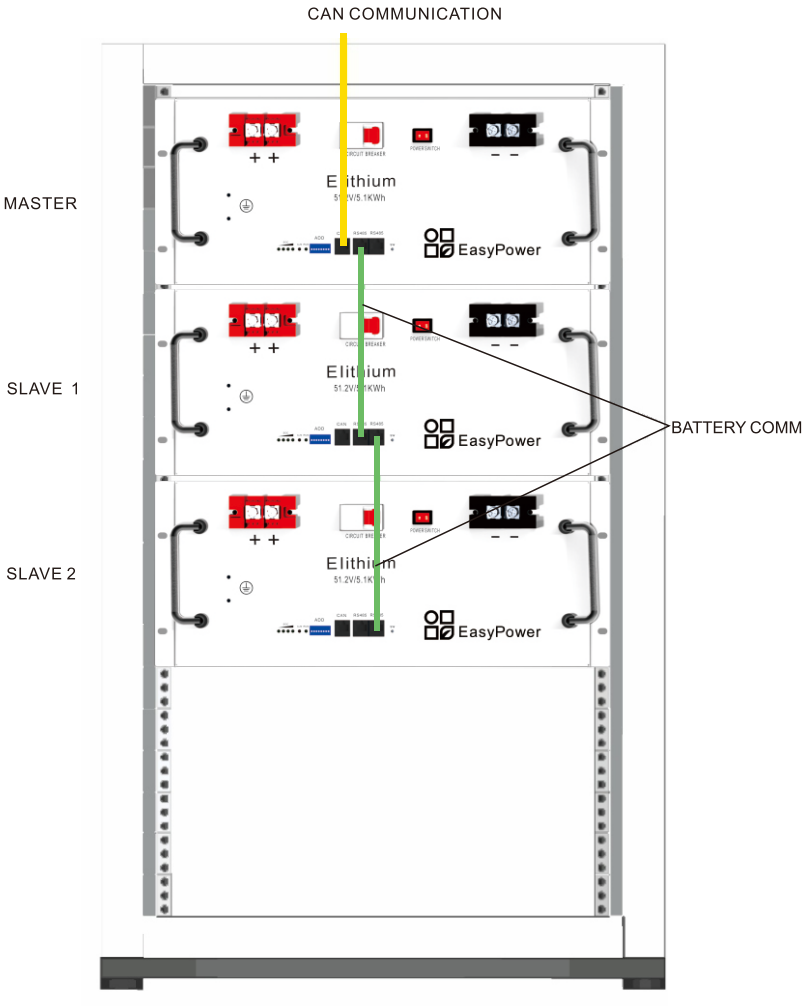
NOTICE

If the battery is installed above the floor or on a platform, make sure that the wall or platform can support the battery's weight. Mounting on Dry wall is not recommended.



1. Determine bracket mounting place to be fixed using this Positioning cardboard.
2. Drill holes in the wall for the M8 expansion screw anchors, which depth should be at least 50 mm. Tighten the screws to a torque around 2.5 N• m.
3. Fasten the battery to bracket fasten hole with M6 screws with 2.0N•m roughly.
4. Up to 2 batteries can be hand from 1 bracket. Suggested anchor sizes:
   - 1 Battery – 8mm
   - 2 Batteries-12mm

5.3.2 Stack Mount Placement



1. The preferred mounting method for E-Lithium is a rack mount system.
2. E-Lithium batteries are compatible with standard 19” Battery Racks
3. It is recommended to use a tray with front and back support at the battery rack to support each battery module.
4. When using a rack mounted system, is imperative to earth the metal cabinet to the Protective earth of the storage system.
5. It is not recommended to stack batteries on top of each other without any corner offsets.

6. BMS Operations

6.1 CAN and RS485 communication

CAN: Each battery is equipped with 1 (one) CAN communication port, this is primarily used for Inverter control communications. For this an RJ45 connection port is supplied. Only the Master battery of the system (when multiple batteries are used)broadcasts information via the CAN port. In a multi-battery system, the master Battery collects information from all the slaves via the built in RS485 ports, this information is collated and made available for CAN communication to the inverter.

RS485: Each battery module is provided with 2 x RS485 connection sockets for serial communication, both in between batteries and to an external monitoring device. Default standard communication speed for the RS485 port is 19,200 BPS / No Parity, Stop Bit 1.

RJ45 connector interface description

Interface	Definition	Other PinOut
RJ45-1 Inverter CAN	**PIN4 : CANH**	
	PIN5 : CANL	
	PIN1、3、8 : NC	485-2B
	PIN2、6、7 : NC	485-2A
RJ45-2	PIN2、7 : 485-1A	
	PIN1、3、8 : 485-1B	
	PIN6: 485-2A	CANH
	PIN5: 485-2B	CANL
RJ45-3	PIN2、7 : 485-1A	
	PIN1、3、8 : 485-1B	
	PIN6: 485-2A	CANH
	PIN5: 485-2B	CANL

Note: Considering wiring compatibility, to meet more connection scenarios of users. The-5pin and-6 pin of RJ45-2 and RJ45-3 are used as optional pins. It can be used as can communication or as the second 485 communication by means of resistance jumper on hardware. Two out of one.

RJ45-1 1 / 3 / 8 pin and 2 / 6 / 7 pin are also optional pins. These pins can be used as the second 485 communication by means of resistance jumper on hardware.

6.2. BMS Operational functions

6.2.1 Voltage detection and protection function

The BMS monitors individual cell voltages with over voltage and undervoltage alarms and protections. Measurement accuracy is CellVolts +/- 10mV. Cell imbalance Alarms and protections are built into the BMS software.

6.2.2 Current detection and protection function

Current measurement is built into the BMS circuit, charging current is displayed as positive current, and discharge current is displayed as negative current. The current sampling accuracy is rated at ± 2% at room temperature. Alarms and protections for over current (Charge and Discharge) are built into the protection's logic.

6.2.3 Temperature detection and protection function

The E-Lithium battery BMS comes equipped with 4 temperature probes to monitor internal cell temperature, 1 environmental probe and 1 MOS probe. Alarms for Over Temperature and under temperature are part of the protection system.

Battery maximum charge and discharge currents are subject to temperature, the BMS will reduce the current progressively down to 0 Amps in cold weather to protect the battery.

Temperature probes used are Thermistors 10K / 3435 / NTC with an accuracy od +/-2degC.

6.2.4 Pre-charge function

The E-Lithium system is compatible with most modern inverters. In order to avoid damages to both the battery module and the inverters, the BMS is equipped with a pre-charge resistor. The pre charge resistor will dampen the inrush currents when the battery is first connected to the inverter and the inverters charge their DC bus to a steady state voltage.

6.2.5 Short circuit protection function

Battery module comes equipped with short circuit detection. If POS and NEG terminals are shorted on the battery output (accidentally or due to inverter internal failure), the BMS will detect the short circuit condition and will open the Positive terminal output automatically. The ALM light (Alarm) will light up to indicate the fault condition. The BMS detects whether there is still an external short circuit every 60 seconds. If there is no short circuit, it will return to the standby state. If there is still a short circuit, it will continue to protect. After 5 continuous cycles of short circuit detection and recovery,the battery will go onto a permanent fault state and will keep the output contactor open. After the short circuit is removed from the battery output circuit the battery can be manually broad to operation by pressing the SW pinhole switch until the battery resets the fault condition and closes the contactor again.

6.2.6 Reverse connection protection function

The battery module is equipped with automatic reverse polarity detection. The protection clears automatically as soon as the reverse polarity connection is removed/corrected.

6.2.7 Battery pack capacity calculation function

The SOC of the battery module can be accurately calculated by integrating the current over time. The SOC estimation has an accuracy of ≤± 5%. The full capacity and current capacity of the battery pack is set in the factory to correspond to the Battery module design. The SOC values are updated dynamically and corrected after the first full charge and discharge. SOC error is reset each time that the battery module cells exceed a certain present full battery voltage set point.

6.2.8 Battery Passive Balancing

The battery module can perform passive cells voltage equalization. This function operates only during the charging cycle and allows the BMS to equalize battery cells exceeding by more than 15mV the average cell voltage values. Equalization

is made possible via current recirculation in between cell pairs via the BMS equalization circuit. Alarms and protections for cell imbalance are present to protect the battery module in the event of battery cells degradation or failures.

6.2.9 Equalization function

Equalization function is available for battery bank rebalancing and SOC recalibration. This procedure is not a field procedure and shall always be conducted by a qualified technician. The equalization opening voltage can be adjusted by software. The setting range is 3.2V ~ 3.8V. The default opening voltage is 3.5V, the equalization current is ≥ 50mA, for as long as equalization resistance temperature is not more than 50 ℃.

6.2.10 Sleep and wake-up function

A Sleep function is provided as part of the BMS programming, this protects the battery module to drain below the point at which the BMS could not operate and could require battery to be manually recharged at a repair center. In order to avoid these 3 sleep modes, refer to the table below.

The pre-programmed sleep voltage for the E-Lithium battery is set at 45 VDC. It is recommended to setup a maximum discharge voltage of 48VDC on the inverter.

Condition	Operational condition	Wakeup condition	Wakeup Mode
1	Normal standby, no charge or discharge for over 48 hours	External power on voltage (36.0V ~ 56.4v), charging, reset button, soft switch.	SW Switch or restart Switch
2	The lowest cell voltage is lower than the Cell over discharge protection value or the total Group voltage is lower than the overall over discharge protection value. After 10 minutes of the condition been present battery module will enters undervoltage sleep	External power on voltage (36.0V ~ 56.4v), charging, reset button, soft switch.	SW Switch or restart Switch

6.2.11 LED indication function

The battery module has 6 LED indicators, 4 green indicators indicate the battery module SOC (25% intervals), 1 red indicator used for fault/Alarm indication, and 1 green operation lamp is used to indicate standby, charging and discharging status of the battery pack.

System state	Protection alarm / normal	RUN	ALM	LED Indicator			
		●	●	●	●	●	●
Shut down	Sleep Mode	OFF	OFF	All OFF			
Standby	Normal	Flash 1	OFF	All OFF			
	Alarm condition	Flash 3	OFF				
Charge	normal	ON	OFF	According to SOC Maximum LED flash 2)			
	Over voltage alarm	OFF	ON				
	Over current alarm	ON	Flash 3	According to SOC			
	Over voltage protection	ON	OFF	Solid ON			
	Over current protection (when the function of infinite current)	OFF	Solid ON	All OFF			
	Current limiting charging	Solid ON	OFF	According to SOC			
Discharge	Normal	Flash 3	OFF	According to SOC			
	Alarm condition	Flash 3	Flash 3				
	Protection of over current, short circuit, reverse connection, etc.	OFF	Solid ON	All OFF			
Temperature	Charging alarm	ON	Flash 3	According to SOC			
	Discharge alarm	Flash 3	Flash 3	According to SOC			
	protection	OFF	ON	All OFF			

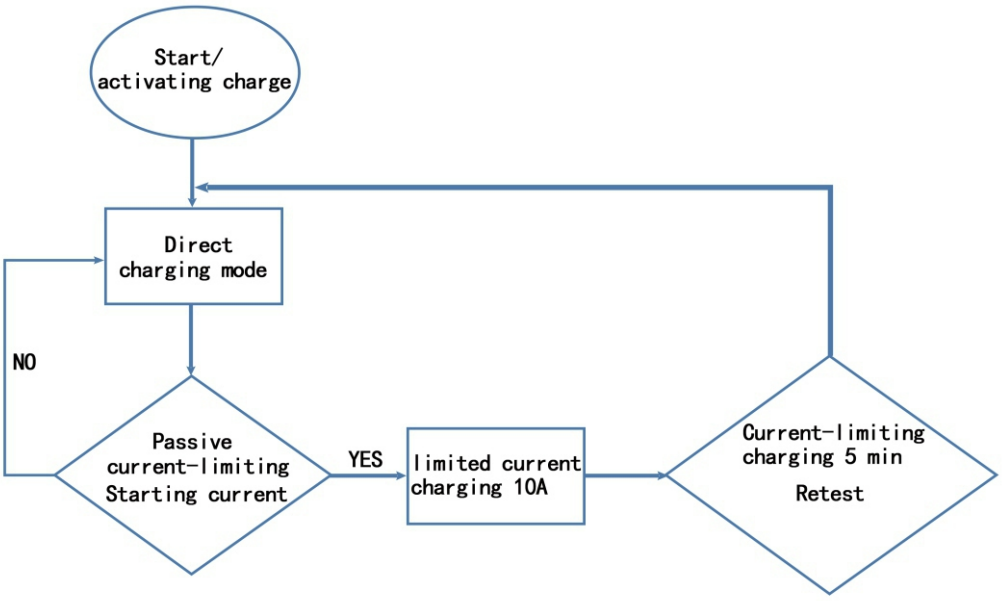
Note: alarm refers to the following categories: the Cell voltage difference is too large, the SOC capacity is low, the cell voltage is low, the overall group voltage is low, charging over-current, discharge over-current, core temperature is high, ambient temperature is low, ambient temperature is high, and the BMS MOS section over temperature.

6.3.12 Charging current limiting function

The battery module BMS does perform charging current limiting as an integral function of integration with most inverters. There are two modes of current control automatically available: active current limiting and Protection current limiting, which are selected according to the demand and state of charge of the battery module.

Active current limiting: During normal battery charge the BMS monitors battery charge current and enables direct charging up to the maximum allowable for the prevailing state of charge. If the current exceeds the allowable current the active limiting, take place and current is reduced to 10 amps by the active limiting circuit. In close loop control the Inverter reads the maximum charge current from the BMS and thus in theory charge limiting is not required although the function is always active in the background as a safety feature.

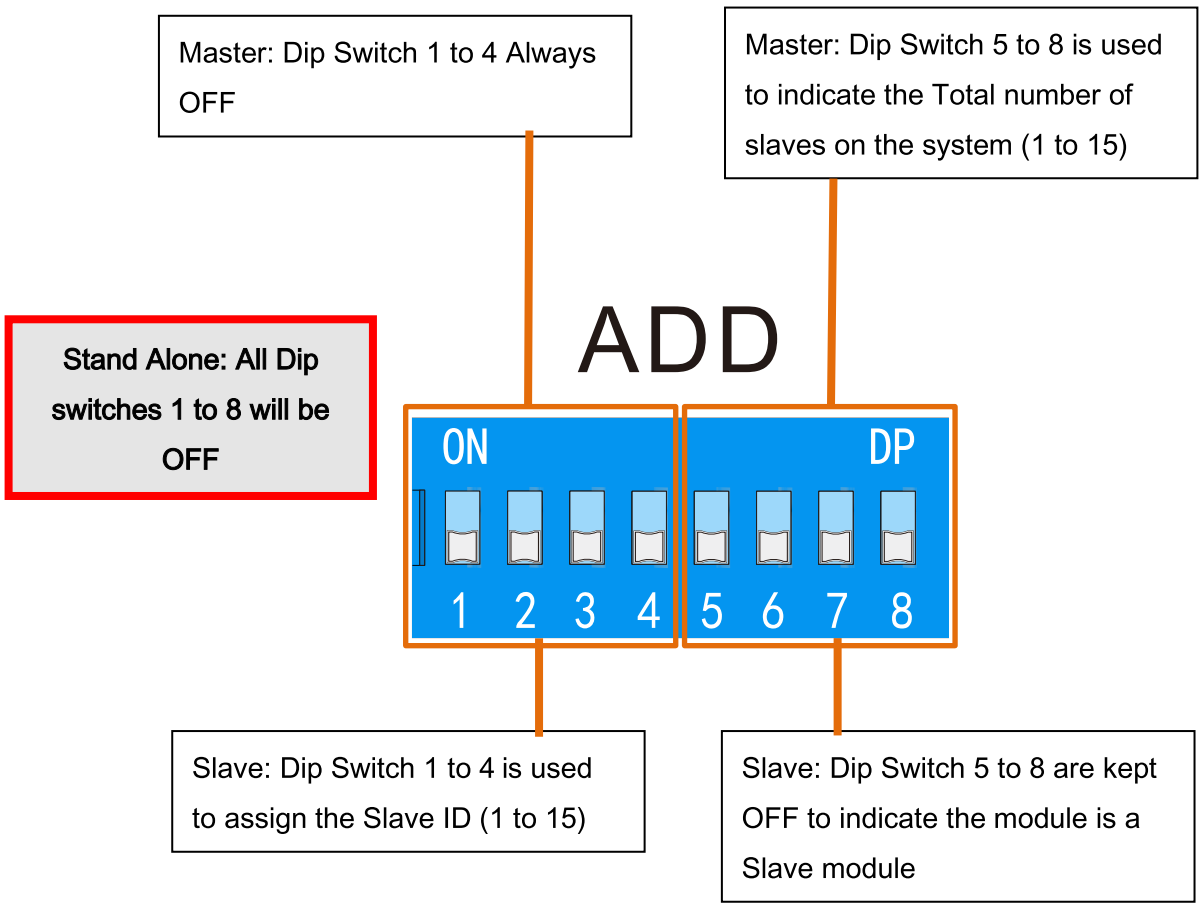
Protection current limiting: If the charging current reaches the charging overcurrent alarm value (current setting 100A), the BMS current control is automatically set to 10A regardless of battery state of charge. After limiting the current for 5 minutes the BMS will release the current limiting and will verify if the charge current redetects whether the charge current reaches the passive current limiting condition. If the current exceeds the limit the charge current limiting is re-enabled.



7. Master Slave – Battery Dip Switches Configuration

The E-Lithium battery system employs a master slave configuration for data capture and communication to the Inverter system. Each battery module comes with an 8-digit dip switch board, which is used to define the function (Master/Slave) of the battery.The switch board also defines Slave ID of each battery and the total number of slaves on the system.The E-Lithium system allows 1 x Masterand 15 x Slaves per battery clusters for a maximum capacity of 81.6Kwh per cluster.

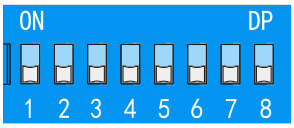
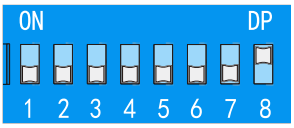
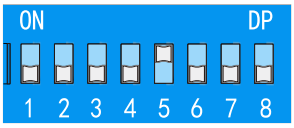
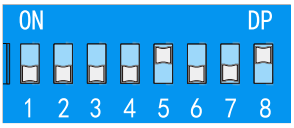
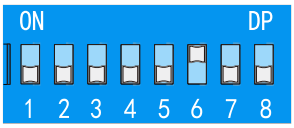
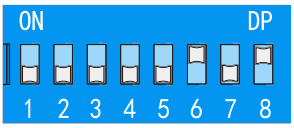
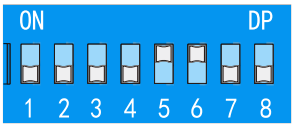
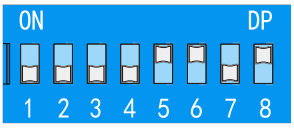
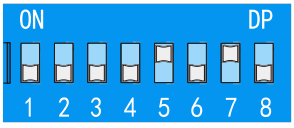
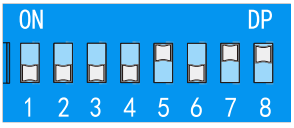
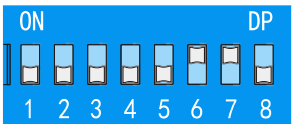
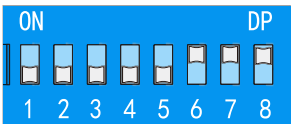
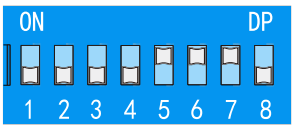
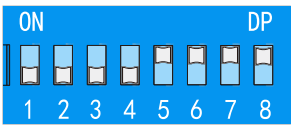
Multiple clusters are possible with the usage of an external communication BMS. Master and Slaves have different Dip Switches configuration which can be found at its respective sections.



7.1 Master Batteries Dip Switch Configuration:

Dip Switches 1 to 4: First 4 Dip Switches (1 to 4) will be kept OFF to designate the module as a Master Batterie. Please note that only the master module communicates to the inverter via the CAN port.

Dip Switches 5 to 8: last 4 Dip Switches (5 to 8) are used to indicate the number of slaves on the system. Ie: for a system with 4 batteries there will be 1xMaster and 3xSlaves batteries. Therefore, the last 4 digits must be set accordingly to 3 Slaves as per the example table below.

Total # of Batteries modules	Total # of Slave Batteries Modules	Master Battery Module Dip Switch Configuration	Total # of Batteries modules	Total # of Slave Batteries Modules	Master Battery Module Dip Switch Configuration
1	0		9	8	
2	1		10	9	
3	2		11	10	
4	3		12	11	
5	4		13	12	
6	5		14	13	
7	6		15	14	
8	7		16	15	

7.2 Slave Batteries Dip Switch Configuration:

Dip Switches 1 to 4: First 4 Dip Switches (1 to 4) will be used to indicate the slave number from slave 1 to slave 15 as per the table below

Dip Switches 5 to 8: last 4 Dip Switches (5 to 8) are used to indicate that the battery is an slave, all 4 dip switches must be in the off position as indicated on the table below.

Slaves Identity	Slaves Battery Module Dip Switch Configuration	Slaves Identity	Slaves Battery Module Dip Switch Configuration
0	N/A	8	
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	

54 Malta Rd, Cosmo Business Park
Johannesburg
Republic of South Africa
+27-117080254
www.easypowersolar.co.za