



M3000 ESS

User Manual

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Statement of Law

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This product complies with the design requirements of environmental protection and personal safety. The storage, use and disposal of the products shall be carried out in accordance with the product manual, relevant contract or relevant laws and regulations.

Customer can check the related information on the website of JiangsuMustek Limited when the product or technology is updated. Web URL : www.mustek.co.za

Please note that the product can be modified without prior notice.

Revision History

Revision NO.	Revision Date	Revision Reason
1.0	2019.04.24	First Published
1.1	2019.06.24	1. System adds DIP switch
1.2	2019.07.29	Update the cable specification

Safety Precautions



Warning

- Please do not put the battery into water or fire, in case of explosion or any other situation that might endanger your life.
- Please connect wires properly while installation, do not reverse connect. To avoid short circuit, please do not connect positive and negative poles with conductor (Wires for instance).
- Please do not stab, hit, trample or strike the battery in any other way.
- Please shut off the power completely when removing the device or reconnecting wires during the daily use or it could cause the danger of electric shock.
- Please use dry powder extinguisher to put out the flame when encountering a fire hazard, liquid extinguisher could result in the risk of secondary disaster.
- For your safety, please do not arbitrarily dismantle any component in any circumstances unless a specialist or an authorized one from our company, device breakdown due to improper operation will not be covered under warranty.



Caution

- We have strict inspection to ensure the quality when products are shipped out, however, please contact us if case bulging or another abnormal phenomenon.
- For your safety, device shall be ground connected properly before normal use.
- To assure the proper use please make sure parameters among the relevant device are compatible.
- **Please do not mixed-use batteries from different manufacturers, different types and models, as well as old and new together.**
- Ambient and storage method could impact the life span and product reliability, please consider the operation environment abundantly to make sure device works in proper condition.
- For long-term storage, the battery should be recharged once every 6 months, and the amount of electric charge shall exceed 80% of the rated capacity.
- Please charge the battery in 18 hours after it discharges fully and starts over-discharging protection.

Formula of theoretical standby time: $T=C/I$ (T is standby time, C is battery capacity, I is total current of all loads).

Preface

Manual declaration

The M3000 lithium iron phosphate battery energy storage system can provide energy storage solutions for photovoltaic power generation users through parallel combination. During the day, the excess power of photovoltaic power generation can be stored in the battery. At night or when needed, the stored electrical energy can be used to supply power to the electrical equipment, which can improve the efficiency of photovoltaic power generation, peak load shifting, and emergency power backup.

This user manual details the basic structure, parameters, basic procedures and methods of installation and operation and maintenance of the equipment.

1 Introduction

1.1 Brief Introduction

M3000 lithium iron phosphate battery system is a standard battery system unit, customers can choose a certain number of M3000 according to their needs, by connecting parallel to form a larger capacity battery pack, to meet the user's long-term power supply needs. The product is especially suitable for applications with high operating temperatures, limited installation space, long power backup time and long service life.

1.2 Product Properties

M3000 energy storage product's anode materials are lithium iron phosphate, battery cells are managed effectively by BMS with better performance, the system's features as below:

- Comply with European ROHS, Certified SGS, employ non-toxic, non-pollution environment-friendly battery.
- Anode materials are lithium iron phosphate (LiFePO₄), safer with longer life span.
- Carries battery management system with better performance, possesses protection function like over-discharge, over-charge, over-current, abnormal temperature.
- Self-management on charging and discharging, Single core balancing function.
- Intelligent design configures integrated inspection module, with 3 remote functions (remote-measuring, remote-communicating and remote-controlling).
- Flexible configurations allow parallel of multi battery for longer standby time.
- Self-ventilation with lower system noise.
- Less battery self-discharge, then recharging period can be up to 10 months during the storage.
- No memory effect so that battery can be charged and discharged shallowly.
- With wide range of temperature for working environment, -20°C ~ +55 °C, circulation span and discharging performance are well under high temperature.
- Less volume, lighter weight.

1.3 Product identity definition

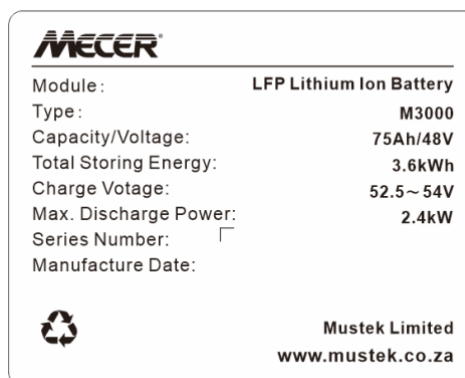


Figure1-1 Battery Energy Storage System nameplate

	<p>Battery voltage is higher than safe voltage, direct contact with electric shock hazard.</p>
	<p>Be careful with your actions and be aware of the dangers.</p>
	<p>Read the user manual before using.</p>
	<p>The scrapped battery cannot be put into the garbage can and must be professionally recycled.</p>
	<p>After the battery life is terminated, the battery can continue to be used after it recycled by the professional recycling organization and do not discard it at will.</p>
<div style="border: 1px solid black; padding: 5px;"> <div style="background-color: red; color: white; text-align: center; padding: 2px;">DANGER <small>HIGH VOLTAGE INSIDE</small></div> <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> </div> <div style="flex: 2; padding-left: 10px;"> <p>* Do not disconnect, disassemble or repair by yourself.</p> <p>* Do not drop, deform, impact, cut or opening with a sharp object.</p> <p>* Do not place near open flame or incinerate.</p> <p>* Do not sit or put heavy things on battery.</p> <p>* Keep away from moisture or liquid.</p> <p>* Keep out of reach of children, animals or insects.</p> <p>* Contact the supplier within 24 hours if anything wrong.</p> <p>Emergency Situations</p> <p>* If leaking, fire, wet or damaged, switch off the breaker and go away from the battery.</p> <p>* Do not touch the leaking liquid. Do not use water, sand or dry powder extinguisher is unable.</p> </div> </div> <div style="margin-top: 10px;"> <p>Dangerous goods warning label on the top of the battery module</p> </div> </div>	

2 Product Specification

2.1 Size and Weight

Table 2-1 M3000 Device size

Product	Nominal Voltage	Nominal Capacity	Dimension	Weight
M3000	DC48V	75Ah	480×380×130mm	≈31kg

2.2 Performance Parameter

Table 2-2 M3000 performance parameter

Item	M3000 Parameter value
Nominal Voltage(V)	48
Work Voltage Range(V)	42~54
Nominal Capacity(Ah)	75
Nominal Energy(kWh)	3.6
Nominal Power(kW)	1.08
Max Power(kW)	2.4
3S Peak Power(kW)	2.64
3S Peak Current(A)	55
Charging Current(A)	37.5
Discharge Current(A)	37.5

2.3 Interface Definition

This section elaborates on interface functions of the front interface of the device.

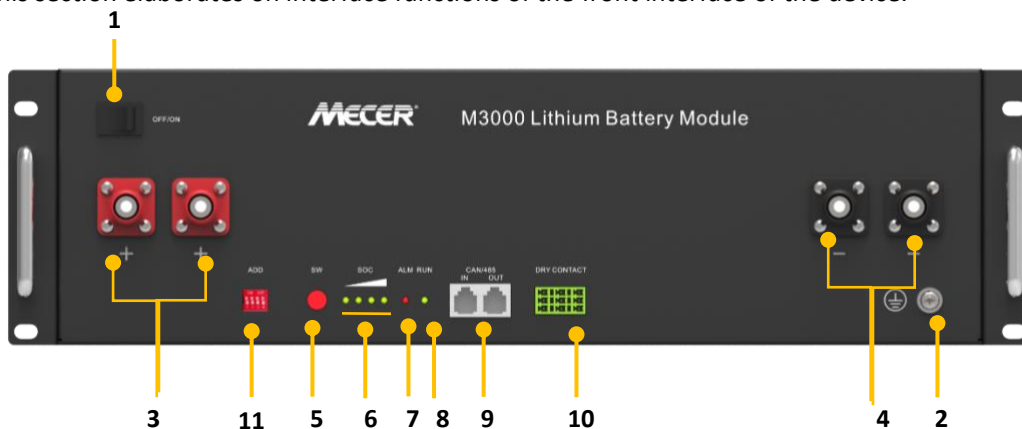


Figure2-1 The sketch of interface.

Table 2-3 Interface Definition

Item	Name	Definition
1	Power switch	OFF/ON, must be in the "ON" state when in use
2	Ground connection point	Shell ground connection
3	Positive socket	Battery output positive or parallel positive line
4	Negative socket	Battery output negative or parallel negative line
5	SW (battery wake/sleep switch)	When the "OFF/ON" switch button is in the ON state, press and hold this button for 3 seconds to put the battery into the power-on or sleep state.
6	SOC	The number of green lights on shows the remaining battery power. See Table 2-3 for details.
7	ALM	Red light flashing when an alarm occurs, red light always on during protection status. After the condition of trigger protection is relieved, it can be automatically closed.
8	RUN	Green light flashing during standby and charging mode. Green light always on when discharging.
9	CAN/485	Communication cascade port, support CAN/ RS485 communication (factory default CAN communication)
10	DRY CONTACT	/
11	ADD	DIP switch

2.3.1 DIP switch definition and description

Table 2-4 Interface Definition

DIP switch position (host communication protocol and baud rate selection)			
#1	#2	#3	#4
Baud rate selection			
ON		OFF	
CAN: 250K,485: 115200		CAN: 500K,485: 9600	

DIP switch description:

When the battery pack is connected in parallel, the host can communicate with the slave through the CAN interface. The host summarizes the information of the entire battery system and communicates with the inverter through CAN or 485. The connection mode is divided into the following two cases:

<p>1. If the host is the latest M3000 battery with DIP switch:</p> <p>(1) The communication cable that communicates with the inverter should use the correct one.</p> <p>(2) After the battery module parallel cable, cascading cable and communication cable with GDW、Solis、LUX、Sofar、DEYE、VICTRON、IMEON、Infinisolar,Sungrow,SMA,RENAC,DELIOS、SAJ(CAN Comm) inverters are connected, all M3000 batteries should not be turned on first, be sure to put the host DIP switch "# 3" to the "ON" position (to the top), then turn on all the M3000 batteries.</p> <p>(3) If the battery module is in communication with the inverters of Growatt hybrid(CAN comm)、GMDE、Saj(485 comm)、Axpret-king turn the host DIP switch "#2" to "ON" position.</p> <p>(4) If the battery module is in communication with the GROWATT-SPF(off-grid) inverter by 485 communication, turn the host DIP switch "#2" and "#3" to "ON".</p> <p>(5) The DIP switch of the slave does not need to be changed.</p> <p>(6) If the energy storage system has only one M3000, it is the host itself, and still follow the above steps.</p> <p>Note: For more information of matching inverter brands, please subject to the latest document <The list of compatibility between Mustek Limited ESS and Inverters >.</p>	<p>2. If the host is a M3000 battery module without the DIP switch:</p> <p>(1) The communication cable that communicates with the inverter should use the correct one which is supplied by MUSTEK LIMITED.</p> <p>(2) After the battery module parallel cable, cascade cable and the inverter communication cable are connected, turn on all M3000 batteries.</p> <p>(3)Before connecting with inverter,please ensure the no-dip battery firmware version support yours inverter.</p>
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Figure 2-2 CAN/485 interface definition

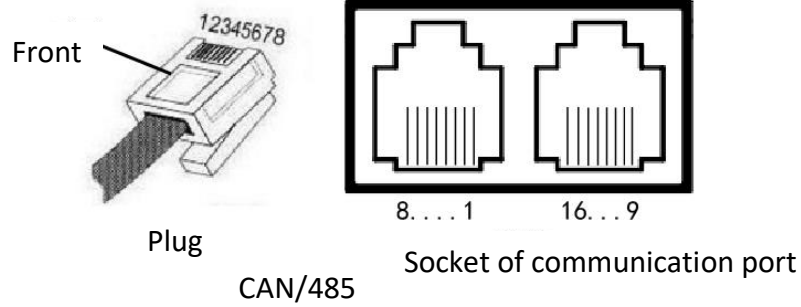


Table 2-4 Pin Definition

Foot position	Color	Definition
PIN1	Orange/white	485A
PIN2	Orange	XGND
PIN3	Green/white	485B
PIN4	Blue	CANH
PIN5	Blue/white	CANL
PIN6	Green	Reserve
PIN7	Brown/white	XIN
PIN8	Brown	Reserve
PIN9	Orange/white	Reserve
PIN10	Orange	XGND
PIN11	Green/white	Reserve
PIN12	Blue	CANH
PIN13	Blue/white	CANL
PIN14	Green	Reserve
PIN15	Brown/white	XOUT
PIN16	Brown	Reserve

Table 2-5 LED status indicators

Battery Status	SOC	LED1	LED2	LED3	LED4	ALM	RUN
Shutdown	/	off	off	off	off	off	off
Standby	$75\% \leq \text{SOC} \leq 100\%$	●	●	●	●	off	Blinking
	$50\% \leq \text{SOC} < 75\%$	●	●	●	off	off	Blinking
	$25\% \leq \text{SOC} < 50\%$	●	●	off	off	off	Blinking
	$5\% < \text{SOC} < 25\%$	●	off	off	off	off	Blinking
	$0\% < \text{SOC} \leq 5\%$	●	off	off	off	Blinking	Blinking
	SOC=0	off	off	off	off	Blinking / ●	Blinking
Charging	SOC=100%	●	●	●	●	off	Blinking
	$75\% \leq \text{SOC} < 100\%$	●	●	●	Blinking	off	Blinking
	$50\% \leq \text{SOC} < 75\%$	●	●	Blinking	off	off	Blinking
	$25\% \leq \text{SOC} < 50\%$	●	Blinking	off	off	off	Blinking

Battery Status	SOC	LED1	LED2	LED3	LED4	ALM	RUN
	0% < SOC < 25%	Blinking	off	off	off	off	Blinking
Discharging	75% ≤ SOC ≤ 100%	●	●	●	●	off	●
	50% ≤ SOC < 75%	●	●	●	off	off	●
	25% ≤ SOC < 50%	●	●	off	off	off	●
	5% < SOC < 25%	●	off	off	off	off	●
	0% < SOC ≤ 5%	●	off	off	off	Blinking	●
	SOC=0	off	off	off	off	Blinking /●	Blinking

● means green light always on ● means red light always on
 Blinking: means green light flashing Blinking: means red light flashing

2.4 Battery Management System(BMS)

2.4.1 Voltage Protection

Discharging Low Voltage Protection :

When any battery cell voltage is lower than the protection value during discharging, the over-discharging protection starts, and the battery buzzer makes an alarm sound. Then battery system stops supplying power to the outside. When the voltage of each cell recovers to rated return range, the protection is over.

Charging Over Voltage Protection :

When total voltage or any battery cell voltage reaches the protection value during charging, battery stops charging. When total voltage or a cell recover to rated return range, the protection is over.

2.4.2 Current Protection

Over Current Protection in Charging :

When the charging current is greater than the protection value, the battery buzzer alarms and the system stops charging. Protection is removed after rated time delaying. When the charging current is at 45~55A, current limit board starts making the charge current become 5A.

Over Current Protection in Discharging :

When the discharge current is greater than the protection value, the battery buzzer alarms and the system stops discharging. Protection is released after rated time delaying.

Note:

The buzzer sound alarm setting can be manually turned off on the background software, and the factory default is on.

2.4.3 Temperature Protection

Less/Over temperature protection in charging :

When battery's temperature is beyond range of 0 °C ~+55 °C during charging, temperature protection starts, device stops charging.
 The protection is over when it recovers to rated return range.

Less/Over temperature protection in discharging :

When battery's temperature is beyond range of $-20^{\circ}\text{C}\sim+55^{\circ}\text{C}$ during discharging, temperature protection starts, device stops supplying power to the outside.
The protection is over when it recovers to rated return range.

2.4.4 Other Protection**Short Circuit Protection :**

When the battery is activated from the shutdown state, if a short circuit occurs, the system starts short-circuit protection for 30 seconds.

Self-Shutdown :

When device connects no external loads and power supply and no external communication for over 72 hours, device will dormant standby automatically.

**Caution**

Battery's maximum discharging current should be more than load's maximum working current.

3 Installation and Configuration

3.1 Ready for installation

Safety Requirement

This system can only be installed by personnel who have been trained in the power supply system and have sufficient knowledge of the power system.

The safety regulations and local safety regulations listed below should always be followed during the installation.

- All circuits connected to this power system with an external voltage of less than 48V must meet the SELV requirements defined in the IEC60950 standard.
- If operating within the power system cabinet, make sure the power system is not charged. Battery devices should also be switched off.
- Distribution cable wiring should be reasonable and has the protective measures to avoid touching these cables while operating power equipment.
- when installing the battery system, must wear the protective items below:



The isolation gloves



Safety goggles



Safety shoes

Figure3-1

3.1.1 Environmental requirements

Working temperature: -20 °C ~ +55 °C

- Charging temperature range is 0°C~+55 °C,
- Discharging temperature range is -20 °C ~+55 °C

Storage temperature: -10 °C ~ +35 °C

Relative humidity: 5% ~ 85%RH

Elevation: no more than 4000m

Operating environment: Indoor installation, sites avoid the sun and no wind, no conductive dust and corrosive gas.

And the following conditions are met:

- Installation location should be away from the sea to avoid brine and high humidity environment.
- The ground is flat and level.
- There is no flammable explosive near to the installation places.
- The optimal ambient temperature is 15°C ~ 30 °C
- Keep away from dust and messy zones

3.1.2 Tools and data

Hardware tool

Tools and meters that may be used are shown in table 3-1.

Table 3-1 Tool instrument

Name	
Screwdriver (word, cross)	AVO meter
Wrench	Clamp meter
Inclined pliers	Insulating tape

Name	
Needle nose pliers	The thermometer
Clip forceps	Wrist strap
Wire stripper	AVO meter
Electric drill	Tape

3.1.3 Technical preparation

Electrical interface check

Devices that can be connected directly to the battery can be user equipment, power supplies, or other power supplies.

- Confirm whether the user's PV power generation equipment, power supply or other power supply equipment has a DC output interface, and measure whether the DC power output voltage meets the voltage range requirements in Table 2-2.
- Confirm that the maximum discharge current capability of the DC power interface of the user's photovoltaic power generation equipment, power supply or other power supply equipment should be greater than the maximum charging current of the products used in Table 2-2.

If the maximum discharge capacity of the DC power interface of the user's photovoltaic power generation equipment is less than the maximum charging current of the products used in Table 2-2, the DC power interface of the user's photovoltaic power generation equipment shall have a current limiting function to ensure the normal operation of the user's equipment.

- Verify that the maximum operating current of the battery-powered user equipment (inverter DC input) should be less than the maximum discharge current of the products used in Table 2-2.








The security check

- Firefighting equipment should be provided near the equipment, such as portable dry powder fire extinguisher.
- Automatic fire fighting system shall be provided for the case where necessary.
- No flammable, explosive and other dangerous articles are placed beside the battery.

3.1.4 Unpacking inspection

- When the equipment arrives at the installation site, loading and unloading should be carried out according to the rules and regulations, to prevent from being exposed to sun and rain.
- Before unpacking, the total number of packages shall be indicated according to the shipping list attached to each package, and the case shall be checked for good condition.
- In the process of unpacking, handle with care and protect the surface coating of the object.
- Open the package, the installation personnel should read the technical documents, verify the list, according to the configuration table and packing list, ensure objects are complete and intact, if the internal packing is damaged, should be examined and recorded in detail.

Packing list is as follows:

Item	Specification	Quantity	Figure
Battery-M3000	48V/75Ah 480×380×130mm	1	
Power cable-positive	Red /25mm ² /L2050mm	1	
Power cable-negative	Black /25mm ² /L2050mm	1	
Parallel cable-positive	Red /25mm ² /L215mm	1	
Parallel cable-negative	Black /25mm ² /L215mm	1	
Communication parallel cable	Black /L250mm/Double RJ45 plug	1	
Communication cable-to inverter	Black /L2000mm /Double RJ45 plug	1	

3.1.5 Engineering coordination

Attention should be paid to the following items before construction:

- Power line specification.
The power line specification shall meet the requirements of maximum discharge current for each product.
- Mounting space and bearing capacity.
Make sure that the battery has enough room to install, and that the battery rack and bracket have enough load capacity.
- Wiring.
Make sure the power line and ground wire are reasonable. Not easy to short-circuit, water and corrosion.

3.2 Equipment installation

Table 3-2 Installation steps

Step1	Installation preparation	Confirm that the ON/OFF switch on the front panel of M3000 unit is in the "OFF" state to ensure no live operation.
Step 2	Mechanical installation	1. Cabinet placement position determination
		2. Top cable harness pre-installed
		3. Battery module installation
Step3	Electrical installation	1. Ground cable installation
		2. Battery module parallel cable installation
		3. Battery module total positive cable installation
		4. Battery module total negative cable installation
		5. Internal CAN communication interface connection
Step4	Battery system self-test	1. Press the ON/OFF switch to the "ON" state
		2. BMS system power-on activation
		3. Check the system output voltage
		4. Shut down the system
Step5	Connecting inverter	1. Connect total positive & total negative cable of the battery system to the inverter
		2. Connect the external CAN communication cable to the inverter

3.2.1 Installation preparation

1. Prepare equipment and tools for installation.
2. Check the M3000 unit and confirm that the ON/OFF switch is in the "OFF" state to ensure no live operation.

3.2.2 Mechanical installation

Installation method:

1. Place the M3000 unit on the cabinet bracket as shown in the figure and push it into the cabinet to the installation position. (The cabinet structure in the figure is for reference only)

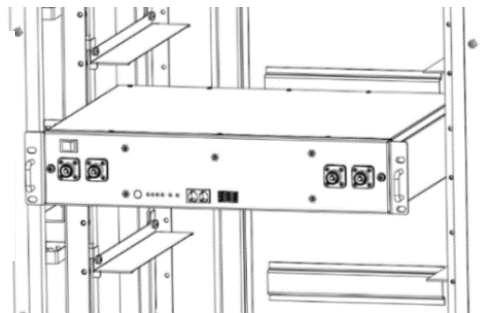


Figure3-2

2. Secure the M3000 unit to the cabinet with a nut through the mounting holes top on the hanging ears of the M3000 unit.

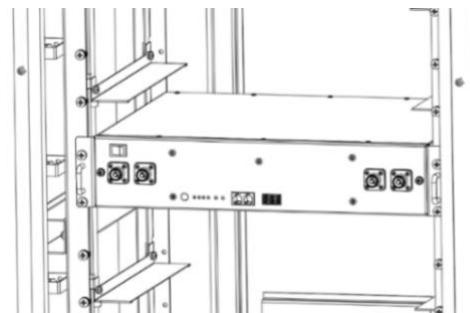


Figure3-3

Installation method 2: With Simple bracket installation

1. As shown in the figure3-4, place two M3000 brackets side by side with a spacing of 300mm and push the M3000 in.

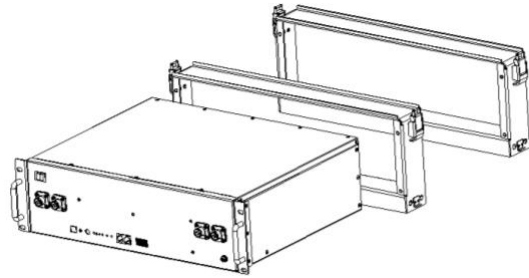


Figure3-4

2. Ensure that the M3000 hanging ears are aligned with the bracket and secure the hanging ears to the bracket with four M6 screws.

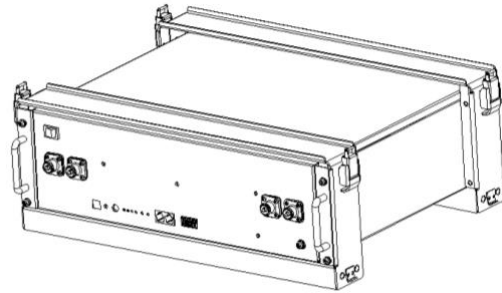


Figure3-5

3. Stack the fixed M3000 and the bracket as shown in the figure 3-6, and fasten the buckle between the upper and lower sides.

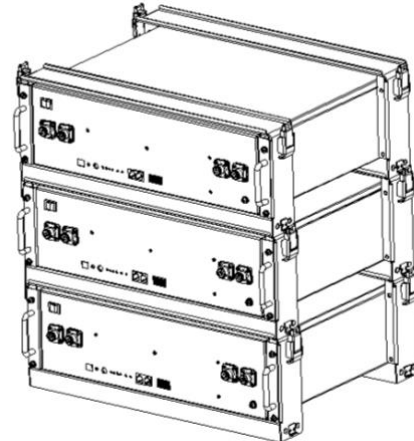


Figure3-6

3.2.3 Electrical installation

Before connecting the power cables, using multimeter to measure cable continuity, short circuit, confirm positive and negative, and accurately mark the cable labels.

Measuring methods:

- Cable availability: select the buzzer and use the probe to measure the ends of the same color cable. If the buzzer calls, it means the cable is available.
- Short circuit judgment: choose multimeter resistor file, probe the same end of positive and negative pole, if the resistor shows infinity, means that the cable is available.
- After visual testing of power line is connected well, the positive and negative poles of the battery shall be connected respectively to the positive and negative poles of the opposite terminal.

It is better to add a circuit breaker between the inverter and the battery system. The selection of

the circuit breaker requires:

$$\text{Voltage: } U > 60V$$

$$\text{Current: } I = \frac{\text{Inverter power}}{45V}$$

The circuit breaker is installed between the battery module and the inverter, as shown in Figure 3-7:

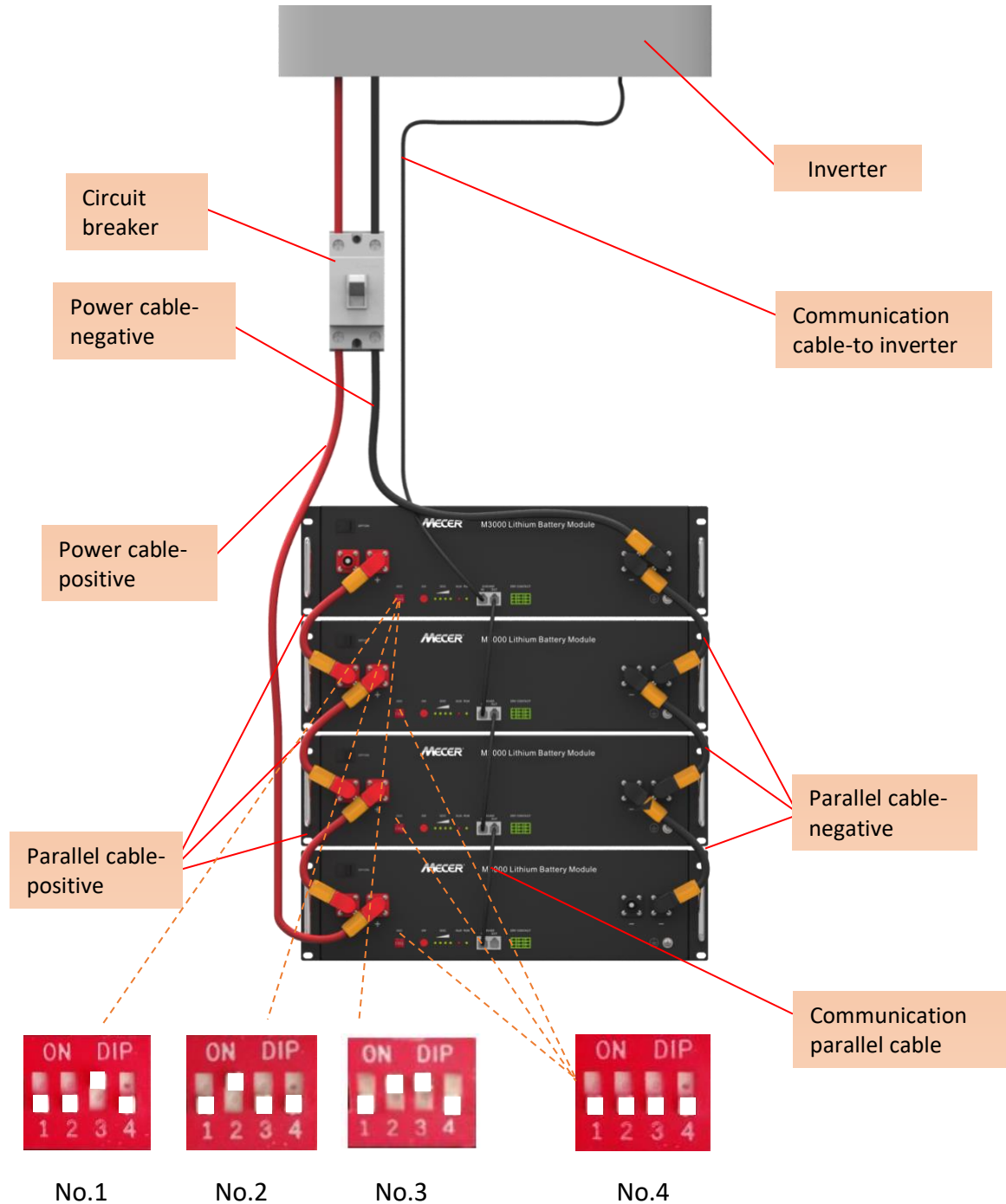


Figure3-7

Note: 1.After the whole system connection,set the master DIP mode according to the inverter model firstly,then start the battery.

2.The BAT-INV comms cable is from inverter comm port to master CAN IN port,BAT-BAT cable is from master CAN OUT to slave1 CAN IN,slave1 CAN OUT to slave2 CAN IN...

3. Each pair of power cable, its limited continuous current is 120A, so if the inverter Max. work current more than 120A, please add power cable according to the proportion.

Note: For more information of matching inverter brands, please subject to the latest document <The list of compatibility between Mustek Limited ESS and Inverters >.

4 Use, maintenance and troubleshooting

4.1 Battery system usage and operation instructions

After completing the electrical installation, follow these steps to start the battery system.

- 1 Refer to the description of the DIP switch of 2.3.1 to prepare the battery module before starting up, then press the ON/OFF button to the ON position, press and hold the SW button for 3 seconds.
After the indicator self-test, the RUN indicator will light and the SOC indicator will be on (100% SOC status in the Figure4-1).

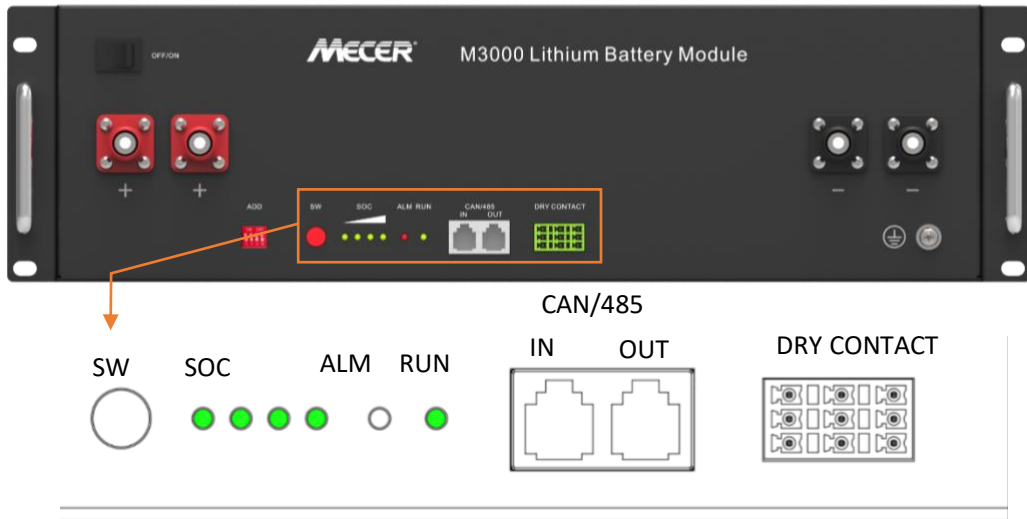


Figure4-1



Note:

After pressing the power button, if the battery status indicator on the front panel continues to be red, please refer to the "4.2 Alarm description and processing". If the failure cannot be eliminated, please contact the dealer timely.

- 2 Use a voltmeter to measure whether the voltage of the circuit breaker battery access terminal is greater than 37V, and check whether the voltage polarity is consistent with the inverter input polarity. If the circuit breaker battery input terminal has a voltage output and is greater than 37V, then the battery has started normal work.
- 3 After confirming that the battery output voltage and polarity are correct, turn on the inverter, close the circuit breaker.
- 4 Check if the indicator of the inverter and battery connection (communication indicator and battery access status indicator) is normal. If it is normal, successfully complete the connection between the battery and the inverter. If the indicator light is abnormal, please refer to the inverter manual for the cause or contact the dealer.

4.2 Alarm description and processing

When the protection action or fault occurs in the system, the alarm signal will be given through the working status indicator on the front panel of the M3000. The network management can query the specific alarm categories.

If the fault such as single cell overvoltage, charging over-current, under-voltage protection, high-temp protection and other abnormalities which affects the output, please deal with it according to Table 4-1.

Table 4-1 Main alarm and Protection

Statue	Alarm category	Alarm indication	Processing
Charge state	Over-current	RED, Buzzer start	Stop charging and find out the cause of the trouble
	High temp	RED	Stop charging
Discharge state	Over-current	RED Buzzer start	Stop discharging and find out the cause of the trouble
	High temp	RED	Stop discharging and find out the cause of the trouble
	Total voltage undervoltage	RED Buzzer start	Start charging
	Cell voltage undervoltage	RED Buzzer start	Start charging

4.3 Analysis and treatment of common faults

Analysis and treatment of common faults in the Table 4-2:

Table 4-2 Analysis and treatment of common faults

No.	Fault phenomenon	Reason analysis	Solution
1	The indicator does not respond after the power on	Total voltage lower than 35V	Check the total voltage
2	No DC output	Battery data status is abnormal. Battery gets into over-discharged protection	Read the battery information on the monitor.
3	The DC power supply time is too short	Battery capacity become smaller	Storage battery replacement or add more modules
4	The battery can't be fully charged to 100%	Charging voltage is too low	Adjust charging voltage at 53.5V or 54V
5	The power cable sparks once power on and ALM light RED	Power connection short-circuit	Turn off the battery, check the cause of the short circuit

6	Communication fault	<p>The DIP setting of the host is wrong/ the battery type of the inverter is wrong/ Communication cable used incorrectly/ The communication cable is incorrectly connected at the battery communication port or the inverter communication port/ The battery firmware version is too low to support the inverter</p>	<p>Check these possible cause one by one</p>
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If you have any technical help or question, please contact the seller in time.



Mecer Limited

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