



LITHIUM BATTERY MODULE

USER MANUAL

M12-400



Preface

The M12 series lithium iron phosphate battery system is a standard and high performance lithium battery system. It supports parallel connection. It has obvious advantages in terms of safety, energy density, service life, and environmental protection. With an intelligent battery management system, it provides customers with a safe and stable one-stop power supply guarantee service.

This user manual introduces in details of product structure, parameters, basic procedures and methods of installation, as well as operation and maintenance of product.

Please follow below request during the procedure of installation, operation and maintenance:

- 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).
- For your safety, product shall be ground connected properly before normal use.
- Please do not mixed-use batteries from different manufacturers, different types or models, neither nor old and new together.
- The M series lithium batteries support parallel connection, but series connection is prohibited.
- Please ensure that the electrical parameters of the related equipments are compatible with each other before use.
- For long-term storage, the battery should be recharged once at least in every 3 months, it needs to be charged to 80% capacity regularly.
- For your safety, please do not arbitrarily dismantle any components in any circumstances unless a specialist or an authorized one from TBB Power. Device breakdown due to improper operation will not be covered under warranty



The product has been strictly inspected before shipment. If you find abnormal phenomena such as swelling of the shell, please contact the sales or TBB Power. The use environment and storage method have a certain impact on the service life and reliability of this product, so environmental factors must be fully considered before installation and use to ensure that the system works in a suitable environment.

Disclaimer: Due to the continuous update and improvement of products and technologies, the content in this document may not completely match the actual product, please understand. For product updates, please contact your sales or TBB Power.

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1. Safety Precautions

1.1 Safety Precautions

- Please pay attention to the safety signs on this product and manual.
- During product installation, operation, and maintenance, electrical safety regulations and related operating procedures must be observed, otherwise it may cause personal injury or product damage. The safety precautions mentioned in the manual are only a supplement to the safety regulations.
- The manufacturer does not assume any responsibility caused by violation of general safety operation requirements or violation of safety standards for design, production and use of equipment.

1.2 General safety precautions

- Please strictly follow the requirements of this manual to dispose of lithium batteries.
- Do not short-circuit lithium batteries.
- Lithium batteries must be installed in a dry and clean environment. It is strictly forbidden to put the battery in water or fire to avoid explosion or other dangers.
- Please do not stab, hit, trample or strike the battery in any other way. Avoid direct sunlight.
- Please do not remove the lithium battery from the original packaging before use.
- Ensure that the positive (+) and negative (-) polarities of the lithium battery and the charging and discharging equipment are correctly connected.
- It is forbidden to use lithium batteries of different manufacturers, models, capacities, and types in parallel.
- Do not charge the lithium battery for a long time when not in use.
- When charging the lithium battery, be sure to use the correct charger and charging voltage. It is recommended to use the power supply equipment manufactured by TBB and set it to TBB SUPPER-L.
- During use, when the system needs to be moved or rewired, the power must be completely cut off and the system must be completely shut down, otherwise there will be a risk of electric shock.
- Do not place metal tools on the battery. Sparks or short circuits can cause an explosion.
- In order to avoid fire and electric shock, please ensure that all cables have good electrical characteristics and suitable wire diameter; it is forbidden to use damaged or too small cables.
- When encountering a fire, please use a dry powder fire extinguisher to extinguish the fire. The use of a liquid fire extinguisher may cause secondary hazards.



Lithium batteries should be kept away from water, dust and pollution sources. Please install the lithium battery in a well-ventilated environment.

1.3 Disposal



After the lithium battery is scrapped, it cannot be discarded at will, and should be sent to a special recycling station for disposal treatment.

2. Product Introduction

2.1 Brief introduction

M12-400 is a 12V lithium battery with a battery capacity of 400Ah. The positive electrode of the battery is made of lithium iron phosphate (LiFePO₄) material. It configures high-performance and high-reliability BMS to effectively manage the cells, including cell overvoltage, under-voltage, charge over-current, discharge over-current, over-temperature, low temperature, short circuit and other protection functions. It also has built-in cell voltage balance, capacity calculation, SOC calculation, cycle life accumulation and low temperature heating functions. It is suitable for energy storage systems of vehicles, ships etc.

2.2 Features

- The positive electrode of the battery is made of lithium iron phosphate (LiFePO₄) material, which has good safety performance and long cycle life. 3000 cycles @ 25°C.
- High-performance BMS with over-discharge, over-charge, over-current, temperature and other protection functions. With automatic charge and discharge management and single cell balance function.
- Supports maximum 300A discharge current.
- Supports up to 4 units in parallel, so that the total capacity can reach 12V 1600Ah
- With external charging activation function. In the shutdown state, when there is an external charging request, the battery can actively wake up, and allow charging and prohibit discharging;
- It can be equipped with battery switch or remote control panel for battery switch and battery status (voltage, current, SOC) display.
- The battery has low self-discharge rate. The standby power consumption after the battery is turned on is <50mA, and it can be reduced to <0.1mA after the battery is turned off.
- Wide working temperature range, -20°C ~ +55°C. Good cycle life and discharge performance at high temperature.
- Built-in low temperature heating element, with TBB power supply system, can realize automatic battery thermal management under low temperature conditions. With external power supply (mains power, solar energy, vehicle engine), the battery temperature can be automatically heated to meet the requirements of charging and discharging under low temperature conditions. It will take about 90 minutes from -20°C to +5°C.
- The battery has small size, light weight and high energy density.
- Comply with European RoHS regulations, pass SGS certification, and use non-toxic, non-polluting environmentally friendly cells.

2.3 Product dimensions



Figure 2-1 Picture of M12-400

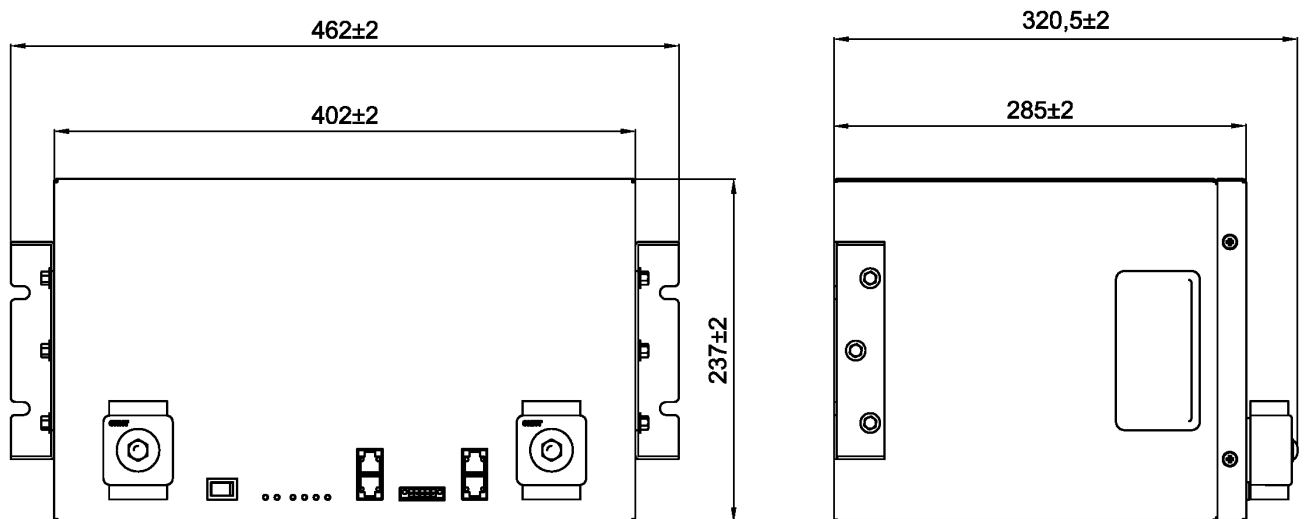


Figure 2-2 Dimensions of M12-400

2.4 External interface definition

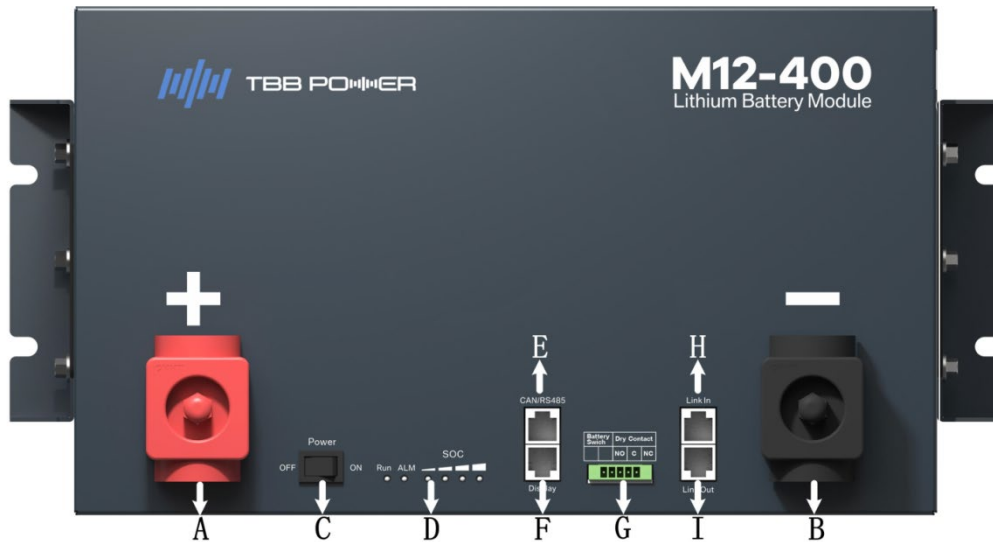



Figure 2-3 M12-400 external interfaces

Table 2-1 External interface description

No.	Silk screen		Name	Definition
A	+		Positive terminal	Battery output positive or parallel positive, M8
B	-		Negative terminal	Battery output negative or parallel negative, M8
C	Power	ON OFF	Battery power switch button	Turn to the "ON" position when in use, and to the "OFF" position when shutting down
D	RUN		Running indicator	Green light, flashing when standby, always on when charging, flashing when discharging; see 2.4.2 for details
	ALM		Fault indicator	Red light, always flashing when warning. Generally, it can be automatically restored after the condition that triggers the protection is lifted; see 2.4.2 for details
			SOC indicator	The number of green lights shows the remaining battery power, see 2.4.2 for details
E	CAN/RS485		External communication port	External communication port, support CAN and RS485 communication
F	Display		MCK interface	MCK display interface
G	Battery Switch		Remote switch interface	Remote switch interface, connect to battery switch, can remotely switch off the lithium battery
	Dry Contact	NO	Output dry contact interface	Relay output normally open contact
		C		Neutral point of relay output
		NC		Relay output normally closed contact
H	Link In		Parallel communication interface	Connect to the Link Out in the previous battery
I	Link Out			Connect to the Link In in the next battery

2.4.1 CAN/RS485interface definition

Table 2-2 CAN/RS485interface definition

Pin terminal	Color	Definition
PIN1	orange/white	--
PIN2	orange	--
PIN3	green/white	RS485A
PIN4	blue	CANH
PIN5	blue/white	CANL
PIN6	green	RS485B
PIN7	brown/white	--
PIN8	brown	--

2.4.2 Indicator light definition

Table 2-3Indicator light definition

Battery status	SOC	LED1	LED2	LED3	LED4	ALM	RUN
Shut down		OFF	OFF	OFF	OFF	OFF	OFF
Power-on static state	75% ≤ SOC ≤ 100%	ON	ON	ON	ON	Flashing when there is a fault, always off when normal	Flashing1
	50%≤SOC<75%	ON	ON	ON	OFF		Flashing1
	25%≤SOC<50%	ON	ON	OFF	OFF		Flashing1
	0%<SOC<25%	ON	OFF	OFF	OFF		Flashing1
	SOC=0	OFF	OFF	OFF	OFF		Flashing1
Charging	SOC=100%	ON	ON	ON	ON		ON
	75% ≤ SOC < 100%	ON	ON	ON	Flashing2		ON
	50%≤SOC<75%	ON	ON	Flashing 2	OFF		ON
	25%≤SOC<50%	ON	Flashing2	OFF	OFF		ON
	0%≤SOC<25%	Flashing2	OFF	OFF	OFF		ON
Discharging	75% ≤ SOC ≤ 100%	ON	ON	ON	ON		Flashing3
	50%≤SOC<75%	ON	ON	ON	OFF		Flashing3
	25%≤SOC<50%	ON	ON	OFF	OFF		Flashing3
	0%<SOC<25%	ON	OFF	OFF	OFF		Flashing3
	SOC=0	OFF	OFF	OFF	OFF		Flashing3
Remark: Flashing 1: on 0.25s, off 3.75s Flashing 2: on 0.5s, off 0.5s Flashing 3: on 0.5s, off 1.5s							

2.5 Optional accessories

2.5.1 Typical wiring

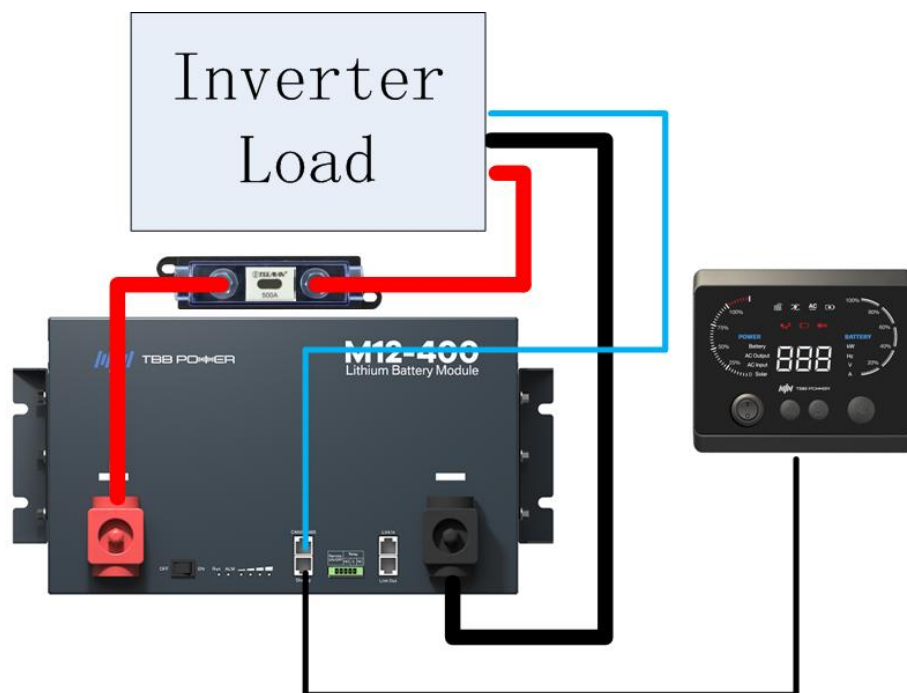





Figure 2-4a Typical wiring diagram 1 (supporting non-TBB inverter)



Figure 2-4b Typical wiring diagram 2 (with TBB inverter)

2.5.2 Power cable installation package (optional)

Table 2-4 Power cable installation package list

Name	Model/Specification	Picture	Q'ty
Fuse holder	BANL-B		1
Fuse	ANL500,500A/32V		1
Power cable	70mm ² ,0.4m,red. Braided cable, soft and easy to bend, easy to install.		1

To connect the fuse, please follow the steps below:

Step 1: Open the protective cover of the fuse holder, as shown in Figure 2-5.



Figure 2-5 Open the protective cover of the fuse holder

Step 2: Install the fuse and power cable, the recommended torque is 15N.m, as shown in Figure 2-6.



Figure 2-6 Install the fuse and power cable

Step 3: Remove the protective cover of the lithium battery (+) terminal, as shown in Figure 2-7.



Figure 2-7 Remove the protective cover of the lithium battery

Step 4: Connect the other end of the power cable to the lithium battery (+) terminal. The recommended torque is 15N.m, as shown in Figure 2-8.



Figure 2-8 Connect the power cable to the lithium battery (+) terminal

2.5.3 MCK display panel (optional)

An external MCK display panel can be used as the display unit of the lithium battery, which can display the current operating information of the lithium battery. It is connected to the lithium battery through a UTP standard network cable.

The MCK display panel has a built-in Bluetooth module, and the operating status of the lithium battery can be monitored through the APP.



Figure 2-9 MCK display panel

When using MCK as an external display unit of lithium battery, please follow the steps below:

Step 1: Use UTP standard network cable to connect MCK and lithium battery Display interface.

Step 2: Please turn the Power switch on the lithium battery to ON.

Step 3: You can directly use the rocker switch on the MCK display panel to turn on and off the lithium battery.

Note: If the lithium battery is connected with a TBB inverter, you can connect the MCK to the COMMON interface of the inverter. The lithium battery is equipped with a remote battery switch. As shown in Figure 2-2b Typical System Wiring Diagram 2.

2.5.4 Remote battery switch (optional)

The remote battery switch can be connected to the Battery Switch interface, and the battery can be turned on and off through the remote battery switch.



Figure 2-10 Remote battery switch

To use the remote battery switch, please follow the steps below:

Step 1: Please turn the Power switch on the lithium battery to ON;

Step 2: Please connect the remote battery switch to the dry contact connector, as shown in Figure 2-9. the lithium battery can be turned on and off through the remote battery switch.



Figure 2-11 Schematic diagram of battery switch installation and wiring

3. Product installation

3.1 General description



Limited to 12V system use. It is forbidden to install and use in series!

Do not install or use damaged lithium batteries!



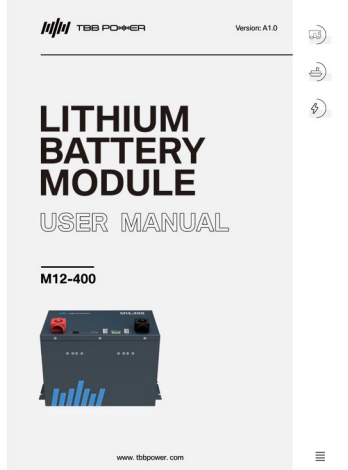
Please make sure that the polarity connection between the lithium battery and the charger and load is correct!

When using lithium batteries in parallel, be sure to use lithium batteries of the same brand, model, cycle life, capacity and SOC status.

3.2 Unpacking inspection

Check whether the lithium battery is in good condition after unpacking. If the lithium battery is damaged, please contact your dealer or our company. Do not install or use damaged lithium batteries!

Please check whether the accessories are complete according to the packing list. If the accessories are not complete, please contact your dealer or our company.

Name	Specification	Q'ty	Picture
Lithium battery	M12-400	1	
Dry contact connector	PLTB1.5-05-BF-3.81	1	
User manual	M12-400	1	

3.3 Positioning and perforation

Please select a plane and drill holes according to the installation positioning requirements in Figure 3-1.

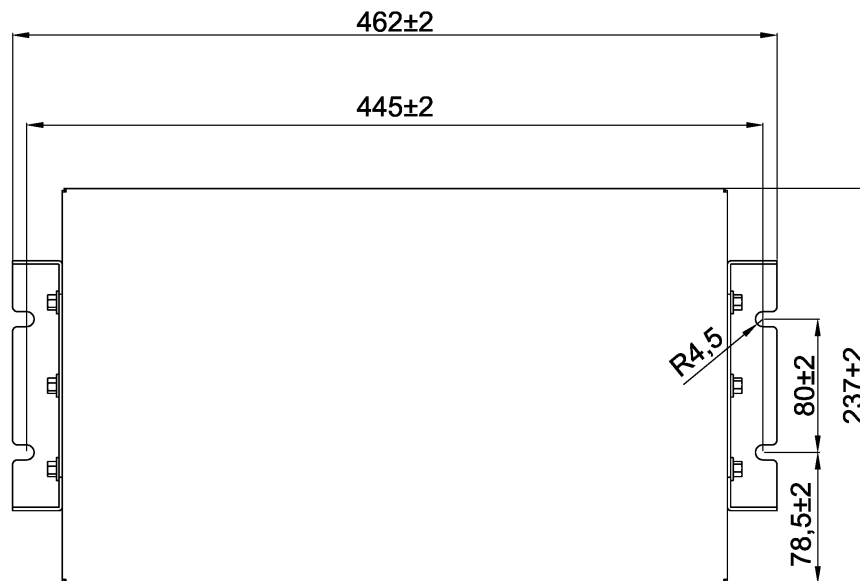


Figure 3-1 Installation positioning requirement

3.4 Installation fixed

Before use, the lithium battery must be effectively fixed and cannot be fixed upside down. The fixing bolt is M8 and the fixing torque is 15N.m. The specific fixing position is shown in Figure 3-2.



Figure 3-2 Fixing of lithium battery

3.5 Single lithium battery wiring

3.5.1 Typical wiring diagram of single battery

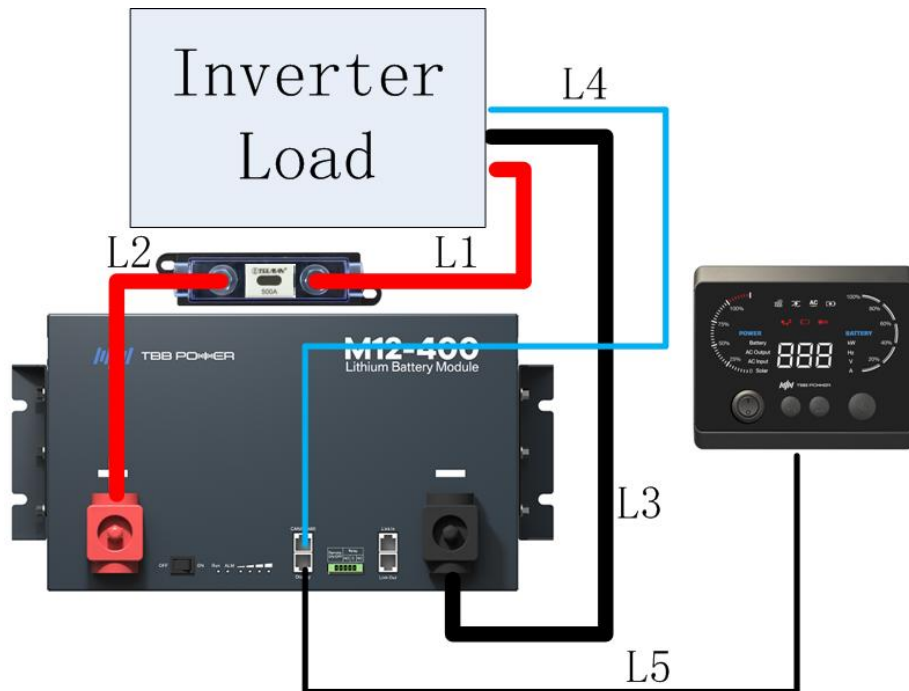


Figure 3-3a Typical wiring diagram 1 (non-TBB inverter)

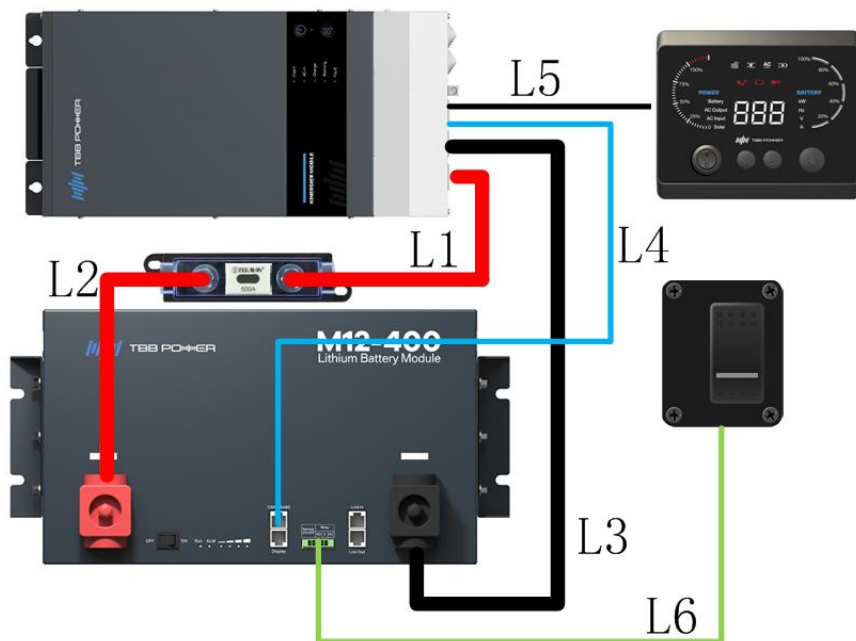


Figure 3-3b Typical wiring diagram 2 (TBB inverter)

Table 3-1 Cable requirements

	Recommended wire diameter	Recommended length	Recommended color	Recommended terminal
L1	$\geq 70\text{mm}^2$	$\leq 3\text{m}$	Red	70-10 copper terminal
L2	$\geq 70\text{mm}^2$	$\leq 0.5\text{m}$	Red	70-10 copper terminal
L3	$\geq 70\text{mm}^2$	$\leq 3.5\text{m}$	Black	70-10 copper terminal
L4	UTP standard network cable	$\leq 9\text{m}$	Blue	--
L5	UTP standard network cable	$\leq 9\text{m}$	Black	--
L6	0.75 mm ²	--	--	Remote battery switch

3.5.2 Power cable wiring



Please make sure that the rocker switch is set to OFF before wiring, and the lithium battery is in the OFF state!

Step 1: Remove the protective cover of the lithium battery (+) terminal.

Step 2: Connect the cable L1 between the fuse and the (+) terminal of the load or charger. Torque requirement: 15N.m. Make sure the wiring is tight and firm.

Step 3: Connect the cable L2 between the fuse and the (+) terminal of the lithium battery. Torque requirement: 15N.m. Make sure the wiring is tight and firm.

Step 4: Install the protective cover of the lithium battery (+) terminal.



Do not connect the (-) terminal first, otherwise it may cause a short circuit!

Step 5: Remove the protective cover of the lithium battery (-) terminal.

Step 6: Connect the cable L3 between the (-) terminal of the load or charger and the (-) terminal of lithium battery. Torque requirement: 15N.m. Make sure the wiring is tight and firm.

Step 7: Install the protective cover of the lithium battery (-) terminal.

3.5.3 Communication cable wiring

3.5.3.1 Typical wiring diagram 1 (with non-TBB inverter)

Step 1: Please use UTP standard network cable to connect the CAN/RS485 communication interface of the lithium battery and the corresponding interface of the inverter or system.

Step 2: Please connect the Display communication interface of the lithium battery to the MCK display communication interface.

Note: If you use the MCK display panel, do not connect to the dry contact connector (provided by TBB).

3.5.3.2 Typical wiring diagram 2 (with TBB inverter)

Step 1: Please use UTP standard network cable to connect the CAN/RS485 communication interface of the lithium battery and the corresponding interface of the inverter or system.

Step 2: Please connect the MCK to the inverter ComMON interface, and turn on and off the inverter through the switch on the MCK;

Step 3: Connect the remote battery switch to the Battery Switch interface of the lithium battery, and turn on and off the lithium battery through the battery switch.

3.5.4 Power ON and Power OFF

3.5.4.1 Typical wiring diagram 1 (non-TBB inverter)

Power ON the battery: please turn the Power switch on the lithium battery to the ON position; and turn the rocker switch on the MCK to the "I" position;

Power OFF the battery: please turn the Power switch on the lithium battery to OFF position; or turn the rocker switch on MCK to "O" position;

3.5.4.2 Typical wiring diagram 2 (TBB inverter)

Power ON the battery: please turn the Power switch on the lithium battery to ON position; and turn the remote battery switch to "I" position;

Power OFF the battery: please turn the Power switch on the lithium battery to OFF; or turn the remote battery switch to "O";

3.6 Connect lithium batteries in parallel

3.6.1 Lithium battery parallel connection diagram

The maximum number of lithium batteries in parallel is 4. To ensure the current sharing of lithium batteries in parallel, please follow the installation and wiring requirements below.

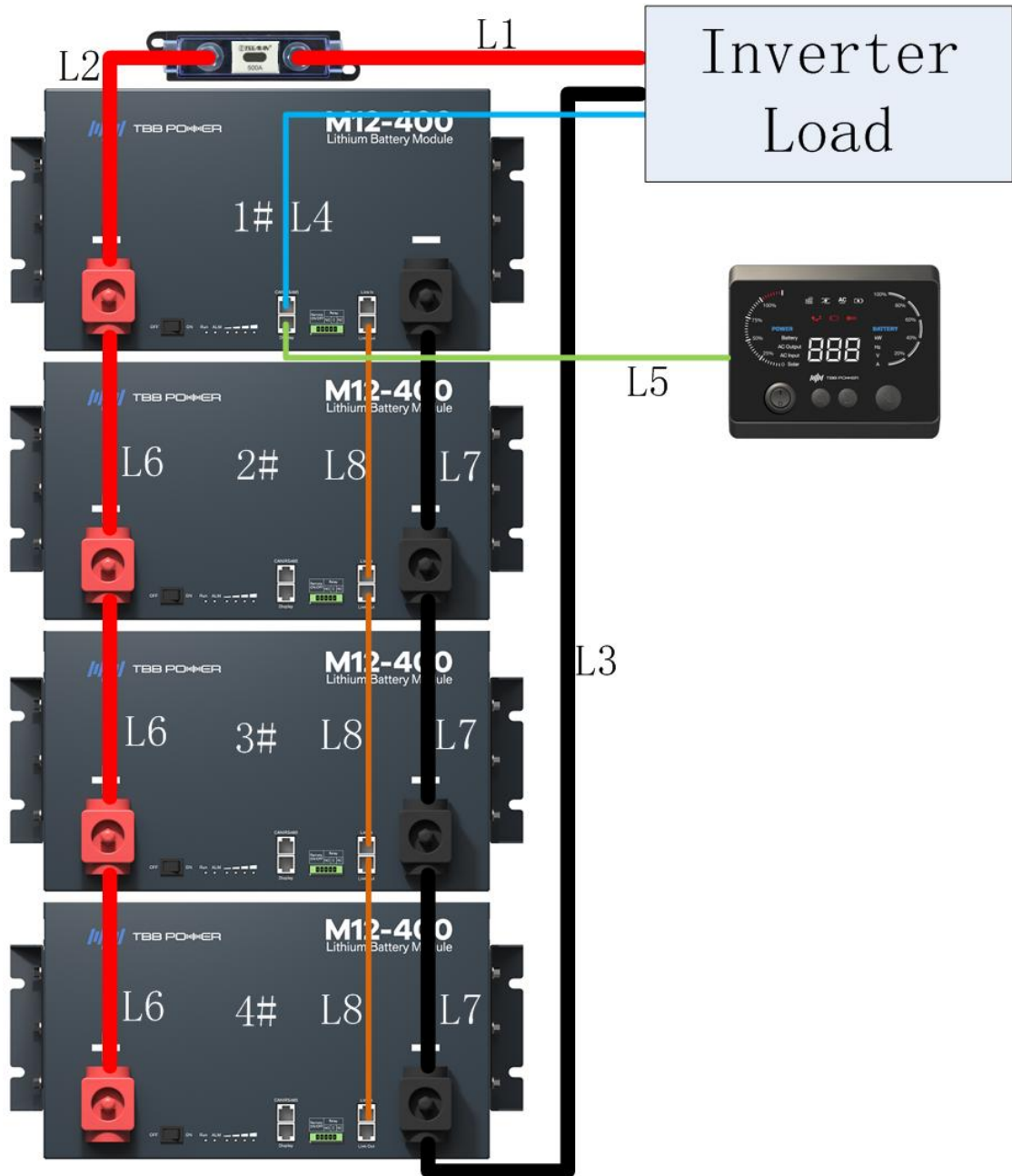


Figure 3-4a Parallel wiring diagram (with non-TBB inverter)

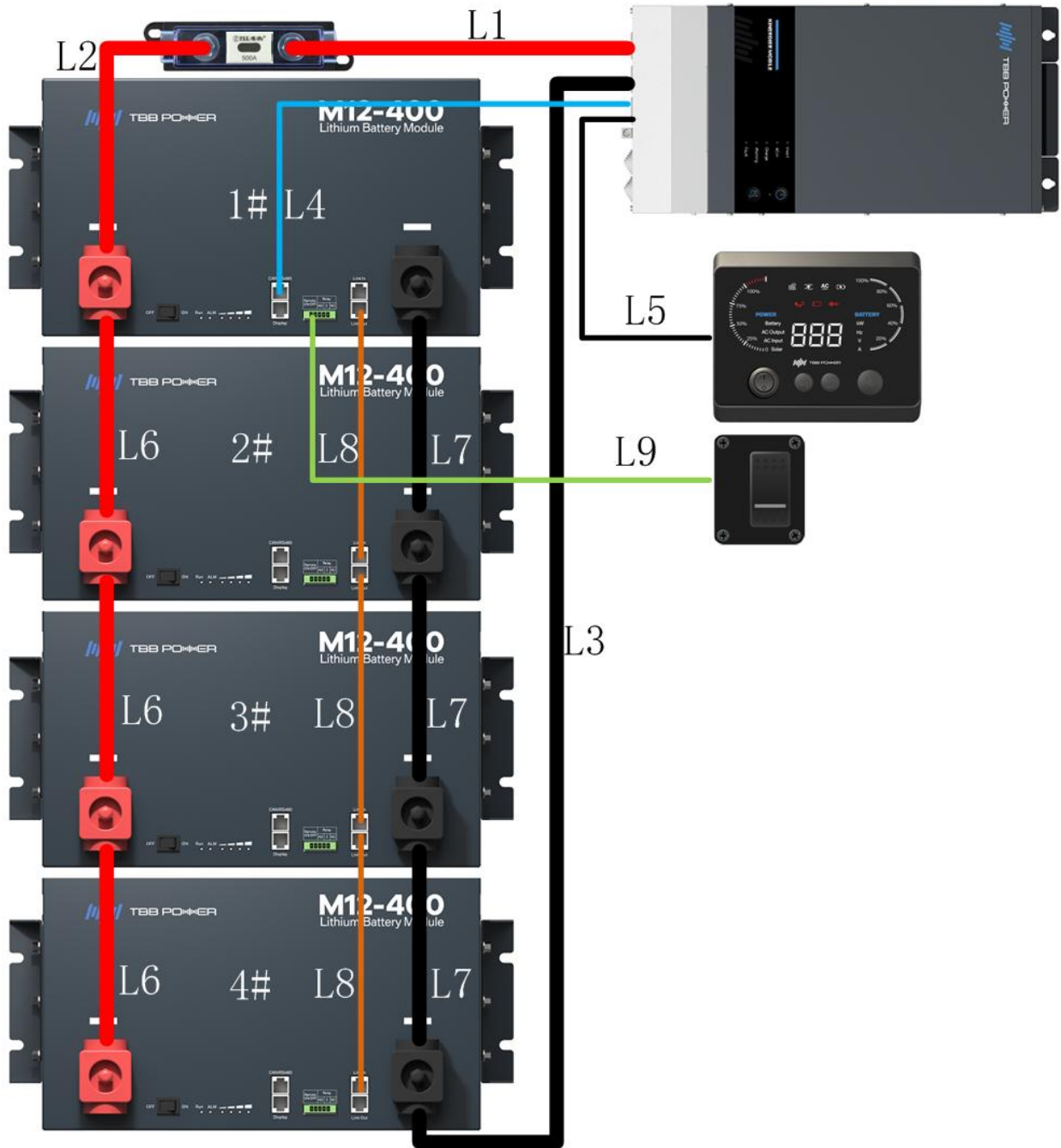


Figure 3-4b Parallel wiring diagram (with TBB inverter)

Table 3-2 Cable requirements ($I_{bat} \leq 300A$)

	Recommended wire diameter	Recommended length	Recommended color	Recommended terminal
L1	$\geq 70mm^2$	$\leq 3m$	Red	70-10 copper terminal
L2	$\geq 70mm^2$	$\leq 0.5m$	Red	70-10 copper terminal
L3	$\geq 70mm^2$	$\leq 3.5m$	Black	70-10 copper terminal
L4	UTP standard network cable	$\leq 9m$	Blue	--
L5	UTP standard network cable	$\leq 9m$	Orange	--
L6	$\geq 70mm^2$	0.25m	Red	70-10 copper terminal
L7	$\geq 70mm^2$	0.25m	Black	70-10 copper terminal
L8	UTP standard network cable	$\leq 9m$	Black	--

Table 3-3 Cable requirements ($I_{bat} \geq 300A$)

Model	Recommended BAT wiring					
	3meters		5meters		7 meters	
300A	2/0AWG	70mm ²	3/0AWG	95mm ²	3/0AWG	95mm ²
350A	3/0AWG	120mm ²	4/0AWG	120mm ²	4/0AWG	150mm ²
400A	4/0AWG	150mm ²	4/0AWG	150mm ²	4/0AWG	150mm ²
450A	/	185mm ²	/	185mm ²	/	185mm ²
500A	/	240mm ²	/	240mm ²	/	240mm ²

3.6.2 Power cable wiring



Please charge all lithium batteries to 100% SOC before wiring! After charging, make sure that the rocker switch is set to OFF, and the lithium battery is in the OFF state!

Step 1: Remove the protective cover of the lithium battery (+) terminal.

Step 2: Connect the parallel cables L6(positive) between the lithium batteries. Torque requirement: 15N.m. Make sure the wiring is tight and firm.

Step 3: Connect the cable L1 between the fuse and the (+) terminal of the load or charger. Torque requirement: 15N.m. Make sure the wiring is tight and firm.

Step 4: Connect the cable L2 between the fuse and the (+) terminal of the lithium battery. Torque requirement: 15N.M. Make sure the wiring is tight and firm.

Step 5: Install the protective cover of the lithium battery (+) terminal.



Do not connect the (-) terminal first, otherwise it may cause a short circuit!

Step 6: Remove the protective cover of the lithium battery (-) terminal.

Step 7: Connect the parallel cables L7(negative) between the lithium batteries. Torque requirement: 15N.M . Make sure the wiring is tight and firm.

Step 8: Connect the cable L3 between the (-) terminal of the load or charger and the (-) terminal of lithium battery. Torque requirement: 15 N.M .Make sure the wiring is tight and firm.

Step 9: Install the protective cover of the lithium battery (-) terminal.

3.6.3 Communication cable wiring

Step 1: Connect the communication cable L8 between lithium batteries (1#~4#);

Step 2: Please use UTP standard network cable to connect the CAN/RS485 communication interface of the 1# lithium battery and the corresponding interface of the inverter or system.

Step 3: Please connect the Display communication interface of the #1 lithium battery to the MCK display communication interface.

Note: If you use the MCK display panel, do not connect to the dry contact connector (provided by TBB).

Note: Please refer to section 3.5 for battery wiring of MCK and remote switch if it is equipped with TBB inverter.

3.6.4 Power ON and Power OFF

Power ON the battery: please turn the Power switch on the #1 lithium battery to the ON position; and turn the rocker switch on the MCK to the "I" position;

Power OFF the battery: please turn the Power switch on the #1 lithium battery to OFF position; or turn the rocker switch on MCK to "O" position;

Note: Please refer to section 3.5 for lithium battery power on and off if it is equipped with TBB inverter.

3.7 Disconnect the lithium battery

Step 1: Please turn OFF the Power switches on all lithium batteries.

Step 2: Please turn off all devices or chargers connected to the lithium battery.

Step 3: Please disconnect the cables between the negative pole of the lithium battery and the load or charger.

Step 4: Please disconnect the cables between the positive pole of the lithium battery and the load or charger.

Note: If you use the MCK display panel, you need to disconnect the network cable between the MCK and the lithium battery.

4. Battery maintenance

4.1 General description

- Before cleaning and maintaining the lithium battery, be sure to disconnect all loads and charging equipment from the lithium battery.
- Before cleaning and maintenance of the lithium battery, please put a protective cover on the terminal to prevent the risk of short circuit caused by contacting the terminal during cleaning and maintenance.



Do not try to open or disassemble the lithium battery!

4.2 Security check

- Check the connection point for loose or broken wires, cracks, deformation, leakage, or other types of damage. If the lithium battery is found to be damaged, it must be replaced in time. It is forbidden to charge or use damaged lithium batteries. Do not touch the liquid leaked from a ruptured lithium battery.
- In order to enable the BMS to calculate the SOC of the lithium battery more accurately and eliminate the cumulative error of the SOC, it is recommended to complete a full discharge (discharge to 0% SOC) and full charge (charge to 100% SOC) every 3 months.

4.3 Surface clean

If you need to clean the lithium battery, please wipe the outer surface of the lithium battery with a soft, dry cloth or paper towel. Do not use liquids, solvents or abrasive tools to clean lithium batteries.



Do not try to open or disassemble the lithium battery!

4.4 Not used for a long time

- If you don't use the battery for a long time, you need to turn the rocker switch on the MCK to "O", or turn the Power switch on the lithium battery to "OFF" to turn off the lithium battery to avoid damage caused by over-discharge of the battery.
- When the battery is not in use for a long time, it needs to be charged to 80% capacity regularly, and the charging cycle is required to be less than 3 months.

5. Storage

Please follow the storage instructions in this manual to increase the service life of the lithium battery during storage. If you do not follow the storage instructions in this chapter for storage, the lithium battery may be over-discharged and damaged. If the inspection reveals that the lithium battery is damaged, please do not try to charge or use it.

The environmental conditions of storage are detailed in Chapter 8

The storage self-discharge rate of lithium battery is less than 3%/month.



When storing the lithium battery, please press the Power switch to OFF. Please disconnect the Battery Switch or MCK from the lithium battery!

- Before storing the lithium battery, please charge the battery to 80% SOC
- Please disconnect all loads and chargers connected to the lithium battery.
- Please turn the Power switch to the OFF position, and disconnect the Battery Switch or MCK.
- Please cover the terminal protection cover.
- Every 3 months, please charge the battery to 80% SOC; after charging is completed, please turn the Power switch to the OFF position, and disconnect the Battery Switch or MCK.

6. Transportation

Before transporting lithium batteries, please check all local, national and international applicable laws and regulations.

In some cases, the transportation of scrapped, damaged or recalled lithium batteries may be specifically restricted or prohibited.

Lithium battery transportation belongs to the ninth category of dangerous goods in the UN3480 standard.

7. Disposal or Recycle

Please discharge the lithium battery to SOC 0% before discarding it. Please use electrical tape or other insulating tape to insulate the positive and negative poles of the battery to prevent short circuits.

Disposal and recycling of lithium batteries should comply with local, state, and federal laws and regulations. Lithium batteries can also be recycled to the manufacturer for disposal.

8. Specification

Model	M12-400
Cell type	LiFePO4
Rated capacity	400Ah
Rated power	5.12kWh
Rated voltage	12.8V
Charging voltage	14.0V~14.2V
Maximum charging current	200A
Continuous discharge current	200A
Maximum discharge current (15 minutes)	300A
Charging temperature range	-20°C~55°C
Discharge temperature range	-20°C~55°C
Storage temperature range (<1 month)	-40°C~45°C, 30%~80% SOC,<65% RH
Storage temperature range (<6 months)	-20°C~35°C, 30%~80% SOC,<65% RH
Operating humidity range	10%~90% RH
Dimensions	462mm*237mm*320.5mm
Weight	42.5kg
IP protection	IP20
Certifications	CB、UL、UN38.3
Shipping class	UN3480
Cycle life	>3000(200A discharge, 200A charge, DoD100%, @25°C)
Maximum number of parallel	4
Display unit	MCK (Optional)

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