FOX-ESS LV5200 Low Voltage Lithium Battery User Manual

Contents

1 FOX-ESS LV5200 Low Voltage Lithium Battery
2 Information
3 Product Introduction
4 Product Symbols
5 Product Safety
6 Product Information
7 Introduction
8 Symbols
9 Safety
10 Installation
11 Battery Module Specifications
12 Product Features
12.1 Installation
13 Tools
14 Installation Steps
15 Commissioning
16 Exclusion
17 Troubleshooting and Maintenance
18 Documents / Resources
18.1 References

FOX-ESS LV5200 Low Voltage Lithium Battery

Information

In order to prevent improper operation before use, please carefully read this manual. The user manual version is updated frequently, the latest version can be downloaded from the official website.

Table of Contents
1. Introduction
2. Symbols
3. Safety

Product Introduction

The document describes the installation, commissioning, maintenance, and troubleshooting of the following low-voltage battery listed below.

- **Battery Model:** LV5200
- **Battery Chemistry:** Lithium Iron Phosphate This manual is designed for qualified personnel only. The tasks described in this document should be performed by authorized and qualified technicians only. After installation, the installer must explain the user manual to the end user.

Product Symbols

Symbol	Explanation
CE mark	The inverter complies with the requirements of the applicable CE guidelines. This mark indicates compound UK prod uct safety certification requirements.
Caution, risk of electric shock.	Do not place nor install near flammable or explosive materials.
Install the product out of reach of children.	
Read the instruction manual before starting the install ation and operation.	
Do not dispose of the product with household wastes.	Recyclable.
Disconnect the equipment before carrying out mainte nance or repair.	
Observe precautions for handling electrostatic discharge sensitive devices.	
PE conductor terminal	
Caution, risk of electric shock, energy storage timed discharge.	

Product Safety

Any work on the batteries should be handled by authorized technicians. Therefore, technicians should familiarize themselves with the contents of this manual before any maintenance or installation is carried out on the system.

Product Information

Battery Module Specifications

Battery module	Nominal capacity (Ah)	Nominal voltage (Vdc)	Nominal energy (kWh)	Battery voltage range (Vdc)	Max. continuous discharging current (A)	Max. continuous charging current (A)	Recommended charging current (CC-CV) (A)	Charging cut-off current (constant current and constant voltage) (A)	Peak charging current (30s) (A)	Peak discharging current (30s) (A)	Cycle life	Discharge capacity (Ah)	Energy density (wh / kg)	Ingress protection	Communication	Weight (kg)	Dimensions (W * H * D) [mm]	Protective class
LV5200	100	51.2	5.12	43.2 – 57.6	100	100	100	5	105	150	-20 – 50	104	IP21	RS485/CAN	49	342*207*600	I	

Battery Charge/discharge Curve

Battery charge	Current protection Trigger
First level over the current	105A, Lasts 30s COC
Second level over current	125A, Lasts 1s COC2
Battery discharge	
First level over the current	110A, Lasts 300s
Second level over current	125A, Lasts 30s
Third level over current	155A, Lasts 1s

Introduction

- The document describes the installation, commissioning, maintenance, and troubleshooting of the following low-voltage battery listed below. LV5200
- The battery chemistry of this product is Lithium Iron Phosphate.
- This manual is designed for qualified personnel only.
- The tasks described in this document should be performed by authorized and qualified technicians only.
- After Installation, the Installer must explain the user manual to the end user.

Symbols

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	Recyclable.
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	Observe precautions for handling electrostatic discharge sensitive devices.

	PE conductor terminal
	Caution, risk of electric shock, energy storage timed discharge.

Safety

Any work on the Batteries should be handled by authorized technicians and hence it is understood that the technicians should familiarize themselves with the contents of this manual before any maintenance or installation is carried out on the system.

Handling

- Do not expose battery to open flame.
- Do not place the product under direct sunlight.
- Do not place the product near flammable materials. It may lead to fire or explosion in case of an accident.

- Store in a cool and dry place with ample ventilation.
- Do not store the product near water sources.
- Store the product on a flat surface.
- Store the product out of reach of children and animals.
- Do not damage the unit by dropping, deforming, impacting, cutting or penetrating with a sharp object. It may cause leakage of electrolytes or fire.
- Do not touch any liquid spilled from the product. There is a risk of electric shock or damage to the skin.
- Always handle the battery wearing insulated gloves.
- Do not step on the product or place any foreign objects on it. This can result in damage.
- Do not charge or discharge the damaged battery.
- Do not store the battery near water sources.

Installation

- Do not connect the LV5200 to inverter conductors or Photo-Voltaic conductors. This will damage the battery and may result in an explosion.
- After unpacking, please check the product for damages and missing parts.
- Make sure that the inverter and battery is completely turned off before commencing installation.
- Do not interchange the positive and negative terminals of the battery.
- Ensure that there is no short circuit of the terminals or with any external device.
- Do not exceed the battery voltage rating of the inverter.
- Do not connect the battery to any incompatible inverter.
- Do not connect different battery types together.
- Please ensure that all the batteries are grounded properly.
- Do not open the battery to repair or disassemble. Only the manufacturer is allowed to carry out any such repairs.
- In case of fire, use only a dry powder fire extinguisher. Liquid extinguishers should not be used.
- Install the batteries only inside the approved manufacturer enclosure. Installing the battery anywhere outside is strictly forbidden.
- Do not install the battery near water sources or places where the battery can get wet.
- Install the battery away from children or pets.
- Do not use the battery in a high static environment where the protection device might be damaged.
- Do not install with other batteries or cells.
- Batteries with different color labels cannot be connected in parallel.

Response to Emergency Situations
The battery can be used in single or multi in parallel. It is designed to prevent hazards or failures. However, manufacturer cannot guarantee their absolute safety. Under exposure to the internal materials of the battery the following recommendations should be carried out by the user.

- If there has been inhalation, please leave the contaminated area immediately and seek medical attention.
- If there has been contact with eyes, rinse the eyes with running water for 15 minutes and seek medical attention immediately.
- If there has been contact with the skin, wash the contacted area with soap thoroughly and seek medical

attention immediately.

- If there has been ingestion, induce vomiting and seek medical attention.

Fire Situation
In situations where the battery is on fire, if it is safe to do so, disconnect the battery pack by turning of the switch to shut off the power to the system. Use an FM-200 or Co2 fire extinguisher for the battery and an ABC fire extinguisher for the other parts of the system. Under any fire situation, please evacuate the people from the building immediately before trying to extinguish it.
Water Situation
The battery modules are not water resistant. Hence care should be taken not to get it wet. If you find the battery completely or partially submerged in water do not try to open. Contact authorized personnel or manufacturers for further instructions.

Product Information

LV5200 photovoltaic energy storage system is a 48V energy storage system based on a lithium-ion ferrous phosphate battery. It is equipped with a customized battery management system (BMS), which is designed for energy storage applications of household photovoltaic power generation users. In the daytime, the surplus power of photovoltaic power generation can be stored in the battery. At night or when necessary, the stored energy can be provided to the electrical equipment, it can improve the use efficiency of photovoltaic power generation, peak-load shifting, and provide emergency standby power.

Battery Module Specifications

Specifications for Battery		**Note**
Battery module	LV5200	
Nominal capacity (Ah)	100	0.5C, 25±2°C
Nominal voltage (Vdc)	51.2	
Nominal energy (kWh)	5.12	
Battery voltage range (Vdc)	43.2 – 57.6	
Max. continuous discharging current (A)	100	
Max. continuous charging current (A)	100	
Recommended charging current (CC-CV) (A)	100	
Charging cut off current (constant current and constant voltage) (A)	5	
Peak charging current (30s) (A)	105	
Peak discharging current (30s) (A)	150	
Cycle life	≥6000@25°C @90% DOD	
Storage temperature (°C)	-20 – 50	
Operating temperature range (°C)	Charge: 0 – 55 Discharge: -15 – 55	
Discharge capacity (Ah)	0°C±2 @ 1C @ 80% 25°C±2 @ 1C @ 100% 45°C±2 @ 1C @ 96%	
Energy density (wh / kg)	104	
Ingress protection	IP21	
Communication	RS485/CAN	
Weight (kg)	49	
Dimensions (W*H*D) [mm]	342*207*600	
Protective class	I	

Battery Charge/discharge Curve

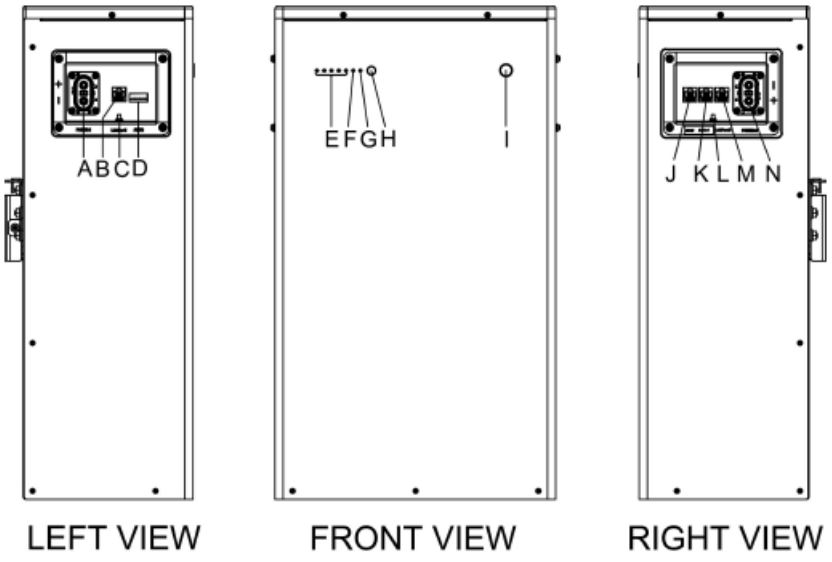
Current protection						
					Trigger	Recover
Battery charge	First COC	level	over	current	≥105A, Lasts 30s	≥60s: Recover
	Second level over current C OC2				≥125A, Lasts 1s	≥60s: Recover
Battery discharge	First DOC	level	over	current	≥110A, Lasts 300s	≥60s: Recover
	Second level over current D OC2				≥125A, Lasts 30s	≥60s: Recover
	Third SC	level	over	current	≥155A, Lasts 1s	≥60s: Recover

Product Features

Battery System Features
The batteries have been fitted with multiple protection systems to ensure the safe operation of the system.
Some of the protection system includes:

- **Inverter interface protection:** Over voltage, over current, external short circuit, reverse polarity, ground fault, over temp, in rush current.
- **Battery Protection:** Internal short circuit, over voltage, over current, over temp, under voltage. The battery system contains the following Interface to allow it to connect and operate efficiently.

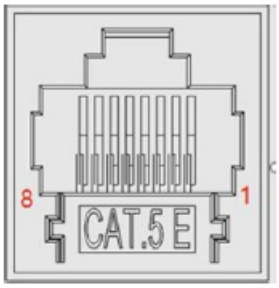
Battery interface:



Object	Description	Object	Description
A	POWER-1	H	Start button
B	LinkPort1	I	Power switch
C	Ground screw	J	CAN
D	Add switch	K	RS485/CAN
E	SOC LED	L	Ground screw
F	Alarm LED	M	LinkPort0
G	Running LED	N	POWER-2

Communication parallel interface (Link Port0, Link Port1, RS485) and communication interface to inverter (CAN/RS485)

- LV5200 has two 485 communication units in series operation, one for master control and one for slave control.
- Network interface description: Link Port0 is connected to the upper battery module, Link Port1 is connected to the lower battery module. CAN / RS485 is the communication interface to the inverter. The interface is defined as follows:



Pin configuration is as follows:
Link Port0

Pin	Function definitions	Function declaration
1	B	RS485-B
2	A	RS485-A
3	GND	GND
4	NC	NC
5	NC	NC
6	GND	GND
7	A	RS485-A
8	B	RS485-B

Link Port1

Pin	Function definitions	Function declaration
1	B	RS485-B
2	A	RS485-A
3	GND	GND
4	NC	NC
5	NC	NC
6	GND	GND
7	A	RS485-A
8	B	RS485-B

RS485

Pin	Function definitions	Function declaration
1	B	RS485-B
2	A	RS485-A
3	GND	GND
4	NC	NC
5	NC	NC
6	GND	GND
7	A	RS485-A
8	B	RS485-B

CAN

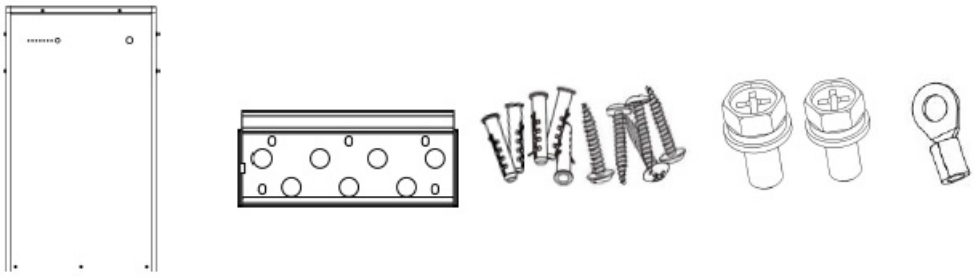
Pin	Function definitions	Function declaration
1	NC	NC
2	GND	GND
3	NC	NC
4	CANH	CANH
5	CANL	CANL
6	NC	NC
7	NC	NC
8	NC	NC

Earth Terminal
This terminal is used to connect the battery to the earth for safety purposes.
Handle
The handle is used to carry or move the battery.
Power Terminal
A set of positive and negative terminals to connect the battery to the inverter. When you are unplugging the wires from the terminals, make sure you press the lock button and then pull it. When installing the plug, do not press the button and push the plug until you hear a click sound.
In addition to the above physical features, the battery has the following performance:

1. 90% Depth of Discharge;
2. Cycle life ≥6000 cycles.

Installation

Items in the package
Please check if following items are including with the package:



Object	Quantity	Description	Note
A	1	Battery	In the Battery Package
B	1	Bracket	
C	5	Expansion Tubes& Expansion Screws	
D	2	Hexagonal Screws	
E	1	Earth Terminal	
F	1	Power Line(0.5m)	
G	1	Communication Network Cable (0.5m)	
H	1	Ground Wire(0.5m)	
I	1	Quick Installation Guide	
Object	**Quantity**	**Description**	**Note**
J	1	Power Line(2m) （Battery to Inverter)	Accessory Package 1
K	1	Communication Network Cable(3m) (Inverter to Battery)	

L To match the different inverters, our accessory packs are differentiated, so please look at the wire markings on the white sleeves before wiring.

L-1

RS485 (Inverter side)

Please plug into the RS485 port of the inverter.

RS485 (Battery side)

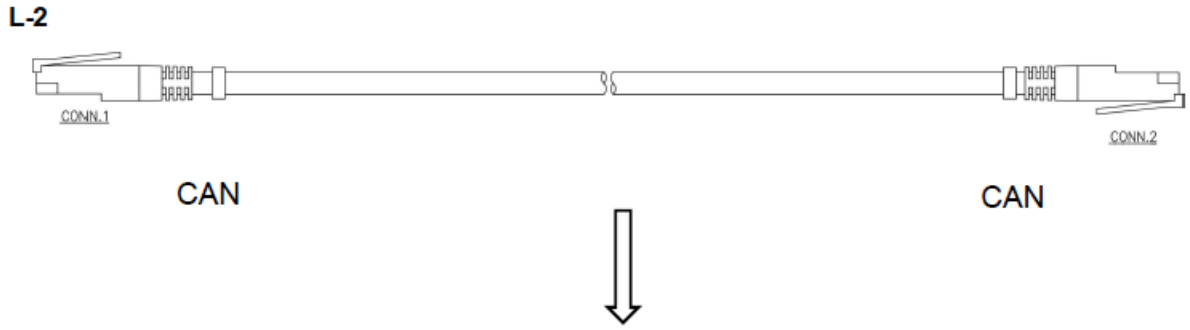
Please plug into the battery RS485 port.

RS485 (Inverter side) Pin definition:

Pin	1	2	3	4	5	6	7	8
Definition	NC	NC	RS485-B	12V	RS485-A	NC	NC	GND

RS485 (Battery side) Pin definition:

Pin	1	2	3	4	5	6	7	8
Definition	RS485-B	RS485-A	GND	NC	NC	GND	RS485-A	RS485-B



One end is plugged into the inverter CAN port, the other end into the battery CAN port.

CAN (Inverter side) Pin definition:

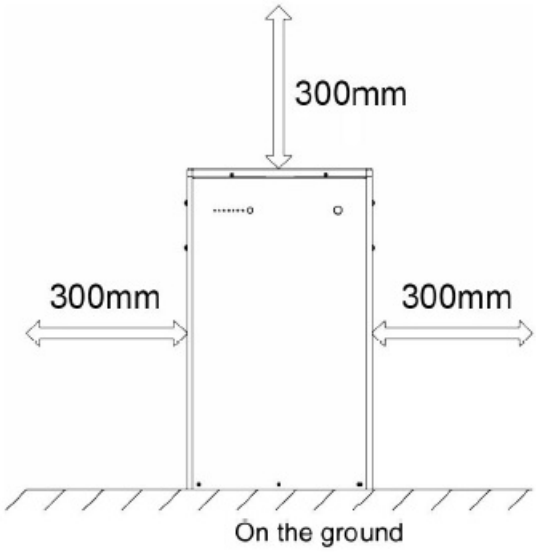
Pin	1	2	3	4	5	6	7	8
Definition	NC	GND	NC	CANH	CANL	NC	NC	NC

CAN (Battery side) Pin definition:

Pin	1	2	3	4	5	6	7	8
Definition	NC	GND	NC	CANH	CANL	NC	NC	NC

1. Use only the parts included with the battery pack to ensure proper installation. If anything is damaged or missing, please contact your distributor.
2. Package 1 is provided separately, not including in battery package. Please contact your distributor if you do not have it. Also you will receive L-1 or L-2 in package 1 .
3. Select an interface (CAN/RS485) based on the actual inverter interface type.
4. If the definition of the communication port from your inverter to the battery is different from all of the above, please make your own communication cable.

Clearance



Position	Min size
Left	300mm
Right	300mm
Top	300mm
Bottom	On the ground

Make sure to leave a space of at least 30 cm. A clearance of at least 30 cm must be left around the battery pack for proper cooling.
Note: Make sure that the battery pack is always exposed to the ambient air. The battery pack is cooled by natural convection. If the battery pack is entirely or partially covered or shielded, it may cause the batter ypack to stop operating.

Tools

The following tools will be required to install the battery.

Screw driver

Crimping modular

Safety shoes

Safety gloves

Safety goggles

Plier

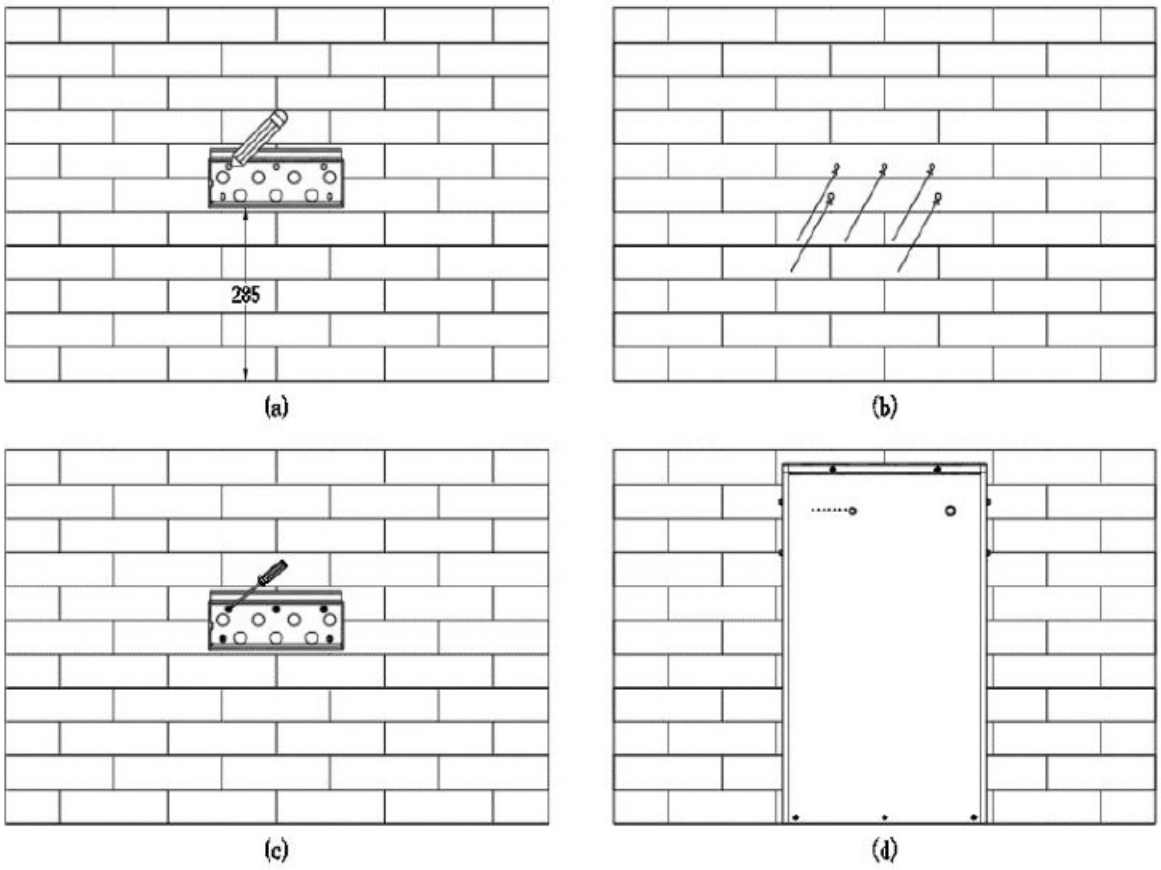
Spanner

Multimeter

Ribbon

Installation Steps

Mounting

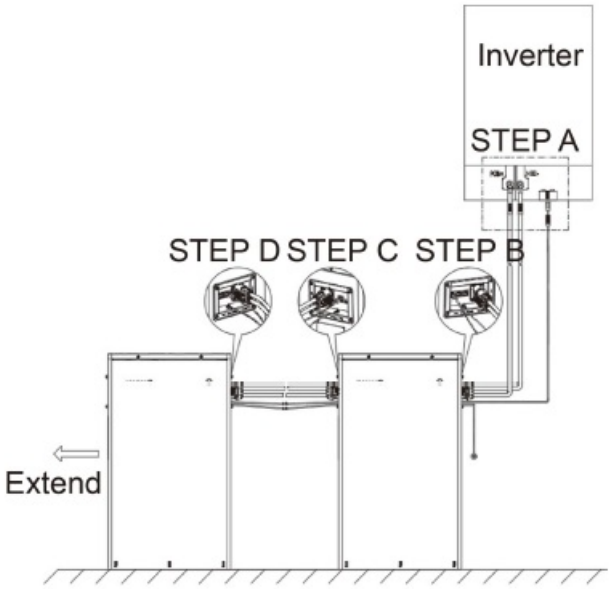


- **STEP-1**

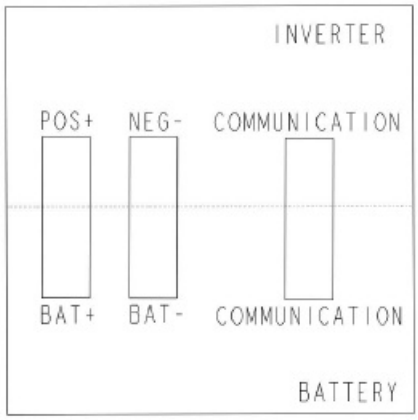
Measure and confirm that the bottom of the bracket is 285mm away from the ground, and mark the 5-hole positions on the bracket with a pen.

- **STEP-2**
  Drill holes with electric drill, make sure the holes are deep enough (at least 50mm) for installation, and then tighten the expansion tubes.
- **STEP-3**
  Install the expansion tubes in the holes, and tighten them. Then install the wall bracket by using the expansion screws.
- **STEP-4**
  Hang the battery over the bracket, move the battery close to it, lower the battery, and make sure the 2 mounting bars on the back are fixed well with the 2 grooves on the bracket.

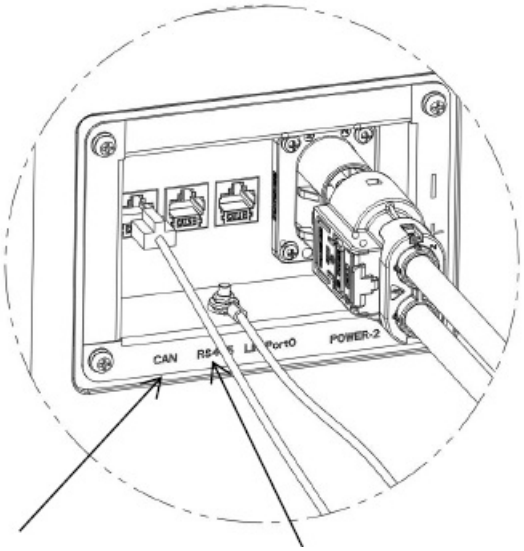
Wiring



- **STEP A**
  Connect BAT + to POS +, BAT – to NEG – respectively. Connect the battery communication network cable to the lithium battery communication port of the inverter.



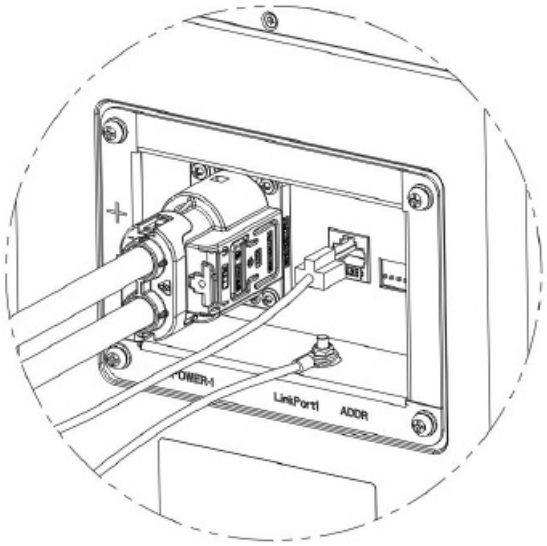
- **STEP B**
  Plug the power plug into any output socket on the left or right of the battery. Connect the communication network cable to the CAN interface of the battery, connect the ground terminal of the battery with the ground wire, and lock the nut.



- Select an interface (CAN/RS485) based on the actual inverter interface type. Please choose L-1 or L-2.
- Parallel multiple batteries, please refer to the following steps.

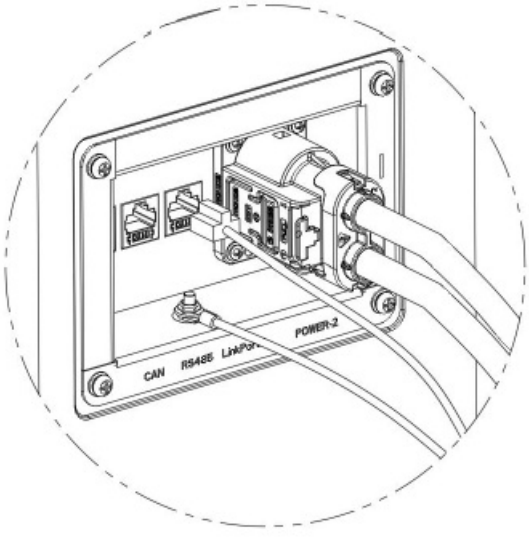
- **STEP C**

  Plug the power line of the parallel battery into the remaining output socket, insert the communication line of the parallel battery into LinkPort1, and lock the ground nut.



- **STEP D**

  Plug the power line of the parallel battery into the remaining output socket, insert the communication line of the parallel battery into LinkPort0, and lock the ground nut.



- **STEP E**

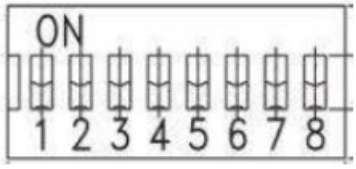
Repeat STEP C through STEP D to insert more batteries (up to 12 batteries).

System Start up

- When connected to the inverter, turn on the battery first to ensure that the battery voltage output is normal, then turn on the inverter.
- All installation and operation must comply with local electrical standards.
- Check all power cables and communication cables carefully.

Turn on the POWER

- **switch Dial address selection:** Definition of address switch for parallel batteries: When the battery pack is connected with multiple batteries in parallel, the address switch can be used to distinguish different pack addresses. The hardware address can be set by the address switch on the board. Addresses 1, 2, 3, and 4 represent the online number of batteries (only the host needs to be configured), 5, 6, 7, and 8 represent the slave address. The slave address needs to be continuous, and can support up to 12 batteries in parallel.
  Single battery address setting: 0001 0000
  Parallel batteries address setting: refer to the table below for the definition of address switch. For example, three batteries are in parallel, and the address switch example is as follows:
  Master dial: 0011 0000, slave 1 dial: 0000 0001, slave 2 dial: 0000 0010



Number of batteries	Master	Slave 1	Slave 2	Slave 3	Slave 4	Slave 5	Slave 6	Slave 7	Slave 8	Slave 9	Slave 10	Slave 11
1	0001 0000											
2	0010 0000	0000 0001										
3	0011 0000	0000 0001	0000 0010									
4	0100 0000	0000 0001	0000 0010	0000 0011								
5	0101 0000	0000 0001	0000 0010	0000 0011	0000 0100							
6	0110 0000	0000 0001	0000 0010	0000 0011	0000 0100	0000 0101						
7	0111 0000	0000 0001	0000 0010	0000 0011	0000 0100	0000 0101	0000 0110					
8	1000 0000	0000 0001	0000 0010	0000 0011	0000 0100	0000 0101	0000 0110	0000 0111				
9	1001 0000	0000 0001	0000 0010	0000 0011	0000 0100	0000 0101	0000 0110	0000 0111	0000 1000			
10	1010 0000	0000 0001	0000 0010	0000 0011	0000 0100	0000 0101	0000 0110	0000 0111	0000 1000	0000 1001		
11	1011 0000	0000 0001	0000 0010	0000 0011	0000 0100	0000 0101	0000 0110	0000 0111	0000 1000	0000 1001	0000 1010	
12	1100 0000	0000 0001	0000 0010	0000 0011	0000 0100	0000 0101	0000 0110	0000 0111	0000 1000	0000 1001	0000 1010	0000 1011

Note: “1”indicates that the Dip switch is “ON”, “0” indicates that the Dip switch is “OFF”. And it also indicates the position of the Dip switch. For example, “0001 0000” indicates that the 4th Dip switch is “ON” the rest are all “OFF”.

1. Please change the address switch in the right position accordingly base on the system battery quantity before power on battery.
2. After pressing the power switch for 1s, all LEDs will be on and flashing, which indicates that the battery is started normally. After pressing the start button for 3s, the battery will turn on the discharge function.

Commissioning

There are seven LED indicators on the front of the battery packs to show its operating status.
Fault status indicated by indicator:

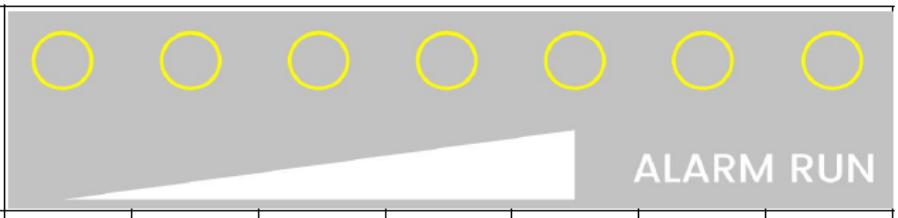
- ● Off
- ○ On
- ◐ Flash

1. The RUN indicator blinks and the ALARM indicator is off: The battery is running.

Status	Description	ALARM					RUN	
CHARGE	0%=SOC	●	●	●	●	●	●	◐
	0%≤SOC≤20%	◐	●	●	●	●	●	◐
	20%≤SOC≤40%	○	◐	●	●	●	●	◐
	40%≤SOC≤60%	○	○	◐	●	●	●	◐
	60%≤SOC≤80%	○	○	○	◐	●	●	◐
	80%≤ SOC < 100%	○	○	○	○	◐	●	◐
	SOC = 100%	○	○	○	○	○	●	◐
DISCHARGE & STAND BY	0%≤SOC≤20%	●	●	●	●	●	●	◐

	20%≤SOC≤40%	○	●	●	●	●	●	◐
	40%≤SOC≤60%	○	○	●	●	●	●	◐
	60%≤SOC≤80%	○	○	○	●	●	●	◐
	80%≤SOC≤90%	○	○	○	○	●	●	◐
	90%≤SOC≤100%	○	○	○	○	○	●	◐

2. RUN indicator Steady on: The device is powered off or the battery is faulty and cannot be charged or discharged.

Status	Description							
Fault	ADC/AFE Fault	◐	●	●	●	●	○	○
	High Voltage Fault	●	◐	●	●	●	○	○
	Low Voltage Fault	◐	◐	●	●	●	○	○
	High Temperature	●	●	◐	●	●	○	○
	Low Temperature	◐	●	◐	●	●	○	○
	Over Current	●	◐	◐	●	●	○	○
	Temperature Difference Alarm	◐	◐	◐	●	●	○	○
	Leakage Fault	●	●	●	◐	●	○	○

	Parallel Communication Fault/ADD Fault	●	◐	●	◐	◐	○	○
	Precharge Fault	◐	◐	●	◐	◐	○	○
	Discharge/ Charge Fault	●	●	◐	◐	◐	○	○

Exclusion

The warranty shall not cover the defects caused by normal wear and tear, inadequate maintenance, handling, storage faulty repair, modifications to the battery or pack by a third party other than manufacturer or manufacturer agent, failure to observe the product specification provided herein or improper use or installation, including but not limited to the following.

- Damage during transport or storage.
- Incorrect Installation of battery into pack or maintenance.
- Use of battery pr pack in inappropriate environment.
- Improper, inadequate, or incorrect charge, discharge or production circuit other than stipulated herein.
- Incorrect use or inappropriate use.
- Insufficient ventilation.
- Ignoring applicable safety warnings and instructions.
- Altering or attempted repairs y unauthorized personnel.
- In case of force majeure (ex: lightning, storm, flood, fire, earthquake, etc.).
- There are no warranties implied or express other than those stipulated herein. the manufacturer shall not be liable for any consequential or indirect damages arising or in connection with the product specification, battery or pack.

Troubleshooting and Maintenance

Maintenance

1. It is recommended that the battery storage time is not more than 6 months.
2. It is required to charge the battery at least once every 6 months, for this charge maintenance make sure the SOC is charged to higher than 70% In the condition of 90% charging. It is recommended that the customers use a low-voltage inverter and fill the battery every half month, otherwise, the SOC will deviate.
3. Every year after installation. The connection of the power connector, grounding point, power cable, and screw are suggested to be checked. Make sure there is no loose, no broken, no corrosion at the connection point. Check the installation environment such as dust, water, insects etc. Make sure it is suitable for the IP21 battery system.

Troubleshooting

When the red/green LED on the panel is flashing or normally on, it does not mean that the LV5200 is abnormal, it may be just an alarm or protection. Please check the ‘LED status indicators’ in Chapter 7 for the detailed faulty definition before any troubleshooting steps. In general, the alarm indication is normal without manual intervention.

When the alarm-triggering state is removed, LV5200 will automatically return to normal use.
Problem determination based on the following points

1. Whether the green light on the power switch is on;
2. Whether the buzzer in BMS is on;
3. Whether the battery system can be communicated with inverter;
4. Whether the battery can be output voltage or not.

Preliminary determination steps

1. The battery system cannot work, when DC is switched on and the POWER is on, the LED doesn't light up or flash, please consider contacting the local distributor.
2. The LED display of BMS is normal, but it cannot charge and discharge. Observe the display screen of the inverter and there is no SOC. Please check whether the RS485 communication between BMS to inverter is well connected. If the connection is good, please replace a RS485 communication cable. If the SOC is still not visible on the inverter display screen, please contact the local distributor.
3. After the battery system is powered on, if you can see the alarm information on the LED and inverter display screen at the same time, please contact the local distributor.

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In order to prevent improper operation before use, please carefully read this manual. The user manual version is updated frequently, the latest version can be downloaded from the official website.

Documents / Resources

User Manual LV5200	FOX-ESS LV5200 Low Voltage Lithium Battery [pdf] User Manual LV5200 Low Voltage Lithium Battery, LV5200, Low Voltage Lithium Battery, Voltage Lithium Battery, Lithium Battery, Battery

References

- Welcome to Fox – High Performance Inverters, Chargers & Batteries