

OPERATION AND MAINTENANCE MANUAL

<https://www.kon-tec.eu/>

LITHIUM IRON PHOSPHATE
LIFEPO₄ BATTERY PACK

51,2 V 100 Ah

KT-LFPES512100



1. Safety Warning

1.1 Safety precautions



Warning

If fail to follow the precautions described may cause serious personnel injury or property damage.

● Explosion risk

- Do not impact the battery with heavy objects.
- Do not squeeze or pierce the battery pack.
- Do not throw the battery pack into the fire.

● Fire risk

- Do not expose the battery pack to the condition over 55°C.
- Do not put the battery near a heat source, such as a fireplace.
- Do not expose the battery pack to direct sunlight for a long time.
- Do not allow the positive and negative connectors of the battery to connect the conductive objects at the same time.

● Electric shock risk

- Do not allow non-technical personnel to disassemble the battery pack.
- Do not touch the battery pack with wet hands.
- Do not expose the battery pack to moisture or liquid environment.
- Do not mix batteries from different manufacturers or different kinds, types or brands.

● Damage risk

- Do not allow the battery to contact with liquid, short-circuit or reverse the positive and negative terminals of the battery.
- Do not use chargers or charging devices unapproved by the manufacturer to charge the battery.
- Do keep clear on top of the battery pack.

1.2 Wearable device

It is strongly recommended to wear the following safety equipment when installing and handling the battery pack.



Insulated gloves



Safety Glasses



Safety Shoes

1.3 Other Tips

- All the product are strictly inspected before shipment, please contact us for replacement if you notice there's any defectives such as swelling.
- Do not disassemble batteries and components; otherwise the manufacturer will not be responsible for any damage caused by unauthorized disassembly or repair.
- Do enable the battery to be safely grounded before use to make sure the system in safe and normal operation.
- Please ensure that the electric parameters of these devices are compatible mutually before connecting the battery to other devices.
- Please take the environmental factors into careful considerations to ensure that the system can work in a suitable condition as the environment and storage methods have a certain impact on the service life and reliability of this product.

1.4 Emergency safety measures

Water invasion: Please cut off the AC power supply of the system first and then disconnect all switched under the premise of ensuring safety.

Electrolyte or gas leakage: Please avoid contacting with the liquid or gas leakage if the electrolyte of battery pack leaks. While if you have been exposed to leakages, please take these steps immediately:

Gas Inhalation: Evacuate the people in the contaminated area and seek medical aid as soon as possible.

Eye Contact: Flush your eye with clean and flowing water for 15 min, and seek medical aid as soon as possible.

Skin Contact: Thoroughly rinse the exposed area with soap and water to be sure no chemical or soap is left on them, and seek medical aid as soon as possible.

Swallowing: Try to induce vomiting, seeks medical aid as soon as possible immediately.

Fire: Please use carbon dioxide fire extinguisher rather than liquid to put out fires.

2. Product Overview

2.1 Background

The lithium-ion battery KT-LFPES512100 adopts advanced LiFePO4 technology so the battery module has multiple advantages of long cycle life, compact structure, light weight, stable performance, which is widely used in the various environment. The system is integrated with smart battery management system and monitor module to meet the unattended requirements, which is very suitable for the field of backup power supply, such as PV energy storage, Micro base station, UPS, etc.

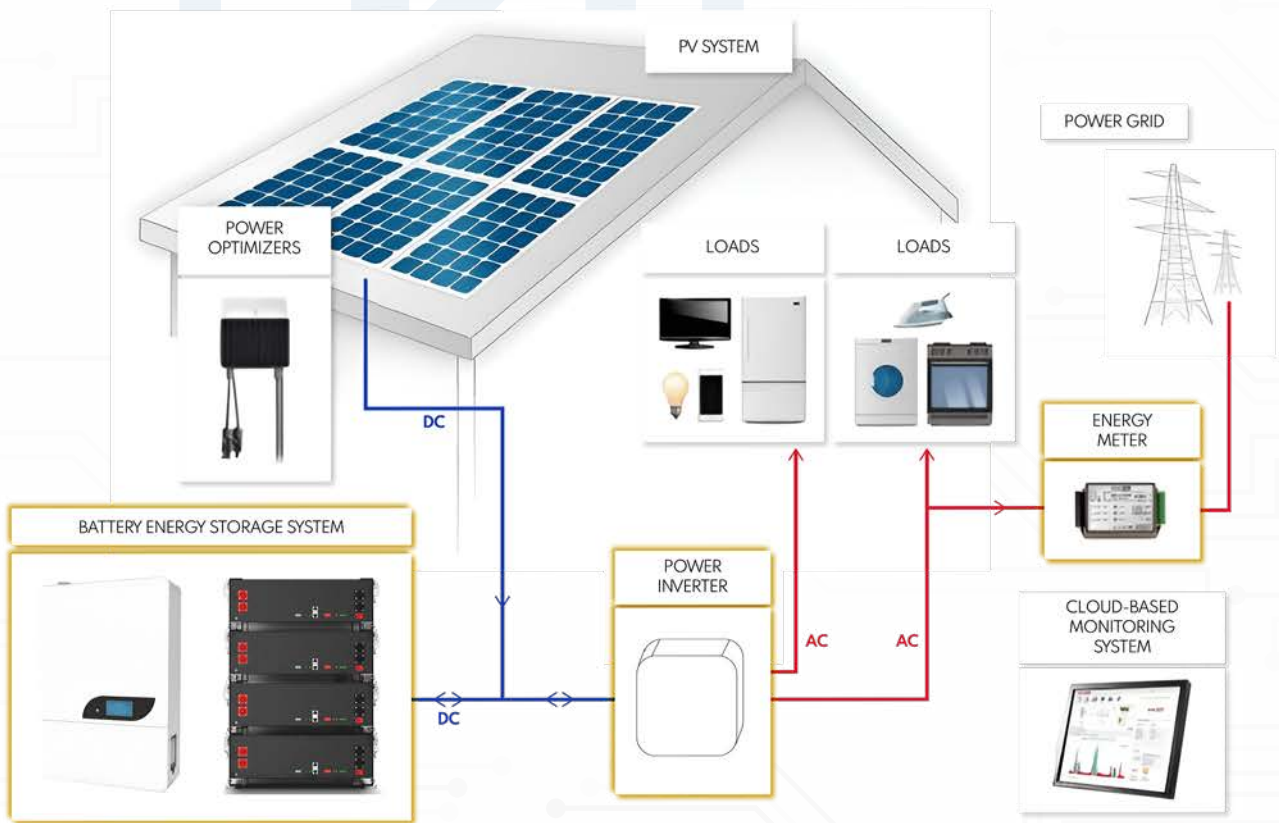
2.2 Product features

- Adopt high performance LFP cells with long lifespan, high safety and wide temperature range.
- With high energy density, compact structure, light weight, and no pollution.
- Built-in BMS with the management functions to battery voltage, current, temperature and battery health.
- With LED display for SOC and operating status, which is easy to read battery status.
- With Communication interface, there're RS485 and CAN by default.
- Use smart balancing module to ensure the consistency of battery and to extend the service life.
- With intelligent design to conform to the national standard requirements, and support for remote measurement, remote communication, remote control, remote adjustment.
- With optional heating function to be used in extremely low temperature area.
- With long lifespan of floating charge, stable performance and maintenance-free.
- With ultra-low consumption of BMS, self-discharge rate and capacity loss rate.
- Equipped with BMS secondary protection function and ultra-high system reliability

2.3 Principle

After starting the system, when the inverter works at on-grid mode, the photovoltaic solar energy will give priority to supply the load if the photovoltaic is sufficient; if there is any surplus, it can be used to charge the battery first; and for more surplus, it will be fed back to the grid. If the photovoltaic solar energy is insufficient or at night, it will automatically switch to the battery to deliver electric power to the load and when it run out of energy also, the excess power will be supplied by the grid.

When the inverter works at off-grid mode, both the load and battery are charged by photovoltaic solar energy during the day, and the load will be supplied by the battery at night. Below is the overall framework of the system:



3. Product description

3.1 Basic parameters

See the basic parameter of KT-LFPES512100 lithium battery as table 3-1:

Table 3-1 Specification

Parameter	Model
Nominal Voltage (V)	51.2
Nominal Capacity (Ah)	100.0
Energy (KWh)	5.12
Width (mm)	442.0±2
Height (mm)	177.5±2
Depth (mm)	450±2
Weight (kg)	~47kg

3.2 Interface definition

See the interface description of KT-LFPES512100 series lithium battery as table 3-2, please note the position of the corresponding interface varies from model to model but with same definition is same.

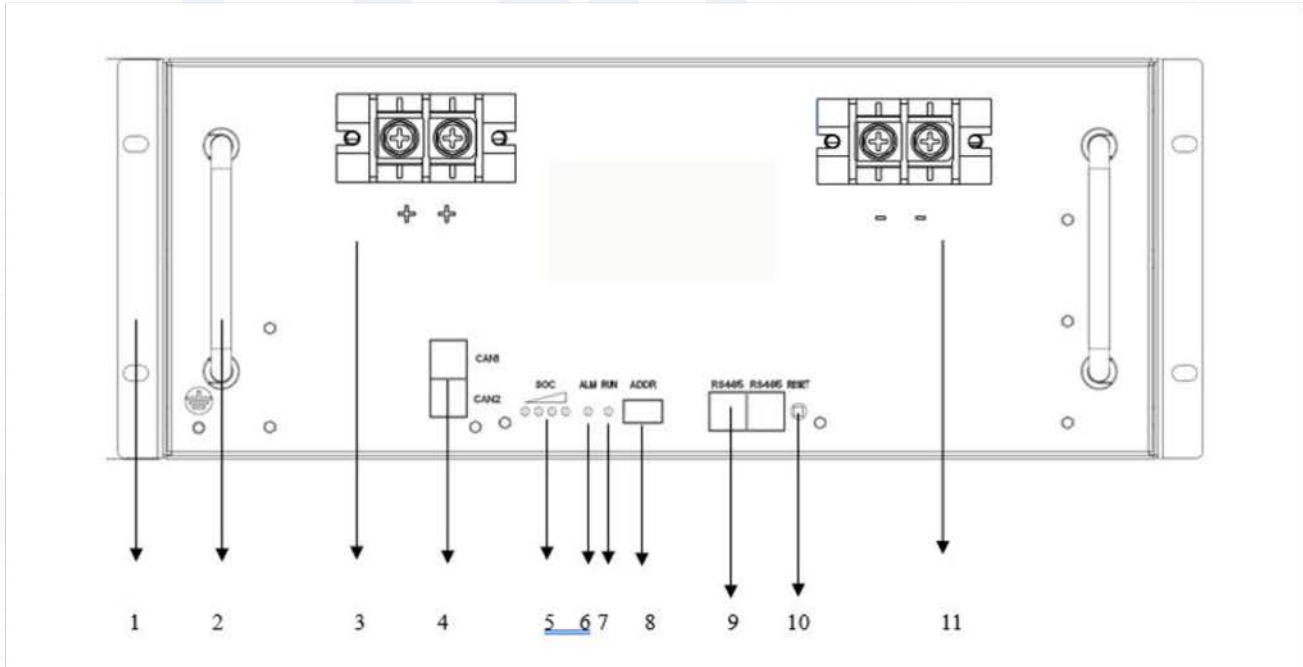


Table 3-2 interface description

No.	Items	Usage description	Remark
1	Mounting ear	Used to fix with the rack or cabinet	
2	Handles	For the handling, installation and disassembly of battery	
3	Positive terminal	Used to connect the charger or the positive of the load device	2Pin
4	CAN communication	For the connection of internal CAN communication	See Table3-3
5	LED indicator *4	Used to indicate the remaining capacity of the battery	See Table 3-6
6	ALM	Used to indicate the battery abnormality	See Table 3-6
7	RUN	Used to indicate the operating status of the battery	See Table 3-6
8	Dial switch address	Used to set the address bit of battery module when multiple batteries are connected in parallel.	See Table 3-5
9	RS 485 communication	Used to connect with inverter or upper computer	See Table 3-3
10	Reset	For manual switch, reset or other operations in the system	See Table3-4

11	Negative terminal	Used to connect the charger or the negative of the load device	2Pin
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Table 3-3 Communication PIN description

PIN No.	RS485	CAN
1	RS485_A	CAN_L
2	RS485_B	CAN_H
3	NC	SGND
4	NC	NC
5	NC	NC
6	NC	SGND
7	RS485_B	CAN_H
8	RS485_A	CAN_L

Table 3-4 Button description

Activate	When the BMS is in dormancy mode, press and hold the button for 2s and release it. It will back to normal situation after the LED indicators light up in turn.
Dormancy	When the BMS is in active state, press and hold the button for 3s and release it. It will back to normal situation after the LED indicators light up in turn.
Reset	When the BMS is in standby or working mode, press and hold the button for 6s and release it, and the BMS will be reset, the system restart.

Table 3-5 Dial switch address

No.	Dial switch address						RS485	CAN
	#1	#2	#3	#4	#5	#6		
0	OFF	OFF	OFF	OFF	See table 3-5-2	Pack 0	Invalid	
1	ON	OFF	OFF	OFF		Pack 1	Master	
2	OFF	ON	OFF	OFF		Pack 2	Slave	
3	ON	ON	OFF	OFF		Pack 3	Slave	
4	OFF	OFF	ON	OFF		Pack 4	Slave	
5	ON	OFF	ON	OFF		Pack 5	Slave	
6	OFF	ON	ON	OFF		Pack 6	Slave	
7	ON	ON	ON	OFF		Pack 7	Slave	
8	OFF	OFF	OFF	ON		Pack 8	Slave	
9	ON	OFF	OFF	ON		Pack 9	Slave	

Note: The BMS of master pack does not support to connect the inverter and the host computer at the same time, otherwise it will occur the communication errors.

Baud rate/ Compatible inverter	#5	#6
250Kbps/ Victron	0	0
500Kbps/ Victron	1	0
Goodwe/Sungrow/Solis/Deye	0	1
SMA/STUDER/Sofar	1	1

Table 3-6 LED indicator description

Mode	Normal/Alarm/Protection	RUN	ALM	LED indicator				description
		●	●	●	●	●	●	
Shutdown	Dormancy	OFF	OFF	OFF	OFF	OFF	OFF	ALL OFF
Standby	Normal	FLASH1	OFF	According to battery state of charge				Standby
	Warning	FLASH1	FLASH3					Low voltage
Charge	Normal	ON	OFF	According to battery state of charge(highest SOC LED: FLASH2)				All alarm except the over charge
	Warning	ON	FLASH3					
	Over-current	OFF	ON	OFF	OFF	OFF	OFF	Stop charging
Discharge	Normal	FLASH3	OFF	According to battery state of charge				
	Warning	FLASH3	FLASH3					
	Under voltage	OFF	FLASH3	OFF	OFF	OFF	OFF	Stop charging
	Over current, short circuit	OFF	ON	OFF	OFF	OFF	OFF	Stop charging
Temperature	Protection	OFF	ON	OFF	OFF	OFF	OFF	Stop charging/discharging
Failure	Cell failure NTC failure Sensor failure MOS failure Charger HV failure	OFF	ON	OFF	OFF	OFF	OFF	Stop charging/discharging

Status		Charge				Discharge			
Capacity indicator		L4 ●	L3 ●	L2 ●	L1 ●	L4 ●	L3 ●	L2 ●	L1 ●
SOC (%)	0~25%	OFF	OFF	OFF	FLASH2	OFF	OFF	OFF	ON
	25~50%	OFF	OFF	FLASH2	ON	OFF	OFF	ON	ON
	50~75%	OFF	FLASH2	ON	ON	OFF	ON	ON	ON
	75~100%	FLASH2	ON	ON	ON	ON	ON	ON	ON
Running indicator ●		ON				FLASH (FLASH3)			

FLASH	ON	OFF
FLASH1	0.25S	3.75S
FLASH2	0.5S	0.5S
FLASH3	0.5S	1.5S

3.3 Performance Specification

Items	KT-LFPES512100	
Rated voltage	51.2V	
Voltage range	40.0~57.6V, Shipping voltage>51.2V	
Charge voltage	56.0V	
Float charge voltage	54.6V	
Inverter/Load Cut-off	49.0V	
Low Voltage Disconnect	48.0V	
Nominal energy	5.12KWh	
Nominal capacity	100Ah	
Standard charge current	≤50A	
Max. charge current	50A	
Standard discharge current	≤50A	
Max. discharge current	Auto adjust when communicating 100A(No communication, ≤35°C)	
Peak discharge current	<120A@15s	
Communication	RS485 /CAN	
Operation temperature ¹	Charge: 0~45°C Discharge:-10~55°C	
Storage temperature	0°C<T<30°C	< 6 months
	-10°C<T<45°C	< 3 months
	Recommended environment	15~35°C, 5~75%RH



Attention

The battery pack will stop working when the ambient temperature exceeds the operating range, so the recommended working temperature range is 15°C to 35°C. Frequently used in the severe environment will deteriorate its performance and cycle life.

3.4 Protection

Items	Description	Remark
Cell/PACK high-voltage	When charging, the system will stop charging if any cell or PACK voltage reach the protection value and it will be released only when both Pack and cell voltage back to the release voltage range.	Automatic recovery
Cell/PACK low-voltage	When discharging, it will reach over-discharged protection of battery to stop discharging if any cell or PACK voltage is under the protection value and it will be released only when all the cell voltage back to the release voltage range.	Can Automatic recovery. Please charge timely, otherwise it may be in Low-power mode to be over-discharged.
High temperature	When the battery cell, MOS, and ambient temperature are higher than the set value, the system will stop charging or discharging according to the category, or disconnect at the same time.	Automatic recovery
Low temperature	When the battery cell, MOS, and ambient temperature are higher than the set value, the system will stop charging or discharging according to the category, or disconnect at the same time.	Automatic recovery
Charge overcurrent	When the charging current is higher than the protection value, the system will stop charging. And it will release from the protection when the system delays after rated time. Please note the maximum charging current provided by power supply should not exceed the protection value when using the battery.	Automatic recovery. If locked after three consecutive times, manual intervention is required.
Overload	When the discharging current is higher than the protection value, the system will stop discharging. And it will release from the protection when the system delays after rated time. Please note the maximum discharging current requested by the load should not exceed the protection value when using the battery.	Automatic recovery. If locked after three consecutive times, manual intervention is required.
Short-circuit/Reversed Polarity	Do not short-circuit	Release from protection when

		removing the load or charging the battery
Temperature, Voltage, Current Abnormal	Enter the failure mode, switch off the circuit breaker, no charging and discharging.	Manual intervention
dormancy mode	After reaching a certain condition, it will be in the dormancy mode	Recoverable

4 Installation and Usage

4.1 Installation preparation

4.1.1 Safety regulations

Only qualified professionals are allowed to carry out the installation, operation and maintenance of KT-LFPES512100 series lithium batteries. Please read this manual and specs carefully before the installation, be familiar with this equipment. During the installation process, please strictly follow the local safety regulations and related operating procedures, and pay attention to the following points:

1. Confirm the inverter is produced by formal manufacturer and compatible with the lithium battery, and check whether the parameters meet the requirements of section 3.3.
2. Please ensure all devices are shut-down before installation, and follow the manufacturer's specifications and warnings.
3. Confirm the cable specs meet the requirements with neat wiring layout to avoid being exposed of these cables when operating the power equipment.
4. Ensure the battery and the power system are reliably grounded during installation.

4.1.2 Environment requirement

The operating environment shall meet the following requirements:

Category	Description
Working temperature	-10°C-55°C 15°C-35°C (optimal temperature)
Relative humidity	5%~90%, No condensation
Altitude	<3000m
On-site requirement	Keep away from heat, direct sunlight; No corrosive, explosive, or flammable gas; No conductive dust that will damage the insulation; Completely isolated from water, and no flammable or explosive materials nearby.

4.1.3 Installation Tools

Installation Tools & details	
Screwdriver (slot, cross)	Multi-meter
Wrench	Clamp meters
Diagonal pliers	Insulating tape
Needle nose pliers	Thermometer (observe the installation environment)
Clamping pliers	Anti-static bracelet
Wire stripper	cable ties

4.1.4 Safety Tips

Please equip with a self-contained breathing apparatus and carbon dioxide fire extinguisher that meets regional/international standards in the vicinity of where the lithium battery placed to make sure the safety.

4.2 Unpack

4.2.1 Unpack precautions

- Please load and unload it in accordance with the specified requirements to prevent sun and rain when you receive the equipment.
- Please check and confirm the goods (such as quantity, package appearance, etc.) according to the "delivery list" before unpacking.
- Do light take and put during unpacking process to protect the surface coating of the object;
- Please record and feedback to the manufacturer if the inner packing is damaged after unpacking.

4.2.2 Packing list

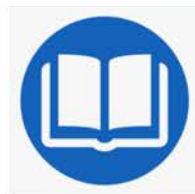
One carton contains the items listed below, please check carefully after unpacking.



Battery



Communication(optional)



Paper/E-User Guide



Factory report & List

4.3 Installation

4.3.1 Installation check

Please check again by on-site personnel on the following conditions or equipment whether meet the requirements before installation:

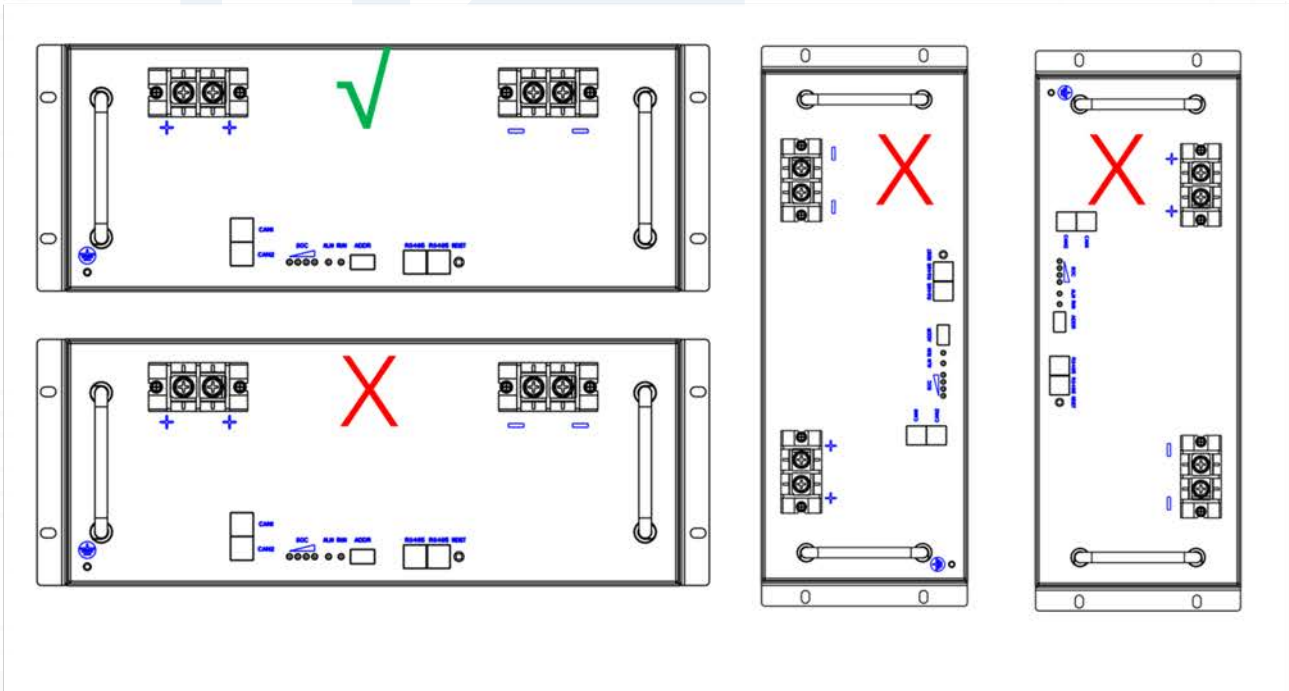
- Check if there's enough space for installation, and if the load-bearing capacity of the bracket or cabinet meets the weight requirements
- Check whether the power cable used meets the maximum current requirement for operation;
- Check whether the overall layout of power supply equipment and batteries at the construction site is reasonable;
- Check whether the installer is wearing anti-static wristband
- Check whether there're two people on the construction site for installation work
- Check if there's potential risks at location of installation site, e.g. flooding, sun exposure, corrosion, and salt spray

4.3.2 Installation procedures

4.3.2.1 Get the battery ready

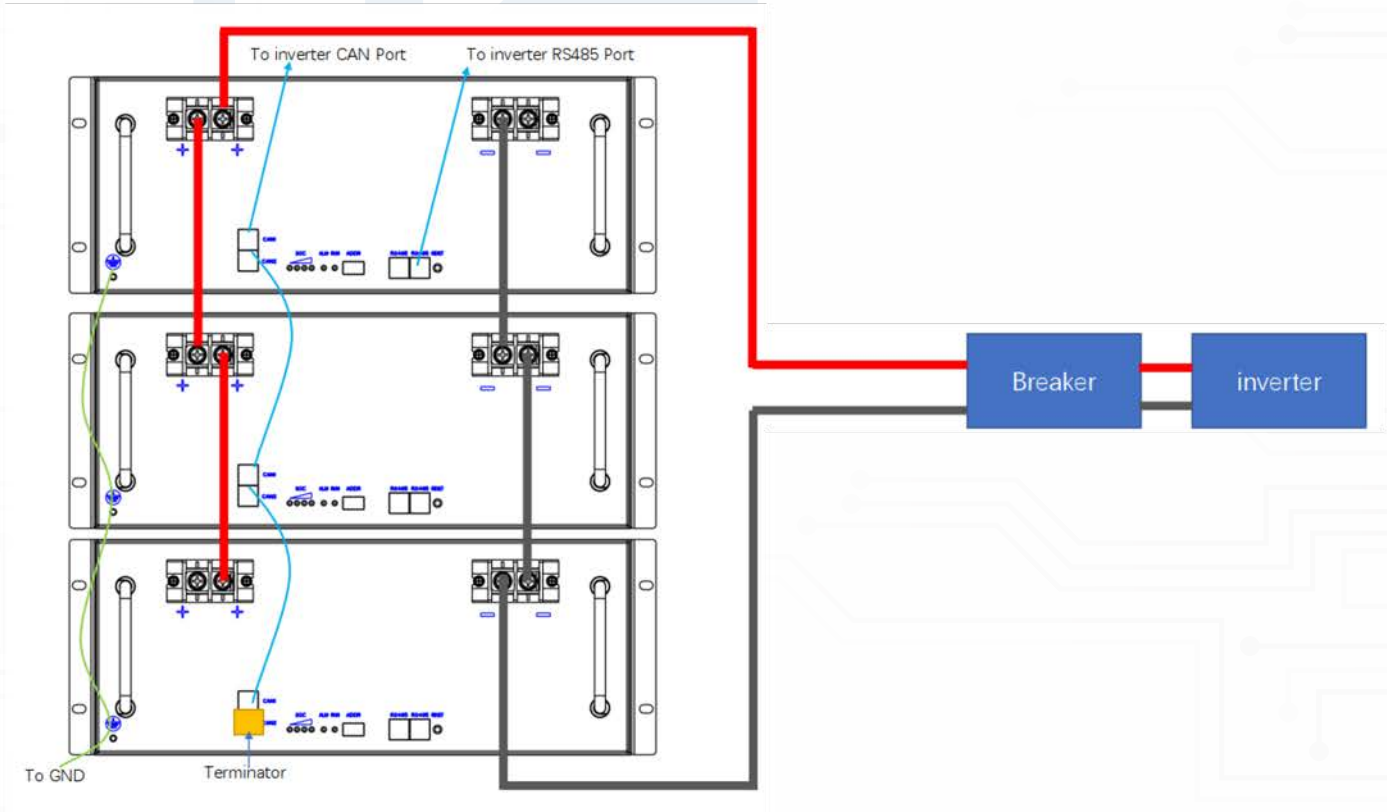
1. Get the battery ready, ensure all the battery indicator is in OFF, and confirm whether the appearance of the battery is normal;
2. Confirm both the battery breaker and the system breaker that connected the battery with inverter are disconnected.
3. Turn on the signal switch of the battery, observe whether there is alarms on the panel, measure it with multi-meter and record battery voltage, then check if it meets the parallel standard: open circuit voltage difference < 0.5V;
4. After confirming that everything is OK, turn off the battery and put it at the installation preparation area for ready-to-install:

Placement description:



4.3.2.2 Structure and electrical installation

1. Get the cabinet ready and assemble it as integrator requested to ensure the cabinet is installed horizontally and reasonable location layout;
2. Prepare all the battery packs, place the batteries on the cabinet tray via manual-lifter, and push the batteries into the cabinet, then fix the battery mounting ears to the cabinet through the crown-nuts;
3. Please double check the battery is in shut down and disconnect the circuit breaker, unscrew the positive/negative terminal bolts of the battery pack, then connect the batteries to the positive/negative bus bar through cables;
4. Unscrew the grounding screw, connect the battery and the grounding bus bar of cabinet through the yellow-green flexible wire to ensure that all connections are reliable
5. Connect the CAN communication interface between the batteries, set the dial switch address as Table 3-5, and insert the matching resistance terminal into the CAN port at the end of battery, as [Figure 4-4](#)



6. Connect the RS485 port of the master battery module to the battery communication interface of the inverter, meanwhile, connect the bus bar of the battery cabinet and the battery input of the inverter through the system breaker;

7. Starting from the master, turn on all battery modules by pressing the reset button, close the battery breakers one by one, and observe whether the breakers can't be closed and any overcurrent occurs during the process. If all works normally, go to the next step; If there's battery breaker can't be closed or overcurrent occurs, please measure the battery voltage separately to evaluate whether it's caused by a large voltage difference.

4.3.2.3 Enabling system

After completing above all steps, turn on the system breaker between the battery cabinet and the inverter, run the inverter and open the setting menu, then select 'Lib' in the battery type, and press the battery on switch to measure the battery voltage, If normal output then turn on the battery to access breaker. At the same time, check whether the communication is normal, if all is ready then enable the system.

Table 4-1 Inverter setting parameters

No.	Items	Description
1	Average charge voltage	56.0V
2	Float charge voltage	54.6V
3	Low SOC limit	10%
4	Inverter/Load Cut-off	49.0V
5	Charging current limited value	50A*N (N is the Quantity of the battery pack)

4.3.2.4 Working at High/Low temperature

Do not charge the battery when it is used below 0°C, while if you want to make it, you need to add internal heating device to heat the battery temperature to $\geq 0^{\circ}\text{C}$ and then charge the battery. The charge factor of batteries in high and low temperature environments should follow the below recommendations:

Operations	Temperature range	Recommend current
Charge	0~10°C	<0.1C(force)
	10~20°C	<0.3C
	20~35°C	<0.5C
	35~45°C	<0.2C
Discharge	-10~55°C	<0.5C

5. Maintenance and Abnormality handling

5.1 Activation and dormancy

5.1.1 System activation

If it meets any of the following conditions when the system is in low-power mode, the system will exit from it and enter the normal running mode:

When the charger is connected, the output voltage of the charger need to higher than 48V.

- 1) Turn on the power button.
- 2) In the case of battery in sleep mode(except battery over-discharge, battery damage, etc.), the monitoring software can wake up the battery.

Remark: The battery will be in low-power mode after cell or PACK reach over-discharged protection, wake up every 4 hours to turn on the charge and discharge MOS. If it can be charged, it will exit from dormancy mode for charging normally; if it can't be charged after 10 consecutive automatic wakeups, it will no longer wake up automatically

When the system is defined as charging ends, the recovery voltage still not reach after 2 days of standby (stand-by time set value), then it will be forced to re-charging till the end of charging again.

5.1.2 System Dormancy

When any following conditions occurs, the system will be in Low Power mode:

- 1) The over-discharge protection of the cell or PACK is not released within 60 seconds
- 2) The lowest cell voltage is lower than the dormancy voltage, and the duration up to the dormancy delay time (meanwhile, it meets the requirements of no communication, no protection, no balance, and no current).
- 3) Shut down through the upper computer.
- 4) Make sure that the input terminal disconnect to external voltage before entering dormancy mode, otherwise it will fail to access to Low Power mode.

5.2 Regular maintenance

- 1) Regularly check whether the usage environment meets the requirements, and ensure the installation location is far away from heat sources.
- 2) Check whether the charging and discharging of the battery pack are normal. You need to recharge in time for

any one of the following situations: over-discharge the battery to protection; often under-charged the battery, and the battery is out of use or stored for over 6 months.

3) Regularly check whether the appearance of the battery and the supporting switching power supply, wiring terminals, communication cables, indicator, etc. work normally.

4) Estimate the charging time and discharging time of the battery according to the actual state of the battery or battery pack, and observe whether the battery or battery pack is abnormal, such as the voltage difference of the battery, at the end of charging and discharging.

5.3 Alarm and abnormality handling

When the ALM alarm red light on the front panel of the battery flashes or stays on, the battery is in alarm or protection. Please refer to Table 3-6 in Chapter 3 to verify the current trigger state of the battery. Usually when the battery arises an "alarm" indicator, it means that the battery is running under relatively critical conditions but still operate normally; when the "protection" indication appears, it means that one or more parameters of the battery have reached the protection threshold, the BMS will cut off the corresponding MOS to ensure the safety of battery. After the related parameters falls back, the battery will automatically return to normal use.

Category	handling measures	description
Unable to start	<ol style="list-style-type: none"> 1. Press and hold RESET to observe whether the battery can be started; 2. Charge the battery and observe it can be started; 	If the battery still can't be turned on normally after above steps, please contact Kon-TEC.
Unable to charge	<ol style="list-style-type: none"> 1. Check whether the cable connection between the battery and the charging device is correct 2. Check whether the setting of charging voltage for charging device is correct; 3. Check whether the battery is in charge protection and try to release 	If the battery still can't be turned on normally after above steps, please contact Kon-TEC.
Unable to discharge	<ol style="list-style-type: none"> 1. Check whether the cable connection between the battery and the load is correct; 2. Check whether the battery occurs short circuit, reverse connection, pre-charge failure, etc. 3. Check whether the battery is in discharge protection and try to release 	If the battery still can't be turned on normally after above steps, please contact Kon-TEC.
ALM always on	Read the reason of the battery abnormality through the software monitor, and try to release from protection.	If the battery still can't be turned on normally after above steps,

		please contact Kon-TEC.
Unable to fully charge	Check whether the setting of charging voltage for charging equipment is correct or whether there's any unreasonable photovoltaic system configuration;	If the battery still can't be turned on normally after above steps, please contact Kon-TEC.
Abnormal communication	Shut down all battery packs first, and then restart all battery packs by referring to the procedures of section 4.3.2.2	If the battery still can't be turned on normally after above steps, please contact Kon-TEC.
Insufficient backup time	Please contact Kon-TEC ASAP	
Big fluctuate output voltage	Please contact Kon-TEC ASAP	
Battery leakage	Please contact Kon-TEC ASAP	

6. Transport, Storage

- a. Do not violently shake, impact or squeeze, and prevent sun and rain during the transportation.
- b. Do light take and put and strictly prevent falling, rolling, and heavy pressure during loading and unloading.
- c. The battery should be placed in a dry, clean, dark, and well-ventilated indoor environment for long-term storage, and the recommended storage temperature range is 15~35°C .
- d. No harmful gases, flammable and explosive products and corrosive chemical substances in the storage location.
- d. The batteries should be stored and transported in close to 50% SOC.
- e. If do not use for a long time, the battery need to be charged every 6 months according to the specs, and it's suggested to charge CC/CV.

Charging method: charge the battery CC/CV @ 56.0V, 50A, and it will stop charging when the current $\leq 0.05C$ or reach the overcharged protection.

Charging standard: When stop charging, the voltage of battery is $\geq 54V$, or after charging for 8 hours, the voltage is $\geq 51.2V$.

- e. No fall down, no pile up over 6 layers, and keep face up.