SolBank

Commissioning Manual

V1.5

CSI Energy Storage Co., Ltd.

This manual is verified to be accurate at the date of publication identified within Section 1.4 CSI reserves the right to make product and documentation modifications at any time.

The images provided in this manual are for demonstration purposes only. Details vary slightly according to product version and market region. CSI has the final interpretation right for all detailed designs of the product.

CanadianSolar

The information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. CSI makes no warranty, expressed or implied, with respect to this information.

Please contact the CSI Technical Team at supportAmerica@csisolar.com for further information or to report inaccuracies or omissions in this manual.

Made in China

Content

1 Preface

1.1 Document Purpose and Scope

The purpose of this document is to provide an overview of the processes and procedures required to operate the SolBank Energy Storage System (ESS) (1500V models only). The scope of this manual is limited to only those tasks applicable to operation of this product. Topics covered include, major component overview, operational safety hazards and precautions, modes of operation, pre- operation checklists, and startup and shutdown procedures.

This manual should be made available to all field personnel participating in the design, installation, operation, and maintenance of the DC SolBank energy storage system. A copy of this Manual should be available on-site at all times.

This manual is to be considered supplemental to project specific design and safety documentation. Please read and understand all aspects of this document prior to initiating SolBank operation.

Should any questions arise, please contact CSI support:

- By telephone at (xxx)xxx-xxxxxx
- By email at supportAmerica@csisolar.com

1.2 Applicable Models

This manual covers the following models only:

- **CSI-SolBank-S-2967-2h-US**
- **CSI-SolBank-S-2967-4h-US**
- **CSI-SolBank-S-2225-1.5h-US**
- **CSI-SolBank-S-2967-2h-EU**
- **CSI-SolBank-S-2967-4h-EU**
- **CSI-SolBank-S-2225-1.5h-EU**

1.3 Reference Documents

The SolBank User Manual exists as part of library of product specific documents. Please consult the following documents to ensure a comprehensive understanding of SolBank attributes.

- *DC SolBank Installation Manual*
- *DC SolBank User Manual*
- *DC SolBank safety Manual*
- *DC SolBank Maintenance Manual*
- *DC SolBank Commissioning Manual*

1.4 Version Control

This is the initial release of the DC SolBank User Manual. As part of CSI's continuous improvement process, CSI reserves the right to make technology and document changes. Please contact CSI support to verify this manual reflects the most recent release or to report omissions or inaccuracies.

Version	Description	Date of Issuance
Commissioning_Manual_1.1	Initial publication date	
Commissioning_Manual_1.2	Format optimization	2022.11.10
Commissioning_Manual_1.3	Add picture caption	2023.8.1
Commissioning_Manual_1.4	Optimized content	2023.12.14
Commissioning_Manual_1.5	Section 5.6 adds instructions for IP address setting and total voltage test	2024.1.18

1.5 Document Safety Notices

Throughout this manual the below indicated labels are used to convey hazards associated with specific tasks and procedures. These safety notices do not represent all hazards present when performing a given task. Installers and operators of the SolBank should adhere to industry safety best practices; site specific Environmental, Health and Safety plans; and local safety requirements and regulations. ***Only properly trained and qualified personnel should be permitted to complete the installation procedures identified in this manual.***

Labels	Explanation
	UKCA mark of conformity.
	CE mark of conformity.
	Indicates a hazardous situation which, if not avoided, could result in death or serious injury. Indicators are not used for property damage hazards unless personal injury risk appropriate to this level is also involved.
	Label the product as inflammable and explosive, and do not involve open flame.
	Electrical hazard sign, non-professional personnel do not approach. Professional personnel are required to perform maintenance and operation.
	Do not discard randomly
	Recycling equipment

1.6 Product Certification and Compliance

The SolBank is compliant with the standards, regulations, and requirements identified in Table 1.

Table 1: SolBank Standard and Compliance

Standard and Compliance	
System	NEC – National Electrical Code® IEC 60529 – Degrees of protection provided by enclosure UL 508 – Standard for Industrial Control Equipment UL 991 – Standard for Tests for Safety-Related Controls Employing Solid- State Devices. UL 1998 – Standard for Software in Programmable Components IEEE C84.1 – Standard Preferred Voltage Ratings for Alternating-Current Electrical Systems IEEE 693 – Recommended Practice for Seismic Design of Substations IEEE 1584-2018 – Guide for Performing Arc-Flash Hazard Calculations Modular Energy Storage Architecture – Energy Storage System (MESA-ESS) Standard
Fire Protection and Safety	NFPA 855 – Installation of Energy Storage Systems NFPA 70E® – Standard for Electrical Safety in the Workplace® NFPA 72 – National Fire Alarm and Signaling Code NFPA 69® – Standard on Explosion Prevention Systems NFPA 68® – Standard on Explosion Protection by Deflagration Venting UL9540A – Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

2 Acronyms and Abbreviations

AC – Alternating Current

AHJ – Authority Having Jurisdiction

BMS – Battery Management System

BOL – Beginning of Life

DC – Direct Current

SolBank Controller – Local Energy Management System (Battery system)

EOR – Engineer of Record

ESS – Energy Storage System

COG – Center of Gravity

HVAC – Heating Ventilation Air-cooled HVAC

IFC - Issued for Construction

LFP – Lithium Iron Phosphate

LOTO – Lock-Out-Tag-Out

NFPA – National Fire Protection Association

PCS – Power Conversion System

PPE – Personnel Protective Equipment

SPD – Surge Protection Device

UPS – Uninterruptible Power Supply

EPC – Engineering, Procurement, and Construction contractor

CapEx - Capital Expenditures

3 Introduction

3.1 Acknowledgement

Thank you for purchasing the containerized SolBank system supplied by CSI Energy Storage Co., Ltd. The SolBank is an advanced modular battery energy storage system incorporating industry leading capabilities enabled by cutting-edge technologies and innovative design. High energy density, liquid cooled battery and power electronics, extended service life, and advanced safety features are just a few of the attributes that set the SolBank apart from other ESS products.

The SolBank is fully factory integrated and tested at CSI's facility, arriving on site with battery racks populated and sub systems installed. This high level of pre-integration results in rapid installation, reduced EPC CapEx, and improved system performance and reliability.

3.2 System Overview

The SolBank System integrates all power electronics, controls, and safety features required to support the DC side of a battery energy storage system. An overview of the SolBank layout and key features is shown in Figure 1 and further described in Table 2.

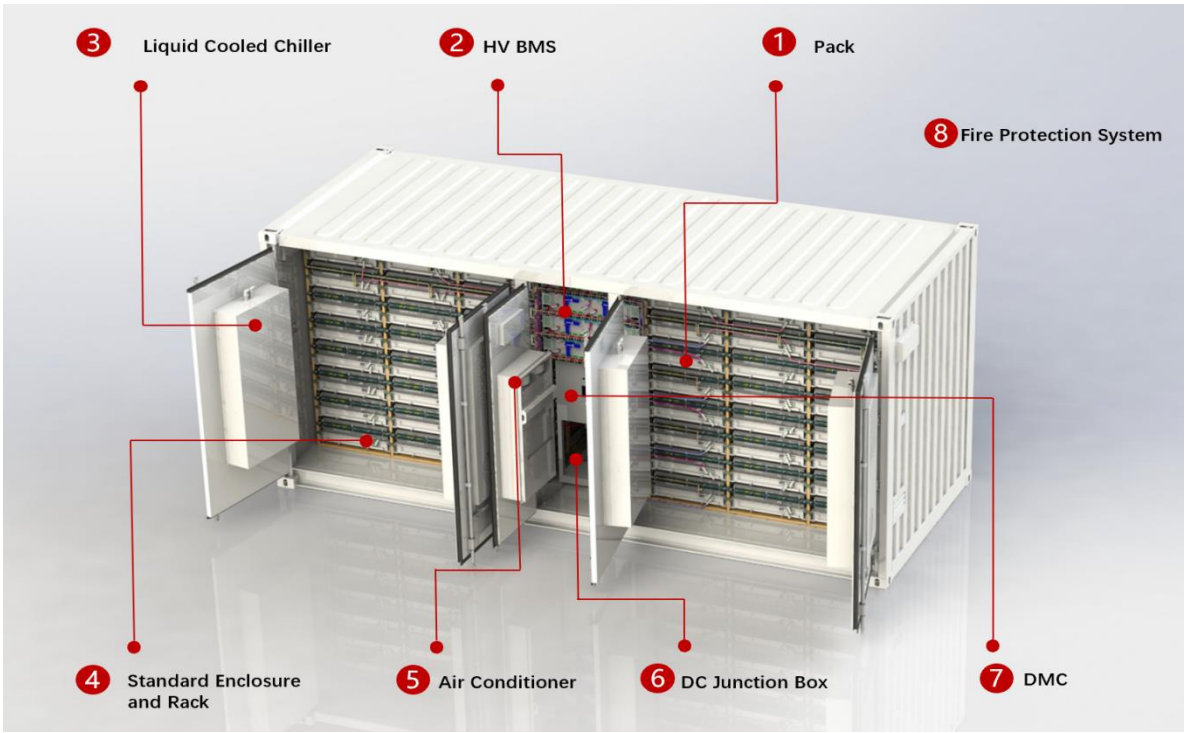


Figure 1: Layout and features of the SolBank

Table 2: Key System Features

NO.	Name	Remarks
1	Pack	The SolBank contains 48/36 Lithium Iron Phosphate (LFP) battery packs, each consisting of 69 series wired battery cells.
2	BMS Box	The SolBank contains 8 or 6 BMS boxes. These are easily accessed for installation and maintenance within the central bay of the container. The BMS ensures optimal battery functionality and safety.
3	Liquid Cooled Chiller	The SolBank liquid-cooled chillers facilitates improved battery temperature management efficiency compares to traditional forced air systems. Each battery pack is liquid cooled, allowing for greater heat dissipation and uniform cell temperature management. During charge and discharge, cell temperature is maintained between 20°C - 35°C.
4	Standard Enclosure and Rack	All models of the SolBank enclosure utilize a standard IP-55 rated 20ft HC container and battery rack design allows for enhanced system modularity without increased production and equipment costs.
5	Air-cooled HVAC	The SolBank air-cooled HVAC is used to control the temperature of the DMC and DC bus combiners within the 25℃(±3) range, as well as the temperature and humidity in the SolBank enclosure.
6	DC bus combiner	The SolBank DC bus combiner contains all primary DC busbar, fusing, Surge Protection Devices (SPD), disconnects, and power monitoring required to safely exchanged power between the SolBank and PCS.
7	DMC	The DMC cabinet houses all aux power distribution equipment including 2-hour backup UPS; System communication, control, and monitoring hardware include network switch, and Local EMS, and all required customer communication, signal, and aux power interfaces.
8	Fire Protection System	SolBank is equipped with heat and smoke detection for fire alarm system and equipped with combustible gas detection and air ventilation for explosion prevention.

3.3 System Specifications

The SolBank system has two models, as shown in Table 3 below. Each model has varying C-rate, power, and energy characteristics. Battery string size, nominal voltages, form factor, and physical dimensions remain consistent across all models.

Table 3: SolBank (DC 1324.8V) Specifications.

SYSTEM MODEL NUMBER	CSI-SolBank-S-2967-4h	CSI-SolBank-S-2967-2h	CSI-SolBank-S-2225-1.5h
Discharge Duration	4-hour	2-hour	1.5-hour
Charge/Discharge C-rate	0.25P	0.5P	0.67P
BOL Cell Energy (kWh)	2.967	2.967	2.225
Usable Energy (kWh)	2800	2750	1.95
Voltage Range (VDC)	1159.2~1490.4		
Recommended Discharge Power (kW)	700	1375	1300
# of LFP Battery Rack	1P414S	1P414S	1P414S
# of BMS boxes	8		6

Table 4: Additional Specifications

SYSTEM MODEL NUMBER	CSI-SolBank-S-2967-4h	CSI-SolBank-S-2967-2h	CSI-SolBank-S-2225-1.5h
Cell Chemistry	LFP		
Rated Capacity (Cell)	280Ah		
Rated Voltage (Cell)	3.2V		
Ingress Protection (Pack)	IP67		
Rack type	1P414S		
Power Rating	0.7MW	1.375MW	1.3MW
Rated Capacity (Nominal)	8*280Ah	8*280Ah	6*280Ah
Rated Voltage (Nominal)	1324.8V		
Enclosure Energy Capacity Rating (Nominal)	2.967MWh	2.967MWh	2.225MWh
Enclosure Usable Energy Capacity	2.8MWh	2.75MWh	1.95MWh
Charging/Discharging Mode	0.25P	0.5P	0.67P
Cooling concept	Liquid-cooled chillers + Air-cooled HVAC		
Dimensions (LxWxH)	6058*2438*2896mm		
Auxiliary power interface	AC400V/ 50Hz, 3 phase 5 wires		
Communication interfaces	Ethernet		
Communication protocols	Modbus TCP/IP		
Cycle Life (25 ℃, 0.25C)	8000 @ 60%SOH. 100%DOD		
Noise	＜75dB(A)		
Environmental temperature	-30°C to 55°C		
Environmental humidity	≤90% RH		
Ingress Protection/Environmental Rating	IP55		
Seismic Parameters	Zone 4		
Altitude	<2000m (derating between 2000 m ~ 4000 m)		
Design Standards/Codes	UL1973, UL9540, UL9540A, IEC62619, NFPA69, NFPA855		

4 Before commissioning

4.1 Safety matters

Lock-out-tag-out (LOTO) procedures should be implemented to prevent accidental energization of equipment.

All personnel operating the SolBank shall be properly trained and qualified.

Personnel shall read and understand all manuals and project documentation and adhere to the requirements and direction within.

Do not initiate SolBank operation until system is fully commissioned and inspected by CSI field engineers, or until all required periodic maintenance is performed.

Do not modify or alter the SolBank without written permission from CSI

4.2 Basic work

Before commissioning, SolBank enclosure shall be installed and fixed properly. DC cables between SolBank and PCS shall be connected and tested. Communication harness between SolBank and PCS shall be connected, auxiliary power supply of SolBank has been connected, and conditions for power on shall be met.

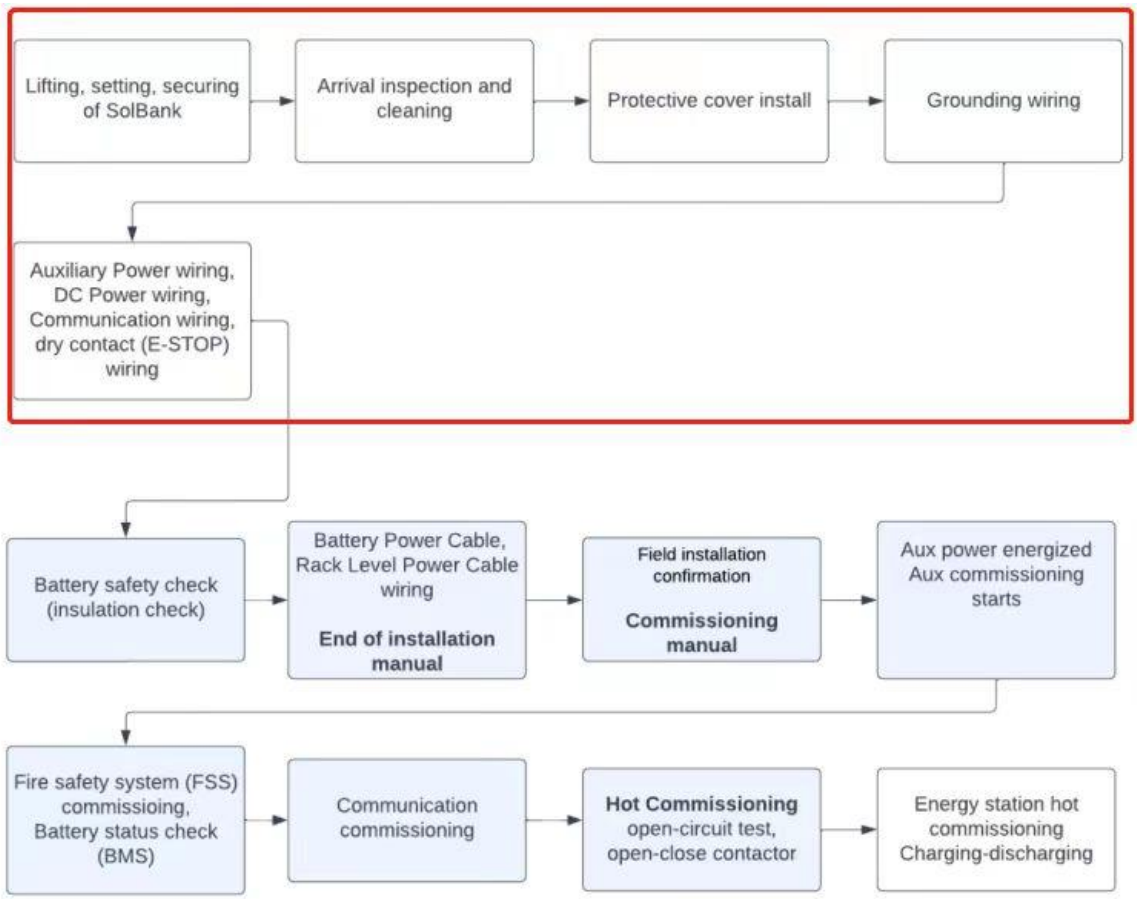
Unpack the container and check that the battery packs fixing screws on the racks are not loose (the anti-loosening cable is not abnormal), and the enclosure should be without any wired odour. If any exception exists, mark it and check it furtherly.

5 Static debugging

The following section outlines the debugging process required to statically debug SolBank and integrate it into an ESS project site. Figure 2 below provides an overview of the SolBank debugging process. These steps must be completed sequentially by qualified personnel.

The following red selection represents the installation content.

In every step of debugging, security is the most important. Please be aware of all safety hazards described in this section and follow the project EHS plan.



5.1 Prepare for debugging

See Section 4 above of this manual.

5.2 Field installation confirmation

Check that the batteries wiring and harnessing are properly connected.

Attached Table 1: Appearance and Installation Inspection Form

5.3 Battery string in series cabling

When the battery cabin voltage check is normal, inform the construction personnel to connect the series lines in the battery string.

Operating Steps:

Check whether the power line buckle of the battery compartment is normal, and confirm it according to the "SOP Standard Operation". After checking the wiring between the packs, measure the total voltage between the strings with a multimeter, the total positive to ground, and the total negative voltage value to the ground, and record it as the following Annex 2: Battery String Voltmeter

5.4 Battery string insulation and safety test

Use an insulation tester (1000V range) to test the insulation resistance of the positive pole of the battery string to ground and the negative pole to the battery pack case. The insulation resistance value shall not be less than 100MΩ.

Disconnect the PCS DC side switch and use an insulation tester (1000V range) to test the insulation resistance values of the DC output positive terminal of the busbar battery string to the box and the DC output negative terminal to ground. The insulation resistance value shall not be less than 100MΩ.

See Annex 3: Insulation Test Sheet

5.5 Power on the auxiliary power supply

While checking the battery pack voltage, ensure that the auxiliary power cable is normal and turn on the control switches of the air-cooled HVAC, liquid-cooled chillers, and UPS step by step from the main switch. To start the UPS, hold down the UPS startup button for 10 sec. Check whether the UPS output voltage is 220VAC.

Operating Steps:

1. Power on the circuit breaker of BMS boxes 1-8.
2. Power on the disconnector in the DC bus combiner.
3. Power on the circuit breakers marked QF1 (Aux power main switch) and QF2 (SPD). Before powering up, measure the voltage value at the input separately with a multimeter, note that the circuit will not be powered on until step 3 is completed.
4. Power on the circuit breaker marked QF3~QF6 (0.5P&0.67P: QF3~QF7). The thermal management system will turn on automatically. At the same time, pay attention to the coolant level and whether the chiller is operating normally.
5. Power on the circuit breaker QF7 (0.5P&0.67P: QF9).
6. Power on the circuit breaker QF8 (0.5P&0.67P: QF10).

7. Power on the circuit breaker QF9 (0.5P&0.67P: QF11).
8. Power on the circuit breaker QF10 (0.5P&0.67P: QF12).
9. Power on the circuit breaker QF11 (0.5P&0.67P: QF13).
10. Power on the circuit breaker QF12 (0.5P&0.67P: QF14).
11. Ensure that all SolBank subsystem are powered up and functioning properly. Ensure that communication between the on-site EMS and SolBank is enabled and functioning properly.
12. Press the BMS box contactor button "ON" to connect the SolBank DC bus to the DC terminal of the PCS.

See Annex 4: Input voltage values for auxiliary equipment.

5.6 Start the control system

After the battery string safety test passes, turn on power supplies for devices such as BMS, fire control, water immersion sensor, and temperature and humidity sensor to check the operating status of each device. Record exceptions in a timely manner.

1. Fire protection system debugging

   Operating Steps:

   Activate the heat sensor with a heat gun or activate the smoke sensor with a smoke generator, the system triggers a first-level fire alarm, the alarm bell rings, and the system stops.

   Activate the temperature detector with a heat gun and activate the smoke sensor with a smoke generator at the same time. The system triggers the secondary fire alarm, the alarm bell rings, the audible and visual alarm is activated, the system stops, and the butterfly valve opens.

   Use combustible gas reagent to trigger the detector, when the combustible gas concentration $\geqslant$ 25% LEL, the combustible gas detector is triggered, the system stops, and the ventilation system operates.

   Annex 6: Fire debugging

2. The air-cooled HVAC and liquid-cooled chiller
3. The thermal management system includes air-cooled HVAC and chillers will automatically start after power-on. If any of them can't work properly, it needs to be isolated and checked.

   After powering on the air-cooled HVAC, set different temperature values through the air-cooled HVAC interface to verify the cooling and heating effects of the air conditioner,

   After the water cooler is powered on, observe whether it operates normally through the interface of the water cooler, and at the same time observe whether the pump has abnormal noise, and pay attention to whether the liquid cooling pipe has liquid leakage and other problems

4. UPS

   To start the UPS, hold down the UPS startup button for 10 sec. Check whether the UPS output voltage is 220VAC.

5. BMS

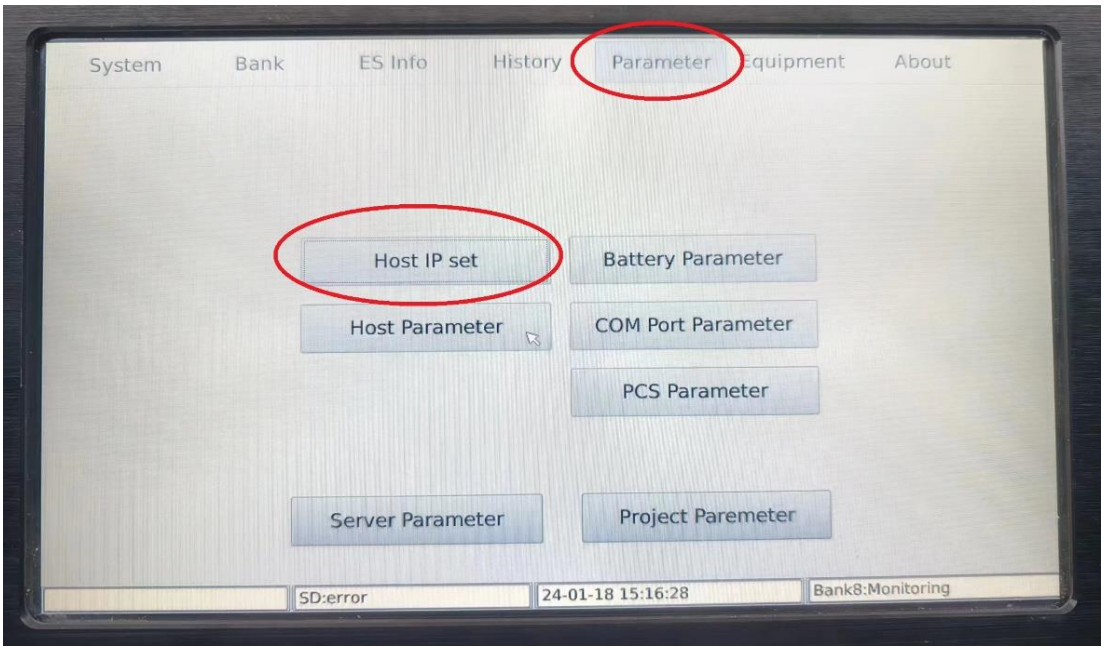
   Check whether the status of the device is normal, whether the battery data is OK, and whether relevant information is uploaded

   Annex 5: Operation Status of Auxiliary Equipment

IP address settings:

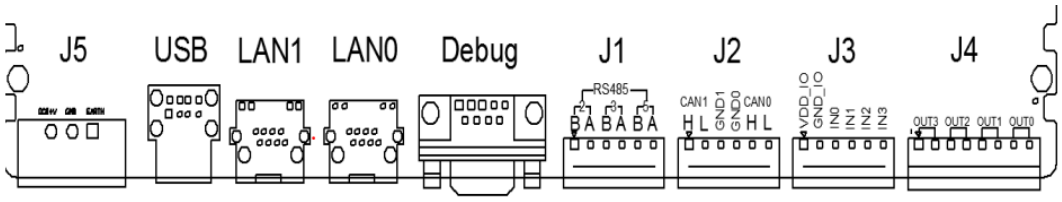
Master Solbank IP setup:

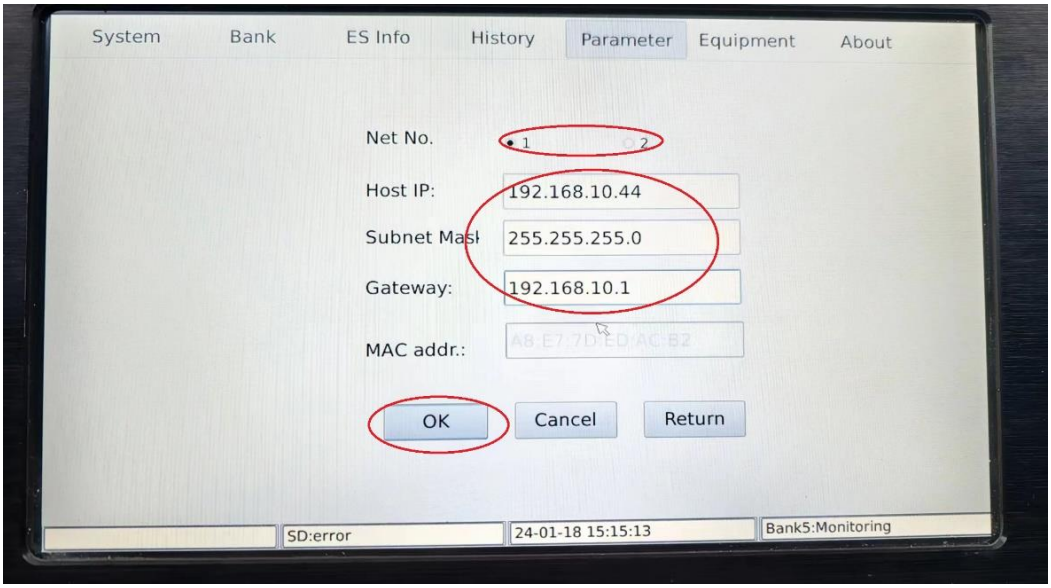
Step 1: Click “Parameter” button on the top of the master Solbank BMS screen, then click the “HOST IP SET” button.



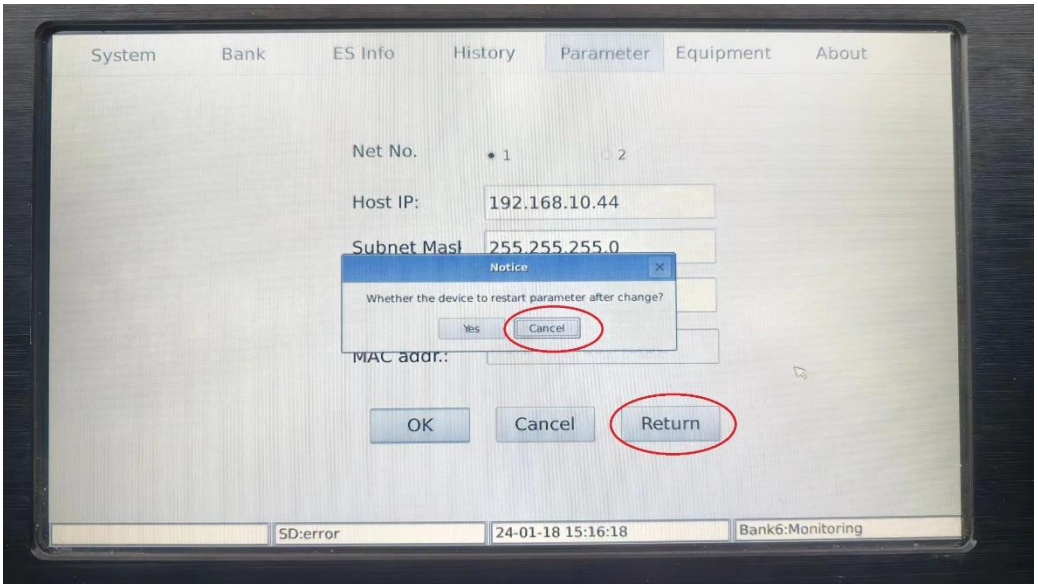
Step 2: Choose net number according to LAN port number and click the corresponding data frame to set IP address, subnet mask and gateway.

The IP addresses of master and slave Solbank must be in the same network segment. The subnet mask is usually set to xxxx (distribute via EMS) and the gate way usually be xxxx (distribute via EMS). The first three segments of the gateway address and the IP address are the same, and the last segment address is set to 1. (The IP address, subnet mask and gateway can be adjusted according to the actual network operating environment)

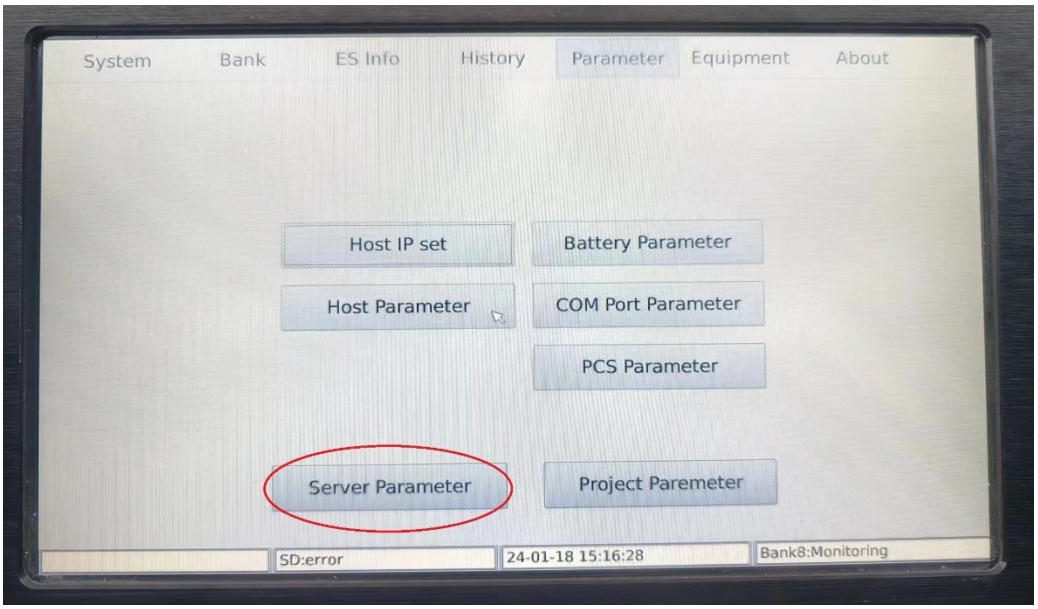




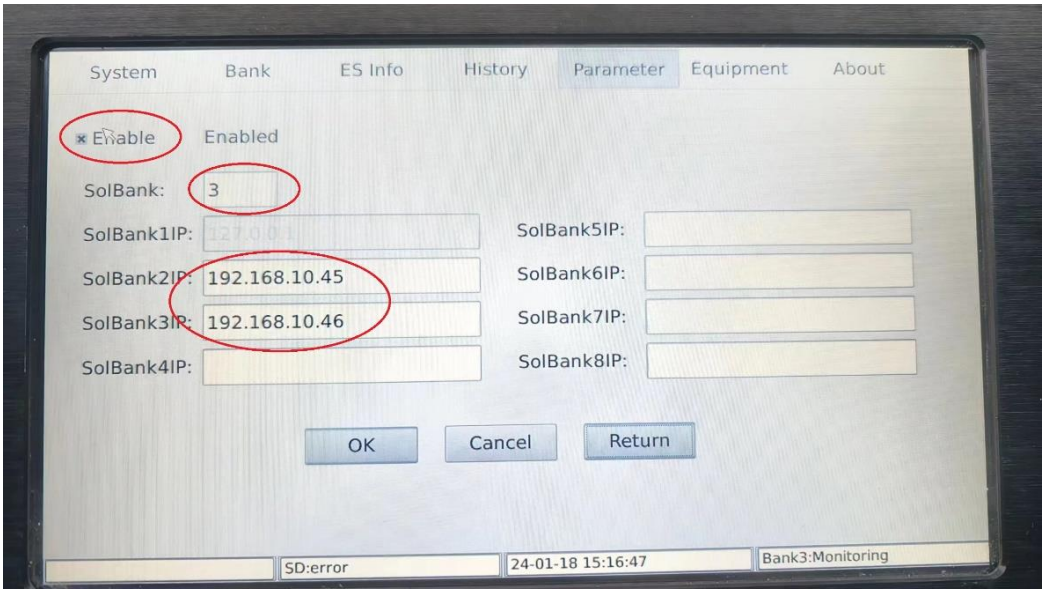
Step 3: Click “OK” button after the parameter setting is completed, and the BMS will prompt whether it needs to be restarted, because there are other parameters to be set, so click “Cancel” button. Then click “Return” button.



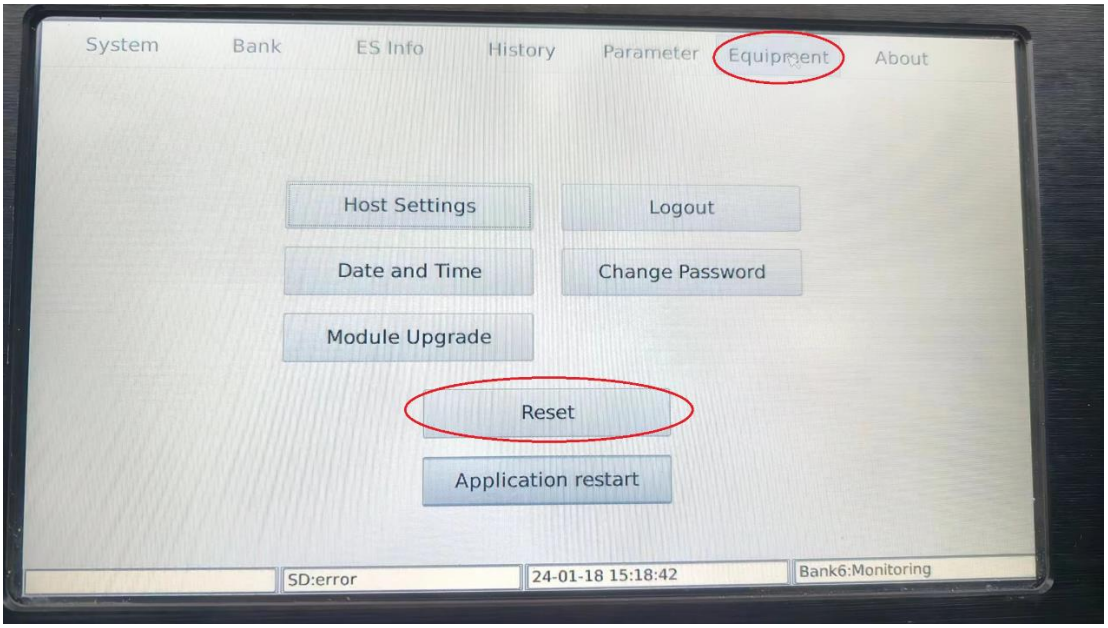
Step 4: Click on the “Server Parameter” button to set parameters of Master-Slave mode.



Step 5: Select the “Enable” option, then set the number of Solbanks, and set the slave IP address. Then click “OK” button after the parameter setting is completed. (Solbank 1 is master and doesn’t need to set the IP address here.)

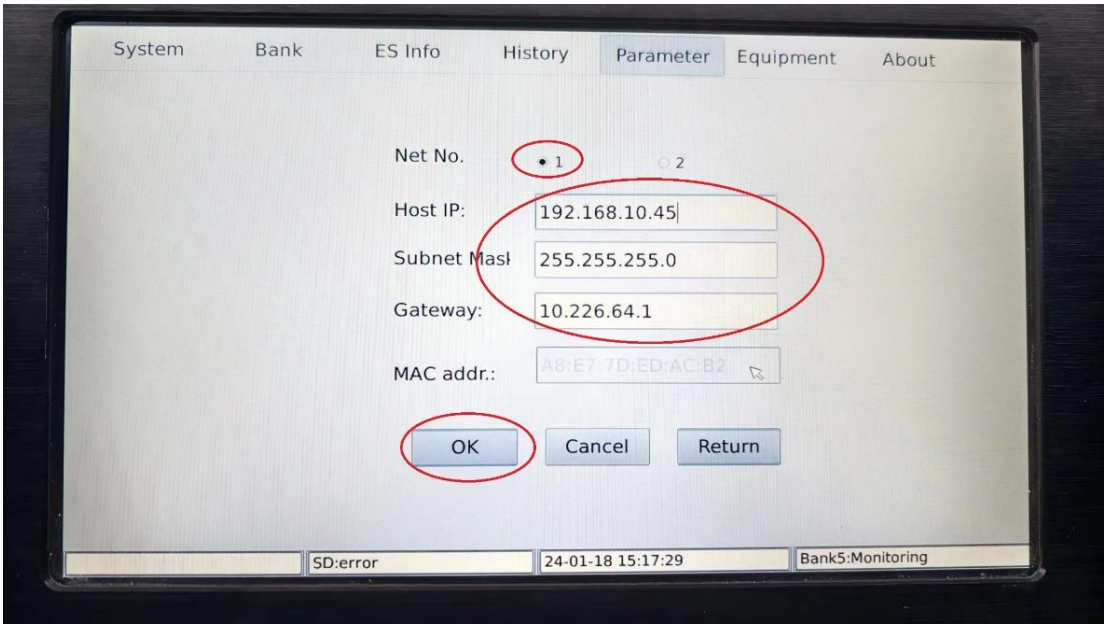


Step 6: Click the “Equipment” button, and then click the “Reset” button. The settings take effect after the BMS is restarted.



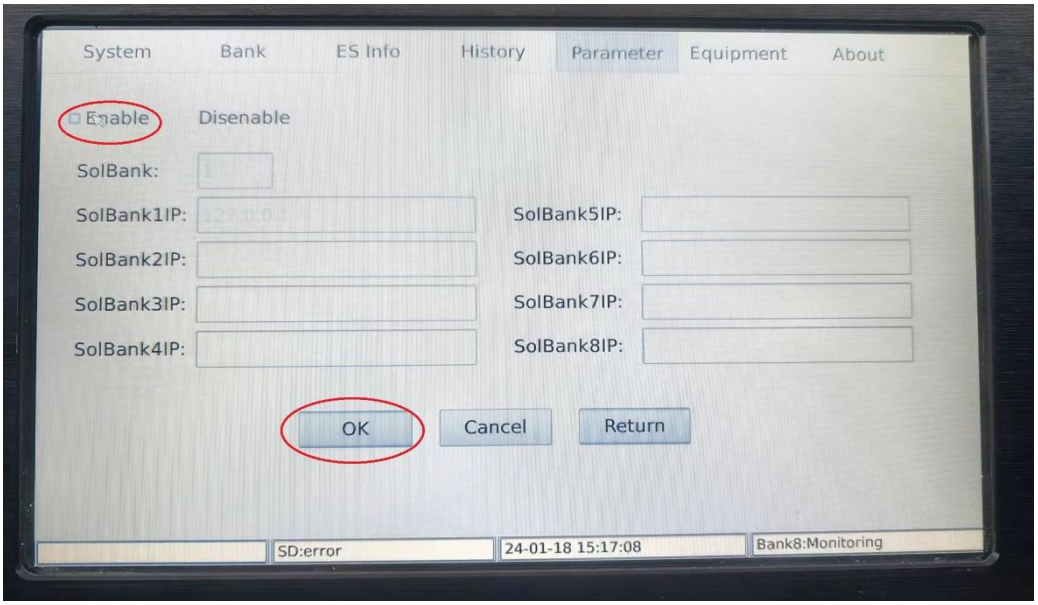
Slave Solbanks IP setup:

Step 1-3 is the same as above, and the IP address must be the same as the IP address set in Step 5 above.



Step 4: Click on the “Server Parameter” button in Parameter Page as above Step 4.

Step 5: Unselect the “Enable” option and click “OK” button.



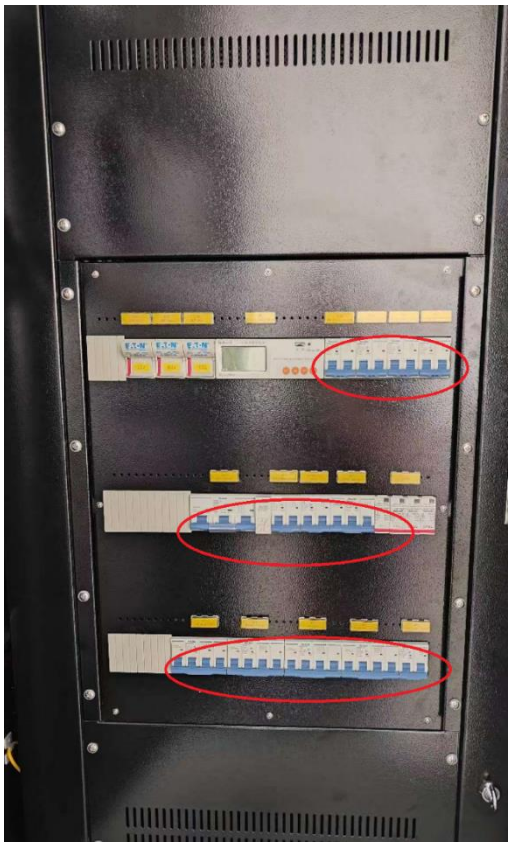
Step 6: Click the “Equipment” button, and then click the “Reset” button as Step 6 (same as Master SolBank) above. The settings take effect after the BMS is restarted.

Tips: If the settings are correct and the wiring is correct, the communication state between the master Solbank and the slave Solbanks can be reading through BCI Modbus.

DC voltage test:

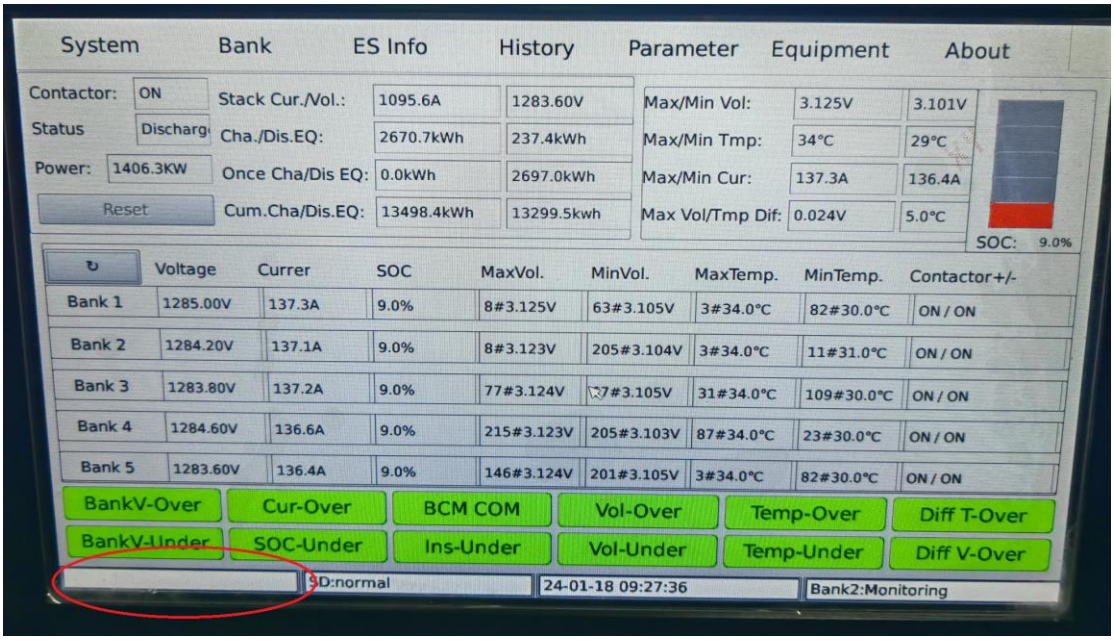
Step 1:

All auxiliary electrical switches are connected, and the 220VAC switch and disconnector on the BMS Box are all connected.



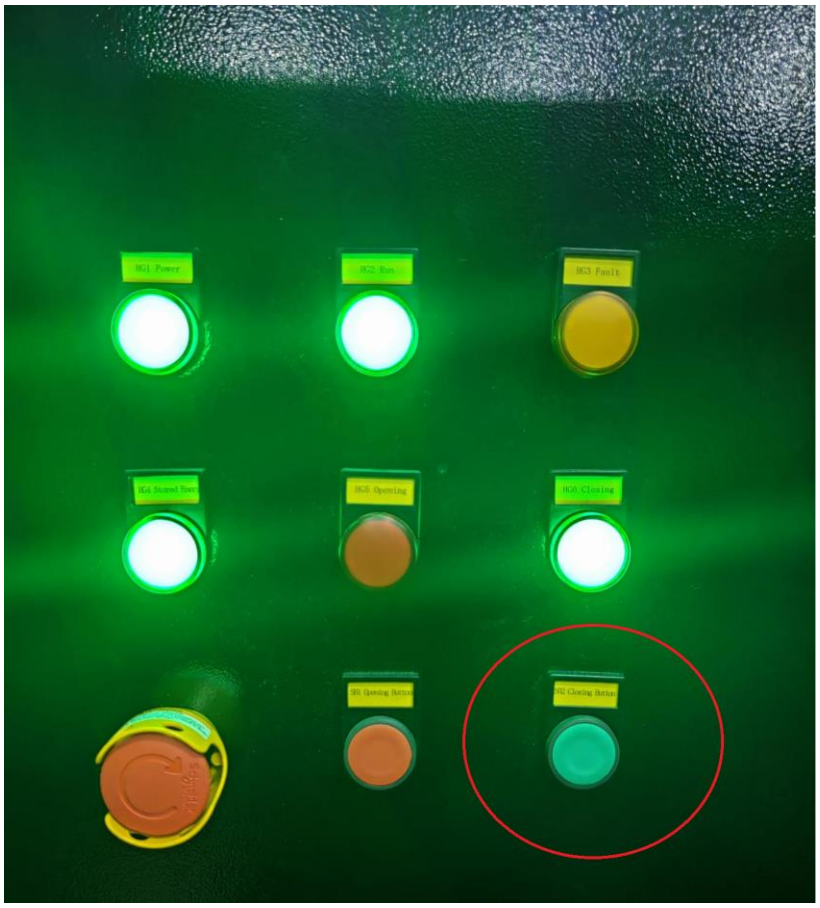
Step 2:

Check whether the BMS is faulty on the page of the Local Controller. If so, the fault needs to be dealt with.



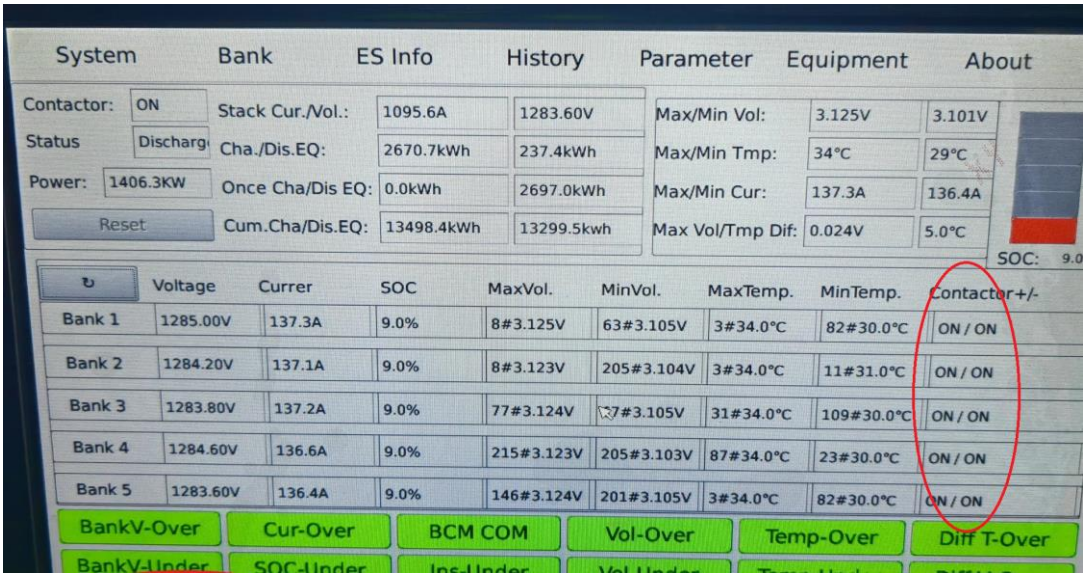
Step 3:

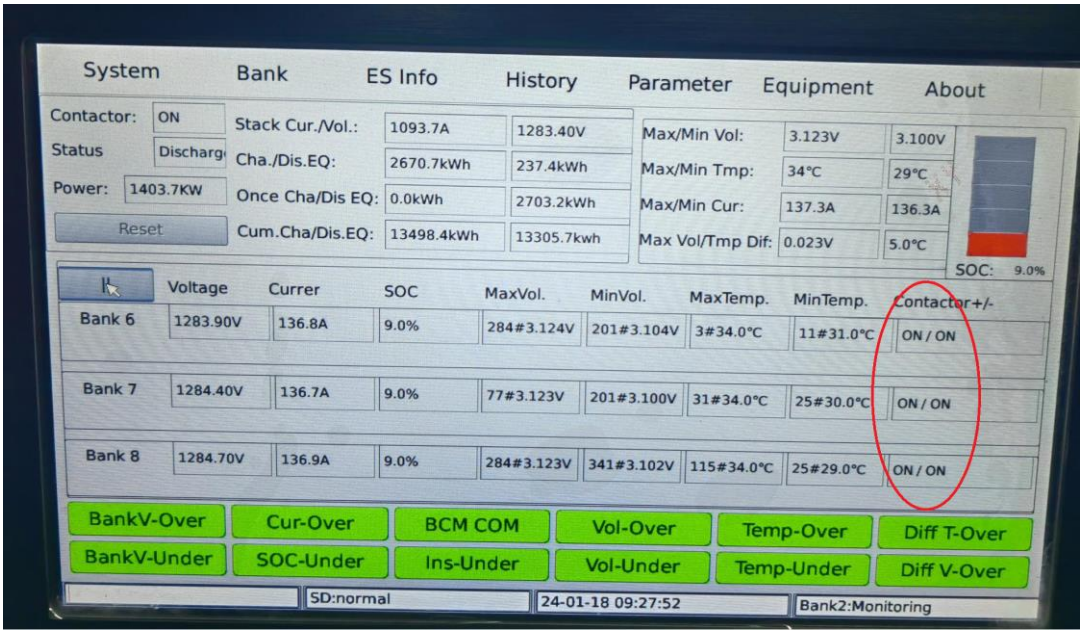
Manually close the DC disconnector QS1 of the DMC, and through Modbus TCP to simulate the BCI and send a power-on command.



Step 4:

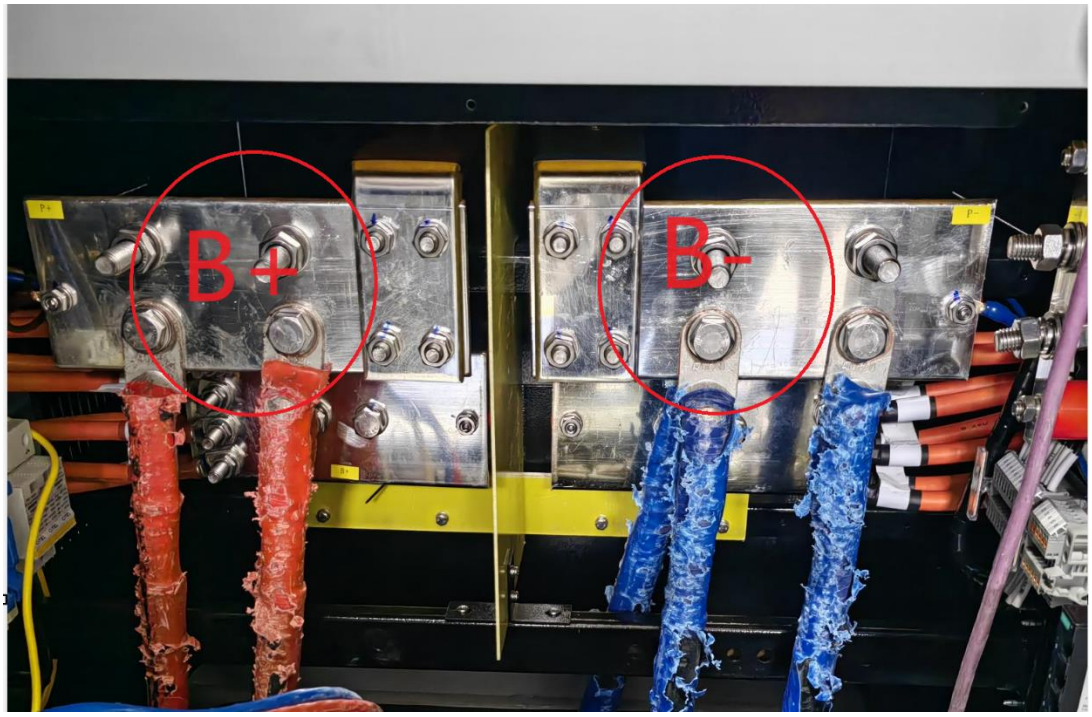
Wait for the BMS to close the contactors and check whether all the contactors on the Local Controller page are closed.





Step 5:

A multimeter (1500VDC) is used to measure the total voltage of the DC busbar.



5.7 SolBank function verification

Artificial operation is used to simulate faults to test the normal protection function of all equipment in SolBank enclosure.

Annex 7: Joint Debugging Test Form

Annex 1: Debug Tool

S/N	Tools	Picture	Use
1	**ZLGCAN**		ZLGCAN tools provide connections between BESS and the real time monitoring system (computer). Flashing and configuring are both done by these tools.
2	**Multimeter**		1500VDC,Test on-off, Test voltage, trouble shooting.
3	**DB9 connector**		DB9 connector and rack connectors are used for connection between CAN tools and BESS.
4	**Manual Charger**		Used for charging/discharging and adjusting SOC of whole battery packs.
5	**Insulation resistance tester**		Insulation resistance test(2500V)
6	**Infrared temperature gun**		Used to test temperature
7	**Others**	/	1. Computer 2. Electrical Schematic Diagram 3. Tool set with screwdriver. 4. Insulating gloves

Annex 2: Record Schedule

Annex 1: Appearance and Installation Inspection Form

Appearance and Installation Inspection Form			
S/N: site specific number: date:			
S/N	**Debugging project**	**Debugging content**	**Inspection results**
1	Remove the protective packaging, inspect the appearance and structure for obvious wear, and ensure that all doors are in good condition		
2	Check if the bolts/screws are loose		
3	Check if the tilting device is functioning properly		
4	Check the internal system for signs of damage		
5	Check signs of leakage in the coolant distribution system		
6	Check damage to racks or other equipment, or transfer of internal safety items		

Annex 2: Battery String Voltmeter

Battery String Voltmeter					
S/N:		Site specific number:		Date:	
S/N	**Debugging project**	**Debugging content**	**Inspection results**	**Qualified or not**	**remarks**
1	Battery string # voltage measurement	Battery string 1 voltage and positive and negative pole to ground voltage			
2		Battery string 2 voltage and positive and negative pole to ground voltage			
3		Battery string 3 voltage and positive and negative pole to ground voltage			
4		Battery string 4 voltage and positive and negative pole to ground voltage			
5		Battery string 5 voltage and positive and negative pole to ground voltage			
6		Battery string 6 voltage and positive and negative pole to ground voltage			
7		Battery string 7 voltage and positive and negative pole to ground voltage			
8		Battery string 8 voltage and positive and negative pole to ground voltage			

Annex 3: Insulation Test Sheet

Insulation Test Sheet

S/N: Site specific number: Date:

S/N	Debugging project	Debugging content	Inspection results	Qualified or not	remarks
1	Insulation measurement of battery string #	Insulation between positive and negative poles of battery string 1 and ground			
2		Insulation between positive and negative poles of battery string 2 and ground			
3		Insulation between positive and negative poles of battery string 3 and ground			
4		Insulation between positive and negative poles of battery string 4 and ground			
5		Insulation between positive and negative poles of battery string 5 and ground			
6		Insulation between positive and negative poles of battery string 6 and ground			
7		Insulation between positive and negative poles of battery string 7 and ground			
8		Insulation between positive and negative poles of battery string 8 and ground			
9	DMC insulation measurement	Primary line insulation (closed contactor)			
10		Secondary insulation (closed contactor)			

Annex 4: Input voltage values for auxiliary equipment (0.5P&0.67P)

Input voltage values for auxiliary equipment (0.5P&0.67P)

S/N: Site specific number: **Date:**

Protector	Circuit Description	Voltage	remarks
QF1	Auxiliary power main switch	480 Vac(US) 400 Vac(EU)	
QF2	Lightning arrester switch	480 Vac(US) 400 Vac(EU)	
QF3	1 # liquid-cooled chiller switch	480 Vac(US) 400 Vac(EU)	
QF4	2 # liquid-cooled chiller switch	480 Vac(US) 400 Vac(EU)	
QF5	3 # liquid-cooled chiller switch	480 Vac(US) 400 Vac(EU)	
QF6	4 # liquid-cooled chiller switch	480 Vac(US) 400 Vac(EU)	
QF7	Air-cooled HVAC switch	480 Vac(US) 230 Vac(EU)	
QF8	Container power switch	230 Vac	
QF9	Fire controller switch	230 Vac	
QF10	UPS Switch	230 Vac	
QF11	BMS Box power switch	230 Vac	
QF12	24V Switch power switch	230 Vac	
QF13	Control power switch	230 Vac	
QF14	Ventilation switch	230 Vac	

Annex 4.1: Input voltage values for auxiliary power (0.25P)

Input voltage values for auxiliary power (0.25P)			
S/N:	Site specific number:	Date:	
Protector	**Circuit Description**	**Voltage**	**remarks**
QF1	Auxiliary power main switch	480 Vac(US) 400 Vac(EU)	
QF2	Lightning arrester switch	480 Vac(US) 400 Vac(EU)	
QF3	1 # liquid-cooled chiller switch	480 Vac(US) 400 Vac(EU)	
QF4	2 # liquid-cooled chiller switch	480 Vac(US) 400 Vac(EU)	
QF5	Air cooled unit switch	480 Vac(US) 230 Vac(EU)	
QF6	Container power switch	230 Vac	
QF7	Fire controller switch	230 Vac	
QF8	UPS Switch	230 Vac	
QF9	BMS box power switch	230 Vac	
QF10	24V Switch power switch	230 Vac	
QF11	Control power switch	230 Vac	
QF12	Ventilation system switch	230 Vac	

Annex 5: Auxiliary equipment operation status

Auxiliary equipment operation status				
S/N:		Site specific number:		Date:
No.	**Debugging project**	**Debugging content**	**Inspection results**	**notes**
1	Are all types of circuit breakers normal?			
2	Does UPS operate normally?			
3	Is the air-cooled HVAC and chiller working properly?			
4	Is water immersion sensor status normal?			
5	Whether the fire protection system is normal?			
6	Is the local E-stop normal?			
7	Is the lighting normal?			

Annex 6: Fire Fighting System Debugging

Fire Fighting System Debugging				
S/N:		Site specific number:	Date:	
No.	Debugging project	Debugging content	Inspection results	Note
1	Smoke alarm	1. When there is a smoke or temperature signal, and there is no combustible gas (H_2) sensor alarm (both levels 2 and 3 are not present): After the alarm signal lasts for 2 sec, BMS reports the corresponding sensor fault level of EMS and handles it according to the system's level 3 severe fault. It outputs a dry contact signal, and EMS notifies PCS to stop (trip). BMS notifies PCS to stop, and notifies chillers and air-cooled HVAC to stop. The intake and ventilation system are not turned on, and the fire alarm bell and light alarm are turned on. BMS delays the opening of the 3 sec control relay and closes the utility circuit breaker. Recovery condition: The fault signal disappears and the fault is eliminated by clicking on the display control after manual maintenance. PS: The switch of the intake and ventilation (exhaust fan) is only related to the presence or absence of combustible gases (both stages 2 and 2 are open), and the ventilation system status does not require clicking the reset button		
2	Temperature alarm			
3	Combustible gas detector	When the combustible gas sensor triggers a Level 2 alarm, there is no smoke or temperature sensing alarm: After the alarm signal lasted for 5 sec, BMS reported a level 2 malfunction of the corresponding sensor to EMS and processed it as a level 3 serious malfunction of the system. The dry contact signal was output, and EMS notifies PCS to stop. BMS notifies PCS to stop, while also turning on the ventilation fans, turning on the fire alarm bell and sound and light alarm. BMS delayed the disconnection of the control relay for 3 seconds. Recovery condition: The fault signal disappears and the fault is eliminated by clicking on the display control after manual maintenance.		

Annex 7: Joint Debugging Test Form

Joint Debugging Test Form

S/N: Site specific number: Date:

number	Fault name		BMS fault display	PCS action	Dry contact action	String contactor action	Main DC circuit breaker action	EMS fault information display	Fault recovery action	Is it consistent	remarks
Individual voltage	Level 1	3.55V									
Too high	Level 2	3.6V									
	Level 3	3.7V									
Individual voltage	Level 1	2.9V									
Too low	Level 2	2.8V									
	Level 3	2.55V									
Individual voltage	Level 1	300mv									
Pressure difference (mV)	Level 2	400mv									
	Level 3	600mv									
High battery charging and discharging temperature (℃)	Level 1	40									
	Level 2	45									
	Level 3	50									
Low battery charging and discharging temperature (℃)	Level 1	10									
	Level 2	5									
	Level 3	0									
Battery temperature	Level 1	10									
Large difference (℃)	Level 2	15									
	Level 3	20									

Low SOC (1%)	Level 1	5%									
	Level 2	/									
	Level 3	/									
High SOC (1%)	Level 1	101%									
	Level 2	/									
	Level 3	/									
Total voltage overvoltage	Level 1	3.55*414									
High	Level 2	3.6*414									
	Level 3	3.7*414									
Total voltage overvoltage	Level 1	2.9*414									
Low	Level 2	2.8*414									
	Level 3	2.55*414									
Power plug-in temperature over temperature alarm (℃)	Level 1	90									
	Level 2	95									
	Level 3	100									
Charging overcurrent (A)	Level 1	195									
	Level 2	200									
	Level 3	205									
Discharge overcurrent (A)	Level 1	195									
	Level 2	200									
	Level 3	205									
Low insulation	Level 1	1000									
(KΩ)	Level 2	500									
	Level 3	100									
Display and control communication	Level 2	/									
fault											
BMU communication failure	Level 3	/									
Display and control: fire protection	Level 3	/									
Fault/Emergency Stop											

Signal/electrical operation/fuse disconnection											
Individual voltage	Level 3	/									
Collection fault											
Monomer temperature	Level 3	Number of invalid temperatures ⩾ 4 or number of invalid temperature slaves ⩾ 3									
Collection fault											
The negative fuse of the BMS box is disconnected	Level 3	/									
The positive fuse of the BMS box is disconnected	Level 3	/									
The isolation switch of the BMS box is disconnected (after stringing, the detection is turned on, and the status before stringing is not determined)	Level 3	/									